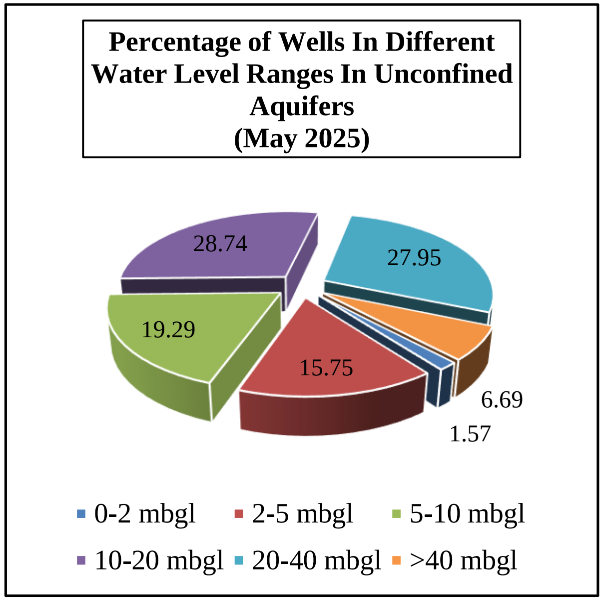

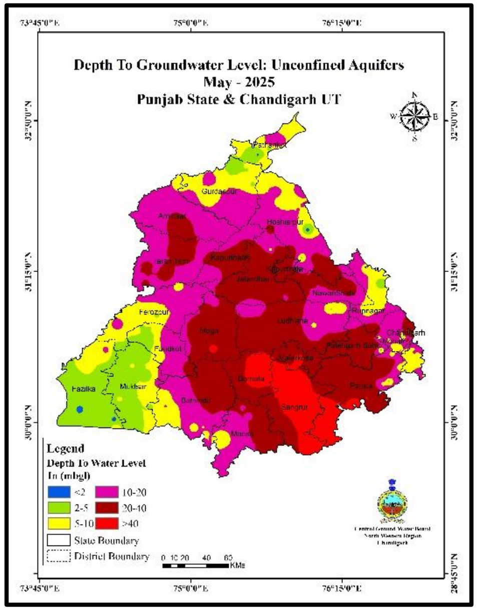

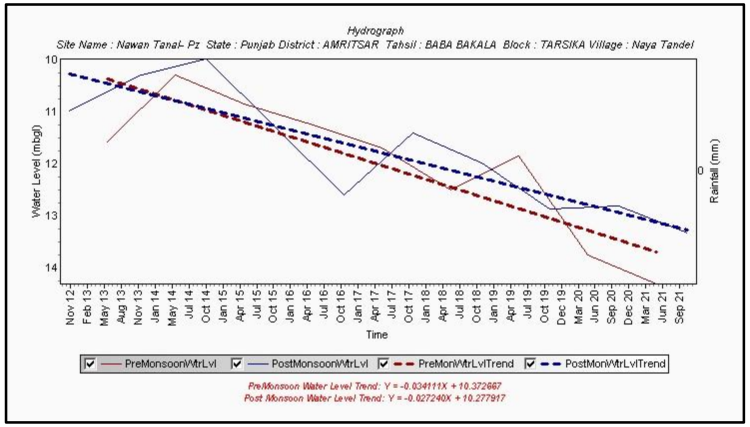

GROUND WATER LEVEL BULLETIN

PUNJAB STATE & CHANDIGARH UT

ABSTRACT

Ground water level Scenario during May 2025 highlighting the **findings, status of ground water level in unconfined aquifers andits** annual and decadal comparison.

CGWB, NORTH WESTERN REGION, CHANDIGARH

SUBMITTED BY

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Scientist 'B' (Hydrogeology) & OIC (RODC),CGWB, NWR, Chandigarh

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 involve climatic parameters like rainfall, evapotranspiration etc., whereas anthropogenic influences include groundwater pumping from the aquifers, recharge due to irrigation systemsand 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 26,000 observation wells called **National Hydrograph Network Stations (NHNS)**, as on 30.04.2025, located all over the country is being monitored.

2.0 STUDY AREA

The Punjab State is located between North latitudes 29° 32’ and 32° 28’ and East longitudes 73° 50’ and 77° 00’. The total geographical area of the state is 50476 sq. km. It is surrounded by the states of Himachal Pradesh in the northeast, Jammu and Kashmir in the north and Haryana and Rajasthan in the south and southwest respectively. The State has a flat alluvial plain except a narrow belt along the southwestern parts where stable sand dunes are seen dotting the landscape. The area occupied by the mountains (Himalayan foothills) in northeast, is about 1243 sq km. Perennial Rivers Sutlej, Beas, Ravi and ephemeral river Ghaggar drain the state. It has a vast network of canal system. With the inception of canals, the fertile land of the State started converting into green fields and experienced spectacular achievement in agricultural production with emphasis on cultivation of paddy and high yielding varieties of crops, as a consequence demand for water increased manifold resulting in over exploitation of ground water resources.

The State has been divided into four main divisions viz. Jalandhar, Patiala,

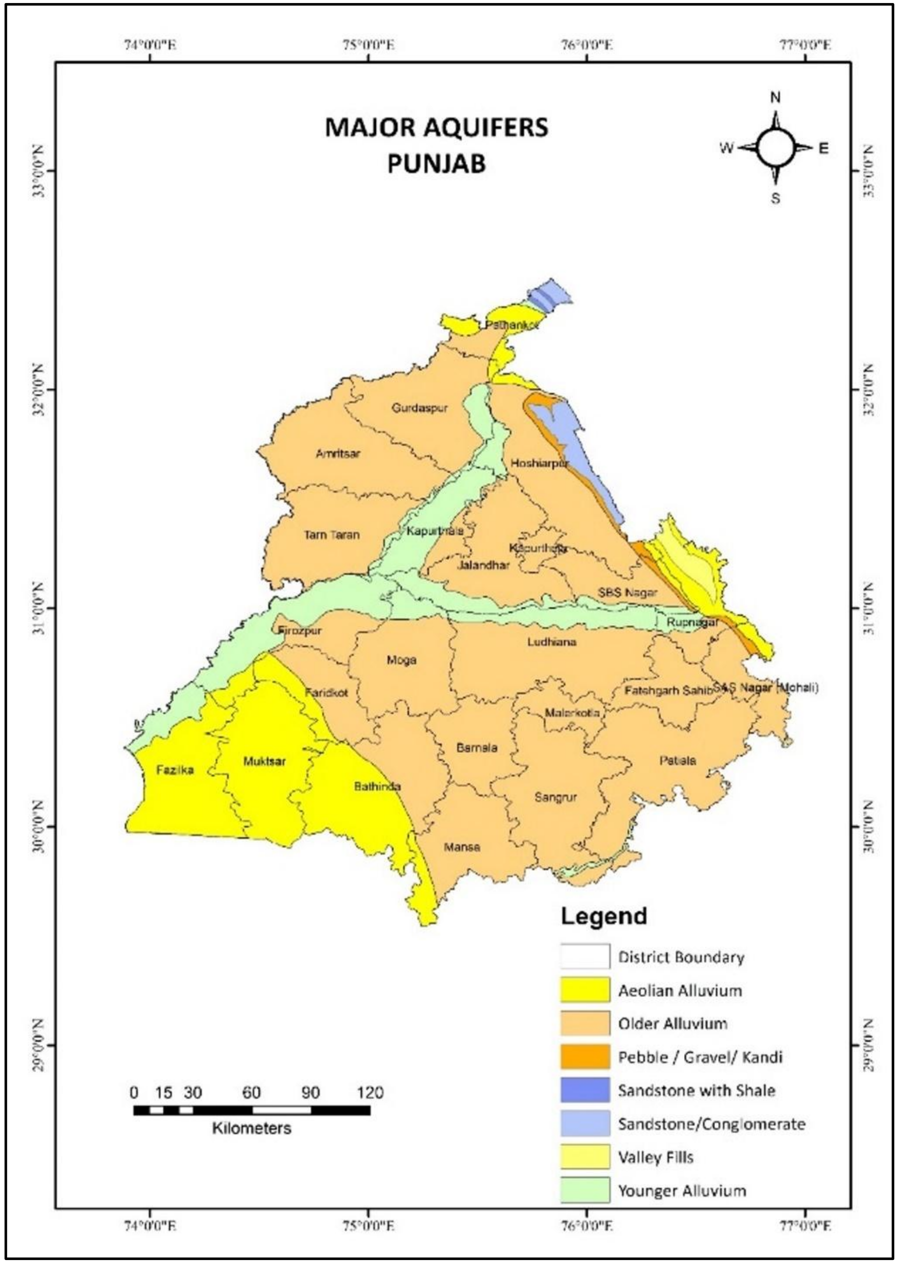


Figure-1: Map showing major aquifers and Hydrogeology of Punjab State & Chandigarh UT

Ferozpur and Faridkot, which are further sub-divided into 23 districts, which are further divided into 77 sub-divisions /tehsils and 146 community development.

The State forms a part of vast Indo-Genetic alluvial plain. Physiographically, the State can be divided into seven distinct units, which run parallel to each other.

I Hilly area: Siwalik Hills on the north and northeastern part.

II Eroded hills with flat land (Plateau): forms top of hills.

III Intermountain valleys

IV Piedmont area: (Kandi zone) immediately southwest of hills.

V. Sirowal Zone: lies further southwest of Kandi area which merges with the alluvium of Ravi, Beas, Sutlej and Ghaggar rivers. 2

VI. Alluvial plains:

a) Active/recent flood plains include meanders and present flood plains.

b) Abandoned flood plains include terraces of rivers, abandoned during Recent age.

c) Bar upland areas: Higher elevated land which remained beyond the reach of rivers but are composed of ancient river channels deposits (older alluvium) plains.

3.0 GROUND WATER LEVEL MONITORING

The Central Ground Water Board, North Western Region, has established 485 Ground water observation wells in Punjab State and Union Territory of Chandigarh for monitoring water level. As on 31.3.2025 there were 461 Ground Water Observation Wells of CGWB in Punjab which include 115 dug wells and 346 piezometers for monitoring shallow & deeper aquifers in Punjab. There are 24 observation wells in Chandigarh, 1 dug wells and 23 Piezometers for monitoring shallow & deeper aquifers.

About 80% of the Ground water observation wells fall in the canal command areas of various canal systems, the areas falling out of the major command is part of Pathankot, Hoshiarpur, Nawanshahr, Ropar and SAS Nagar districts, parts of Gurdaspur, Jalandhar and Ludhiana districts. The district wise details of Ground water observation wells are given in Table 1 and location of these Ground water observation wells is shown in Figure 2.

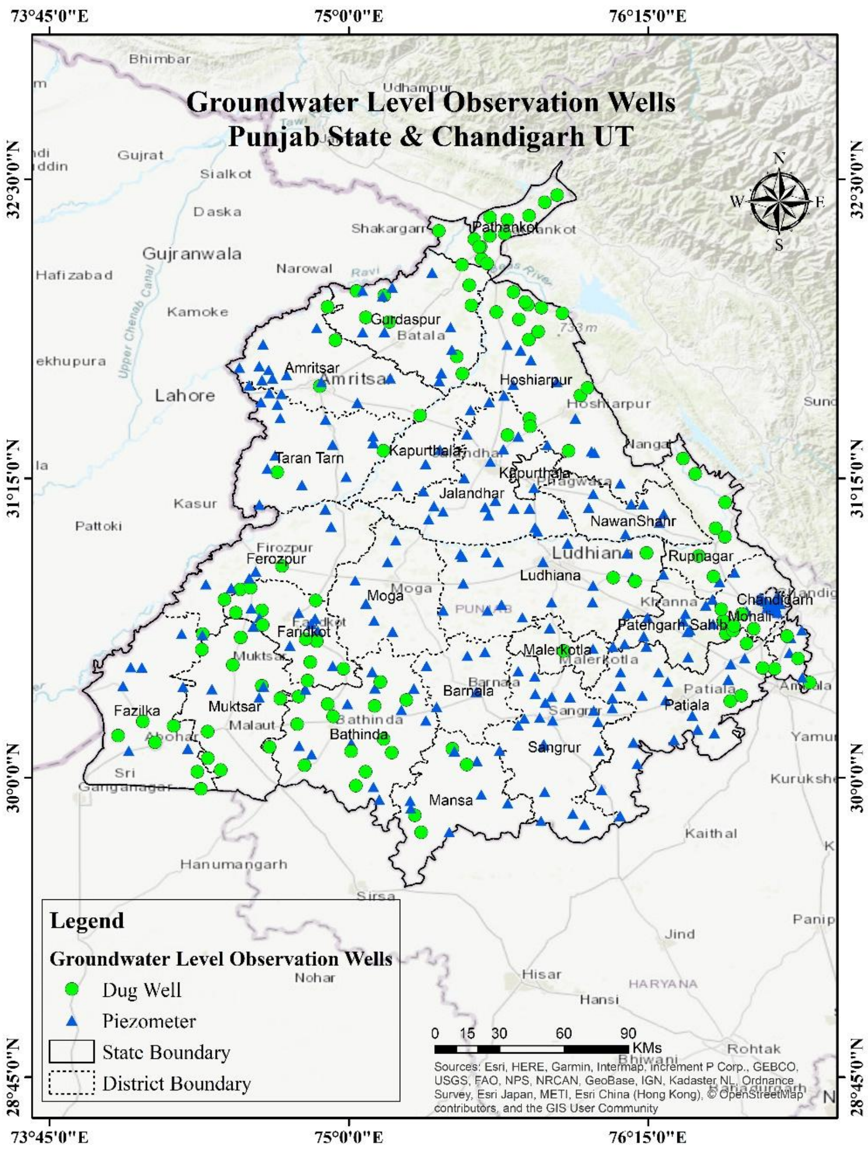


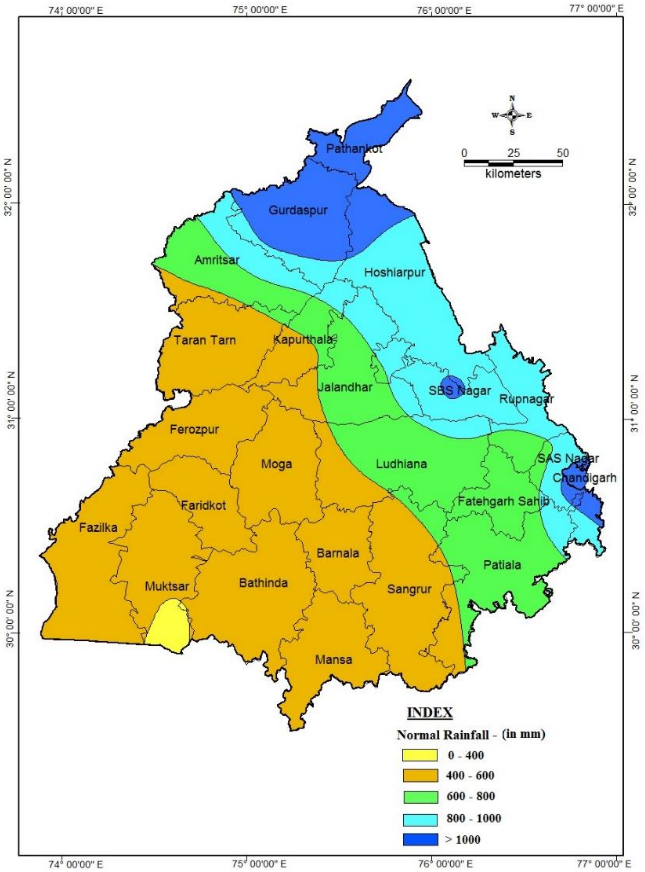
Figure- 2: Map showing locations of monitoring wells (NHNS) in Punjab State & Chandigarh UT

S. No.	Districts	Dug Wells	Piezometers	Total
1	**Amritsar**	4	23	27
2	**Barnala**	0	6	6
3	**Bathinda**	14	20	34
4	**Faridkot**	12	9	21
5	**Fatehgarh Sahib**	4	19	23
6	**Fazilka**	7	11	18
7	**Ferozpur**	2	13	15
8	**Gurdaspur**	9	20	29
9	**Hoshiarpur**	13	18	31
10	**Jalandhar**	2	38	40
11	**Kapurthala**	0	16	16
12	**Ludhiana**	3	29	32
13	**Malerkotla**	1	4	5
14	**Mansa**	4	12	16
15	**Moga**	0	8	8
16	**Mohali**	7	11	18
17	**Muktsar**	7	7	14
18	**NawanShahr**	0	7	7
19	**Pathankot**	13	0	13
20	**Patiala**	4	31	35
21	**Rupnagar**	7	1	8
22	**Sangrur**	0	27	27
23	**Taran Tarn**	2	16	18
24	**Chandigarh UT**	1	23	24
Total		**116**	**369**	**485**

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

4.0 RAINFALL

Rainfall in Punjab State and Chandigarh UT is predominantly influenced by the southwest monsoon, which accounts for nearly 70–80% of the total annual precipitation, occurring mainly between late June and September. The average annual rainfall exhibits significant spatial variability—ranging from about 400 mm in the arid southwestern districts such as Fazilka and Bathinda to over 1,000 mm in the sub-montane northern regions like Gurdaspur, Pathankot, and Ropar. Chandigarh, situated in the Shivalik foothills, receives comparatively higher rainfall, averaging around 1,100–1,200 mm annually. This variability plays a crucial role in groundwater recharge, with the central and southern regions of Punjab receiving insufficient rainfall to sustainably replenish aquifers. The high dependence on groundwater for irrigation, especially for water-intensive crops like paddy, coupled with declining and erratic rainfall patterns, has exacerbated groundwater depletion. Hence, a comprehensive understanding of rainfall distribution and trends is vital for developing sustainable groundwater management strategies in the region.



S. No.	District	2015
1	Amritsar	1166.7
2	Tarn Taran	562.9
3	Kapurthala	451.3
4	Jalandhar	653.2
5	Hoshiarpur	378.5
6	Rupnagar (Ropar)	593.8
7	Mohali (SAS Nagar)	821.7
8	Ludhiana	832.0
9	Firozpur	622.4
10	Faridkot	171.0
11	Bathinda	490.9
12	Mansa	391.1
13	Moga	151.5
14	Sangrur	434.8
15	Barnala	492.7
16	Patiala	326.4
17	Fatehgarh Sahib	514.1
18	Gurdaspur	685.9

Figure-3: Isohyetal map of Normal Rainfall In Punjab State anad Chandigarh UT.

Table 2: District-wise rainfall In Punjab State anad Chandigarh UT.

5.0 GROUND WATER LEVEL SCENARIO (MAY, 2025)

5.1 UNCONFINED AQUIFER

5.1.1 DEPTH TO WATER LEVEL DATA

The behavioral pattern of water level in May 2025 along with depth to water level map (Fig.5) is discussed below.

The depth to water level lies between 1.25 mbgl in Dugwell in Village Dhalorian, District Pathankot and 53.50 mbgl in Piezometer in Leisure Valley, Sector-10 (C) Chandigarh. Very shallow water levels of 0-2 m (causing water logging) occur in 1.57% of wells and 0.09% area of the state in isolated patches in Fazilka and Hoshiarpur districts. Shallow water levels of 2-5 m have been observed in 15.75% of the wells and 9.97% of the total area that lies in central parts of state i.e Fazilka, Rupnagar, Hoshiapur, Fazilka, Muktsar and Pathankot districts. The water levels between 5-10 m are observed in Fazilka, Ferozpur, Faridkot, Muktsar, Bathinda, Mansa, Gurdaspur, Hoshiarpur, Pathankot, Rupnagar and Chandigarh districts. About 19.29% of wells and 15.37% of the area fall in this range. Moderately Deep water levels (10-20 m) are observed in 28.74% wells covering about 32.30% area of the State Amritsar, Gurdaspur, Faridkot, Bathinda, Fazilka, Hoshiarpur, Nawanshahr, Mansa and Tarn Taran districts. Deep water levels (20-40 m) are observed in parts of Bathinda, Mansa, Moga. Jalandhar, Kapurthala, Ludhiana, Patiala, Fatehgarh Sahib, Nawanshahr, Amritsar and Sangrur districts and observed in 27.95% wells covering about 35.26% area of the state. Very deep water levels (>40 m) are observed in 6.69% wells as patches in Sangrur, Barnala, Patiala and Malerkotala districts covering 7.00% area of the State.

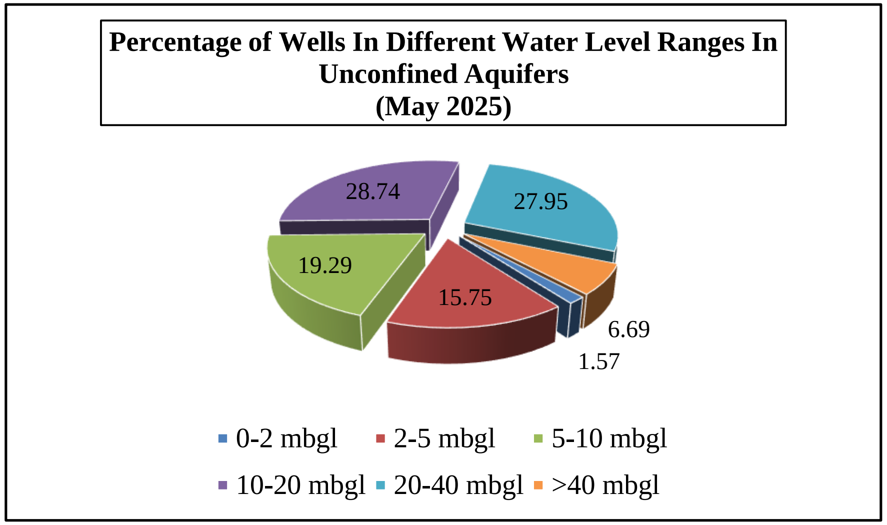


Figure-4: Percentage of wells in different water level ranges in unconfined aquifer.

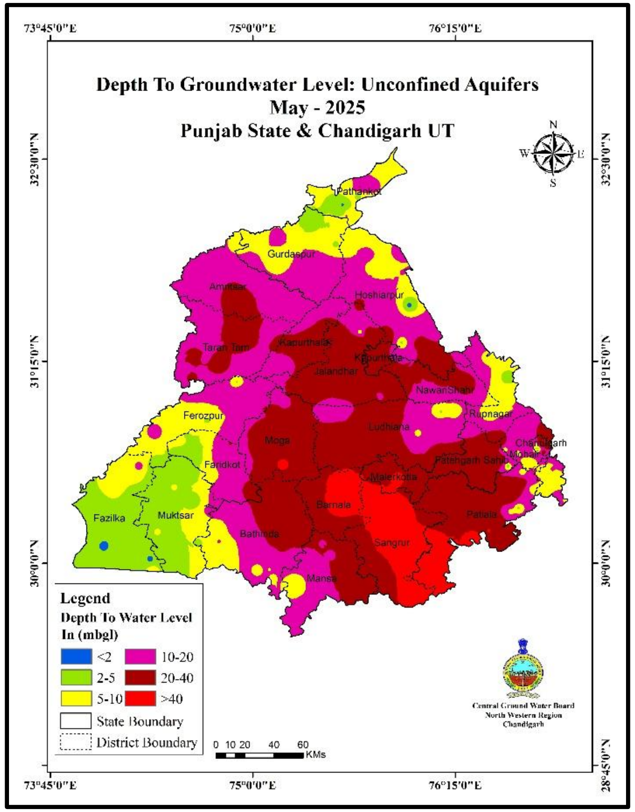


Figure-5: Depth to Water Level Map Unconfined Aquifer, May 2025

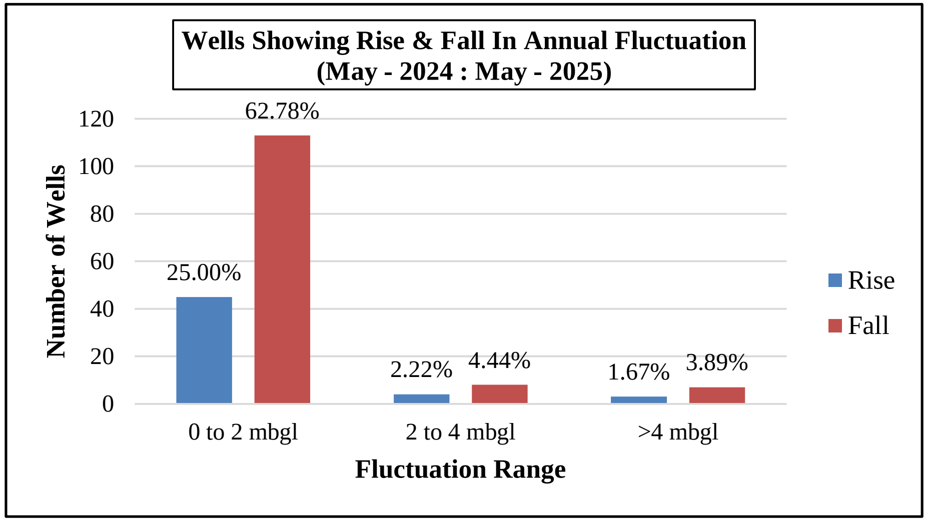


Figure-6: Percentage of wells showing rise and fall in WL in unconfined aquifer (May 2024 to May 2025)

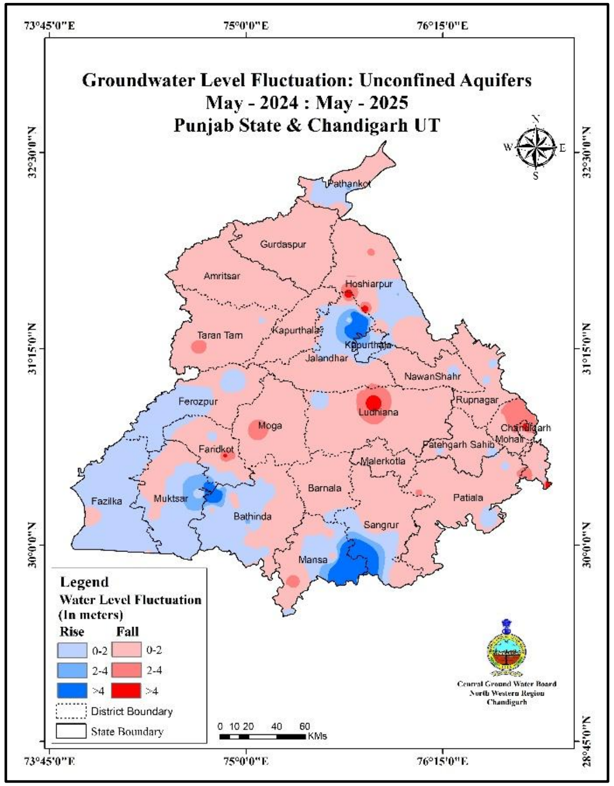


Figure-7: Annual water level fluctuation in unconfined aquifer(May 2024 to May 2025)

5.1.2 ANNUAL FLUCTUATION IN WATER LEVEL

Annual Fluctuation of Water Level in Unconfined Aquifer (Pre-monsoon 2024 – Pre-monsoon 2025)

In order to know the impact of rainfall and ground water withdrawal during last one year, annual water level fluctuations for period May 2024 and May 2025 are calculated. The behavior of annual fluctuations is discussed in the following paragraph and depicted in Fig.7.

Rise in Water Levels:

The water level rise has been recorded in 28.89% of wells monitored and covering 26.25% area of the State. Water level rise in the range of 0-2 m is observed in 25.00% wells and 22.48% of area. Water level rise 2-4m is observed in 2.22% wells and 1.81% of area. The water level rise of >4m is observed in 1.67% wells and 1.96% of area as isolated patch in Sangrur, Mansa, Muktsar, Bathinda, Kapurthala and Jalandhar districts.

Fall in Water Levels:

The annual fluctuation depicts general decline of water levels in 71.11% of wells monitored and covering 73.75% area of the State. The decline has been observed in all districts of the state. Water level decline the range of 0-2 m is observed in 62.78% of wells and 70.89% of the area. Water level decline in the range of 2-4 m is observed in 4.44% of wells and 2.54% of the area. Whereas, the water level decline of >4m is observed in 3.89% of wells and less than 1% of the area during the period, as isolated patches in Ludhiana, Chandigarh and Hoshiarpur districts.

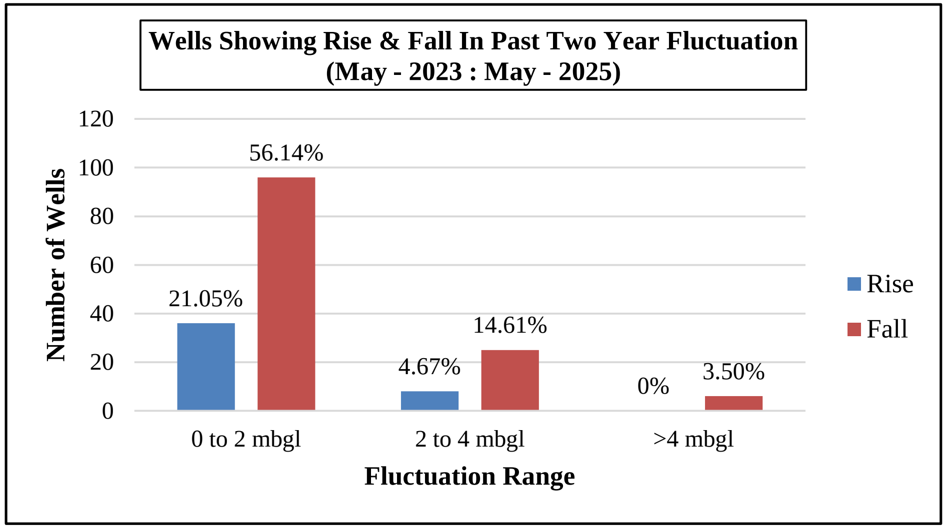


Figure-8: Percentage of wells showing rise and fall in WL in unconfined aquifers (May 2023 to May 2025)

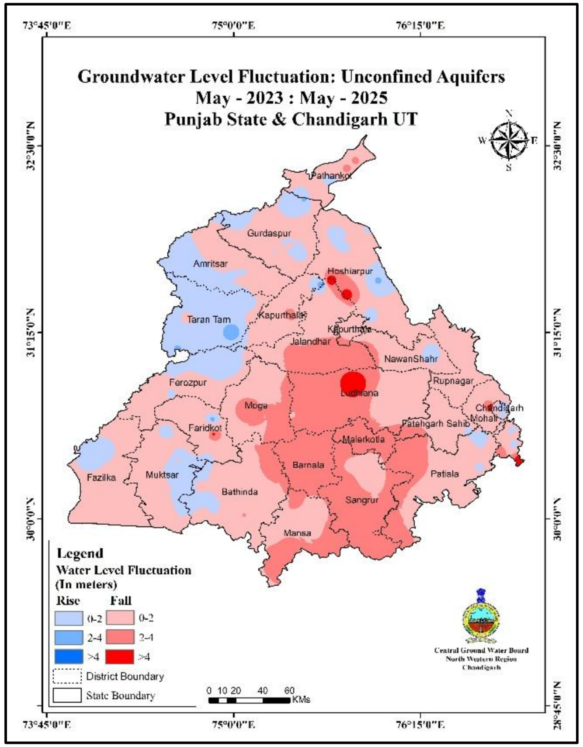


Figure-9: Water Level Fluctuation Map (May 2023 to May 2025)

Past Two Year Fluctuation of Water Level in Unconfined Aquifer (May 2023 to May 2025)

In order to know the impact of rainfall and ground water withdrawal during last two years, past two year water level fluctuations for period May 2023 and May 2025 are calculated. The behavior of annual fluctuations is discussed in the following paragraph and depicted in Fig.9.

Rise in Water Levels

The water level rise has been recorded in 25.72% of wells monitored and covering 27.14% area of the State. Water level rise in the range of 0-2 m is observed in 21.05% wells and 13.57% of area. Water level rise 2-4m is observed in 4.67% wells and 13.57% of area. The water level rise of >4m is observed in none of the wells and none of area.

Fall in Water Levels

The annual fluctuation depicts general decline of water levels in 74.285% of wells monitored and covering 72.86% area of the State. The decline has been observed in all districts of the state. Water level decline the range of 0-2 m is observed in 56.14% of wells and 51.47% of the area. Water level decline in the range of 2-4 m is observed in 14.61% of wells and 20.76% of the area. Whereas, the water level decline of >4m is observed in 3.50% of wells and less than 1% of the area during the period, as isolated patches in Ludhiana, Hoshiarpur and SAS Nagar districts.

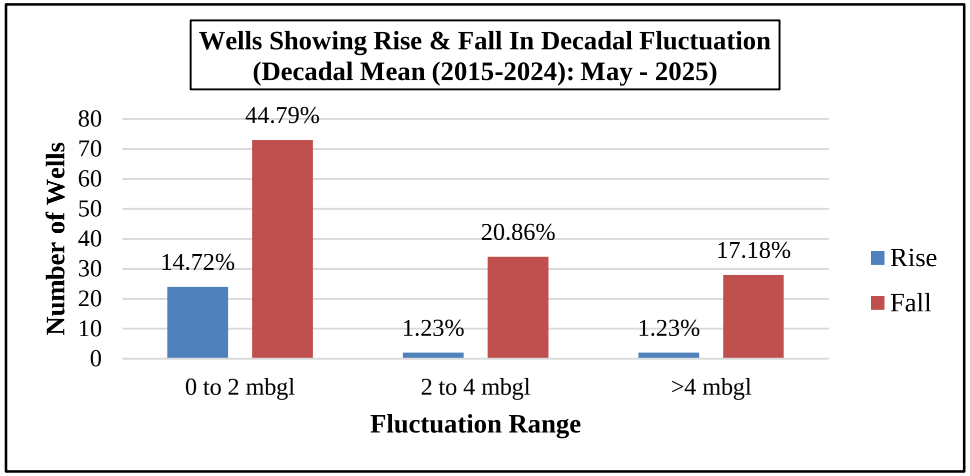


Figure-10: Percentage of wells showing rise and fall in WL in unconfined Aquifer (Decadal Mean May (2015-2024) to May 2025)

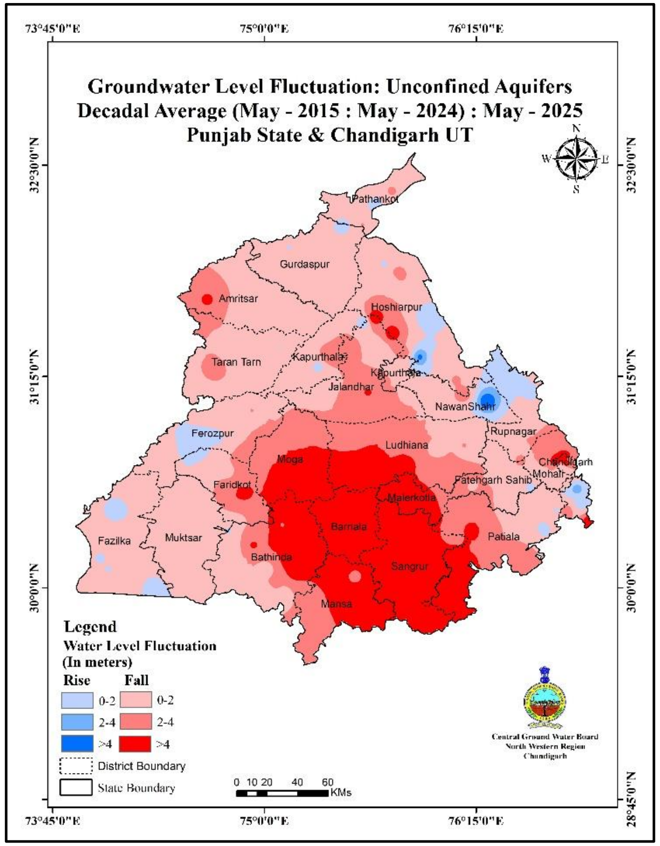


Figure-11: Water level fluctuation in unconfined Aquifer(Decadal Mean May (2015-2024) to May 2025)

5.1.3 DECADAL FLUCTUATION IN WATER LEVEL

Decadal Fluctuation of Water Level in Unconfined Aquifer
Decadal Mean (2015-2024): May - 2025

Changes in water level behaviour since last one decade are determined using decadal mean data. Water level mean of past one decade (2015-2024) for each ground water observation well is computed and compared with the respective water level data of May 2025. The behaviour of water level over the period under reference is discussed in paragraph below along with Fig.11.

Rise in Water Levels:

The decadal mean fluctuations show that rise in 49.56% of observation wells monitored covering about 1.06% area of the state. Water level rise in the range of 0-2 m is observed in 34.91% of wells and less than 1% of the area. Water level rise of 2-4m is observed in 8.62% of wells and less than 1% of the area. Water level rise of >4m is observed in 6.03% of wells and less than 1% of the state area as isolated patch in Nawanshahr district.

Fall in Water Levels:

The decadal mean fluctuations show that decline in 50.44% of observation wells monitored covering about 98.94% area of the state. The decline has been observed in all districts of the state. The decline of 0-2 m has been observed in about 31.90% of wells and 53.06% of area. Water level decline of 2-4 m is observed in 9.91% of the wells and 22.95% of the area. Water level decline of >4m is observed in 22.94% of the wells and 8.41% of area during the period, in Sangrur, Moga, Barnala, Mansa, Bathinda and Chandigarh districts.

6.0 SUMMARY

The Groundwater Level Bulletin for Punjab State & Chandigarh UT, published by the Central Ground Water Board, North Western Region, Chandigarh presents an assessment of the groundwater scenario as of May 2025, focusing on unconfined aquifers and comparing annual and decadal trends. Groundwater monitoring across 485 observation wells reveals significant spatial variations in water table depths, ranging from 1.25 meter to over 53 meters below ground level. Annual and two-year analyses indicate a general decline in groundwater levels across more than half the state, with localized rises in certain districts. The decadal comparison shows even grave situation, with over 90% of wells recording declining levels, though some areas exhibit improvement. Rainfall variability, excessive groundwater extraction for irrigation, and limited recharge are major contributing factors. To address this, recommendations include a mix of demand-side measures like crop diversification and smart irrigation, alongside supply-side strategies such as artificial recharge, wastewater reuse, and rainwater harvesting.

7.0 RECOMMENDATIONS

The declining trend of ground water level in Punjab State & Chandigarh UT can be improved by Demand and Supply-Side Interventions for Water Conservation which are as given below:

1. **Demand Side Interventions**
   - Change in Paddy Variant – Switching from PUSA-44 (150 days maturity) to PR-126 (117 days maturity) can save 25% of groundwater.
   - Use of AI and Tensiometers – AI-based irrigation and tensiometers help optimize water usage, reducing irrigation needs from 1102 mm/acre to 820 mm/acre.
   - Reduction of Standing Water Column – Lowering the water column from 145 cm to 120 cm in rice cultivation reduces water consumption.

2. **Supply Side Interventions**
   - Artificial recharge structures in government buildings can aid groundwater conservation. Lining of Unlined Channels – Converting unlined irrigation channels to lined ones can reduce groundwater overdraft.
   - Underground Pipelines – Expanding underground pipeline coverage can decrease groundwater development.
   - Canal Water for Irrigation – Maximizing canal water usage can improve groundwater recharge and reduce dependence on groundwater.
   - Artificial Recharge in Paleochannels – Excavating ponds and constructing recharge trenches in paleochannels can enhance groundwater recharge.
   - Reuse of Wastewater – Treating and reusing pond water through the 3-pond system or Thapar model, with solar-powered lifting, helps conserve groundwater.
   - Construction of Injection Wells – Injection wells at minor canal outlets can use surplus canal water to recharge groundwater.
   - Rainwater Harvesting – Installing rainwater harvesting structure after sufficient scientific study.