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GROUND WATER RESOURCES OF KERALA
(MARCH 2020)



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PREFACE

The State of Kerala has a total area of about 38,863 sq.km which is only 1.2 percent of the geographical area of India. The State is home to about 3 percent of the population of the country. Though richly endowed with surface water source such as rivers, tanks and ponds and having average annual rainfall of about 3000 mm, the topographic and geomorphic settings of the State allows utilization of only a small portion of the available resources. Nearly 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 utilization of available resources. Increasing population, rapid urbanization and industrialization has resulted in increase In use of ground water resource 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. This requires realistic estimates of the availability of ground water resources and the current status of Its utilization.

The dynamic ground water resources of the State are being periodically assessed jointly by the State Ground water Department, Government of Kerala and the Central Ground water Board, Ministry of water Resources, Government of India. following the methodology recommended by the Ground Water Estimation Committee (GEC} constituted by the Government of India. The previous assessment was carried out in 2017. Salient features of the estimation of dynamic ground water resources of Kerala as on March 2020, as per modified GEC 2015 methodology recommendations are presented in this report. The report was approved by the state level committee in the 2nd meeting convened on 26.07.2021 and subsequently submitted to CGWB Headquarters and minor modifications on ground water extraction is incorporated.

This report has been prepared through the sincere and painstaking efforts of the officers of the Ground Water Department. Government of Kerala, Thiruvananthapuram and Central Ground Water Board, Kerala Region, Thiruvananthapuram under the supervision and guidance of the Regional Director. I take this opportunity to thank every one of them for their help and cooperation in the preparation of this report. I am also thankful to the Chairman and members of the State Level Committee for Re-estimation of the Ground water Resources of Kerala for their valuable guidance and encouragement during the estimation and for finalizing the report. Thanks are due to various organizations of Government of Kerala and Government of India for fruitful discussions and for providing data required for the assessment of ground water resources of the State. All possible care has been taken to assess various components of the ground water resource of the State are realistically as possible. T hope this compilation will be of help to the planners, administrators and all stake holders in Kerala and will serve as a useful guide for the optimal and sustainable management of the limited ground water resources of Kerala.

(Dr.A.Subburaj)
Regional Director

GROUND WATER RESOURCES OF KERALA (MARCH 2020)

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GROUNDWATER RESOURCES OF KERALA (As on March 31, 2020)

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 2017. Salient features of the estimation of dynamic ground water resources of Kerala as on March 2020, 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 the current assessment (developed by CGWB 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 dates 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 (see **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 March 2020. 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.612/2020/WRD dated 28.09.2020 (**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 and static resources of Kerala as on 31.3.2020 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 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 coordinated 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 March-2020 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 5th 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 March 2020 was computed as per GEC-2015 norms and was approved in the 2nd meeting of the State Level Committee for the re-establishment of ground water resources of Kerala on 26.7.21.

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.

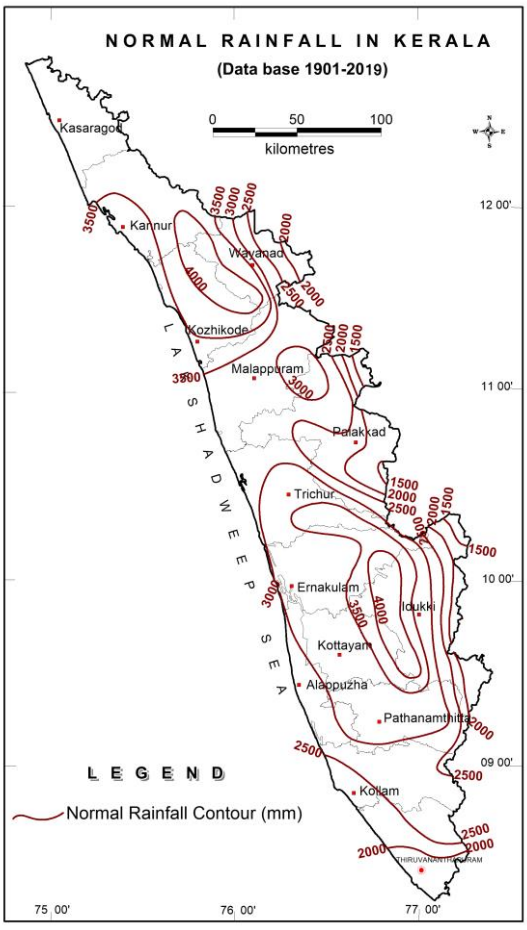

Figure 1. Distribution of Normal

2.2 Rainfall

Kerala receives normal annual rainfall of 3060 mm, 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 87 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.

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

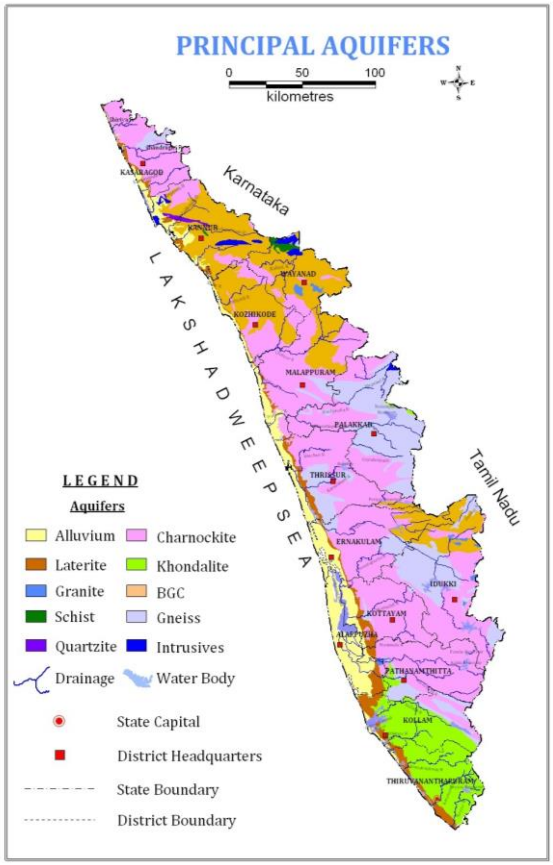

Figure 2. Principal Aquifers of Kerala

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.

2.5 Ground Water level Conditions in 2019

The depth to water level was monitored from 1602 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 November is taken as post-monsoon water level, based on temporal distribution of long-term rainfall in the State.

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).

2.5.1 Depth to water level during Pre-monsoon Period (April 2019)

During the month of April 2019, the depth to water level in the state varied widely from 0.09 to 55.23 mbgl in both dug wells and piezometers. Shallow water level in the range of 0 – 2 mbgl is mainly seen in Alappuzha district, coastal tracts of Ernakulam, Thrissur, Kollam districts and in the valley portion located in Kottayam and Idukki districts. The areas falling in the midland region generally show water level in the range of 2 – 10 mbgl. Water level of more than 20 m bgl is seen as isolated patches in Thiruvananthapuram, Kollam, Kannur and Kasargod districts. The analysis of the data reveals that 79.28 % of the monitoring wells (GWMWs) have water levels within the range of 0.1 to10 mbgl. Deeper water level (> 20 mbgl) is seen in Thiruvananthapuram, Kollam, Kannur and Kasargod districts as isolated pockets which can be attributed to the local hydrogeological conditions such as thick lateritic overburden and the wells situated at elevated areas. In Kollam, Kottayam, Kozhikode, Kannur, Kasaragod, Malappuram, Thiruvananthapuram and Thrissur districts, more than 50% of monitoring wells show water level greater than 5 m bgl. Map showing the spatial distribution of ground water levels in the phreatic zone during pre-monsoon period is given as **Fig 3**. In districts, more than 50% of monitoring wells show water level greater than 5 m bgl.

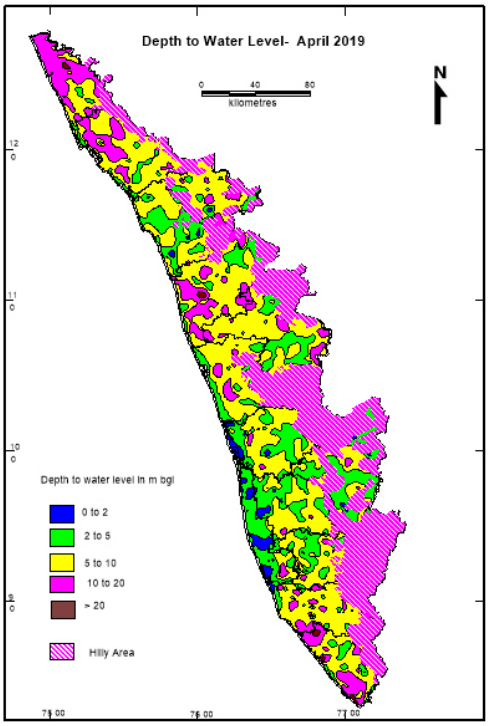

Figure 3. Spatial Distribution of Ground Water Levels in Kerala (Apr. 2019)

2.5.2 Depth to water level during August 2019

During the month of August 2019, the depth to water level in Kerala State in dug wells varied widely from 0.01 to 36.55 mbgl. Shallow water level in the range of 0 –2 mbgl is seen in Alappuzha district, coastal tracts of Ernakulam, in the valley portion found in Idukki, Pathanamthitta Thrissur Kottayam, and Kozhikode districts and as small patches in remaining districts. The areas falling in the midland region generally show water level in the range of 2 –10 mbgl. Water level of more than 20 m bgl is seen in very few patches in Thiruvananthapuram district only. The analysis of the data reveals that 94.19 % of the monitoring wells (GWMWs) shows water level within the range of 0.1 to10 mbgl. Deeper water level (> 20 mbgl) is seen in Thiruvananthapuram (Kanjiramkulam), Kollam, Malappuram, Kannur and Kasargod district as isolated pockets which can be attributed to the local hydrogeological conditions mainly due to thick lateritic overburden and moreover the wells are located in an elevated area. In Kollam district it is observed that more than 50% of monitoring wells show water level greater than 5 m.bgl, followed by Trivandrum showing 40%. Deepest water level is encountered in Malappuram district.

2.5.3 Depth to Water Level during Post-monsoon Period (November 2019)

During the month of November 2019, the depth to water level in Kerala State in dug wells varied widely from 0.1 to 34.33 mbgl. Shallow water level in the range of 0 – 2 mbgl is seen in Alappuzha, coastal tracts of Ernakulam, Kollam, Thrissur and Kozhikode districts, as well as in the valley portion found in the eastern part of Idukki, Palghat, Wayanad and Kozhikode districts. The areas falling in the midland region generally show water level in the range of 2 – 10 mbgl. Water level of more than 20 m bgl is seen as patches in Thiruvananthapuram, Palakkad and Kasargod districts. The analysis of the data reveals that 92.76 % of the monitoring wells (GWMWs) shows water level within the range of 0.1 to 10 mbgl. Deeper water level (> 20 mbgl) is mainly observed in Thiruvananthapuram (Kanjiramkulam, Melvettoor, Othukkungal, Tirupuram, Veyloor), Kasargod (Mavinakatta) districts as isolated pockets, which can be attributed to the local hydrogeological conditions mainly due to thick lateritic overburden and moreover the wells are located in an elevated area. Kollam and Thrissur districts have observed more than 50% of monitoring wells show water level greater than 5 m bgl. Deepest water level is encountered in Trivandrum district. Spatial variation of ground water levels in Kerala during post-monsoon season (Nov-2019) is given in **figure 4**.

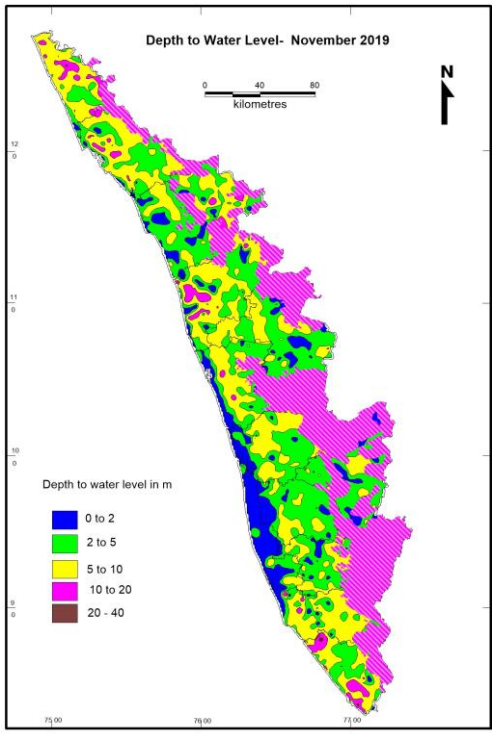

Figure 4. Spatial Distribution of Ground Water Levels in Kerala (Nov. 2019)

2.5.4 Depth to water level during January 2020

During the month of January 2020, the depth to water level in the State varied widely from 0.31 to 55.23 mbgl in dug wells. Shallow water level in the range of 0 – 2 mbgl is seen in Alappuzha district, coastal tracts of Kollam, Ernakulam, Thrissur and Kozhikode districts and in the valley portion located in the eastern part of Idukki districts and also as small patches in Kottayam district. The areas falling in the midland region generally show water level in the range of 5 – 10 mbgl. Water level of more than 20 m bgl is seen as isolated patches in Thiruvananthapuram, Kasargod, Kannur and Kollam districts. The analysis of the data reveals that 80.21 % of the monitoring wells (GWMWs) have water levels within the range of 0.1 to10 mbgl. Deeper water level (> 20 mbgl) is seen in Thiruvananthapuram (Kanjiramkulam, Mulloor,

Thonakkal, Veyloor, and Pulluvila,). Palghat, Kasargod and Kannur district as isolated pockets which can be attributed to the local hydrogeological conditions such as thick lateritic overburden and the wells situated at elevated areas. In Kannur, Kasargod, Kollam Kottayam, Malappuram, Palghat and Thrissur more than 50% of monitoring wells show water level greater than 5 m bgl. Deepest water level is recorded in Thiruvananthapuram district.

2.5.5 Fluctuation of Ground Water Levels between April 2019 and November 2019

Comparison of November 2019 water level with that of April 2019 indicates rise in water level in the range of 0 – 14.10 meters in most parts of the state, whereas fall in water level also is noticed in certain small isolated pockets mainly in Ernakulam, Thrissur, Kottayam, Pathanamthitta and Alappuzha district. Rise in water level in the range of 0-4 m were observed mostly in all districts of the whereas fall in the water level in the range of 0-4 m is mainly noticed as isolated patches from Alappuzha and Ernakulam districts on the southern part and Kannur, Malappuram and Thrissur districts on the northern part of the state. Rise in water level is represented by 82.26 % of total monitoring wells. **Figure 5** depicts the water level fluctuations between Apr-2019 and Nov-2019 in the state.

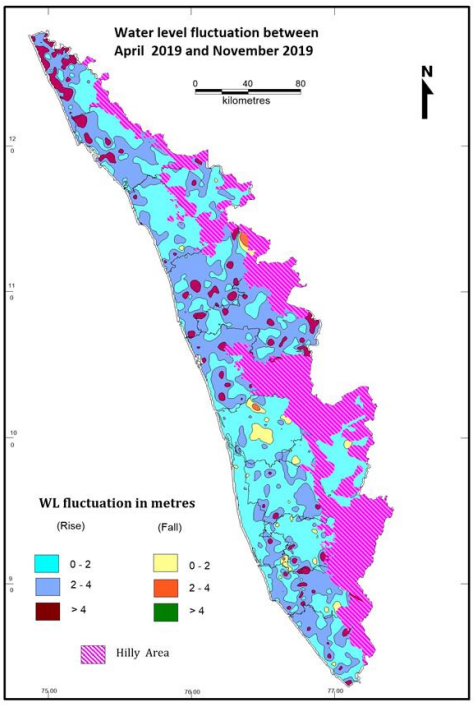

Figure 5. Water level fluctuation between April 2019 and November 2019

2.5.6 Long-term Fluctuation of Ground Water levels

The long-term fluctuations in ground water levels in the State have been studied by comparing the pre- and post-monsoon water levels during 2019 with the average fluctuation of the previous 10 years (2009-2018).

2.5.6.1 Fluctuation between Mean April (2009-2018) and April 2019

The change in water level over the last ten years period is brought out by the comparison of water level with the mean value of April 2019 measurements of the period 2009-2018.This analysis indicate that the change in water level is mostly restricted to +2 (rise) to -2 (fall) m as recorded by 93.62 % of GWMW. However, fall in water level is predominant and continuous in all districts as represented by 54.1 % of monitoring wells. In Alappuzha, Kannur, Kasargod, Kottayam, Kozhikkode, Thrissur and Palakkad districts, fall in the range of 0-2 m bgl is more than 50 % of total GWMW. The Rise in water level is also continuous in all districts as represented by 45.75 % of total GWMW. Pathanamthitta and Wayanad district have highest no of wells (58%) with rising trend in the range of 0-2 m bgl.

2.5.6.2 Fluctuation between Mean November (2009-2018 and November 2019

The change in water level over the last ten years period is brought out by the comparison of November 2019 water level with the mean value of November measurements of the period 2009-2018.This analysis indicate that the change in water level is mostly restricted to +2(rise) to -2(fall) m as recorded by 92.27 % of GWMW. However, rise in water level is as represented by 75.86 % of monitoring wells.

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°C. 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 districts, 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 districts and is found more in Alappuzha district.

3.0 GROUND WATER RESOURCES ESTIMATION METHODOLOGY, 2015.

Ground water resource as in 2020 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.

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

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 ith year

r(normal) - Normal monsoon season rainfall

ri - Rainfall in the monsoon season for the ith 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 –

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

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

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

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

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

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

$$Alloc = 22 \times N \times L_g \; mm \; per \; year \; \ldots\ldots\ldots\

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.

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

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:

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

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.

$$Q_P = S \times A \times \Delta h = S \times A \times (h_t - h_0) \quad \ldots\ldots\ldots\

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 (2017), ground water Extraction for domestic uses has been computed based on the population in 2011, projected to the year 2017. In the current analysis population in census year 2011 is projected to the assessment year of 2020. 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.

4.1.6 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

4.1.5 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 (2020)

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.5.**

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 2020 as the base year. Wherever data pertaining to 2020 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

5.3 Total Annual Ground Water Recharge

The Total Annual Ground Water Availability in Kerala State as on March 31, 2020, has been computed as **5.65 Billion Cubic Metre (BCM)**. Rainfall recharge accounts for about **74.33** 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.**

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

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**
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

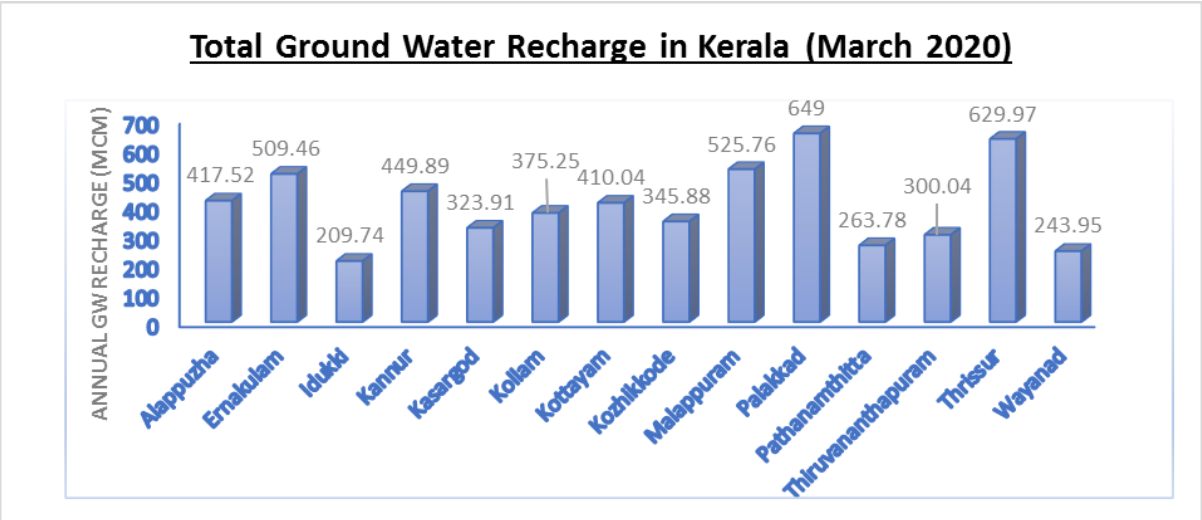

Figure 6. Contribution of districts to the Total Ground Water Recharge in Kerala

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 2020 is given in **Annexure III D.** As per the computation, Annual Extractable Ground Water Recharge for the entire State is **5.12 billion cubic metre (BCM)**. The district-wise availability in the State ranges from **188.77 MCM** in Idukki district to **584.10 MCM** in Palakkad district. The spatial distribution of Annual Extractable Ground Water Recharge in Kerala as in March 2020 in depth units (m) is shown in **Fig.7.**

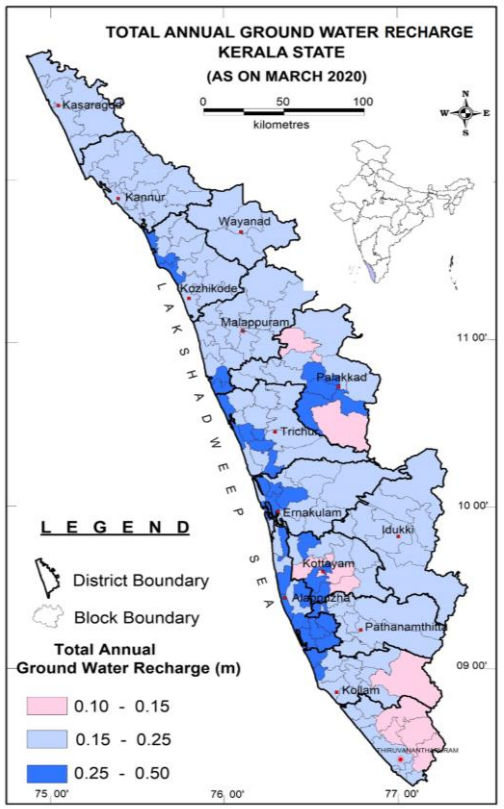

Figure 7. Spatial Distribution of Total Annual Ground Water Recharge in Kerala (2020)

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 (2020). 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 **1.47 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. 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 **1.16 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 **2.645 BCM** and ranges from **53.07 MCM** in Wayanad district to **331.37 MCM** in Palakkad 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**.

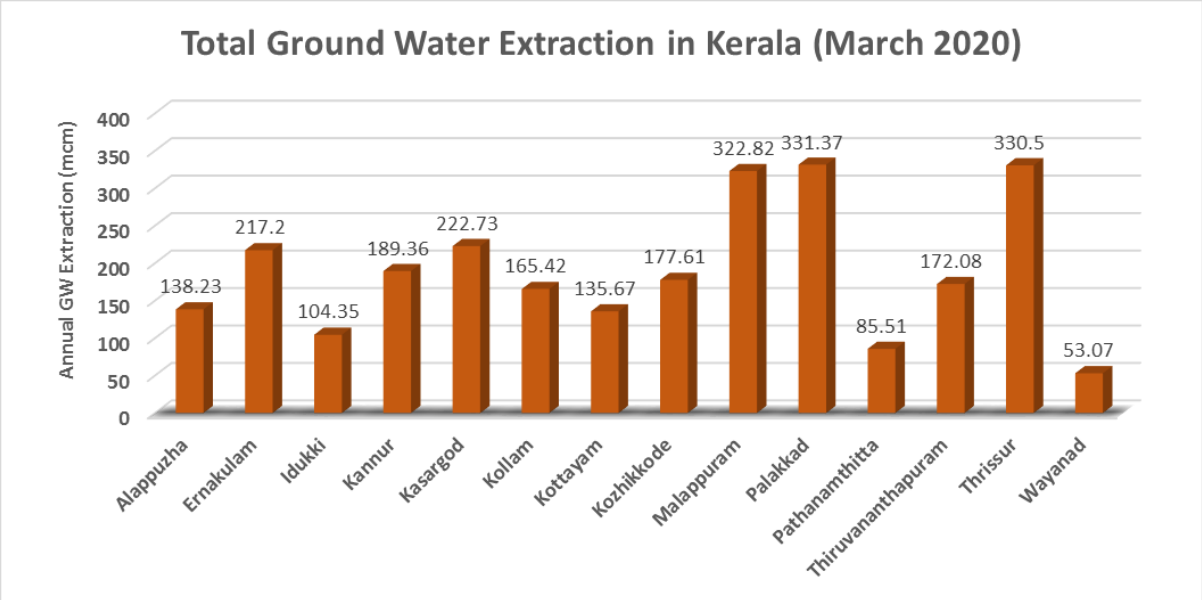

Figure 8. Distribution of Ground Water Extraction in Kerala as in March 2020

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 **2.25 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 **2.13 BCM**. The district-wise net ground water availability ranges from **31.97 MCM** in Kasaragod district to **245.61 MCM** in Alappuzha 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.**

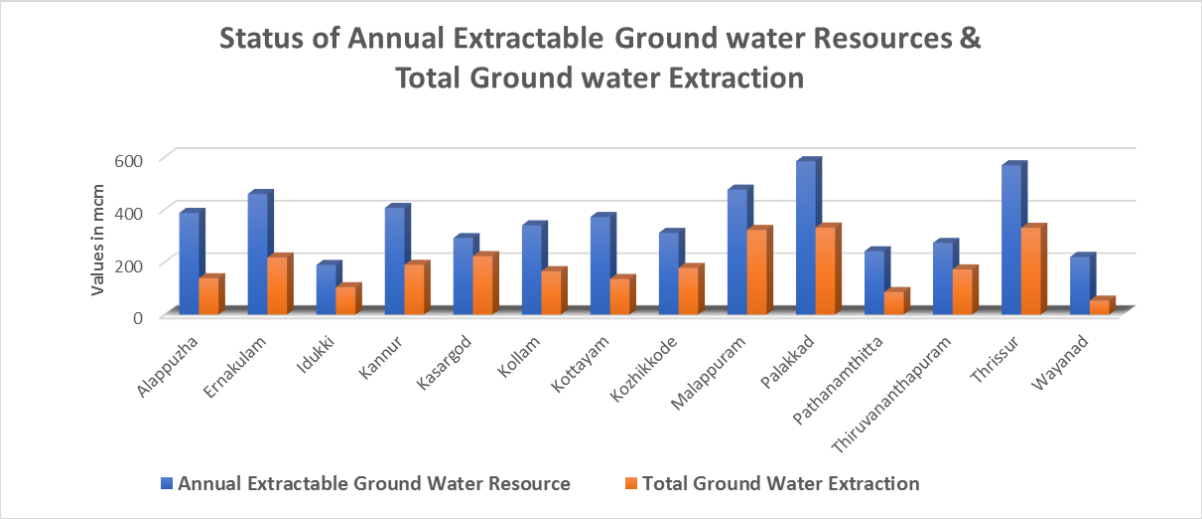

Figure 9. Status of Annual Extractable Ground Water Resources & Ground Water Extraction (As in March 2020)

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 **51.68** %. The Stage of Ground Water Extraction is the highest in Kasaragod district **(76.40%)** and the lowest in Wayanad district **(24.17%).** Block-wise details of Stage of Ground Water Extraction as in March 2020 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"; **29** blocks are "Semi-critical" and **120** 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 (2008-2019) 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 (Aryad) Alappuzha district, (Chittur, Kollengode, Malapuzha, Palakkad) Palakkad district. Only one assessment unit is 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 **387.42 MCM** and existing Gross Ground Water Extraction is of the order of **138.23 MCM. The** Stage of Ground Water Extraction is **35.68 %.** All the blocks in the district are Safe from the point of view of ground water extraction.

The in storage ground water resources of phreatic zone (unconfined aquifer) is **662.69 MCM**, and the confined zone is **263.85 MCM**. The total ground water resources of the district are **1313.96 MCM.**

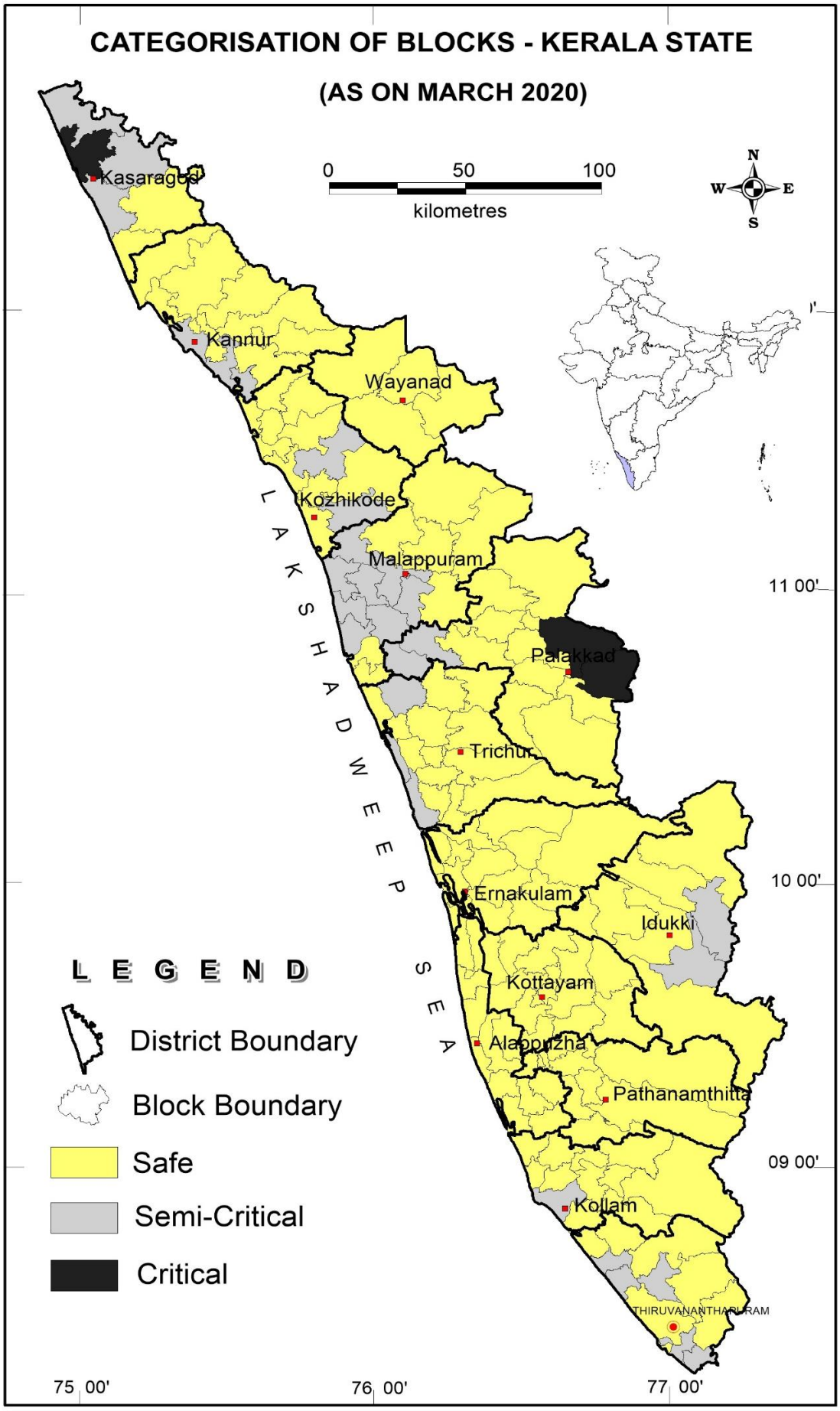

Figure 10. Categorization of Blocks in Kerala (As in March 2020)

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 **459.60 MCM** and existing Gross Ground Water Extraction is of the order of **217.20 MCM. The** Stage of Ground Water Extraction is **47.26 %.** All the blocks in the district are Safe from the point of view of ground water extraction.

The **in storage ground water resources** of phreatic zone (unconfined aquifer) is **788.24 MCM**, the semi- confined zone is **565.81 MCM**. The total ground water resources of the district are 1813.65 **MCM**

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 **188.77 MCM** and existing Gross Ground Water Extraction is of the order of **104.35 MCM. The** Stage of Ground Water Extraction is **55.28%.** Out of 8 blocks in the district, 2 have been categorized as 'Semi-critical' (Kattappana and Nedumkandam) and 6 blocks as 'Safe'.

The **in storage ground water resources** of phreatic zone (unconfined aquifer) is **126.60 MCM**, the semi- confined zone is **138.08**. The total ground water resources of the district are 453.45 **MCM**

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 **406.38 MCM** and existing Gross Ground Water Extraction is of the order of **189.36 MCM. The** Stage of Ground Water Extraction is **46.60%.** Out of 11 blocks in the district, 3 have been categorized as 'Semi-critical' viz; **Kannur, Thalassery and Panur** and 8 blocks as 'Safe'.

The **in-storage ground water resources** of phreatic zone (unconfined aquifer) is **491.80 MCM**, the semi- confined zone is **513.01 MCM**. The total ground water resources of the district are **1411.18 MCM**

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 **291.52 MCM** and existing Gross Ground Water Extraction is of the order of **222.73 MCM. The** Stage of Ground Water Extraction is **76.40%.** Out of 6 blocks in the district, 1 has been categorized as 'Critical' **viz. Kasaragod;** 3 as 'Semi-critical' viz. **Kanhangad, Karadka and Manjeshwar blocks** and 2 blocks as 'Safe'.

The **in storage ground water resources** of phreatic zone (unconfined aquifer) is **250.65 MCM**, the semi- confined zone is **296.69 MCM**. The total ground water resources of the district are **838.86 MCM**

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 **340.07 MCM** and existing Gross Ground Water Extraction is of the order of **165.42 MCM. The** Stage of Ground Water Extraction is **48.64%.** Out of 11 blocks in the district, 1 block **(Mukhathala)** is 'Semi-critical' and 10 blocks are 'Safe'.

The **in storage ground water resources** of phreatic zone (unconfined aquifer) is **371.88 MCM**, the semi- confined zone is **281.97 MCM** and the confined zone is **109.51 MCM**. The total ground water resources of the district are **1103.42 MCM**

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 **371.91 MCM** and existing Gross Ground Water Extraction is of the order of **135.67 MCM. The** Stage of Ground Water Extraction is **36.48%.** All the blocks in the district are in 'Safe' category.

The **in storage ground water resources** of phreatic zone (unconfined aquifer) is **313.69 MCM**, the semi- confined zone is **267.70 MCM** and the confined zone is **50.78 MCM**. The total ground water resources of the district are **1004.08 MCM**

Table 7: Summary of Major Components of Dynamic Ground Water Resources of Kerala (2020)

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)	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	300.69	4.29	44.51	68.04	417.52	30.10	387.42
2	ERNAKULAM	Non-command	354.05	12.72	73.03	69.67	509.46	49.86	459.60
3	IDUKKI	Non-command	179.95	3.11	8.12	18.56	209.74	20.97	188.77
4	KANNUR	Non-command	384.55	8.73	18.19	38.42	449.89	43.51	406.38
5	KASARGOD	Non-command	262.61	18.24	5.09	43.49	323.91	32.39	291.52
6	KOLLAM	Non-command	273.62	8.27	65.64	27.72	375.25	35.18	340.07
7	KOTTAYAM	Non-command	297.16	7.63	49.30	55.95	410.04	38.13	371.91
8	KOZHIKODE	Non-command	311.87	3.99	15.65	14.37	345.88	34.59	311.30
9	MALAPPURAM	Non-command	396.31	8.86	43.69	76.90	525.76	49.79	475.97
10	PALAKKAD	Non-command	356.08	39.75	6.99	246.18	649.00	64.90	584.10
11	PATHANAMTHITTA	Non-command	183.73	4.94	55.72	19.40	263.78	22.46	241.32
12	TRIVANDRUM	Non-command	210.75	5.70	56.24	27.34	300.04	27.18	272.86
13	THRISSUR	Non-command	458.74	8.41	19.99	142.83	629.97	61.14	568.83
14	WAYANAD	Non-command	232.66	4.42	0.00	6.86	243.95	24.39	219.55
	KERALA STATE		**4202.77**	**139.06**	**462.16**	**855.71**	**5654.19**	**534.61**	**5119.58**
	TOTAL (BCM)		**4.20**	**0.14**	**0.46**	**0.86**	**5.65**	**0.53**	**5.12**

Table.7 (Continued)

Sl. No.	Assessment Unit/ District	Command / Non-Command	Annual Extractable Ground Water Recharge (MCM)	Current Annual Ground Water Extraction (MCM)				Annual Ground water 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	387.42	38.50	2.61	97.11	138.23	100.70	245.61	35.68
2	ERNAKULAM	Non-command	459.60	81.68	1.85	133.67	217.20	191.46	184.61	47.26
3	IDUKKI	Non-command	188.77	60.63	0.13	43.59	104.35	43.59	84.42	55.28
4	KANNUR	Non-command	406.38	83.98	0.26	105.12	189.36	142.57	181.67	46.60
5	KASARGOD	Non-command	291.52	159.19	0.14	63.39	222.73	110.55	31.97	76.40
6	KOLLAM	Non-command	340.07	51.07	0.19	114.17	165.42	126.10	162.71	48.64
7	KOTTAYAM	Non-command	371.91	50.60	0.03	85.04	135.67	91.94	229.34	36.48
8	KOZHIKODE	Non-command	311.30	48.70	0.07	128.84	177.61	209.62	78.16	57.05
9	MALAPPURAM	Non-command	475.97	95.35	0.09	227.38	322.82	601.65	153.15	67.82
10	PALAKKAD	Non-command	584.10	186.32	6.00	139.05	331.37	227.61	193.66	56.73
11	PATHANAMTHITTA	Non-command	241.32	38.69	0.00	46.82	85.51	46.82	155.82	35.43
12	TRIVANDRUM	Non-command	272.86	52.91	0.06	119.10	172.08	135.86	84.02	63.06
13	THRISSUR	Non-command	568.83	201.49	0.39	128.63	330.50	171.27	195.67	58.10
14	WAYANAD	Non-command	219.55	13.63	1.58	37.85	53.07	50.47	153.86	24.17
	KERALA STATE		**5119.58**	**1162.74**	**13.41**	**1469.76**	**2645.90**	**2250.21**	**2134.67**	**51.68%**
	TOTAL (BCM)			**1.16**	**0.013**	**1.47**	**2.65**	**2.25**	**2.13**	**51.68**

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 **311.30 MCM** and existing Gross Ground Water Extraction is of the order of **177.61 MCM. The** Stage of Ground Water Extraction is **57.05%.** Out of 12 blocks in the district, 2 are 'Semi-critical'**(Balussery and Kunnamangalam)** and others are 'Safe'.

The **in storage ground water resources** of phreatic zone (unconfined aquifer) is **236.33 MCM**, the semi- confined zone is **309.25 MCM**. The total ground water resources of the district are **856.87 MCM**

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 **322.82 MCM** and existing Gross Ground Water Extraction is of the order of **475.97 MCM. The** Stage of Ground Water Extraction is **67.82%**. Out of 15 blocks in the district, 8 are 'Semi-critical' (Kondotty, Kuttipuram, Malappuram, Mankada, Thanur, Thirurangadi, Tirur & Vengara) and remaining blocks are 'Safe'.

The **in-storage ground water resources** of phreatic zone (unconfined aquifer) is **595.16 MCM**, the semi- confined zone is **599.40 MCM** and the confined zone is **58.62 MCM**. The total ground water resources of the district are **1729.15 MCM**

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 dug wells 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 **584.10 MCM** and existing Gross Ground Water Extraction is of the order of **331.37 MCM. The** Stage of Ground Water Extraction is **56.73%.** 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'.

The **in-storage ground water resources** of phreatic zone (unconfined aquifer) is **547.50 MCM**, the semi- confined zone is **475.02 MCM.** The total ground water resources of the district is **1606.62 MCM**

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 **241.32 MCM** and existing Gross Ground Water Extraction is of the order of **85.51 MCM. The** Stage of Ground Water Extraction is **35.43%.** All the 8 blocks of the district have been categorized as 'Safe'.

The **in-storage ground water resources** of phreatic zone (unconfined aquifer) is **163.72 MCM**, the semi- confined zone is **198.35 MCM**. The total ground water resources of the district is **603.4 MCM**

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 **272.86 MCM** and existing Gross Ground Water Extraction is of the order of **172.08 MCM. The** Stage of Ground Water Extraction is **63.06 %.** Out of 11 blocks, 5 are 'Semi critical' (**Athiyannur, Chirayinkil, Nedumangad, Parassala and Pothencode)** and 6 are 'Safe'.

The **in-storage ground water resources** of phreatic zone (unconfined aquifer) is **353.08 MCM**, the semi- confined zone is **330.76 MCM** and the confined zone is **36.49 MCM**. The total ground water resources of the district are **993.18 MCM.**

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 **568.83 MCM** and existing Gross Ground Water Extraction is of the order of **330.5 MCM. The** Stage of Ground Water Extraction is **58.10%.** Out of 16 blocks in the district, 3 are 'Semi-critical' (**Chowannur, Mathilakam and Thalikulam).** All the other blocks are safe.

The **in-storage ground water resources** of phreatic zone (unconfined aquifer) is **685.51 MCM**, the semi- confined zone is **377.11 MCM.** The total ground water resources of the district are **1631.44 MCM**

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 **219.55 MCM** and existing Gross Ground Water Extraction is of the order of **53.07 MCM. The** Stage of Ground Water Extraction is **24.17 %.** All four blocks in the district are 'Safe'.

The **in-storage ground water resources** of phreatic zone (unconfined aquifer) is **171.31 MCM** and the semi- confined zone is **299.80 MCM**. The total ground water resources of the district are **690.67 MCM**

The district wise Ground Water Availability is presented Table 7

5.11 Comparison of the Dynamic Ground Water Resources as in (2017) & (2020)

A comparison of the major components of dynamic ground water resources of Kerala during 2017 and 2020, along with justification is given in **Table. 8**

A comparative analysis of the components of dynamic ground water resources during 2017 and 2020 shows that the annual extractable ground water recharge for Kerala during 2020 has decreased by 1.76 % when compared with the corresponding figures during 2017. The annual ground water Extraction for all uses has decreased by 0.93% during the period. The net ground water availability for future use in the state shows a decrease of 11.34 % in 2020 when compared to the corresponding figures computed in 2017. The Stage of Ground Water Extraction in the State shows an decrease from 51.24 % during 2017 to 51.68% during 2020. The variation in the spatial distribution of various recharge and discharge components resulting from the changes in ground water levels and re-organization of blocks 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 decreased from 30 to 29 whereas the number of 'Safe' blocks increased from 119 to 120. There is change in the number of Critical block from 2 to 3. There is no overexploited category compared to previous assessment.

Table 8: District wise Total Ground Water Availability of Kerala State (2020)

Total Ground Water Availability -2020											
Kerala State in ham											
S.No	**District**	**Annual Extractable Ground Water Recharge of unconfined Aquifer**	**In storage Ground Water Resources of Unconfined Aquifer**	**Total Ground Water Availability of Unconfined Aquifer**	**Dynamic Ground Water Resources of Semi-Confined Aquifer**	**In storage Ground Water Resources of Semi-Confined Aquifer**	**Total Ground Water Availability of Semi-Confined Aquifer**	**Dynamic Ground Water Resources of Confined Aquifer**	**In storage Ground Water Resources of Confined Aquifer**	**Total Ground Water Availability of Confined Aquifer**	**Total Ground Water Availability of the Assessment Unit**
		Unconfined Aquifer			**Semi-Confined Aquifer**			**Confined Aquifer**			
		1	***2***	***3=1+2***	***4***	***5***	***6=4+5***	***7***	***8***	***9=7+8***	***10=3+6+9***
1	Alappuzha	38741.68	66268.66	105010.34	0.00	0.00	0.00	0.00	26385.44	26385.44	131395.78
2	Ernakulam	45959.59	78823.79	124783.38	0.00	56581.20	56581.20	0.00	0.00	0.00	181364.58
3	Idukki	18876.90	12659.90	31536.80	0.00	13808.45	13808.45	0.00	0.00	0.00	45345.25
4	Kannur	40637.97	49179.99	89817.96	0.00	51300.94	51300.94	0.00	0.00	0.00	141118.90
5	Kasaragod	29151.64	25064.59	54216.23	0.00	29669.40	29669.40	0.00	0.00	0.00	83885.63
6	Kollam	34006.61	37187.55	71194.16	0.00	28196.85	28196.85	0.00	10951.46	10951.46	110342.47
7	Kottayam	37191.29	31369.22	68560.51	0.00	26770.36	26770.36	0.00	5077.60	5077.60	100408.47
8	Kozhikode	31129.50	23632.76	54762.26	0.00	30925.22	30925.22	0.00	0.00	0.00	85687.48
9	Malappuram	47596.71	59516.45	107113.16	0.00	59939.74	59939.74	0.00	5861.63	5861.63	172914.53
10	Palakkad	58410.11	54749.90	113160.01	0.00	47501.80	47501.80	0.00	0.00	0.00	160661.81
11	Pathanamthitta	24132.21	16372.38	40504.59	0.00	19834.99	19834.99	0.00	0.00	0.00	60339.58
12	Thiruvananthapuram	27285.58	35307.72	62593.30	0.00	33075.86	33075.86	0.00	3648.93	3648.93	99318.09
13	Thrissur	56882.56	68550.64	125433.20	0.00	37710.55	37710.55	0.00	0.00	0.00	163143.75
14	Wayanad	21955.28	17131.44	39086.72	0.00	29980.02	29980.02	0.00	0.00	0.00	69066.74
	Total (ham)	**511957.6**	**575815.0**	**1087772.6**	**0.0**	**465295.4**	**465295.4**	**0.0**	**51925.1**	**51925.1**	**1604993.1**
	Total (bcm)	**5.12**	**5.76**	**10.88**	**0.00**	**4.65**	**4.65**	**0.00**	**0.52**	**0.52**	**16.05**

Table 9: Comparison of Major Components of Dynamic Ground Water Resources of Kerala (2017 & 2020)

Sl. No	Component			Variation in 2020 w.r. to 2017	Variation (%)	Remarks /Justification
		2017	2020			
1	Total Annual Ground Water Recharge (MCM)	5769	5654	-115	-1.99	Variation due mainly to the changes in the precipitation and consequent water level fluctuations and 16% reduction in recharge from other sources.
2	Annual Extractable Ground Water Recharge (MCM)	5212	5120	-92	-1.76	- do -
3	Total Ground Water Extraction (MCM)	2671	2646	-25	-0.93	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)	2408	2135	-273	-11.34	The variation is due to reduction in the extractable ground water recharge as per GEC-2015 computation.
5	Stage of Ground Water Extraction (%)	51.24	51.68	0.44	+0.86	

CONTRIBUTORS PAGE

I COMPUTATION OF GROUND WATER RESOURCES

CENTRAL GROUND WATER BOARD

1.	Dr. A. Subburaj	Regional Director
2	Dr. NVinayachandran	Scientist-D (SHG)
3	Santana Subramani	Scientist C
4	Vijesh. V.K	Scientist-B (JHG)
5	Roopesh G Krishnan	Scientist-B (JHG)
6	S. Singathurai	Scientist-B (JHG)
7	Anisha K.	Scientist-B (JHG)
8	N.Veerababu	Scientist-B (GP)
9	Sreehari Sarangan M S	Scientist-B (JHG)
10	Arun Kumar A.V.	Assistant Hydrogeologist.

GROUND WATER DEPARTMENT

1.	Dr. Santhosh N	Hydrogeologist
2	Dr. Anseena Beegom A S	Hydrogeologist
3	Bushra A	Jr. Hydrogeologist
4	Santy S R	Jr. Hydrogeologist

II CARTOGRAPHY

1.	Tonny Eapen	Chief Draughtsman, CGWB

III SCRUTINY& FINALISATION OF REPORT

1.	Dr.A Subburaj	Regional Director, Kerala Region, Thiruvananthapuram
2	Ancy Joseph	Superintending Hydrogeologist, 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 28.9.2020

File No.GW1/208/2020-WRD

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.612/2020/WRD Dated,Thiruvananthapuram, 28/09/2020

Read 1 G.O(Rt)No. 888/2017/WRD dated 30/10/2017.

2 Letter No. 11/CGWB/KR/T 20/ 20-21-852, dated 21/07/2020 from the Head of office, Central Ground Water Board, Kerala region, Thiruvananthapuram.

ORDER

Government had constituted a Committee vide Government Order read as 1st paper above for Estimation of Ground Water Resources of Kerala, as per the Ground Water Estimation Committee 2015 methodology .

The Head of Office, Central Ground Water Board , Kerala region in his letter read as 2nd paper above has requested Government to re-constitute the State Level Committee for Re-estimation of Ground Water Resources as per the Ground Water Estimation Methodology 2015 for the assessment of Ground Water resources as on March 2020.

In the circumstances reported by the Head of Office, Central Ground Water Board, Kerala Region, Government are pleased to reconstitute the State Level Committee for Re-estimation of Ground Water Estimation Methodology 2015 for the assessment of groundwater resources as on March 2020 with the following members.

The Additional Chief Secretary, Water Resources Department	Chairman
The Director, Ground Water Deparatment	Member
The Director, Agriculture Department	Member
The Managing Director, Kerala Water Authority	Member
The Chief Engineer, Irrigation & Administration	Member

File No.GW1/208/2020-WRD

The Director, Department of Industry & 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 : 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)
T K JOSE
ADDITIONAL CHIEF SECRETARY

To: The Additional Chief Secretary, Water Resources Department
The Director, Ground Water Department, Thiruvananthapuram
The Director, Agriculture Department
The Managing Director, Kerala Water Authority
The Chief Engineer, Irrigation & Administration
The General Manager, NABARD, Thiruvananthapuram
The Executive Director, Centre of Water Resources Development and Management
The Regional Director, Central Ground Water Board, Thiruvananthapuram
I&PRD
Stock file/Office Copy.

Forwarded /By order
Section Officer

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

/2021 File No.GW1/124/2021-WRD 16

MINUTES OF THE SECOND STATE LEVEL MEETING ON RE-ESTIMATION OF GROUND WATER RESOURCES OF KERALA STATE AS ON MARCH 2020

The Second State Level Meeting on Re-estimation of Ground Water Resources of Kerala State was held through VC on 26.07.2021 under the Chairmanship of Shi.Pranabjyoti Nath IAS, l Secretary, Water Resources Department and Chairman of Ground Water Re-Estimation Committee at 3 p.m. The following members attended the meeting:

1.	**Shi.Venkatesapathy S, IAS, Managing Director, KWA & Director, GWD**	**Member**
2.	**Dr.A.Subburaj, Regional Director, CGWB**	**Member Secretary**
3.	**Shi.Alex Varghese, Chief Engineer, Irrigation & Administration**	**Member**
4.	**Smt.Ancy Joseph, Superintending Hydrogeologist (General), Ground Water Department**	**Member**
5.	**Shi.Sanjeev Gopalakrishna, Jt.Director of Agriculture (Water Management), Agriculture Department**	**Member**
6.	**Shi.K.Subrahmanyam, AGM (EPD Section), NABARD, Thiruvananthapuram**	**Member**
7.	**Dr. Manoj Samuel, Executive Director, CWRDM**	**Member**
8.	**Dr. Priju, Scientist, CWRDM**	**Invitee**

At the outset, the Chairman welcomed the members and appreciated CGWB for completion of re-assessment of ground water resource as on March 2020. Then Chairman invited the Regional Director, CGWB to deliver a presentation on Ground Water Resources of Kerala State. Dr.A.Subburaj, Regional Director, CGWB, Kerala Region briefed the methodology adopted for estimation of ground water resources in the State of Kerala and appraised the status of ground water resource in Kerala as per the last assessment carried out during 2020. The details of deliberations during the meeting is given below:

- Chairman raised a query regarding the decrease in Annual Extractable Ground Water Resource by 92.17 MCM. Regional Director, CGWB explained the reasons attributing to the new norms included in new methodology (GEC-2015) regarding rainfall recharge estimation. As the new methodology incorporated minimum and maximum threshold limit for rainfall and 10% reduction in the rainfall made for recharge estimation as per the new norms resulted in the decrease of Total Annual Extractable Ground Water Resource. Moreover, the Regional Director pointed out that micro-level aquifer mapping studies carried out under NAQUIM programme brought a clear picture about the aquifer disposition in terms of vertical as well as lateral extent. And the monitoring wells

inventoried during the study provided a detailed insight on Ground Water scenario of various administrative units which refined the existing database.

- An explanation for the decrease in Ground Water extraction by 26.19 MCM was sought by the Chairman and Managing Director, KWA. Regional Director, CGWB explained this reduction in ground water extraction can be due to the increase in surface water supply schemes implemented in the state by KWA and other agencies.
- Managing Director, KWA and Director, Ground Water Department opined that the sample size considered for estimation has to be escalated in the next estimation. Regional Director accepted the suggestion and intimated the valuable outputs of NAQUIM studies will resolve the highlighted item.
- Chairman appreciated the efforts of CGWB in Re-assessment of Ground Water Resources and opined that inferences should be detailed on the report which will be a path-finder for policy-makers. He urged the need for more management measures in critical and semi-critical blocks of the State so as to improve the groundwater scenario of these blocks and ensure the advance of State's ranking in national level.
- Executive Engineer, CWRDM raised queries whether effect of recent flood in Kerala and its efforts on GW scenario has been considered during assessment. Regional Director, CGWB responded that control points were less in those basins to integrate that factor.

Finally, the assessment of dynamic Ground Water Resources of Kerala as on 31.03.2020 was approved by the committee and Chairman directed Regional Director, CGWB to share the presentation with all other committee members.

The meeting ended with thanks to the Chair.

ANNEXURE IIIA: GENERAL DESCRIPTION OF GROUND WATER ASSESSMENT UNITS

State			**KERALA**							
District			**ALAPPUZHA**							
Assessment Year			**2020**							
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			**2020**							
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			**2020**								
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			**2020**							
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			**2020**							
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			**2020**							
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			**2020**							
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			**2020**							
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			**2020**							
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			**2020**							
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			**2020**							
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			**2020**							
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			**2020**							
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			**2020**							
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 (2020)

State		**KERALA**				
District		**ALAPPUZHA**				
Assessment Year		**2020**				
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	2805.64	2.53	1.58	0.95
2	Aryad	Non-Command	2805.64	1.73	0.88	0.85
3	Bharanikkavu	Non-Command	2805.64	7.53	6.98	0.55
4	Champakkulam	Non-Command	2805.64	1.65	0.83	0.82
5	Chengannur	Non-Command	2805.64	4.94	3.72	1.22
6	Harippad	Non-Command	2805.64	1.81	0.93	0.88
7	Kanjikkuzhy	Non-Command	2805.64	1.45	0.91	0.55
8	Mavelikkara	Non-Command	2805.64	3.43	2.15	1.29
9	Muthukulam	Non-Command	2805.64	2.62	1.60	1.03
10	Pattanakkad	Non-Command	2805.64	2.04	1.23	0.81
11	Thycattussery	Non-Command	2805.64	2.37	1.39	0.98
12	Veliyanad	Non-Command	2805.64	1.01	0.98	0.03
Total		**Non-Command**	**2805.64**	**2.76**	**1.93**	**0.83**

State		**KERALA**				
District		**ERNAKULAM**				
Assessment Year		**2020**				
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	2990.37	2.71	1.68	1.03
2	Angamaly	Non-Command	2990.37	6.73	6.16	0.57
3	Edappally	Non-Command	2990.37	1.64	1.20	0.44
4	Koovappady	Non-Command	2990.37	6.16	4.68	1.48
5	Kothamangalam	Non-Command	2990.37	4.44	3.19	1.25
6	Moovattupuzha	Non-Command	2990.37	5.81	4.71	1.10
7	Mulamthuruthy	Non-Command	2990.37	6.28	4.83	1.45
8	Palluruthy	Non-Command	2990.37	1.31	0.79	0.51
9	Pampakkuda	Non-Command	2990.37	6.79	5.11	1.68
10	Parakkadavu	Non-Command	2990.37	6.18	5.41	0.76
11	Paravoor	Non-Command	2990.37	1.58	1.13	0.45
12	Vadavukodu	Non-Command	2990.37	5.51	4.56	0.95
13	Vazhakkulam	Non-Command	2990.37	9.27	7.15	2.12
14	Vypeen	Non-Command	2990.37	1.16	0.79	0.37
Total		**Non-Command**	**2990.37**	**4.68**	**3.67**	**1.01**

State		**KERALA**				
District		**IDUKKI**				
Assessment Year		**2020**				
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	3642.01	7.02	5.87	1.15
2	Arudai	Non-Command	3642.01	4.71	3.36	1.35
3	Devikulam	Non-Command	3642.01	2.77	1.83	0.93
4	Elam Desom	Non-Command	3642.01	4.48	3.41	1.07
5	Idukki	Non-Command	3642.01	4.65	3.71	0.94
6	Kattappana	Non-Command	3642.01	4.88	4.65	0.23
7	Nedumkandam	Non-Command	3642.01	5.29	4.68	0.61
8	Thodupuzha	Non-Command	3642.01	3.92	3.22	0.70
TOTAL		**Non-Command**	**3642.01**	**4.72**	**3.84**	**0.87**

State		**KERALA**				
District		**KANNUR**				
Assessment Year		**2020**				
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	3299.73	9.75	7.67	2.08
2	Irikkur	Non-Command	3299.73	7.72	6.37	1.36
3	Iritty	Non-Command	3299.73	6.49	5.57	0.93
4	Kallyasseri	Non-Command	3299.73	7.52	5.91	1.61
5	Kannur	Non-Command	3299.73	9.06	7.91	1.15
6	Kuthuparamba	Non-Command	3299.73	7.15	5.60	1.55
7	Panur	Non-Command	3299.73	6.37	5.59	0.79
8	Payyannur	Non-Command	3299.73	8.58	7.01	1.57
9	Peravoor	Non-Command	3299.73	6.23	5.21	1.02
10	Taliparamba	Non-Command	3299.73	11.13	9.14	1.98
11	Thalassery	Non-Command	3299.73	6.65	5.25	1.41
Total		**Non-Command**	**3299.73**	**7.88**	**6.47**	**1.40**

State		**KERALA**				
District		**KASARGOD**				
Assessment Year		**2020**				
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	3592.61	9.77	7.04	2.72
2	Karadka	Non-Command	3592.61	12.64	11.16	1.48
3	Kasaragod	Non-Command	3592.61	13.22	11.02	2.20
4	Manjeswar	Non-Command	3592.61	11.31	8.61	2.70
5	Nileswaram	Non-Command	3592.61	7.49	5.58	1.91
6	Parappa	Non-Command	3592.61	9.16	8.14	1.03
Total		**Non-Command**	**3592.61**	**10.60**	**8.59**	**2.01**

State		**KERALA**				
District		**KOLLAM**				
Assessment Year		**2020**				
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	2417.69	7.88	5.79	2.09
2	Chadayamangalam	Non-Command	2417.69	7.96	6.63	1.33
3	Chavara	Non-Command	2417.69	2.21	1.23	0.97
4	Chittumala	Non-Command	2417.69	11.50	8.76	2.74
5	Ithikkara	Non-Command	2417.69	10.62	8.72	1.90
6	Kottarakkara	Non-Command	2417.69	9.63	6.82	2.80
7	Mukhathala	Non-Command	2417.69	7.31	5.97	1.33
8	Oachira	Non-Command	2417.69	3.76	2.47	1.29
9	Pathanapuram	Non-Command	2417.69	8.33	6.23	2.10
10	Sasthamkotta	Non-Command	2417.69	8.43	6.67	1.76
11	Vettikkavala	Non-Command	2417.69	6.83	4.92	1.91
Total		**Non-Command**	**2417.69**	**7.68**	**5.84**	**1.84**

State		**KERALA**				
District		**KOTTAYAM**				
Assessment Year		**2020**				
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	2875.89	3.54	2.71	0.83
2	Ettumanoor	Non-Command	2875.89	3.49	2.48	1.02
3	Kaduthuruthy	Non-Command	2875.89	3.90	3.72	0.18
4	Kanjirappally	Non-Command	2875.89	5.64	4.37	1.28
5	Lalam	Non-Command	2875.89	6.55	4.76	1.79
6	Madappally	Non-Command	2875.89	8.37	6.89	1.49
7	Pallom	Non-Command	2875.89	6.71	4.85	1.86
8	Pampady	Non-Command	2875.89	5.69	4.89	0.80
9	Uzhavoor	Non-Command	2875.89	4.29	2.85	1.44
10	Vaikom	Non-Command	2875.89	2.16	1.66	0.50
11	Vazhoor	Non-Command	2875.89	5.99	5.15	0.84
Total		**Non-Command**	**2875.89**	**5.12**	**4.03**	**1.09**

State		**KERALA**				
District		**KOZHIKODE**				
Assessment Year		**2020**				
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	3382.46	4.47	3.63	0.84
2	Chelannur	Non-Command	3382.46	4.60	3.07	1.54
3	Koduvally	Non-Command	3382.46	3.58	2.50	1.08
4	Kozhikode	Non-Command	3382.46	4.67	3.29	1.39
5	Kunnamangalam	Non-Command	3382.46	7.16	5.54	1.62
6	Kunnummal	Non-Command	3382.46	4.85	2.57	2.28
7	Melady	Non-Command	3382.46	4.86	1.71	3.15
8	Panthalayani	Non-Command	3382.46	4.63	2.96	1.66
9	Perambra	Non-Command	3382.46	5.65	4.98	0.67
10	Thodannur	Non-Command	3382.46	5.21	4.27	0.94
11	Tuneri	Non-Command	3382.46	7.44	5.62	1.82
12	Vadakara	Non-Command	3382.46	5.34	3.77	1.57
Total		**Non-Command**	**3382.46**	**5.21**	**3.66**	**1.55**

State		**KERALA**				
District		**MALAPPURAM**				
Assessment Year		**2020**				
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	2802.79	9.82	8.07	1.75
2	Kalikavu	Non-Command	2802.79	6.11	4.12	1.99
3	Kondotty	Non-Command	2802.79	6.99	4.41	2.58
4	Kuttippuram	Non-Command	2802.79	8.53	7.61	0.92
5	Malappuram	Non-Command	2802.79	7.19	5.87	1.32
6	Mankada	Non-Command	2802.79	8.29	5.82	2.47
7	Nilamboor	Non-Command	2802.79	5.83	4.12	1.70
8	Perinthalmanna	Non-Command	2802.79	7.24	5.70	1.54
9	Perumpadappu	Non-Command	2802.79	6.95	4.65	2.31
10	Ponnani	Non-Command	2802.79	8.06	5.69	2.38
11	Tanur	Non-Command	2802.79	6.17	4.63	1.54
12	Tirurangadi	Non-Command	2802.79	7.24	6.34	0.90
13	Tirur	Non-Command	2802.79	5.55	4.29	1.25
14	Vengara	Non-Command	2802.79	11.46	8.76	2.70
15	Wandoor	Non-Command	2802.79	7.28	5.96	1.32
Total		**Non-Command**	**2802.79**	**7.51**	**5.74**	**1.78**

State		**KERALA**				
District		**PALAKKAD**				
Assessment Year		**2020**				
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	2187.33	5.15	3.63	1.52
2	Attappadi	Non-Command	2187.33	6.53	6.05	0.48
3	Chittur	Non-Command	2187.33	6.78	5.35	1.42
4	Kollengode	Non-Command	2187.33	6.49	3.97	2.52
5	Kuzhalmannam	Non-Command	2187.33	5.32	3.62	1.70
6	Malampuzha	Non-Command	2187.33	5.66	3.92	1.75
7	Mannarkkad	Non-Command	2187.33	6.50	4.64	1.86
8	Nenmara	Non-Command	2187.33	5.61	3.40	2.20
9	Ottappalam	Non-Command	2187.33	8.50	6.37	2.13
10	Palakkad	Non-Command	2187.33	5.80	3.77	2.03
11	Pattambi	Non-Command	2187.33	7.97	5.78	2.19
12	Sreekrishnapuram	Non-Command	2187.33	8.10	6.78	1.32
13	Thrithala	Non-Command	2187.33	8.66	7.07	1.59
	Total	**Non-Command**	**2187.33**	5.15	3.63	1.52

State		**KERALA**				
District		**PATHANAMTHITTA**				
Assessment Year		**2020**				
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	2780.03	4.87	3.92	0.95
2	Koipuram	Non-Command	2780.03	7.21	6.24	0.97
3	Konni	Non-Command	2780.03	5.91	5.67	0.23
4	Mallappally	Non-Command	2780.03	5.23	5.18	0.05
5	Pandalam	Non-Command	2780.03	5.63	4.79	0.85
6	Parakode	Non-Command	2780.03	7.34	5.70	1.63
7	Pulikeezh	Non-Command	2780.03	4.12	3.08	1.04
8	Ranni	Non-Command	2780.03	4.91	4.28	0.63
Total		**Non-Command**	**2780.03**	**5.65**	**4.86**	**0.79**

State		**KERALA**				
District		**THIRUVANANTHAPURAM**				
Assessment Year		**2020**				
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	1818.94	12.24	9.20	3.03
2	Chirayinkil	Non-Command	1818.94	7.43	5.45	1.99
3	Kilimanoor	Non-Command	1818.94	9.14	7.80	1.34
4	Nedumangad	Non-Command	1818.94	6.54	4.93	1.61
5	Nemom	Non-Command	1818.94	8.68	6.90	1.78
6	Parassala	Non-Command	1818.94	11.22	9.58	1.64
7	Perumkadavila	Non-Command	1818.94	6.81	6.12	0.69
8	Pothencode	Non-Command	1818.94	9.69	7.98	1.71
9	Vamanapuram	Non-Command	1818.94	7.24	4.67	2.57
10	Varkala	Non-Command	1818.94	14.78	13.67	1.11
11	Vellanad	Non-Command	1818.94	7.10	5.49	1.62
TOTAL		**Non-Command**	**1818.94**	**9.17**	**7.44**	**1.74**

State		**KERALA**				
District		**THRISSUR**				
Assessment Year		**2020**				
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	3176.64	6.42	4.54	1.88
2	Chalakkudy	Non-Command	3176.64	5.67	5.43	0.24
3	Chavakkad	Non-Command	3176.64	4.32	2.57	1.75
4	Cherpu	Non-Command	3176.64	10.40	7.80	2.61
5	Chowannur	Non-Command	3176.64	9.14	7.36	1.79
6	Irinjalakkuda	Non-Command	3176.64	7.61	6.08	1.54
7	Kodakara	Non-Command	3176.64	6.61	5.29	1.32
8	Mala	Non-Command	3176.64	8.62	6.38	2.24
9	Mathilakom	Non-Command	3176.64	2.28	1.27	1.01
10	Mullassery	Non-Command	3176.64	3.58	0.79	2.79
11	Ollukkara	Non-Command	3176.64	6.60	5.17	1.43
12	Pazhayannur	Non-Command	3176.64	5.42	4.30	1.12
13	Puzhakkal	Non-Command	3176.64	10.36	9.02	1.34
14	Thalikkulam	Non-Command	3176.64	3.82	2.37	1.45
15	Vadakkancherry	Non-Command	3176.64	8.09	5.08	3.01
16	Vellangallur	Non-Command	3176.64	5.57	5.02	0.55
TOTAL		**Non-Command**	**3176.6**	**6.53**	**4.90**	**1.63**

State		**KERALA**				
District		**WAYANAD**				
Assessment Year		**2020**				
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	3149.6	7.68	6.31	1.37
2	Mananthavady	Non-Command	3149.6	5.64	5.55	0.09
3	Panamaram	Non-Command	3149.6	8.34	5.97	2.38
4	Sulthanbathery	Non-Command	3149.6	7.97	5.46	2.51
Total		**Non-Command**	**3149.6**	**7.41**	**5.82**	**1.59**

ANNEXURE III B (Contd.): DATA VARIABLES USED IN THE ASSESSMENT OF DYNAMIC GROUND WATER RESOURCES OF KERALA (2020

District		**ALAPPUZHA**				
Assessment Year		**2020**				
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	6130		
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	8543		
4	Champakkulam	Non-Command	DW	102		
			DW with pump	21		
			STW/BW	26		
			*Others	5671		
5	Chengannur	Non-Command	DW	256		
			DW with pump	1392		
			STW	38		
			*Others	8925		
6	Harippad	Non-Command	DW	295		
			DW with pump	825		
			STW	355		
			*Others	8313		
7	Kanjikkuzhy	Non-Command	DW	12		
			DW with pump	130		

District		**ALAPPUZHA**				
Assessment Year		**2020**				
Sl. No.	**Assessment Unit**	**Sub-unit (Command / Non-Command/ Poor Quality)**	**Type of Structure**	**No. of Structures**		
				Irrigation	**Domestic**	**Industrial**
			STW	154		
			*Others	7777		
8	Mavelikkara	Non-Command	DW	362		
			DW with pump	185		
			STW	118		
			*Others	7976		
9	Muthukulam	Non-Command	DW	72		
			DW with pump	358		
			STW	292		
			*Others	8190		
10	Pattanakkad	Non-Command	DW	15		
			DW with pump	68		
			STW	125		
			*Others	9609		
11	Thycattussery	Non-Command	DW	29		
			DW with pump	159		
			STW	80		
			*Others	4713		
12	Veliyanad	Non-Command	DW	21		
			DW with pump	235		
			STW	10		
			*Others	2061		
			STW: Shallow tube wells and bore wells * Others: Irrigation through domestic wells			

District		**ERNAKULAM**				
Assessment Year		**2020**				
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		

District		**ERNAKULAM**				
Assessment Year		**2020**				
Sl. No.	**Assessment Unit**	**Sub-unit (Command/ non-Command /**	**Type of Structure**	**No. of Structures**		
				Irrigation	**Domestic**	**Industrial**
10	Parakkadavu	Non - Command	DW	0		
			DW with pump	1980		
			STW	109		
			*Others	7321		
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		**2020**				
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)	8755		
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)	9340		
7	Nedumkandam	Non-command	DW	198		
			DW with pump	690		
			STW	1855		

District		**IDUKKI**				
Assessment Year		**2020**				
Sl. No.	**Assessment Unit**	**Sub-unit (Command/ non-Command/ poor quality)**		**No. of Structures**		
			Type of Structure	**Irrigation**	**Domestic**	**Industrial**
			Others (pl. specify)	8159		
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		2020				
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)	5017		
2	Irikkur	Non-command	DW	62		
			DW with pump	985		
			STW	290		
			Others (pl. specify)	12005		
3	Iritty	Non-command	DW	112		
			DW with pump	1320		
			STW	9		
			Others (pl. specify)	14688		
4	Kallyasseri	Non-command	DW	25		
			DW with pump	1100		
			STW	118		
			Others (pl. specify)	10251		
4	Kannur	Non-command	DW	26		
			DW with pump	2836		
			STW	80		
			Others (pl. specify)	16676		
5	Kuthuparamba	Non-command	DW	48		
			DW with pump	955		
			STW	136		
			Others (pl. specify)	8286		
6	Panur	Non-command	DW	20		
			DW with pump	764		

District		**KANNUR**				
Assessment Year		**2020**				
Sl. No.	**Assessment Unit**	**Sub-unit (Command/ non-Command/ poor quality)**		**No.of Structures**		
			Type of Structure	**Irrigation**	**Domestic**	**Industrial**
			STW	98		
			Others (pl. specify)	6843		
6	Payyannur	Non-command	DW	48		
			DW with pump	698		
			STW	262		
			Others (pl. specify)	7060		
7	Peravoor	Non-command	DW	96		
			DW with pump	1200		
			STW	119		
			Others (pl. specify)	8464		
8	Taliparamba	Non-command	DW	28		
			DW with pump	658		
			STW	201		
			Others (pl. specify)	16825		
9	Thalassery	Non-command	DW	18		
			DW with pump	674		
			STW	31		
			Others (pl. specify)	6282		
			STW: Shallow tube wells and bore wells * Others: Irrigation through domestic wells			

District		**KASARGOD**				
Assessment Year		**2020**				
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)	7573		
2	Karadka	Non-command	DW	725		
			DW with pump	7750		
			STW	397		
			*Others (pl. specify)	6507		
3	Kasaragod	Non-command	DW	552		
			DW with pump	4802		
			STW	541		
			Others (pl. specify)	8307		
4	Manjeswar	Non-command	DW	1145		
			DW with pump	6325		
			STW	309		
			Others (pl. specify)	7474		
5	Nileswaram	Non-command	DW	79		
			DW with pump	1895		
			STW	321		
			Others (pl. specify)	7539		
6	Parappa	Non-command	DW	345		
			DW with pump	6485		
			STW	361		
			Others (pl. specify)	8610		
			STW: Shallow tube wells and bore wells * Others: Irrigation through domestic wells			

District		**KOLLAM**				
Assessment Year		**2020**				
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	417		

District		**KOLLAM**				
Assessment Year		**2020**				
Sl. No.	**Assessment Unit**	**Sub-unit (Command/ non-Command/ poor quality)**		**No. of Structures**		
			Structure	**Irrigation**	**Domestic**	**Industrial**
			pump			
			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		**2020**				
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	346		

District		**KOTTAYAM**				
Assessment Year		**2020**				
Sl. No.	**Assessment Unit**	**Sub-unit (Command/ non-Command/ poor quality)**		**No.of Structures**		
			Type of Structure	**Irrigation**	**Domestic**	**Industrial**
			pump			
			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		**2020**				
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)	9160		
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		

District		**KOZHIKODE**				
Assessment Year		**2020**				
Sl. No.	**Assessment Unit**	**Sub-unit (Command/ non-Command/ poor quality)**		**No. of Structures**		
			Structure	**Irrigation**	**Domestic**	**Industrial**
			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		**2020**				
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		

District		MALAPPURAM				
Assessment Year		2020				
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Type of Structure	No .of Structures		
				Irrigation	Domestic	Industrial
			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		

District		**MALAPPURAM**				
Assessment Year		**2020**				
Sl. No.	**Assessment Unit**	**Sub-unit (Command/ non-Command/ poor quality)**	**Type of Structure**	**No .of Structures**		
				Irrigation	**Domestic**	**Industrial**
			DW with pump	765		
			STW	0		
			Others (pl. specify)	7397		
15	Wandoor	Non-command	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		**2020**				
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)	12687		
2	Attappadi	Non-command	DW	2		
			DW with pump	1837		
			STW	78		
			Others (pl. specify)	992		
3	Chittur	Non-command	DW	85		
			DW with pump	1144		
			STW	4523		
			Others (pl. specify)	10722		
4	Kollengode	Non-command	DW	0		
			DW with pump	2810		
			STW	307		
			Others (pl. specify)	7512		
5	Kuzhalmannam	Non-command	DW	40		
			DW with pump	1597		
			STW	144		
			Others (pl. specify)	8414		
6	Malampuzha	Non-command	DW	60		
			DW with pump	378		
			STW	1144		
			Others (pl. specify)	8701		
7	Mannarkkad	Non-command	DW	5		
			DW with	1002		

District		PALAKKAD				
Assessment Year		2020				
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)		No .of Structures		
			Type of Structure	Irrigation	Domestic	Industrial
			pump			
			STW	88		
			Others (pl. specify)	12254		
8	Nenmara	Non-command	DW	20		
			DW with pump	2701		
			STW	139		
			Others (pl. specify)	8065		
9	Ottappalam	Non-command	DW	198		
			DW with pump	1788		
			STW	51		
			Others (pl. specify)	9014		
10	Palakkad	Non-command	DW	0		
			DW with pump	1541		
			STW	96		
			Others (pl. specify)	9001		
11	Pattambi	Non-command	DW	0		
			DW with pump	4322		
			STW	126		
			Others (pl. specify)	10728		
12	Sreekrishna puram	Non-command	DW	0		
			DW with pump	1692		
			STW	53		
			Others (pl. specify)	8447		
13	Thrithala	Non-command	DW	0		
			DW with pump	1138		
			STW	107		
			Others (pl.	9130		

District		**PALAKKAD**				
Assessment Year		**2020**				
Sl. No.	**Assessment Unit**	**Sub-unit (Command/ non-Command/ poor quality)**		**No .of Structures**		
			Type of Structure	**Irrigation**	**Domestic**	**Industrial**
			specify)			
			STW: Shallow tube wells and bore wells, * Others: Irrigation through domestic wells			

District		**PATHANAMTHITTA**				
Assessment Year		**2020**				
Sl. No.	**Assessment Unit**	**Sub-unit (Command/ non-Command/ poor quality)**		**No.of Structures**		
			Type of Structure	**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	474		

District		**PATHANAMTHITTA**				
Assessment Year		**2020**				
Sl. No.	**Assessment Unit**	**Sub-unit (Command/ non-Command/ poor quality)**		**No.of Structures**		
			Type of Structure	**Irrigation**	**Domestic**	**Industrial**
			pump			
			STW	55		
			Others (pl. specify)	5400		
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		**2020**				
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		

District		**THIRUVANANTHAPURAM**				
Assessment Year		**2020**				
Sl. No.	**Assessment Unit**	**Sub-unit (Command/ non-Command/ poor quality)**	**Type of Structure**	**No.of Structures**		
				Irrigation	**Domestic**	**Industrial**
			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		**2020**				
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		

District		THRISSUR				
Assessment Year		2020				
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Structure	No.of Structures		
				Irrigation	Domestic	Industrial
			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		
15	Thalikkulam	Non-command	DW	0		
			DW with	1825		

District		**THRISSUR**				
Assessment Year		**2020**				
Sl. No.	**Assessment Unit**	**Sub-unit (Command/ non-Command/ poor quality)**	**Structure**	**No.of Structures**		
				Irrigation	**Domestic**	**Industrial**
			pump			
			STW	1010		
			Others (pl. specify)	10051		
16	Vadakkanchery	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		**2020**				
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 (2020)

State		**KERALA**										
District		**ALAPPUZHA**										
Assessment Year		**2020**										
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	0.00002 - 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	0
							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			0.000	0.00005
							DW	0.1	0.4				

State		KERALA										
District		ALAPPUZHA										
Assessment Year		2020										
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
					m		with pump					5
							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			
5	Chengannur	Non-Command	Alluvium	0.15	Alluvium	0.1	DW	0.012	0.048			0.75 / 0.75
							DW with pump	0.1	0.4			
							STW	0.03	0.12			
							Others (pl.		0.008			

State		KERALA											
District		ALAPPUZHA											
Assessment Year		2020											
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-mon
							specify)						
6	Harippad	Non-Command	Alluvium	0.16	Alluvium	0.1	DW	0.016	0.064			0.00002 - 41.18	0.00002 - 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	0.00002
							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				

State		KERALA											
District		ALAPPUZHA											
Assessment Year		2020											
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-mon
							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 - 49.235	0.0005 - 49.235
							DW with pump	0.08	0.32				
							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	Thycattu	Non-	Alluvium	0.16		0.1	DW	0.012	0.048			0.4	0.45

State		**KERALA**											
District		**ALAPPUZHA**											
Assessment Year		**2020**											
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**
	ssery	Command			Alluvium		DW with pump	0.06	0.24			5	
							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				
							* Others: Irrigation through domestic wells						
							STW: Shallow Tube wells and Bore wells						

State		**KERALA**											
District		**ERNAKULAM**											
Assessment Year		**2020**											
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			0.0092 to 23.018	0.0092 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			0.002 to 5.444	0.002 to 5.444
							DW with pump	0.08	0.32				
							STW	0.08	0.32				

State		**KERALA**										
District		**ERNAKULAM**										
Assessment Year		**2020**										
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				
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				
							Others (pl. specify)		0.03				
5	Kothamangalam	Non - Command	Laterite	0.04	Laterite	0.07	DW	0.012	0.048			0.004 to 1.2	0.004 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			0.0113 to 4.17	0.0113 to 4.17

State		**KERALA**											
District		**ERNAKULAM**											
Assessment Year		**2020**											
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			4.17	
							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			5.119	5.119
							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 4.639	0.005 to 4.639
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							Others (pl. specify)		0.02				

State		**KERALA**											
District		**ERNAKULAM**											
Assessment Year		**2020**											
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**
9	Pampakkuda	Non - Command	Laterite	0.04	Laterite	0.07	DW	0.012	0.048			0.0012 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		**2020**										
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				
12	Vadavukodu	Non - Command	Laterite	0.047	Laterite	0.075	DW	0.012	0.048			0.0042 to 1.905	0.0042 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			0.0015 to 3.255	0.0015 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

State		**KERALA**											
District		**ERNAKULAM**											
Assessment Year		**2020**											
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	0.08	0.32				
							Others (pl. specify)		0.007				
							* Others: Irrigation through domestic wells						
							STW: Shallow Tube wells and Bore wells						

State		**KERALA**											
District		**IDUKKI**											
Assessment Year		**2020**											
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	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 3.04	0.0006 to 3.04
							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				

State		KERALA										
District		IDUKKI										
Assessment Year		2020										
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)		0.01				
4	Elam Desom	Non-command	Crysttalline	0.019	Crysttalline	0.08	DW	0.012	0.048			0.0006 to 0.54	0.0006 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			0.00035 to 0.18	0.00035 to 0.18
							DW with pump	0.08	0.32				
							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

State		**KERALA**										
District		**IDUKKI**										
Assessment Year		**2020**										
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)		0.008				
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				

State		**KERALA**											
District		**IDUKKI**											
Assessment Year		**2020**											
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: Irrigation through domestic wells						
							STW: Shallow Tube wells and Bore wells						

State		**KERALA**											
District		**KANNUR**											
Assessment Year		**2020**											
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			0.0038	0.0038
							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			0.00325	0.00325
							DW with pump	0.1	0.4				
							STW	0.1	0.4				

State		KERALA											
District		KANNUR											
Assessment Year		2020											
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)		0.032				
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
							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

State		**KERALA**											
District		**KANNUR**											
Assessment Year		**2020**											
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)		0.02				
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	0.0357	Laterite	0.0678	DW	0.016	0.08			0	0
							DW with pump	0.1	0.4				
							STW	0.1	0.4				
							Others (pl.		0.028				

State		**KERALA**											
District		**KANNUR**											
Assessment Year		**2020**											
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)						
9	Peravoor	Non-command	Laterite	0.025	Laterite	0.077	DW	0.016	0.064			0.004	0.004
							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			0.5998	0.5998
							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			0.07 to 2.1	0.07 to 2.1
							DW with pump	0.08	0.3				

State		**KERALA**											
District		**KANNUR**											
Assessment Year		**2020**											
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)		0.02				
							* Others: Irrigation through domestic wells						
							STW: Shallow Tube wells and Bore wells						

State		**KERALA**											
District		**KASARGOD**											
Assessment Year		**2020**											
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				

State		KERALA											
District		KASARGOD											
Assessment Year		2020											
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				
4	Manjeswar	Non-command	Laterite	0.03	Laterite	0.075	DW	0.016	0.064			0.0006 to 0.86	0.0006 to 0.86
							DW with pump	0.1	0.4				
							STW	0.15	0.6				
							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			0.0004 to	0.0004 to

State		**KERALA**										
District		**KASARGOD**										
Assessment Year		**2020**										
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	0.35			0.855	0.855
							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		**2020**											
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			0.00105 to 0.608	0.00105 to 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 to 0.435	0.001 to 0.436
							DW with pump	0.06	0.3				
							STW	0.1	0.38				

State		**KERALA**											
District		**KOLLAM**											
Assessment Year		**2020**											
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				
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. specify)		0.02				
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			0.0015 to 0.69	0.0015 to 0.69

State		**KERALA**											
District		**KOLLAM**											
Assessment Year		**2020**											
Sl. No.	**Assessment Unit**	**Sub-unit (Commanded/ 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	0.08	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			0.001 to 0.045	0.001 to 0.045
							DW with pump	0.05	0.24				
							STW	0.05	0.2				
							Others (pl. specify)		0.02				

State		**KERALA**											
District		**KOLLAM**											
Assessment Year		**2020**											
Sl. No.	**Assessment Unit**	**Sub-unit (Commad/ 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
9	Pathanapuram	Non-command	Laterite	0.025	Laterite	0.07	DW	0.012	0.04			0.001 to 0.225	0.001 to 0.225
							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	0.025	Laterite	0.06	DW	0.012	0.04			0.0015 to 0.09	0.0015 to 0.09
							DW with pump	0.06	0.32				
							STW	0.06	0.24				

State		**KERALA**											
District		**KOLLAM**											
Assessment Year		**2020**											
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						

State		**KERALA**											
District		**KOTTAYAM**											
Assessment Year		**2020**											
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		0.072	0.072
							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			0.0192	0.0192
							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				

State		KERALA										
District		KOTTAYAM										
Assessment Year		2020										
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)		0.0175				
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			0.024	0.024
							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			0.072	0.072
							DW with pump	0.08	0.32				

State		KERALA										
District		KOTTAYAM										
Assessment Year		2020										
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)		0.026				
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

State		**KERALA**										
District		**KOTTAYAM**										
Assessment Year		**2020**										
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)		0.0485				
10	Vaikom	Non-command	Alluvial	0.12	Alluvial	0.09	DW	0.012	0.048			0.0168	0.0168
							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			0.2976	0.2976
							DW with pump	0.08	0.32				
							STW	0.06	0.24				
							Others (pl. specify)		0.027				
							* Others: Irrigation through domestic wells						

State		**KERALA**										
District		**KOTTAYAM**										
Assessment Year		**2020**										
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		**MALAPPURAM**										
Assessment Year		**2020**										
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		0.00198	0.00198
							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			0.0006	0.0006
							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				

State		**KERALA**										
District		**MALAPPURAM**										
Assessment Year		**2020**										
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)		0.022				
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				
							Others (pl. specify)		0.015				
6	Mankada	Non-command	Laterite	0.04	Laterite	0.07	DW	0.012	0.048			0	0
							DW with	0.08	0.32				

State		**KERALA**										
District		**MALAPPURAM**										
Assessment Year		**2020**										
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
							pump						
							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	Perumpadapp	Non-	Alluvial	0.16	Alluvial	0.1	DW	0.01	0.04			0.008	0.008

State		**KERALA**										
District		**MALAPPURAM**										
Assessment Year		**2020**										
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
	u	command						2	8				
							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			0.0008	0.0008
							DW with pump	0.08	0.32				
							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			0.0029	0.0029
							DW with pump	0.08	0.32				
							STW	0.08	0.32				

State		**KERALA**										
District		**MALAPPURAM**										
Assessment Year		**2020**										
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)		0.025				
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			0.0008	0.0008
							DW with	0.08	0.32				

State		**KERALA**											
District		**MALAPPURAM**											
Assessment Year		**2020**											
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
							pump						
							STW	0.2	0.8				
							Others (pl. specify)		0.028				
15	Wandoor	Non-command	Laterite	0.025	Laterite	0.08	DW	0.024	0.096			0.0011	0.0011
							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		2020											
Sl. No.	Assessment Unit	Sub-unit (Commanded/ 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 Crystal lines	0.06	DW	0.012	0.048	Computed on the basis of projected population, per capita requirement & fractional load on ground water		0.03	0.03
							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 Crystal lines	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 Crystal lines	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-	Weather	0.03	Weath	0.08	DW	0.024	0.09			0.004	0.004

State		KERALA										
District		PALAKKAD										
Assessment Year		2020										
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	ed Crystallines		ered Crystal lines				6			to 0.85	to 0.85
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							Others (pl. specify)	0	0.015				
5	Kuzhalmannam	Non-command	Weathered Crystallines	0.025	Weathered Crystal lines	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	Crystal line	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	0.025	Weathered	0.06	DW	0.012	0.048			0.0025 to	0.0025 to

State		**KERALA**										
District		**PALAKKAD**										
Assessment Year		**2020**										
Sl. No.	**Assessment Unit**	**Sub-unit (Commad/ 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**
			Crystallines		Crystal lines		DW with pump	0.08	0.32		1.175	1.175
							STW	0.2	0.8			
							Others (pl. specify)	0	0.024			
8	Nenmara	Non-command	Weathered Crystallines	0.025	Weathered Crystal lines	0.06	DW	0.012	0.048		0	0
							DW with pump	0.08	0.32			
							STW	0.2	0.8			
							Others (pl. specify)	0	0.014			
9	Ottappalam	Non-command	Weathered Crystallines	0.025	Weathered Crystal lines	0.07	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			
10	Palakkad	Non-command	Laterite	0.025	Laterite	0.07	DW	0.024	0.096		7.3	7.3

State		KERALA										
District		PALAKKAD										
Assessment Year		2020										
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	0.2	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				
							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			0.0075	0.0075

State		**KERALA**											
District		**PALAKKAD**											
Assessment Year		**2020**											
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	0.2	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		2020											
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			0.0015	0.0015
							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.		0.015				

State		KERALA										
District		PATHANAMTHITTA										
Assessment Year		2020										
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
							specify)						
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				
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				

State		KERALA										
District		PATHANAMTHITTA										
Assessment Year		2020										
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 (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				
							* Others: Irrigation through domestic wells						
							STW: Shallow Tube wells and Bore wells						

State		**KERALA**										
District		**THIRUVANANTHAPURAM**										
Assessment Year		**2020**										
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 0.016	0.00015 to 0.016
							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				

State		**KERALA**										
District		**THIRUVANANTHAPURAM**										
Assessment Year		**2020**										
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 (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				
5	Nemom	Non-command	Laterite	0.05	Laterite	0.076	DW	0.024	0.096			0.0001 to 0.002	0.0001 to 0.002
							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	0.0015

State		KERALA										
District		THIRUVANANTHAPURAM										
Assessment Year		2020										
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
							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			0.001	0.001
							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		**2020**										
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			0.0006 to 0.003	0.0006 to 0.003
							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				

State		**KERALA**											
District		**THIRUVANANTHAPURAM**											
Assessment Year		**2020**											
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 (pl. specify)		0.018				
							* Others: Irrigation through domestic wells						
							STW: Shallow Tube wells and Bore wells						

State		KERALA										
District		THRISSUR										
Assessment Year		2020										
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		0.972	0.972
							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			0.0015 to 5.4	0.0015 to 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				

State		**KERALA**										
District		**THRISSUR**										
Assessment Year		**2020**										
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)		0.014				
4	Cherpu	Non-command	Weathered Granite	0.05	Weathered Granite	0.068	DW	0.024	0.096			0	0
							DW with pump	0.06	0.24				
							STW	0.06	0.24				
							Others (pl. specify)		0.011				
5	Chowannur	Non-command	Laterite	0.06	Laterite	0.092	DW	0.012	0.048			0.42	0.42
							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

State		**KERALA**										
District		**THRISSUR**										
Assessment Year		**2020**										
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)		0.013				
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	0
							DW with pump	0.05	0.2				
							STW	0.06	0.32				
							Others (pl. specify)		0.015				

State		**KERALA**										
District		**THRISSUR**										
Assessment Year		**2020**										
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**
9	Mathilakom	Non-command	Alluvial	0.14	Alluvial	0.1	DW	0.024	0.096			0	0
							DW with pump	0.06	0.24				
							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	0
							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				

State		KERALA										
District		THRISSUR										
Assessment Year		2020										
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				
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			5.4	5.4
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.02				
14	Thalikkulam	Non-command	Alluvial	0.16	Alluvial	0.104	DW	0.024	0.096			0	0

State		KERALA											
District		THRISSUR											
Assessment Year		2020											
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	0.06	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	Vadakkanchery	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				

State		KERALA											
District		THRISSUR											
Assessment Year		2020											
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: Irrigation through domestic wells						
							STW: Shallow Tube wells and Bore wells						

State		**KERALA**											
District		**WAYANAD**											
Assessment Year		**2020**											
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				

State		**KERALA**										
District		**WAYANAD**										
Assessment Year		**2020**										
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				
4	Sulthan Bathery	Non-command	Weathered Granite	0.031	Weathered Granite	0.08	DW	0.016	0.064			0.001 to 43.2	0.001 to 43.2
							DW with pump	0.08	0.32				
							STW	0.1	0.4				
							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 (2020)

State		**KERALA**							
District		**ALAPPUZHA**							
Assessment Year		**2020**							
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 Recharge [(8)-(9)]**
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1	Ambalappuzha	Non-command	1673.68	0.09	148.05	347.72	2169.54	108.48	2061.06
2	Aryad	Non-command	2047.43	32.06	434.6	153.08	2667.17	133.35	2533.82
3	Bharanikkavu	Non-command	2380.08	146.58	251.31	1096.77	3874.74	193.73	3681.01
4	Champakkulam	Non-command	2497.75	1.08	330.54	1124.77	3954.14	395.41	3558.73
5	Chengannur	Non-command	3593.32	13.54	322.23	581.07	4510.16	225.5	4284.66
6	Harippad	Non-command	2487.78	73.55	245.8	840.45	3647.58	182.38	3465.2
7	Kanjikkuzhy	Non-command	2035.38	0.14	545.63	181.86	2763.01	276.3	2486.71
8	Mavelikkara	Non-command	2784.44	109.12	497.62	449.58	3840.76	384.08	3456.68
9	Muthukulam	Non-command	3229.94	30.21	577.24	191.34	4028.73	402.88	3625.85
10	Pattanakkad	Non-command	2109.33	10.05	538.59	79.03	2737	136.85	2600.15
11	Thycattussery	Non-command	3302.14	12.06	304.24	74.42	3692.86	184.64	3508.22
12	Veliyanad	Non-command	1927.5	0.08	255.08	1683.55	3866.21	386.62	3479.59
	TOTAL (ha.m)	**Non-command**	**30068.77**	**428.56**	**4450.93**	**6803.64**	**41751.90**	**3010.22**	**38741.68**
	TOTAL (MCM)	**Non-command**	**300.69**	**4.29**	**44.51**	**68.04**	**417.52**	**30.10**	**387.42**

State		**KERALA**							
District		**ERNAKULAM**							
Assessment Year		**2020**							
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 Recharge [(8)-(9)]**
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1	Alangad	Non-command	1432.73	94.5	263.15	380.26	2170.64	108.53	2062.11
2	Angamaly	Non-command	3470.07	116.54	733.37	856.21	5176.19	517.62	4658.57
3	Edappally	Non-command	3284.96	23.15	694.24	255.16	4257.51	425.75	3831.76
4	Koovappady	Non-command	4366.09	96.23	922.73	979.37	6364.42	636.44	5727.98
5	Kothamangalam	Non-command	3294.15	60.07	696.19	573.91	4624.32	462.43	4161.89
6	Moovattupuzha	Non-command	2861.98	121.97	604.85	315.21	3904.01	390.4	3513.61
7	Mulamthuruthy	Non-command	2338.72	58.98	494.27	285.44	3177.41	317.74	2859.67
8	Palluruthy	Non-command	1361.01	0	287.64	0	1648.65	164.86	1483.79
9	Pampakkuda	Non-command	2541.12	78.79	537.04	804.29	3961.24	396.12	3565.12
10	Parakkadavu	Non-command	1847.74	48.62	390.5	237.82	2524.68	252.47	2272.21
11	Paravoor	Non-command	1568.5	47.78	331.49	148.08	2095.85	209.59	1886.26
12	Vadavukodu	Non-command	2853.85	205.65	603.13	990.33	4652.96	465.3	4187.66
13	Vazhakkulam	Non-command	3164.1	315.32	668.7	1123.2	5271.32	527.13	4744.19
14	Vypeen	Non-command	1019.56	4.31	75.28	17.26	1116.41	111.64	1004.77
	TOTAL (ha.m)	**Non-command**	**35404.58**	**1271.91**	**7302.58**	**6966.54**	**50945.61**	**4986.02**	**45959.59**
	TOTAL (MCM)	**Non-command**	**354.05**	**12.72**	**73.03**	**69.67**	**509.46**	**49.86**	**459.60**

State		**KERALA**							
District		**IDUKKI**							
Assessment Year		**2020**							
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 Recharge [(8)-(9)]**
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1	Adimali	Non-command	3039.81	76.21	137.11	181.34	3434.47	343.44	3091.03
2	Azhutha	Non-command	2759.74	34.83	124.48	183.54	3102.59	310.26	2792.33
3	Devikulam	Non-command	2300.37	16.08	103.76	64.04	2484.25	248.42	2235.83
4	Elam Desom	Non-command	1640.02	45.72	73.97	292.73	2052.44	205.24	1847.2
5	Idukki	Non-command	2558.58	38.82	115.4	177.81	2890.61	289.06	2601.55
6	Kattappana	Non-command	1895.75	59.6	85.51	418.49	2459.35	245.93	2213.42
7	Nedumkandam	Non-command	2056.34	2.53	92.75	245.55	2397.17	239.72	2157.45
8	Thodupuzha	Non-command	1744.79	37.41	78.7	292.53	2153.43	215.34	1938.09
	TOTAL (ha.m)	**Non-command**	**17995.40**	**311.20**	**811.68**	**1856.03**	**20974.31**	**2097.41**	**18876.90**
	TOTAL (MCM)	**Non-command**	**179.95**	**3.11**	**8.12**	**18.56**	**209.74**	**20.97**	**188.77**

State		**KERALA**							
District		**KANNUR**							
Assessment Year		**2020**							
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 Recharge [(8)-(9)]**
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1	Edakkad	Non-command	1546.21	68.51	184.28	340.59	2139.59	213.96	1925.63
2	Irikkur	Non-command	6046.27	257.2	0	747.35	7050.82	705.08	6345.74
3	Iritty	Non-command	5384.31	48.3	0	359.97	5792.58	579.26	5213.32
4	Kallyasseri	Non-command	2572.79	32.98	0	213.34	2819.11	281.91	2537.2
5	Kannur	Non-command	2535.86	84.51	0	334.86	2955.23	147.76	2807.47
6	Kuthuparamba	Non-command	1862.64	32.06	221.99	167.45	2284.14	228.41	2055.73
7	Panur	Non-command	1214.31	17.38	0	99.05	1330.74	133.08	1197.66
8	Payyannur	Non-command	5501.29	49.13	655.64	244.11	6450.17	645.02	5805.15
9	Peravoor	Non-command	3510.2	35.88	0	247.41	3793.49	379.35	3414.14
10	Taliparamba	Non-command	6349.67	129.63	756.75	795.04	8031.09	803.11	7227.98
11	Thalassery	Non-command	1931.55	117.77	0	292.84	2342.16	234.21	2107.95
	TOTAL (ha.m)	**Non-command**	**38455.10**	**873.35**	**1818.66**	**3842.01**	**44989.12**	**4351.15**	**40637.97**
	TOTAL (MCM)	**Non-command**	**384.55**	**8.73**	**18.19**	**38.42**	**449.89**	**43.51**	**406.38**

State		**KERALA**							
District		**KASARGOD**							
Assessment Year		**2020**							
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 Recharge [(8)-(9)]**
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1	Kanhangad	Non-command	3831.38	127.15	0	551.24	4509.77	450.97	4058.8
2	Karadka	Non-command	4409.5	262.95	508.58	918.97	6100	610	5490
3	Kasaragod	Non-command	4045.24	267.89	0	794.28	5107.41	510.74	4596.67
4	Manjeswar	Non-command	5250.21	275.13	0	897.88	6423.22	642.32	5780.9
5	Nileswaram	Non-command	3120.56	104.45	0	340.06	3565.07	356.51	3208.56
6	Parappa	Non-command	5603.86	235.21	0	846.17	6685.24	668.53	6016.71
	TOTAL (ha.m)	**Non-command**	**26260.75**	**1272.78**	**508.58**	**4348.60**	**32390.71**	**3239.07**	**29151.64**
	TOTAL (MCM)	**Non-command**	**262.61**	**12.73**	**5.09**	**43.49**	**323.91**	**32.39**	**291.52**

State		**KERALA**							
District		**KOLLAM**							
Assessment Year		**2020**							
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 Recharge [(8)-(9)]**
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1	Anchal	Non-command	6473.96	183.62	1279.47	357.64	8294.69	829.47	7465.22
2	Chadayamangalam	Non-command	2666	51.99	882.05	244.12	3844.16	384.42	3459.74
3	Chavara	Non-command	1700.75	1.02	378.99	73.78	2154.54	107.73	2046.81
4	Chittumala	Non-command	1917.38	18.79	460.13	136.68	2532.98	126.65	2406.33
5	Ithikkara	Non-command	2267.26	31.63	298.72	184.09	2781.7	278.17	2503.53
6	Kottarakkara	Non-command	1465.62	67.7	484.9	330.76	2348.98	234.9	2114.08
7	Mukhathala	Non-command	2651.36	135.54	349.33	345.38	3481.61	348.16	3133.45
8	Oachira	Non-command	2617.08	23.26	577.24	180.57	3398.15	339.81	3058.34
9	Pathanapuram	Non-command	2366.4	75.7	782.93	231.99	3457.02	345.7	3111.32
10	Sasthamkotta	Non-command	1447.59	135.29	478.94	324.25	2386.07	238.61	2147.46
11	Vettikkavala	Non-command	1788.35	102.52	591.68	362.27	2844.82	284.49	2560.33
	TOTAL (ha.m)	**Non-command**	**27361.75**	**827.06**	**6564.38**	**2771.53**	**37524.72**	**3518.11**	**34006.61**
	TOTAL (MCM)	**Non-command**	**273.62**	**8.27**	**65.64**	**27.72**	**375.25**	**35.18**	**340.07**

State		**KERALA**							
District		**KOTTAYAM**							
Assessment Year		**2020**							
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 Recharge [(8)-(9)]**
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1	Erattupetta	Non-command	2046.68	15.21	498.37	99.89	2660.15	266.02	2394.13
2	Ettumanoor	Non-command	2437.87	15.79	260.68	399.01	3113.35	311.34	2802.01
3	Kaduthuruthy	Non-command	2495.75	169.13	607.72	1391.74	4664.34	466.44	4197.9
4	Kanjirappally	Non-command	3363.54	18.32	819.03	160.88	4361.77	436.18	3925.59
5	Lalam	Non-command	2430.12	58.14	259.85	239.5	2987.61	298.77	2688.84
6	Madappally	Non-command	3969.38	21	644.37	583.56	5218.31	521.83	4696.48
7	Pallom	Non-command	3568.61	62.75	834.72	1284.11	5750.19	287.51	5462.68
8	Pampady	Non-command	2508.7	14.52	268.25	97.64	2889.11	288.91	2600.2
9	Uzhavoor	Non-command	2818.04	39.6	301.33	777.73	3936.7	393.67	3543.03
10	Vaikom	Non-command	2012.76	332.68	215.22	545.76	3106.42	310.64	2795.78
11	Vazhoor	Non-command	2064.34	15.6	220.74	15.59	2316.27	231.62	2084.65
	TOTAL (ha.m)	**Non-command**	**29715.8**	**762.74**	**4930.28**	**5595.41**	**41004.2**	**3812.93**	**37191.29**
	TOTAL (MCM)	**Non-command**	**297.16**	**7.63**	**49.30**	**55.95**	**410.04**	**38.13**	**371.91**

State		**KERALA**							
District		**KOZHIKODE**							
Assessment Year		**2020**							
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 Recharge [(8)-(9)]**
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1	Ballussery	Non-command	2406.64	67.03	18.89	245.9	2738.46	273.85	2464.61
2	Chelannur	Non-command	2391.63	35.12	18.77	110.82	2556.34	255.64	2300.7
3	Koduvally	Non-command	4708.84	39.99	37.5	172.5	4958.83	495.88	4462.95
4	Kozhikode	Non-command	2472.27	34.86	365.65	143.74	3016.52	301.65	2714.87
5	Kunnamangalam	Non-command	2931.15	55.39	23.01	181.15	3190.7	319.07	2871.63
6	Kunnummal	Non-command	2604.55	42.03	20.44	111.54	2778.56	277.86	2500.7
7	Melady	Non-command	2148.23	16.85	11.24	52.03	2228.35	222.84	2005.51
8	Panthalayani	Non-command	3193.02	20.24	314.83	74.4	3602.49	360.25	3242.24
9	Perambra	Non-command	3136.43	41.38	463.88	142.73	3784.42	378.44	3405.98
10	Thodannur	Non-command	1669.11	15.52	13.1	63.15	1760.88	176.09	1584.79
11	Tuneri	Non-command	1738.2	21.48	13.64	77.57	1850.89	185.09	1665.8
12	Vadakara	Non-command	1786.76	9.07	264.26	61.82	2121.91	212.19	1909.72
	TOTAL (ha.m)	**Non-command**	**31186.83**	**398.96**	**1565.21**	**1437.35**	**34588.35**	**3458.85**	**31129.50**
	TOTAL (MCM)	**Non-command**	**311.87**	**3.99**	**15.65**	**14.37**	**345.88**	**34.59**	**311.30**

State		**KERALA**							
District		**MALAPPURAM**							
Assessment Year		**2020**							
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 Recharge [(8)-(9)]**
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1	Areacode	Non-command	3945.21	82.82	632	503.61	5163.64	516.36	4647.28
2	Kalikavu	Non-command	3784.51	42.58	606.26	333.89	4767.24	476.73	4290.51
3	Kondotty	Non-command	2692.85	82.39	58.2	517.34	3350.78	335.07	3015.71
4	Kuttippuram	Non-command	2205.46	63.02	47.67	1121.49	3437.64	343.77	3093.87
5	Malappuram	Non-command	2795.44	50.37	447.81	548.73	3842.35	384.23	3458.12
6	Mankada	Non-command	2126.38	58.06	40.67	450.15	2675.26	133.76	2541.5
7	Nilamboor	Non-command	3154.96	32.29	68.19	513.28	3768.72	376.88	3391.84
8	Perinthalmanna	Non-command	4054.99	117.19	649.59	746.84	5568.61	556.86	5011.75
9	Perumpadappu	Non-command	1758.66	63.3	187.82	357.41	2367.19	236.72	2130.47
10	Ponnani	Non-command	2314.9	46.66	247.22	547.5	3156.28	315.63	2840.65
11	Thanur	Non-command	2078.93	51.93	333.03	370.77	2834.66	283.47	2551.19
12	Thriurangadi	Non-command	2067.18	31.93	331.15	554.39	2984.65	298.46	2686.19
13	Tirur	Non-command	1809.86	52.14	289.93	355.05	2506.98	250.7	2256.28
14	Vengara	Non-command	2407.76	47.48	39.6	399.95	2894.79	144.74	2750.05
15	Wandoor	Non-command	2434	63.9	389.91	369.19	3257	325.7	2931.3
	TOTAL (ha.m)	**Non-command**	**39631.09**	**886.06**	**4369.05**	**7689.59**	**52575.79**	**4979.08**	**47596.71**
	TOTAL (MCM)	**Non-command**	**396.31**	**8.86**	**43.69**	**76.90**	**525.76**	**49.79**	**475.97**

State		**KERALA**							
District		**PALAKKAD**							
Assessment Year		**2020**							
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 Recharge [(8)-(9)]**
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1	Alathur	Non-command	2414.34	603.01	47.41	4652.46	7717.22	771.73	6945.49
2	Attappadi	Non-command	4214.1	105.1	82.74	205.66	4607.6	460.76	4146.84
3	Chittur	Non-command	2700.22	454.98	53.02	3264.1	6472.32	647.23	5825.09
4	Kollengode	Non-command	2733.65	544.65	53.68	3269.26	6601.24	660.12	5941.12
5	Kuzhalmannam	Non-command	2307.97	438.86	45.32	5115.21	7907.36	790.73	7116.63
6	Malampuzha	Non-command	1749.98	186.05	34.36	1611.17	3581.56	358.15	3223.41
7	Mannarkkad	Non-command	3041.22	292.03	59.71	690.98	4083.94	408.4	3675.54
8	Nenmara	Non-command	2466.44	96.81	48.43	516.83	3128.51	312.85	2815.66
9	Ottappalam	Non-command	3280.32	419.94	64.41	641.81	4406.48	440.65	3965.83
10	Palakkad	Non-command	2487.45	387.04	48.84	3195.84	6119.17	611.92	5507.25
11	Pattambi	Non-command	3204.02	138.02	62.91	492.46	3897.41	389.74	3507.67
12	Sreekrishnapuram	Non-command	2644.46	244.48	51.92	706.93	3647.79	364.78	3283.01
13	Thrithala	Non-command	2363.64	64.46	46.41	255.01	2729.52	272.95	2456.57
	TOTAL (ha.m)	**Non-command**	**35607.81**	**3975.43**	**699.16**	**24617.72**	**64900.12**	**6490.01**	**58410.11**
	TOTAL (MCM)	**Non-command**	**356.08**	**39.75**	**6.99**	**246.18**	**649.00**	**64.90**	**584.10**

State		**KERALA**							
District		**PATHANAMTHITTA**							
Assessment Year		**2020**							
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 Recharge [(8)-(9)]**
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1	Elanthoor	Non-command	1321.66	51.65	414.99	170.56	1958.86	195.88	1762.98
2	Koipuram	Non-command	1538.78	57.62	483.17	187.3	2266.87	226.69	2040.18
3	Konni	Non-command	3647.8	66.37	1145.38	229.4	5088.95	508.9	4580.05
4	Mallappally	Non-command	1918.41	28.6	602.37	171.43	2720.81	272.08	2448.73
5	Pandalam	Non-command	1448.45	116.82	454.8	356.47	2376.54	237.66	2138.88
6	Parakode	Non-command	3883.18	120.49	1137.35	583.71	5724.73	286.23	5438.5
7	Pulikeezh	Non-command	1611.92	30.84	390.88	85.77	2119.41	105.97	2013.44
8	Ranni	Non-command	3002.66	21.16	942.82	154.97	4121.61	412.16	3709.45
	TOTAL (ha.m)	**Non-command**	**18372.9**	**493.55**	**5571.76**	**1939.61**	**26377.8**	**2245.57**	**24132.21**
	TOTAL (MCM)	**Non-command**	**183.73**	**4.94**	**55.72**	**19.40**	**263.78**	**22.46**	**241.32**

State		**KERALA**							
District		**THIRUVANANTHAPURAM**							
Assessment Year		**2020**							
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 Recharge [(8)-(9)]**
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1	Athiyannur	Non-command	1087.64	24.96	249.56	118.12	1480.28	148.03	1332.25
2	Chirayinkil	Non-command	1191.81	74.3	273.46	244.86	1784.43	178.44	1605.99
3	Kilimanoor	Non-command	2170.94	34.52	498.13	431.18	3134.77	313.48	2821.29
4	Nedumangad	Non-command	1440.09	33.31	450.36	171.82	2095.58	104.78	1990.8
5	Nemom	Non-command	4299.22	32	986.47	137.52	5455.21	545.52	4909.69
6	Parassala	Non-command	1240.98	31.6	284.75	179.36	1736.69	173.67	1563.02
7	Perumkadavila	Non-command	2116.31	189.52	728.39	524.56	3558.78	355.88	3202.9
8	Pothencode	Non-command	1082	12.66	248.27	256.34	1599.27	159.93	1439.34
9	Vamanapuram	Non-command	2496.83	90.14	667.85	289.83	3544.65	177.23	3367.42
10	Varkala	Non-command	1335.6	32.24	306.46	185.4	1859.7	185.97	1673.73
11	Vellanad	Non-command	2614.03	15.04	930.11	195.44	3754.62	375.47	3379.15
	TOTAL (ha.m)	**Non-command**	**21075.45**	**570.29**	**5623.81**	**2734.43**	**30003.98**	**2718.40**	**27285.58**
	TOTAL (MCM)	**Non-command**	**210.75**	**5.70**	**56.24**	**27.34**	**300.04**	**27.18**	**272.86**

state		**KERALA**							
District		**THRISSUR**							
Assessment Year		**2020**							
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 Recharge [(8)-(9)]**
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1	Anthikkad	Non-command	2414.39	40.69	51.88	1726.13	4233.09	423.31	3809.78
2	Chalakkudy	Non-command	3229.63	109.38	104.09	1135.26	4578.36	457.84	4120.52
3	Chavakkad	Non-command	3243.07	18.7	69.68	274.27	3605.72	360.58	3245.14
4	Cherpu	Non-command	1707.84	72.73	36.69	1823.95	3641.21	364.12	3277.09
5	Chowannur	Non-command	3240.9	23.55	104.45	1059.21	4428.11	442.81	3985.3
6	Iringalakkuda	Non-command	2344.95	76.35	75.58	870.88	3367.76	336.78	3030.98
7	Kodakara	Non-command	3712.35	19.59	119.64	1003.37	4854.95	485.49	4369.46
8	Mala	Non-command	2645.63	170.38	85.27	1012.04	3913.32	391.33	3521.99
9	Mathilakom	Non-command	3292.82	8.94	93.48	311.22	3706.46	185.32	3521.14
10	Mullassery	Non-command	2055.55	9.43	44.17	1060.12	3169.27	316.93	2852.34
11	Ollukkara	Non-command	3261.81	27.22	105.12	251.94	3646.09	364.61	3281.48
12	Pazhayannur	Non-command	4320.53	17.41	139.25	448.84	4926.03	492.6	4433.43
13	Puzhakkal	Non-command	3629.66	129.9	116.98	1922.63	5799.17	579.92	5219.25
14	Thalikkulam	Non-command	2030.72	6.31	43.63	264.66	2345.32	234.53	2110.79
15	Vadakkancherry	Non-command	2962.33	45.2	505.46	587.77	4100.76	410.07	3690.69
16	Vellangallur	Non-command	1782.08	64.89	304.08	530.27	2681.32	268.14	2413.18
	TOTAL (ha.m)	**Non-command**	**45874.26**	**840.67**	**1999.45**	**14282.56**	**62996.94**	**6114.38**	**56882.56**
	TOTAL (MCM)	**Non-command**	**458.74**	**8.41**	**19.99**	**142.83**	**629.97**	**61.14**	**568.83**

State		**KERALA**							
District		**WAYANAD**							
Assessment Year		**2020**							
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 Recharge [(8)-(9)]**
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1	Kalpetta	Non-command	6739.06	116.01	0	176.25	7031.32	703.14	6328.18
2	Mananthavady	Non-command	6690.17	183.15	0	215.57	7088.89	708.89	6380
3	Panamaram	Non-command	3794.97	58.46	0	113.99	3967.42	396.74	3570.68
4	Sulthanbathery	Non-command	6042.03	84.64	0	180.47	6307.14	630.72	5676.42
	TOTAL (ha.m)	**Non-command**	**23266.23**	**442.26**	**0.00**	**686.28**	**24394.77**	**2439.49**	**21955.28**
	TOTAL (MCM)	**Non-command**	**232.66**	**4.42**	**0.00**	**6.86**	**243.95**	**24.39**	**219.55**

ANNEXURE III D (Contd.):ASSESSMENT OF DYNAMIC GROUND WATER RESOURCES OF KERALA (2020).

State		KERALA								
District		ALAPPUZHA								
Assessment Year		2020								
Sl. No.	Assessment Unit/ Block	Command / Non-Command	Annual Extractable Ground Water Recharge (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	Ambalappuzha	Non-command	2061.06	147.84	8.19	649.66	805.70	673.64	1231.38	39.09
2	Aryad	Non-command	2533.82	296.52	0.00	1399.66	1696.18	1451.33	785.97	66.94
3	Bharanikkavu	Non-command	3681.01	426.83	0.27	771.39	1198.50	799.86	2454.04	32.56
4	Champakkulam	Non-command	3558.73	73.93	0.02	522.21	596.16	541.49	2943.29	16.75
5	Chengannur	Non-command	4284.66	788.46	1.50	854.68	1644.64	886.23	2608.47	38.38
6	Harippad	Non-command	3465.20	759.60	82.39	722.91	1564.91	749.59	1873.61	45.16
7	Kanjikkuzhy	Non-command	2486.71	282.72	0.11	753.97	1036.80	781.80	1422.08	41.69
8	Mavelikkara	Non-command	3456.68	206.32	0.75	830.98	1038.05	861.65	2387.96	30.03
9	Muthukulam	Non-command	3625.85	463.02	98.47	1079.54	1641.05	1119.40	1944.94	45.26
10	Pattanakkad	Non-command	2600.15	135.14	68.37	973.22	1176.74	1009.15	1387.48	45.26
11	Thycattussery	Non-command	3508.22	175.44	0.90	719.37	895.71	745.92	2585.96	25.53
12	Veliyanad	Non-command	3479.59	94.27	0.00	433.79	528.07	449.80	2935.51	15.18
	TOTAL (ha.m)		**38741.68**	**3850.09**	**260.98**	**9711.38**	**13822.51**	**10069.86**	**24560.69**	**35.68**
	TOTAL (MCM)		**387.42**	**38.50**	**2.61**	**97.11**	**138.23**	**100.70**	**245.61**	**35.68**

State	**KERALA**
District	**ERNAKULAM**
Assessment Year	**2020**

Sl. No.	**Assessment Unit/ Block**	**Command / Non-Command**	**Annual Extractable GroundWater Recharge (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	2062.11	421.74	46.87	954.01	1422.61	1366.40	227.11	68.99
2	Angamaly	Non-command	4658.57	739.77	46.11	999.16	1785.03	1431.07	2441.63	38.32
3	Edappally	Non-command	3831.76	168.38	10.89	2091.69	2270.97	2995.87	656.61	59.27
4	Koovappady	Non-command	5727.98	763.18	13.02	855.41	1631.60	1225.18	3726.61	28.48
5	Kothamangalam	Non-command	4161.89	645.08	2.42	1146.60	1794.10	1642.24	1872.15	43.11
6	Moovattupuzha	Non-command	3513.61	994.99	8.48	1186.13	2189.60	1698.87	811.27	62.32
7	Mulamthuruthy	Non-command	2859.67	687.04	10.24	1192.48	1889.76	1707.96	454.43	66.08
8	Palluruthy	Non-command	1483.79	150.18	9.29	199.18	358.64	285.28	1039.05	24.17
9	Pampakkuda	Non-command	3565.12	751.08	5.15	666.35	1422.59	954.39	1854.49	39.90
10	Parakkadavu	Non-command	2272.21	760.02	8.11	817.98	1586.12	1171.57	332.50	69.81
11	Paravoor	Non-command	1886.26	593.68	14.40	305.90	913.99	438.14	840.03	48.46
12	Vadavukodu	Non-command	4187.66	497.52	3.84	829.16	1330.52	1187.58	2498.72	31.77
13	Vazhakkulam	Non-command	4744.19	945.06	6.62	1532.52	2484.20	2194.99	1597.52	52.36
14	Vypeen	Non-command	1004.77	49.96	0.00	590.70	640.67	846.05	108.75	63.76
	TOTAL (ha.m)		**45959.59**	**8167.69**	**185.44**	**13367.28**	**21720.40**	**19145.59**	**18460.87**	**47.26**
	TOTAL (MCM)		**459.60**	**81.68**	**1.85**	**133.67**	**217.20**	**191.46**	**184.61**	**47.26**

State	**KERALA**

District		**IDUKKI**								
Assessment Year		**2020**								
Sl. No.	**Assessment Unit/ Block**	**Command / Non-Command**	**Annual Extractable Ground Water Recharge (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	3091.03	843.73	1.18	485.53	1330.44	485.53	1760.59	43.04
2	Azhutha	Non-command	2792.33	707.23	6.08	554.65	1267.95	554.65	1524.38	45.41
3	Devikulam	Non-command	2235.83	240.42	0.00	467.51	707.93	467.51	1527.90	31.66
4	Elam Desom	Non-command	1847.20	762.50	1.08	494.96	1258.53	494.96	588.67	68.13
5	Idukki	Non-command	2601.55	658.36	0.36	445.02	1103.74	445.02	1497.81	42.43
6	Kattappana	Non-command	2213.42	1049.26	1.32	726.80	1777.38	726.80	436.04	80.30
7	Nedumkandam	Non-command	2157.45	1097.07	1.18	627.93	1726.19	627.93	431.26	80.01
8	Thodupuzha	Non-command	1938.09	704.49	1.83	556.30	1262.62	556.30	675.47	65.15
	TOTAL (ha.m)		**18876.90**	**6063.04**	**13.04**	**4358.70**	**10434.78**	**4358.70**	**8442.12**	**55.28**
	TOTAL (MCM)		**188.77**	**60.63**	**0.13**	**43.59**	**104.35**	**43.59**	**84.42**	**55.28**

State		**KERALA**								
District		**KANNUR**								
Assessment Year		**2020**								
Sl. No.	**Assessment Unit/ Block**	**Command / Non-Command**	**Annual Extractable GroundWater Recharge (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	1925.63	379.68	0.00	505.72	885.40	685.85	860.10	45.98
2	Irikkur	Non-command	6345.74	977.11	0.02	1224.48	2201.61	1660.64	3707.97	34.69
3	Iritty	Non-command	5213.32	1145.27	0.01	1060.68	2205.98	1438.49	2629.53	42.31
4	Kallyasseri	Non-command	2537.20	696.02	0.00	724.24	1420.26	982.22	858.96	55.98
5	Kannur	Non-command	2807.47	1175.96	10.14	853.62	2039.73	1157.68	463.68	72.65
6	Kuthuparamba	Non-command	2055.73	693.34	0.00	639.24	1332.58	866.94	495.45	64.82
7	Panur	Non-command	1197.66	458.56	0.00	588.20	1046.76	797.71	150.90	87.40
8	Payyannur	Non-command	5805.15	678.76	0.00	1291.01	1969.77	1750.88	3375.51	33.93
9	Peravoor	Non-command	3414.14	918.10	0.02	717.84	1635.97	973.54	1522.47	47.92
10	Taliparamba	Non-command	7227.98	897.26	11.22	1677.11	2585.59	2274.49	4045.01	35.77
11	Thalassery	Non-command	2107.95	377.72	4.72	1230.03	1612.47	1668.16	57.35	76.49
	TOTAL (ha.m)		**40637.97**	**8397.78**	**26.13**	**10512.18**	**18936.12**	**14256.60**	**18166.93**	**46.60**
	TOTAL (MCM)		**406.38**	**83.98**	**0.26**	**105.12**	**189.36**	**142.57**	**181.67**	**46.60**

State		**KERALA**								
District		**KASARGOD**								
Assessment Year		**2020**								
Sl. No.	**Assessment Unit/ Block**	**Command / Non-Command**	**Annual Extractable GroundWater Recharge (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	4058.80	1783.29	1.71	1147.47	2932.48	2023.79	250.00	72.25
2	Karadka	Non-command	5490.00	3331.11	3.48	712.07	4046.66	1238.69	916.72	73.71
3	Kasaragod	Non-command	4596.67	2955.22	1.49	1397.94	4354.63	2431.78	242.04	94.73
4	Manjeswar	Non-command	5780.90	3572.08	1.72	1181.49	4755.29	2055.26	151.84	82.26
5	Nileswaram	Non-command	3208.56	1291.40	3.80	918.26	2213.46	1597.37	315.99	68.99
6	Parappa	Non-command	6016.71	2986.39	1.71	982.04	3970.15	1708.31	1320.29	65.99
	TOTAL (ha.m)		**29151.64**	**15919.49**	**13.91**	**6339.27**	**22272.67**	**11055.20**	**3196.88**	**76.40**
	TOTAL (MCM)		**291.52**	**159.19**	**0.14**	**63.39**	**222.73**	**110.55**	**31.97**	**76.40**

State		**KERALA**								
District		**KOLLAM**								
Assessment Year		**2020**								
Sl. No.	**Assessment Unit/ Block**	**Command / Non-Command**	**Annual Extractable Ground Water Recharge (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	7465.22	616.54	0.09	500.12	1116.74	552.37	6296.23	14.96
2	Chadayamangalam	Non-command	3459.74	590.02	1.22	1017.37	1608.61	1123.68	1744.82	46.50
3	Chavara	Non-command	2046.81	283.68	0.87	997.62	1282.18	1101.86	660.39	62.64
4	Chittumala	Non-command	2406.33	489.09	12.20	1069.19	1570.48	1180.91	724.13	65.26
5	Ithikkara	Non-command	2503.53	342.20	1.31	1147.01	1490.51	1266.85	893.18	59.54
6	Kottarakkara	Non-command	2114.08	466.94	1.38	871.54	1339.86	962.61	683.15	63.38
7	Mukhathala	Non-command	3133.45	397.33	0.81	1809.83	2207.96	1998.94	736.38	70.46
8	Oachira	Non-command	3058.34	456.34	0.11	1060.42	1516.89	1171.23	1430.64	49.60
9	Pathanapuram	Non-command	3111.32	491.71	0.45	954.13	1446.30	1053.83	1565.32	46.49
10	Sasthamkotta	Non-command	2147.46	456.48	0.24	1015.16	1471.88	1121.23	569.51	68.54
11	Vettikkavala	Non-command	2560.33	516.32	0.19	974.29	1490.79	1076.09	967.74	58.23
	TOTAL (ha.m)		**34006.61**	**5106.65**	**18.87**	**11416.69**	**16542.20**	**12609.60**	**16271.49**	**48.64**
	TOTAL (MCM)		**340.07**	**51.07**	**0.19**	**114.17**	**165.42**	**126.10**	**162.71**	**48.64**

State		**KERALA**								
District		**KOTTAYAM**								
Assessment Year		**2020**								
Sl. No.	**Assessment Unit/ Block**	**Command / Non-Command**	**Annual Extractable Ground Water Recharge (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	2394.13	456.02	0.14	595.27	1051.43	642.20	1295.77	43.92
2	Ettumanoor	Non-command	2802.01	320.07	0.04	928.90	1249.01	1002.13	1479.77	44.58
3	Kaduthuruthy	Non-command	4197.90	632.76	0.04	723.39	1356.18	780.43	2784.68	32.31
4	Kanjirappally	Non-command	3925.59	581.29	0.00	942.68	1523.97	1017.00	2327.30	38.82
5	Lalam	Non-command	2688.84	296.29	0.05	571.03	867.35	616.06	1776.46	32.26
6	Madappally	Non-command	4696.48	588.99	0.29	1221.55	1810.82	1317.85	2789.36	38.56
7	Pallom	Non-command	5462.68	551.01	0.00	1401.43	1952.45	1511.93	3399.73	35.74
8	Pampady	Non-command	2600.20	269.66	0.00	617.92	887.57	666.64	1663.91	34.13
9	Uzhavoor	Non-command	3543.03	552.32	0.00	746.27	1298.59	805.11	2185.60	36.65
10	Vaikom	Non-command	2795.78	434.79	0.03	200.13	634.96	235.25	2125.70	22.71
11	Vazhoor	Non-command	2084.65	376.68	2.38	555.83	934.89	599.65	1105.94	44.85
	TOTAL (ha.m)		**37191.29**	**5059.88**	**2.97**	**8504.39**	**13567.22**	**9194.25**	**22934.22**	**36.48**
	TOTAL (MCM)		**371.91**	**50.60**	**0.03**	**85.04**	**135.67**	**91.94**	**229.34**	**36.48**

State		KERALA								
District		KOZHIKODE								
Assessment Year		2020								
Sl. No.	Assessment Unit/ Block	Command / Non-Command	Annual Extractable Ground Water Recharge (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	2464.61	907.88	0.00	1153.53	2061.41	1876.78	403.20	83.64
2	Chelannur	Non-command	2300.70	412.04	0.00	1169.97	1582.01	1903.51	718.69	68.76
3	Koduvally	Non-command	4462.95	555.84	5.55	1566.92	2128.31	2549.35	1352.21	47.69
4	Kozhikode	Non-command	2714.87	466.52	1.03	1335.76	1803.31	2173.26	74.06	66.42
5	Kunnamangalam	Non-command	2871.63	635.26	0.18	1703.96	2339.40	2772.31	532.23	81.47
6	Kunnummal	Non-command	2500.70	358.08	0.00	1075.12	1433.21	1749.20	393.41	57.31
7	Melady	Non-command	2005.51	197.33	0.18	643.41	840.92	1046.81	761.19	41.93
8	Panthalayani	Non-command	3242.24	265.65	0.00	954.19	1219.84	1552.45	1424.14	37.62
9	Perambra	Non-command	3405.98	415.26	0.15	892.88	1308.29	1452.71	1537.86	38.41
10	Thodannur	Non-command	1584.79	180.27	0.00	730.23	910.51	1188.08	216.43	57.45
11	Tuneri	Non-command	1665.80	269.09	0.00	794.00	1063.09	1291.82	104.89	63.82
12	Vadakara	Non-command	1909.72	206.51	0.00	863.77	1070.28	1405.35	297.86	56.04
	TOTAL (ha.m)		**31129.50**	**4869.73**	**7.09**	**12883.75**	**17760.58**	**20961.63**	**7816.17**	**57.05**
	TOTAL (MCM)		**311.30**	**48.70**	**0.07**	**128.84**	**177.61**	**209.62**	**78.16**	**57.05**

State		**KERALA**								
District		**MALAPPURAM**								
Assessment Year		**2020**								
Sl. No.	**Assessment Unit/ Block**	**Command / Non-Command**	**Annual Extractable GroundWater Recharge (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	4647.28	720.24	2.17	2328.63	3051.05	6161.67	1596.23	65.65
2	Kalikavu	Non-command	4290.51	563.38	0.16	1742.45	2305.99	4610.61	1984.52	53.75
3	Kondotty	Non-command	3015.71	827.65	0.00	1778.59	2606.24	4706.23	409.47	86.42
4	Kuttippuram	Non-command	3093.87	829.13	0.00	1595.98	2425.10	4223.04	668.77	78.38
5	Malappuram	Non-command	3458.12	523.83	0.00	2030.80	2554.63	5373.58	903.49	73.87
6	Mankada	Non-command	2541.50	696.26	0.00	1084.48	1780.74	2869.57	760.76	70.07
7	Nilamboor	Non-command	3391.84	456.23	0.00	1289.92	1746.16	3413.19	1645.68	51.48
8	Perinthalmanna	Non-command	5011.75	1018.35	0.00	1897.79	2916.14	5021.64	2095.61	58.19
9	Perumpadappu	Non-command	2130.47	869.24	2.19	561.02	1432.45	1484.47	698.02	67.24
10	Ponnani	Non-command	2840.65	345.08	0.22	1307.28	1652.59	3459.12	1188.06	58.18
11	Thanur	Non-command	2551.19	757.13	3.18	1390.76	2151.07	3680.01	400.12	84.32
12	Thriurangadi	Non-command	2686.19	648.70	0.00	1512.54	2161.24	4002.25	524.95	80.46
13	Tirur	Non-command	2256.28	404.64	0.00	1382.52	1787.16	3658.20	469.12	79.21

State		**KERALA**								
District		**MALAPPURAM**								
Assessment Year		**2020**								
Sl. No.	**Assessment Unit/ Block**	**Command / Non-Command**	**Annual Extractable GroundWater Recharge (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)**			
14	Vengara	Non-command	2750.05	513.12	0.22	1593.50	2106.84	4216.47	643.21	76.61
15	Wandoor	Non-command	2931.30	362.35	0.60	1241.59	1604.55	3285.31	1326.75	54.74
	TOTAL (ha.m)		**47596.71**	**9535.32**	**8.74**	**22737.86**	**32281.95**	**60165.36**	**15314.76**	**67.82**
	TOTAL (MCM)		**475.97**	**95.35**	**0.09**	**227.38**	**322.82**	**601.65**	**153.15**	**67.82**

State		**KERALA**								
District		**PALAKKAD**								
Assessment Year		**2020**								
Sl. No.	**Assessment Unit/ Block**	**Command / Non-Command**	**Annual Extractable GroundWater Recharge (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	6945.49	2227.56	0.12	1429.80	3657.47	2340.49	2377.33	52.66
2	Attappadi	Non-command	4146.84	761.56	0.00	304.90	1066.46	499.10	2886.18	25.72
3	Chittur	Non-command	5825.09	4469.80	174.18	1174.50	5818.47	1922.58	6.62	99.89
4	Kollengode	Non-command	5941.12	1540.68	5.11	694.70	2240.48	1137.17	3258.17	37.71
5	Kuzhalmannam	Non-command	7116.63	1193.40	72.00	923.26	2188.66	1511.32	4339.91	30.75
6	Malampuzha	Non-command	3223.41	1598.43	259.44	1140.83	2998.70	1867.47	224.71	93.03
7	Mannarkkad	Non-command	3675.54	783.20	2.36	1463.45	2249.01	2395.58	494.40	61.19
8	Nenmara	Non-command	2815.66	1027.20	0.00	673.15	1700.36	1101.91	686.54	60.39
9	Ottappalam	Non-command	3965.83	922.30	0.00	1271.84	2194.15	2081.93	961.59	55.33
10	Palakkad	Non-command	5507.25	892.42	14.60	1539.19	2446.21	2519.56	2080.67	44.42
11	Pattambi	Non-command	3507.67	1577.65	0.00	1215.33	2792.98	1989.42	714.69	79.62
12	Sreekrishnapuram	Non-command	3283.01	898.74	72.00	975.36	1946.10	1596.60	715.67	59.28
13	Thrithala	Non-command	2456.57	739.00	0.05	1098.52	1837.55	1798.20	619.02	74.80
	TOTAL (ha.m)		**58410.11**	**18631.94**	**599.85**	**13904.83**	**33136.60**	**22761.33**	**19365.50**	**56.73**
	TOTAL (MCM)		**584.10**	**186.32**	**6.00**	**139.05**	**331.37**	**227.61**	**193.66**	**56.73**

State		**KERALA**								
District		**PATHANAMTHITTA**								
Assessment Year		**2020**								
Sl. No.	**Assessment Unit/ Block**	**Command / Non-Command**	**Annual Extractable GroundWater Recharge (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	1762.98	360.50	0.01	370.35	730.85	370.35	1032.13	41.46
2	Koipuram	Non-command	2040.18	418.91	0.00	470.64	889.54	470.64	1150.64	43.60
3	Konni	Non-command	4580.05	432.97	0.00	698.62	1131.58	698.62	3448.47	24.71
4	Mallappally	Non-command	2448.73	336.02	0.02	538.94	874.98	538.94	1573.75	35.73
5	Pandalam	Non-command	2138.88	731.58	0.00	502.38	1233.96	502.38	904.92	57.69
6	Parakode	Non-command	5438.50	891.18	0.00	918.19	1809.37	918.19	3629.13	33.27
7	Pulikeezh	Non-command	2013.44	331.60	0.00	544.94	876.54	544.94	1136.90	43.53
8	Ranni	Non-command	3709.45	365.99	0.00	637.88	1003.87	637.88	2705.58	27.06
	TOTAL (ha.m)		**24132.21**	**3868.74**	**0.04**	**4681.94**	**8550.69**	**4681.94**	**15581.52**	**35.43**
	TOTAL (MCM)		**241.32**	**38.69**	**0.00**	**46.82**	**85.51**	**46.82**	**155.82**	**35.43**

State		**KERALA**								
District		**THIRUVANANTHA PURAM**								
Assessment Year		**2020**								
Sl. No.	**Assessment Unit/ Block**	**Command / Non-Command**	**Annual Extractable GroundWater Recharge (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	1332.25	358.21	0.06	789.85	1148.11	901.00	72.99	86.18
2	Chirayinkil	Non-command	1605.99	333.07	0.10	978.18	1311.35	1115.83	156.99	81.65
3	Kilimanoor	Non-command	2821.29	450.18	0.00	1081.21	1531.38	1233.36	1137.76	54.28
4	Nedumangad	Non-command	1990.80	539.92	0.00	1067.20	1607.12	1217.38	233.50	80.73
5	Nemom	Non-command	4909.69	484.89	1.64	2790.81	3277.34	3183.54	1239.62	66.75
6	Parassala	Non-command	1563.02	591.53	0.41	657.29	1249.23	749.78	221.30	79.92
7	Perumkadavila	Non-command	3202.90	570.03	0.33	1019.96	1590.32	1163.49	1469.05	49.65
8	Pothencode	Non-command	1439.34	593.16	2.17	652.26	1247.59	744.05	99.96	86.68
9	Vamanapuram	Non-command	3367.42	511.76	1.64	975.12	1488.52	1112.35	1741.67	44.20
10	Varkala	Non-command	1673.73	296.29	0.00	855.43	1151.70	975.80	401.66	68.81
11	Vellanad	Non-command	3379.15	562.12	0.00	1042.73	1604.85	1189.47	1627.56	47.49
	TOTAL (ha.m)		**27285.58**	**5291.15**	**6.36**	**11910.05**	**17207.51**	**13586.05**	**8402.06**	**63.06**
	TOTAL (MCM)		**272.86**	**52.91**	**0.06**	**119.10**	**172.08**	**135.86**	**84.02**	**63.06**

State		KERALA								
District		THRISSUR								
Assessment Year		2020								
Sl. No.	Assessment Unit/ Block	Command / Non-Command	Annual Extractable GroundWater Recharge (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	3809.78	1023.42	1.94	672.69	1698.05	895.73	1888.69	44.57
2	Chalakkudy	Non-command	4120.52	1675.96	10.81	921.15	2607.94	1226.58	1207.15	63.29
3	Chavakkad	Non-command	3245.14	1117.64	0.01	911.50	2029.13	1213.72	913.79	62.53
4	Cherpu	Non-command	3277.09	1140.64	0.00	489.86	1630.50	652.29	1484.16	49.75
5	Chowannur	Non-command	3985.30	1418.88	0.84	1479.45	2899.17	1969.99	595.59	72.75
6	Iringalakkuda	Non-command	3030.98	1008.55	0.74	729.54	1738.83	971.44	1050.25	57.37
7	Kodakara	Non-command	4369.46	1624.58	3.80	899.22	2527.60	1197.37	1543.71	57.85
8	Mala	Non-command	3521.99	1717.96	0.00	739.17	2457.13	984.26	819.77	69.77
9	Mathilakom	Non-command	3521.14	1412.58	0.00	1343.36	2755.94	1788.77	319.79	78.27
10	Mullassery	Non-command	2852.34	920.44	0.00	450.20	1370.65	599.48	1332.41	48.05
11	Ollukkara	Non-command	3281.48	652.22	3.60	790.68	1446.51	1052.85	1572.80	44.08
12	Pazhayannur	Non-command	4433.43	1043.28	0.00	848.07	1891.35	1129.26	2260.89	42.66
13	Puzhakkal	Non-command	5219.25	1707.42	10.80	542.80	2261.02	722.78	2778.25	43.32
14	Thalikkulam	Non-command	2110.79	1031.42	0.00	621.25	1652.67	827.24	252.13	78.30
15	Vadakkancherry	Non-command	3690.69	1602.12	6.41	847.63	2456.15	1128.67	953.50	66.55
16	Vellangallur	Non-command	2413.18	1051.78	0.00	575.97	1627.75	766.95	594.45	67.45
	TOTAL		**56882.56**	**20148.8**	**38.96**	**12862.5**	**33050.39**	**17127.38**	**19567.33**	**58.10**

State		KERALA								
District		THRISSUR								
Assessment Year		2020								
Sl. No.	Assessment Unit/ Block	Command / Non-Command	Annual Extractable GroundWater Recharge (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)			
	(ha.m)			7		5				
	TOTAL (MCM)		568.83	201.49	0.39	128.63	330.50	171.27	195.67	58.10

State		**KERALA**								
District		**WAYANAD**								
Assessment Year		**2020**								
Sl. No.	**Assessment Unit/ Block**	**Command / Non-Command**	**Annual Extractable Ground Water Recharge (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	6328.18	293.98	72.00	1077.93	1443.91	1437.35	4524.85	22.82
2	Mananthavady	Non-command	6380.00	323.85	0.00	986.69	1310.53	1315.69	4740.47	20.54
3	Panamaram	Non-command	3570.68	263.38	0.00	843.45	1106.83	1124.69	2182.61	31.00
4	Sulthanbathery	Non-command	5676.42	481.94	86.40	877.24	1445.58	1169.74	3938.34	25.47
	TOTAL (ha.m)		**21955.28**	**1363.15**	**158.40**	**3785.31**	**5306.85**	**5047.47**	**15386.27**	**24.17**
	TOTAL (MCM)		**219.55**	**13.63**	**1.58**	**37.85**	**53.07**	**50.47**	**153.86**	**24.17**

ANNEXURE III E: ASSESSMENT OF DYNAMIC GROUND WATER RESOURCES OF KERALA - ASSESSMENT UNIT WISE CATEGORIZATION (2020)

State		**KERALA**			
District		**ALAPPUZHA**			
Assessment Year		**2020**			
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	39.09	Safe
2	Aryad	8772	8772	66.94	Safe
3	Bharanikkavu	12995	12995	32.56	Safe
4	Champakkulam	15383	15383	16.75	Safe
5	Chengannur	14996	14996	38.38	Safe
6	Harippad	11439	11439	45.16	Safe
7	Kanjikkuzhy	11013	11013	41.69	Safe
8	Mavelikkara	10044	10044	30.03	Safe
9	Muthukulam	11651	11651	45.26	Safe
10	Pattanakkad	10871	10871	45.26	Safe
11	Thycattussery	14159	14159	25.53	Safe
12	Veliyanad	13190	13190	15.18	Safe
	District	**141403**	**141403**	**33.78**	**Safe**

State		**KERALA**			
District		**ERNAKULAM**			
Assessment Year		**2020**			
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	68.99	Safe
2	Angamaly	23197	21197	38.32	Safe
3	Edappally	16053	16053	59.27	Safe
4	Koovappady	38560	35560.5	28.48	Safe
5	Kothamangalam	82997	22997	43.11	Safe
6	Moovattupuzha	21480	19980	62.32	Safe
7	Mulamthuruthy	16327	16327	66.08	Safe
8	Palluruthy	6651	6651	24.17	Safe
9	Pampakkuda	18740	17740	39.90	Safe
10	Parakkadavu	11881	11881	69.81	Safe
11	Paravoor	7665	7665	48.46	Safe
12	Vadavukodu	18595	18595	31.77	Safe
13	Vazhakkulam	19328	19328	52.36	Safe
14	Vypeen	5642	5642	63.76	Safe
	District	**294447**	**226947.5**	**43.83**	**Safe**

State		**KERALA**			
District		**IDUKKI**			
Assessment Year		**2020**			
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	43.04	Safe
2	Azhutha	107442	14542	45.41	Safe
3	Devikulam	96343	16043	31.66	Safe
4	Elam Desom	18722	9722	68.13	Safe
5	Idukki	73482	13482	42.43	Safe
6	Kattappana	37238	11238	**80.30**	Semi-critical
7	Nedumkandam	34190	12190	**80.01**	Semi-critical
8	Thodupuzha	16474	10474	65.15	Safe
9	District	**435805**	**108891**	**58.38**	**Safe**

State		**KERALA**			
District		**KANNUR**			
Assessment Year		**2020**			
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	45.98	Safe
2	Irikkur	41290	36290	34.69	Safe
3	Iritty	42709	31509	42.31	Safe
4	Kallyasseri	14339	14339	55.98	Safe
5	Kannur	12678	12678	**72.65**	Semi-critical
6	Kuthuparamba	18235	12935	64.82	Safe
7	Panur	7383	7383	**87.40**	Semi-critical
8	Payyannur	39212	34212	33.93	Safe
9	Peravoor	42542	21342	47.92	Safe
10	Taliparamba	57403	40703	35.77	Safe
11	Thalassery	12057	12057	**76.49**	Semi-critical
	District	**296796**	**232396**	**45.54**	**Safe**

State		**KERALA**			
District		**KASARGOD**			
Assessment Year		**2020**			
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	**72.25**	Semi-critical
2	Karadka	37247	26247	**73.71**	Semi-critical
3	Kasaragod	25876	25876	**94.73**	Critical
4	Manjeswar	34136	33136	**82.26**	Semi-critical
5	Nileswaram	19695	19695	68.99	Safe
6	Parappa	54668	35368	65.99	Safe
	District	**196130**	**164830**	**79.64**	**Semi-critical**

State		**KERALA**			
District		**KOLLAM**			
Assessment Year		**2020**			
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	14.96	Safe
2	Chadayamangalam	24903	24903	46.50	Safe
3	Chavara	7490	7490	62.64	Safe
4	Chittumala	12125	12125	65.26	Safe
5	Ithikkara	12573	12573	59.54	Safe
6	Kottarakkara	13310	13310	63.38	Safe
7	Mukhathala	14703	14703	**70.46**	Semi-critical
8	Oachira	11641	11641	49.60	Safe
9	Pathanapuram	27995	20095	46.49	Safe
10	Sasthamkotta	12791	12791	68.54	Safe
11	Vettikkavala	16947	16947	58.23	Safe
	District	**249100**	**211200**	**49.46**	**Safe**

State		**KERALA**			
District		**KOTTAYAM**			
Assessment Year		**2020**			
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	43.92	Safe
2	Ettumanoor	21460	21460	44.58	Safe
3	Kaduthuruthy	15806	15806	32.31	Safe
4	Kanjirappally	35290	23290	38.82	Safe
5	Lalam	19110	19110	32.26	Safe
6	Madappally	11950	11950	38.56	Safe
7	Pallom	17802	17802	35.74	Safe
8	Pampady	20550	20550	34.13	Safe
9	Uzhavoor	22460	22460	36.65	Safe
10	Vaikom	13190	13190	22.71	Safe
11	Vazhoor	16910	16910	44.85	Safe
	District	**222088**	**197088**	**36.32**	**Safe**

State		**KERALA**			
District		**KOZHIKODE**			
Assessment Year		**2020**			
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	**83.64**	Semi-critical
2	Chelannur	13866	13866	68.76	Safe
3	Koduvally	39048	27298	47.69	Safe
4	Kozhikode	16351	16351	66.42	Safe
5	Kunnamangalam	33794	16994	**81.47**	Semi-critical
6	Kunnummal	26252	13152	57.31	Safe
7	Melady	8407	8407	41.93	Safe
8	Panthalayani	9855	9855	37.62	Safe
9	Perambra	27502	17902	38.41	Safe
10	Thodannur	9677	9677	57.45	Safe
11	Tuneri	14397	11497	63.82	Safe
12	Vadakara	7228	7228	56.04	Safe
	District	**234230**	**166180**	**58.02**	**Safe**

State		**KERALA**			
District		**MALAPPURAM**			
Assessment Year		**2020**			
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	65.65	Safe
2	Kalikavu	68912	24412	53.75	Safe
3	Kondotty	18624	18624	**86.42**	Semi-critical
4	Kuttippuram	17868	17868	**78.38**	Semi-critical
5	Malappuram	18032	18032	**73.87**	Semi-critical
6	Mankada	15245	15245	**70.07**	Semi-critical
7	Nilamboor	62120	21820	51.48	Safe
8	Perinthalmanna	28203	27203	58.19	Safe
9	Perumpadappu	5899	5899	67.24	Safe
10	Ponnani	9706	9706	58.18	Safe
11	Thanur	12756	12756	**84.32**	Semi-critical
12	Thriurangadi	13001	13001	**80.46**	Semi-critical
13	Tirur	11105	11105	**79.21**	Semi-critical
14	Vengara	14845	14845	**76.61**	Semi-critical
15	Wandoor	25308	15308	54.74	Safe
	District	**354981**	**254181**	**67.22**	**Safe**

State		**KERALA**			
District		**PALAKKAD**			
Assessment Year		**2020**			
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	52.66	Safe
2	Attappadi	70323	22323	25.72	Safe
3	Chittur	31468	31468	**99.89**	Critical
4	Kollengode	21411	19911	37.71	Safe
5	Kuzhalmannam	19212	19212	30.75	Safe
6	Malampuzha	40394	20394	**93.03**	Critical
7	Mannarkkad	45535	29535	61.19	Safe
8	Nenmara	79847	23953	60.39	Safe
9	Ottappalam	27306	27306	55.33	Safe
10	Palakkad	20706	20706	44.42	Safe
11	Pattambi	20744	20744	**79.62**	Semi-critical
12	Sreekrishnapuram	22013	22013	59.28	Safe
13	Thrithala	17216	17216	**74.80**	Semi-critical
	District	**447622**	**298228**	**55.48**	**Safe**

State		**KERALA**			
District		**PATHANAMTHITTA**			
Assessment Year		**2020**			
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	41.46	Safe
2	Koipuram	12367	12367	43.60	Safe
3	Konni	86477	25977	24.71	Safe
4	Mallappally	15418	15418	35.73	Safe
5	Pandalam	11641	11641	57.69	Safe
6	Parakode	27152	22642	33.27	Safe
7	Pulikeezh	6866	6866	43.53	Safe
8	Ranni	92132	24132	27.06	Safe
	District	**262675**	**133010**	**36.93**	**Safe**

State		**KERALA**			
District		**THIRUVANANTHAPURAM**			
Assessment Year		**2020**			
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	**86.18**	Semi-critical
2	Chirayinkil	10151	10151	**81.65**	Semi-critical
3	Kilimanoor	17977	17977	54.28	Safe
4	Nedumangad	15603	15603	**80.73**	Semi-critical
5	Nemom	33727	33727	66.75	Safe
6	Parassala	8221	8221	**79.92**	Semi-critical
7	Perumkadavila	28538	27038	49.65	Safe
8	Pothencode	7415	7415	**86.68**	Semi-critical
9	Vamanapuram	42115	27115	44.20	Safe
10	Varkala	10209	10209	68.81	Safe
11	Vellanad	37212	29212	47.49	Safe
	District	**218797**	**194297**	**41.58**	**Safe**

State		**KERALA**			
District		**THRISSUR**			
Assessment Year		**2020**			
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	44.57	Safe
2	Chalakkudy	61069	20369	63.29	Safe
3	Chavakkad	9917	9917	62.53	Safe
4	Cherpu	8448	8448	49.75	Safe
5	Chowannur	17774	17774	**72.75**	Semi-critical
6	Iringalakkuda	12073	12073	57.37	Safe
7	Kodakara	29812	20812	57.85	Safe
8	Mala	12713	12713	69.77	Safe
9	Mathilakom	14635	14635	**78.27**	Semi-critical
10	Mullassery	6585	6585	48.05	Safe
11	Ollukkara	31572	20572	44.08	Safe
12	Pazhayannur	23695	23695	42.66	Safe
13	Puzhakkal	22892	22892	43.32	Safe
14	Thalikkulam	6568	6568	**78.30**	Semi-critical
15	Vadakkancherry	23659	18659	66.55	Safe
16	Vellangallur	11069	11069	67.45	Safe
	District	**302385**	**236685**	**57.67**	**Safe**

State		**KERALA**			
District		**WAYANAD**			
Assessment Year		**2020**			
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	22.82	Safe
2	Mananthavady	66651	41051	20.54	Safe
3	Panamaram	35086	23286	31.00	Safe
4	Sulthanbathery	52974	37074	25.47	Safe
	District	**213062**	**142762**	**24.51**	**Safe**

ANNEXURE III F: ASSESSMENT OF DYNAMIC GROUND WATER RESOURCES OF KERALA-ADMINISTRATIVE UNIT WISE CATEGORIZATION (2020)

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)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Alappuzha	12	0			0			0			12/6	Aryad	Iron, Fluoride (Deeper zone)
													Kanjikkuzhy	Iron
													Mavelikkara	Iron
													Muthukulam	Iron, Nitrate
													Pattanakkad	Iron
													Thycattussery	Iron
2	Ernakulam	14	0			0			0			14/6	Parakkadavu	Iron
													Edappally	Nitrate
													Kothamangalam	Iron
													Mulamthuruthy	Salinity
													Pampakkuda	Iron
													Vadavukodu	Iron
3	Idukki	8	0			0			2/2	Kattappana	Nitrate	6/4	Devikulam	Nitrate, Iron
													Idukki	Iron
										Nedumkanda	Iron		Elamdesom	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)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
										m			Thodupuzha	Iron
4	Kannur	11	0			0			3/0			8/3	Edakkad	Nitrate
													Irikkur	Iron
													Payyannur	Iron
5	Kasargod	6	0			1/1	Kasargod	Iron, Nitrate	3/3	Kanhangad	Iron	2/1	Nileshvwaram	Iron
										Karadka	Iron			
										Manjeswar	Iron			
6	Kollam	11	0	-		0			1/1	Mukhathala	Iron	10/10	Anchal	Iron
													Chadayamangalam	Iron, Nitrate
													Chavara	Iron, Heavy metals
													Ithikkara	Iron, Nitrate
													Kottarakkara	Iron
													Chittumala	Iron
													Oachira	Iron, Nitrate
													Pathanapuram	Iron
													Sasthamkotta	Iron
													Vettikkavala	Iron
	Kottayam	11	0			0						11/6	Kanjirappally	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)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
													Madappally	Nitrate
													Pampady	Iron
													Uzhavoor	Nitrate
													Vaikom	Salinity
													Vazhoor	Iron
8	Kozhikode	12	0			0			2/2	Balussery	Iron	10/4	Chelannur	Iron
										Kunnamangalam	Iron			
													Kozhikode	Nitrate, Iron
													Melady	Iron
													Perambra	Iron
9	Malappuram	15	0			0			8/7	Kondotty	Iron	7/4	Areacode	Iron
										Tirurangadi	Iron			
										Kuttippuram	Iron, Nitrate			
										Malappuram	Iron			
										Tanur	Iron		Nilamboor	Nitrate
										Tirur	Iron, Nitrate		Perinthalmanna	Iron
										Mankada	Iron			
													Ponnani	Salinity, Nitrate
1	Palakkad	13	0			2/2	Chittur	Fluoride,	2/2	Pattambi	Iron	9/9	Alathur	Salinity

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)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0								Salinity, Nitrate						
							Malampuzha	Fluoride		Thrithala	Iron		Attappadi	Iron, Nitrate, Fluoride
													Kollengode	Nitrate, Fluoride
													Kuzhalmannam	Salinity, Iron
													Mannarkkad	Iron
													Nenmara	Iron
													Ottappalam	Nitrate
													Palakkad	Nitrate, Fluoride
													Sreekrishnapuram	Iron
11	Pathanamthitta	8	0			0						8/5	Koipuram	Iron
													Konni	Iron
													Pandalam	Iron
													Parakode	Iron
													Ranni	Iron
12	Thiruvananthapuram	11	0			0			5/5	Athiyanur	Nitrate	6/6	Kilimanoor	Iron, Nitrate
										Nedumangad	Iron, Nitrate			
										Parassala	Nitrate		Nemom	Salinity, Iron, 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)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
										Chirayinkil	Iron, Nitrate		Perumkadavila	Iron, Nitrate
										Pothencode	Nitrate			
													Vamanapuram	Iron, Nitrate
													Varkala	Iron, Nitrate
													Vellanad	Iron
13	Thrissur	16	0			0			3/3	Mathilakam	Iron	13/7	Chalakkudy	Iron
										Thalikkulam	Iron, Salinity			
										Chowannur	Iron		Chavakkad	Iron
													Cherpu	Iron
													Kodakara	Iron
													Mala	Iron, Nitrate
													Ollukkara	Iron
													Puzhakkal	Iron, Nitrate
14	Wayanad	4	0			0			0	-		4/2	Kalpetta	Iron
													Mananthavady	Iron, Nitrate
	KERALA STATE	**152**	**0**			**3**			**29**			**120**		

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

Additional Potential Recharge under Specific Conditions in Kerala. (2020)				
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**
District:				

Additional Potential Recharge under Specific Conditions in Kerala. (2020)				
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)**
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**
State Total		**38603.6**	**0.00**	**38603.6**
		386.04 MCM	**0.00**	**386.4MCM**

ANNEXURE IV: INSTORAGE GROUND WATER RESORUCES

State: KERALA

District: ALAPPUZHA

Assessment Year -2020

Sl. No.	Assessment Unit	Non-command area (Ha)	Maximum limit of fluctuation in phreatic aquifer (mbgl)	Phreatic aquifer thickness (in storage, m)	Confined thickness (in storage, m)	Phreatic in storage parameter	Confined in storage parameter	Phreatic instorage volume (Ha-m)	Semi-confined instorage volume (Ha-m)	Total In storage volume (Ha-m)
1	Ambalappuzha	6890	4	31	115	0.016	0.002	3417.44	1584.70	5002.14
2	Aryad	8772	4	31	115	0.016	0.002	4350.91	2017.56	6368.47
3	Bharanikkavu	12995	10	30	110	0.016	0.002	6237.60	2858.90	9096.50
4	Champakkulam	15383	4	31	115	0.016	0.002	7629.97	3538.09	11168.06
5	Chengannur	14996	8	32	110	0.008	0.002	3838.98	3299.12	7138.10
6	Harippad	11439	4	31	115	0.016	0.002	5673.74	2630.97	8304.71
7	Kanjikkuzhy	11013	4	31	115	0.016	0.002	5462.45	2532.99	7995.44
8	Mavelikkara	10044	5	35	110	0.014	0.002	4921.56	2209.68	7131.24
9	Muthukulam	11651	4	31	115	0.016	0.002	5778.90	2679.73	8458.63
10	Pattanakkad	10871	4	31		0.016	0.002	5392.02	0.00	5392.02
11	Thycattussery	14159	4	31		0.016	0.002	7022.86	0.00	7022.86
12	Veliyanad	13190	4	31	115	0.016	0.002	6542.24	3033.70	9575.94
Total		**141403**						**66268.66**	**26385.44**	**92654.10**

State: KERALA											
District: ERNAKULAM											
Assessment Year -2020											
Sl. No.	**Assessment Unit**	**Non-command area (Ha)**	**Maximum limit of fluctuation in phreatic aquifer (mbgl)**	**Phreatic aquifer thickness (in storage,m)**	**Semi-confined thickness (in storage,m)**	**Phreatic in storage parameter**	**Semi-confined in storage parameter**	**Confined in storage parameter**	**Phreatic instorage volume (Ha-m)**	**Semi-confined instorage volume (Ha-m)**	**Total In storage volume (Ha-m)**
1	Alangad	7331	5	30	65	0.008	0.004	0.002	1759.44	1906.06	3665.50
2	Angamaly	21197	9	31	60	0.006	0.003	0.0015	3942.64	3815.46	7758.10
3	Edappally	16053	5	30	30	0.032	0.016	0.008	15410.88	7705.44	23116.32
4	Koovappady	35560.5	10	25	65	0.01	0.005	0.0025	8890.13	11557.16	20447.29
5	Kothamangalam	22997	10	25	65	0.008	0.004	0.002	4599.40	5979.22	10578.62
6	Moovattupuzha	19980	10	30	60	0.005	0.0025	0.00125	2997.00	2997.00	5994.00
7	Mulamthuruthy	16327	10	30	60	0.006	0.003	0.0015	2938.86	2938.86	5877.72
8	Palluruthy	6651	5	30	0	0.032	0.016	0.008	6384.96	0.00	6384.96
9	Pampakkuda	17740	8	32	60	0.008	0.004	0.002	4541.44	4257.60	8799.04
10	Parakkadavu	11881	8	32	60	0.01	0.005	0.0025	3801.92	3564.30	7366.22
11	Paravoor	7665	5	30	0	0.032	0.016	0.008	7358.40	0.00	7358.40
12	Vadavukodu	18595	8	32	60	0.01	0.005	0.0025	5950.40	5578.50	11528.90
13	Vazhakkulam	19328	10	25	65	0.01	0.005	0.0025	4832.00	6281.60	11113.60
14	Vypeen	5642	5	30	0	0.032	0.016	0.008	5416.32	0.00	5416.32
Total		**226947.5**							**78823.79**	**56581.20**	**135404.99**

State: KERALA
District: IDUKKI
Assessment Year- 2020

Sl. No.	Assessment Unit	Non-command area (Ha)	Maximum limit of fluctuation in phreatic aquifer (mbgl)	Phreatic aquifer thickness (in storage,m)	Semi-confined thickness (in storage,m)	Phreatic in storage parameter	Semi-confined in storage parameter	Phreatic instorage volume (Ha-m)	Semi-confined instorage volume (Ha-m)	Total In storage volume (Ha-m)
1	Adimali	21200	8	27	65	0.004	0.002	2289.6	2756	5045.6
2	Azhutha	14542	7	33	60	0.004	0.002	1919.544	1745.04	3664.584
3	Devikulam	16043	8	27	65	0.004	0.002	1732.644	2085.59	3818.234
4	Elam Desom	9722	7	33	60	0.004	0.002	1283.304	1166.64	2449.944
5	Idukki	13482	6	29	65	0.004	0.002	1563.912	1752.66	3316.572
6	Kattappana	11238	8	27	65	0.004	0.002	1213.704	1460.94	2674.644
7	Nedumkandam	12190	8	27	65	0.004	0.002	1316.52	1584.7	2901.22
8	Thodupuzha	10474	8	32	60	0.004	0.002	1340.672	1256.88	2597.552
Total		**108891**						**12659.9**	**13808.45**	**26468.35**

State: KERALA										
District: KANNUR										
Assessment Year -2020										
Sl. No.	**Assessment Unit**	**Non-command area (Ha)**	**Maximum limit of fluctuation in phreatic aquifer (mbgl)**	**phreatic aquifer thickness (in storage,m)**	**Semi-confined thickness (in storage, m)**	**Phreatic in storage parameter**	**Semi-confined in storage parameter**	**Phreatic instorage volume (Ha-m)**	**Semi-confined instorage volume (Ha-m)**	**Total In storage volume (Ha-m)**
1	Edakkad	8948	8	32	60	0.008	0.004	2290.69	2147.52	4438.21
2	Irikkur	36290	9	26	65	0.004	0.002	3774.16	4717.70	8491.86
3	Iritty	31509	7	28	65	0.004	0.002	3529.01	4096.17	7625.18
4	Kallyasseri	14339	7	33	60	0.008	0.004	3785.50	3441.36	7226.86
5	Kannur	12678	8	32	60	0.012	0.006	4868.35	4564.08	9432.43
6	Kuthuparamba	12935	10	30	60	0.006	0.003	2328.30	2328.30	4656.60
7	Panur	7383	8	27	65	0.006	0.003	1196.05	1439.69	2635.73
8	Payyannur	34212	7	28	65	0.012	0.006	11495.23	13342.68	24837.91
9	Peravoor	21342	8	32	60	0.004	0.002	2731.78	2561.04	5292.82
10	Taliparamba	40703	9	31	60	0.008	0.004	10094.34	9768.72	19863.06
11	Thalassery	12057	8	32	60	0.008	0.004	3086.59	2893.68	5980.27
Total		**232396**						**49179.99**	**51300.94**	**100480.93**

State: KERALA										
District: KASARGOD										
Assessment Year -2020										
Sl. No.	**Assessment Unit**	**Non-command area (Ha)**	**Maximum limit of fluctuation in phreatic aquifer (mbgl)**	**Phreatic aquifer thickness (in storage,m)**	**Semi-confined thickness (in storage,m)**	**Phreatic in storage parameter**	**Semi-confined in storage parameter**	**Phreatic instorage volume (Ha-m)**	**Semi-confined instorage volume (Ha-m)**	**Total In storage volume (Ha-m)**
1	Kanhangad	24508	12	23	60	0.006	0.003	3382.104	4411.44	7793.544
2	Karadka	26247	18	22	60	0.006	0.003	3372.204	4724.46	8096.664
3	Kasaragod	25876	16	24	60	0.006	0.003	3654.144	4657.68	8311.824
4	Manjeswar	33136	14	26	60	0.006	0.003	5169.216	5964.48	11133.7
5	Nileswaram	19695	10	30	60	0.006	0.003	3545.1	3545.1	7090.2
6	Parappa	35368	12	28	60	0.006	0.003	5941.824	6366.24	12308.06
Total		**164830**						***25064.59***	***29669.4***	***54733.99***

State: KERALA													
District: KOLLAM													
Assessment Year: 2020													
Sl. No.	**Assessment Unit**	**Non-command area (Ha)**	**Maximum limit of fluctuation in phreatic aquifer (mbgl)**	**Phreatic aquifer thickness (in storage, m)**	**Semi-confined thickness (in storage, m)**	**Confined thickness (in storage, m)**	**Phreatic in storage parameter**	**Semi-confined in storage parameter**	**Confined in storage parameter**	**Phreatic instorage volume (Ha-m)**	**Semi-confined instorage volume (Ha-m)**	**Confined instorage volume (Ha-m)**	**Total In storage volume (Ha-m)**
1	Anchal	64622	10	25	65		0.003	0.0015	0.00075	4846.65	6300.65	0.00	11147.30
2	Chadayamangalam	24903	10	35	55		0.003	0.0015	0.00075	2614.82	2054.50	0.00	4669.31
3	Chavara	7490	5	30	40	50	0.016	0.008	0.004	3595.20	2396.80	1498.00	7490.00
4	Chittumala	12125	8	27	65		0.004	0.002	0.001	1309.50	1576.25	0.00	2885.75
5	Ithikkara	12573	12	33	35	70	0.011	0.0055	0.00275	4564.00	2420.30	2420.30	9404.60
6	Kottarakkara	13310	10	30	60		0.003	0.0015	0.00075	1197.90	1197.90	0.00	2395.80
7	Mukhathala	14703	8	32	30	80	0.016	0.008	0.004	7527.94	3528.72	4704.96	15761.62
8	Oachira	11641	4	36	40	50	0.016	0.008	0.004	6705.22	3725.12	2328.20	12758.54
9	Pathanapuram	20095	9	31	60		0.003	0.0015	0.00075	1868.84	1808.55	0.00	3677.39
10	Sasthamkotta	12791	8	27	65		0.004	0.002	0.001	1381.43	1662.83	0.00	3044.26
11	Vettikkavala	16947	9	31	60		0.003	0.0015	0.00075	1576.07	1525.23	0.00	3101.30
Total		**211200**								**37187.55**	**28196.85**	**10951.46**	**76335.86**

State: KERALA													
District: KOTTAYAM													
Assessment Year: 2020													
Sl. No.	**Assessment Unit**	**Non-command area (Ha)**	**Maximum limit of fluctuation in phreatic aquifer (mbgl)**	**Phreatic aquifer thickness (in storage, m)**	**Semi-confined thickness (in storage, m)**	**Cconfined thickness (in storage, m)**	**Phreatic in storage parameter**	**Ssemi-confined in storage parameter**	**Confined in storage parameter**	**Phreatic instorage volume (Ha-m)**	**Semi-confined instorage volume (Ha-m)**	**Confined instorage volume (Ha-m)**	**Total In storage volume (Ha-m)**
1	Erattupetta	14560.00	7.00	28.00	65.00		0.00	0.00	0.00	1223.04	1419.60	0.00	2642.64
2	Ettumanoor	21460.00	8.00	32.00	60.00		0.01	0.00	0.00	5493.76	5150.40	0.00	10644.16
3	Kaduthuruthy	15806.00	8.00	32.00	60.00		0.00	0.00	0.00	2023.17	1896.72	0.00	3919.89
4	Kanjirappally	23290.00	8.00	27.00	65.00		0.00	0.00	0.00	2515.32	3027.70	0.00	5543.02
5	Lalam	19110.00	10.00	25.00	65.00		0.00	0.00	0.00	1433.25	1863.23	0.00	3296.48
6	Madappally	11950.00	10.00	30.00	30.00	80.00	0.01	0.00	0.00	2868.00	1434.00	1912.00	6214.00
7	Pallom	17802.00	8.00	37.00	55.00		0.01	0.00	0.00	5269.39	3916.44	0.00	9185.83
8	Pampady	20550.00	8.00	32.00	60.00		0.00	0.00	0.00	1972.80	1849.50	0.00	3822.30
9	Uzhavoor	22460.00	8.00	27.00	65.00		0.00	0.00	0.00	1819.26	2189.85	0.00	4009.11
10	Vaikom	13190.00	6.00	34.00	30.00	80.00	0.01	0.01	0.00	5381.52	2374.20	3165.60	10921.32
11	Vazhoor	16910.00	8.00	27.00	65.00		0.00	0.00	0.00	1369.71	1648.73	0.00	3018.44
Total		**197088.00**								**31369.22**	**26770.36**	**5077.60**	**63217.18**

State: KERALA										
District: KOZHIKODE										
Assessment Year: 2020										
Sl. No.	**Assessment Unit**	**Non-command area (Ha)**	**Maximum limit of fluctuation in phreatic aquifer (mbgl)**	**Phreatic aquifer thickness (instorage, m)**	**Semi-confined thickness (in storage,m)**	**Phreatic in storage parameter**	**Semi-confined in storage parameter**	**Phreatic instorage volume (Ha-m)**	**Semi-confined instorage volume (Ha-m)**	**Total In storage volume (Ha-m)**
1	Balussery	13953	8	27	65	0.003	0.0015	1130.19	1360.42	2490.61
2	Chelannur	13866	7	33	60	0.003	0.0015	1372.73	1247.94	2620.67
3	Koduvally	27298	9	26	65	0.003	0.0015	2129.24	2661.56	4790.80
4	Kozhikode	16351	12	33	55	0.005	0.0025	2697.92	2248.26	4946.18
5	Kunnamangalam	16994	10	30	60	0.003	0.0015	1529.46	1529.46	3058.92
6	Kunnummal	13152	8	27	65	0.002	0.001	710.21	854.88	1565.09
7	Melady	8407	8	32	110	0.016	0.008	4304.38	7398.16	11702.54
8	Panthalayani	9855	9	31	110	0.016	0.008	4888.08	8672.40	13560.48
9	Perambra	17902	8	27	65	0.003	0.0015	1450.06	1745.45	3195.51
10	Thodannur	9677	8	32	60	0.003	0.0015	928.99	870.93	1799.92
11	Tuneri	11497	8	32	60	0.003	0.0015	1103.71	1034.73	2138.44
12	Vadakara	7228	8	32	60	0.006	0.003	1387.78	1301.04	2688.82
Total		**166180**						**23632.76**	**30925.22**	**54557.98**

State: KERALA													
District: MALAPPURAM													
Assessment Year -2020													
Sl. No.	**Assessment Unit**	**Non-command area (Ha)**	**Maximum limit of fluctuation in phreatic aquifer (mbgl)**	**Phreatic aquifer thickness (in storage, m)**	**Semi-confined thickness (in storage, m)**	**Confined thickness (in storage, m)**	**Phreatic in storage parameter**	**Semi-confined in storage parameter**	**Confined in storage parameter**	**Phreatic instorage volume (Ha-m)**	**Semi-confined instorage volume (Ha-m)**	**Confined instorage volume (Ha-m)**	**Total In storage volume (Ha-m)**
1	Areacode	28357	8	27	65		0.006	0.00	0.00	4593.83	5529.62	0.00	10123.45
2	Kalikavu	24412	8	32	60		0.006	0.00	0.00	4687.10	4394.16	0.00	9081.26
3	Kondotty	18624	10	30	60		0.006	0.00	0.00	3352.32	3352.32	0.00	6704.64
4	Kuttippuram	17868	10	30	60		0.01	0.01	0.00	5360.40	5360.40	0.00	10720.80
5	Malappuram	18032	10	30	60		0.006	0.00	0.00	3245.76	3245.76	0.00	6491.52
6	Mankada	15245	10	30	60		0.008	0.00	0.00	3658.80	3658.80	0.00	7317.60
7	Nilamboor	21820	8	27	65		0.006	0.00	0.00	3534.84	4254.90	0.00	7789.74
8	Perinthalmanna	27203	9	31	60		0.004	0.00	0.00	3373.17	3264.36	0.00	6637.53
9	Perumpadappu	5899	8	32	60	50	0.032	0.02	0.01	6040.58	5663.04	2359.60	14063.22
10	Ponnani	9706	6	34	60	50	0.022	0.011	0.0055	7260.09	6405.96	2669.15	16335.20
11	Tanur	12756	6	34	60		0.006	0.003	0.0015	2602.22	2296.08	0.00	4898.30
12	Tirur	11105	10	30	60	50	0.006	0.003	0.0015	1998.90	1998.90	832.88	4830.68
13	Tirurangadi	13001	10	30	60		0.01	0.005	0.0025	3900.30	3900.30	0.00	7800.60
14	Vengara	14845	10	25	65		0.008	0.004	0.002	2969.00	3859.70	0.00	6828.70
15	Wandoor	15308	8	32	60		0.006	0.003	0.0015	2939.14	2755.44	0.00	5694.58
Total		**254181**								**59516.45**	**59939.74**	**5861.63**	**125317.81**

State: KERALA										
District: PALAKKAD										
Assessment Year: 2020										
Sl. No.	**Assessment Unit**	**Non-command area (Ha)**	**Maximum limit of fluctuation in phreatic aquifer (mbgl)**	**Phreatic aquifer thickness (instorage,m)**	**Semi-confined thickness (in storage, m)**	**Phreatic in storage parameter**	**Semi-confined in storage parameter**	**Phreatic instorage volume (Ha-m)**	**Semi-confined instorage volume (Ha-m)**	**Total In storage volume (Ha-m)**
1	Alathur	23447	6	34	60	0.006	0.003	4783.19	4220.46	9003.65
2	Attappadi	22323	7	28	65	0.006	0.003	3750.26	4352.99	8103.25
3	Chittur	31468	10	40	50	0.006	0.003	7552.32	4720.20	12272.52
4	Kollengode	19911	8	37	55	0.006	0.003	4420.24	3285.32	7705.56
5	Kuzhalmannam	19212	7	33	60	0.006	0.003	3803.98	3458.16	7262.14
6	Malampuzha	20394	8	32	60	0.004	0.002	2610.43	2447.28	5057.71
7	Mannarkkad	29535	9	31	60	0.006	0.003	5493.51	5316.30	10809.81
8	Nenmara	23953	8	32	60	0.006	0.003	4598.98	4311.54	8910.52
9	Ottappalam	27306	7	38	55	0.004	0.002	4150.51	3003.66	7154.17
10	Palakkad	20706	7	33	60	0.004	0.002	2733.19	2484.72	5217.91
11	Pattambi	20744	9	36	65	0.006	0.003	4480.70	4045.08	8525.78
12	Sreekrishnapuram	22013	10	30	60	0.006	0.003	3962.34	3962.34	7924.68
13	Thrithala	17216	10	35	55	0.004	0.002	2410.24	1893.76	4304.00
Total		**298228**						**54749.90**	**47501.80**	**102251.70**

State: KERALA										
District: PATHANAMTHITTA										
Assessment Year: 2020										
Sl. No.	**Assessment Unit**	**Non-command area (Ha)**	**Maximum limit of fluctuation in phreatic aquifer (mbgl)**	**Phreatic aquifer thickness (instorage,m)**	**Semi-confined thickness (in storage,m)**	**Phreatic in storage parameter**	**Semi-confined in storage parameter**	**Phreatic instorage volume (Ha-m)**	**Semi-confined instorage volume (Ha-m)**	**Total In storage volume (Ha-m)**
1	Elanthoor	10622	8	32	60	0.003	0.0015	1019.71	955.98	1975.69
2	Koipuram	12367	8	32	60	0.003	0.0015	1187.23	1113.03	2300.26
3	Konni	25977	8	27	65	0.003	0.0015	2104.14	2532.76	4636.89
4	Mallappally	15418	9	26	65	0.003	0.0015	1202.60	1503.26	2705.86
5	Pandalam	11641	8	27	65	0.008	0.004	2514.46	3026.66	5541.12
6	Parakode	22642	8	27	65	0.004	0.002	2445.34	2943.46	5388.80
7	Pulikeezh	6866	6	39	105	0.015	0.0075	4016.61	5406.98	9423.59
8	Ranni	24132	9	26	65	0.003	0.0015	1882.30	2352.87	4235.17
Total		**129665**						**16372.38**	**19834.99**	**36207.37**

State : KERALA													
District :THIRUVANANTHAPURAM													
Assessment Year: 2020													
Sl. No.	**Assessment Unit**	**Non-command area (Ha)**	**Maximum limit of fluctuation in phreatic aquifer (mbgl)**	**Phreatic aquifer thickness (in storage, m)**	**Semi-confined thickness (in storage, m)**	**Confined thickness (in storage, m)**	**Phreatic in storage parameter**	**Semi-confined in storage parameter**	**Confined in storage parameter**	**Phreatic instorage volume (Ha-m)**	**Semi-confined instorage volume (Ha-m)**	**Confined instorage volume (Ha-m)**	**Total In storage volume (Ha-m)**
1	Athiyannur	7629	15	35	50		0.004	0.002	0.001	1068.06	762.9	0	1830.96
2	Chirayinkil	10151	9	31			0.01	0.005	0.0025	3146.81	0	0	3146.81
3	Kilimanoor	17977	12	28	60		0.008	0.004	0.002	4026.848	4314.48	0	8341.328
4	Nedumangad	15603	10	25	65		0.008	0.004	0.002	3120.6	4056.78	0	7177.38
5	Nemom	33727	9	36	55		0.002	0.001	0.0005	2428.344	1854.985	0	4283.329
6	Parassala	8221	15	25	60		0.012	0.006	0.003	2466.3	2959.56	0	5425.86
7	Perumkadavila	27038	10	25	65		0.004	0.002	0.001	2703.8	3514.94	0	6218.74
8	Pothencode	7415	9	26	35	80	0.02	0.008	0.004	3855.8	2076.2	2372.8	8304.8
9	Vamanapuram	27115	9	26	65		0.006	0.003	0.0015	4229.94	5287.425	0	9517.365
10	Varkala	10209	12	38	50	50	0.01	0.005	0.0025	3879.42	2552.25	1276.125	7707.795
11	Vellanad	29212	10	25	65		0.006	0.003	0.0015	4381.8	5696.34	0	10078.14
Total		***194297***								**35307.72**	**33075.86**	**3648.925**	**72032.51**

State: KERALA										
District: THRISSUR										
Assessment Year: 2020										
Sl. No.	**Assessment Unit**	**Non-command area (Ha)**	**Maximum limit of fluctuation in phreatic aquifer (mbgl)**	**phreatic aquifer thickness (instorage,m)**	**semi-confined thickness (in storage,m)**	**phreatic in storage parameter**	**semi-confined in storage parameter**	**phreatic instorage volume (Ha-m)**	**semi-confined instorage volume (Ha-m)**	**Total In storage volume (Ha-m)**
1	Anthikkad	9904	10	30	0	0.02	0.01	5942.4	0	5942.4
2	Chalakkudy	20369	8	27	65	0.006	0.003	3299.778	3971.955	7271.733
3	Chavakkad	9917	6	34	0	0.016	0.008	5394.848	0	5394.848
4	Cherpu	8448	10	35	55	0.012	0.006	3548.16	2787.84	6336
5	Chowannur	17774	10	35	55	0.006	0.003	3732.54	2932.71	6665.25
6	Irinjalakkuda	12073	9	31	60	0.01	0.003	3742.63	2173.14	5915.77
7	Kodakara	20812	8	32	60	0.006	0.003	3995.904	3746.16	7742.064
8	Mala	12713	8	37	55	0.01	0.003	4703.81	2097.645	6801.455
9	Mathilakom	14635	6	29	0	0.016	0.008	6790.64	0	6790.64
10	Mullassery	6585	8	27	0	0.016	0.008	2844.72	0	2844.72
11	Ollukkara	20572	8	32	60	0.006	0.003	3949.824	3702.96	7652.784
12	Pazhayannur	23695	8	27	65	0.006	0.003	3838.59	4620.525	8459.115
13	Puzhakkal	22892	10	35	55	0.007	0.0035	5608.54	4406.71	10015.25
14	Thalikkulam	6568	6	29	67	0.016	0.008	3047.552	3520.448	6568
15	Vadakkancherry	18659	9	24	67	0.006	0.003	2686.896	3750.459	6437.355
16	Vellangallur	11069	10	35	0	0.014	0.007	5423.81	0	5423.81
Total		***236685***						**68550.64**	**37710.55**	**106261.19**

State: KERALA										
District: WAYANAD										
Assessment Year: 2020										
Sl. No.	Assessment Unit	Non-command area (Ha)	Maximum limit of fluctuation in phreatic aquifer (mbgl)	Phreatic aquifer thickness(in storage,m)	Semi-confined thickness (in storage,m)	Phreatic in storage parameter	Semi-confined in storage parameter	Phreatic instorage volume (Ha-m)	Semi-confined instorage volume (Ha-m)	Total In storage volume (Ha-m)
1	Kalpetta	41351	10	20	70	0.006	0.003	4962.12	8683.71	13645.8
2	Mananthavady	41051	10	20	70	0.006	0.003	4926.12	8620.71	13546.8
3	Panamaram	23286	10	20	70	0.006	0.003	2794.32	4890.06	7684.38
4	Sulthanbathery	37074	10	20	70	0.006	0.003	4448.88	7785.54	12234.4
Total		**142762**						**17131.4**	**29980**	**47111.5**

ANNEXURE-V:TOTAL GROUND WATER RESOURCE AVAILABILITY

Total Ground Water Resource Availability -2020											
State: KERALA											
District: ALAPPUZHA											
S.No	**Name of the Assessment Unit**	**Annual Extractable Ground Water Recharge of unconfined Aquifer**	**In storage Ground Water Resources of Unconfined Aquifer**	**Total Ground Water Availability of Unconfined Aquifer**	**Dynamic Ground Water Resources of Semi-Confined Aquifer**	**In storage Ground Water Resources of Semi-Confined Aquifer**	**Total Ground Water Availability of Semi-Confined Aquifer**	**Dynamic Ground Water Resources of Confined Aquifer**	**In storage Ground Water Resources of Confined Aquifer**	**Total Ground Water Availability of Confined Aquifer**	**Total Ground Water Availability of the Assessment Unit**
		Unconfined Aquifer			**Semi-Confined Aquifer**			**Confined Aquifer**			
		6	***7***	***8=6+7***	***9***	***10***	***11=9+10***	***12***	***13***	***14=12+13***	***15=8+11+14***
1	Ambalappuzha	2061.06	3417.44	5478.50	0.00	0.00	0.00	0.00	1584.70	1584.70	7063.20
2	Aryad	2533.82	4350.91	6884.73	0.00	0.00	0.00	0.00	2017.56	2017.56	8902.29
3	Bharanikkavu	3681.01	6237.60	9918.61	0.00	0.00	0.00	0.00	2858.90	2858.90	12777.51
4	Champakkulam	3558.73	7629.97	11188.70	0.00	0.00	0.00	0.00	3538.09	3538.09	14726.79
5	Chengannur	4284.66	3838.98	8123.64	0.00	0.00	0.00	0.00	3299.12	3299.12	11422.76
6	Harippad	3465.20	5673.74	9138.94	0.00	0.00	0.00	0.00	2630.97	2630.97	11769.91
7	Kanjikkuzhy	2486.71	5462.45	7949.16	0.00	0.00	0.00	0.00	2532.99	2532.99	10482.15
8	Mavelikkara	3456.68	4921.56	8378.24	0.00	0.00	0.00	0.00	2209.68	2209.68	10587.92
9	Muthukulam	3625.85	5778.90	9404.75	0.00	0.00	0.00	0.00	2679.73	2679.73	12084.48
10	Pattanakkad	2600.15	5392.02	7992.17	0.00	0.00	0.00	0.00	0.00	0.00	7992.17
11	Thycattussery	3508.22	7022.86	10531.08	0.00	0.00	0.00	0.00	0.00	0.00	10531.08
12	Veliyanad	3479.59	6542.24	10021.83	0.00	0.00	0.00	0.00	3033.70	3033.70	13055.53
	Total (ham)	**38741.68**	**66268.66**	**105010.34**	**0.00**	**0.00**	**0.00**	**0.00**	**26385.44**	**26385.44**	**131395.78**

Total Ground Water Resource Availability -2020											
State: KERALA											
District: ERNAKULAM											
S.No	**Name of the Assessment Unit**	**Annual Extractable Ground Water Recharge of unconfined Aquifer**	**In storage Ground Water Resources of Unconfined Aquifer**	**Total Ground Water Availability of Unconfined Aquifer**	**Dynamic Ground Water Resources of Semi-Confined Aquifer**	**In storage Ground Water Resources of Semi-Confined Aquifer**	**Total Ground Water Availability of Semi-Confined Aquifer**	**Dynamic Ground Water Resources of Confined Aquifer**	**In storage Ground Water Resources of Confined Aquifer**	**Total Ground Water Availability of Confined Aquifer**	**Total Ground Water Availability of the Assessment Unit**
		Unconfined Aquifer			**Semi-Confined Aquifer**			**Confined Aquifer**			
		6	***7***	***8=6+7***	***9***	***10***	***11=9+10***	***12***	***13***	***14=12+13***	***15=8+11+14***
1	Alangad	2062.11	1759.44	3821.55	0.00	1906.06	1906.06	0.00	0.00	0.00	5727.61
2	Angamaly	4658.57	3942.64	8601.21	0.00	3815.46	3815.46	0.00	0.00	0.00	12416.67
3	Edappally	3831.76	15410.88	19242.64	0.00	7705.44	7705.44	0.00	0.00	0.00	26948.08
4	Koovappady	5727.98	8890.13	14618.11	0.00	11557.16	11557.16	0.00	0.00	0.00	26175.27
5	Kothamangalam	4161.89	4599.40	8761.29	0.00	5979.22	5979.22	0.00	0.00	0.00	14740.51
6	Moovattupuzha	3513.61	2997.00	6510.61	0.00	2997.00	2997.00	0.00	0.00	0.00	9507.61
7	Mulamthuruthy	2859.67	2938.86	5798.53	0.00	2938.86	2938.86	0.00	0.00	0.00	8737.39
8	Palluruthy	1483.79	6384.96	7868.75	0.00	0.00	0.00	0.00	0.00	0.00	7868.75
9	Pampakkuda	3565.12	4541.44	8106.56	0.00	4257.60	4257.60	0.00	0.00	0.00	12364.16
10	Parakkadavu	2272.21	3801.92	6074.13	0.00	3564.30	3564.30	0.00	0.00	0.00	9638.43
11	Paravoor	1886.26	7358.40	9244.66	0.00	0.00	0.00	0.00	0.00	0.00	9244.66
12	Vadavukodu	4187.66	5950.40	10138.06	0.00	5578.50	5578.50	0.00	0.00	0.00	15716.56
13	Vazhakkulam	4744.19	4832.00	9576.19	0.00	6281.60	6281.60	0.00	0.00	0.00	15857.79
14	Vypeen	1004.77	5416.32	6421.09	0.00	0.00	0.00	0.00	0.00	0.00	6421.09
	Total (ham)	**45959.59**	**78823.79**	**124783.38**	**0.00**	**56581.20**	**56581.20**	**0.00**	**0.00**	**0.00**	**181364.58**

Total Ground Water Resource Availability -2020											
State: KERALA											
District: IDUKKI											
S.No	**Name of the Assessment Unit**	**Annual Extractable Ground Water Recharge of unconfined Aquifer**	**In storage Ground Water Resources of Unconfined Aquifer**	**Total Ground Water Availability of Unconfined Aquifer**	**Dynamic Ground Water Resources of Semi-Confined Aquifer**	**In storage Ground Water Resources of Semi-Confined Aquifer**	**Total Ground Water Availability of Semi-Confined Aquifer**	**Dynamic Ground Water Resources of Confined Aquifer**	**In storage Ground Water Resources of Confined Aquifer**	**Total Ground Water Availability of Confined Aquifer**	**Total Ground Water Availability of the Assessment Unit**
		Unconfined Aquifer			**Semi-Confined Aquifer**			**Confined Aquifer**			
		6	***7***	***8=6+7***	***9***	***10***	***11=9+10***	***12***	***13***	***14=12+13***	***15=8+11+14***
1	Adimali	3091.03	2289.60	5380.63	0.00	2756.00	2756.00	0.00	0.00	0.00	8136.63
2	Azhutha	2792.33	1919.54	4711.87	0.00	1745.04	1745.04	0.00	0.00	0.00	6456.91
3	Devikulam	2235.83	1732.64	3968.47	0.00	2085.59	2085.59	0.00	0.00	0.00	6054.06
4	Elam Desom	1847.20	1283.30	3130.50	0.00	1166.64	1166.64	0.00	0.00	0.00	4297.14
5	Idukki	2601.55	1563.91	4165.46	0.00	1752.66	1752.66	0.00	0.00	0.00	5918.12
6	Kattappana	2213.42	1213.70	3427.12	0.00	1460.94	1460.94	0.00	0.00	0.00	4888.06
7	Nedumkandam	2157.45	1316.52	3473.97	0.00	1584.70	1584.70	0.00	0.00	0.00	5058.67
8	Thodupuzha	1938.09	1340.67	3278.76	0.00	1256.88	1256.88	0.00	0.00	0.00	4535.64
	Total (ham)	**18876.90**	**12659.90**	**31536.80**	**0.00**	**13808.45**	**13808.45**	**0.00**	**0.00**	**0.00**	**45345.25**

Total Ground Water Resource Availability -2020											
State: KERALA											
District: KANNUR											
S.No	**Name of the Assessment Unit**	**Annual Extractable Ground Water Recharge of unconfined Aquifer**	**In storage Ground Water Resources of Unconfined Aquifer**	**Total Ground Water Availability of Unconfined Aquifer**	**Dynamic Ground Water Resources of Semi-Confined Aquifer**	**In storage Ground Water Resources of Semi-Confined Aquifer**	**Total Ground Water Availability of Semi-Confined Aquifer**	**Dynamic Ground Water Resources of Confined Aquifer**	**In storage Ground Water Resources of Confined Aquifer**	**Total Ground Water Availability of Confined Aquifer**	**Total Ground Water Availability of the Assessment Unit**
		Unconfined Aquifer			**Semi-Confined Aquifer**			**Confined Aquifer**			
		6	***7***	***8=6+7***	***9***	***10***	***11=9+10***	***12***	***13***	***14=12+13***	***15=8+11+14***
1	Edakkad	1925.63	2290.69	4216.32	0.00	2147.52	2147.52	0.00	0.00	0.00	6363.84
2	Irikkur	6345.74	3774.16	10119.90	0.00	4717.70	4717.70	0.00	0.00	0.00	14837.60
3	Iritty	5213.32	3529.01	8742.33	0.00	4096.17	4096.17	0.00	0.00	0.00	12838.50
4	Kallyasseri	2537.20	3785.50	6322.70	0.00	3441.36	3441.36	0.00	0.00	0.00	9764.06
5	Kannur	2807.47	4868.35	7675.82	0.00	4564.08	4564.08	0.00	0.00	0.00	12239.90
6	Kuthuparamba	2055.73	2328.30	4384.03	0.00	2328.30	2328.30	0.00	0.00	0.00	6712.33
7	Panur	1197.66	1196.05	2393.71	0.00	1439.69	1439.69	0.00	0.00	0.00	3833.39
8	Payyannur	5805.15	11495.23	17300.38	0.00	13342.68	13342.68	0.00	0.00	0.00	30643.06
9	Peravoor	3414.14	2731.78	6145.92	0.00	2561.04	2561.04	0.00	0.00	0.00	8706.96
10	Taliparamba	7227.98	10094.34	17322.32	0.00	9768.72	9768.72	0.00	0.00	0.00	27091.04
11	Thalassery	2107.95	3086.59	5194.54	0.00	2893.68	2893.68	0.00	0.00	0.00	8088.22
	Total (ham)	**40637.97**	**49179.99**	**89817.96**	**0.00**	**51300.94**	**51300.94**	**0.00**	**0.00**	**0.00**	**141118.90**

Total Ground Water Resource Availability -2020											
State: KERALA											
District: KASARGOD											
S.No	**Name of the Assessment Unit**	**Annual Extractable Ground Water Recharge of unconfined Aquifer**	**In storage Ground Water Resources of Unconfined Aquifer**	**Total Ground Water Availability of Unconfined Aquifer**	**Dynamic Ground Water Resources of Semi-Confined Aquifer**	**In storage Ground Water Resources of Semi-Confined Aquifer**	**Total Ground Water Availability of Semi-Confined Aquifer**	**Dynamic Ground Water Resources of Confined Aquifer**	**In storage Ground Water Resources of Confined Aquifer**	**Total Ground Water Availability of Confined Aquifer**	**Total Ground Water Availability of the Assessment Unit**
		Unconfined Aquifer			**Semi-Confined Aquifer**			**Confined Aquifer**			
		6	***7***	***8=6+7***	***9***	***10***	***11=9+10***	***12***	***13***	***14=12+13***	***15=8+11+14***
1	Kanhangad	4058.80	3382.10	7440.90	0.00	4411.44	4411.44	0.00	0.00	0.00	11852.34
2	Karadka	5490.00	3372.20	8862.20	0.00	4724.46	4724.46	0.00	0.00	0.00	13586.66
3	Kasaragod	4596.67	3654.14	8250.81	0.00	4657.68	4657.68	0.00	0.00	0.00	12908.49
4	Manjeswar	5780.90	5169.22	10950.12	0.00	5964.48	5964.48	0.00	0.00	0.00	16914.60
5	Nileswaram	3208.56	3545.10	6753.66	0.00	3545.10	3545.10	0.00	0.00	0.00	10298.76
6	Parappa	6016.71	5941.82	11958.53	0.00	6366.24	6366.24	0.00	0.00	0.00	18324.77
	Total (ham)	**29151.64**	**25064.59**	**54216.23**	**0.00**	**29669.40**	**29669.40**	**0.00**	**0.00**	**0.00**	**83885.63**

Total Ground Water Resource Availability -2020											
State: KERALA											
District: KOLLAM											
S.No	**Name of the Assessment Unit**	**Annual Extractable Ground Water Recharge of unconfined Aquifer**	**In storage Ground Water Resources of Unconfined Aquifer**	**Total Ground Water Availability of Unconfined Aquifer**	**Dynamic Ground Water Resources of Semi-Confined Aquifer**	**In storage Ground Water Resources of Semi-Confined Aquifer**	**Total Ground Water Availability of Semi-Confined Aquifer**	**Dynamic Ground Water Resources of Confined Aquifer**	**In storage Ground Water Resources of Confined Aquifer**	**Total Ground Water Availability of Confined Aquifer**	**Total Ground Water Availability of the Assessment Unit**
		Unconfined Aquifer			**Semi-Confined Aquifer**			**Confined Aquifer**			
		6	***7***	***8=6+7***	***9***	***10***	***11=9+10***	***12***	***13***	***14=12+13***	***15=8+11+14***
1	Anchal	7465.22	4846.65	12311.87	0.00	6300.65	6300.65	0.00	0.00	0.00	18612.52
2	Chadayamangalam	3459.74	2614.82	6074.56	0.00	2054.50	2054.50	0.00	0.00	0.00	8129.05
3	Chavara	2046.81	3595.20	5642.01	0.00	2396.80	2396.80	0.00	1498.00	1498.00	9536.81
4	Chittumala	2406.33	1309.50	3715.83	0.00	1576.25	1576.25	0.00	0.00	0.00	5292.08
5	Ithikkara	2503.53	4564.00	7067.53	0.00	2420.30	2420.30	0.00	2420.30	2420.30	11908.13
6	Kottarakkara	2114.08	1197.90	3311.98	0.00	1197.90	1197.90	0.00	0.00	0.00	4509.88
7	Mukhathala	3133.45	7527.94	10661.39	0.00	3528.72	3528.72	0.00	4704.96	4704.96	18895.07
8	Oachira	3058.34	6705.22	9763.56	0.00	3725.12	3725.12	0.00	2328.20	2328.20	15816.88
9	Pathanapuram	3111.32	1868.84	4980.16	0.00	1808.55	1808.55	0.00	0.00	0.00	6788.71
10	Sasthamkotta	2147.46	1381.43	3528.89	0.00	1662.83	1662.83	0.00	0.00	0.00	5191.72
11	Vettikkavala	2560.33	1576.07	4136.40	0.00	1525.23	1525.23	0.00	0.00	0.00	5661.63
	Total (ham)	**34006.61**	**37187.55**	**71194.16**	**0.00**	**28196.85**	**28196.85**	**0.00**	**10951.46**	**10951.46**	**110342.47**

Total Ground Water Resource Availability -2020											
State: KERALA											
District: KOTTAYAM											
S.No	**Name of the Assessment Unit**	**Annual Extractable Ground Water Recharge of unconfined Aquifer**	**In storage Ground Water Resources of Unconfined Aquifer**	**Total Ground Water Availability of Unconfined Aquifer**	**Dynamic Ground Water Resources of Semi-Confined Aquifer**	**In storage Ground Water Resources of Semi-Confined Aquifer**	**Total Ground Water Availability of Semi-Confined Aquifer**	**Dynamic Ground Water Resources of Confined Aquifer**	**In storage Ground Water Resources of Confined Aquifer**	**Total Ground Water Availability of Confined Aquifer**	**Total Ground Water Availability of the Assessment Unit**
		Unconfined Aquifer			**Semi-Confined Aquifer**			**Confined Aquifer**			
		6	***7***	***8=6+7***	***9***	***10***	***11=9+10***	***12***	***13***	***14=12+13***	***15=8+11+14***
1	Erattupetta	2394.13	1223.04	3617.17	0.00	1419.60	1419.60	0.00	0.00	0.00	5036.77
2	Ettumanoor	2802.01	5493.76	8295.77	0.00	5150.40	5150.40	0.00	0.00	0.00	13446.17
3	Kaduthuruthy	4197.90	2023.17	6221.07	0.00	1896.72	1896.72	0.00	0.00	0.00	8117.79
4	Kanjirappally	3925.59	2515.32	6440.91	0.00	3027.70	3027.70	0.00	0.00	0.00	9468.61
5	Lalam	2688.84	1433.25	4122.09	0.00	1863.23	1863.23	0.00	0.00	0.00	5985.32
6	Madappally	4696.48	2868.00	7564.48	0.00	1434.00	1434.00	0.00	1912.00	1912.00	10910.48
7	Pallom	5462.68	5269.39	10732.07	0.00	3916.44	3916.44	0.00	0.00	0.00	14648.51
8	Pampady	2600.20	1972.80	4573.00	0.00	1849.50	1849.50	0.00	0.00	0.00	6422.50
9	Uzhavoor	3543.03	1819.26	5362.29	0.00	2189.85	2189.85	0.00	0.00	0.00	7552.14
10	Vaikom	2795.78	5381.52	8177.30	0.00	2374.20	2374.20	0.00	3165.60	3165.60	13717.10
11	Vazhoor	2084.65	1369.71	3454.36	0.00	1648.73	1648.73	0.00	0.00	0.00	5103.09
	Total (ham)	**37191.29**	**31369.22**	**68560.51**	**0.00**	**26770.36**	**26770.36**	**0.00**	**5077.60**	**5077.60**	**100408.47**

Total Ground Water Resource Availability -2020											
State: KERALA											
District: KOZHIKODE											
S.No	**Name of the Assessment Unit**	**Annual Extractable Ground Water Recharge of unconfined Aquifer**	**In storage Ground Water Resources of Unconfined Aquifer**	**Total Ground Water Availability of Unconfined Aquifer**	**Dynamic Ground Water Resources of Semi-Confined Aquifer**	**In storage Ground Water Resources of Semi-Confined Aquifer**	**Total Ground Water Availability of Semi-Confined Aquifer**	**Dynamic Ground Water Resources of Confined Aquifer**	**In storage Ground Water Resources of Confined Aquifer**	**Total Ground Water Availability of Confined Aquifer**	**Total Ground Water Availability of the Assessment Unit**
		Unconfined Aquifer			**Semi-Confined Aquifer**			**Confined Aquifer**			
		6	***7***	***8=6+7***	***9***	***10***	***11=9+10***	***12***	***13***	***14=12+13***	***15=8+11+14***
1	Balussery	2464.61	1130.19	3594.80	0.00	1360.42	1360.42	0.00	0.00	0.00	4955.22
2	Chelannur	2300.70	1372.73	3673.43	0.00	1247.94	1247.94	0.00	0.00	0.00	4921.37
3	Koduvally	4462.95	2129.24	6592.19	0.00	2661.56	2661.56	0.00	0.00	0.00	9253.75
4	Kozhikode	2714.87	2697.92	5412.79	0.00	2248.26	2248.26	0.00	0.00	0.00	7661.05
5	Kunnamangalam	2871.63	1529.46	4401.09	0.00	1529.46	1529.46	0.00	0.00	0.00	5930.55
6	Kunnummal	2500.70	710.21	3210.91	0.00	854.88	854.88	0.00	0.00	0.00	4065.79
7	Melady	2005.51	4304.38	6309.89	0.00	7398.16	7398.16	0.00	0.00	0.00	13708.05
8	Panthalayani	3242.24	4888.08	8130.32	0.00	8672.40	8672.40	0.00	0.00	0.00	16802.72
9	Perambra	3405.98	1450.06	4856.04	0.00	1745.45	1745.45	0.00	0.00	0.00	6601.49
10	Thodannur	1584.79	928.99	2513.78	0.00	870.93	870.93	0.00	0.00	0.00	3384.71
11	Tuneri	1665.80	1103.71	2769.51	0.00	1034.73	1034.73	0.00	0.00	0.00	3804.24
12	Vadakara	1909.72	1387.78	3297.50	0.00	1301.04	1301.04	0.00	0.00	0.00	4598.54
	Total (ham)	**31129.50**	**23632.76**	**54762.26**	**0.00**	**30925.22**	**30925.22**	**0.00**	**0.00**	**0.00**	**85687.48**

Total Ground Water Resource Availability -2020											
State: KERALA											
District: MALAPPURAM											
S.No	**Name of the Assessment Unit**	**Annual Extractable Ground Water Recharge of unconfined Aquifer**	**In storage Ground Water Resources of Unconfined Aquifer**	**Total Ground Water Availability of Unconfined Aquifer**	**Dynamic Ground Water Resources of Semi-Confined Aquifer**	**In storage Ground Water Resources of Semi-Confined Aquifer**	**Total Ground Water Availability of Semi-Confined Aquifer**	**Dynamic Ground Water Resources of Confined Aquifer**	**In storage Ground Water Resources of Confined Aquifer**	**Total Ground Water Availability of Confined Aquifer**	**Total Ground Water Availability of the Assessment Unit**
		Unconfined Aquifer			**Semi-Confined Aquifer**			**Confined Aquifer**			
		6	***7***	***8=6+7***	***9***	***10***	***11=9+10***	***12***	***13***	***14=12+13***	***15=8+11+14***
1	Areacode	4647.28	4593.83	9241.11	0.00	5529.62	5529.62	0.00	0.00	0.00	14770.73
2	Kalikavu	4290.51	4687.10	8977.61	0.00	4394.16	4394.16	0.00	0.00	0.00	13371.77
3	Kondotty	3015.71	3352.32	6368.03	0.00	3352.32	3352.32	0.00	0.00	0.00	9720.35
4	Kuttippuram	3093.87	5360.40	8454.27	0.00	5360.40	5360.40	0.00	0.00	0.00	13814.67
5	Malappuram	3458.12	3245.76	6703.88	0.00	3245.76	3245.76	0.00	0.00	0.00	9949.64
6	Mankada	2541.50	3658.80	6200.30	0.00	3658.80	3658.80	0.00	0.00	0.00	9859.10
7	Nilamboor	3391.84	3534.84	6926.68	0.00	4254.90	4254.90	0.00	0.00	0.00	11181.58
8	Perinthalmanna	5011.75	3373.17	8384.92	0.00	3264.36	3264.36	0.00	0.00	0.00	11649.28
9	Perumpadappu	2130.47	6040.58	8171.05	0.00	5663.04	5663.04	0.00	2359.60	2359.60	16193.69
10	Ponnani	2840.65	7260.09	10100.74	0.00	6405.96	6405.96	0.00	2669.15	2669.15	19175.85
11	Thanur	2551.19	2602.22	5153.41	0.00	2296.08	2296.08	0.00	0.00	0.00	7449.49
12	Thriurangadi	2686.19	1998.90	4685.09	0.00	1998.90	1998.90	0.00	832.88	832.88	7516.87
13	Tirur	2256.28	3900.30	6156.58	0.00	3900.30	3900.30	0.00	0.00	0.00	10056.88
14	Vengara	2750.05	2969.00	5719.05	0.00	3859.70	3859.70	0.00	0.00	0.00	9578.75
15	Wandoor	2931.30	2939.14	5870.44	0.00	2755.44	2755.44	0.00	0.00	0.00	8625.88
	Total (ham)	**47596.71**	**59516.45**	**107113.16**	**0.00**	**59939.74**	**59939.74**	**0.00**	**5861.63**	**5861.63**	**172914.52**

Total Ground Water Resource Availability -2020											
State: KERALA											
District: PALAKKAD											
S.No	**Name of the Assessment Unit**	**Annual Extractable Ground Water Recharge of unconfined Aquifer**	**In storage Ground Water Resources of Unconfined Aquifer**	**Total Ground Water Availability of Unconfined Aquifer**	**Dynamic Ground Water Resources of Semi-Confined Aquifer**	**In storage Ground Water Resources of Semi-Confined Aquifer**	**Total Ground Water Availability of Semi-Confined Aquifer**	**Dynamic Ground Water Resources of Confined Aquifer**	**In storage Ground Water Resources of Confined Aquifer**	**Total Ground Water Availability of Confined Aquifer**	**Total Ground Water Availability of the Assessment Unit**
		Unconfined Aquifer			**Semi-Confined Aquifer**			**Confined Aquifer**			
		6	***7***	***8=6+7***	***9***	***10***	***11=9+10***	***12***	***13***	***14=12+13***	***15=8+11+14***
1	Alathur	6945.49	4783.19	11728.68	0.00	4220.46	4220.46	0.00	0.00	0.00	15949.14
2	Attappadi	4146.84	3750.26	7897.10	0.00	4352.99	4352.99	0.00	0.00	0.00	12250.09
3	Chittur	5825.09	7552.32	13377.41	0.00	4720.20	4720.20	0.00	0.00	0.00	18097.61
4	Kollengode	5941.12	4420.24	10361.36	0.00	3285.32	3285.32	0.00	0.00	0.00	13646.68
5	Kuzhalmannam	7116.63	3803.98	10920.61	0.00	3458.16	3458.16	0.00	0.00	0.00	14378.77
6	Malampuzha	3223.41	2610.43	5833.84	0.00	2447.28	2447.28	0.00	0.00	0.00	8281.12
7	Mannarkkad	3675.54	5493.51	9169.05	0.00	5316.30	5316.30	0.00	0.00	0.00	14485.35
8	Nenmara	2815.66	4598.98	7414.64	0.00	4311.54	4311.54	0.00	0.00	0.00	11726.18
9	Ottappalam	3965.83	4150.51	8116.34	0.00	3003.66	3003.66	0.00	0.00	0.00	11120.00
10	Palakkad	5507.25	2733.19	8240.44	0.00	2484.72	2484.72	0.00	0.00	0.00	10725.16
11	Pattambi	3507.67	4480.70	7988.37	0.00	4045.08	4045.08	0.00	0.00	0.00	12033.45
12	Sreekrishnapuram	3283.01	3962.34	7245.35	0.00	3962.34	3962.34	0.00	0.00	0.00	11207.69
13	Thrithala	2456.57	2410.24	4866.81	0.00	1893.76	1893.76	0.00	0.00	0.00	6760.57
	Total (ham)	**58410.11**	**54749.90**	**113160.01**	**0.00**	**47501.80**	**47501.80**	**0.00**	**0.00**	**0.00**	**160661.81**

Total Ground Water Resource Availability -2020											
State: KERALA											
District: PATHANAMTHITTA											
S.No	**Name of the Assessment Unit**	**Annual Extractable Ground Water Recharge of unconfined Aquifer**	**In storage Ground Water Resources of Unconfined Aquifer**	**Total Ground Water Availability of Unconfined Aquifer**	**Dynamic Ground Water Resources of Semi-Confined Aquifer**	**In storage Ground Water Resources of Semi-Confined Aquifer**	**Total Ground Water Availability of Semi-Confined Aquifer**	**Dynamic Ground Water Resources of Confined Aquifer**	**In storage Ground Water Resources of Confined Aquifer**	**Total Ground Water Availability of Confined Aquifer**	**Total Ground Water Availability of the Assessment Unit**
		Unconfined Aquifer			**Semi-Confined Aquifer**			**Confined Aquifer**			
		6	***7***	***8=6+7***	***9***	***10***	***11=9+10***	***12***	***13***	***14=12+13***	***15=8+11+14***
1	Elanthoor	1762.98	1019.71	2782.69	0.00	955.98	955.98	0.00	0.00	0.00	3738.67
2	Koipuram	2040.18	1187.23	3227.41	0.00	1113.03	1113.03	0.00	0.00	0.00	4340.44
3	Konni	4580.05	2104.14	6684.19	0.00	2532.76	2532.76	0.00	0.00	0.00	9216.94
4	Mallappally	2448.73	1202.60	3651.33	0.00	1503.26	1503.26	0.00	0.00	0.00	5154.59
5	Pandalam	2138.88	2514.46	4653.34	0.00	3026.66	3026.66	0.00	0.00	0.00	7680.00
6	Parakode	5438.5	2445.34	7883.84	0.00	2943.46	2943.46	0.00	0.00	0.00	10827.30
7	Pulikeezh	2013.44	4016.61	6030.05	0.00	5406.98	5406.98	0.00	0.00	0.00	11437.03
8	Ranni	3709.45	1882.30	5591.75	0.00	2352.87	2352.87	0.00	0.00	0.00	7944.62
	Total (ham)	**24132.21**	**16372.38**	**40504.59**	**0.00**	**19834.99**	**19834.99**	**0.00**	**0.00**	**0.00**	**60339.58**

Total Ground Water Resource Availability -2020											
State: KERALA											
District: THIRUVANANTHAPURAM											
S.No	**Name of the Assessment Unit**	**Annual Extractable Ground Water Recharge of unconfined Aquifer**	**In storage Ground Water Resources of Unconfined Aquifer**	**Total Ground Water Availability of Unconfined Aquifer**	**Dynamic Ground Water Resources of Semi-Confined Aquifer**	**In storage Ground Water Resources of Semi-Confined Aquifer**	**Total Ground Water Availability of Semi-Confined Aquifer**	**Dynamic Ground Water Resources of Confined Aquifer**	**In storage Ground Water Resources of Confined Aquifer**	**Total Ground Water Availability of Confined Aquifer**	**Total Ground Water Availability of the Assessment Unit**
		Unconfined Aquifer			**Semi-Confined Aquifer**			**Confined Aquifer**			
		6	***7***	***8=6+7***	***9***	***10***	***11=9+10***	***12***	***13***	***14=12+13***	***15=8+11+14***
1	Athiyannur	1332.25	1068.06	2400.31	0.00	762.90	762.90	0.00	0.00	0.00	3163.21
2	Chirayinkil	1605.99	3146.81	4752.80	0.00	0.00	0.00	0.00	0.00	0.00	4752.80
3	Kilimanoor	2821.29	4026.85	6848.14	0.00	4314.48	4314.48	0.00	0.00	0.00	11162.62
4	Nedumangad	1990.80	3120.60	5111.40	0.00	4056.78	4056.78	0.00	0.00	0.00	9168.18
5	Nemom	4909.69	2428.34	7338.03	0.00	1854.99	1854.99	0.00	0.00	0.00	9193.02
6	Parassala	1563.02	2466.30	4029.32	0.00	2959.56	2959.56	0.00	0.00	0.00	6988.88
7	Perumkadavila	3202.90	2703.80	5906.70	0.00	3514.94	3514.94	0.00	0.00	0.00	9421.64
8	Pothencode	1439.34	3855.80	5295.14	0.00	2076.20	2076.20	0.00	2372.80	2372.80	9744.14
9	Vamanapuram	3367.42	4229.94	7597.36	0.00	5287.43	5287.43	0.00	0.00	0.00	12884.79
10	Varkala	1673.73	3879.42	5553.15	0.00	2552.25	2552.25	0.00	1276.13	1276.13	9381.53
11	Vellanad	3379.15	4381.80	7760.95	0.00	5696.34	5696.34	0.00	0.00	0.00	13457.29
	Total (ham)	**27285.58**	**35307.72**	**62593.30**	**0.00**	**33075.86**	**33075.86**	**0.00**	**3648.93**	**3648.93**	**99318.09**

Total Ground Water Resource Availability -2020											
State: KERALA											
District: THRISSUR											
S.No	**Name of the Assessment Unit**	**Annual Extractable Ground Water Recharge of unconfined Aquifer**	**In storage Ground Water Resources of Unconfined Aquifer**	**Total Ground Water Availability of Unconfined Aquifer**	**Dynamic Ground Water Resources of Semi-Confined Aquifer**	**In storage Ground Water Resources of Semi-Confined Aquifer**	**Total Ground Water Availability of Semi-Confined Aquifer**	**Dynamic Ground Water Resources of Confined Aquifer**	**In storage Ground Water Resources of Confined Aquifer**	**Total Ground Water Availability of Confined Aquifer**	**Total Ground Water Availability of the Assessment Unit**
		Unconfined Aquifer			**Semi-Confined Aquifer**			**Confined Aquifer**			
		6	***7***	***8=6+7***	***9***	***10***	***11=9+10***	***12***	***13***	***14=12+13***	***15=8+11+14***
1	Anthikkad	3809.78	5942.40	9752.18	0.00	0.00	0.00	0.00	0.00	0.00	9752.18
2	Chalakkudy	4120.52	3299.78	7420.30	0.00	3971.96	3971.96	0.00	0.00	0.00	11392.25
3	Chavakkad	3245.14	5394.85	8639.99	0.00	0.00	0.00	0.00	0.00	0.00	8639.99
4	Cherpu	3277.09	3548.16	6825.25	0.00	2787.84	2787.84	0.00	0.00	0.00	9613.09
5	Chowannur	3985.30	3732.54	7717.84	0.00	2932.71	2932.71	0.00	0.00	0.00	10650.55
6	Iringalakkuda	3030.98	3742.63	6773.61	0.00	2173.14	2173.14	0.00	0.00	0.00	8946.75
7	Kodakara	4369.46	3995.90	8365.36	0.00	3746.16	3746.16	0.00	0.00	0.00	12111.52
8	Mala	3521.99	4703.81	8225.80	0.00	2097.65	2097.65	0.00	0.00	0.00	10323.45
9	Mathilakom	3521.14	6790.64	10311.78	0.00	0.00	0.00	0.00	0.00	0.00	10311.78
10	Mullassery	2852.34	2844.72	5697.06	0.00	0.00	0.00	0.00	0.00	0.00	5697.06
11	Ollukkara	3281.48	3949.82	7231.30	0.00	3702.96	3702.96	0.00	0.00	0.00	10934.26
12	Pazhayannur	4433.43	3838.59	8272.02	0.00	4620.53	4620.53	0.00	0.00	0.00	12892.55
13	Puzhakkal	5219.25	5608.54	10827.79	0.00	4406.71	4406.71	0.00	0.00	0.00	15234.50
14	Thalikkulam	2110.79	3047.55	5158.34	0.00	3520.45	3520.45	0.00	0.00	0.00	8678.79
15	Vadakkancherry	3690.69	2686.90	6377.59	0.00	3750.46	3750.46	0.00	0.00	0.00	10128.05
16	Vellangallur	2413.18	5423.81	7836.99	0.00	0.00	0.00	0.00	0.00	0.00	7836.99
	Total (ham)	**56882.56**	**68550.642**	**125433.2**	**0**	**37710.552**	**37710.552**	**0.00**	**0.00**	**0.00**	**163143.75**

Total Ground Water Resource Availability -2020											
State: KERALA											
District: WAYANAD											
S.No	**Name of the Assessment Unit**	**Annual Extractable Ground Water Recharge of unconfined Aquifer**	**In storage Ground Water Resources of Unconfined Aquifer**	**Total Ground Water Availability of Unconfined Aquifer**	**Dynamic Ground Water Resources of Semi-Confined Aquifer**	**In storage Ground Water Resources of Semi-Confined Aquifer**	**Total Ground Water Availability of Semi-Confined Aquifer**	**Dynamic Ground Water Resources of Confined Aquifer**	**In storage Ground Water Resources of Confined Aquifer**	**Total Ground Water Availability of Confined Aquifer**	**Total Ground Water Availability of the Assessment Unit**
		Unconfined Aquifer			**Semi-Confined Aquifer**			**Confined Aquifer**			
		6	***7***	***8=6+7***	***9***	***10***	***11=9+10***	***12***	***13***	***14=12+13***	***15=8+11+14***
1	Kalpetta	6328.18	4962.12	11290.30	0.00	8683.71	8683.71	0.00	0.00	0.00	19974.01
2	Mananthavady	6380.00	4926.12	11306.12	0.00	8620.71	8620.71	0.00	0.00	0.00	19926.83
3	Panamaram	3570.68	2794.32	6365.00	0.00	4890.06	4890.06	0.00	0.00	0.00	11255.06
4	Sulthanbathery	5676.42	4448.88	10125.30	0.00	7785.54	7785.54	0.00	0.00	0.00	17910.84
	Total (ham)	**21955.28**	**17131.44**	**39086.72**	**0.00**	**29980.02**	**29980.02**	**0.00**	**0.00**	**0.00**	**69066.74**