GROUND WATER LEVEL BULLETIN

AUGUST- 2024

HIMACHAL PRADESH

ABSTRACT

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

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 involve climatic parameters like rainfall, evapotranspiration etc., whereas anthropogenic influences 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, May, August and November. The regime monitoring started in the year 1969 by Central Groundwater Board. A network of 25437 observation wells called **National Hydrograph Network Stations (NHNS)**, as on 30.04.2023, located all over the country is being monitored.

STUDY AREA

Himachal Pradesh is located between the north latitude30^{o}22’40” &33^{o}12’40”and east longitude 75^{o}47’55” & 79^{o}04’20”. It falls in Survey of India topographic sheets Nos. 52D, 52H, 52L, 53A, 53B, 53F, 53E and 53I and covers an area of 55,673 sq km. It is one of the predominantly hilly states in India, which lies in the western Himalayas. The length of Himachal Pradesh is about 355 km i.e., from northwestern part of Chamba to southeastern part of Kinnaur. The breadth of the state is about 270 km i.e., from western part of Una to northeast part of Lahaul and Spiti Disrtict. The state is bounded by the state of Jammu & Kashmir in north, Punjab state in west, Haryana state in south and Uttrakhand state in southeast and shares an international border with China (Tibet) in northeast.

Administratively, the state is divided in 12 Districts, 76 Tehsils, 34 Sub-Tehsils and 78 Blocks. There are 20,690 villages, 3,226 Gram Panchayats, 59 towns, 28 Nagar Panchayats and 25 Nagar Parishads including Municipal Corporations. Lahaul & Spiti is the largest and Hamirpur is the smallest District of the state with geographical area of 12,835 and 1,118 sq km respectively.

The state has a population of 68,64,602 persons (Census 2011) having an average population density of 128 person per sq km. The male population in the state is 34,81,873 persons and female population is 33,82,729. The rural

and urban population in the state is 61,76,050 and 6,00,552 persons respectively. The density of population in the state varies from as low as 2 persons/sq.km in Lahaul and Spiti District to 406 persons/sq km in Hamirpur District as compared to the state average of 128 persons/sq km.

Himachal region presents an intricate mosaic of mountain ranges, hills and valleys with altitude ranging from 350 m to 6500 m amsl. The Dhauladhar range looks in supreme majesty over the Kangra valley while the Pir Panjal, the Great Himalaya and the Zanskar ranges guard over Chamba, Lahaul & Spiti, Kullu and Kinnaur Districts. The mountain slopes are covered with forests and meadows. The valleys below are interspersed with numerous streams, fields and quiet homesteads. There is general increase in elevation from east to west and from south to north. The physiographic divisions from south to north are the Outer Himalayas also known as Siwaliks (350 to 1500 m amsl), the Lesser Himalayan Range (1500-5000 m amsl), Great Himalayan Range (5000 – 6000 m amsl) and Zanskar Range (> 6000 m amsl)

Himachal state has a unique distinction of having drainage systems of both the Indus and the Ganga basin. The major river systems of the region are the Chandra-Bhaga or the Chenab, the Ravi, the Beas, the Satluj and the Yamuna. The catchments of the rivers are fed by snow and rainfall, And are protected by fairly extensive cover of natural vegetation. Major rivers of the Indus River basin are the Chenab, the Ravi, the Beas and the Satluj. The Yamuna is the only river contributing water to Ganga basin.

The southwestern monsoon contributes about 70% of rain fall during monsoon period from July to September and about 30%occurs during non-monsoon period due to western disturbances and in the form of thunder storm. Generally, rainfall increases from south to north. Western disturbances also shower rainfall in winters. Beyond Kullu towards Lahaul & Spiti and Kinnaur, rain fall decreases due to rain shadow effect. Spiti is the driest area with 50 mm rainfall because of being enclosed by High Mountain from all sides. The average annual rainfall in the Districts of the state varies from about 600 mm in Lahaul & Spiti to more than 2400 mm in Kangra.

GROUND WATER LEVEL MONITORING

Central Ground Water Board, Northern Himalayan Region, is monitoring changes in groundwater regime in Himachal 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 Aug 2024 was 220 which include 137 dug wells, 56 piezometers and 27 springs. In Aug 2024, 223 wells which include 137 dug wells, 59 piezometers and 27 springs. The district-wise breakup of the water level monitoring stations is given in **Table-1**.

Sl. No	Name of the District	Number of GW Monitoring Stations (AUG-2024)				
		Dug Well	Piezometer	Hand pump	Spring	Total
1	Hamirpur	6	3	-	-	9
2	Bilaspur	4	8	-	-	12
3	Kangra	46	19	-	2	67
4	Kullu	2	3	-	-	5
5	Mandi	10	-	-	4	14
6	Sirmaur	19	11	-	-	30
7	Solan	14	5	-	-	19
8	Una	34	8	-	-	42
9	Chamba	2	2	-	21	25
	TOTAL	137	59	-	27	**223**

Table-1 District-wise breakup of the water level monitoring stations

RAINFALL

The rainfall data collected and compiled from weekly and monthly weather reports from India Meteorological Department were used to analyze the rainfall for the period June 2024 – August 2024. Table-2 gives the district-wise rainfall data for the period June 2024 – August 2024.

Month- June 2024				
S.No	District	Act (mm)	Nor (mm)	Dep (%)
1	Bilaspur	44.4	102.1	-57
2	Chamba	40.1	121.8	-67
3	Hamirpur	39.6	114.1	-65
4	Kangra	60.7	181.4	-67
5	Kinnaur	16.1	41.8	-61
6	Kullu	43.4	86.9	-50
7	Lahaul & Spiti	25	47.8	-48
8	Mandi	73.8	171.5	-57
9	Shimla	80.3	110.4	-27
10	Sirmaur	76.5	165.8	-54
11	Solan	89.4	137.3	-35
12	Una	54.9	103.8	-47
13	**Sub- Division HP**	46.2	101.1	-54

Month- July 2024				
S.No	District	Act (mm)	Nor (mm)	Dep (%)
1	Bilaspur	204.5	272.2	-25
2	Chamba	196.2	305.7	-36
3	Hamirpur	207.9	328.5	-37
4	Kangra	581.5	589.3	-1
5	Kinnaur	38.3	65.9	-42
6	Kullu	161.4	184	-12
7	Lahaul & Spiti	12.1	131.5	-91
8	Mandi	352.6	386.5	-9
9	Shimla	195.3	210.2	-7
10	Sirmaur	254	437	-42
11	Solan	142.4	303.3	-53
12	Una	176.8	329	-46
13	**Sub- Division HP**	180.5	255.9	-29

Month- August 2024				
S.No	**District**	**Act (mm)**	**Nor (mm)**	**Dep (%)**
1	Bilaspur	404.8	316.8	28
2	Chamba	239.3	291.7	-18
3	Hamirpur	320.5	400.6	-20
4	Kangra	654.8	631.5	4
5	Kinnaur	52.6	77.6	-32
6	Kullu	144.5	180.2	-20
7	Lahaul & Spiti	43.4	117.6	-63
8	Mandi	421.6	395.3	7
9	Shimla	300	196.4	53
10	Sirmaur	522.9	402.1	30
11	Solan	271.6	287.9	-6
12	Una	305.3	372.2	-18
13	**Sub- Division HP**	243.6	256.8	-5

LEGEND: L. EXCESS (+60% OR MORE) EXCESS (+20% TO +59%) NORMAL (+19% TO -19%) DEFICIENT (-20% TO -59%) L. DEFICIENT (-60% TO -99%) NO RAIN (-100%) NO DATA

Table-2 District-wise Rainfall from 01.06.2024 to 31.08.2024

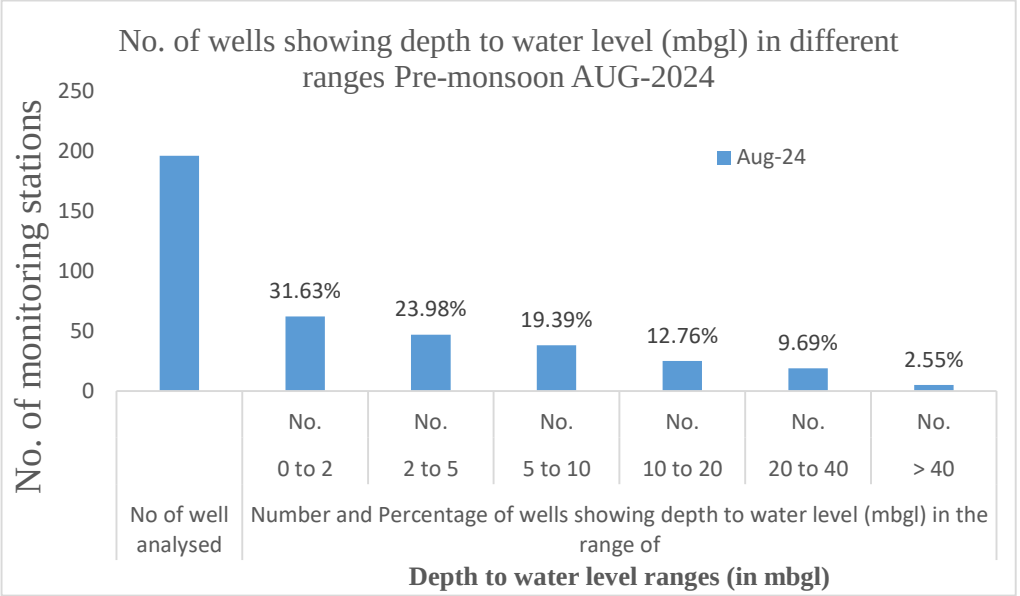
DEPTH TO WATER LEVEL (AUG-2024)

The depth to water level, recorded during Aug 2024 ranged between 0.07 m (Kangra District) and 95 m bgl (Tikkri (Pz) Solan District). Out of 196 stations monitored, the majority of 110 NHS (56.13%) recorded DTWL, in the range between 2 - 20 m bgl. 62 stations (31.63%), recorded shallow water levels, less than 2 m bgl and 24 stations (12.24%), recorded deep water levels, more than 20 m bgl in the state.

A perusal of the DTW map for August 2024 indicates that the shallow water level area less than 2 m bgl occurs in all the valleys of Himachal Pradesh, mainly in Balh valley (Mandi District), all the valleys of Kangra District including Kangra Palampur valley and Nurpur-Indaura valley, eastern & central part of Una valley and northern part of Kullu valley. 2-5 m bgl and 5-10 m bgl water level is recorded in couple of pockets in almost all the valley areas. 10-20 m bgl water level is recorded in pockets in Una Valley, northern part of Paonta valley and Nalagarh valley. Deeper water levels are found at some places in Nalagarh and Una valley.

Season	No of well analysed	Number and Percentage of wells showing depth to water level (mbgl) in the range of											
		0 to 2		2 to 5		5 to 10		10 to 20		20 to 40		> 40	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Aug-24	196	62	31.63	47	23.98	38	19.39	25	12.76	19	9.69	5	2.55

Depth to Water Level Distribution of Percentage of Observation Wells Pre -monsoon 2024



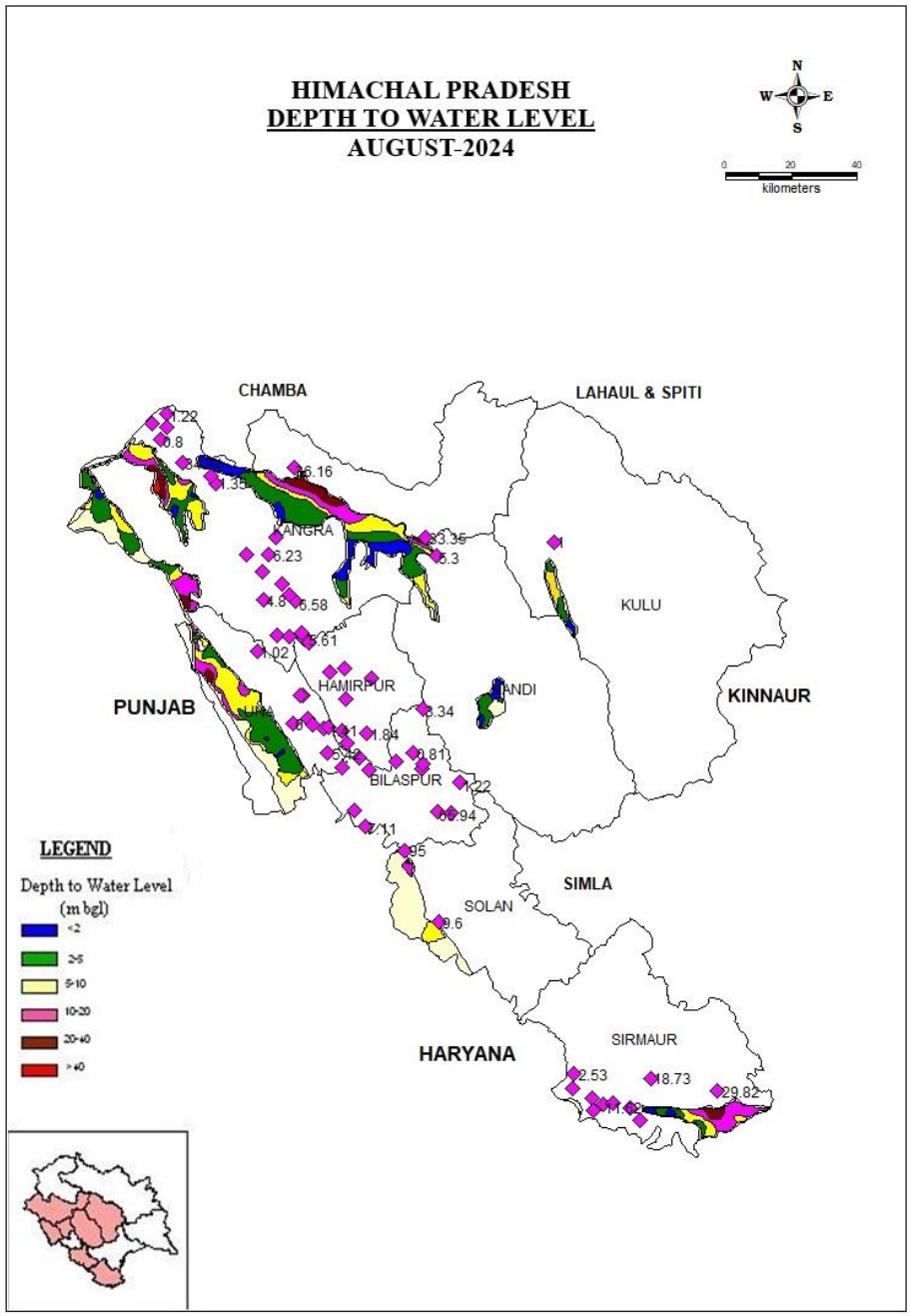


Fig:1 Depth to Water Level Aug-2024

SEASONAL WATER LEVEL FLUCTUATION

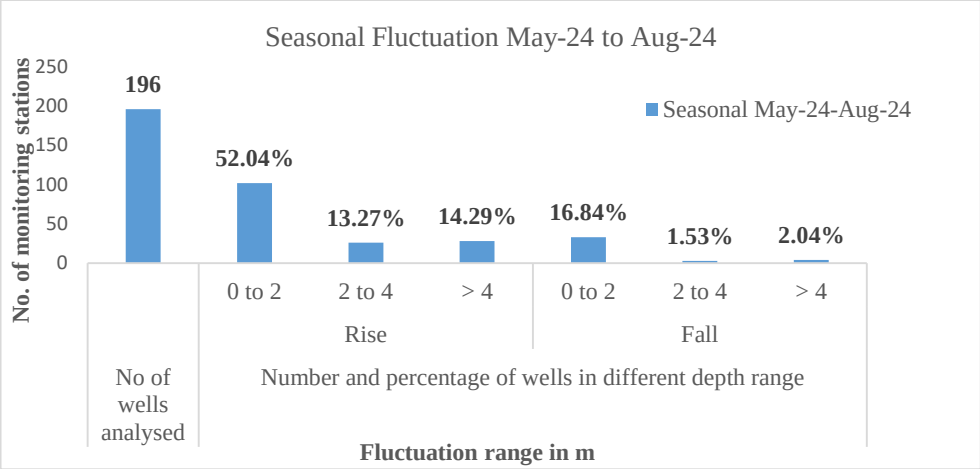
To study the effect of monsoon and subsequent utilization for various needs like agriculture, irrigation and domestic etc, changes in water level are studied and are discussed below.

May 2024 to Aug 2024

Seasonal fluctuation of water level was analyzed for 196 stations for the period May 2024 – Aug 2024. Out of the 196 stations, 156 stations have shown rise in water level and remaining 40 stations have shown fall in water level.

The minimum rise in water level of 0.08 m was observed in Kangra District and the maximum rise 10.89 m was noticed in Sirmaur District. Out of the 156 stations which have shown rise in water level, 102 stations show rise between the range of 0 to 2 m, 26 stations between 2 to 4 m and remaining 28 stations show rise more than 4 m.

Comparison	Season	No of wells analysed	Number and percentage of wells in different depth range											
			Rise						Fall					
			0 to 2	%	2 to 4	%	> 4	%	0 to 2	%	2 to 4	%	> 4	%
Seasonal	May-24-Aug-24	196	102	52.04	26	13.27	28	14.29	33	16.84	3	1.53	4	2.04



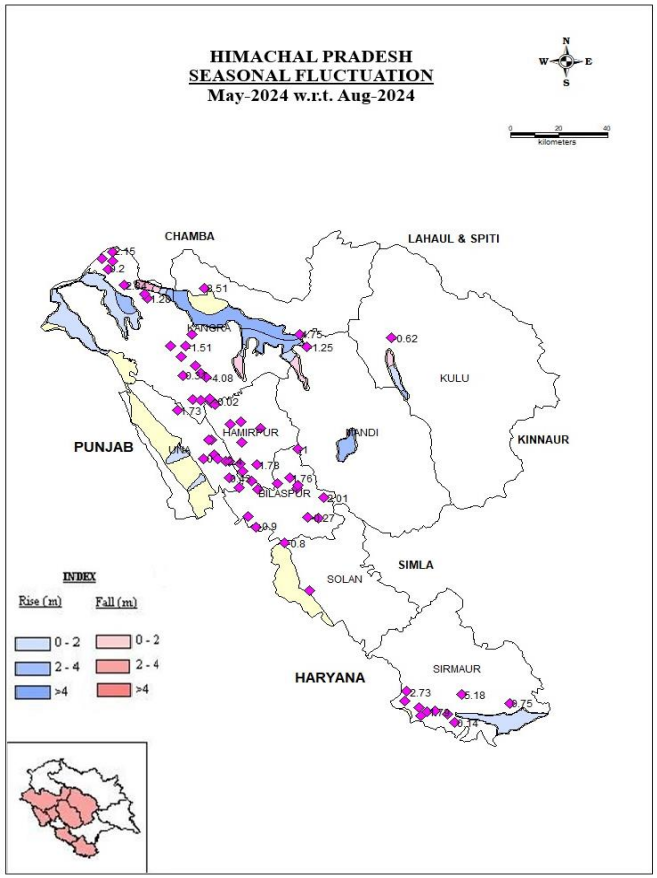


Fig:2 Seasonal fluctuations for the period January 2024 – Aug 2024

ANNUAL WATER LEVEL FLUCTUATION

Annual fluctuation in water level of GWMS during different monitoring period was analysed and discussed below.

Aug 2023 to Aug 2024

Annual fluctuation of water level, has been worked out by comparing depth to water level of Aug 2023, with Aug 2024 and the data presented its frequency distribution in various rise and fall ranges.

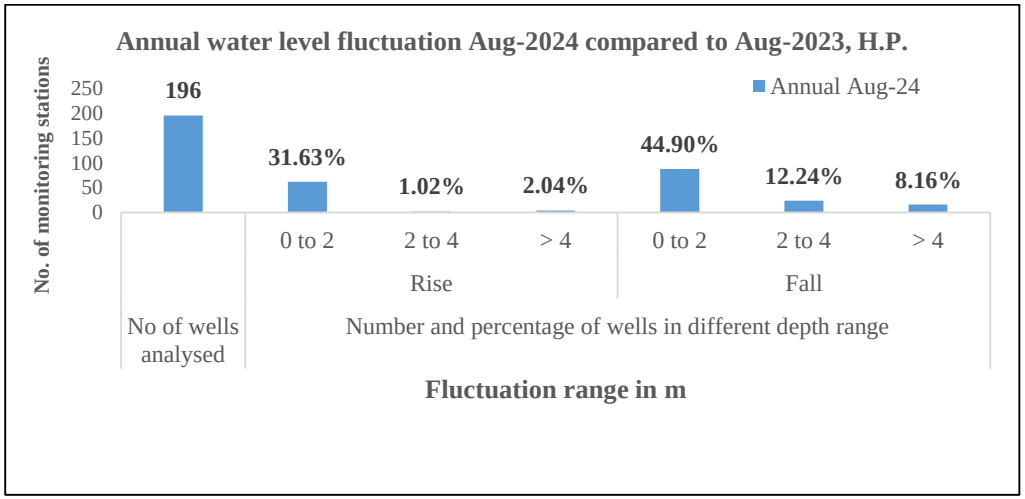
Out of the 196 stations analysed, 68 stations (34.69%) have shown rise in water level ranging from 0.01 (Mandi District) to 10.98 m (Solan District).

Out of 68 stations which have shown rise in water level, 62 stations (91.18%) show rise between the range of 0 to 2 m, 2 station (2.94%) has shown rise between 2 to 4 m and 4 station (5.88%) shown rise more than 4 m.

Similarly, for 128 stations which have shown fall in water level, 88 stations (68.75%) show fall between the range of 0 to 2 m, 24 stations (18.75%) have shown fall between 2 to 4 m and 16 stations (12.5%) has shown fall more than 4 m.

A perusal of map of Annual Water Level Fluctuation for August 2023 to August 2024 shows fall in water level in all the monitoring areas including Kangra Palampur valley, of Indora-Nurpur valley, Nallagarh valley, Kullu valley and of Una valley. Areas are showing water level rise in small parts of Paonta valley, kangra palampur valley and Nurpur Indora valley.

Comparison	Season	No of wells analysed	Number and percentage of wells in different depth range											
			Rise						Fall					
			0 to 2	%	2 to 4	%	> 4	%	0 to 2	%	2 to 4	%	> 4	%
Annual	Aug-24	196	62	31.63	2	1.02	4	2.04	88	44.90	24	12.24	16	8.16



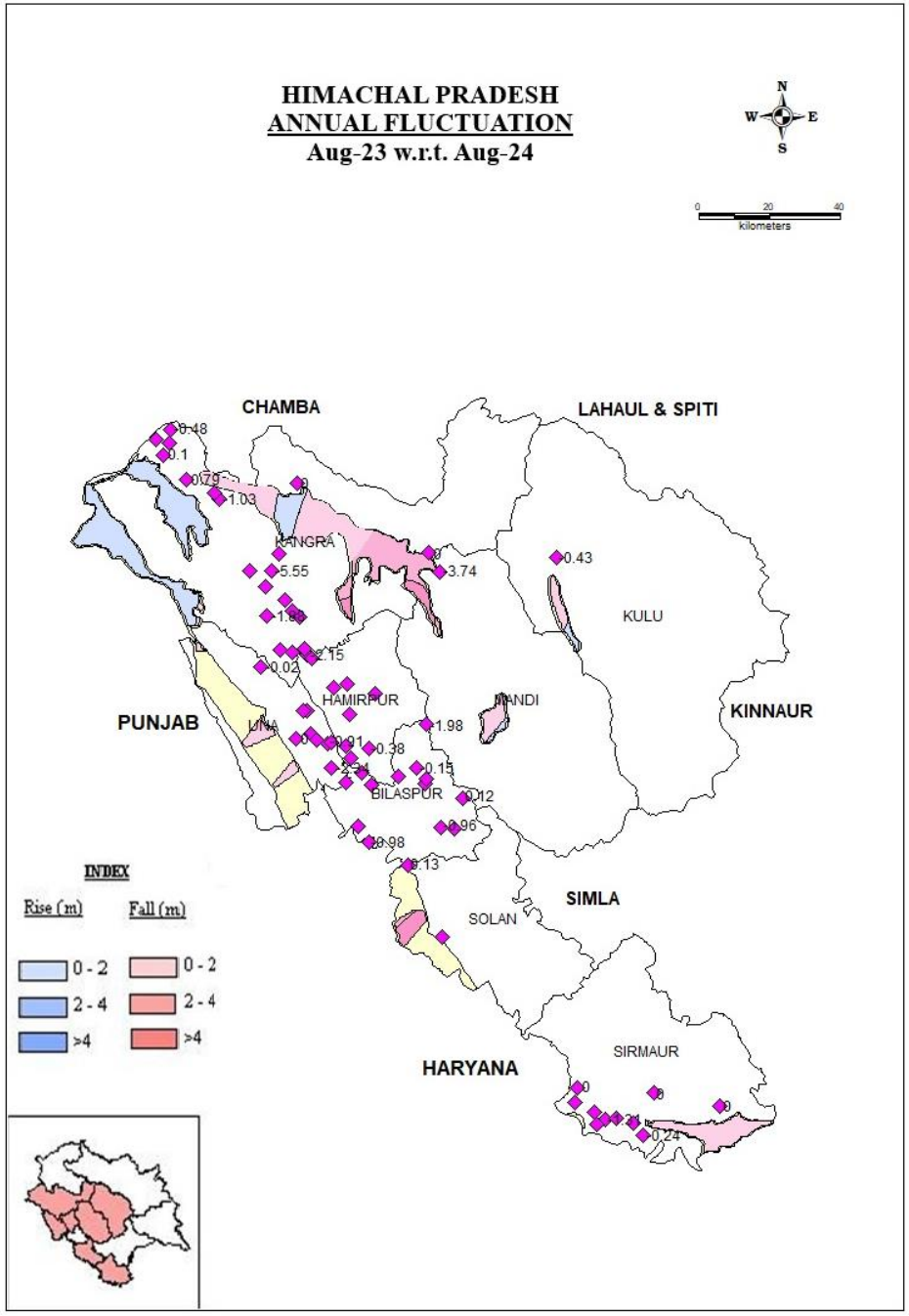


Fig:3 Annual fluctuations for the period Aug 2023 – Aug 2024

DECADAL FLUCTUATIONS

The decadal variations were analyzed considering the decadal average of water level and the water level for the respective period.

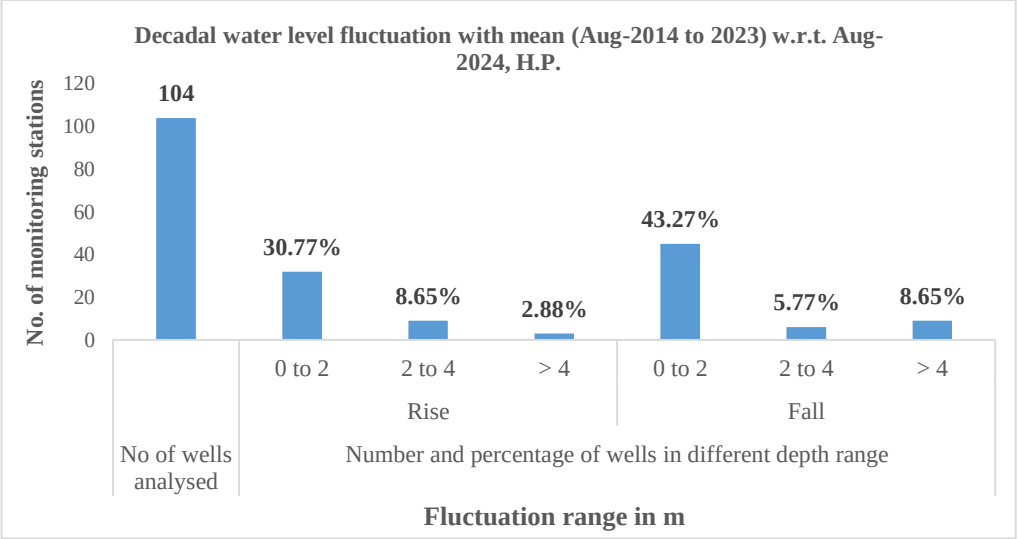
Decadal average of Aug (2014-2023) to Aug 2024

Decadal water level fluctuation has been worked out by comparing water level data of Aug 2024 with the average mean of 10 years' water level data of Aug (2014-2023) and is presented frequency distribution in various ranges.

A perusal shows that out of 104 stations analyzed, 44 stations (42.31%) have shown rise and 60 stations (57.69%), have shown fall in water level. Out of 44 stations 32 stations (72.73%) are showing rise in water level between 0 to 2 m, 9 stations (20.45%) between 2 to 4 m and 3 stations (6.82%), more than 4 m. Out of 60 stations, 45 stations (75%) show fall in water level between 0 to 2 m, 6 stations (10 %) between 2 to 4 m and 9 stations (15%) more than 4 m. A minimum rise in water level of 0.002 m was noticed in Kangra Districts and the maximum rise of 9.39 m is noticed in Solan District. Similarly, the minimum fall of 0.001 m is noticed in Mandi District & maximum fall of 6.15 m is noticed in Solan District.

A perusal of map Decadal Average of August (2014 - 2023) to August 2024 shows fall in water level majority areas of all the valley areas, except a few places in all valleys which are showing rise. Fall is shown in Nurpur and Nalagarh valley, central part of Sirmaur District complete Nalagargh valley of Solan District, central part of Una valley of Una District, some part of Balh valley of Mandi District and north central part of Kangra Palampur valley of Kangra District. Fall in water level, >4 m is shown in Kangra and Solan District. Similarly rise in water level is noticed in Solan Valley, Southern part of Una valley in Una District part of Kangra valley of Kangra District.

Comparison	Season	No of wells analysed	Number and percentage of wells in different depth range											
			Rise						Fall					
			0 to 2	%	2 to 4	%	> 4	%	0 to 2	%	2 to 4	%	> 4	%
Decadal	Aug-24	104	32	30.77	9	8.65	3	2.88	45	43.27	6	5.77	9	8.65



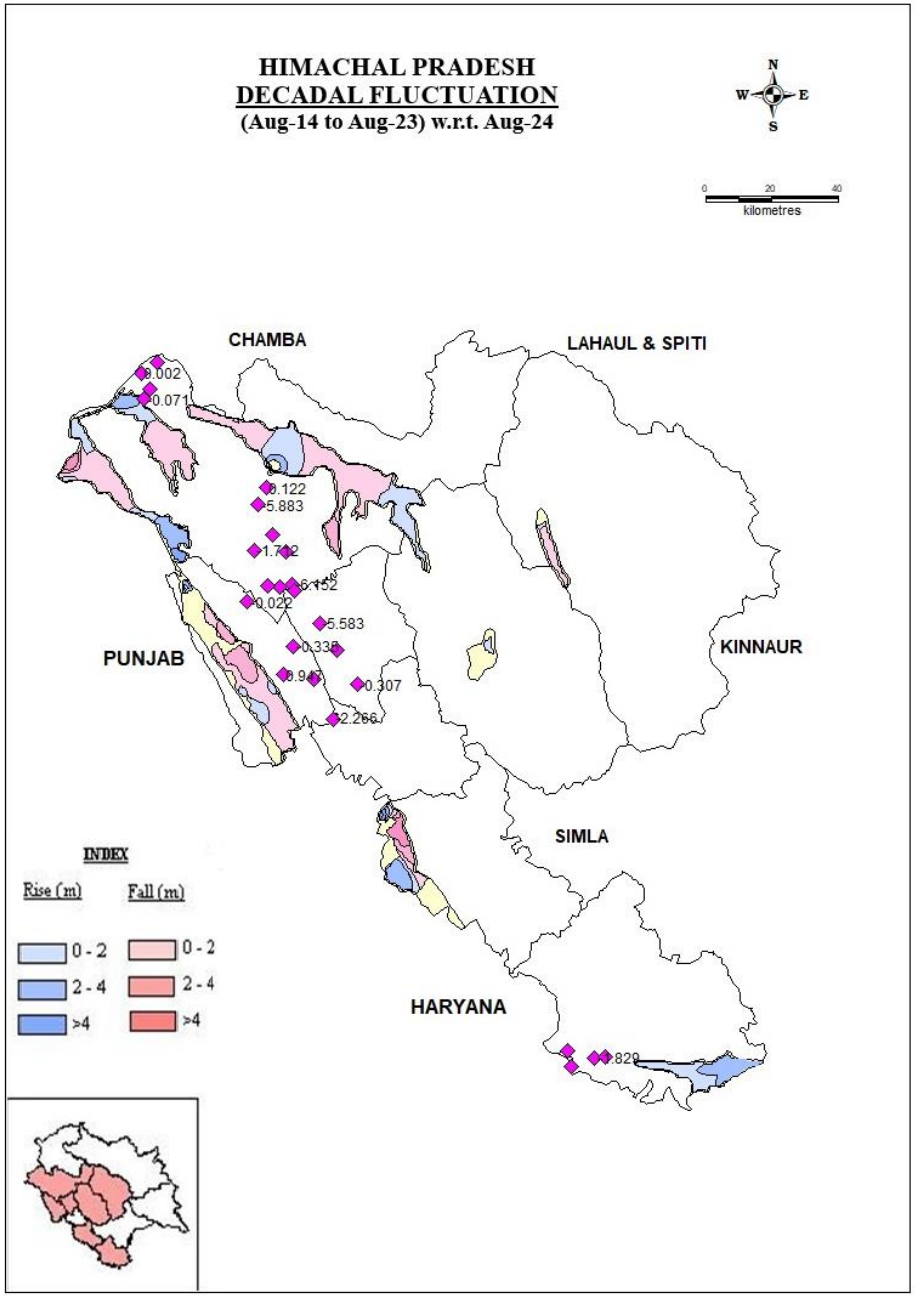


Fig. 4: Decadal water level fluctuation, Decadal mean Aug (2014-2023) Vs Aug-2024

SUMMARY

As a component of the National Ground Water Monitoring Programme, the CGWB, NHR, Dharamshala 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 Aug. As of Aug-2024, the Northern Himalayan Region of the Central Ground Water Board monitored 137 dug wells, 59 piezometers and 27 springs. This comprehensive effort aims to portray the variations in the state's ground water conditions across different aquifers.

In Aug 2024, around 88% of the state's area exhibited a depth to water level within 20 meters below ground level. Deeper water levels of more than 20 m cover 12 % area of the State covering mainly Una, Sirmaur,Solan, Kangra, districts.

Annual water level comparison with previous year Aug-2023 to Aug-2024 has shown that about 34.69% area of the state experienced rise in annual water level fluctuation. 42.31% of the area experienced rise in decadal mean water level of 2014-2023 with respect to Aug, 2024.