GOVERNMENT OF KERALA
GROUNDWATER DEPARTMENT

GROUNDWATER LEVEL MONITORING REPORT – MAY 2021

Water is a replenishable natural resource which is essential for the existence of all living beings. In the past, the demand of water is mostly limited to domestic and in the agricultural sector. Due to the developments in agricultural and industrial sector the demand of water is increasing many folds since last few decades. Surface water resource alone couldn't meet the increasing demand and hence persuaded to depend on groundwater resource during the past few decades made stress on groundwater regime. In order to sustain the groundwater resources, proper groundwater management practices are needed.

Rainfall is the primary source for groundwater recharge and has a vital role in the sustainability of groundwater resource in the state. Groundwater level fluctuation results from the seasonal availability of rainfall. Kerala state experiences four distinct seasons namely winter (January-February), Pre-monsoon (March-May), Monsoon (South-West) June to September and Post-monsoon (North-East) from October to December. Average annual precipitation in the state is nearly 3000 mm. The rainfall in the State is controlled primarily by the South-West and North-East monsoons. About 90% of the rainfall occurs during six monsoon months (South-West monsoon contributes major portion of rainfall (65-70%) and about 16% from the North-East) and remaining from summer showers.

The winter rainfall (January-February) occurred in the state during 2020 is 9.6 mm, which is 57% deficient than that of the normal Rainfall (22.4 mm). From pre-monsoon season 2020 (March-May) the state received normal rainfall (387.5 mm).

While, the winter rainfall occurred in the state during 2021 (January - February) is 114.1mm, which is 410% large excess than that of the normal rainfall. Most of the locations in the state get recharged from the excess rainfall occurred during this season. The actual pre-monsoon rainfall occurred in the state during 2021 is 750.9 mm which is 108% excess than that of the normal rainfall (361.5 mm). All the 14 districts of the state received Large Excess rain. Pathanamthita district received the highest rain fall,1342.6mm which is 171% large excess and Wayanad received 465.1mm which is 69%large excess and Palakkad received440.9mm which is 81% large excess.

Since large excess rainfall occurred during pre-monsoon season, most of the observation wells got recharged during this season than that of the previous year (2020).

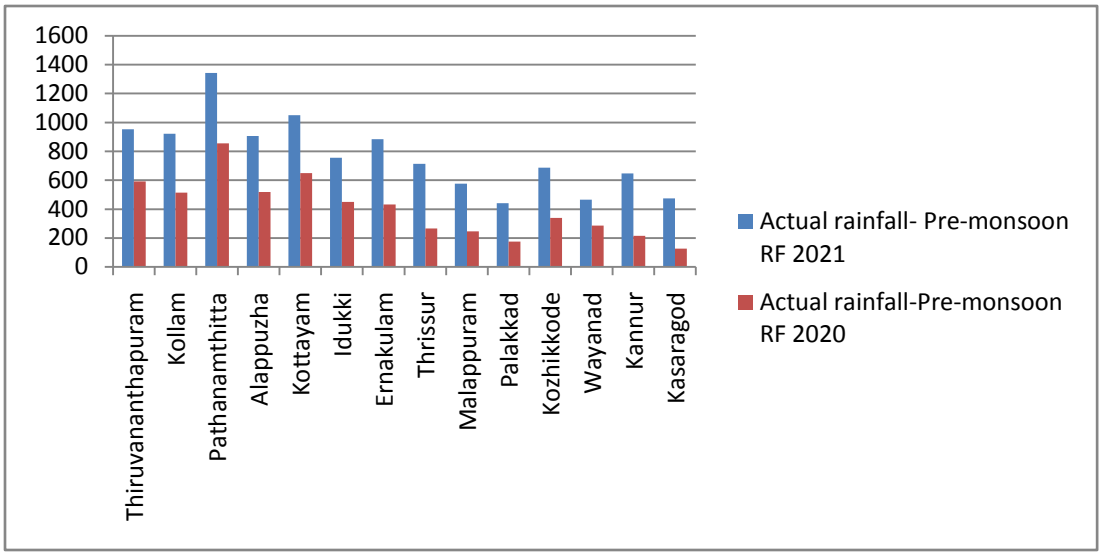

Fig:1. Comparison of actual Pre-monsoon rainfall occurred during 2021 wrt 2020

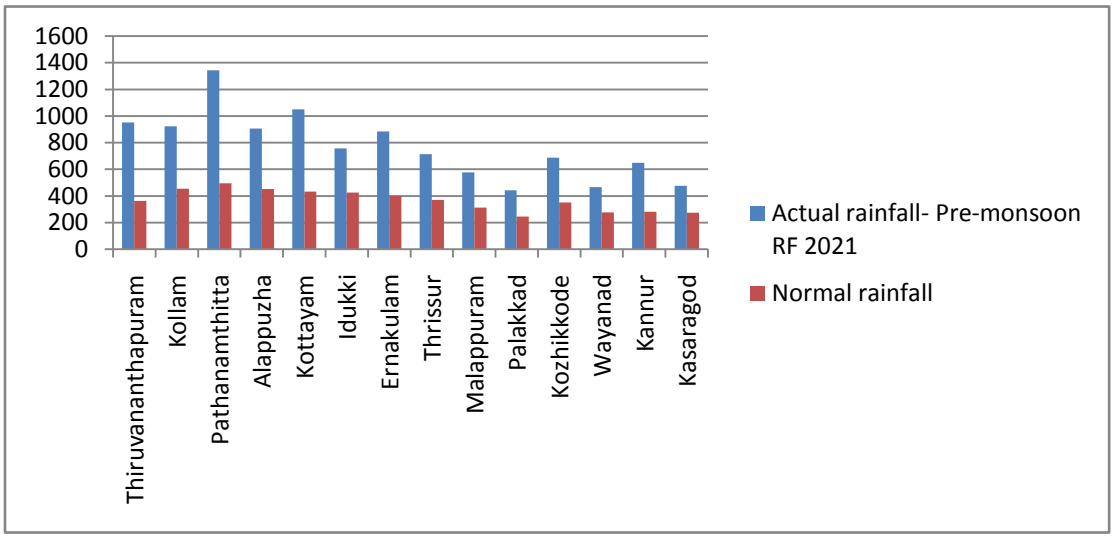

Fig:2. Comparison of actual Pre-monsoon rainfall occurred during 2021 wrt Normal Rainfall

Geology: Kerala, the southernmost state of Indian peninsula, is having a geographical area of 38863 km^2. The land area extends between latitude 8°17'30" and 12°27'40" and longitude 74°51'57" and 77°24'47". Physiographically, Kerala state is sandwiched between Western Ghats on the east and Arabian Sea on the west. Being the part of the southern Indian peninsula, the peninsular geological formations exist in the state. The major geological formations in the state

comprises crystalline rocks of Archaean Age, sedimentary rock formations of tertiary age and sub recent to recent rock formations of quaternary age.

Occurrence of Groundwater resource: Groundwater occurs under phreatic, semi-confined and confined conditions, Groundwater in unconfined aquifer is mainly utilized through tube wells in sedimentary terrain and through bore wells in hard rock areas.

Groundwater monitoring network: Short term and long term changes in the climatic conditions influence the groundwater scenario of an area. Groundwater level data are the principal information required for assessing the groundwater status and groundwater resource estimation.

Groundwater Department is maintaining a network of observation wells throughout the state representing various hydrogeological units. Observation wells includes dug wells (owned by public and private) and purpose built piezometers (bore wells and tube wells). Water level data has been collected monthly and water samples collected and analysis done periodically.

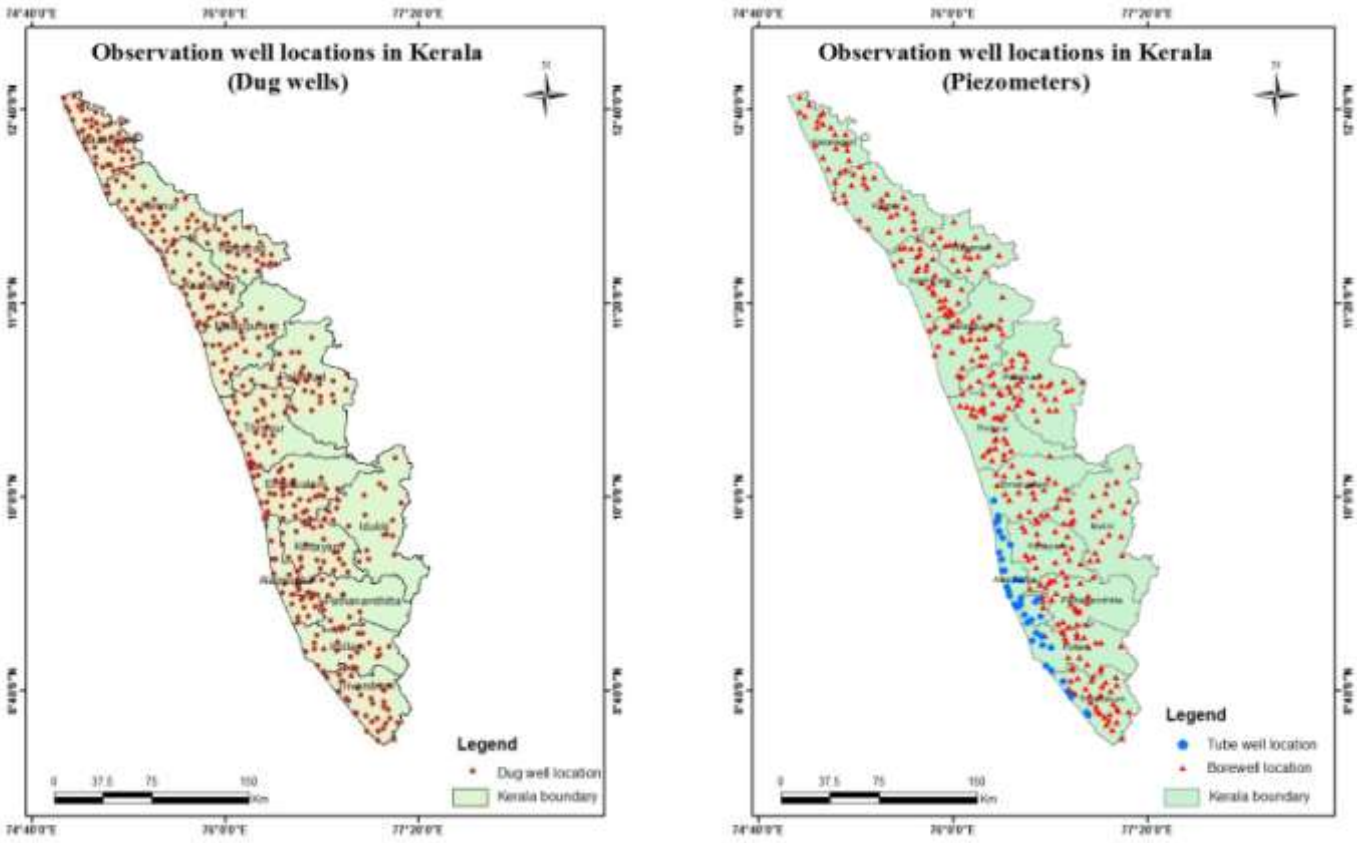

Fig:3. Location map of observation dug wells and piezometers (bore wells & tube wells)

Analysis of Groundwater level data – May 2021

During the month of May 2021, groundwater level in 368 dug wells and 355 purpose built piezometers (bore wells- 343 and tube wells – 12) has been monitored. The data collected from the observation wells during the month of May 2021 has been compared with previous year's corresponding month data and also with respect to decadal mean data of the corresponding month to assess the groundwater scenario in the state.

I. Depth to Groundwater level during May 2021

Dug wells- The depth to groundwater level in the observation dug wells during the month of May 2021 ranges from a minimum of -0.65 m to a maximum of 16.71 mbgl. Out of 368 dug wells monitored water level in 20% of dug wells shows a depth to water level ranges from 0-2 m, 34% ranges between 2-5 m, 33% ranges between 5-10 m and 13% dug wells recorded depth to water level ranges between 10-20 mbgl. Dug wells in Pathanamthitta, Kottayam, Idukki, and Ernakulam show water level below 10 mtrs. None of the wells show water level above 20m. Table showing well frequency during May 2021 is appended. (Annexure-I)

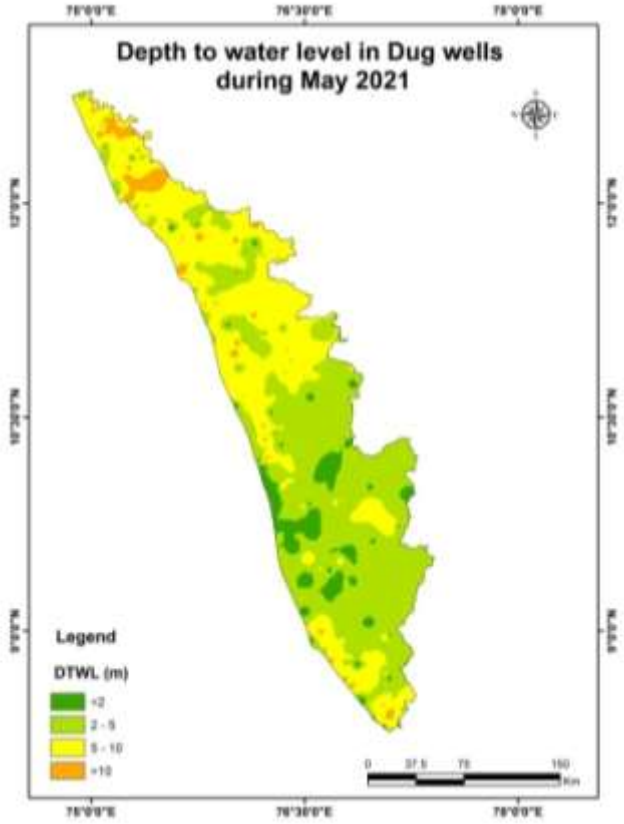

Fig:4. Depth to water level in Dug wells during May 2021

Borewells (hardrock terrain):- The depth to groundwater level in the observation bore wells during the month of May 2021 ranges from a minimum of -0.6 m to a maximum of 46.78 mbgl. Out of 343 bore wells monitored, water level in 10% of bore wells shows a depth to water level range from 0-2 m, 26 % ranges between 2-5 m, 32% ranges between 5-10 m, 24% of bore wells ranges between 10-20 m, and 8% ranges more than 20 m . Borewells in Thiruvananthapuram, Kollam, Pathanamthitta, Kottayam, and Ernakulam districts show water level below20 mbgl. Table showing well frequency during May 2021 is appended. (Annexure-I)

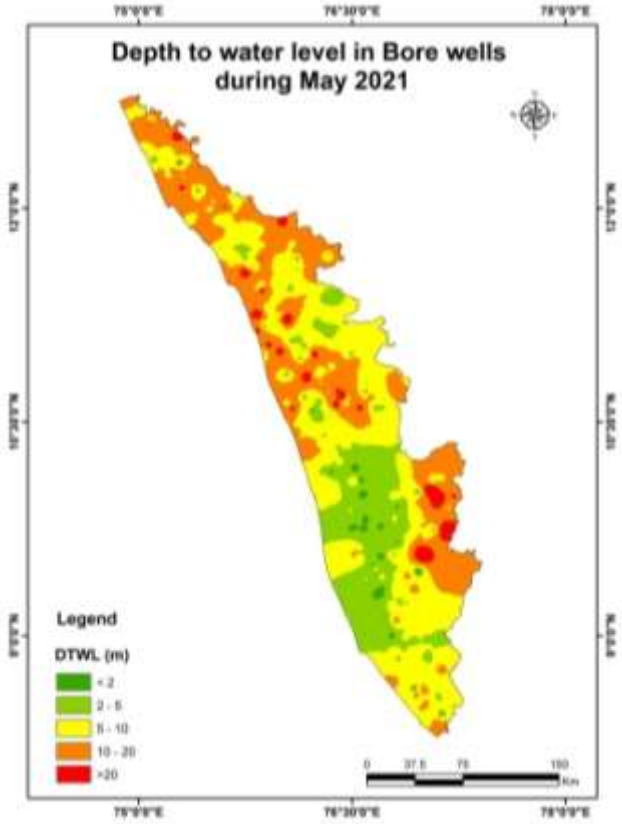

Fig:5. Depth to water level in Bore wells during May 2021

Tube wells (coastal sedimentary terrain) - The depth to groundwater level in the observation tube wells during the month of May 2021 ranges from a minimum of 2. 96 m to a maximum of 35.25 mbgl . Out of 12 tube wells monitored in the state, water level in 25 % of tube wells ranges between 2-5 m, 25 % of tube wells ranges between 5-10 m , 25% ranges between 10-20 m and 25% ranges more than 20m. Table showing tube well frequency is appended.(Annexure-I)

II. Comparison of Groundwater level in May 2021 with respect to May 2020

Comparison of the groundwater level in MAY 2021with respect to the corresponding month in the previous year, indicates that 24 % of observation dug wells show a fall in water level and 76 % of the wells shows no remarkable change /marginal rise in water level. Out of 24% of the dug wells shows a falling trend, 63% recorded fall in water level less than 0.5 m, 19 % of dug wells show fall in the range between 0.5-1m, 10% of dug wells show fall in the range between 1-1.5 m, 1% of dug wells show a fall in the range between 1.5 -2m and 6% dug wells show a fall in water level more than 2m. Table showing water level comparison of dug wells during May 2021with respect to May 2020 is appended. (Annexure-II).

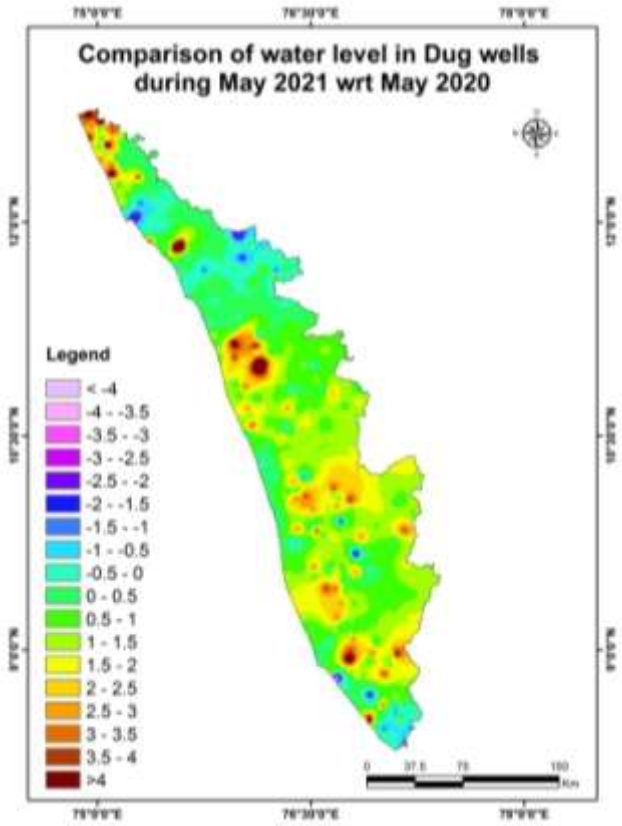

Fig:6. Comparison of water level in Dug wells during May 2021 wrt May 2020

Comparison of the water level in observation bore wells (hard rock terrain in midland and high land areas) in May 2021 with that of the previous year, it has been noticed that 23% of bore wells show fall in water level and 77% of the wells shows no remarkable change/marginal rise in water level. Out of 23 % of the bore wells shows a falling trend, 54 % of the bore wells recorded fall in water level less than 0.5m, 15 % show fall in the range between 0.5 - 1m, 8%

of bore wells show fall in the range between 1 - 1.5m, 5 % of bore wells show a fall in range between, 1.5-2m, 18% of bore wells show a fall in water level more than 2m. Table showing water level comparison of bore wells during May 2021 with respect to May 2020 is appended. (Annexure-II)

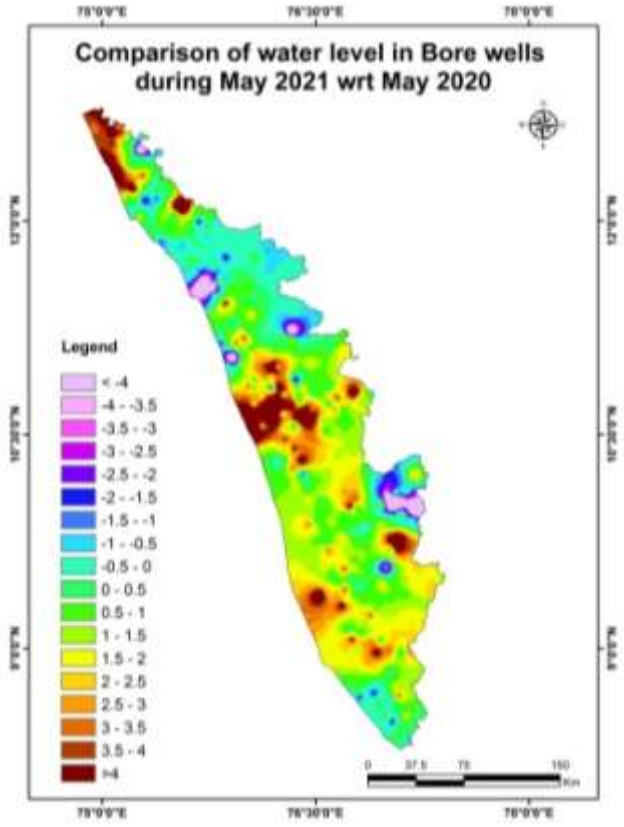

Fig:7. Comparison of water level in Bore wells during May 2021 wrt May 2020

Comparison of the water level in observation tube wells (in the coastal sedimentary areas) during May 2021 with that of the previous year reveals that 9 % of tube wells recorded a falling trend and 91 % of the wells shows no remarkable change /marginal rise of water level. Out of 9% of the tube wells showing a falling trend, 100% wells recorded fall in range between 0.5 to 1m and no wells show a fall in water level above 1m. Table showing comparison of water level during May 2021 with respect to May 2020 is appended. (Annexure-II)

III. Comparison of Groundwater level in May 2021 with respect to Decadal mean (2011- 20)

Comparison of the water level in May 2021 with respect to the decadal mean, it has

been noticed that 15 % of observation dug wells recorded a fall in water level and 85% of the wells shows marginal rise /no remarkable change in water level. Out of 15% of the dug wells show a falling trend, 67% of the dug wells recorded fall in water level less than 0.5m, 16% show fall in the range between 0.5-1m, 13% of dug wells show fall in the range between 1-1.5m, 2 % of dug wells show a fall in range between 1.5-2m and 2% of dug wells show a fall in range more than 2m. Table showing water level comparison of dug wells during May 2021 with respect to decadal mean is appended. (Annexure-III)

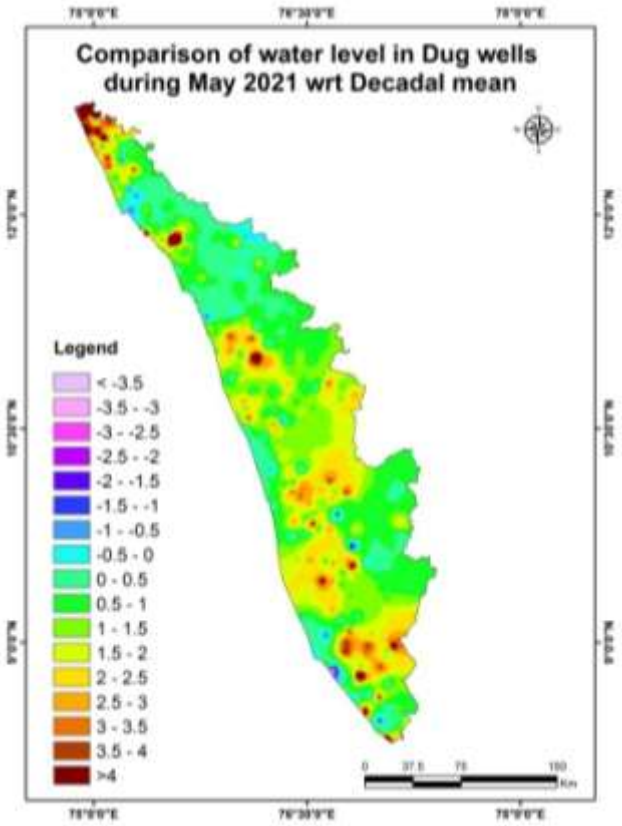

Fig:7. Comparison of water level in Dug wells during May 2021 wrt Decadal mean

Compared water level in the observation bore wells during May 2021 with that of the decadal mean. It has been noticed that 23% of bore wells show fall in water level, and 77% of the wells shows marginal rise, no remarkable change in water level. Out of 23 % of the bore wells shows a falling trend , 44 % shows a fall in water level less than 0.5m, 19 % show fall in the range between 0.5 - 1m, 8% show fall in the range between 1-1.5 m, 5% of wells show a fall in range between 1.5 - 2m, 24% show a fall in water level more than 2 m. Table showing water level comparison of bore wells during May 2021 with respect to decadal mean is appended.

(Annexure-III)

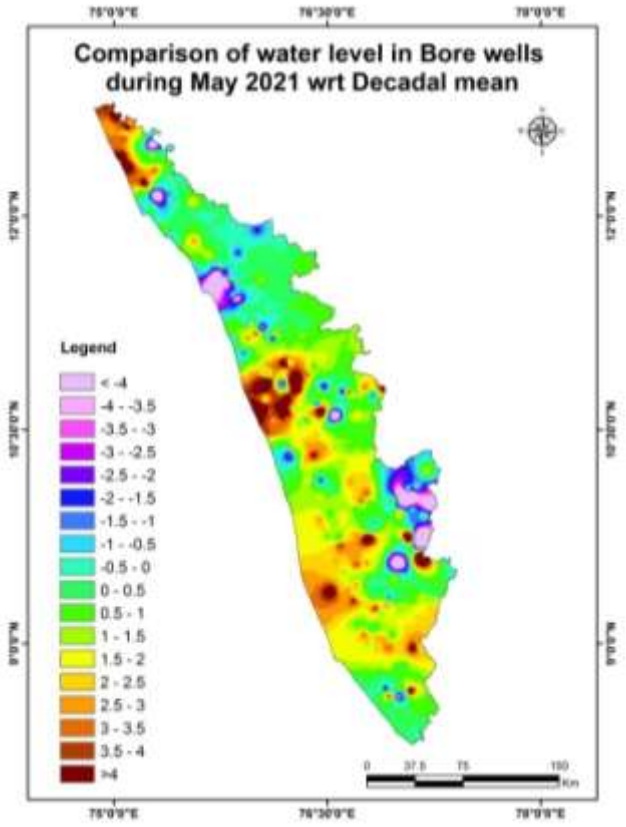

Fig:8. Comparison of water level in Bore wells during May 2021 wrt Decadal mean

Comparison of the water level in the observation tube wells during May 2021 with that of the decadal mean reveals that 50 % of tube wells recorded a falling trend and 50 % of the tube wells show marginal rise/no remarkable change in water level. Out of 50 % of the tube wells shows a falling trend, 67% of the tube wells show fall in water level less than 0.5m and 33% show fall in the range between 0.5-1m. No tube wells show water level fall more than 1m. Table showing water level comparison of tube wells during May 2021 with respect to decadal mean is appended. (Annexure-III)

Summary

Rainfall

- The winter rainfall (January-February) occurred in the state during 2020 is 9.6 mm, which is 57% deficient than that of the normal Rainfall (22.4 mm).

- The winter rainfall occurred in the state during 2021 (January - February) is 114.1mm, which is 410% large excess than that of the normal rainfall.
- The rainfall during the pre-monsoon (March-May 2020) occurred in the state is 387.5 mm, which is 7% more than the normal rainfall in this season.
- The pre-monsoon rainfall occurred in the state during 2021 is 750.9 mm which is 108% large excess than that of the normal rainfall (361.5 mm)

Groundwater level

- The depth to groundwater level in the observation dug wells during the month of May 2021 range from a minimum of -0.65 m to a maximum of 16.71 mbgl, in bore wells -0.6 m to a maximum of 46.78 mbgl and in the tube wells 2.96 m to a maximum of 35.25 mbgl.
- Comparison of the water level in May 2021 with respect to the previous year, reveals that 24 % of observation dug wells, 23 % of bore wells and 1% of tube wells recorded a falling trend. 58.1% of the observation wells with falling trend show decline in water level less than 0.5 m.
- Comparison of groundwater level in May 2021 with respect to the decadal mean reveals that 15 % of observation dug wells, 23 % of bore wells and 50% of tube wells recorded a falling trend. 54.3% of the observation wells with falling trend show decline in water level less than 0.5 m.
- Wells showing decline of water level more than 2 m during long term analysis will be monitored closely.
- Most of the locations in the state get recharged from the large excess rainfall occurred during the pre-monsoon season (March-May 2021) than that of the pre-monsoon season in the previous year (March-May 2020).

Districtwise Observation well Frequency on May 2021 — Annexure I

District	Well Type	No. of WL measured	DTWL(mbgl)		Depth range of wells (mts)				
			Min	Max	0 to 2	2 to 5	5 to 10	10 to 20	>20
	Dug well	30	-0.65	15.38	6	8	9	7	0
	Bore well	32	-0.60	19.93	3	3	16	10	0
Thiruvananthapuram	Tube well	4	4.08	10.43	0	1	2	1	0
	Dug well	21	0.76	12.46	8	6	5	2	0
	Bore well	15	0.15	9.23	1	9	5	0	0
Kollam	Tube well	7	2.96	35.25	0	2	0	2	3
	Dug well	14	0.34	5.42	7	6	1	0	0
Pathanamthitta	Bore well	25	-0.18	15.20	6	8	7	4	0
	Dug well	20	-0.29	8.50	11	7	2	0	0
Kottayam	Bore well	23	-0.52	16.75	9	9	3	2	0
	Dug well	20	0.36	9.05	4	10	6	0	0
Idukki	Bore well	23	1.23	41.66	2	7	6	3	5
	Dug well	37	0.09	7.04	16	15	6	0	0
	Bore well	24	-0.27	10.16	4	15	4	1	0
Ernakulam	Tube well	1	9.92	9.92	0	0	1	0	0
	Dug well	31	0.90	13.01	7	12	8	4	0
Thrissur	Bore well	37	-0.13	35.02	4	6	15	7	5
	Dug well	25	1.03	13.73	3	9	9	4	0
Malappuram	Bore well	30	1.95	46.78	1	11	10	4	4
	Dug well	31	0.83	10.28	3	16	10	2	0
Palakkad	Bore well	33	1.67	27.81	1	5	13	11	3
	Dug well	33	1.66	14.32	1	10	19	3	0
Kozhikkode	Bore well	34	0.95	41.35	1	10	10	8	5

	Dug well	26	0.28	12.32	4	6	12	4	0
Wayanad	Bore well	19	1.86	23.51	1	1	6	10	1
	Dug well	35	1.25	16.71	3	7	17	8	0
Kannur	Bore well	27	1.50	23.50	1	1	11	12	2
	Dug well	45	0.75	15.99	2	12	17	14	0
Kasaragod	Bore well	21	0.03	30.49	1	3	5	10	2

Comparison of Water level May 2021 with respect to May 2020 **Annexure II**

District	Well Type	No. of WL Measured	Water level	Total	0 - 0.5 m	0.5 - 1 m	1-1.5m	1.5 - 2 m	>2 m
					No.	No.	No.	No.	No.
	Dug well	31	Rise	17	9	4	0	1	3
			Fall	14	5	3	5	0	1
	Bore well	33	Rise	23	11	8	1	1	2
			Fall	10	3	3	1	0	3
	Tube well	4	Rise	3	2	1	0	0	0
Thiruvananthapuram			Fall	1	0	1	0	0	0
	Dug well	20	Rise	17	4	2	2	1	8
			Fall	3	2	0	0	0	1
	Bore well	14	Rise	14	0	3	1	1	9
			Fall	0	0	0	0	0	0
	Tube well	6	Rise	6	3	0	1	1	1
Kollam			Fall	0	0	0	0	0	0
	Dug well	14	Rise	13	2	4	0	2	5
			Fall	1	1	0	0	0	0
	Bore well	25	Rise	24	7	7	2	2	6
Pathanamthitta			Fall	1	0	1	0	0	0

Kottayam	Dug well	20	Rise	15	5	1	1	3	5
			Fall	5	3	1	0	0	1
	Bore well	24	Rise	22	7	3	3	1	8
			Fall	2	2	0	0	0	0
Idukki	Dug well	20	Rise	18	2	7	3	4	2
			Fall	2	1	0	0	1	0
	Bore well	23	Rise	16	4	6	1	2	3
			Fall	7	3	1	0	0	3
Ernakulam	Dug well	38	Rise	34	11	2	3	4	14
			Fall	4	3	0	1	0	0
	Bore well	24	Rise	23	6	4	3	5	5
			Fall	1	0	0	0	1	0
	Tube well	1	Rise	0	0	0	0	0	0
			Fall	1	0	0	0	1	0
Thrissur	Dug well	31	Rise	23	5	6	3	3	6
			Fall	8	7	1	0	0	0
	Bore well	37	Rise	33	3	3	4	1	22
			Fall	4	1	3	0	0	0
Malappuram	Dug well	26	Rise	25	5	4	3	4	9
			Fall	1	0	1	0	0	0
	Bore well	28	Rise	21	3	4	2	3	9
			Fall	7	5	0	0	0	2
Palakkad	Dug well	31	Rise	27	5	6	8	5	3
			Fall	4	3	1	0	0	0
	Bore well	33	Rise	28	7	4	3	3	11
			Fall	5	3	0	0	0	2
Kozhikkode	Dug well	33	Rise	22	14	7	0	0	1
			Fall	11	9	1	1	0	0
	Bore well	33	Rise	22	14	4	0	2	2
			Fall	11	7	0	2	1	1

	Dug well	26	Rise	10	5	2	3	0	0
			Fall	16	7	6	1	0	2
	Bore well	19	Rise	5	3	2	0	0	0
Wayanad			Fall	14	10	2	1	0	1
	Dug well	35	Rise	21	15	5	0	0	1
			Fall	14	9	3	1	0	1
	Bore well	28	Rise	15	9	2	2	1	1
Kannur			Fall	13	6	2	2	2	1
	Dug well	43	Rise	38	11	3	2	6	16
			Fall	5	5	0	0	0	0
	Bore well	21	Rise	18	1	2	1	0	14
Kasaragod			Fall	3	2	0	0	0	1

Comparison of Water level May 2021 with respect to 10 yrs mean **Annexure III**

District	Well Type	No. of WL Measured	Water level	Total	0 - 0.5 m	0.5 - 1 m	1 - 1.5 m	1.5 - 2 m	<2 m
					No.	No.	No.	No.	No.
	Dug well	31	Rise	22	10	1	4	2	5
			Fall	9	4	4	1	0	0
	Bore well	33	Rise	22	8	10	2	1	1
			Fall	11	7	2	0	0	2
	Tube well	4	Rise	2	2	0	0	0	0
Thiruvananthapuram			Fall	2	1	1	0	0	0
	Dug well	20	Rise	17	2	2	4	1	8
			Fall	3	1	0	1	0	1
	Bore well	15	Rise	15	1	2	0	5	7
			Fall	0	0	0	0	0	0
	Tube well	7	Rise	4	0	2	0	1	1
Kollam			Fall	3	2	1	0	0	0

	Dug well	14	Rise	14	4	2	1	2	5
			Fall	0	0	0	0	0	0
	Bore well	25	Rise	21	5	4	4	1	7
Pathanamthitta			Fall	4	2	1	1	0	0
	Dug well	20	Rise	18	2	2	3	3	8
			Fall	2	1	0	0	1	0
	Bore well	24	Rise	24	3	3	1	5	12
Kottayam			Fall	0	0	0	0	0	0
	Dug well	20	Rise	15	3	9	1	1	1
			Fall	5	3	1	1	0	0
	Bore well	23	Rise	13	5	2	1	2	3
Idukki			Fall	10	5	0	1	0	4
	Dug well	38	Rise	37	8	7	4	2	16
			Fall	1	1	0	0	0	0
	Bore well	24	Rise	22	5	3	4	4	6
			Fall	2	1	0	0	1	0
	Tube well	1	Rise	0	0	0	0	0	0
Ernakulam			Fall	1	1	0	0	0	0
	Dug well	31	Rise	25	6	5	6	2	6
			Fall	6	4	2	0	0	0
	Bore well	37	Rise	31	2	4	2	5	18
Thrissur			Fall	6	4	0	0	0	2
	Dug well	26	Rise	22	4	3	3	2	10
			Fall	4	4	0	0	0	0
	Bore well	30	Rise	24	3	6	6	2	7
Malappuram			Fall	6	3	0	1	0	2
	Dug well	31	Rise	30	4	8	7	5	6
			Fall	1	1	0	0	0	0
	Bore well	33	Rise	23	1	3	4	2	13
Palakkad			Fall	10	3	2	1	0	4

	Dug well	33	Rise	28	14	10	2	2	0
			Fall	5	4	0	1	0	0
	Bore well	34	Rise	21	12	5	2	0	2
Kozhikkode			Fall	13	4	4	1	1	3
	Dug well	26	Rise	17	8	4	3	0	2
			Fall	9	8	1	0	0	0
	Bore well	19	Rise	15	11	3	1	0	0
Wayanad			Fall	4	1	1	0	2	0
	Dug well	35	Rise	28	16	7	4	0	1
			Fall	7	4	1	2	0	0
	Bore well	28	Rise	17	9	6	0	0	2
Kannur			Fall	11	4	5	1	0	1
	Dug well	43	Rise	40	5	4	5	3	23
			Fall	3	2	0	1	0	0
	Bore well	21	Rise	19	1	1	1	3	13
Kasaragod			Fall	2	1	0	0	0	1

Observation well frequency on May2021 **Abstract I**

Well Type	No of WL measured	DTWL (mbgl)		Location		Depth range of wells (m)				
		min	max	min	max	0 to 2	2 to 5	5 to 10	10 to 20	>20
Dug well	368	-0.65	16.71	TVM OW02, Athiyannur,Thiruvananthapuram	Taliparamba, KNR-POW-C8	75	124	121	48	0
						20%	34%	33%	13%	0%
Bore well	343	-0.6	46.78	28, Vamanapuram, Thiruvananthapuram	MPM174, Areekode, Malappuram	35	88	111	82	27
						10%	26%	32%	24%	8%
Tube well	12	2.96	35.25	KLM/17, Mughathala, Kollam	KLM/29, Sasthamkotta, Kollam	0	3	3	3	3
						0%	25%	25%	25%	25%

Comparison of Water level May 2021 with respect to May 2020 Abstract II

Well type	No. of WL Measured	Water level	Total	0 - 0.5 m	0.5 - 1 m	1 - 1.5 m	1.5 - 2 m	>2 m
Dug well	368	Rise	280	93	53	28	33	73
		%	76%	33%	19%	10%	12%	26%
		Fall	88	55	17	9	1	6
		%	24%	63%	19%	10%	1%	7%
Bore well	342	Rise	264	75	52	23	22	92
		%	77%	28%	20%	9%	8%	35%
		Fall	78	42	12	6	4	14
		%	23%	54%	15%	8%	5%	18%
Tube well	11	Rise	10	6	1	1	1	1
		%	91%	60%	10%	10%	10%	10%
		Fall	1	0	1	0	0	0
		%	9%	0%	100%	0%	0%	0%

Comparison of Water level May2021 with respect to 10 yrs mean **Abstract III**

Well type	No. of WL Measured	Water level	Total	0 - 0.5 m	0.5 - 1 m	1 - 1.5 m	1.5 - 2 m	>2 m
Dug well	368	Rise	313	86	64	47	25	91
		%	85%	28%	20%	15%	8%	29%
		Fall	55	37	9	7	1	1
		%	15%	67%	16%	13%	2%	2%
Bore well	344	Rise	265	64	52	28	30	91
		%	77%	25%	20%	10%	11%	34%
		Fall	79	35	15	6	4	19
		%	23%	44%	19%	8%	5%	24%
Tube well	12	Rise	6	2	2	0	1	1
		%	50%	33%	33%	0%	17%	17%
		Fall	6	4	2	0	0	0
		%	50%	67%	33%	0%	0%	0%