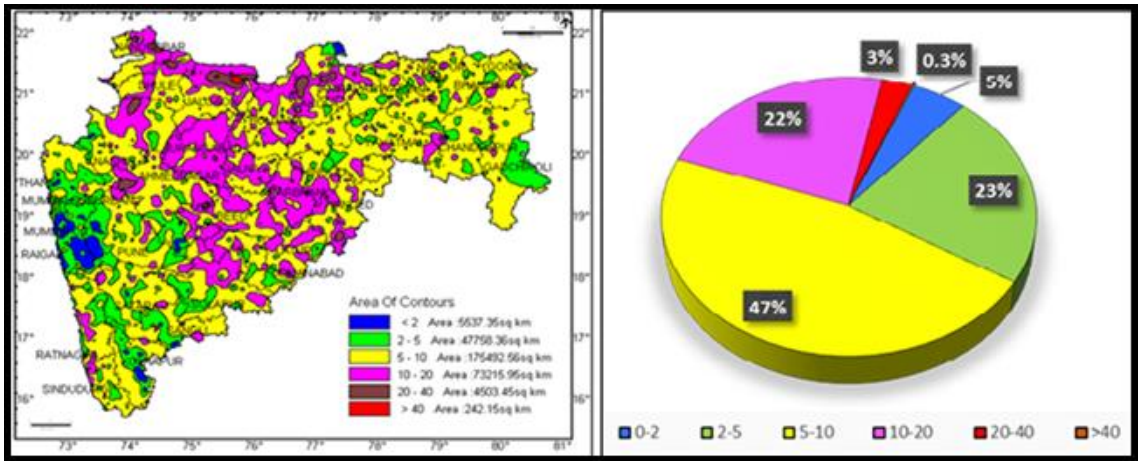
GOVERNMENT OF INDIA
MINISTRY OF JAL SHAKTI
DEPARTMENT OF WATER RESOURCES, RIVER DEVELOPMENT & GANGA REJUVENATION



GROUND WATER LEVEL BULLETIN

May- 2024

Maharashtra

ABSTRACT

Ground water level Scenario during May-2024 highlights the findings, status of ground water level in different aquifers and its seasonal, annual and decadal comparison.

CENTRAL GROUND WATER BOARD
CENTRAL REGION, NAGPUR

1. INTRODUCTION

Since 1969, Central Ground Water Board (CGWB) monitors ground water levels all over the country four times a year during January, May, August and November. A Groundwater bulletin has been prepared by CGWB depicting changes in groundwater regime of the country through different seasons. It is an effort to obtain information on groundwater levels through representative monitoring wells. The natural conditions affecting the groundwater regime involve climatic parameters like rainfall, evapotranspiration etc., whereas anthropogenic influences include pumping from the aquifer, recharge due to irrigation systems and other practices like waste disposal etc. This continuous monitoring provides a valuable tool to decipher the seasonal and long-term changes in ground water levels, and in turn helps in managing the ground water resources in a more scientific and effective manner.

2. STUDY AREA

The State of Maharashtra occupies the west-central part of India and lies between latitudes 15°45' to 22°00' N and longitudes 73°0' to 80°59' E (**Fig.1**) Maharashtra, the third largest state in India has a total geographical area of 3, 07,713 sq km with 9.4 % of the country area. It is bounded on north by Gujarat, north-east and east by Madhya Pradesh, south-east south by Telangana, south-west by Karnataka and Goa and in the west by the Arabian Sea. Administratively, the state is governed by 36 districts which are grouped into six divisions namely Konkan, Pune, Nashik, Chatrapati Sambhaji Nagar (Aurangabad), Amravati and Nagpur. The State is further divided into five regions namely Konkan, Western Maharashtra, Khandesh, Marathwada and Vidarbha. Total population of the State is 112.37 million out of which 50.81 million (45.21%) is urban and 61.56 million (54.78%) is rural. The average density of population is 365 persons/km^2. The overall growth in total population during decade is ~15.99 % (2001 to 2011 census).

Central Ground Water Board, Central Region, Nagpur has set up a network of 2091 observation wells known as the Ground Water Monitoring Wells (GWMW's) located all over Maharashtra which comprises of 1777 dug wells and 314 piezometers. The average density of Monitoring stations is 147 Km^2/well.

Physiographically, the state can be divided into 3 units namely Sahyadri Range (Western Ghats), the Western Coastal Tract (Konkan), and the Eastern Plateau (Deccan Plateau). Godavari, Krishna, Tapi, Mahanadi, Narmada and Coastal Basins are the Major River basins in the State. About 75% area of Maharashtra is drained by eastward flowing rivers, viz., the Godavari and

Krishna draining into the Bay of Bengal, the remaining 25% of the area is drained by westward flowing rivers, viz., Tapi and Konkan coastal rivers, draining into the Arabian Sea. 45% of state's water resources are from West Flowing Rivers which are mainly monsoon specific rivers emanating from the Ghats and draining into the Arabian Sea. ~53 % of network stations fall in Godavari basin, 16 % fall in Tapi, 16% fall in Krishna, and 15 % network stations fall in the Coastal basins.

~82 % area of the Maharashtra State (2,49,934 sq km) is covered by Deccan trap basalts, whereas rest of area is covered by Quaternary alluvium (14,526 sq km; 4.7 %), Gondwanas (4800 sq km; 1.6 %), Precambrian (Vindhyans, Cuddapahs, and Kaladgi group of rocks - 6,217 sq km; 2%) and Archaean's (32,235 sq km; 10.5%). The aquifers are grouped under three major hydrogeological groups namely unconsolidated, semi-consolidated and consolidated and nine different types of hydrogeological sub-groups based on geological age and hydrogeological characters.

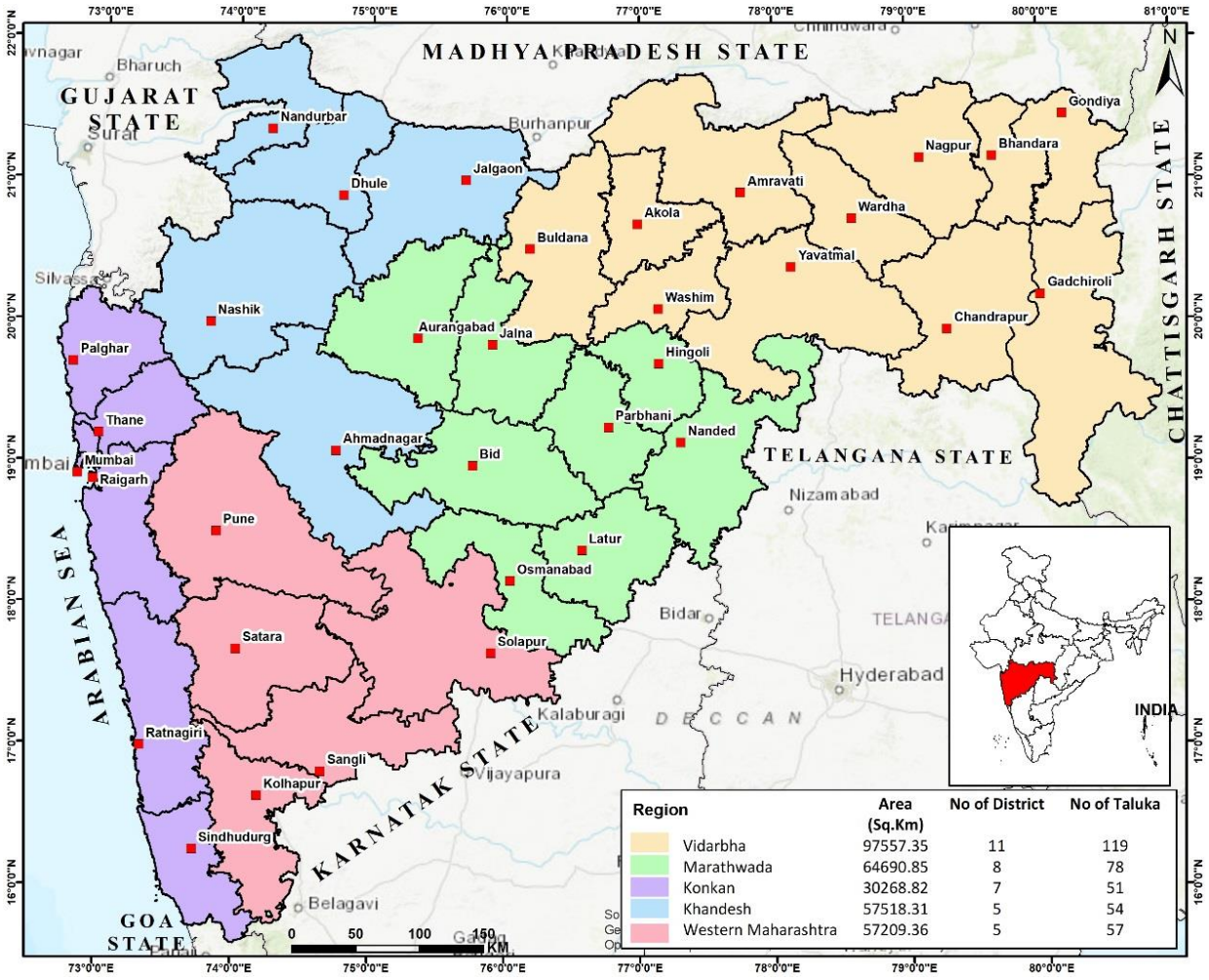


Fig. 1: Location & administrative division, Maharashtra state.

3.0 GROUND WATER MONITOIRNG

Central Ground Water Board (CGWB) monitors ground water levels all over the country, four times a year in order to bring out spatial and temporal changes in ground water regime. This continuous monitoring provides a valuable tool to decipher the seasonal and long-term changes in ground water levels and in turn helps in managing the ground water resources in a scientific and effective manner.

Analysis of data is carried out through GEMS a dedicated software. Out of 2091 ground water monitoring wells, 80 dug wells and 4 Borewells were found dry and are represented by their corresponding well depth. The district wise location of wells are presented on **Fig.2** and tabulated in **Table-1.**

District	Active		Dry		Wells Not Monitored #		No of wells		
	DW	BW	DW	BW	DW	BW	DW	BW	Total well
Ahmednagar	77	11	2	0	1	0	80	11	91
Akola	25	7	1	0	0	0	26	7	33
Amravati	88	15	1	0	2	1	91	16	107
Chatrapati Sambhaji Nagar	48	3	3	0	0	0	51	3	54
Beed	57	1	8	0	0	0	65	1	66
Bhandara	31	4	0	0	1	0	32	4	36
Buldana	67	52	4	1	1	0	72	53	125
Chandrapur	55	11	7	0	5	1	67	12	79
Dhule	34	3	2	2	0	2	36	7	43
Gadchiroli	40	4	3	0	0	0	43	4	47
Gondia	17	8	1	0	1	0	19	8	27
Hingoli	19	0	9	0	1	0	29	0	29
Jalgaon	59	5	3	0	0	0	62	5	67
Jalna	47	6	2	0	0	0	49	6	55
Kolhapur	40	4	0	0	0	0	40	4	44
Latur	41	7	0	0	0	0	41	7	48
Mumbai City	6	0	0	0	0	0	6	0	6
Mumbai Suburban	19	0	0	0	0	0	19	0	19
Nagpur	81	28	2	1	3	2	86	31	117
Nanded	44	1	7	0	5	1	56	2	58
Nandurbar	21	4	1	0	0	0	22	4	26
Nashik	70	6	2	0	1	2	73	8	81

Osmanabad	37	3	1	0	1	0	39	3	**42**
Parbhani	31	3	13	0	3	0	47	3	**50**
Pune	49	4	1	0	3	0	53	4	**57**
Raigad	49	1	0	0	0	0	49	1	**50**
Ratnagiri	61	18	1	0	1	0	63	18	**81**
Sangli	40	19	0	0	1	0	41	19	**60**
Satara	54	2	0	0	1	1	55	3	**58**
Sindudurg	58	16	0	0	0	1	58	17	**75**
Solapur	55	7	0	1	0	0	55	8	**63**
Thane	61	2	5	0	0	0	66	2	**68**
Wardha	61	9	0	0	0	1	61	10	**71**
Washim	47	6	0	0	1	0	48	6	**54**
Yavatmal	77	27	0	0	0	0	77	27	**104**
Grand Total	**1666**	**297**	**79**	**5**	**32**	**12**	**1777**	**314**	**2091**

Table 1: District wise status of GWMWs May 2024

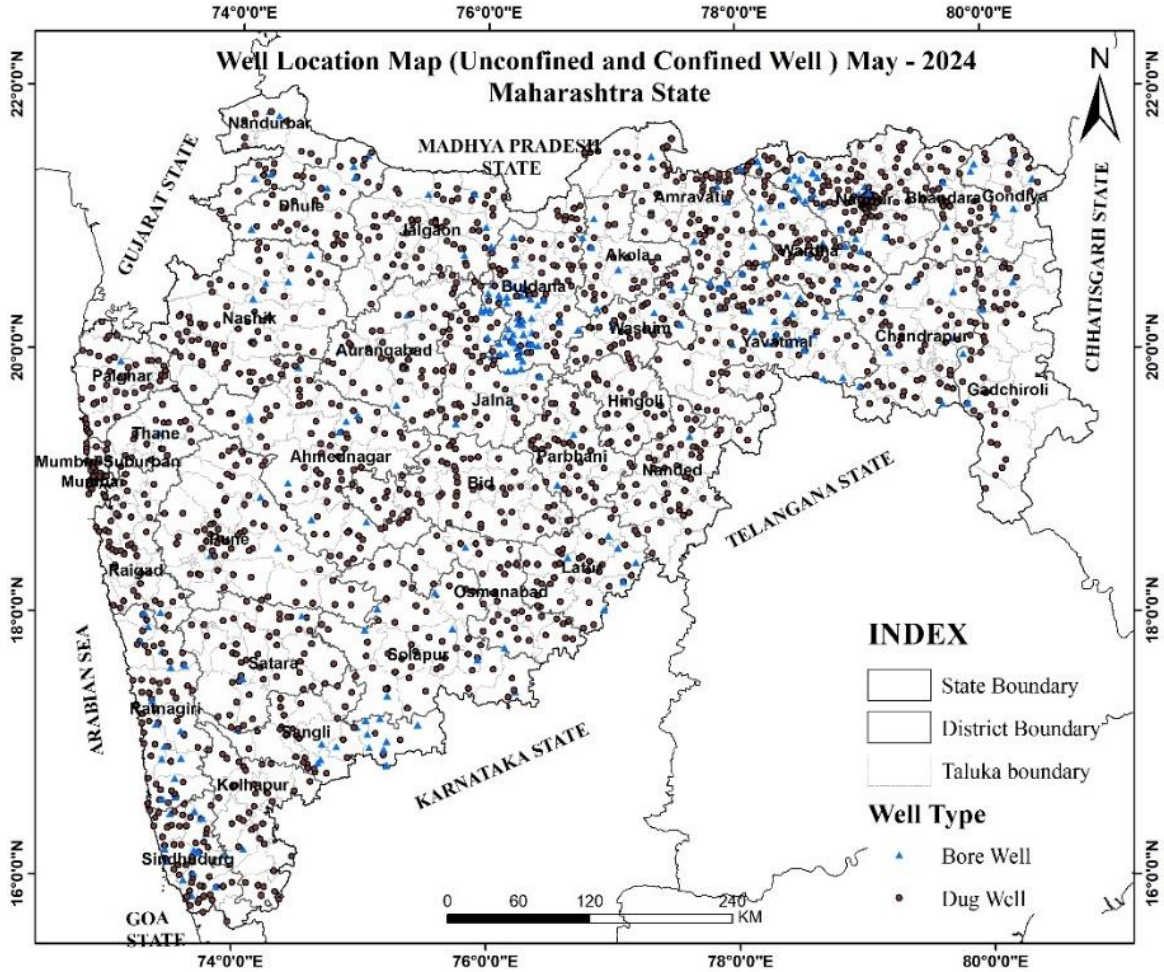


Fig. 2: Location of GWMWs Maharashtra.

4.0 RAINFALL

As per the Indian Meteorological Department (IMD), the departure of monsoon rainfall from normal rainfall for the period from 1st June 2023 to 30th September 2023 for all districts of Maharashtra has been considered to correlate the prevailing ground water level scenario. The district-wise data analysis indicates that out of 35 districts, 25 districts received normal rainfall, 2 received excess and 9 district deficient rainfall (**Fig.3 & Table-2**).

Table 2: District wise departure of rainfall with respect to Normal rainfall (01-06-2024 to 30-09-2024)

S. No.	District	% Departure of RF wrt Normal (Monsoon 2023)	Category (Monsoon 2023)
1	Ahmednagar	-10	Normal
2	Akola	-23	Deficient
3	Amravati	-27	Deficient
4	Aurangabad	-11	Normal
5	Beed	-21	Deficient
6	Bhandara	7	Normal
7	Buldhana	-8	Normal
8	Chandrapur	3	Normal
9	Dhule	-9	Normal
10	Gadchiroli	6	Normal
11	Gondia	-8	Normal
12	Hingoli	-23	Deficient
13	Jalgaon	6	Normal
14	Jalna	-33	Deficient
15	Kolhapur	-16	Normal
16	Latur	-8	Normal
17	Mumbai Suburban	5	Normal
18	Mumbai	-5	Normal
19	Nagpur	5	Normal
20	Nanded	23	Excess
21	Nandurbar	-3	Normal
22	Nashik	3	Normal
23	Osmanabad	-24	Deficient
24	Palghar	21	Normal
25	Parbhani	-17	Normal
26	Pune	-6	Normal
27	Raigad	13	Normal

28	Ratnagiri	-2	Normal
29	Sangli	-44	Deficient
30	Satara	-37	Deficient
31	Sindhudurg	6	Normal
32	Solapur	-30	Deficient
33	Thane	27	Excess
34	Wardha	-3	Normal
35	Washim	-15	Normal
36	Yavatmal	14	Normal

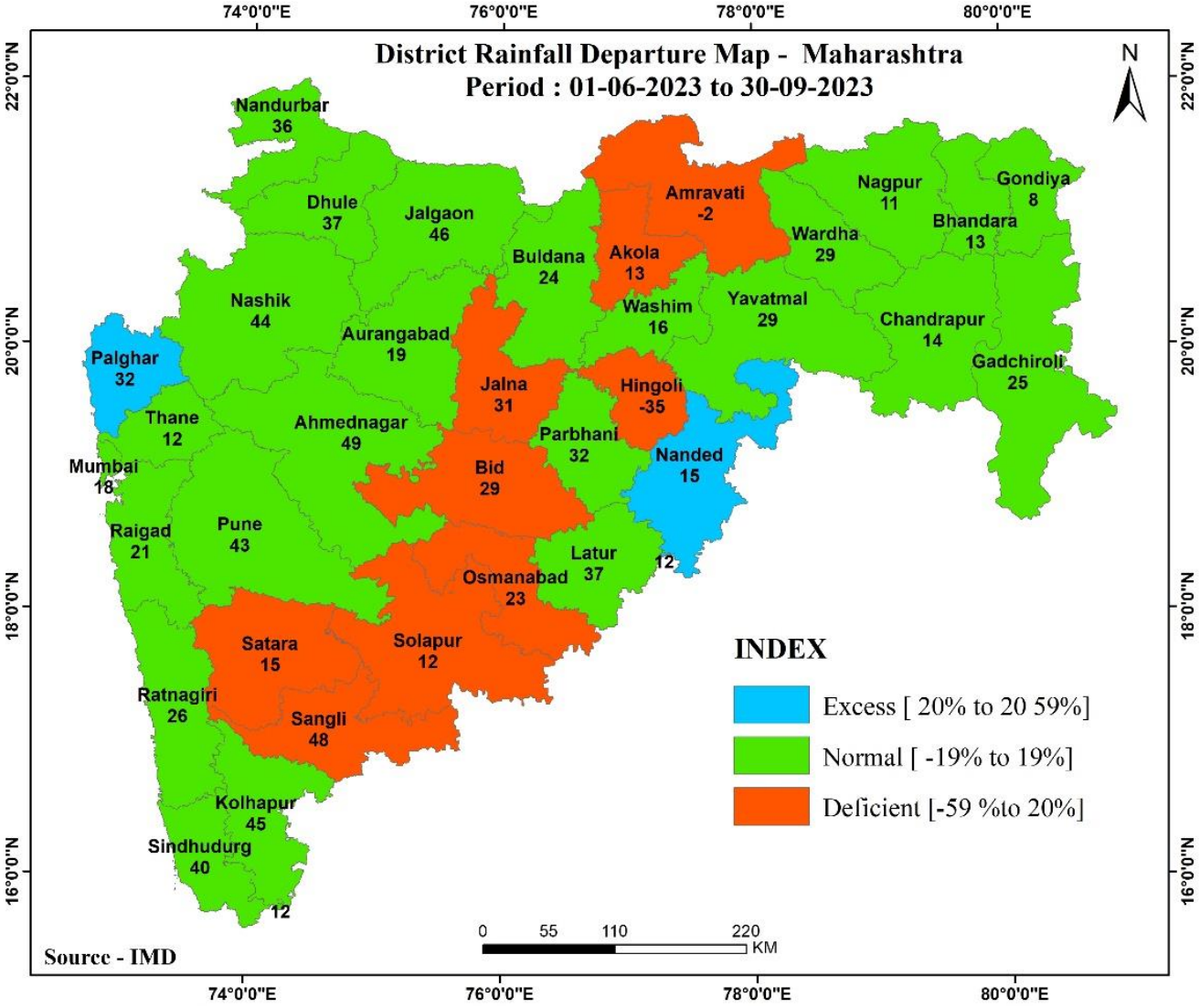


Fig. 3: Rainfall deviation (June 2023-September 2023) from normal rainfall.

5.0 GROUND WATER LEVEL SCENARIO (MAY 2024)

5.1 SHALLOW AQUIFER (UNCONFINED)

5.1.1 DEPTH TO WATER LEVEL

Depth to water level in unconfined Aquifer (May 2024)

During pre-monsoon season of 2024, depth to water level in unconfined aquifer (Dug Well zone) ranges from 0.1 to 69.50 m bgl, shallowest in Raigad district and deepest in Jalgaon district (**Fig.4)**. Shallow water levels of < 2 m bgl are observed in 5 % of wells (5537 km^2). In 23 % wells covering ~47758 km^2 area have shown water levels in the range of 2-5 m bgl, falling in Raigad, Thane district and in parts of Pune, Kolhapur, Sangli, Satara, Jalgaon and Nashik districts. Water levels in the range of 5-10 m bgl are more predominant and covers ~175493 km^2 (47 % of wells). In ~25% wells, water levels are in the range of >10 m bgl. The frequency of distribution of wells in different water levels zones is presented as pie diagram in **Fig.5**.

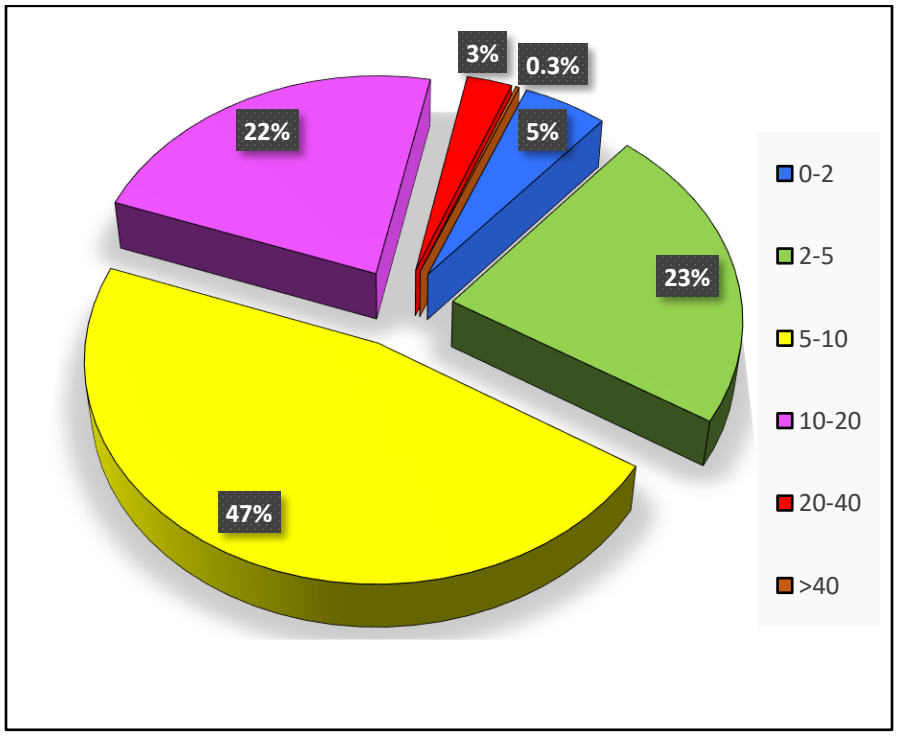


Fig 5: Percentage of wells in different water level ranges in unconfined aquifer.

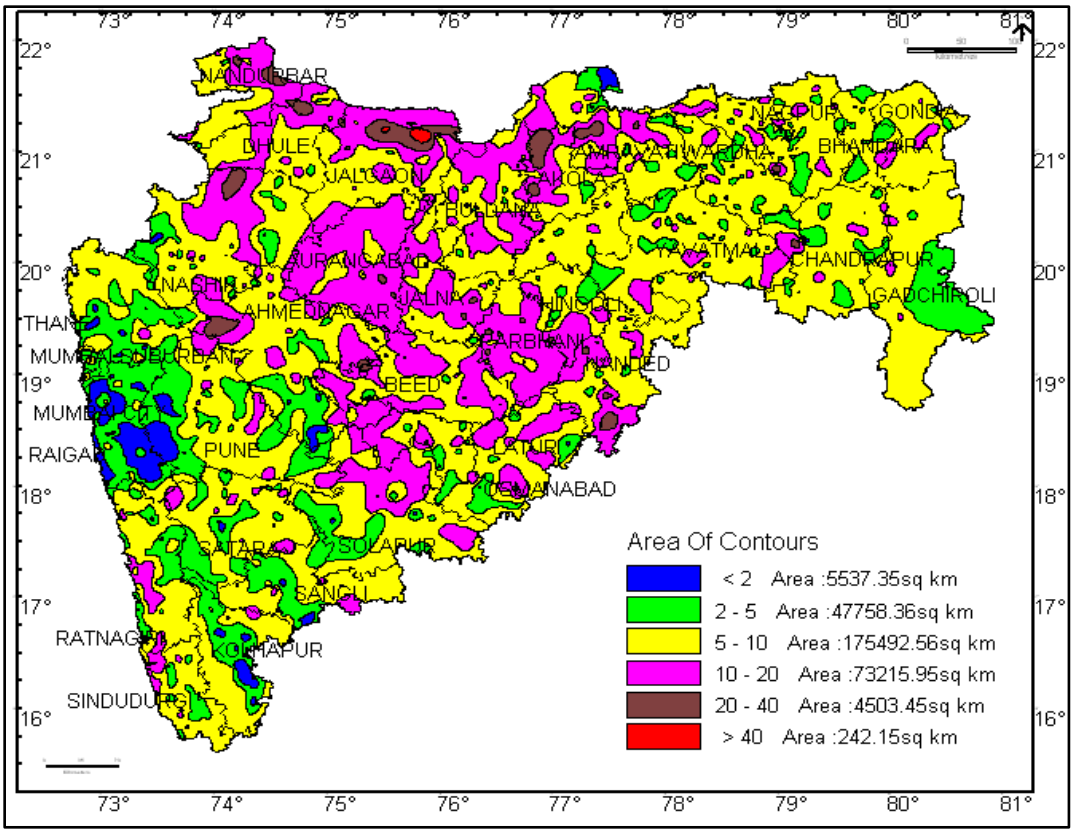


Fig 4: Depth to Water Level of Unconfined Aquifer During May 2024

5.1.2 SEASONAL FLUCTUATION IN WATER LEVEL

Unconfined Aquifer (May 2024 WRT January 2024)

During this period, water levels have shown a general decline in about 80 % of wells covering almost entire State in about 2,64,477 km^2 area (86 %) (**Fig.6**). This fall in water level is a normal phenomenon, since, the period between January and May represents a receding period in a given hydrological cycle and bears the impact of major abstraction of the ground water resources mainly for agriculture activities during rabi season and summer crops. Fall in water levels up to 2 m is exhibited in about 38.3 % of wells covering about 124999 km^2 area. In 22.7 % of wells covering about 93589 km^2 area shown decline between 2 and 4 m. More than 4 m fall are noticed in ~19.4 % of wells covering about 46184 km^2 area.

However, about 2 % of wells, (2001 km^2) area shows rise in water level of >4 m in parts of Kolhapur, Satara, Amravati, and Pune districts and small isolated parts of Wardha, Jalgaon, Nandurbar, Nashik, Parbhani, Hingoli,

Nanded, Osmanabad, Ahmednagar, Ratnagiri, Sindhudurg and Sangli districts. Only 14 % wells, covering 39,995 km^2 area show rise in water level up to 2 m. The Rise and Fall of wells in % is depicted in **Fig.7**.

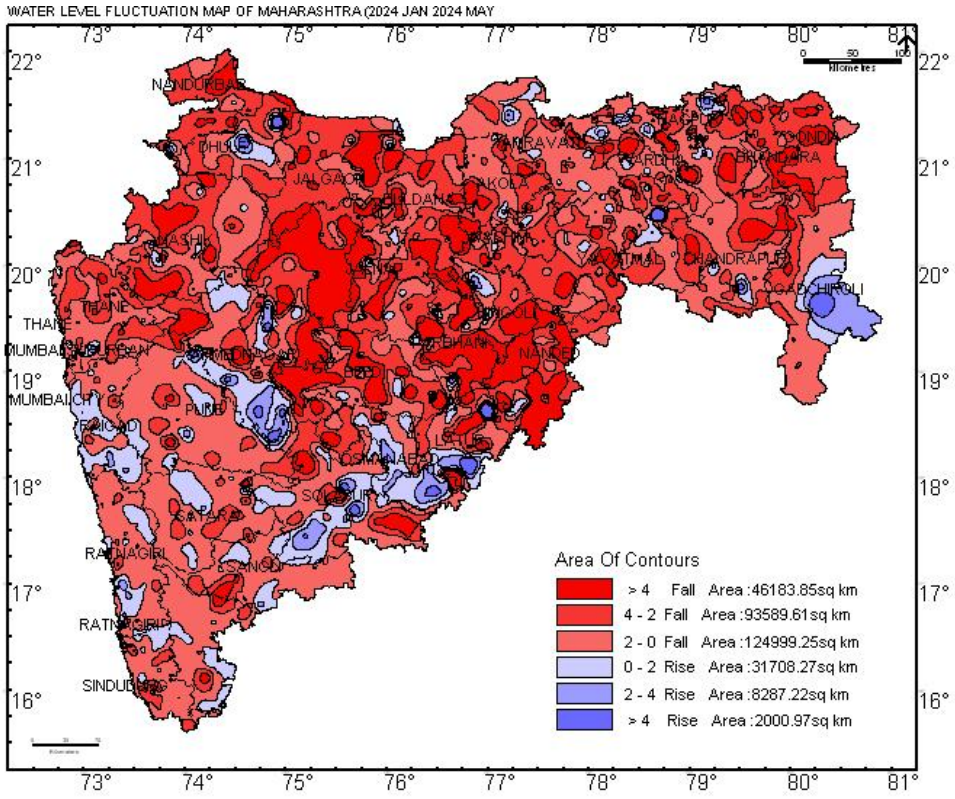


Fig.6: Water level fluctuations (May-24 WRT to January-24)

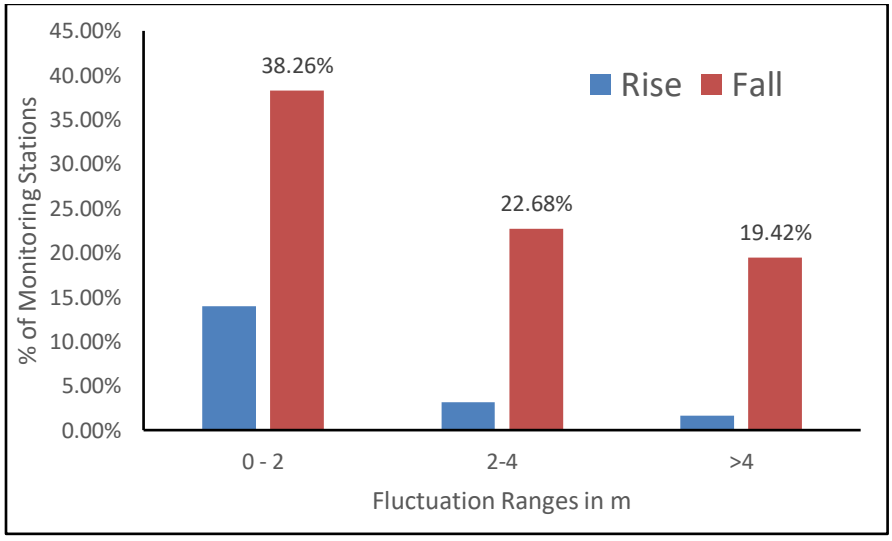


Fig 7: Seasonal water level Fluctuation in unconfined aquifer (January 2024 to May 2024)

5.1.3 ANNUAL FLUCTUATION IN WATER LEVEL FLUCTUATION

Unconfined Aquifer (May 2024 WRT May 2023)

The water level data in respect of 1673 wells for the month of May 2024 is analyzed and compared with May-2023 data. It is observed that ~39 % of wells have recorded rise in water level during May 2024 as compared with the water level data of May 2023 and 47.3 % wells have recorded fall in water level in the range of 0-2 m, 2-4 m and >4 m (**Fig.8**).

Rise: The rise in water levels <2 m is observed in 28 % of wells covering about 85870 km^2 area. 2 to 4 m rise is observed in 16277 km^2 6.4% wells and > 4 is observed in 4 % of wells covering about 9609 km^2. The rise is mostly occurred in Vidarbha region, central-northern part of state, southern part and in coastal region of the state.

Fall: The decline in water levels is observed in about 47.3 % of states geographical area. Fall less than 2 m is observed in 124638 km^2 area, 2-4 m in 44179 km^2 area and > 4 m in 26195 km^2 area.

The frequency distribution of % of wells showing rise and fall is shown as bar diagram in **Fig.9.**

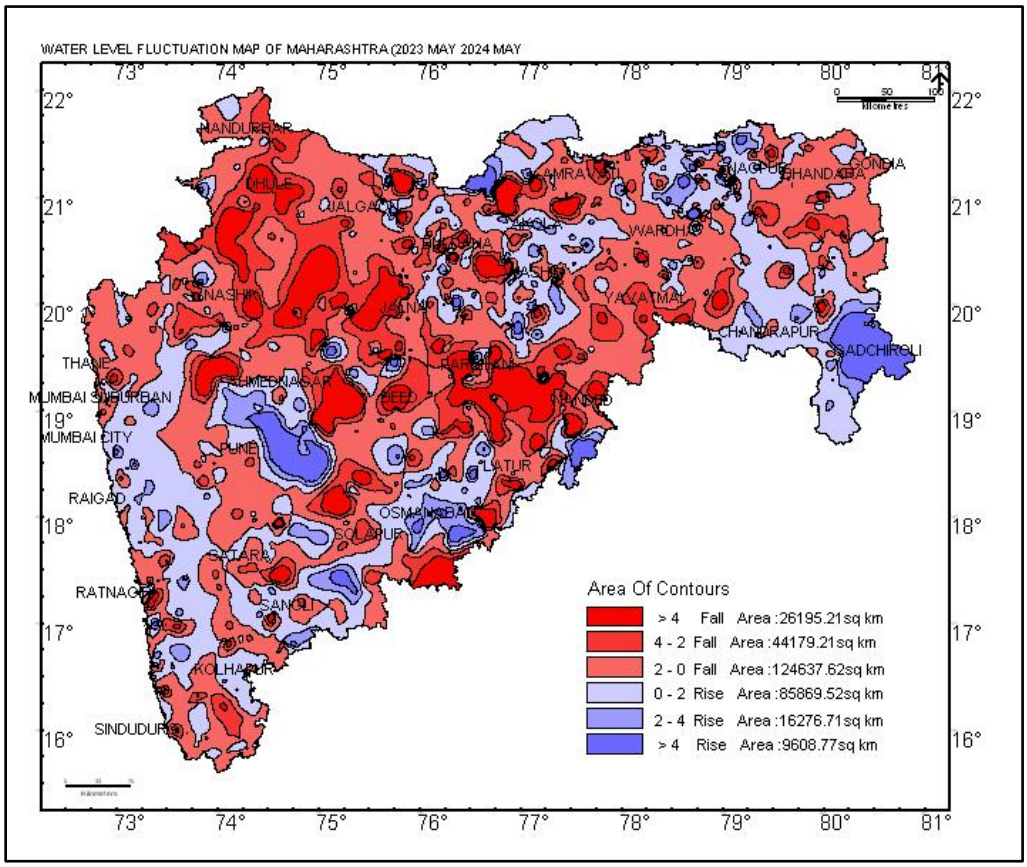


Fig.8: Annual water level fluctuations in unconfined aquifer During May-24 WRT May-23.

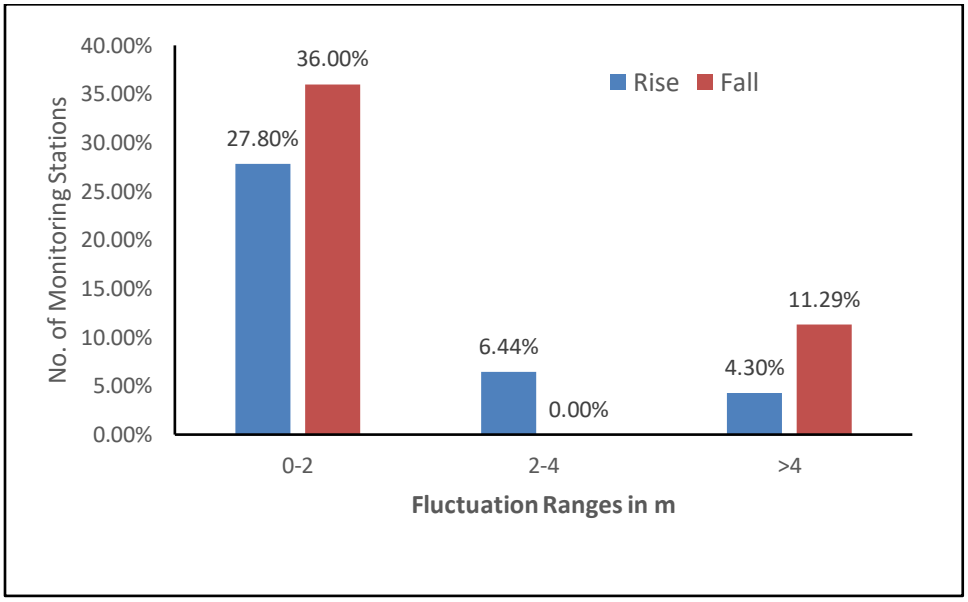


Fig.9: % of wells showing rise & fall in WL, unconfined aquifer (May-24 WRT to May-23).

Unconfined Aquifer (May 2024 WRT May-2022)

Rise:

In the state, rise is observed in about 47.3% of wells covering 1,31,122 Km^2 (43%) (**Fig.10**). In 34% wells, water levels have shown a rise of < 2 m and in 8 % wells, it shown rise 2-4 m. more than 4 m rise is observed in 5 % wells. Rise is mostly observed in Vidarbha region and in central western part of the state.

Fall:

In the state, fall is observed in about 51 % of wells covering 1,75,646 Km^2 (57%) (**Fig.10**). In 31 % wells, water levels have shown fall < 2 m and in 10 % wells water levels have fallen by 2-4 m. more than 4 m fall is observed in 5 % wells. Fall is mostly observed in Nashik and Marathwada region.

The distribution of rise and fall in water levels is shown as bar diagram in **Fig. 11**.

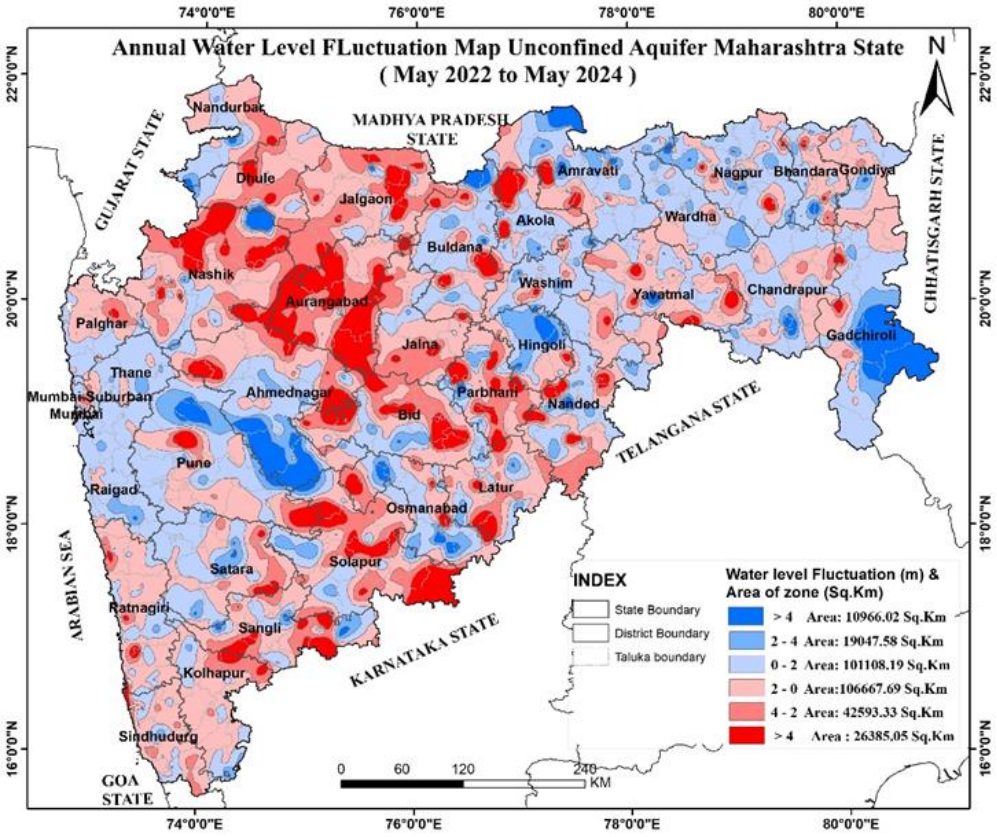


Fig.10: Annual water level fluctuations in unconfined aquifer During May-24 WRT May-22.

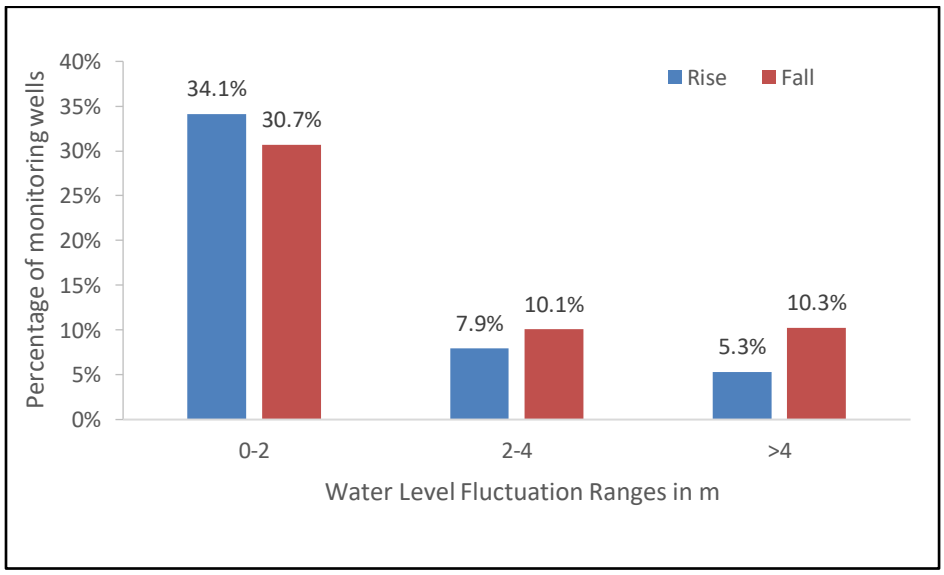


Fig.11: Percentage of wells rise and fall in WL in unconfined aquifer (May-24 WRT May-22).

5.1.4 DECADAL FLUCTUATION IN WATER LEVEL
Unconfined Aquifer (May-2024 WRT May-2014-23)

Rise:

The perusal of map shows that in 60 % of wells covering about 190,756 km^2 area (62 % states geographical area) shows a rise in water level (**Fig.13)**. In 40 % wells rise up to 2 m is observed covering ~1,38,137 km^2. in 13 % wells rise in the range of 2-4 m covering 36699 km^2 area and rise of >4 m is observed in 15919 km^2 area. Maximum rise is observed in eastern parts of Gadchiroli, and in southern parts of Ahmednagar district and in patches in other parts of state.

Fall:

Fall in water levels is observed in 38% of states area covering 116011 km^2 (**Fig.13)**. In 26.5 % wells fall up to 2 m is observed covering ~87797 km^2. in 7.7 % wells fall in the range of 2-4 m covering 19346 km^2 area and fall of >4 m is observed in 8868 km^2 area. A significant Decline of > 4 m is observed in major parts of Thane, Dhule, Nashik, Pune, Osmanabad, Akola, Jalgaon, and Nandurbar Districts and isolated parts in almost all the districts. This decline is mainly due to negative departure in rainfall during 2023 WRT decadal rainfall and more ground water extraction for agriculture and domestic needs. The frequency distribution of % of wells showing rise and fall is shown as bar diagram in **Fig.12.**

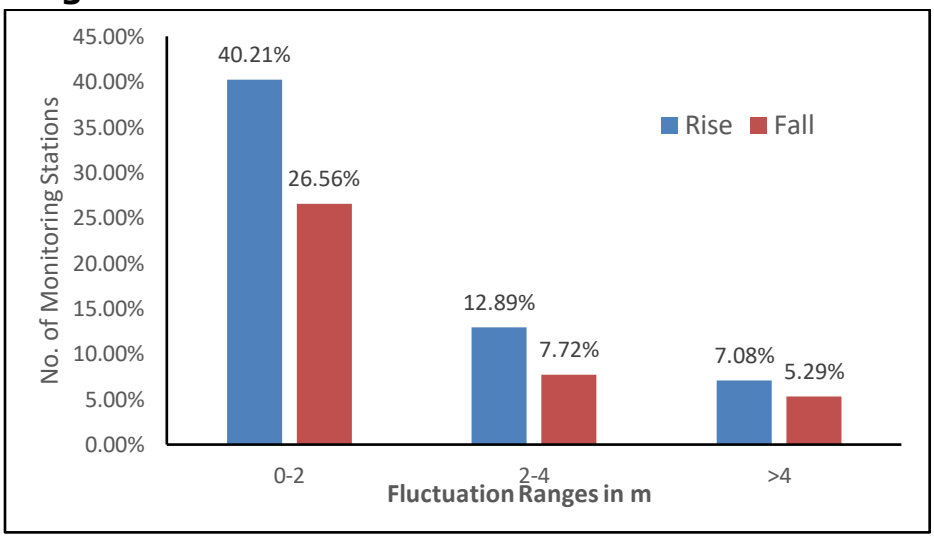


Fig.12: Percentage of wells rise and fall in WL in unconfined aquifer (May-24 WRT Decadal 2014-23).

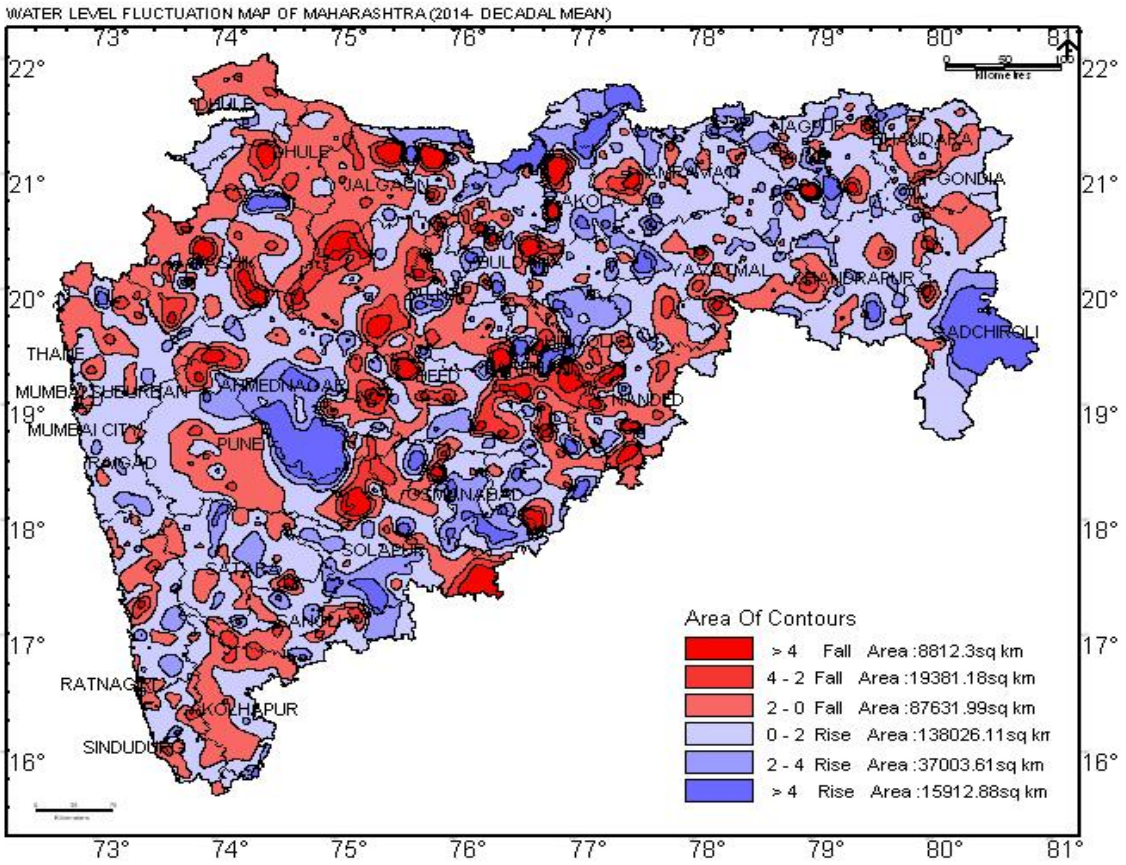


Fig.-13: Decadal water level fluctuations in unconfined aquifer During May-24 WRT Decadal May-2014-23).

5.2 DEEPER AQUIFER (SEMI-CONFINED/CONFINED)

5.2.1 DEPTH TO PIEZOMETRIC LEVEL IN SEMI-CONFINED/CONFINED AQUIFER (MAY 2024)

During pre-monsoon season of 2024, depth to water level in confined/semi-confined aquifer (deeper aquifer) from 280 monitored wells varies from 0.52 to 191 m bgl, shallowest in Buldhana district and deepest in Sangali district **(Fig.14).**

Shallow water levels of < 2 m bgl are observed in 1 % of wells (40 km^2). In 9 % wells covering ~3399 km^2 area have shown water levels in the range of 2-5 m bgl. Water levels in the range of 5-10 m bgl are spread in ~47139 km^2 (~30 % of wells). In ~27 % wells, water levels are in the range of 10-20 and 20-40 and > 40 m water levels are observed in 87161 and 68713 km^2 area respectively.

The frequency of distribution of wells in different water levels zones is presented as pie diagram in **Fig.15**.

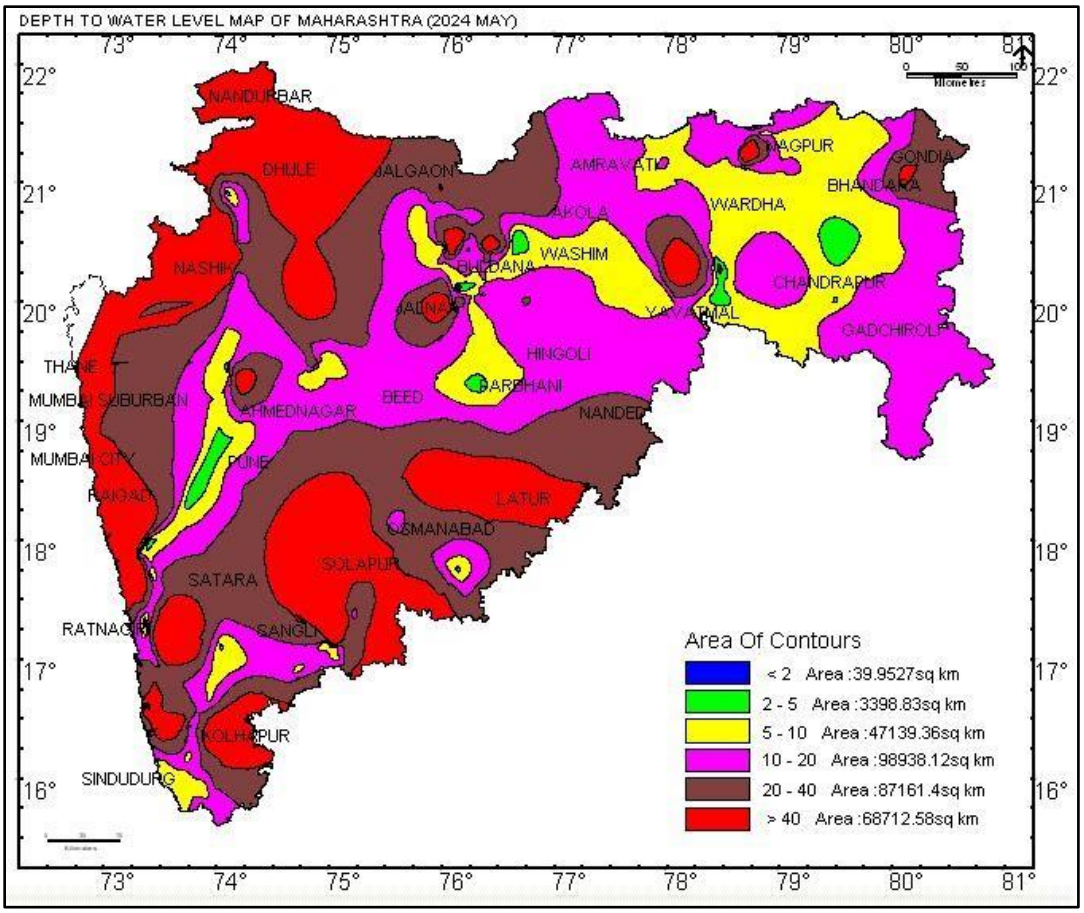


Fig 14: Depth to Piezometric Level in Deeper Aquifer in May 2024.

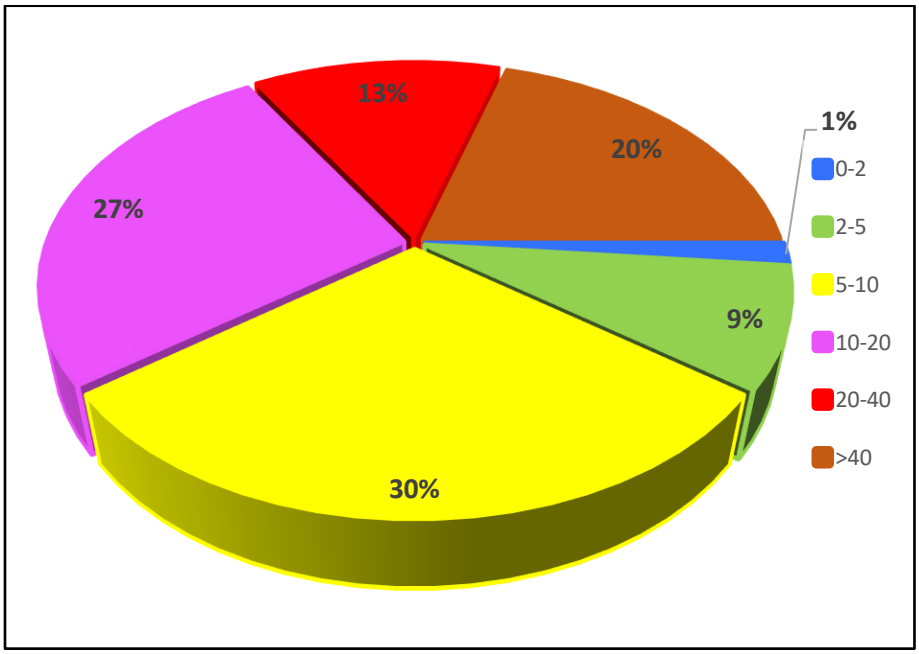


Fig.15: % of wells in different piezometric levels (May 2024).

5.2.2 SEASONAL FLUCTUATION IN PIEZOMETRIC LEVEL

Semi Confined/Confined Aquifer (May 2024 WRT January 2024)

Rise:

Out of 29 Wells, water level of less than 2 m is recorded in 12 % wells, 2 to 4 m in 1.2 % wells and more than 4 m in 4.2 % of wells (Fig.16).

Fall:

Out of 136 Wells, water level of <2 m is recorded in 32 % wells, 2 to 4 m in 19 % wells and more than 4 m in 31 % of the wells (Fig.16).

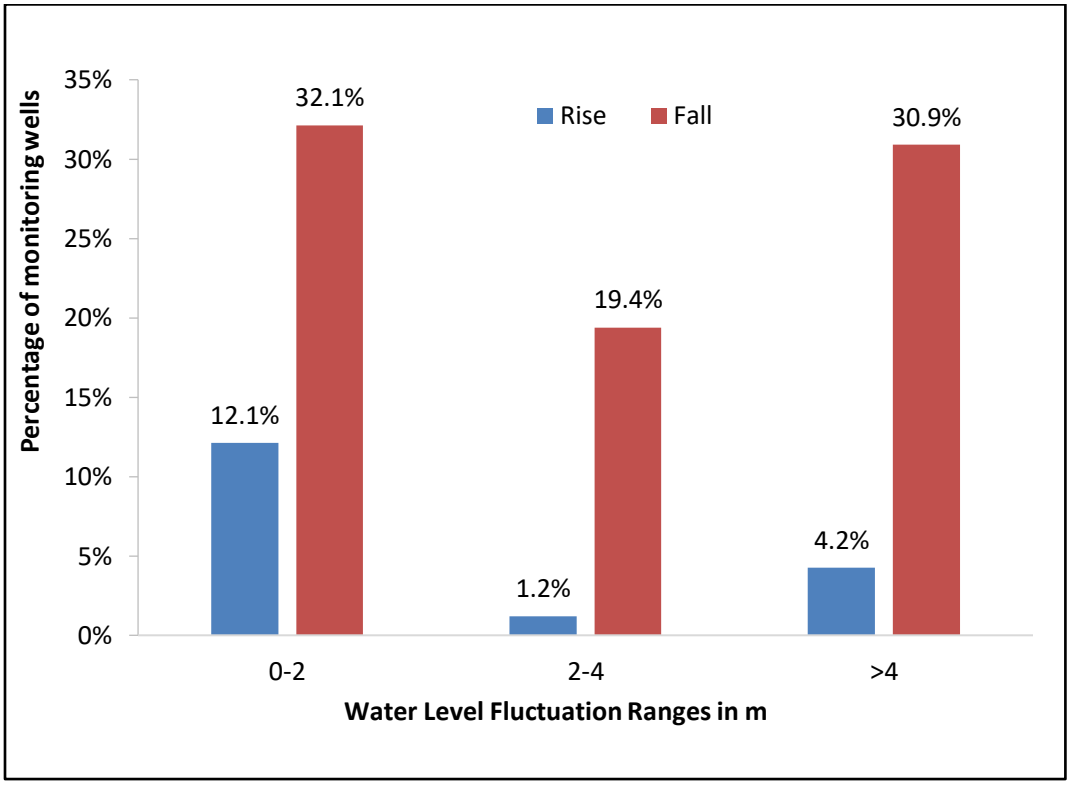


Fig.16: % of Wells showing rise and fall in Piezometric level in Semi confined/ Confined Aquifer (During May-2024 WRT to January-24).

5.2.3 ANNUAL FLUCTUATION IN PIEZOMETRIC LEVEL
Semi Confined/Confined Aquifer (May 23 to May 2024)

Rise:

Out of 46 Wells water level of less than 2 m is recorded in 16.8 % wells, 2 to 4 m in 8.0 % wells and more than 4 m in 15.9 % of the wells. (**Fig.17**).

Fall:

Out of 67 Wells water level of less than 2 m is recorded in 23.9 % wells, 2 to 4 m in 11.5 % wells and more than 4 m in 23.9 % of the wells. (**Fig.17**).

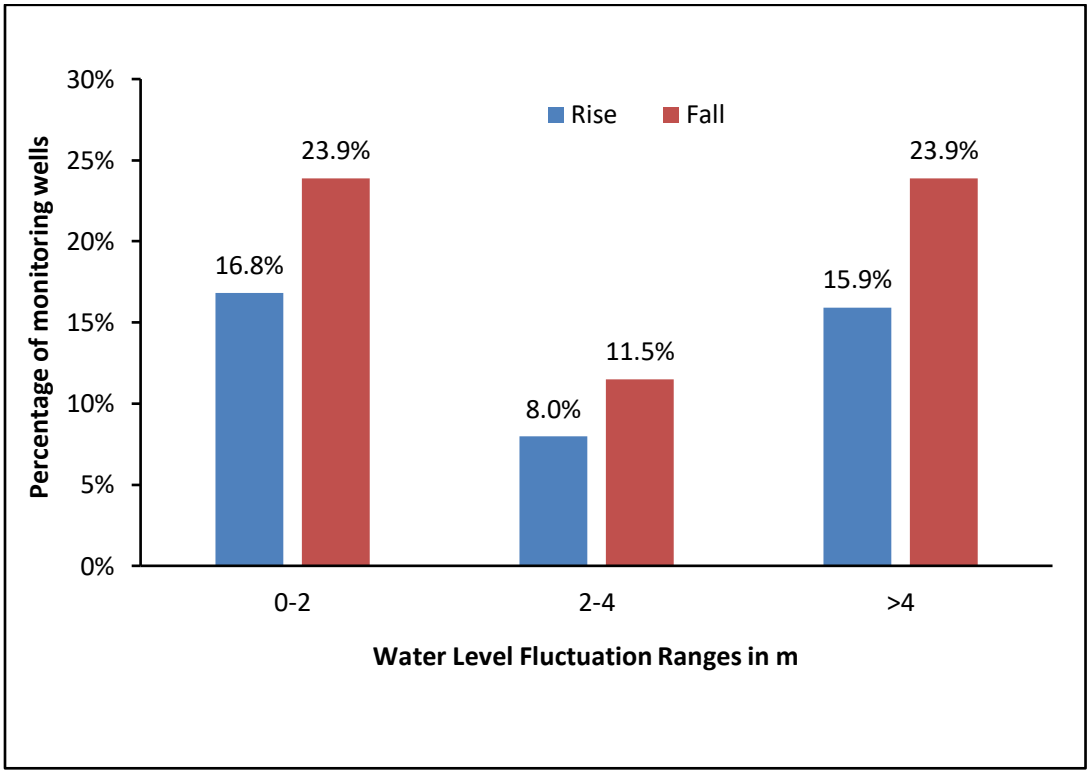


Fig.17: % of wells showing rise and fall in WL in Semi confined/confined aquifer (During May-2024 WRT May-2023).

Semi Confined/Confined Aquifer (During May-2024 WRT May 2022)

Rise:

Out of 27 Wells water level of less than 2 m is recorded in 32.1 % wells, 2 to 4 m in 1.8 % wells and more than 4 m in 14.3 % of the wells. (**Fig.18**).

Fall:

Out of 29 Wells water level of less than 2 m is recorded in 19.6 % wells, 2 to 4 m in 5.4 % wells and more than 4 m in 26.8 % of the wells. (**Fig.18**).

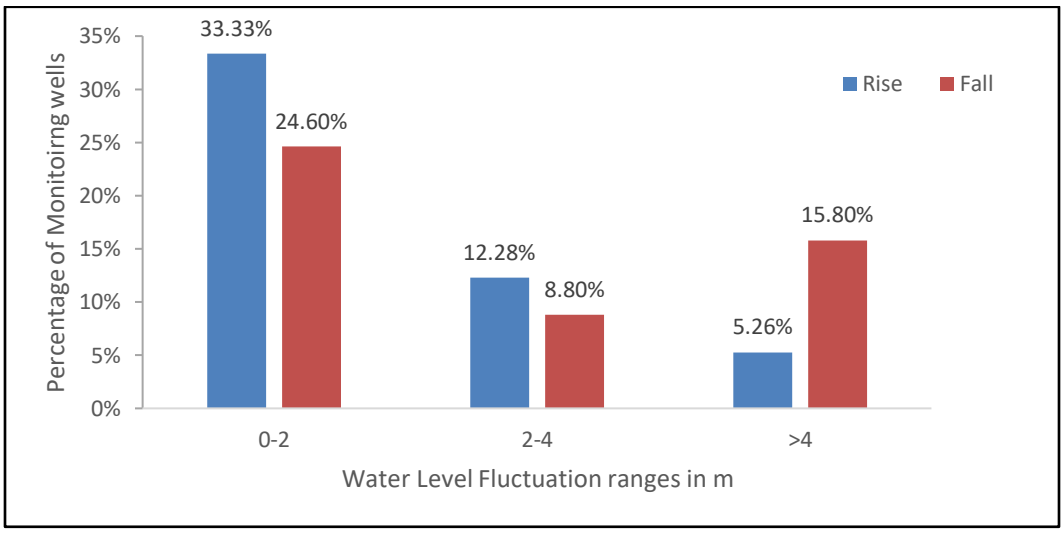


Fig.18: % of wells showing rise and fall in WL in Semi confined/confined aquifer (During May-2024 WRT May-2022)

5.2.4 DECADAL FLUCTUATION IN WATER LEVEL

Semi Confined/Confined Aquifer (During May 2014-2023 WRT May-2024)

Rise:

Out of 59 Wells water level of less than 2 m is recorded in 19.0 % wells, 2 to 4 m in 13.2 % wells and more than 4 m in 16.5 % of the wells. (**Fig.19**).

Fall:

Out of 61 Wells water level of less than 2 m is recorded in 20.7 % wells, 2 to 4 m in 6.6 % wells and more than 4 m in 23.1 % of the wells. (**Fig.19**).

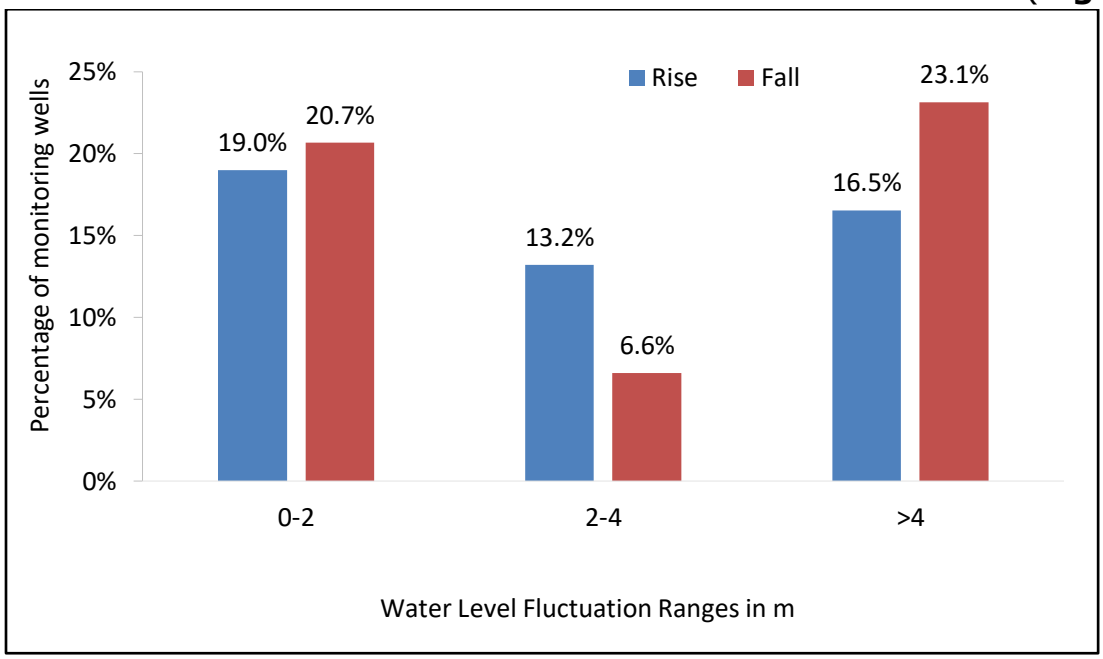


Fig.19: Percentage of wells showing rise and fall in Piezometric Level in confined/semi-confined Aquifer (May-2024 WRT Decadal Mean May (2014 -2023).

6.0 SUMMARY

The groundwater levels in the state are monitored through a network of 2091 wells during four times a year: August, November, January and May and this report evaluates groundwater levels during pre-monsoon season of 2024 (May).

The pre-monsoon season groundwater level analysis provides critical insights into seasonal trends and long-term changes, emphasizing the need for sustainable groundwater management. Notable declines in specific regions underscore the impact of agricultural demand, rainfall variability, and groundwater extraction. The 2023 monsoon saw varying rainfall patterns across districts, influencing groundwater recharge. Districts with deficient rainfall reported greater declines in groundwater levels.

Un-confined (Shallow) Aquifer:

- The water levels from both un-confined (Shallow Aquifer) and confined/semi-confined (Deeper Aquifer) are analyzed for their distribution with different ranges and also compared with annual and decadal water levels.
- During this season, in shallow aquifer water levels are in the range of 0.1 to 69.5 m bgl and the more predominate water level range is 5-10 m, which occupies about 57% of states geographical area and in 47% of wells. Shallowest levels were observed in Raigad district, while the deepest in Jalgaon district. In most of coastal region, water levels are very shallow (0-2 m and 2-5 m bgl). In central and northern part of state, deeper water levels (>10 m) are observed.
- The seasonal fluctuations in water levels during May-24 with respect to January-24 shows that 80% of wells have shown fall in water levels. This fall is a normal phenomenon, since, the period between January and May represents a receding period in a given hydrological cycle and bears the impact of major abstraction of the ground water resources mainly for agriculture activities during rabi season and summer crops. In rest of wells fall is observed covering parts of Gadchiroli, Osmanabad and coastal districts.
- The annual fluctuations in water levels May-24 WRT to May-23, shows rise in water levels in 39% of the wells in the range of 0-2, 2-4 and > 4 m and fall in water levels is observed in about 47 % of wells. The rise is mostly occurred in Vidarbha region, central-northern part of state, southern part and in coastal region of the state and fall in other parts of state.

- The annual fluctuations in WL during May-24 WRT to May-22, shows rise in water levels in the range of 0-2,2-4 and > 4 m in 47.3 % of wells and fall in water levels is observed in about 51 % of wells. Rise is mostly observed in Vidarbha region and in central western part of the state and fall in Nashik and Marathwada region.
- The decadal fluctuations in water levels during May-24 with respect to last decade (2014-23) of the same season shows rise in 40% of wells, covering 62 % states geographical area. Maximum rise is observed in eastern parts of Gadchiroli, and in southern parts of Ahmednagar district and in patches in other parts of state. Fall in water levels is observed in 38 % of states area and significant Decline of > 4 m is observed in major parts of Thane, Dhule, Nashik, Pune, Osmanabad, Akola, Jalgaon, and Nandurbar Districts and isolated parts in all districts. This decline is mainly due to negative departure in rainfall during 2023 WRT decadal rainfall and more ground water extraction for agriculture and domestic needs.

Semi Confined/ Confined Aquifer (Deeper Aquifer):

- In deeper aquifers (confined/semi-confined) water levels are in the range of 0.5 to 191 m bgl, shallowest in Buldhana district and deepest in Sangli district.
- The seasonal fluctuations in water levels during May-24 with respect to January-24 shows that ~82.4 % of wells, have shown fall in water levels. This fall is a normal phenomenon, since, the period between January and May represents a receding period in a given hydrological cycle and bears the impact of major abstraction of ground water resources mainly for agriculture activities during rabi season and summer crops.
- The annual fluctuations during May-24 WRT to May-23, shows rise in water levels in the range of 0-2,2-4 and > 4 m in 40.7 % of wells and fall is observed in ~59 % of wells.
- The annual fluctuations in water level during May-24 WRT to May-22, shows rise in water levels in the range of 0-2,2-4 and > 4 m in 48.2 % of wells and fall in about 52 % of wells.
- The decadal fluctuations during May-24 WRT to May-2014-23, shows rise in water levels in the range of 0-2,2-4 and > 4 m in 49 % of wells and fall in about 50 % of wells.