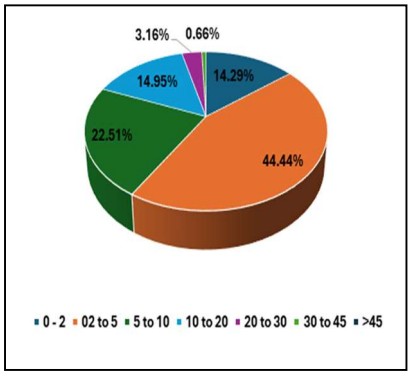

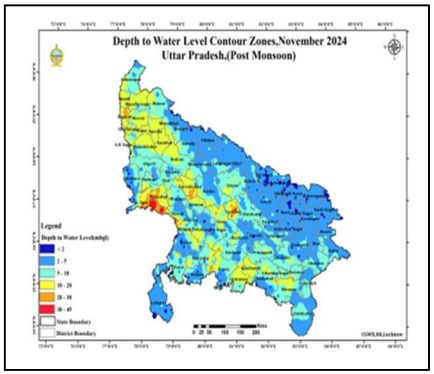

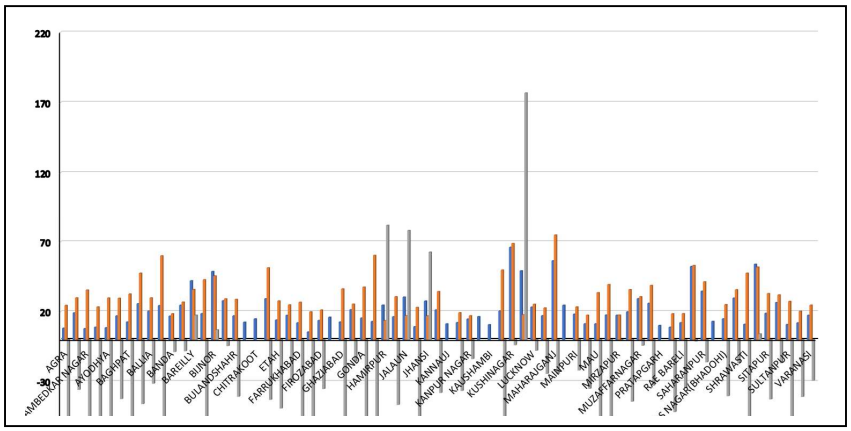

GROUND WATER LEVEL BULLETIN
UTTAR PRADESH
NOVEMBER 2024

ABSTRACT

Ground water level Scenario during November – 2024 highlighting the finding, status of ground water level in different aquifer and its annual and decadal comparison.

CGWB, NORTHERN REGION LUCKNOW

1.0. INTRODUCTION

Groundwater bulletin is 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 important attributes of groundwater regime monitoring are groundwater level. The natural conditions affecting the groundwater regime in volve climatic parameters like rainfall, vapor transpiration etc. whereas anthropogenic in fluences include pumpage from the aquifer, recharge due to irrigation systems and other practices like waste disposal etc.

Groundwater levels are being measured by Central Ground Water Board four times a year during January, March, April, May, August and November. The regime monitoring started in the year 1969 by Central Groundwater Board. A network of 1464 observation wells called National Hydrograph Network Stations (NHNS), as on 30.11.2024, located all over the State is being monitored.

2.0. STUDYAREA

The State of Uttar Pradesh forms a part of vast Gangetic Alluvial Plain covering an area of 2,40,928 Sq. Km. and lies between North latitude $23^0$52'12" & $30^0$24'30" and East longitude $77^0$05'38" & $84^0$38'30". It is bounded by Uttarakhand on the NW, Nepal on the NE, Bihar on the East, Madhya Pradesh in the South, and Haryana, Delhi & Rajasthan in the West as shown in figure 1.

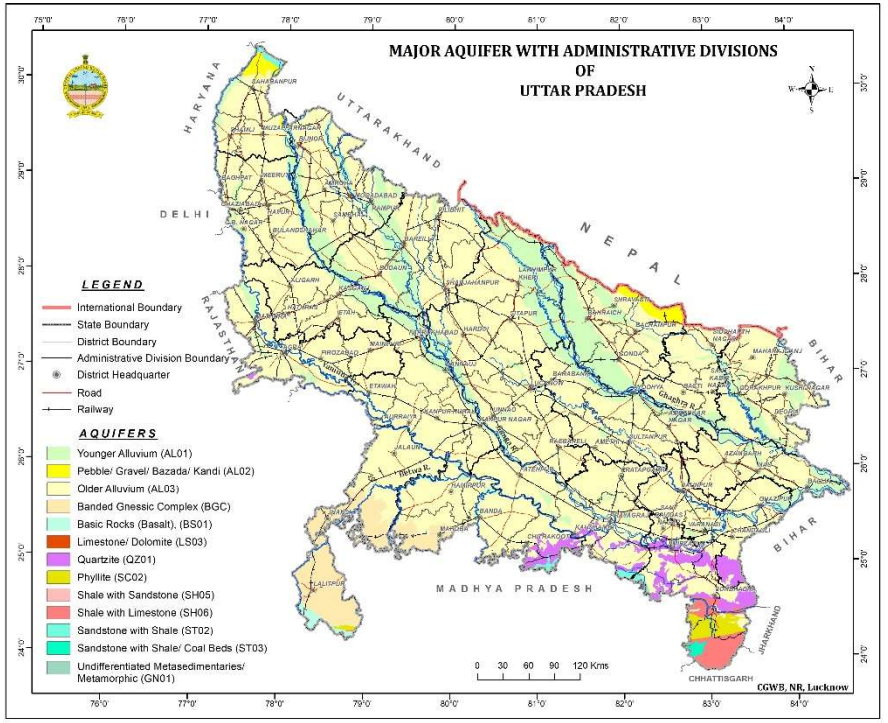

Figure-1: Map showing major aquifers and administrative divisions of UP

The state is covered with rich fertile soil and underlain by a large thickness of alluvium making it one of the richest grounds water repositories of the world. Ground water is a major source of fresh water on earth. It is the most dependable source of water, comparatively free

from the vagaries of nature, easily accessible, available at the point of use and economical. Hence it is being developed indiscriminately and the ground water reservoir is stressed. The State being the most populous in the country, with a population density of 829 persons per sq. km and a high rate of population growth (20%), its demand for water is soaring. Also due to industrialization, urbanization and modern farming practices, its quality is also at stake.

demand for water is soaring. Also due to industrialization, urbanization and modern farming practices its quality is also at stake.

The food production in Uttar Pradesh is commensurate with the self-sufficiency of the country. One of the major contributors for this sufficiency is irrigation. To meet this high irrigational requirement, water resources are being increasingly developed. Ground water contributes to about 71 % of the irrigation needs of the State. The indiscriminate development of ground water has resulted in depletion of groundwater storage and lowering of water level in certain areas on one hand. On other side the surface water development in shallow water level has resulted in water logging and soil salinization. The geology and structure of the formations existing in an area control by occurrence and movement of ground water. The geomorphic conditions also have a great impact on ground water scenario. The larger part of the State is under lain by fluvial sediments laid down in the fore deep between Plateau region in south and Himalayas in north during the Quaternary period by the Indus-Ganga system of drainage over the Precambrian topography existing during geological past. These deposits owe their origin to riverine activity. The southern part of the State has entirely different geological conditions being underlain by Precambrian formations under a thin alluvial cover. Broadly, the State can be divided into two hydrogeological units.

1. Unconsolidated zone.
2. Consolidated, hard rock zone.

The hydrogeological conditions of the above two units widely differ and are discussed subsequently in brief.

Unconsolidated Zone:

This unit covers nearly 85% of the State area. The unconsolidated formations comprising the area have been deposited through mighty rivers originating from the great Himalayan Mountains. These sediments are an admixture of pebble, gravel, sand, silt, clay and kankar. The sediments are generally coarser in the north and gradually become finer southeast ward along downstream of the drainage which is a typical feature of fluvial deposits. This zone consists of mainly two parts, the Terai and the Alluvial Plain. However, the foot hill zone is very small part of Bhaber belt and lies in the northern parts of Bijnore and Saharanpur districts. The Terai is a narrow-disconnected belt along

the northwestern fringe of the State. The Alluvial Plain occupies the area south of Terai and can further be divided into two sub units - Younger Alluvium and Older Alluvium.

The younger alluvium occurs mostly along the present-day flood plain area. The continuous shifting of the drainage network with time caused reworking of their earlier deposits giving rise to the younger alluvium. The older alluvium occupying comparatively high area covers major part of the Plain. A typical characteristic of older alluvium is formation of kankar within itself due to leaching of calcium carbonate under favourable climatic conditions. The kankar occasionally forms pans restricting downward movement of water.

The thickness of alluvial sediments is variable and generally goes up-to 500m. below which occur the semi-consolidated Upper Siwalik formations. The Shallower basement occurs in isolated areas which are known as “Basement highs." This unconsolidated zone is porous and permeable with primary intergranular porosity and has good ground water potential. The sub- surface correlation of formations in the state has shown presence of several aquifers down to a depth of 750 m below the ground. These aquifers mainly encountered in Central Ganga Plain have been grouped on the basis of lithological characters as well as based on interpretation of electrical logs of Boreholes drilled and are as follows:

1. First aquifer 0.0 – 150.00 mbgl
2. Second aquifer 160.00 – 210.00 mbgl
3. Third aquifer 250.00 – 360.00 mbgl
4. Forth deep aquifer 380.00 – 600.00 mbgl

The upper part of the first aquifer down to 50 mbgl is the main source of drinking water through hand pumps and dug wells and is unconfined in nature. The first aquifer as a whole which is under unconfined to semi-confined conditions, it is the most potential aquifer group which is the main source of groundwater in the State extensively exploited through private as well as Government tube wells to meet the drinking water and irrigation needs. The deeper aquifers are confined in nature being exploited to a very limited extent. The yield of the second aquifer is limited while the third aquifer is potential. The shallow and phreatic aquifers are under heavy stress.

Consolidated Zone:

The Bundelkhand Vindhyan plateau region is underlain by a variety of Precambrian formations, mostly granite and granite gneisses, Vindhyan sandstone, limestone & shale, under a thin a alluvial cover or without alluvial cover. As such these formations are hard and compact and devoid of any primary porosity. The ground water in these formations occurs in the secondary porosity of these formations. The secondary porosity has developed due to cracks and fractures which are open at

the surface and tighten at depth. The ground water occurs under unconfined or water level conditions in these formations.

The alluvial sediments of moderate depth along the river course sand in valleys form potential ground water repositories. The weathered mantle over the entire until so forms potential aquifers. These aquifers are being monitored mostly through open wells over the area.

3.0. GROUNDWATER LEVEL MONITORING

Central Ground Water Board, Northern Region, is monitoring changes in groundwater regime in Uttar Pradesh State on quarterly basis continuously. This is facilitated by a network of monitoring stations in the State located in diverse hydrogeological and geomorphic units. The number of operational wells till November 2024 was 1464 which include 1006 dug wells and 458 piezometers shown in **figure** 2. The district-wise breakup of the water level monitoring stations is given in **Table-1**.

Table-1: District-wise distribution of water level monitoring station

S. No.	District	Number of Water Level Monitoring Stations		
		November, 2024		
		DW	PZ	Total
1	Aligarh	9	4	13
2	Hathras	5	4	9
3	Mathura	17	3	20
4	Bulandshahar	2	14	16
5	Gautam Budha Nagar	0	8	8
6	Etah	2	4	6
7	Farukkhabad	1	4	5
8	Mainpuri	4	5	9
9	Agra	6	11	17
10	Firozabad	0	6	6
11	Kasganj	4	11	15
12	Auraiya	9	2	11
13	Etawah	11	2	13
14	Kanpur Dehat	12	1	13
15	Kanpur Nagar	16	1	17
16	Kannauj	11	2	13
17	Barabanki	37	4	41
18	Lucknow	9	15	24
19	Unnao	24	5	29
20	Sitapur	27	6	33
21	Raebareily	30	5	35
22	Sultanpur	33	6	39
23	Ayodhya	13	5	18
24	Ambedkar Nagar	9	16	25

S. No.	District	Number of Water Level Monitoring Stations		
		November, 2024		
		DW	PZ	Total
25	Amethi	36	2	38
26	Bahraich	20	15	35
27	Shrawasti	13	6	19
28	Gonda	25	4	29
29	Balrampur	17	9	26
30	Siddharth Nagar	14	10	24
31	Basti	14	3	17
32	Sant Kabir Nagar	10	1	11
33	Maharajganj	13	1	14
34	Deoria	28	1	29
35	Kushinagar	28	0	28
36	Gorakhpur	15	16	31
37	Jhansi	20	2	22
38	Lalitpur	19	4	23
39	Jalaun	32	5	37
40	Bareily	11	4	15
41	Pilibhit	8	3	11
42	Shahajahanpur	3	0	3
43	Budaun	0	10	10
44	Hardoi	16	7	23
45	Lakhimpur Kheri	26	5	31
46	Bijnor	6	14	20

S. No.	District	Number of Water Level Monitoring Stations		
		November, 2024		
		DW	PZ	Total
47	Amroha	0	9	9
48	Moradabad	5	6	11
49	Rampur	4	6	10
50	Sambhal	0	11	11
51	Ghaziabad	0	3	3
52	Saharanpur	7	11	18
53	Muzaffarnagar	2	10	12
54	Meerut	1	12	13
55	Baghpat	2	9	11
56	Hapur	0	4	4
57	Shamli	0	4	4
58	Ballia	21	2	23
59	Azamgarh	22	10	32
60	Mau	13	3	16
61	Ghazipur	22	11	33
62	Banda	10	18	28
63	Hamirpur	12	11	23
64	Mahoba	10	6	16
65	Chitrakoot	10	14	24
66	Fatehpur	13	14	27
67	Pratapgarh	29	2	31
68	Prayagraj	38	0	38

S. No.	District	Number of Water Level Monitoring Stations		
		November, 2024		
		DW	PZ	Total
69	Kaushambi	10	2	12
70	Jaunpur	30	8	38
71	Varanasi	11	2	13
72	Chandauli	15	4	19
73	Sonbhadra	22	0	22
74	Bhadohi	7	0	7
75	Mirzapur	25	0	25
Grand Total		**1006**	**458**	**1464**

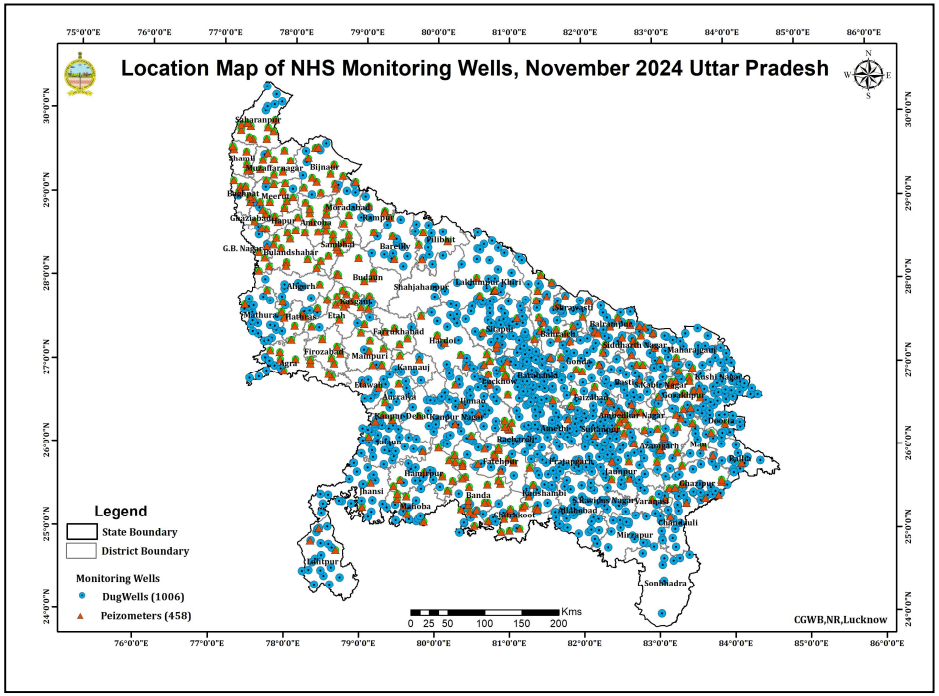

Figure-2: Map showing locations of monitoring wells (NHNS) in Uttar Pradesh

4.0. RAINFALL

The district wise monthly grided rainfall data collected from Indian Meteorological Department; India WRIS were used to analyzed the rainfall pattern (As per latest rainfall data available). Figure-3 shows actual Rainfall of the district during the period of June-August, 2024. Table-2 gives the district wise normal rainfall and actual rainfall June-August, 2023-2024 with the departure from normal rainfall.

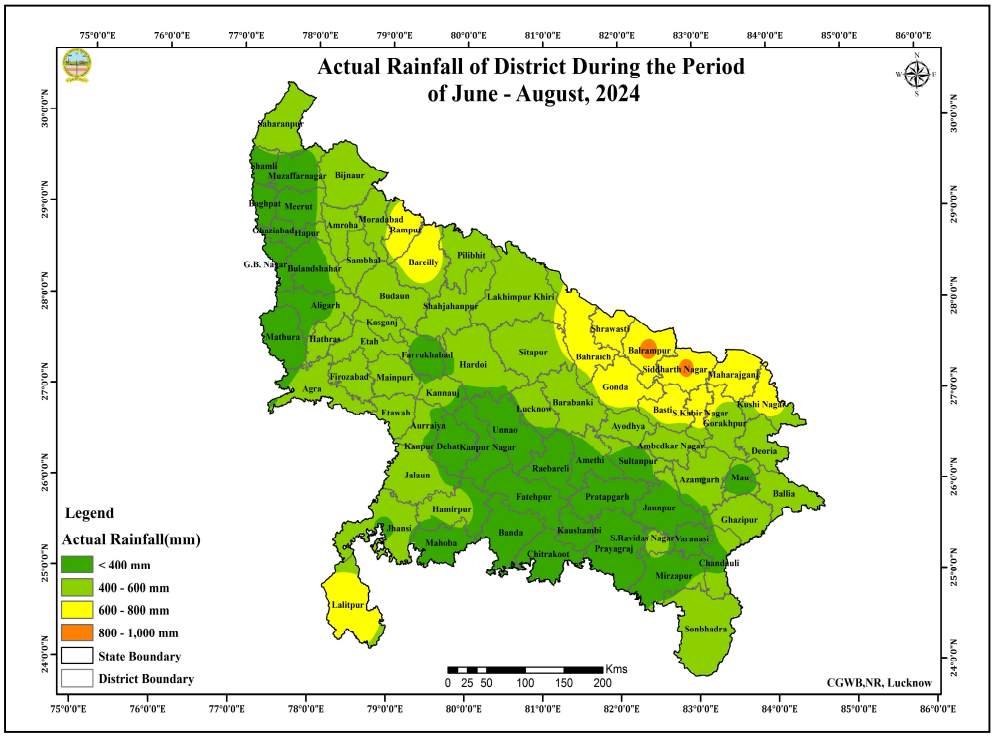

Figure-3: Actual Rainfall of the district during the period of June-August, 2024

Table-2: District wise variability of rainfall (June to August 2024) in Uttar Pradesh (2024)

S.No	District	Total Normal Rainfall (mm) 2024	Total Actual Rainfall (mm), 2023	Deviation%	Total Actual Rainfall (mm), 2024	Deviation%	% Deviation 2024 to 2023
1	Agra	556.8	433.12	-22.21	422.06	-24.20	-2.62
2	Aligarh	485.7	514.59	5.95	360.25	-25.83	-42.84
3	Ambedkar nagar	698	433.2	-37.94	416.69	-40.30	-3.96
4	Auraiya	569.8	424.39	-25.52	407.14	-28.55	-4.24
5	Ayodhya	680.7	461.15	-32.25	445.51	-34.55	-3.51
6	Azamgarh	725.7	375.47	-48.26	398.38	-45.10	5.75
7	Baghpat	451.5	621.31	37.61	265.39	-41.22	-134.11
8	Bahraich	768.4	639.47	-16.78	756.72	-1.52	15.49
9	Ballia	714.1	437.3	-38.76	399.91	-44.00	-9.35
10	Balrampur	868.3	621.96	-28.37	824.04	-5.10	24.52
11	Banda	709.9	428.79	-39.60	392.52	-44.71	-9.24
12	Bara banki	707.1	630.49	-10.83	477.38	-32.49	-32.07
13	Bareilly	735.4	497.2	-32.39	681.19	-7.37	27.01
14	Basti	770.7	506.85	-34.24	696.46	-9.63	27.22
15	Bijnor	762.2	1027.12	34.76	472.49	-38.01	-117.38
16	Budaun	613.8	647.23	5.45	480.08	-21.79	-34.82
17	Bulandshahr	531.7	512.58	-3.60	393.42	-26.01	-30.29
18	Chandauli		376.6		393.11		4.20

S.No	District	Total Normal Rainfall (mm) 2024	Total Actual Rainfall (mm), 2023	Deviation%	Total Actual Rainfall (mm), 2024	Deviation%	% Deviation 2024 to 2023
19	Chitrakoot		411.22		372.42		-10.42
20	Deoria	768.3	430.25	-44.00	443.08	-42.33	2.90
21	Etah	522	703.93	34.85	529.91	1.52	-32.84
22	Etawah	597.6	465.06	-22.18	410.52	-31.31	-13.29
23	Farrukhabad	631.5	448.14	-29.04	319.45	-49.41	-40.28
24	Fatehpur	670.2	253.65	-62.15	176.47	-73.67	-43.74
25	Firozabad	546.7	678.78	24.16	494.46	-9.56	-37.28
26	Gautam buddha Nagar		306.55		244.64		-25.31
27	Ghaziabad	500.1	370.94	-25.83	251.3	-49.75	-47.61
28	Ghazipur	713.5	420.9	-41.01	486.92	-31.76	13.56
29	Gonda	790.3	582.33	-26.32	790.7	0.05	26.35
30	Gorakhpur	847.1	473.73	-44.08	548.66	-35.23	13.66
31	Hamirpur	597.1	605.18	1.35	466.02	-21.95	-29.86
32	Hardoi	632.4	487.78	-22.87	427.46	-32.41	-14.11
33	Jalaun	627.3	471.85	-24.78	510.95	-18.55	7.65
34	Jaunpur	684.1	382.98	-44.02	375.15	-45.16	-2.09
35	Jhansi	675.7	537.09	-20.51	392.88	-41.86	-36.71
36	Jyotiba phule nagar	657.2	696.51	5.98	498.97	-24.08	-39.59

S.No	District	Total Normal Rainfall (mm) 2024	Total Actual Rainfall (mm), 2023	Deviation%	Total Actual Rainfall (mm), 2024	Deviation%	% Deviation 2024 to 2023
37	Kannauj		572.69		419.94		-36.37
38	Kanpur dehat	576.5	330.46	-42.68	254.37	-55.88	-29.91
39	Kanpur nagar	583.6	400.99	-31.29	292.91	-49.81	-36.90
40	Kansiram nagar		643.14		493.44		-30.34
41	Kaushambi		330.02		307.65		-7.27
42	Kheri	761.2	629.57	-17.29	648.1	-14.86	2.86
43	Kushinagar	900.2	487.9	-45.80	460.69	-48.82	-5.91
44	Lalitpur	780.7	642.15	-17.75	739.46	-5.28	13.16
45	Lucknow	636.7	780.11	22.52	471.55	-25.94	-65.44
46	Mahamaya nagar	509	581.88	14.32	467.57	-8.14	-24.45
47	Maharajganj	983.4	590.59	-39.94	682.87	-30.56	13.51
48	Mahoba		542.27		331.21		-63.72
49	Mainpuri	530.3	627.33	18.30	426.26	-19.62	-47.17
50	Mathura	434.2	355.04	-18.23	285.54	-34.24	-24.34
51	Mau	766.4	412.61	-46.16	336.29	-56.12	-22.69
52	Meerut	613.2	796.7	29.92	383.34	-37.49	-107.83
53	Mirzapur	647.3	358.1	-44.68	374.61	-42.13	4.41

S.No	District	Total Normal Rainfall (mm) 2024	Total Actual Rainfall (mm), 2023	Deviation%	Total Actual Rainfall (mm), 2024	Deviation%	% Deviation 2024 to 2023
54	Moradabad	689.2	631.57	-8.36	519.25	-24.66	-21.63
55	Muzaffarnagar	569	704.3	23.78	360.76	-36.60	-95.23
56	Pilibhit	784.6	561.09	-28.49	560.51	-28.56	-0.10
57	Pratapgarh		324.01		343.02		5.54
58	Prayagraj	652.3	291.62	-55.29	328.83	-49.59	11.32
59	Rae bareli	649.4	376.29	-42.06	208.83	-67.84	-80.19
60	Rampur	810.7	772.28	-4.74	724.94	-10.58	-6.53
61	Saharanpur	630.9	1032.54	63.66	503.36	-20.22	-105.13
62	Sant kabir nagar		687.07		668.65		-2.75
63	Bhadohi	687.3	350.67	-48.98	423.68	-38.36	17.23
64	Shahjahanpur	693.4	491.51	-29.12	499.07	-28.03	1.51
65	Shrawasti	768.4	575.78	-25.07	733.2	-4.58	21.47
66	Siddharth nagar	859.4	650.72	-24.28	826.25	-3.86	21.24
67	Sitapur	655.8	478.64	-27.01	499.23	-23.87	4.12
68	Sonbhadra	748.2	516.18	-31.01	596.49	-20.28	13.46
69	Sultanpur	703.8	385.12	-45.28	321.52	-54.32	-19.78
70	Unnao	629	375.06	-40.37	282.78	-55.04	-32.63
71	Varanasi	636.9	357.1	-43.93	345.73	-45.72	-3.29
	Average	**672.61**	**520.55**	**-19.56**	**458.37**	**-30.92**	**-19.28**

The Average normal and normal rainfall in (mm) for the month from June 2024 to August 2024 comes to be 672.61 and 458.37 respectively. From the Map of deviation % in rainfall from normal June 2024 to August 2024, it is inferred that most of the regions in the UP fall in the category of normal to deficit as shown in figure-4. This shows that most of the region of UP receives the moderate to heavy rainfall. Average % deviation in august 2024 w.r.t. august 2023 is -19.28%. There is no drastic change in the rainfall pattern in august 2024 as compared to previous year.

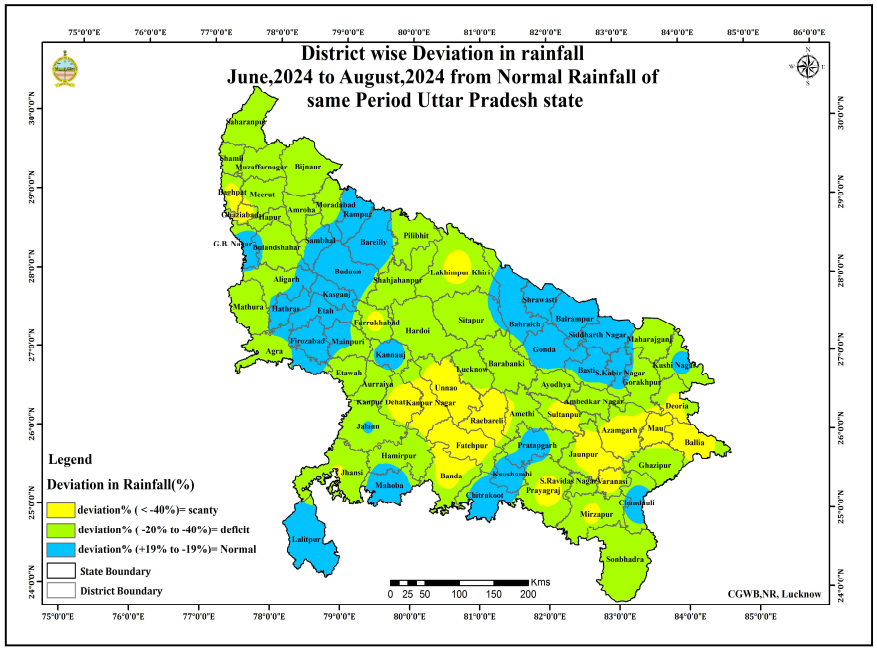

Figure-4: District wise deviation % in Rainfall during the period of June-August,2024

5.0. GROUNDWATER LEVEL SCENARIO (NOVEMBER 2024)

5.1. SHALLOW AQUIFER (UNCONFINED)

5.1.1. DEPTH TO WATER LEVEL

Depth To Water Level in Unconfined Aquifer (November 2024)

The depth to water level of 1204 wells is used for the analysis. It shows that water level varies between 0.38 mbgl (Jalaun district) to 44.2 mbgl (Agra). Water level of less than 2 mbgl is recorded in 172 wells (14.29%), between 2 to 5 mbgl in 535 wells (44.44%), between 5 to 10 mbgl in 271 wells (22.51%), between 10 to 20 mbgl in 180 wells (14.95%), between 20-30 mbgl in 38 wells (3.16%) and water level between 30-45 mbgl is registered in 8 wells (0.66%). Map showing depth to Water level of unconfined aquifers is shown in Figure – 5 and percentage of wells of different water level ranges for unconfined aquifers is shown in Figure No. 6. Shallow water level of less than 2 mbgl is seen in isolated patches in parts of Moradabad, Bareilly, Shrawasti, Balrampur, Siddharth nagar, Basti, Sant Kabir nagar, Maharajganj, Deoria, Azamgarh, Kusinagar, Jaunpur, Amethi, Prayagraj, Rai Bareilly, Fatehpur, Banda, Mahoba, Lalitpur, Jalaun, Mathura, Kanpur nagar and Kanpur dehat districts of UP. Water level of 2 to 5 mbgl is majorly observed in Terai region of UP namely Moradabad, Rampur, Bareilly, Pilibhit, Shahjahanpur, Lakhimpur Kheri, Shrawasti, Bahraich, Balrampur, Mathura, Gonda, Siddharth Nagar, Basti, Sant Kabir Nagar, Gorakhpur, Azamgarh, Maharajganj, Kushinagar, Deoria, Mau, Mainpuri, Hardoi, Mahoba, Jalaun, Aurraiya, Ballia Chandauli, Sonbhadra and isolated patches are seen in the parts of Ghazipur, Mirzapur, Prayagraj, Jaunpur, Sultanpur, Amethi, Raebareli, Barabanki, Unnao, Kanpur Nagar, Kannauj, Lalitpur, Etawah, Aligarh, Kasganj and Banda districts of Uttar Pradesh .

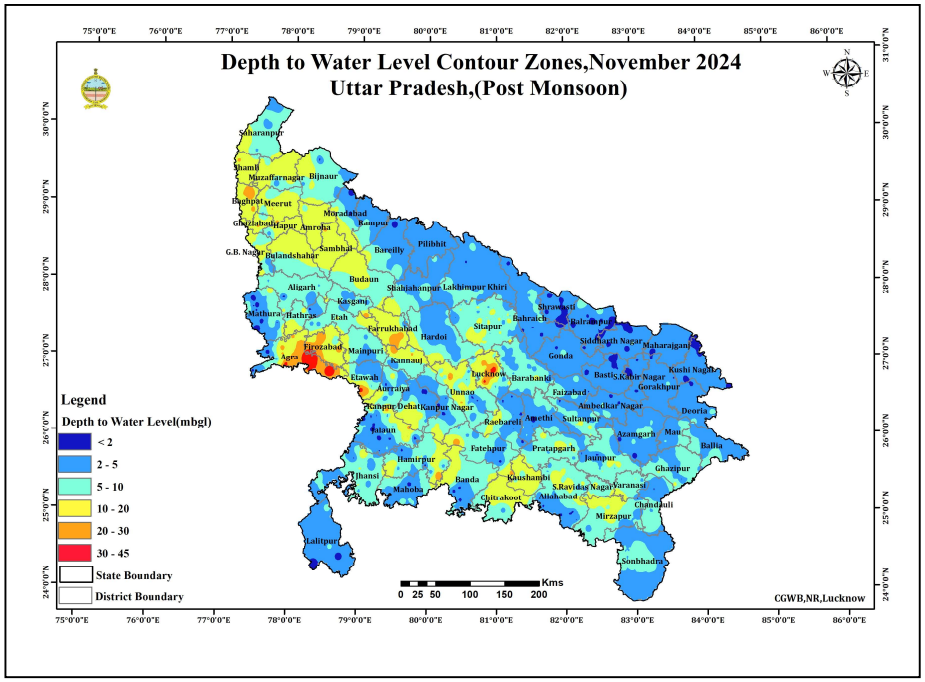

Figure-5: Depth to water level of unconfined aquifer during November 2024

Depth to water level of 5 to 10 mbgl which is observed in the parts of Saharanpur, Bijnaur, Muzaffarnagar, Moradabad, Rampur, Bareilly, Shahjahanpur, Lakhimpur Kheri, Hardoi, Sitapur, Lucknow, Unnao, Barabanki, Raebareli, Amethi, Ayodhya, Pratapgarh, Sultanpur, Ambedkar Nagar, Prayagraj, Jaunpur, Azamgarh, Mau, Ballia, Ghazipur, Mirzapur, Kanpur Nagar, Kanpur Dehat, Banda, Mahoba, Hamirpur, Jhansi, Jalaun, Aurraiya, Kannauj, Etawah, Mainpuri, Kasganj, Etah, Aligarh, Hathras, Mathura and Aligarh districts of UP.

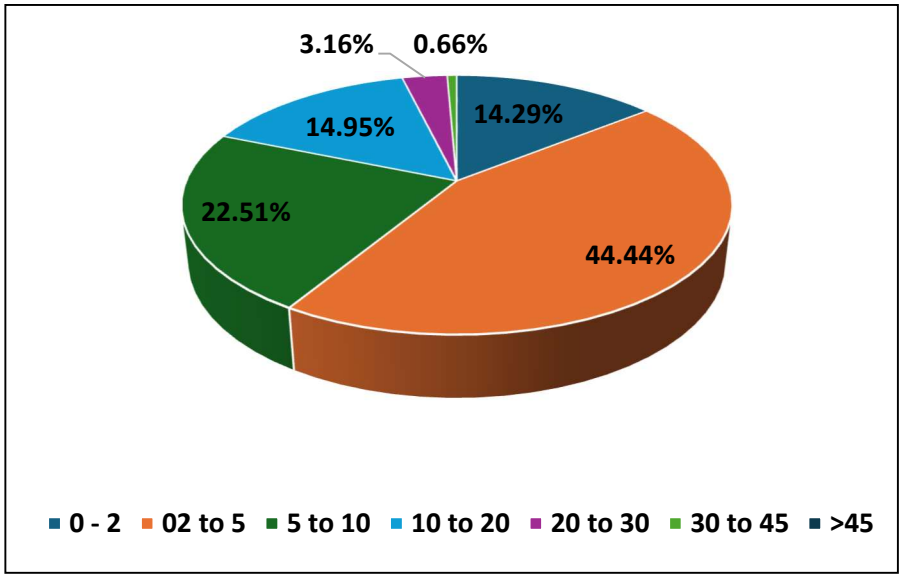

Figure-6 Percentage of wells in different water level ranges in Unconfined aquifer

Water level of 10 to 20 mbgl are observed mostly in Middle Gangetic plains parts namely Saharanpur, Shamli, Baghpat, Ghaziabad, Muzaffarnagar, Bijnor, Meerut, Hapur, Amroha, Sambhal, Gautam Budh Nagar, Bulandshahar, Budaun, Farrukhabad, Kannauj, Hathras, Agra, Firozabad, Etawah, Kanpur Dehat , Kanpur Nagar, Jalaun, Hamirpur, Banda, Hardoi, Sitapur, Fatehpur, Raebareli, Lucknow, Unnao, Kaushambi, Chitrakoot, Pratapgarh, Prayagraj, Mirzapur and Ghazipur districts of U.P. Deeper water levels of more than 20 mbgl is observed in the parts of Baghpat, Shamli, Ghaziabad, Sambhal, Agra, Firozabad, Farrukabad, Etawah, Jalaun, Kasganj, Kannauj, Lucknow,

Unnao, Hamirpur and Fatehpur districts.

5.1.2 SEASONAL FLUCTUATION IN WATER LEVEL

Seasonal Fluctuation of Water Level in Unconfined Aquifer (May 2024 to November 2024)

Rise in Water Levels:

Out of 667 wells, water level rise of less than 2m is recorded in 392 wells (58.77)% , 2 to 4m in 165 wells (24.74%) and more than 4m in 32 wells (4.8%) as shown in Fig-8. Water level rise of less than 2m are mostly observed in all parts of the state and rise in 2 – 4m is mostly observed in Bundelkhand region of UP and along with it is also noticed in Kanpur Nagar, Kanpur Dehat, Aurraiya, Etawah, Mainpuri, Firozabad, Hathras, Rampur, Bijnaur, Amroha, Moradabad, Sambhal , Raibareli, Amethi, Azamgarh, Gorakhpur, Maharajganj, Kushi nagar, Gonda, Ballia, Ambedkar nagar and Saharanpur Districts. Rise of more than 4m is significantly observed in isolated patches of Saharanpur, Mathura, Firozabad, Fatehpur, Banda, Mahoba, Jhansi, Lalitpur, Mirzapur, Chandauli , Azamgarh and Gorakhpur districts of UP.

Fall in Water Levels:

Out of 667 wells that have registered fall in water levels, 67 wells (10%) have recorded less than 2m while 5 wells (0.75%) in the range of 2 to 4m and remaining 6 wells (0.9%) registered water level fall of more than 4m. Fall of less than 2m is mainly observed in isolated parts of Gautam Buddha Nagar, Ghazibad, Bagpat, Agra, Kasganj, Farukhabad,

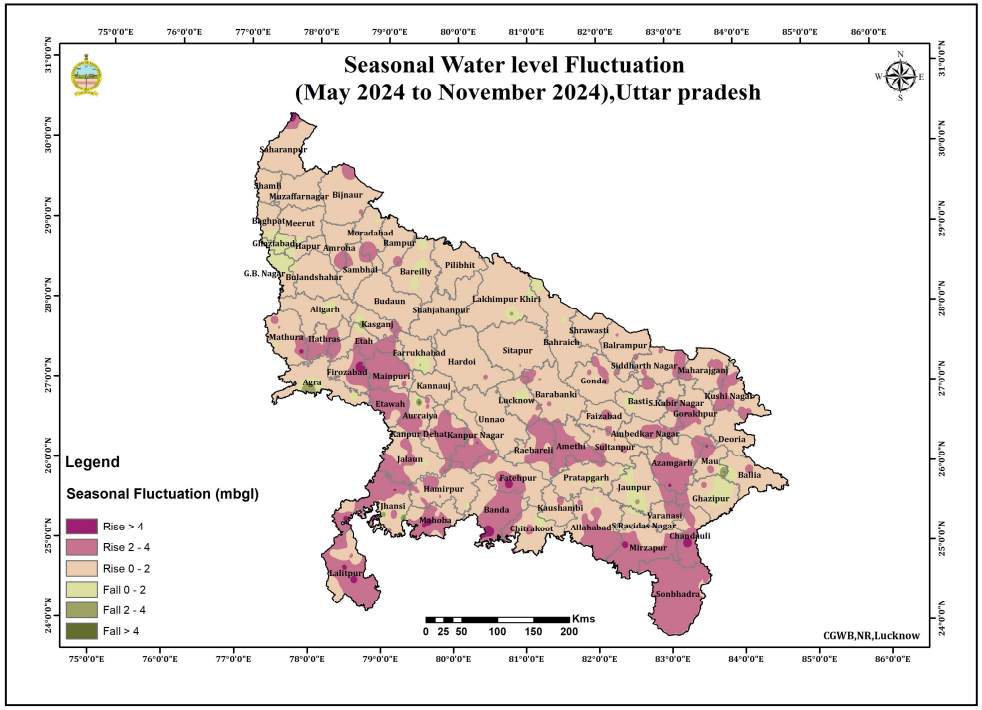

Figure-7: Seasonal water level fluctuation in unconfined Aquifer (May 2024 to November 2024)

Bareilly, Jhansi, Lucknow, Lakhimpur Kheri, Hamirpur, Chitrakoot and Pratapgarh districts of UP. Fall of 2 to 4m is observed mainly in Agra, Kasganj, Jalaun, Aurraiya, Jhansi and Mau region. Fall greater than 4m is seen in isolated patches of district Aurraiya and Mau. Map showing seasonal water level fluctuation is shown in Fig.7

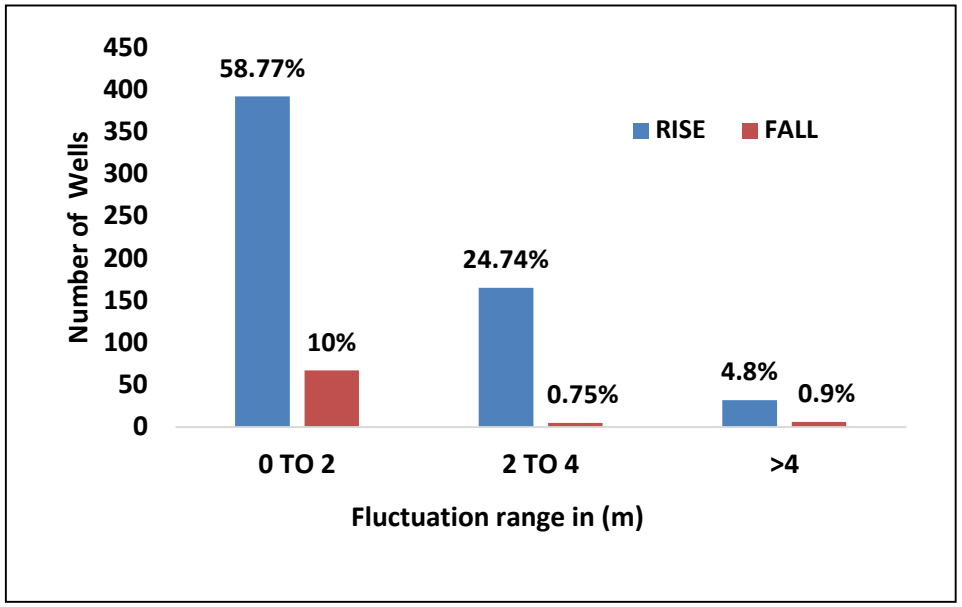

Figure-8: Percentage of wells showing rise and fall in WL in Unconfined Aquifer (May 2024 w.r.t. November 2024)

5.1.3 ANNUAL FLUCTUATION IN WATER LEVEL

Rise in Water Levels: Out of 806 wells analyzed, it is observed that, the rise in water level of less than 2m is recorded in 315 wells (39.08%) , 2 to 4 in 27 wells (3.55%) and more than 4 m in 8 wells (0.99%). Water level rise of less than 2m is seen in Middle Gangetic Plains, Bundelkhand region and Eastren parts of UP along with Meerut, Gonda, Ambedkar nagar, Unnao, Rai barelli, Amethi, Sultanpur, Kanpur nagar, Kanpur Dehat, Sonbhadra and Varanasi districts. Water level rise of 2 to 4 m is observed mainly in, Agra, Mathura, Hathars, Etah, Jalaun, Kaushambi, Jaunpur, Unnao, Azamgarh, Barabanki, Bahraich, Mau, Mirzapur and Sonbhadra districts. Rise of more than 4m is significantly observed in Agra, Etah, Jalaun and Jaunpur districts.

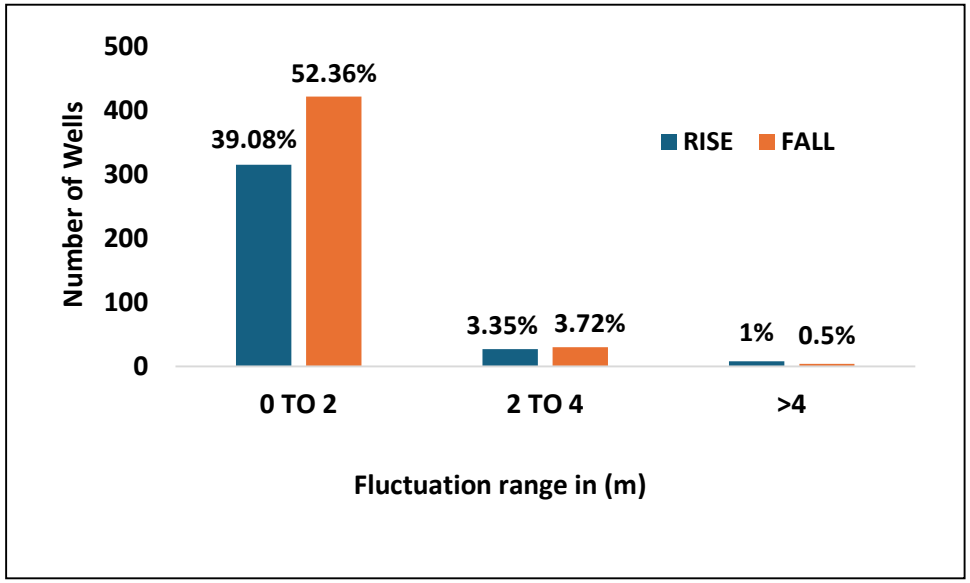

Figure-9: Percentage of wells showing rise and fall in WL in Unconfined Aquifer (November 2023 w.r.t. November2024)

Fall in Water Levels: Out of 806 wells analyzed, 422 wells(52.36%) of the area shows fall in water levels and recorded water level of less than 2m fall, while 30 wells (3.72%) are in the range of 2 to 4m and remaining 4 wells (0.5%) shows fall of more than 4m. Fall of less than 2m is mainly observed in Terai Region and Bundelkhand region of UP along with Farrukabad, Mainpuri, Kannauj, Etawah, Aurraiya, Jalaun,

Jhansi, Sonbhadra, Chaundali, Mirzapur, Sant Ravidas Nagar, Jaunpur, Gazipur, Ballia, Deoria and Gorakhpur districts in UP.

Fall of 2 to 4 m is observed mainly in isolated patches of Saharanpur, Shamli, Jalaun, Lucknow, Barabanki, Bahraich, Amethi, Jaunpur, Prayagraj, Sant Ravidas nagar, Ghazipur, Mirzapur, Chitrakoot and Jhansi districts. Fall of more than 4m is observed in isolated patches of Sant Ravidas nagar, Mirzapur, and Chitrakoot districts. Percentage of wells showing rise and fall in WL for unconfined aquifer (Nov2023 to Nov2024) in Figure–9 and annual water level fluctuation in unconfined aquifer (Nov 2023 -2024) is shown in Figure- 10.

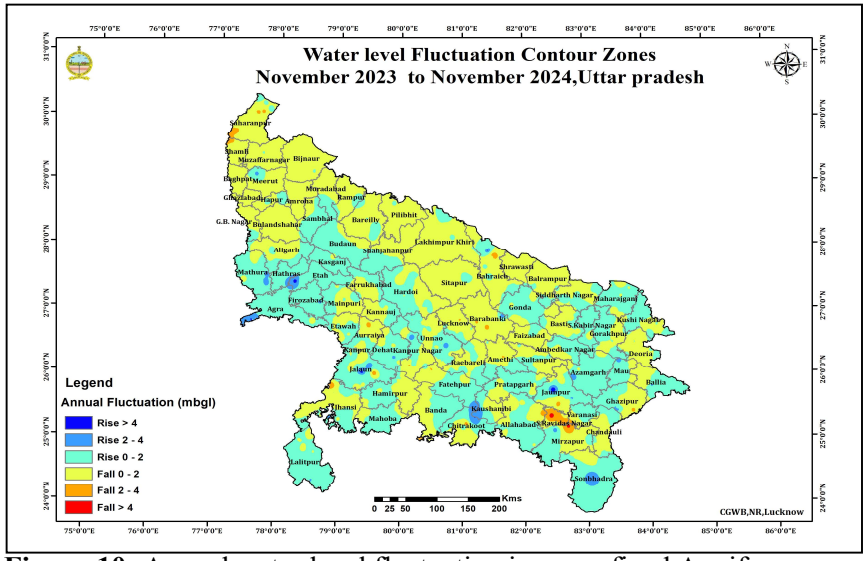

Figure-10: Annual water level fluctuation in unconfined Aquifer (November 2023 to November 2024)

5.1.4 Decadal Fluctuation of Water Level in Unconfined Aquifer (Decadal Mean November (2014-2023) to November 2024)

Rise in Water Levels:

Out of 511 analyzed wells, the rise in water level of less than 2m is recorded in 214wells (41.88%), 2 to 4 m in 31 wells (6.07 %) and more than 4m in 9 wells (1.76%). Water level rise of less than 2m is seen in Saharanpur, Shamli, Bijnor, Aligarh, Agra, Mathura, Mainpuri, Firozabad, Kanpur Dehat, Kanpur Nagar, Jalaun, Hamirpur, Bareilly, Shahjahanpur, Rampur, Jhansi, Lalitpur, Mahoba, Azamgarh, Banda, Basti, Siddharth Nagar, Balrampur, Sitapur, Hardoi, Shrawasti, Gorakhpur, Bahraich, Gonda, Deoria, Ghazipur, Sonbhadra, Chitrakoot, Fatehpur, Prayagraj, Mau and Varanasi regions. Water level rise of 2 to 4 m is observed mainly in isolated patches of Mathura, Hathras, Etah, Agra, Jalaun, Jhansi, Hamirpur, Lalitpur, Fatehpur, Jaunpur, Mau and Varanasi districts and rise of more than 4m is significantly observed in Etah, Jalaun, Kanpur Nagar, Hamirpur, Fatehpur and Varanasi districts of UP.

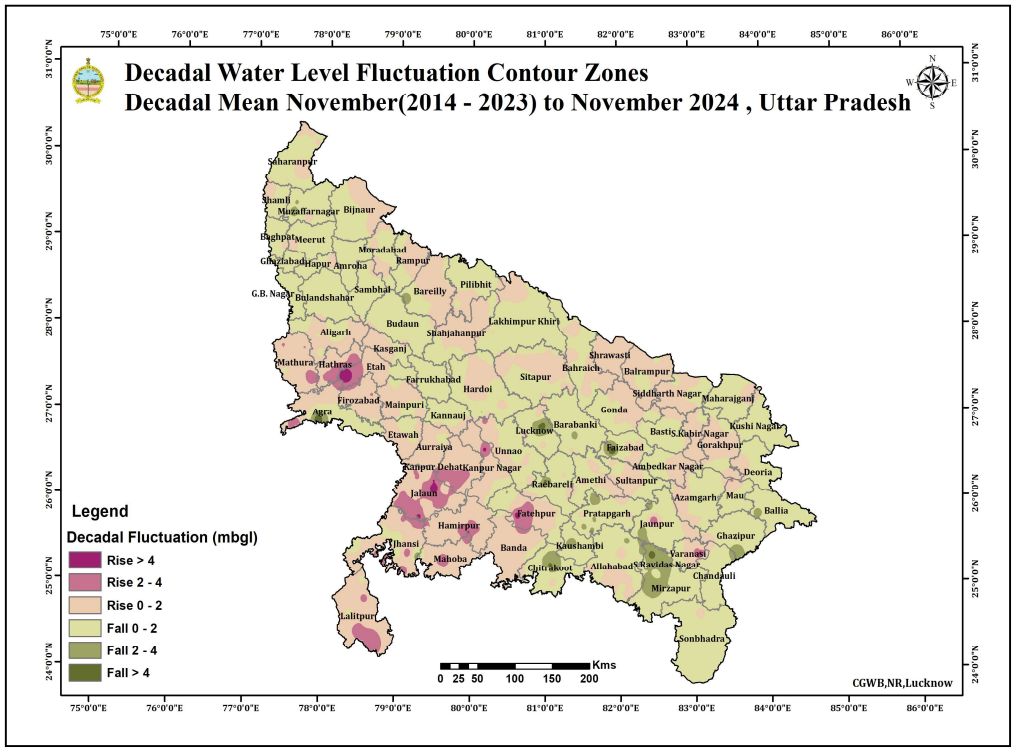

Figure-11: Decadal Water level Contour Zones, Decadal Mean November (2014-2023) w.r.t. November 2024)

Fall in Water Levels:

Out of the 511 analyzed wells, 222 wells (43.44%) of the area shows, fall in water levels of less than 2m while 27 wells (5.28%) in the range of 2 to 4m and remaining 8 wells (1.57%) registered water level fall of more than 4m. Fall of less than 2 m is observed in major parts in Eastern parts of Uttar Pradesh along with Ghazipur, Kushi Nagar, Maharajganj, Pratapgarah, Amethi, Rae Barielly, Ballia, Jaunpur, Deoria and Ayodhya districts. Central parts of Uttar Pradesh such as Hardoi, Sitapur, Lakhimpur Kheri, Lucknow, Barabanki, Unnao and Gonda districts and Westren parts of UP namely Amroha, Bulandshahr, Aligarh, Budaun, Sambhal, Bijnore, Muzaffaranagar, Saharanpur, Baghpat, Merrut, Gaziabad, Hapur and Rampur districts. Fall of 2 to 4m is observed in isolated patches of Agra, Muzaffarnagar, Lucknow, Bareilly, Barabanki, Raibarelly, Pratapgarh, Prayagraj, Kaushambi, Chitrakoot, Sant Ravidas nagar, Gazipur, Ballia, Mirzapur and Jaunpur districts. Fall more than 4m is observed in isolated patches of Agra, Lucknow, Ayodhaya, Sant Ravidas Nagar, Raibareilly and Chitrakoot districts of UP. Decadal Water level fluctuation form (November 2014-2023) with respect to November 2024 is shown in the Figure–11 and percentage of wells showing rise and fall in WL for Unconfined Aquifer (Decadal fluctuation (2014-2023) w.r.t. November 2024) is shown in Figure-12.

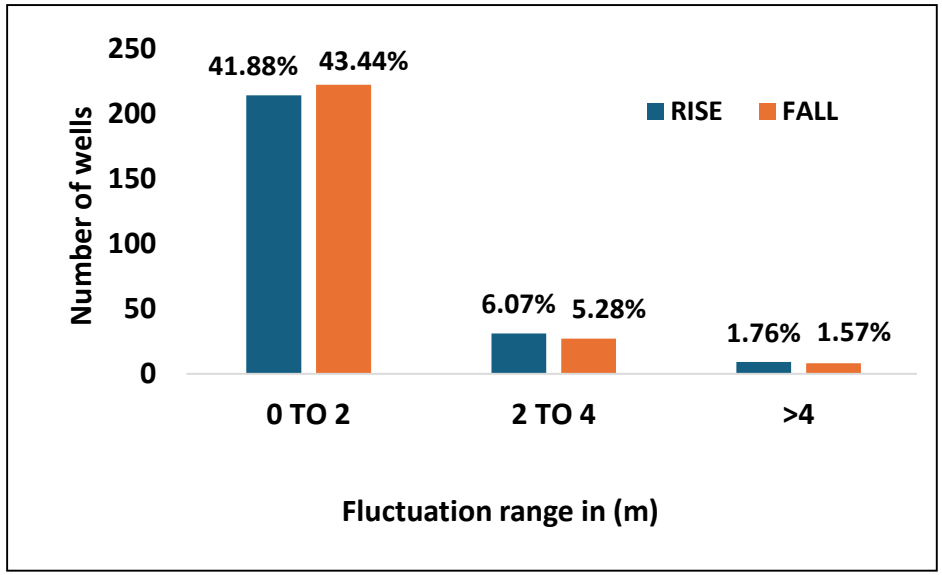

Figure-12: Percentage of wells showing rise and fall in WL in Unconfined Aquifer (Decadal Fluctuation (2014-2023) w.r.t. November 2024)

5.2 DEEPER AQUIFER (CONFINED/SEMI-CONFINED)

5.2.1 DEPTH TO WATER LEVEL

Depth To Piezometric Head in Confined/Semi-Confined Aquifer (November 2024)

Analysis of piezometric head of 198 wells shows piezometric head vary between 0.12 mbgl (Mahoba) to 50.59 mbgl (Agra district). Piezometric head of less than 2 mbgl is recorded in 22 wells, between 2 to 5 mbgl in 56 wells, between 5 to 10 mbgl in 47 wells, between 10 to 20 mbgl in 48 wells, between 20-30 mbgl in 19 wells, greater than 30 mbgl in 6 wells. Percentage of wells of different piezometric head ranges for confined aquifer is shown in Figure-13. Shallow piezometric head of less than 2 mbgl is noticed in Bahraich, Banda, Azamgarh, Gorakhpur, Ayodhaya, Shrawasti, Siddharath nagar, Mau and Mahoba districts comprising 11.11% area of State. Piezometric head of 2 to 5 mbgl mainly observed in parts of Bijnore, Budaun, Bulandshahr, Etah, Fatehpur, Ambedkar nagar, Azamgarh, Bahraich, Balrampur, Chandauli, Chitrakoot, Banda, Gorakhpur, Hathras, Jhansi, Jaunpur, Lakhimpur Kheri, Siddharathnagar, Unnao, Shrawasti, Rampur and Sambhal districts of the State which constitute 28.28% area of UP.

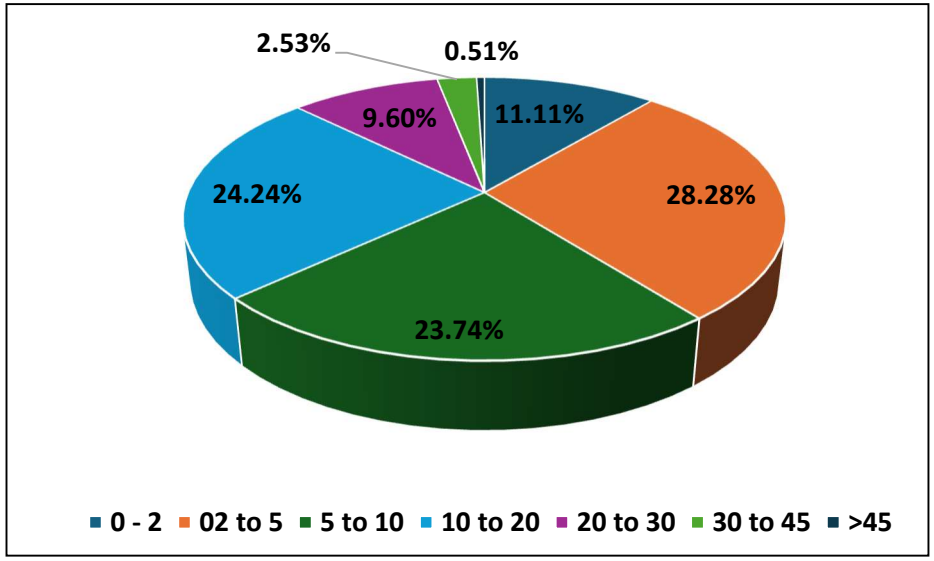

Figure-13: Percentage of wells in different piezometric head ranges in

Confined aquifer

Piezometric head of 5 to 10 mbgl observed in significant area of Ambedkar Nagar, Azamgarh, Ayodhaya Bahraich, Bijnore, Bulandshahr, Budaun, Lakhimpur Kheri, Meerut, Hapur, Hathras, Muzaffarnagar, Rampur, Saharanpur, Sitapur, Gorakhpur, Chitrakoot, Fatehpur, Ghazipur and Unnao districts, occupies 23.74% area of the state. Piezometric head of 10 to 20 mbgl is observed mostly in Saharanpur, Balrampur, Chitrakoot, Fatehpur, Shamli, Bahraich, Baghpat, Meerut, Ghazipur, Azamgarh, Moradabad, Pratapgarh, Gautam Budh Nagar, Bulandshahr, Sambhal and Budaun districts which covers 24.24% area of whole UP. The piezometric head of 20-30 mbgl is observed in Baghpat, Banda, Bijnore, Budaun Fatehpur, Hamirpur, Hathras, Kaushambi, Muzaffarnagar, Varanasi, Sambhal and Shamli comprising 9.6% area and piezometric head of greater than 30 mbgl constitutes nearly 3% area mainly in Agra, Hamirpur, Mathura and Muzaffarnagar district of UP.

5.2.2 SEASONAL FLUCTUATION IN WATER LEVEL

Seasonal Fluctuation of Piezometric Head in Confined/ Semi-Confined Aquifer (May 2024 to November 2024)

Rise in Piezometric Head:

Out of 78 wells, rise in piezometric head of less than 2m is recorded in 39 wells (50%), 2 to 4m in 18 wells (23.08%) and more than 4m in 4 wells (5.13%). Percentage wise distribution of wells is shown in Figure-14. Rise in Piezometric head of less than 2m is seen in Meerut, Shambal, Chitrakoot, Banda, Unnao, Ambedkar Nagar, Gonda, Rampur, Mahoba, Bahraich, Lakhimpur Kheri, Gorakhpur, Sitapur, Siddharth Nagar and Fatehpur districts. Rise in Piezometric head of 2 to 4m is observed mainly in districts such as, Azamgarh, Mahoba, Banda, Chitrakoot, Fatehpur, Gorakhpur, Sambhal and Mau districts. Rise of more than 4m is significantly observed in Banda, Fatehpur and Mahoba districts of UP

Fall in Piezometric Head:

Out of 78 analyzed wells, fall in piezometric head of less than 2m is recorded in 14 wells (17.95%) while 3 wells (3.85%) are in the range of 2 to 4m. Fall of less than 2m is mainly observed in parts of Bagpat, Fatehpur, Azamgarh, Ambedkar nagar, Banda, Mau, Meerut, Hamirpur, Mahoba and Chitrakoot districts. Fall of 2 to 4m is observed mainly in Fatehpur, Hamirpur and Banda region.

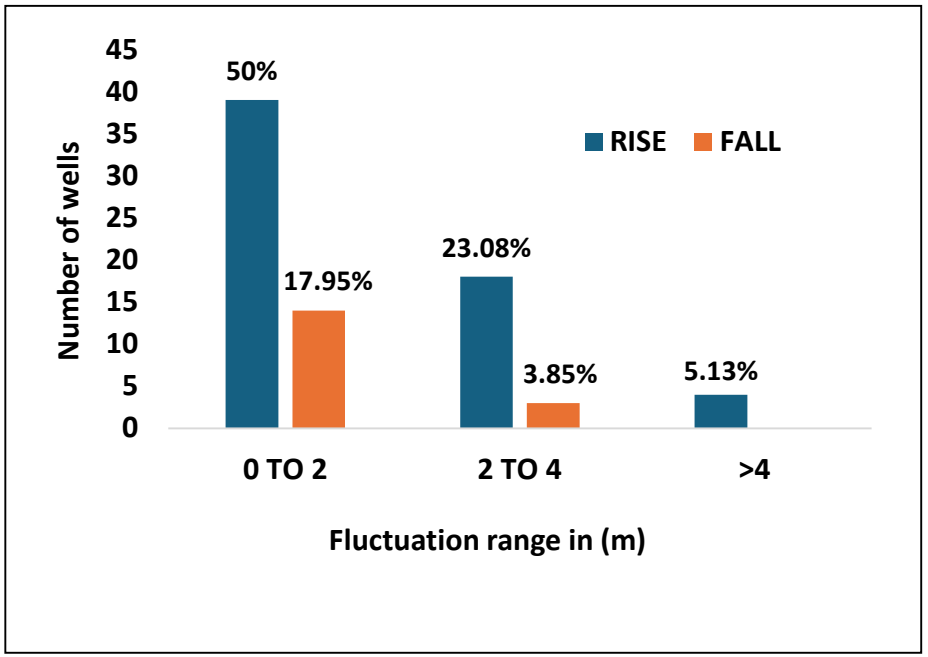

Figure-14: Percentage of wells showing rise and fall in WL in Confined Aquifer (May 2024 w.r.t. November 2024)

5.2.3 ANNUAL FLUCTUATION IN PIEZOMETRIC HEAD

Annual Fluctuation of Piezometric Head in Confined / Semi-confined Aquifer (November 2023 to November 2024)

Rise in piezometric head:

Out of 88 wells, the rise of less than 2m piezometric head is recorded in 32 wells (36.36%), between 2m–4m in 8 wells (9.09%). Rise of more than 4m Piezometric head is observed in 1 well (1.14%). Piezometric head rise of less than 2m is seen in the districts of Banda, Chitrakoot, Mahoba, Azamgarh, Fatehpur, Gorakhpur, Gonda, Siddharathnagar, Ambedkar nagar, Hamirpur, Balrampur, Meerut, Rampur, Mau and Sambhal districts. Rise in piezometric head from 2 – 4m is seen significantly in Chitrakoot, Banda, Sambhal, Mau, Azamgarh and Jaunpur district. Rise in piezometric head greater than 4m is seen in parts of Jalaun district of UP.

Fall in Piezometric Head: Out of 88 analyzed wells 43 wells (48.86%) shows fall in piezometric head of less than 2m while 3 wells (3.41%) registered piezometric head fall between 2m-4m. Fall greater than 4m is observed in 1 well (1.14%). Fall of less than 2m is mainly observed in parts of Baghpat, Bahraich, Banda, Chitrakoot, Mahoba, Fatehpur, Unnao, Azamgarh, Ambedkar nagar, Ayodhaya, Gorakhpur, Sitapur, Moradabad, Siddharathnagar, Lakhimpur Kheri, Rampur and Meerut districts. Piezometric head fall of 2 – 4m in parts of Chitrakoot and Azamgarh districts. Piezometric head fall of greater than 4m is seen in Mau district of UP. Percentage of wells showing rise and fall in piezometric head of confined aquifer (November 2023 to November 2024) is shown in the Figure –15.

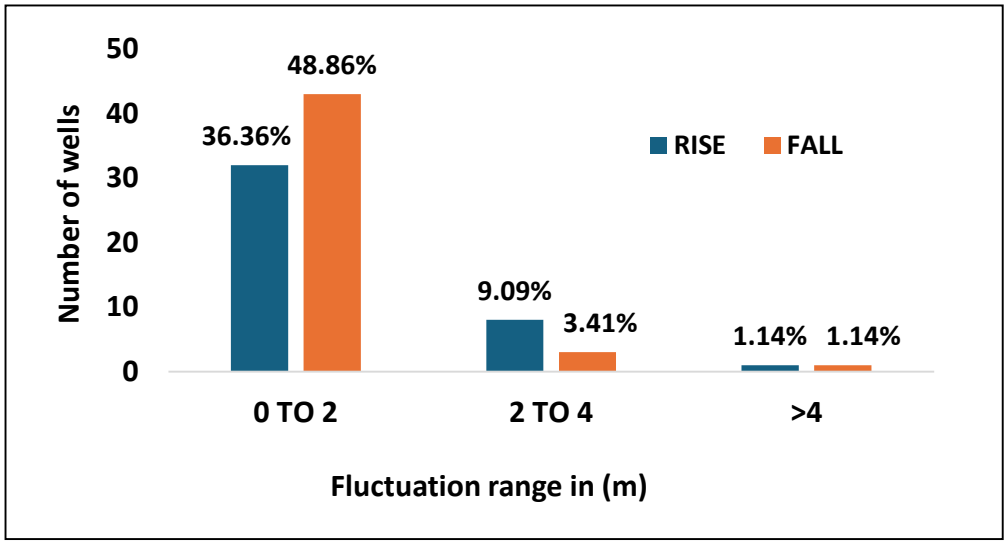

Figure15: Percentage of wells showing rise and fall in piezometer head in Confined (November 2023 to November 2024)

5.2.4 Decadal Fluctuation of Piezometric Head in Confined/Semi-confined Aquifer (Decadal Mean November (2014-2023) to November 2024)

Rise in piezometric head:

Out of 4 wells, that have registered rise in piezometric head, 3 wells (75%) have recorded rise of less than 2m in Meerut, Rampur and Gautam Buddha nagar district and 1well (25%) of Gautam Buddha nagar district have recorded rise between 2-4 m.

Percentage of wells showing rise and fall in piezometric head in confined/semi- confined Aquifer (Decadal Mean November (2014-2023 to November 2024) is shown in Figure – 16.

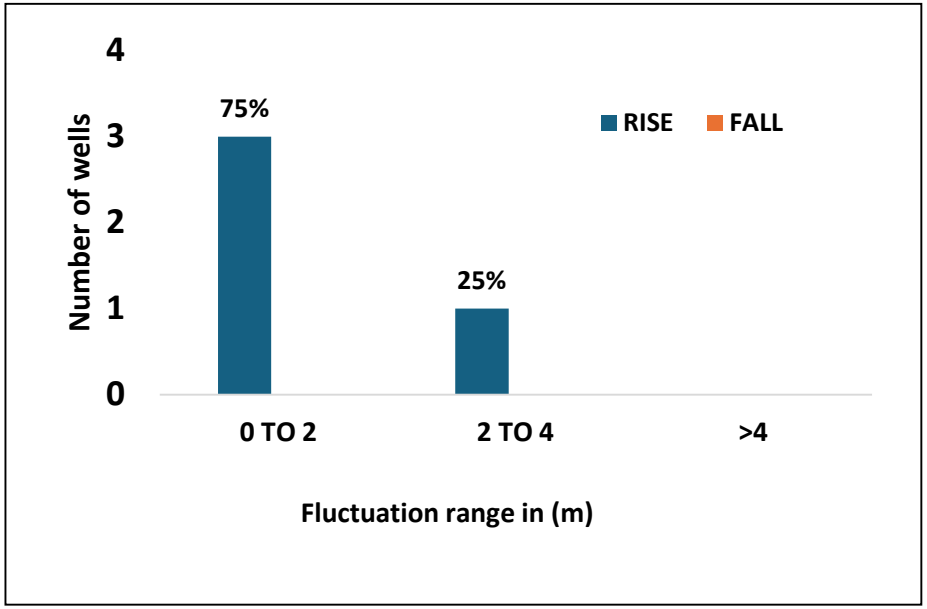

Figure-16: Percentage of wells showing rise and fall in piezometric head in Confined/semi- Confined Aquifer (Decadal Mean November (2014-2023 to November 2024).

6.0. SUMMARY

As a component of the National Ground Water Monitoring Programme, the CGWB, NR, Lucknow conducts monitoring of the ground water conditions on a quarterly basis: in January, pre-monsoon May, August, and post-monsoon November. Additionally, a yearly assessment of ground water quality is performed in May and November. As of

November 30, 2024, the Northern Region-Central Ground Water Board supervises 1006 dug wells and 458 piezometers. This comprehensive effort aims to portray the variations in the State's ground water conditions across different aquifers. In November 2024, around 80% of the State's area exhibited a depth to water level within 10 meters below ground level for unconfined aquifers and around 63% for confined aquifer. Deeper water levels of more than 20m cover 4% area of the State covering mainly of Baghpat, Shamli, Ghaziabad, Sambhal, Agra, Firozabad, Farrukabad, Etawah, Jalaun, Kasganj, Kannauj, Lucknow, Unnao, Hamirpur and Fatehpur districts.

The ground water level in Uttar Pradesh during November 2024 has been significantly influenced by monsoonal rainfall patterns. This has result in rise in the water level in many districts of UP. Districts of UP like Bareilly, Balrampur, Siddharath nagar, Basti, Gonda, Bahraich, Shrawasti, Maharajganj, Lalitpur and Kushi Nagar receives actual rainfall greater than 600mm. Annual water level comparison with previous year November-2023 to November-2024 has shown rise in about 43% area of the state in unconfined and 46% area in confined aquifer because of normal to moderate rainfall in 2024. Seasonal fluctuation comparison with May-2024 to November-2024 has shown rise in about 88% area of the state in unconfined and 78% area in confined aquifer. Around 50% of the area experienced rise of water level in decadal mean water level fluctuation of November, 2013-2024, with respect to November,2024, in unconfined aquifer whereas in confined aquifer all monitoring stations have experienced rise in decadal mean water level of November 2014-2023 with respect to November,2024. The monsoon in 2024 witnessed significant fluctuations in rainfall pattern across the state. The evident rise in annual ground water level during November 2024 in Uttar Pradesh can be attributed to a substantial normal to moderate in rainfall when comparing 2024 to 2023.