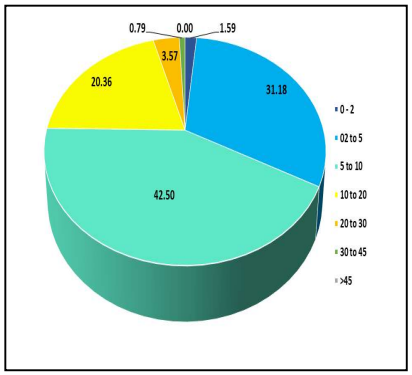

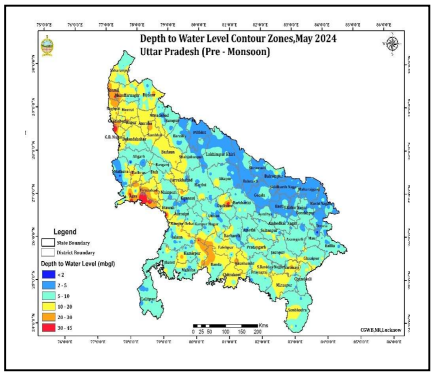

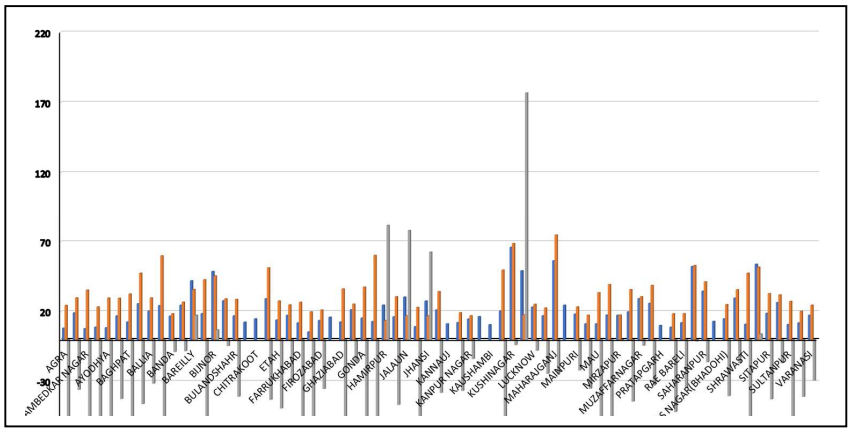

GROUND WATER LEVEL BULLETIN
UTTAR PRADESH
AUGUST 2024

ABSTRACT

Ground water level Scenario during August – 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 31.08.2024, 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.

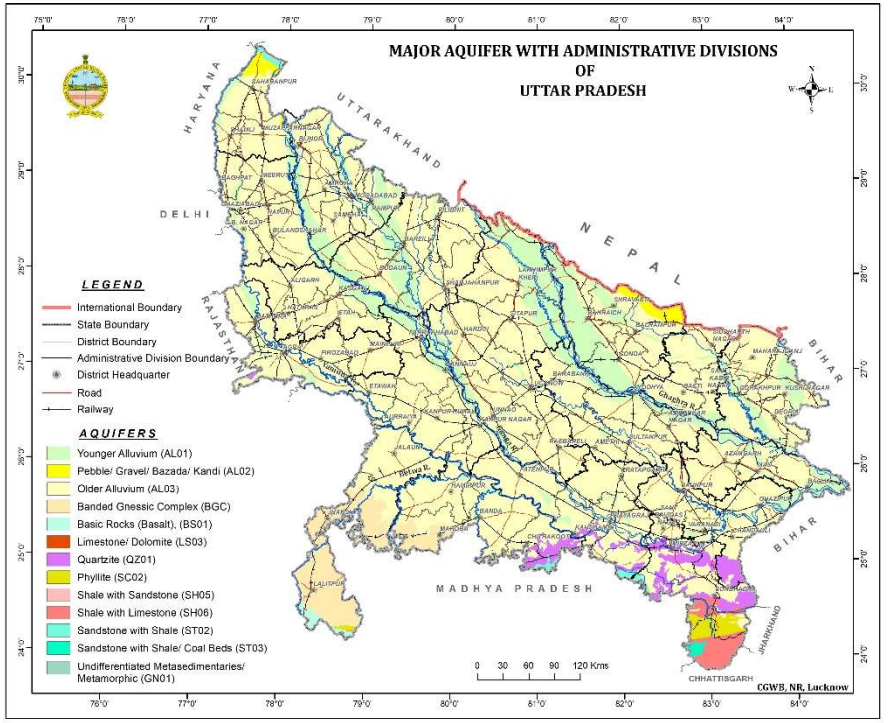

Figure-1: Map showing major aquifers and administrative divisions of UP

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 May 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		
		August, 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
25	Amethi	36	2	38

S. No.	District	Number of Water Level Monitoring Stations		
		August, 2024		
		DW	PZ	Total
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
47	Amroha	0	9	9

S. No.	District	Number of Water Level Monitoring Stations		
		August, 2024		
		DW	PZ	Total
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
69	Kaushambi	10	2	12

S. No.	District	Number of Water Level Monitoring Stations		
		August, 2024		
		DW	PZ	Total
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**

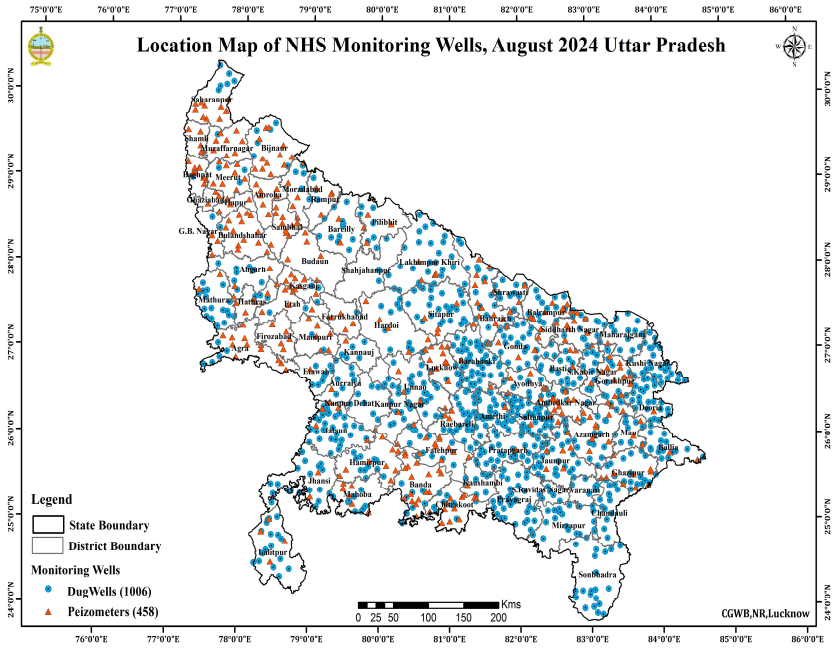

Figure-2: Map showing monitoring wells during August 2024

4.0. RAINFALL

The district wise monthly grided rainfall data collected from Indian Meteorological Department; India WRIS were used to analyzed the rainfall pattern. Table-2 gives the district wise normal rainfall and actual rainfall of Pre-monsoon 2023 and Pre-monsoon 2024 with the departure from normal rainfall.

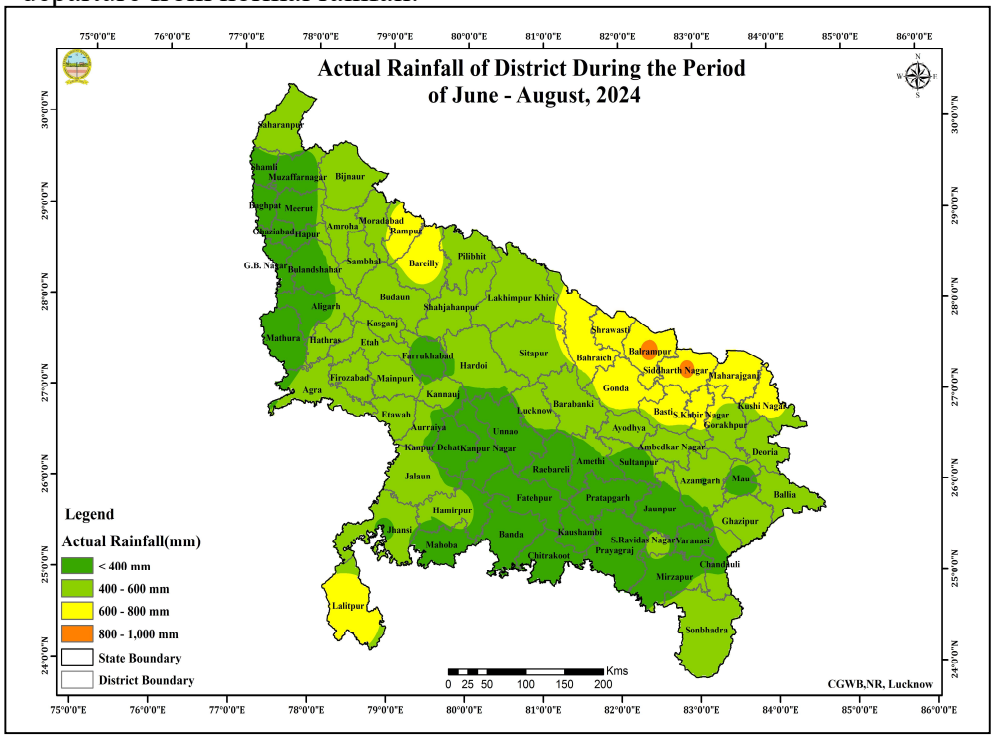

Figure-3: Actual Rainfall of the district during the period of June-August, 2024

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
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		306.55		244.64		-25.31

S.No.	District	Total Normal Rainfall	Total Actual Rainfal	Deviation %	Total Actual Rainfa	Deviation%	% Deviation
	Nagar						
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
37	Kannauj		572.69		419.94		-36.37
38	Kanpur	576.5	330.46	-	254.37	-55.88	-29.91

S.No.	District	Total Normal Rainfall	Total Actual Rainfal	Deviation %	Total Actual Rainfa	Deviation%	% Deviation
	dehat			42.68			
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

S.No.	District	Total Normal Rainfall	Total Actual Rainfal	Deviation %	Total Actual Rainfa	Deviation%	% Deviation
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
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. 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.

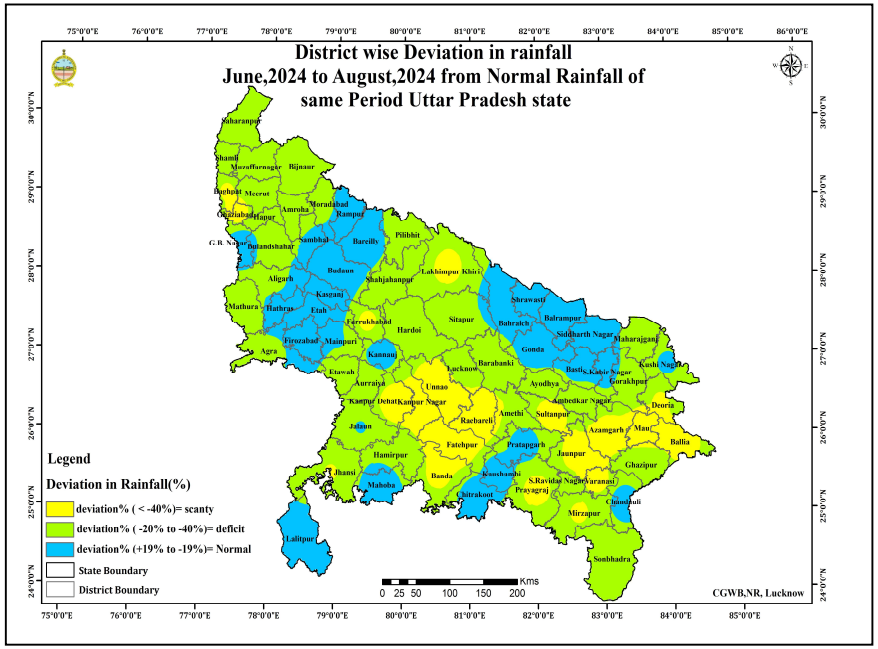

Figure-4: District wise deviation % in Rainfall during the period of June-August,2024

5.0. GROUNDWATER LEVEL SCENARIO (AUGUST 2024)

5.1. SHALLOW AQUIFER (UNCONFINED)

5.1.1. DEPTH TO WATER LEVEL

Depth To Water Level in Unconfined Aquifer (August 2024)

The depth to water level of 1093 wells is used for the analysis. It shows that water levels vary between 0.01mbgl (Mathura district) to 44.47 (Lucknow). Water level of less than 2 mbgl is recorded in 344 wells 31.47% of wells, between 2 to 5 mbgl in 346 wells, between 5 to 10 mbgl in 230 wells, between 10 to 20 mbgl in 134 wells, between 20-30 mbgl in 31 wells and water level between 30-40 mbgl is registered in 8 wells (0.73%). Percentage of wells shown in Figure No. 6 for unconfined aquifers and Depth to Water level of unconfined aquifers is shown in Figure – 5. Shallow water level of less than 2 mbgl is seen in isolated patches in parts of Mathura, Mainpuri, Aurraiya, Jalaun, Jhansi, Hamirpur, Mahoba, Banda, Prayagraj, Chandauli, Maharajganj, Basti, Balrampur, Siddharathnagar, Bahraich, Pilibhit, Lakhimpur Khiri, Hardoi, Mainpuri and Kasganj districts of UP. Water level of 2 to 5 mbgl is majorly observed in the parts of Moradabad, Rampur, Bareilly, Pilibhit, Shahjahanpur, Lakhimpur Kheri, Sitapur, Shrawasti, Bahraich, Balrampur, Gonda, Sidhdharth Nagar, Basti, Sant Kabir Nagar, Gorakhpur, Maharajganj, Kushinagar, Deoria, Mau, Ballia and isolated patches are seen in the parts of Ghazipur, Chandauli, Sonbhadra, Mirzapur, Prayagraj, Jaunpur, Sultanpur, Amethi, Raebareli, Barabanki, Unnao, Kanpur Nagar, Kannauj, Jalaun, Aurraiya, Etawah, Mainpuri, Hardoi, Mahoba districts of Uttar Pradesh covering the area of 31.66% the State.

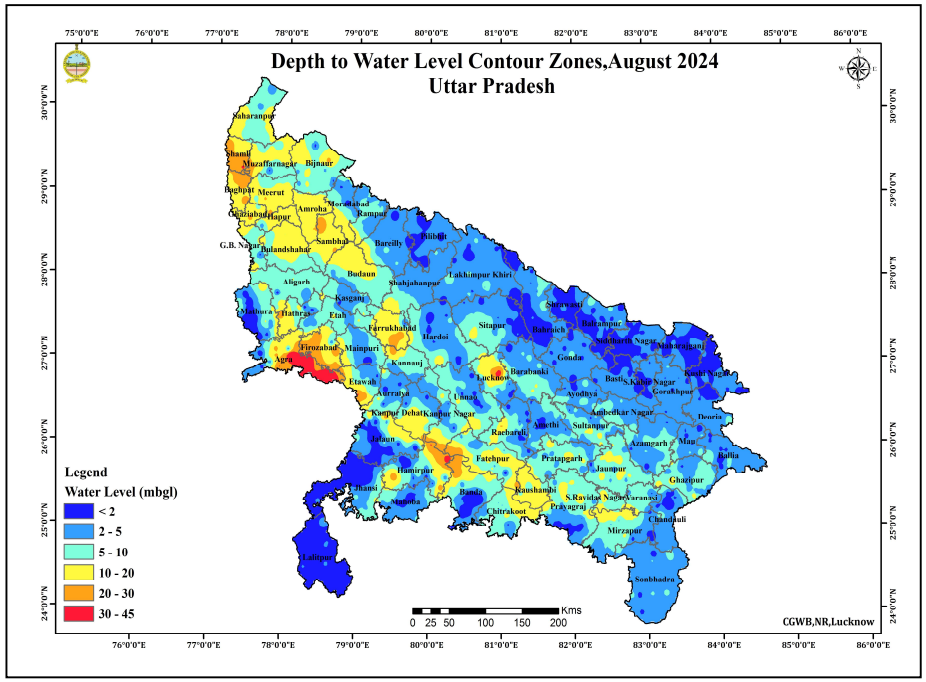

Figure-5: Depth to water level of unconfined aquifer during August 2024

The 21.04% area has 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, Barabanki, Raebareli, Amethi, Ayodhya, Pratapgarh, Sultanpur, Ambedkar Nagar, Prayagraj, Jaunpur, Azamgarh, Mau, Ballia, Ghazipur, Mirzapur, Unnao, Kanpur Nagar, Kanpur Dehat, Banda, Mahoba, Hamirpur, Jhansi, Jalaun, Aurraiya, Kannauj, Etawah, Mainpuri, Kasganj, Etah, Aligarh, Hathras, Mathura.

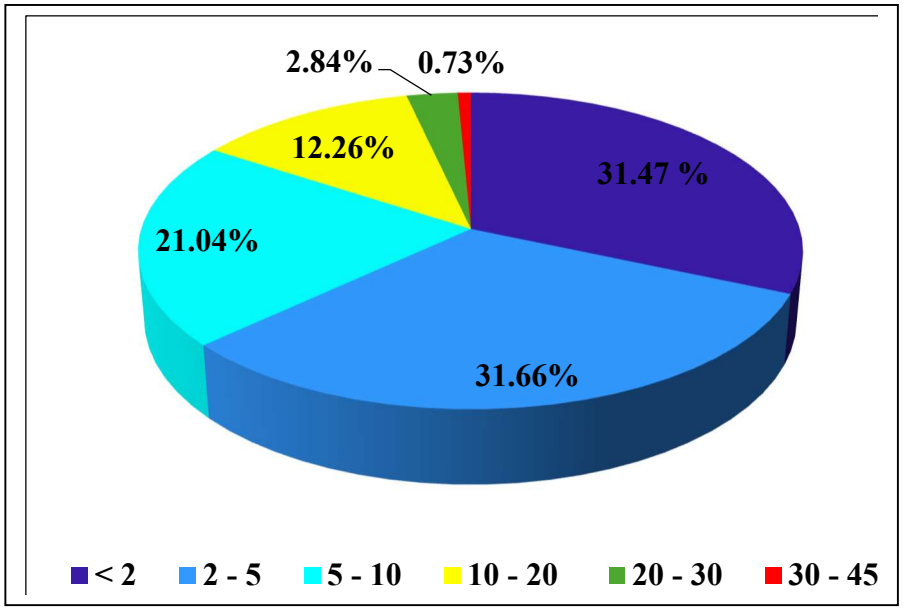

Figure-6 Percentage of wells in different water level ranges in Unconfined aquifer

12.26% of the area falls under Water level of 10 to 20 mbgl and are observed in parts of Saharanpur, Shamli, Baghpat, Ghaziabad, Muzaffarnagar, Bijnor, Meerut, Hapur, Amroha, Sambhal, Gautam Budh Nagar, Bulandshahar, Budaun, Farrukhabad, Etah, Hathras, Mathura, Agra, Firozabad, Etawah, Kanpur Dehat and Nagar, Jalaun, Hamirpur, Banda, Fatehpur, Raebareli, Lucknow, Kaushambhi, Chitrakoot, Pratapgarh, Prayagraj, Mirzapur and Ghazipur districts Deeper water levels of more than 20 mbgl cover 3.5% area mainly in the parts of Baghpat, Shamli, Muzaffarnagar, Ghaziabad, Sambhal, Agra, Firozabad, Etawah, Lucknow, Hamirpur, Fatehpur and Banda.

5.1.2 ANNUAL FLUCTUATION IN WATER LEVEL

Rise in Water Levels: Out of 828 wells analyzed, it is observed that, the rise in water level of less than 2m is recorded in 360 wells (43.48%) , 2 to 4 in 76 wells (9.18%) and more than 4 m in 35 wells (4.23%). Water level rise of less than 2m is seen in parts of Moradabad, Rampur, Bareilly, Firozabad, Mainpuri, Etawah, Aurraiya, Kannauj, Farrukhabad, Kanpur Dehat, Kanpur Nagar, Jhansi, Hamirpur, Jalaun, Mahoba, Lalitpur, Lakhimpur Kheri, Shahjahanpur, Hardoi, Lucknow, Barabanki, Gonda, Siddharth Nagar, Balrampur, Basti, Maharajganj, Kushinagar, Ballia, Ghazipur, Chandauli, Prayagraj, Fatehpur, Chitrakoot districts. Water level rise of 2 to 4 m is observed mainly in, Agra, Firozabad, Aurraiya, Jalaun, Chitrakoot, Banda, Fatehpur, Varanasi, Ghazipur, Chandauli, Sonbhadra, Mirzapur and Jhansi districts. Rise of more than 4m is significantly observed in Agra, Aurraiya, Banda, Chitrakoot, Fatehpur, Mirzapur, Chaundali and Sonbhadra districts.

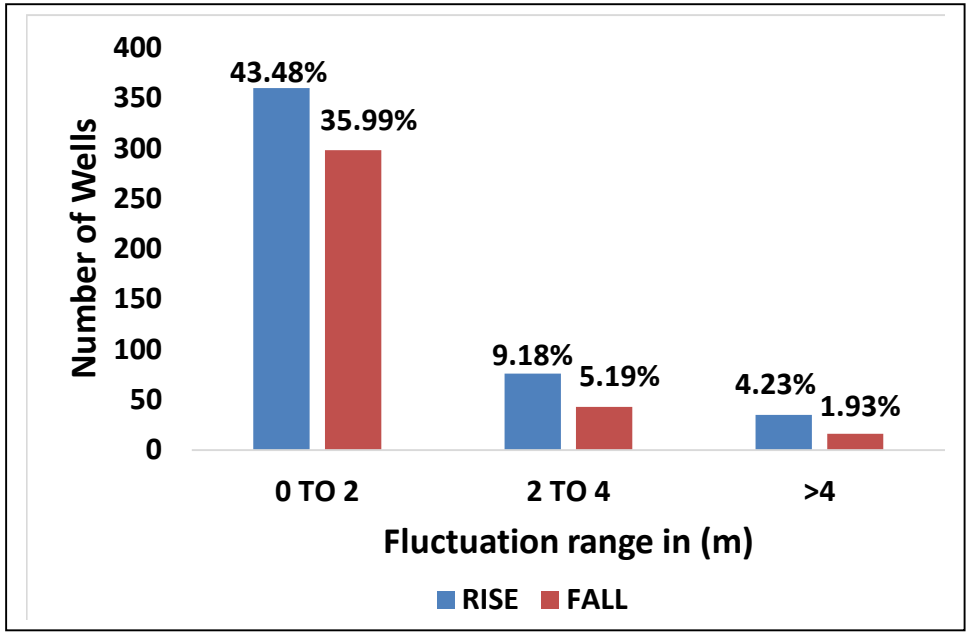

Figure-7: Percentage of wells showing rise and fall in WL in Unconfined Aquifer (Annual Fluctuation (2023-24)

Falling Water Levels: Out of 828 wells analyzed, nearly 36% of the area shows fall in water levels and recorded water level of less than 2m fall, while 5.19% of wells are in the range of 2 to 4m and remaining 1.93% shows fall of more than 4m. Fall of less than 2m is mainly observed in Saharanpur, Shamli, Muzzafarnagar, Bagpat, Merrut, Bijnore, Amroha, Hapur, Ghaziabad, Bulandshahr, Bareilly, Aligarh, Kasganj, Sitapur, Lakhimpur kheri, Lucknow, Raibareilly, Amethi, Barabanki, Unnao, Fatehpur, Hamirpur, Pratapgarh,

Prayagraj, Jaunpur, Azamgarh, Deoria districts in UP.

Fall of 2 to 4 m is observed mainly in isolated patches of Saharanpur, Sambhal, Aligarh, Kannauj, Kasganj, Jalaun, Kanpur Nagar, Unnao, Raibareilly, Kaushambi, Pratapgarh, Jaunpur, Ayodhaya, Prayagraj and Ambedkar nagar Fall of more than 4m is observed in isolated patches of Sambhal, Aurraiya, Unnao, Prayagraj, Mirzapur, Kaushambi and Varanasi districts. Percentage of wells showing rise and fall in WL for unconfined aquifer (Aug2023 to Aug2024) in Figure – 7and annual water level fluctuation in unconfined aquifer (Aug 2023 -2024) is shown in Figure- 8.

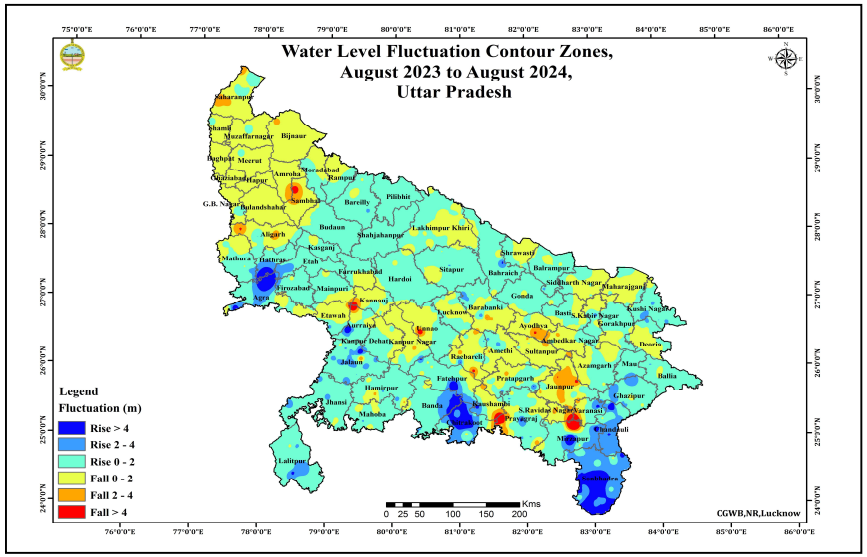

Figure-8: Annual water level fluctuation in Unconfined aquifer (August 2023 -24)

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

Rise in Water Levels:

Out of 558 analyzed wells, the rise in water level of less than 2m is recorded in 248 wells (44.36%), 2 to 4 m in 57 wells (10.2 %) and more than 4m in 22 wells (3.94%). Water level rise of less than 2m is seen in Bijnor, Aligarh, Agra, Mathura, Mainpuri, Firozabad, Kanpur Dehat, Jalaun, Hamirpur, Jhansi, Mahoba, Azamgarh, Banda, Basti, Siddharth Nagar, Balrampur, Shrawasti, Bahraich, Gonda, Deoria, Ghazipur, Sonbhadra, Chitrakoot, Fatehpur, Prayagraj, Mau and Chaundali regions. Water level rise of 2 to 4 m is observed mainly in isolated patches of Jalaun, Jhansi, Hamirpur, Lalitpur, Fatehpur, Moradabad, Sonbhadra and chaundali districts and rise of more than 4m is significantly observed in Hathras, Agra, Firozabad, Aurraiya, Fatehpur, Lalitpur, Jalaun districts of UP.

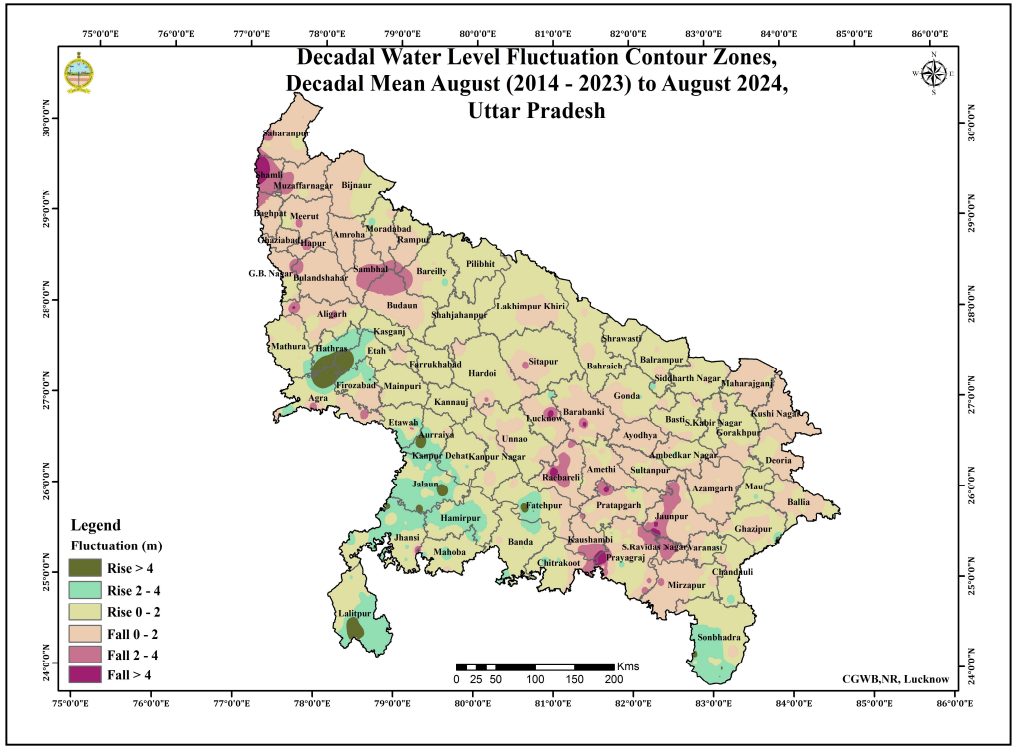

Figure-9: Decadal Water level Contour Zones, Decadal Mean August (2014-2023) w.r.t. August 2024)

Fall in Water Levels:

Out of the 558 analyzed wells, 173 wells (30.95%) of the area shows, fall in water levels of less than 2m while 44 wells (7.87%) in the range of 2 to 4m and remaining 14 wells (2.5%) registered water level fall of more than 4m. Fall of less than 2 m is observed in major parts of Eastern Uttar Pradesh such as Ghazipur, Kushi Nagar, Maharajganj, Pratapgarah, Amethi, Rae barielly, Ballia, Jaunpur, Deoria, Ayodhya , Central parts of Uttar Pradesh such as Hardoi, Sitapur, Lakhimpur Kheri, Lucknow, Barabanki, Unnao and Gonda districts and Westren parts of UP namely Amroha, Bulandshar, Aligarh, Badaun, Sambhal, Bijnore, Muzzafaranagar, Saharanpur, Baghpat, Merrut, Gaziabad, Hapur and Rampur. Fall of 2 to 4m is observed in isolated patches of Shamli, Muzzafarnagar, Aligarh, Sambhal, Lucknow, Barabanki, Raibarelly , Amethi, Prayagraj , Kaushambi, Chitrakoot and Jaunpur districts . Fall more than 4m is observed in isolated patches of Shamli, Lucknow, Barabanki, Raibareilly, Pratapgarh, Jaunpur, Prayagraj districts of UP. Decadal Water level fluctuation form (August 2014-2023) with respect to August 2024 is shown in the Figure – 9 and percentage of wells showing rise and fall in WL for Unconfined Aquifer (Decadal fluctuation (2014-2023) w.r.t. August 2024) is shown in Figure-10.

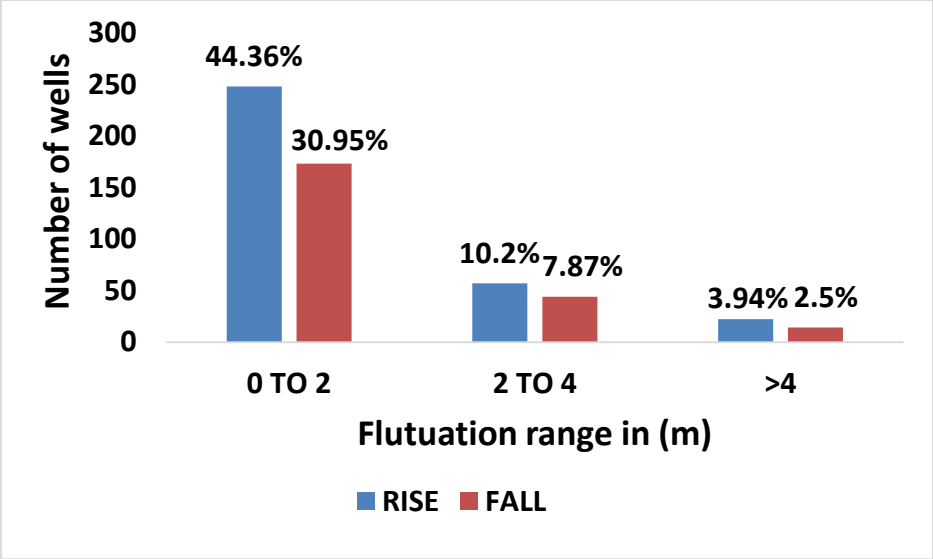

Figure-10: Percentage of wells showing rise and fall in WL in Unconfined Aquifer (Decadal Fluctuation (2014-2023) w.r.t. August 2024)

5.2 DEEPER AQUIFER (CONFINED/SEMI-CONFINED)

5.2.1 DEPTH TO WATER LEVEL

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

Analysis of piezometric head of 202 wells shows piezometric head vary between 0.05 mbgl (Mau) to 48.68 mbgl (Agra district). Piezometric level of less than 2 mbgl is recorded in 35 wells, between 2 to 5 mbgl 46 wells, between 5 to 10 mbgl in 50 wells, between 10 to 20 mbgl in 45 wells, between 20-30 mbgl in 21 wells, greater than 30 mbgl in 5 wells Percentage of wells in different piezometric head ranges for Confined aquifer is shown in Figure-11. Shallow piezometer head of less than 2 mbgl is noticed in Bahraich, Agra, Banda, Gorakhpur, Jhansi, Lalitpur, Shrawasti, Siddharath nagar, Mau and Mahoba districts comprising 17.33% area of State. Piezometric head of 2 to 5 mbgl mainly observed in parts of Ambedkar nagar, Ayodhaya, Azamgarh, Bahraich, Chitrakoot, Banda, Gorakhpur, Mahoba, Siddharathnagar, Unnao, Shrawasti, Rampur, Sambhal districts of the State constitute 22.77% area of UP.

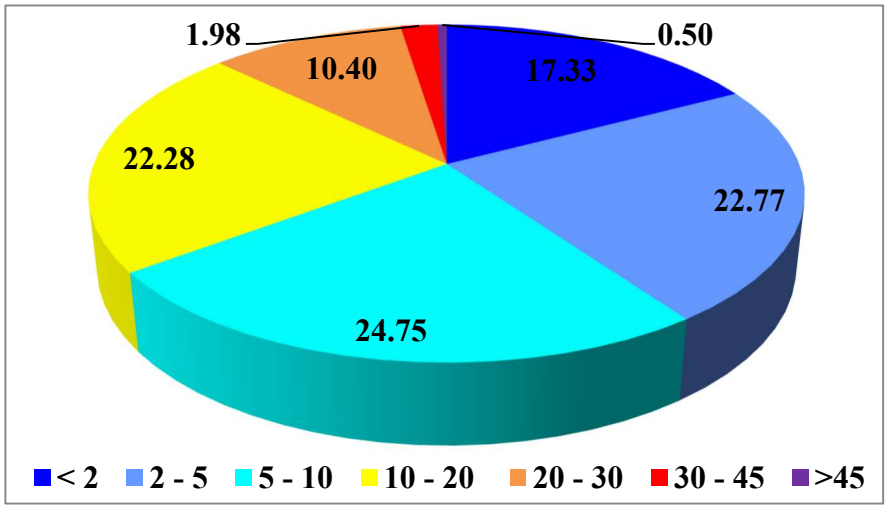

Figure-11: Percentage of wells in different piezometric head ranges in Confined aquifer

Eastern to North-Eastern part of the State falls under piezometric head of 5 to 10 mbgl with significant area of Ambedkar Nagar, Azamgarh,

Bahraich, Bijnore, Bulandshahr, Lakhimpur Kheri, Meerut, Muzzafaranagar, Rampur, Saharanpur, Sitapur, Gorakhpur and Unnao districts occupies 24.75% area of the state. Piezometric head of 10 to 20 mbgl is observed mostly in Saharanpur, Balrampur, Chitrakoot, Fatehpur, Shamli, Baghpat, Meerut, Ghazipur, Bulandshahar, Sambhal, Budaun and Unnao districts covers 22.27% area of whole UP. The piezometric head of 20-30 mbgl is observed in Agra, Baghpat, Banda, Bijnore, Fatehpur, Hamirpur, Hathras, Moradabad, Muzzafarnagar, Saharanpur, and Shamli comprising 10.4% area and piezometric head of greater than 30 mbgl constitutes nearly 2% area mainly in Agra, Hamirpur, Mathura and Muzaffarnagar district

5.2.3 ANNUAL FLUCTUATION IN PIEZOMETRIC HEAD

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

Rise in piezometric head:

Out of 89 wells, the rise of less than 2m piezometric head is recorded in 33 wells (37.08%), between 2m – 4m in 6 wells (6.74%). Piezometric head rise more than 4m in 3 wells (3.37%). Piezometric head rise of less than 2m is seen in the districts of Banda, Chitrakoot, Mahoba, Azamgarh, Fatehpur, Gorakhpur, Gonda, Siddharathnagar, Bahraich, Balrampur, Lakhimpur Kheri and Sambhal districts. Peizometric head rise from 2 – 4m is seen significantly in Chitrakoot, Banda, Fatehpur and Jalaun district. Piezometric head rise greater than 4m is seen in parts of Banda, Chitrakoot and Fatehpur districts.

Fall in Piezometric Head: Out of 89 analyzed wells 33 wells (37.08%) shows fall in piezometric head of less than 2m while 10 wells (11.24%) registered piezometric head fall between 2m-4m. Fall greater than 4m is observed in 4 wells (4.49%). Fall of less than 2m is mainly observed in parts of Chitrakoot, Mahoba, Jaunpur, Hamirpur, Unnao, Ayodhaya, Gorakhpur, Sitapur Sambhal, Bulandhshar, Siddharathnagar, Lakhimpur Kheri, Rampur, Meerut, Baghpat districts. Piezometric head fall of 2 – 4m in minor parts of Ambedkar Nagar, Hamirpur, Unnao and Moradabad districts. Piezometric head fall of greater than 4m is seen in Gazipur, Fatehpur and Ambedkar Nagar districts. Percentage of wells showing rise and fall in piezometric head of confined aquifer (August 2023 to August2024) is shown in the Figure – 12.

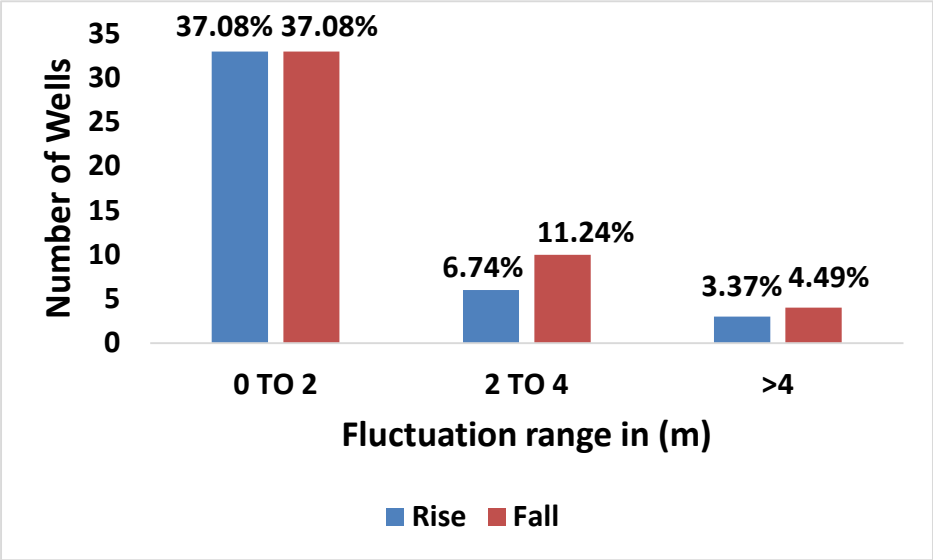

Figure12: Percentage of wells showing rise and fall in piezometer head in Confined (August 2023 to August 2024)

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

Rise in piezometric head:

Out of 6 wells, that have registered rise in piezometric levels, 3 wells (50%) have recorded less than 2m in Meerut, Rampur and Ghaziabad district of the state.

Fall in piezometric head: Out of 6 wells, 16.67% wells have shown fall of less than 2m in Bulandshahr district while 33.33% wells have recorded fall in the range of 2m-4m in Bulandshar and amroha districts of UP. Percentage of wells showing rise and fall in piezometric head in confined/semi- confined Aquifer (Decadal Mean August (2014-2023 to August 2024) in Figure – 13.

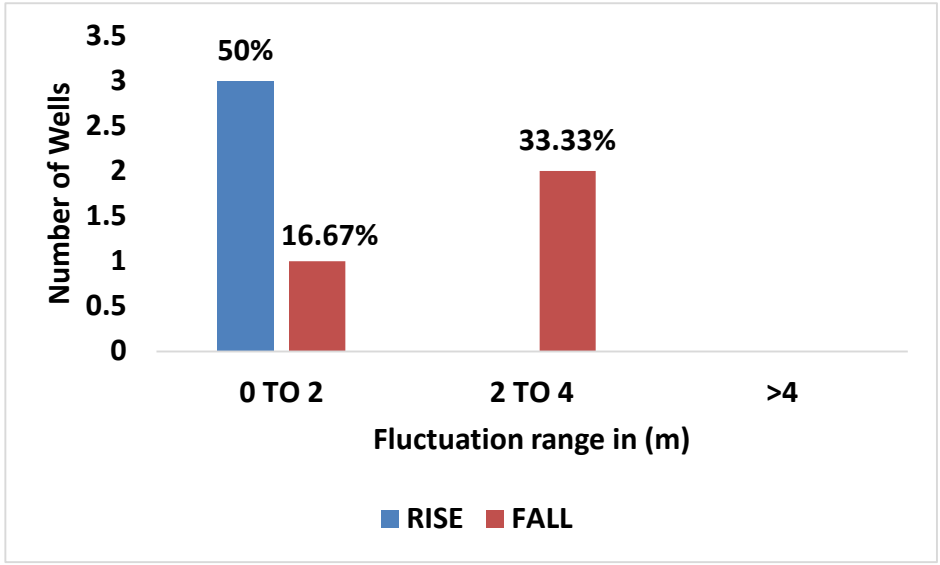

Figure-13: Percentage of wells showing rise and fall in piezometric head in Confined/semi- Confined Aquifer (Decadal Mean August (2014-2023 to August 2024).

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. As of August

31, 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 states ground water conditions across different aquifers. In August 2024, around 84% of the state's area exhibited a depth to water level within 10 meters below ground level for unconfined aquifers and around 65% for confined. Deeper water levels of more than 20m cover 4% area of the State covering mainly Muzaffarnagar, Ghaziabad, Sambhal, Firozabad, Etawah, Lucknow, Hamirpur, Fatehpur, Banda, Agra, Gautam Buddha Nagar, Lucknow, Baghpat, Hamirpur and Jhansi districts.

The ground water level in Uttar Pradesh during August2024 has been significantly influenced by rainfall patterns from June 2024 to August 2024.This period witnessed a departure of 30.92% from the normal, classifying most of the region in the category of normal rainfall. 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, Sharawasti, Maharajganj receives actual rainfall greater than 600mm. Annual water level comparison with previous year August-2023 to August-2024 has shown rise in about 57% area of the state in unconfined and 42% area in confined aquifer because of normal to moderate rainfall in 2024. Around 58% of the area experienced rise of water level in decadal mean water level fluctuation of August, 2013-2024, with respect to August,2024, in unconfined aquifer whereas 50% of the area experienced rise in decadal mean water level of August 2014-2023 with respect to August,2024 in confined aquifer. The monsoon in 2024 witnessed significant fluctuations in rainfall pattern across the state. The evident rise in annual ground water level during August 2024 in Uttar Pradesh can be attributed to a substantial normal to moderate in rainfall when comparing 2024 to 2023.