भूजल स्तर बुलेटिन

(जनवरी 2025)

Ground water Level Bulletin

(January 2025)

केंद्रीय भूमि जल बोर्ड

मध्य-पूर्वी क्षेत्र

पटना

Central Ground Water Board
Mid-Eastern Region
Patna

Content List

1.0 Introduction

The Central Ground Water Board (CGWB) prepares a groundwater bulletin that depicts changes in the groundwater regime of the state across different seasons. This bulletin is based on data collected from representative monitoring wells to assess groundwater levels.

Groundwater regime monitoring is influenced by both natural and human factors. Natural factors include climatic parameters such as rainfall and evapotranspiration, while human activities like groundwater extraction, irrigation recharge, and waste disposal also impact water levels.

The CGWB monitors groundwater levels four times a year—during January, March/April/May, August, and November. This monitoring regime was initiated in 1969. In Bihar, a network of 916 monitoring wells, known as National Hydrograph Network Stations (NHNS), is used for this purpose

2.0 Study Area

Bihar state lies between 83° 19' 50" and 88° 17' 40" E Longitudes and 24° 20' 10" and 27° 31' 15" N Latitudes *(Source: https://state.bihar.gov.in/)* . It shares international border with Nepal in the north and is bounded in the east, west and south by West Bengal, Uttar Pradesh and Jharkhand states respectively. The state covers geographical area of 94,163 Sq.km and has its capital at Patna (Fig 1).

Administratively, the state of Bihar is divided into 38 districts and 534 community development blocks.

Figure-1: Map showing major administrative divisions of Bihar

Geologically, the state is underlain by diverse rock types of different geological ages from Pre-Cambrian to Recent. The Proterozoic and Archean Pre-Cambrian rocks, including granite, granitic-gneiss, quartzite, phyllites, slates, and metabasics, are prominent. The Chhotanagpur Granite Gneissic Complex (CGGC), with mica-bearing pegmatite in Gaya, Nawada, and Munger, is found near Jharkhand. Meta-sedimentary rocks like phyllite, schist, and quartzite also appear in these areas. Groundwater is influenced by the weathered mantle and saprolite zone thickness, ranging from 5 to 20 meters. It exists under unconfined conditions in the weathered mantle and saprolite zone and under confined to semi-confined conditions in joints and fractures.

The Vindhyan Super-Group, in Rohtas, Kaimur, and Aurangabad districts, includes sandstone, limestone, quartzite, and schist. These rocks are consolidated and mostly unaffected by tectonic disturbances. Vindhyan sandstones, with low primary porosity, host groundwater in the weathered residuum and secondary porosity under unconfined conditions. The weathered residuum is 5 to 10 meters thick.

The Siwalik formation, from the Upper Tertiary age, is found in West Champaran district. Comprising sandstone, conglomerate, red clay, and spongy limestone, these hills have faults and confined groundwater in deep sandstones.

Quaternary alluvium covers 89% of Bihar, with recent to sub-recent sediments over 300 meters thick in north Bihar plain, thinning southward. Groundwater is under unconfined conditions within 70 meters depth, with deeper aquifers exhibiting confined conditions. *(Source CGWB, Yearbook 2021-22)*

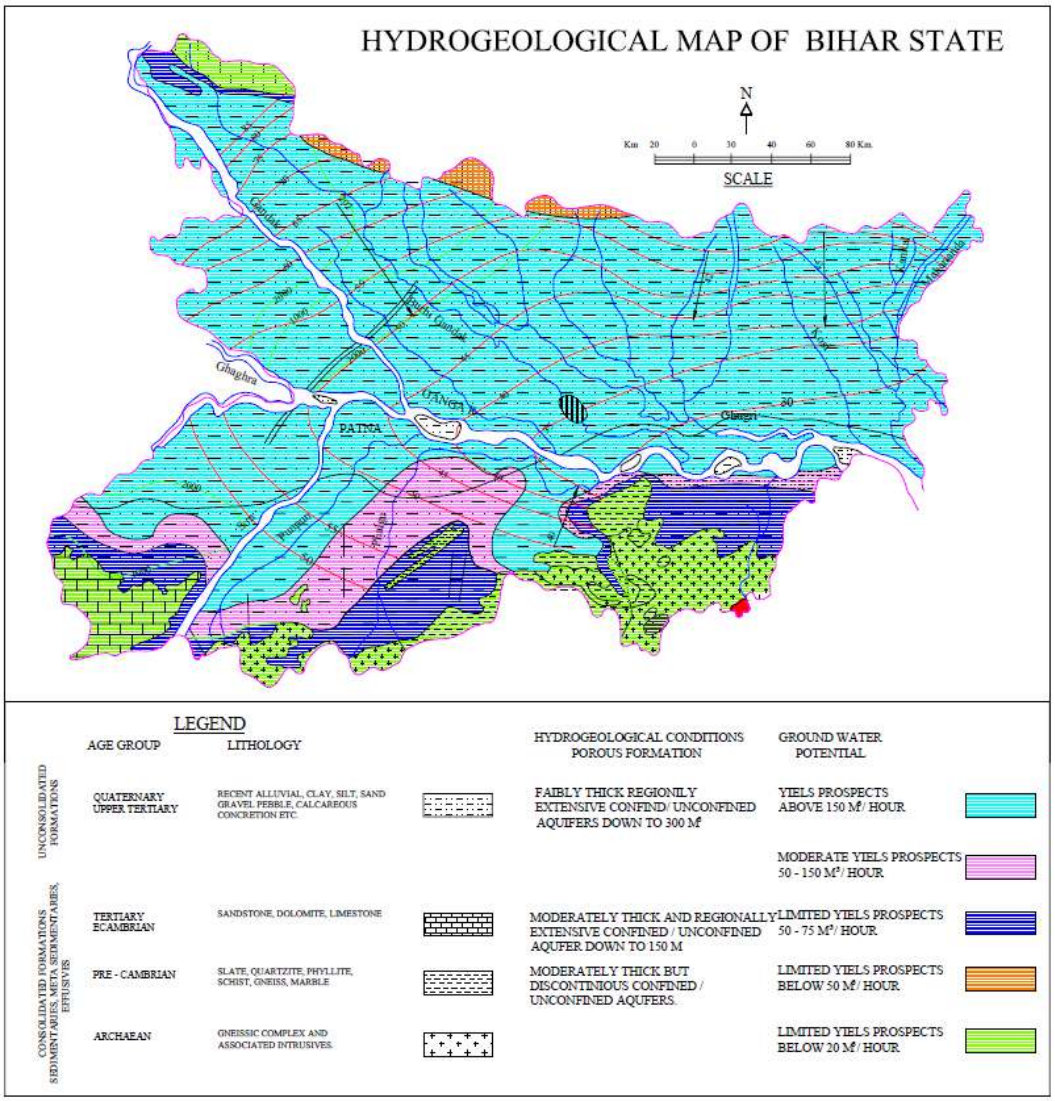

Figure-2: Hydrogeological Map of Bihar state

3.0 Ground Water Level Monitoring

Central Ground Water Board, Mid Eastern Region, Patna, is monitoring changes in groundwater regime in the state on quarterly basis continuously. This is facilitated by a network of monitoring stations in the State located in diverse hydrogeological and geomorphic units. As of May 2024, there are 916 monitoring wells for groundwater regime monitoring. Out of the 916 monitoring stations, 817 are dug wells and the remaining 99 are piezometers. Groundwater level data was successfully collected from 773 of these wells. The remaining wells could not be monitored due to various factors. The district-wise breakup of the water level monitoring stations is given in **Table-1**.

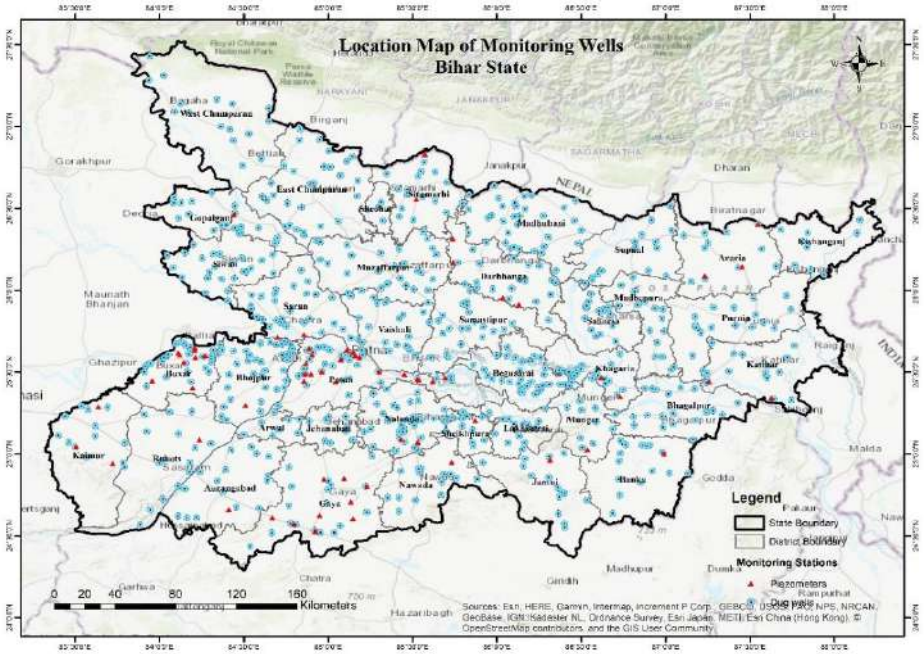

Figure 3- Map showing Location map of Monitoring wells Bihar

Table :1

District-wise distribution of water level monitoring stations in Bihar

Name of District	No. of Dug wells	No. of Tubewells	Total
Araria	9	4	13
Arwal	10	0	10
Aurangabad	15	3	18
Banka	15	1	16
Begusarai	36	0	36
Bhagalpur	43	0	43
Bhojpur	44	2	46
Buxar	33	8	41
Darbhanga	19	7	26
Gaya	17	11	28
Gopalganj	22	4	26
Jamui	16	1	17
Jehanabad	9	2	11
Kaimur (Bhabua)	14	3	17
Katihar	17	3	20
Khagaria	17	1	18
Kishanganj	10	0	10
Lakhisarai	12	0	12
Madhepura	16	0	16
Madhubani	24	0	24
Munger	11	0	11
Muzaffarpur	28	0	28
Nalanda	41	4	45
Nawada	15	1	16
Pashchim Champaran	18	3	21
Patna	39	26	65
Purbi Champaran	37	1	38
Purnia	19	0	19
Rohtas	19	1	20
Saharsa	18	0	18
Samastipur	24	3	27
Saran	38	3	41
Sheikhpura	11	1	12
Sheohar	5	0	5
Sitamarhi	16	2	18
Siwan	26	2	28
Supaul	25	0	25
Vaishali	29	2	31
Total	817	99	916

Table 1- District wise distribution of water level monitoring stations in Bihar

4.0 Rainfall

Bihar received varied rainfall in 2023-24, impacting groundwater recharge. Kishanganj recorded the highest rainfall (2032.77 mm), while Arwal had the lowest (573.68 mm). The state's rainfall was predominantly monsoon-driven, with 80-90% occurring from June to September. High-rainfall districts (>1000 mm) like Kishanganj, Supaul, and West Champaran experienced significant surface and subsurface recharge. Moderate rainfall zones (700-1000 mm) including Muzaffarpur, Bhagalpur, and Saharsa districts. Low-rainfall districts (<700 mm) such as Bhojpur, may face groundwater deficits, requiring conservation efforts.

Rainfall during Ground Water Assessment Year 2023-24 for Bihar State

DISTRICT	Actual Rainfall (mm)		
	Monsoon	Non-Monsoon	Total
ARARIA	1021.98	299.64	1321.62
ARWAL	503.76	69.92	573.68
AURANGABAD	484.04	112.66	596.70
BANKA	551.96	226.25	778.21
BEGUSARAI	558.08	233.83	791.91
BHAGALPUR	434.65	243.33	677.98
BHOJPUR	550.91	120.95	671.86
BUXAR	443.18	82.67	525.85
DARBHANGA	434.74	225.52	660.26
EAST CHAMPARAN	636.89	205.25	842.14
GAYA	579.94	118.60	698.53
GOPALGANJ	610.60	125.77	736.38
JAMUI	608.50	198.26	806.76
JEHANABAD	428.36	103.70	532.06
KAIMUR	514.29	81.10	595.39
KATIHAR	513.71	340.66	854.37
KHAGARIA	435.37	261.56	696.93
KISHANGANJ	1532.87	499.90	2032.77
LAKHISARAI	432.24	195.33	627.57
MADHEPURA	539.14	278.97	818.11
MADHUBANI	561.49	267.62	829.11
MUNGER	412.17	217.04	629.22
MUZAFFARPUR	722.02	179.26	901.27
NALANDA	523.93	136.86	660.79
NAWADA	556.58	175.41	731.99
PATNA	491.32	123.19	614.51
PURNEA	699.85	335.64	1035.48
ROHTAS	486.12	88.10	574.22
SAHARSA	531.49	275.07	806.56
SAMASTIPUR	550.51	171.09	721.61
SARAN	518.39	86.66	605.04
SHEIKHPURA	463.99	178.43	642.43
SHEOHAR	554.48	110.66	665.14
SITAMARHI	545.84	212.50	758.34
SIWAN	560.61	118.22	678.83
SUPAUL	684.15	272.95	957.10
VAISHALI	612.24	149.95	762.19
WEST CHAMPARAN	749.19	260.44	1009.64

Table 2- Rainfall data for the state of Bihar

5.0 Ground Water Level Scenario

5.1 Unconfined Aquifer

5.1.1 Depth to Water Level Data

The depth to the water table is monitored in 705 dug wells across various districts. Water levels range from 0.2 mbgl in Nalanda district to 15.6 mbgl in Bhagalpur district. The distribution of water levels is as follows:

a) Less than 2 mbgl: 7% of the monitored wells.
b) Between 2 and 5 mbgl: 62% of the monitored wells.
c) Greater than 5 mbgl: 31% of the monitored wells.

It has been observed that in major portion of the state of Bihar (especially in the northern part), the ground water level ranges from 2 to 5 mbgl.

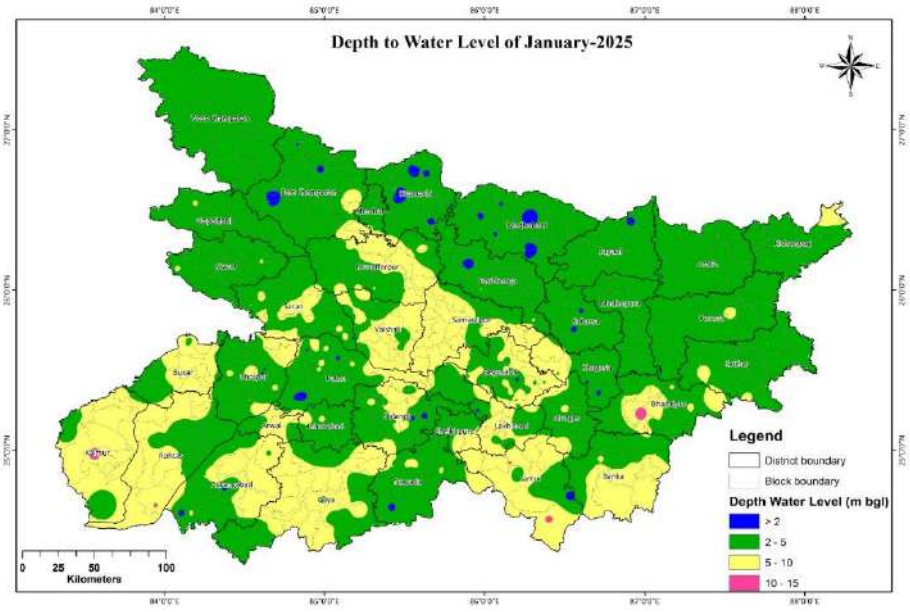

Figure 4- Map showing Depth to Water Level of January 2025

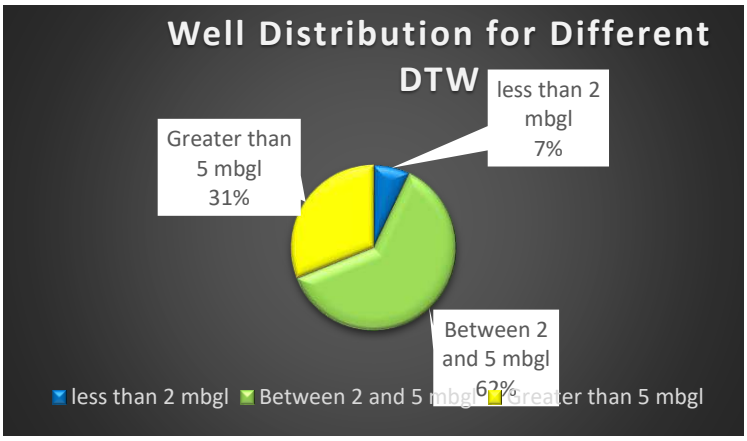

Figure 5- Graph showing well frequency distribution for different ranges of DTWL

5.1.2 Seasonal Fluctuation in Water Level

Seasonal Fluctuation of Water Level in Unconfined Aquifer (May/Pre-monsoon 2024 to January 2025)

Rise in Water Levels:

Out of 558 dug wells considered for analysis, 467 wells (83.7%) showed a rise in water levels. Out of 467 wells, 77% recorded rise of less than 2 meters,it is predominantly observed across Bihar. 19% of wells recorded rise between 2 to 4 meters, while the remaining wells recorded rise of more than 4 meters.

Fall in Water Levels:

Out of 558 dug wells considered for analysis, 91 (16.3%) wells recorded a fall in water levels. Out of 91 wells, 91% showed a decrease of less than 2 meters, which is observed in very small patches throughout the state, 6% recorded a fall between 2 to 4 meters, while the remaining wells recorded a fall of more than 4 meters.

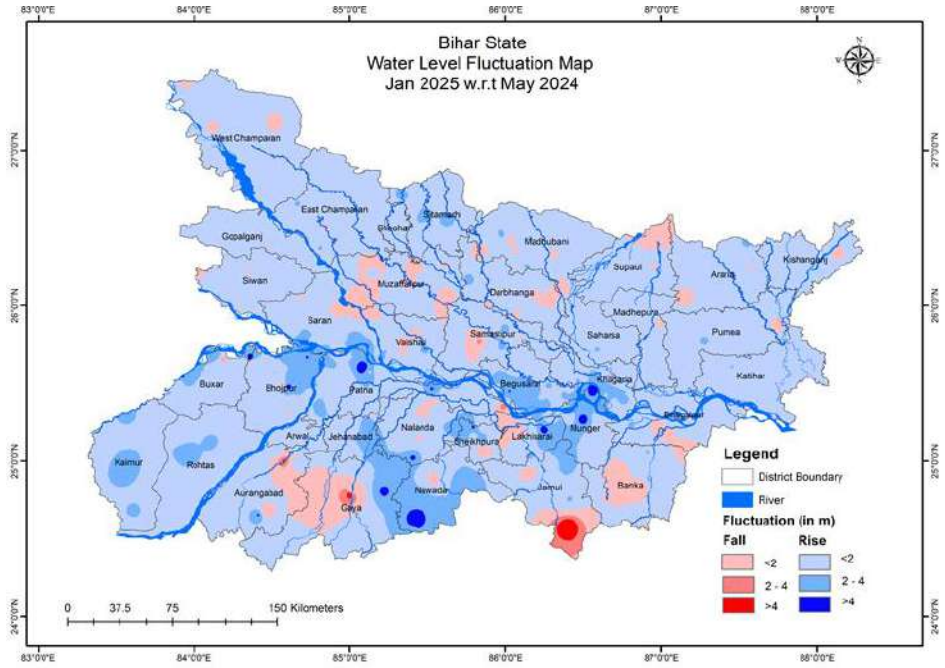

Figure 6- Map showing Seasonal Fluctuation of Water Level in Unconfined Aquifer (May/Pre-monsoon 2024 to January 2025)

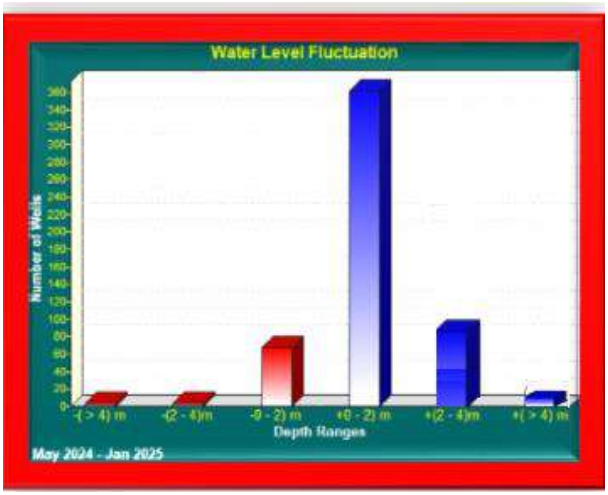

Figure 7- Graph showing Seasonal Fluctuation of Water Level in Unconfined Aquifer (May/Pre-monsoon 2024 to January 2025)

Seasonal Fluctuation of Water Level in Unconfined Aquifer (August 2024 to January 2025)

Rise in Water Levels:

Out of 645 dug wells considered for analysis, 116 wells (18 %) showed a rise in water levels, and out of 116 wells 84 % of wells recorded rise of less than 2 meters and 10% recorded rise between 2 to 4 meters while the remaining wells recorded a rise of more than 4 meters. Rise of less than 2 m are mainly observed in Nawada, Sheikhpura and Nalanda districts.

Fall in Water Levels:

Out of the 645 dug wells analyzed, 529 wells (82 %) recorded a decline in water levels. Out of 529 wells, 70% showed a fall of less than 2 meters, 22% recorded a fall between 2 to 4 meters, while the remaining wells recorded a decline of more than 4 meters. A decrease of less than 2 meters was observed throughout Bihar.

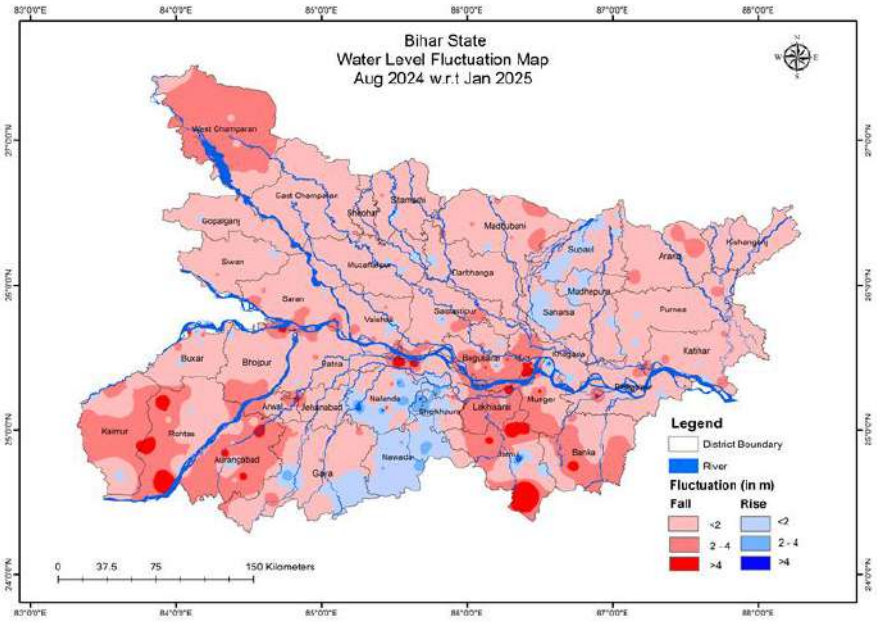

Figure 8- Map showing Seasonal Fluctuation of Water Level in Unconfined Aquifer (August 2024 to January 2025)

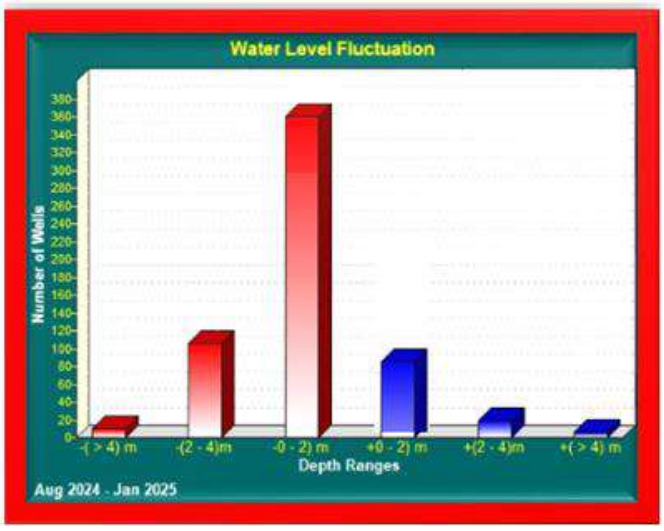

Figure 9- Graph showing Seasonal Fluctuation of Water Level in Unconfined Aquifer (August 2024 to January 2025)

Seasonal Fluctuation of Water Level in Unconfined Aquifer (November 2024 to January 2025)

Rise in Water Levels:

Out of the 618 dug wells considered for analysis, 155 wells (25%) showed a rise in water levels. Out of 155 wells, 93.5% recorded a rise of less than 2 meters, 5.9% recorded a rise between 2 to 4 meters, while 0.6% showed a rise of more than 4 meters. A rise of less than 2 meters is mainly observed in Saharsa and Supaul districts.

Fall in Water Levels:

Out of the 618 dug wells analyzed, 463 wells (75 %) recorded a decline in water levels. Out of 463 wells, 88.6% showed a fall of less than 2 meters, 11% recorded a fall between 2 to 4 meters, and 0.4% showed a decline of more than 4 meters. A fall of less than 2 meters is observed throughout Bihar, while a decline of 2 to 4 meters is mainly observed in Kaimur and Aurangabad districts.

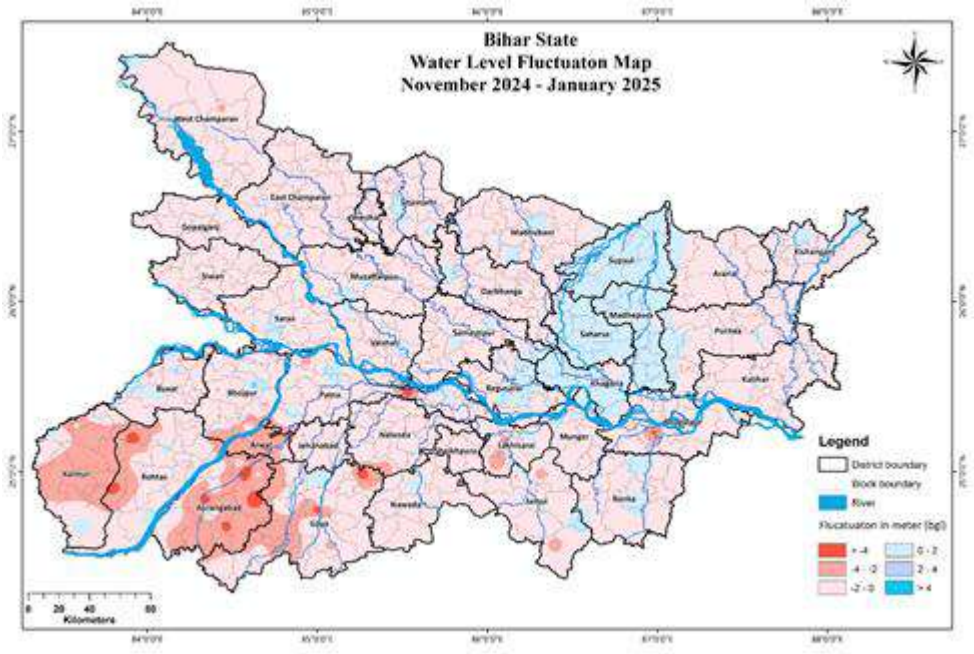

Figure 10- Map showing Seasonal Fluctuation of Water Level in Unconfined Aquifer (November 2024 to January 2025)

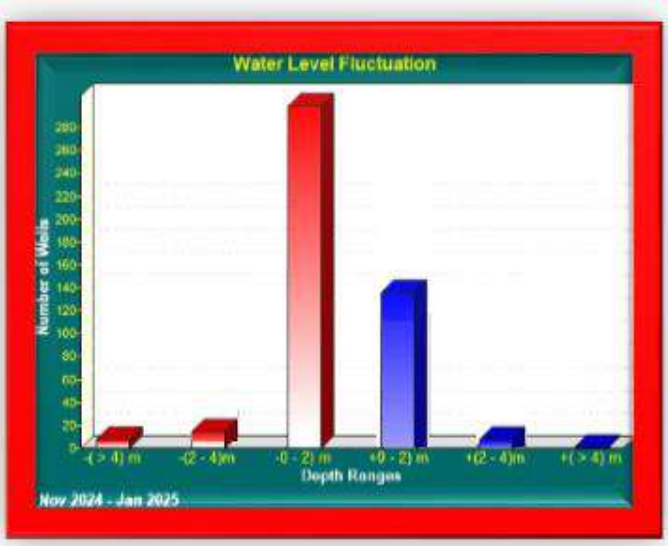

Figure 11- Graph showing Seasonal Fluctuation of Water Level in Unconfined Aquifer (November 2024 to January 2025)

5.1.3 Annual Fluctuation in Water Level

Annual Fluctuation of Water Level in Unconfined Aquifer (January 2024 to January 2025)

Rise in Water Levels:

Out of 520 dug wells considered for analysis, 257 wells (49.4 %) showed a rise in water levels, and out of 257 wells 90 % of wells recorded rise of less than 2 meters and 7 % recorded rise between 2 to 4 meters while rest rise more than 4 meters. Rise of less than 2m are mainly observed in West Champaran, East Champaran, Sitamarhi. Sheohar, Katihar, Purnea and Kishanganj.

Fall in Water Levels:

Out of 520 dug wells considered for analysis, 263 wells (50.6 %) recorded a fall in water levels, and out of the 263 wells 91% of wells showed a fall of less than 2 meters, while 7% recorded between 2 to 4 meters and rest fall more than 4 m. A fall of less than 2 meters was mainly observed in Darbhanga, Vaishali, Kaimur, Rohtas, Banka, Gaya and Aurangabad.

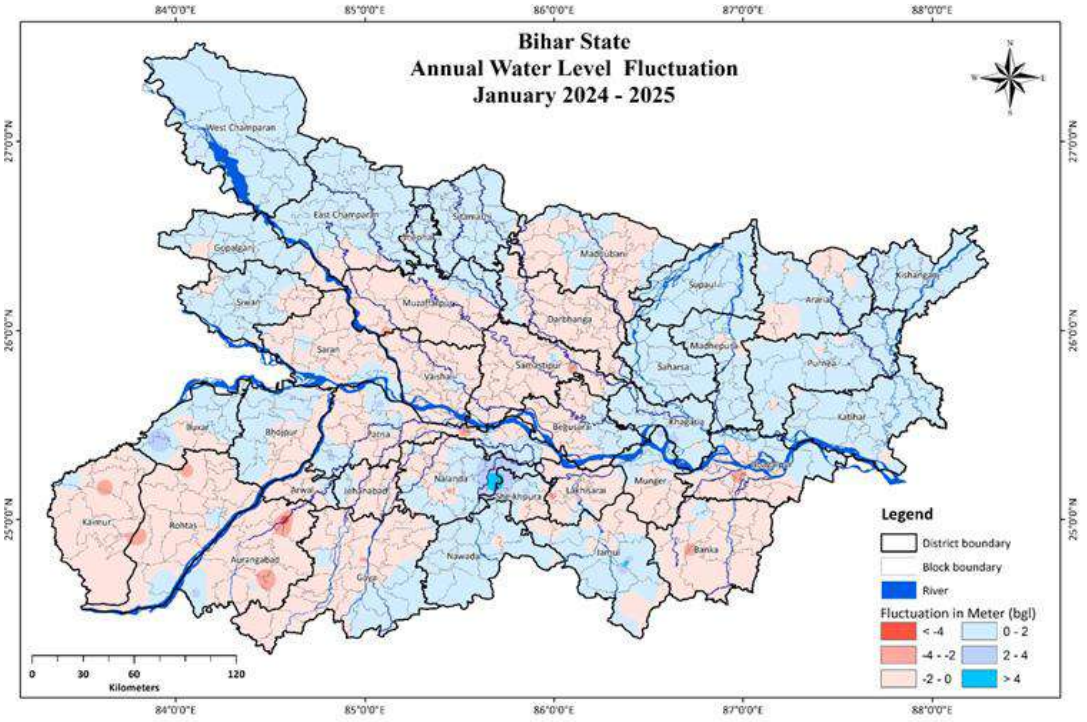

Figure 12- Map showing Annual Fluctuation of Water Level in Unconfined Aquifer (January 2024 to January 2025)

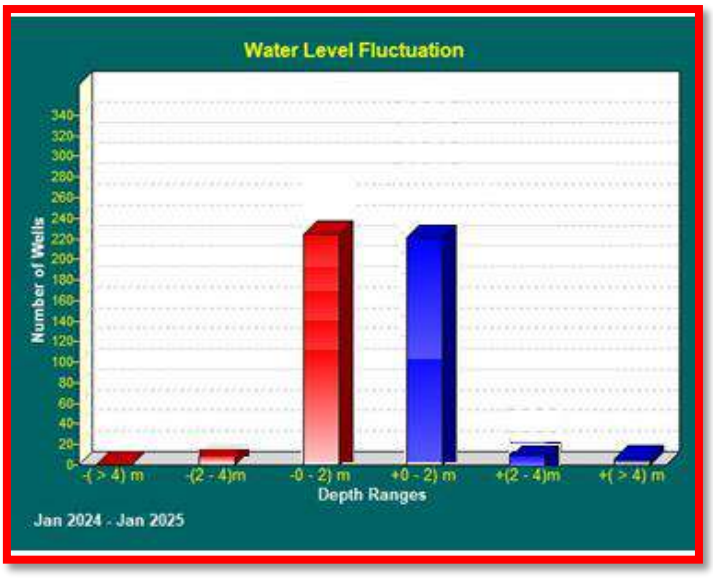

Figure 13- Graph showing Annual Fluctuation of Water Level in Unconfined Aquifer (January 2024 to January 2025)

Annual Fluctuation of Water Level in Unconfined Aquifer (January 2023 to January 2025)

Rise in Water Levels:

Out of 649 dug wells considered for analysis, 275 wells (42.4 %) showed a rise in water levels, and out of 275 wells 85 % of wells recorded rise of less than 2 meters and 10% recorded rise between 2 to 4 meters while rest shows more than 4 meters rise. Rise of less than 2m are mainly observed in Sitamarhi, Madhubani, Supaul, Jamui, Munger and Nawada Districts.

Fall in Water Levels:

Out of the 649 dug wells considered for analysis, 374 wells (57.6 %) recorded a fall in water levels. Out of 374 wells, 87% showed a fall of less than 2 meters, 10% recorded a fall between 2 to 4 meters, and the remaining wells recorded a fall of more than 4 meters. A fall of less than 2 meters was mainly observed in West Champaran, Sarai, Purnea, Saran, Bhojpur, Patna, Katihar, and Banka districts.

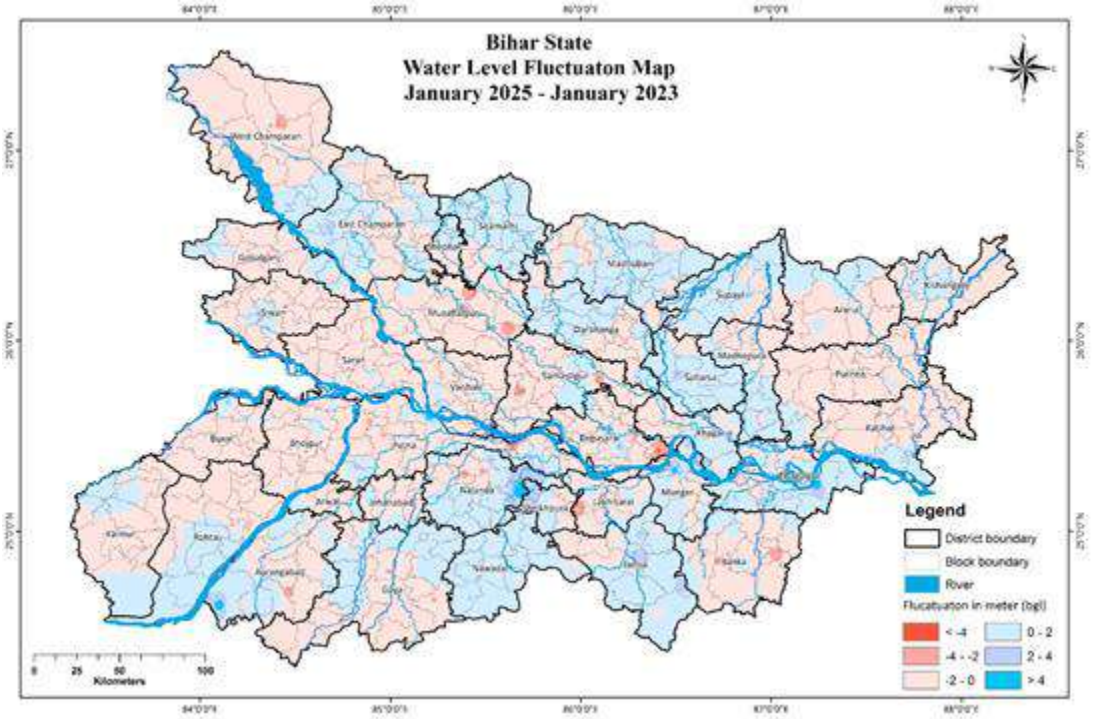

Figure 14- Map showing Annual Fluctuation of Water Level in Unconfined Aquifer (January 2023 to January 2025)

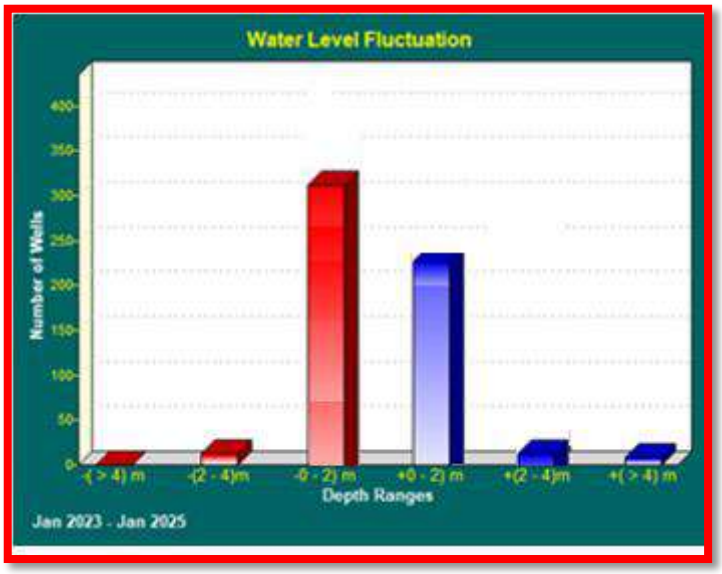

Figure 15- Graph showing Annual Fluctuation of Water Level in Unconfined Aquifer (January 2023 to January 2025)

5.1.4 Decadal Fluctuation in Water Level

Decadal Fluctuation of Water Level in Unconfined Aquifer (Decadal Mean January (2015-2024) to January 2025)

Rise in Water Levels:

Out of the 572 dug wells considered for analysis, 220 wells (38.5 %) showed a rise in water levels. Out of 220 wells, 91% recorded a rise of less than 2 meters, 7% recorded a rise between 2 to 4 meters, while the remaining wells showed a rise of more than 4 meters. A rise of less than 2 meters is mainly observed in Supaul, Saharsa, Khagaria, Munger, Nawada, Sitamarhi, and Sheikhpura districts.

Fall in Water Levels:

Out of the 572 dug wells considered for analysis, 352 wells (61.5 %) recorded a fall in water levels. Out of 352 wells, 92% showed a fall of less than 2 meters, 7% recorded a fall between 2 to 4 meters, and the remaining wells recorded a fall of more than 4 meters. A decrease of less than 2 meters was observed throughout Bihar.

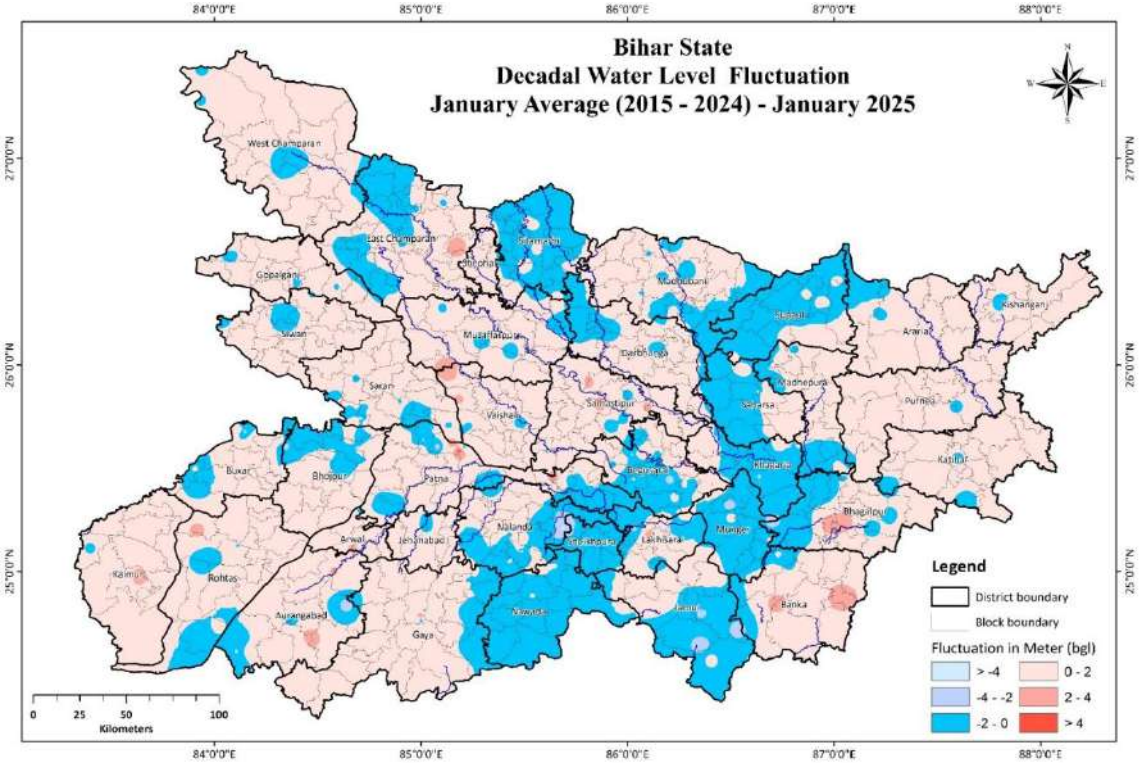

Figure 16- Map showing Decadal Fluctuation of Water Level in Unconfined Aquifer (Decadal Mean January (2015-2024) to January 2025)

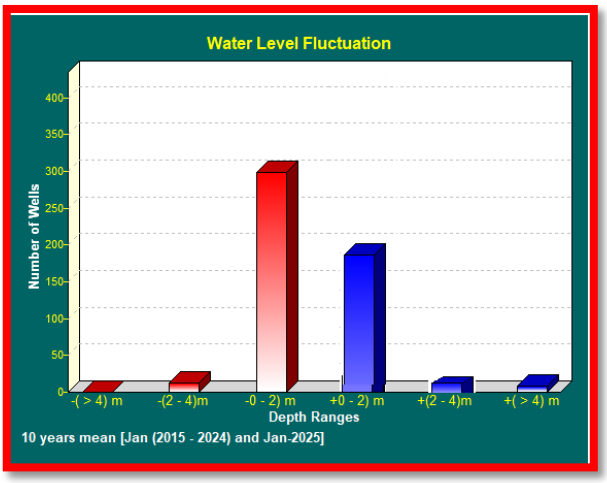

Figure 17- Graph showing Decadal Fluctuation of Water Level in Unconfined Aquifer (Decadal Mean January (2015-2024) to January 2025)

5.2 Confined/Semiconfined Aquifer

5.2.1 Depth to Piezometric Level

The depth to the Piezometric Level is monitored in 68 tube wells across various districts. Water levels range from 2.6 mbgl in Munger district to 15.7 mbgl in Gaya district. The distribution of water levels is as follows:

a) Between 2 to 5 mbgl: 36.76% of the monitored wells.

b) Between 5 to 10 mbgl: 52.65% of the monitored wells.

c) More than 10 mbgl: 20.59% of the monitored wells.

Water levels ranging from 2 to 5 mbgl are predominantly observed in Katihar, Araria, Munger, and Khagaria districts. Water levels between 5 to 10 mbgl are mainly observed in Muzaffarpur, Darbhanga, Saran, Aurangabad, and Banka districts.

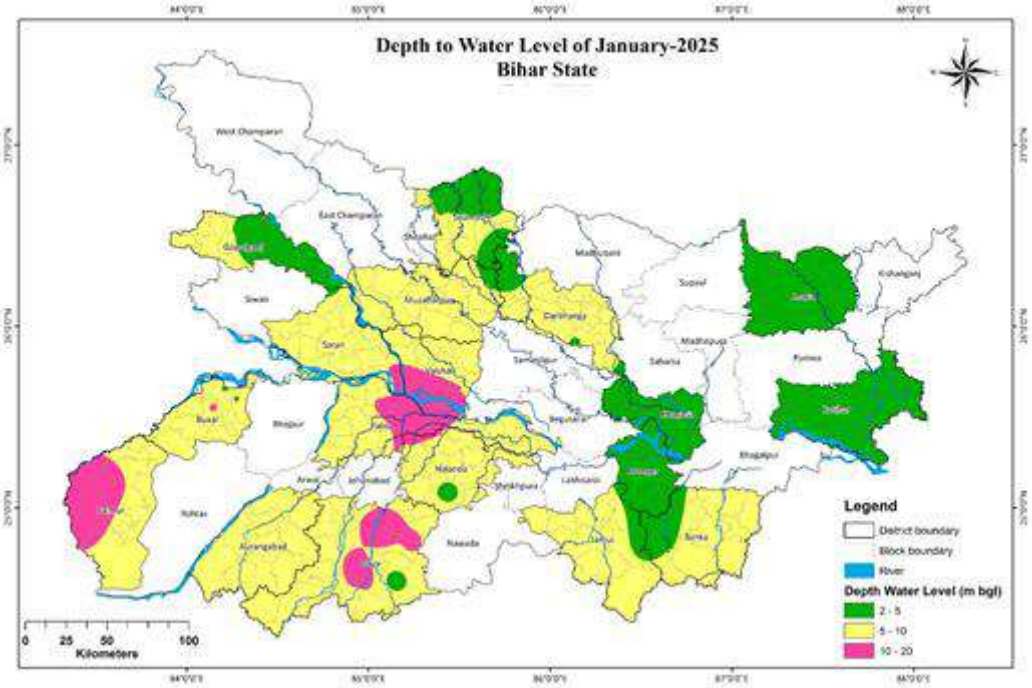

Figure 18- Map showing Depth to Piezometric Level (January 2025)

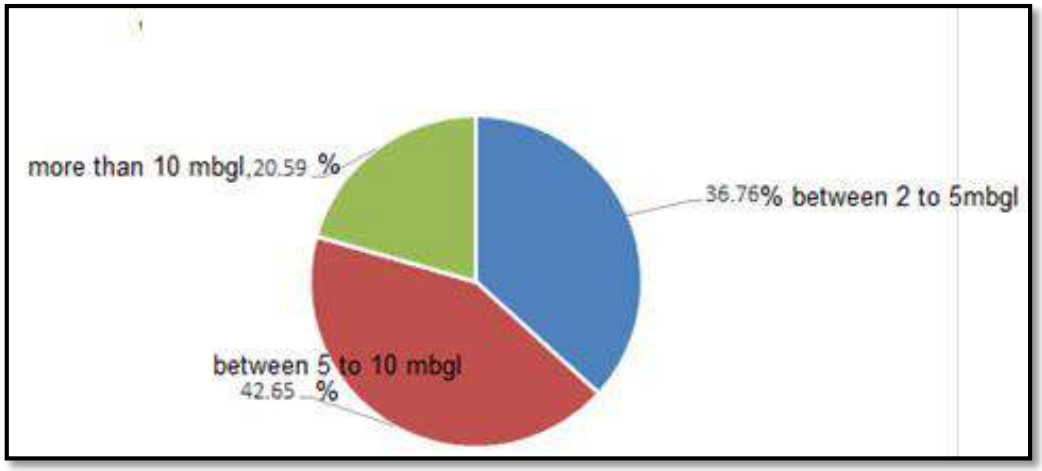

Figure 19- Diagram showing Depth to Piezometric Level (January 2025)

5.2.2 Seasonal Fluctuation in Piezometric level

Seasonal Fluctuation of Piezometric Level in Confined/Semiconfined Aquifer (May/Pre-monsoon 2024 to January 2025)

Rise in Water Levels:

Out of 36 tube wells considered for analysis, 28 wells showed a rise in water levels and out of 28 wells 19 (68%) wells recorded a rise of less than 2 meters and 8 (28%) recorded rise between 2 to 4 meters while one well Deo (Aurangabad) rise more than 4 meters.

Fall in Water Levels:

Out of 36 tube wells considered for analysis, 9 wells showed a fall in water levels, and out of 9 wells 8 (89%) wells recorded fall of less than 2 meters and one well Bikram (Patna) recorded fall between 2 to 4 meters.

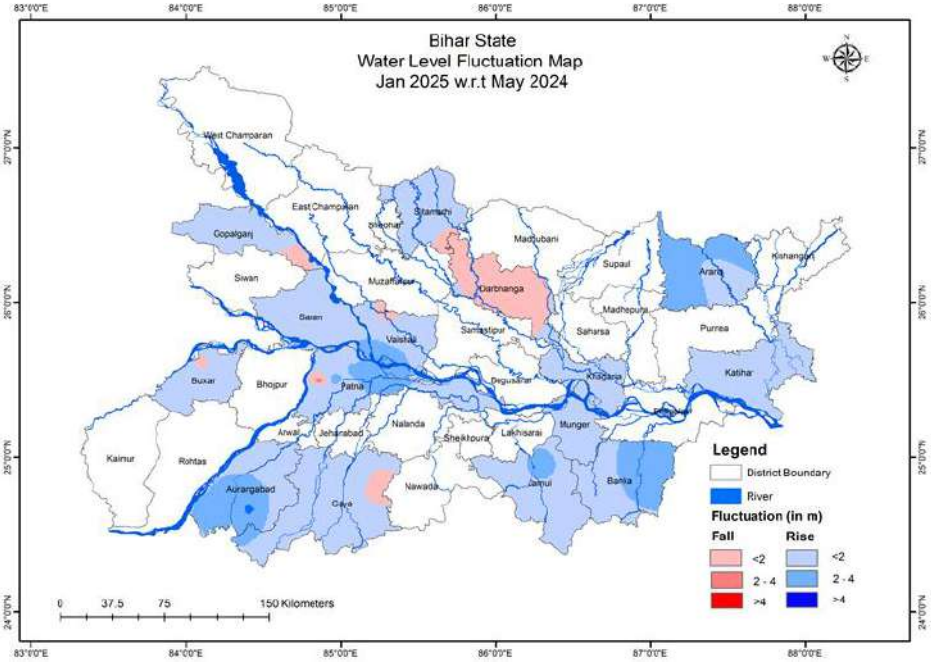

Figure 20- - Map showing Seasonal Fluctuation of Piezometric Level in Confined/Semiconfined Aquifer (May/Pre-monsoon 2024 to January 2025

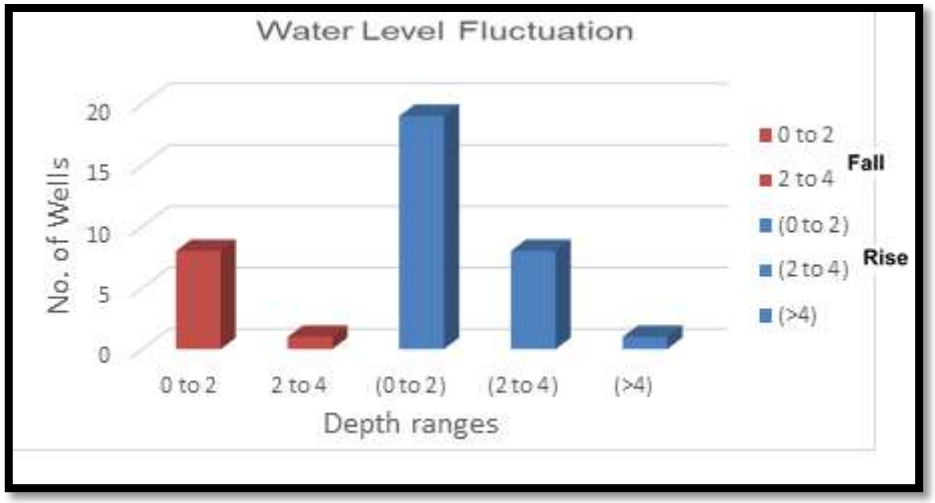

Figure 21- - Graph showing Seasonal Fluctuation of Piezometric Level in Confined/Semiconfined Aquifer (May/Pre-monsoon 2024 to January 2025

Seasonal Fluctuation of Piezometric Level in Confined/Semiconfined Aquifer (August 2024 to January 2025)

Rise in Water Levels:
Out of 28 wells 3 wells viz. Amas(Gaya), Simri (Buxar), Sonbarsa(Sitamarhi) shows rise in water level less than 2 meters.

Fall in Water Levels:
Out of 28 tube wells considered for analysis, 25 wells showed a fall in water levels, and out of 25 wells 16 (64%) wells recorded an decrease of less than 2 meters and 6 (24%) recorded an decrease between 2 and 4 meters while rest fall more than 4 meters

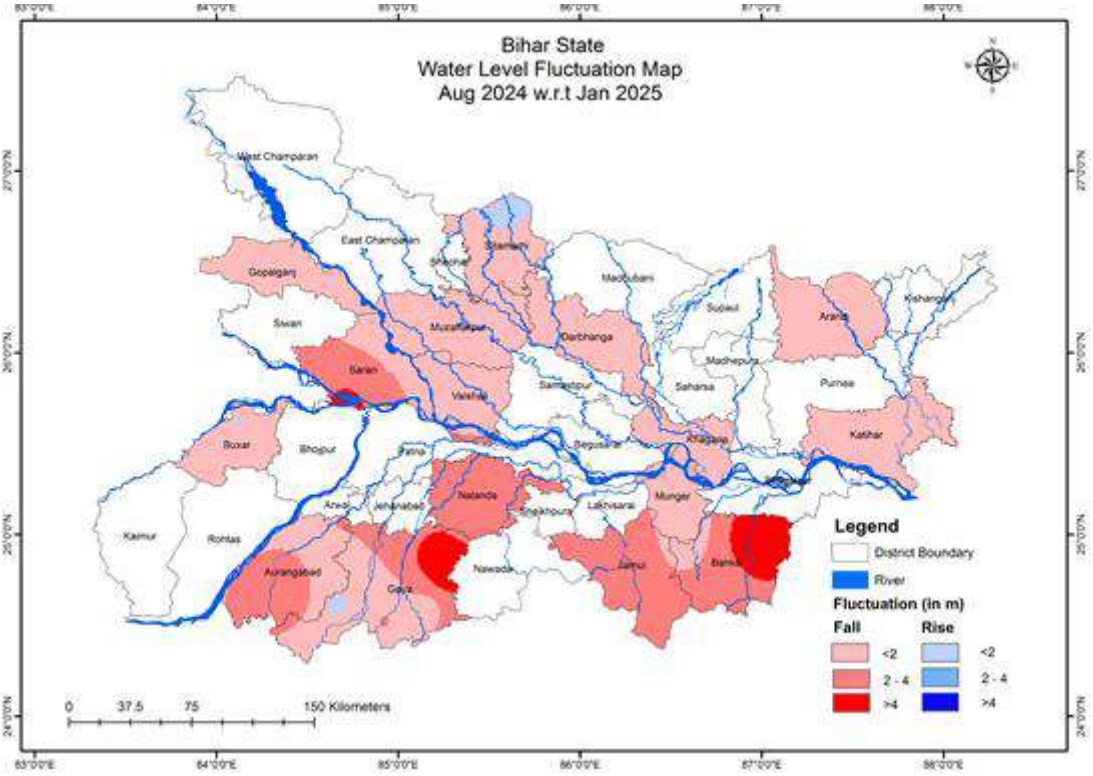

Figure 22- - Map showing Seasonal Fluctuation of Piezometric Level in Confined/Semiconfined Aquifer (August 2024 to January 2025)

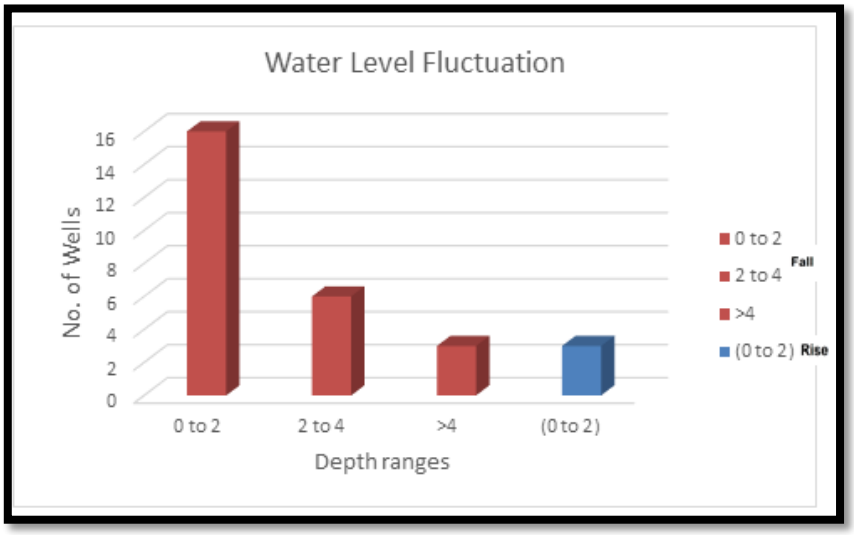

Figure 23- Graph showing Seasonal Fluctuation of Piezometric Level in Confined/Semiconfined Aquifer (August 2024 to January 2025)

Seasonal Fluctuation of Piezometric Level in Confined/Semiconfined Aquifer (November 2024 to January 2025)

Rise in Water Levels:
Out of 24 wells 4 wells viz. Baikunthpur(Gopalganj), Simri (Buxar), Raniganj(Araria) shows rise in water level less than 2 meters.

Fall in Water Levels:
Out of 24 tube wells considered for analysis, 20 wells recorded a fall in water levels, and out of 20 wells 13 (65%) wells recorded fall of less than 2 meters and 5 (25%) recorded fall between 2 to 4 meters while rest fall more than 4 meters

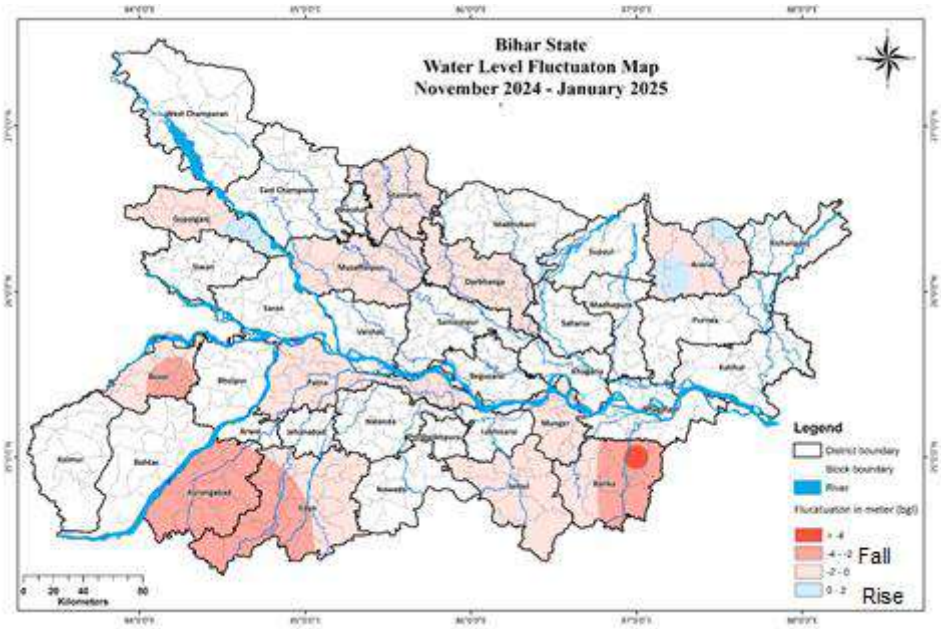

Figure 24- Map showing Seasonal Fluctuation of Piezometric Level in Confined/Semiconfined Aquifer (November 2024 to January 2025)

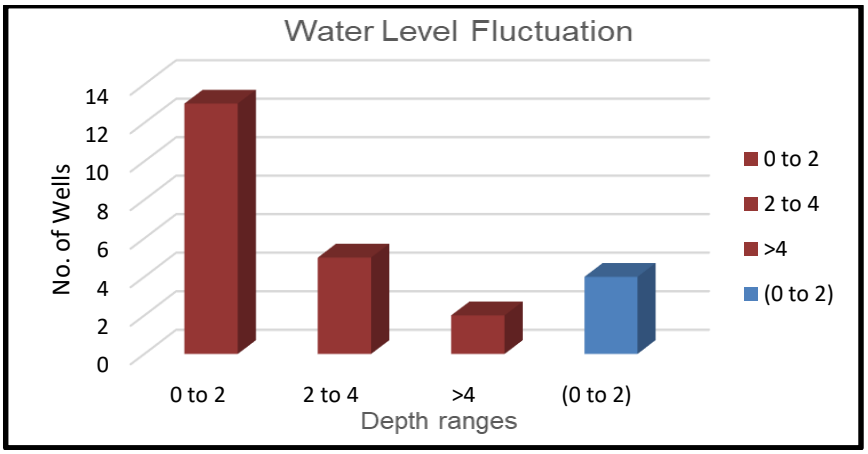

Figure 25- Graph showing Seasonal Fluctuation of Piezometric Level in Confined/Semiconfined Aquifer (November 2024 to January 2025)

5.2.3 Annual Fluctuation in Piezometric Level

Annual Fluctuation of Piezometric Level in Confined/Semiconfined Aquifer (January 2024 to January 2025)

Rise in water Levels

Out of 31 tube wells considered for analysis, 9 wells showed a rise in water levels, and all 9 number of wells showed a rise of less than 2 meters.

Fall in Water Levels:

Out of 31 tube wells considered for analysis, 22 wells recorded a fall in water levels, and out of 22 wells 19 number of wells recorded fall of less than 2 meters and rest wells recorded fall of between 2 to 4 meter

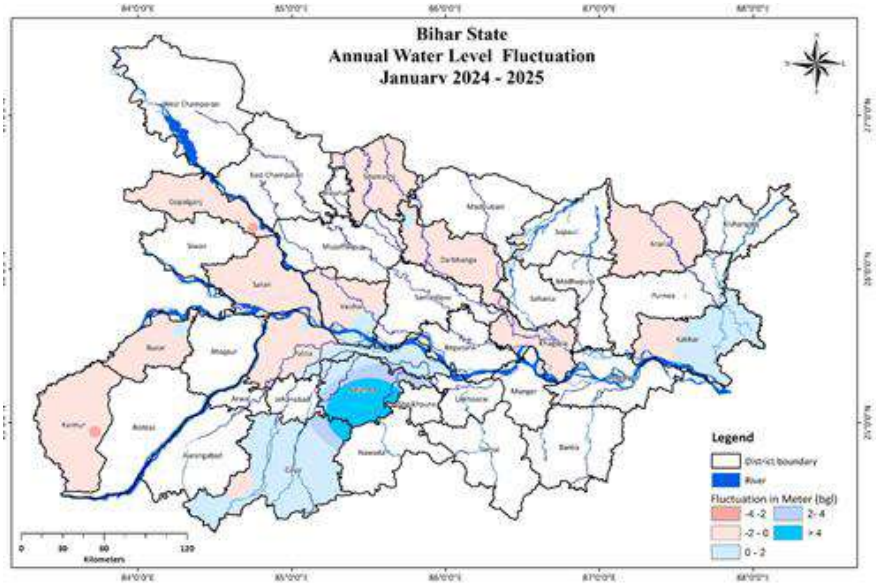

Figure 26 Map showing Annual Fluctuation of Piezometric Level in Confined/Semiconfined Aquifer (January 2024 to January 2025)

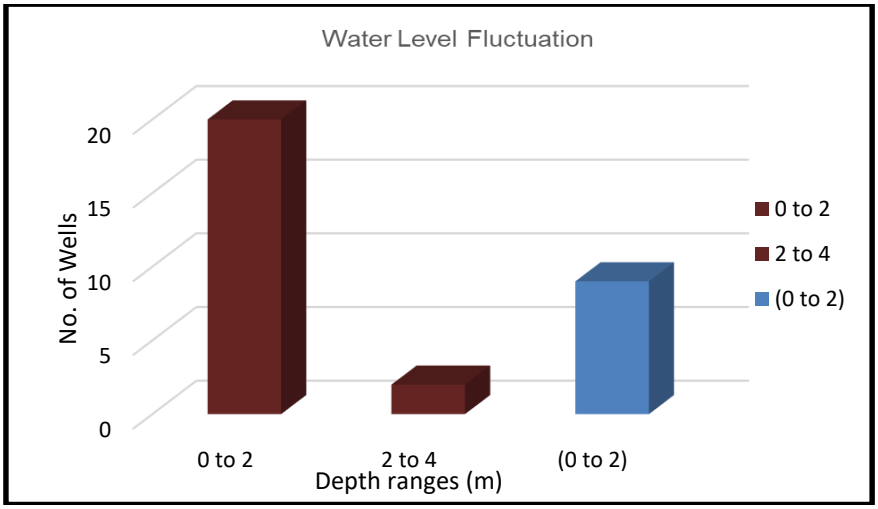

Figure 27 Graph showing Annual Fluctuation of Piezometric Level in Confined/Semiconfined Aquifer (January 2024 to January 2025)

Annual Fluctuation of Piezometric Level in Confined/Semiconfined Aquifer (January 2023 to January 2025)
Rise in Water Levels:

Out of 25 tube wells considered for analysis, 12 wells showed a rise in water levels, and out of 12 wells 7 number of wells recorded rise of less than 2 meters and 3 wells recorded rise of between 2 to 4 meters while rest rise more than 4 meters.

Fall in Water Levels:

Out of 25 tube wells considered for analysis, 13 wells recorded a fall in water levels, and all 13 number of wells showed a fall of less than 2 meters.

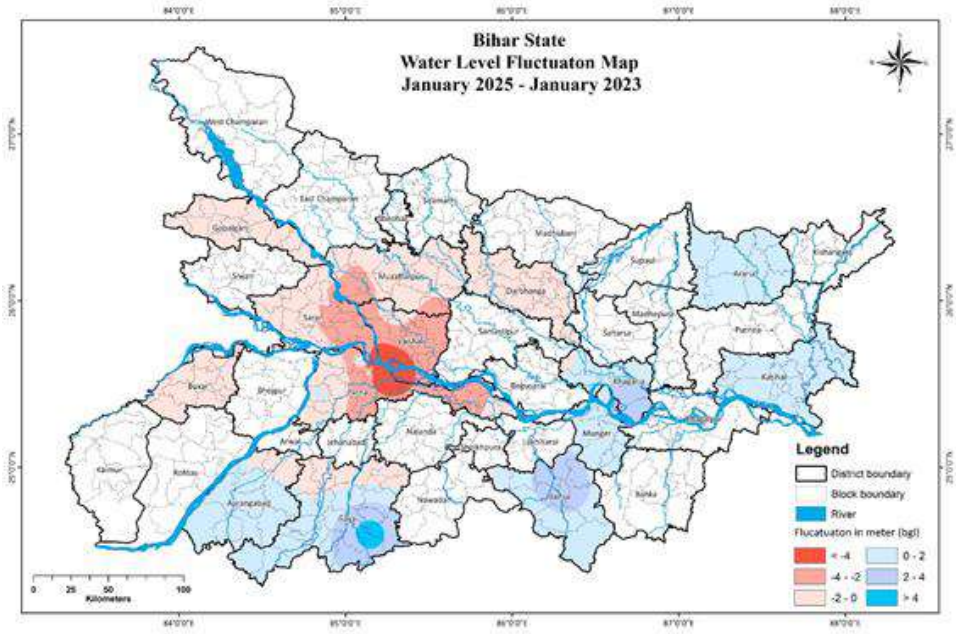

Figure 28 Map showing Annual Fluctuation of Piezometric Level in Confined/Semiconfined Aquifer (January 2023 to January 2025)

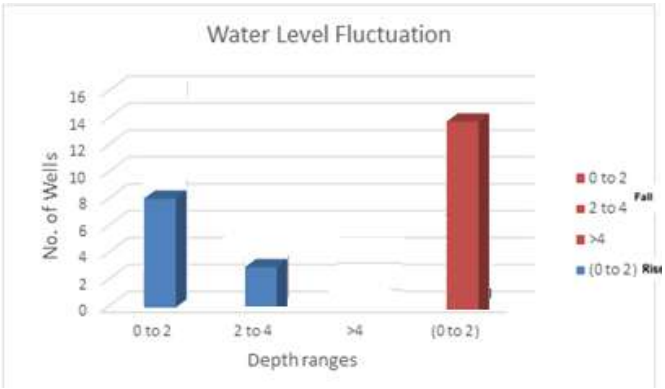

Figure 29 Graph showing Annual Fluctuation of Piezometric Level in Confined/Semiconfined Aquifer (January 2023 to January 2025)

5.2.4 Decadal Fluctuation in Piezometric Level

Decadal Fluctuation of Piezometric Level in Confined/Semiconfined Aquifer (Decadal Mean January (2015-2024) to January 2025)

Rise in Water Levels:

Out of 9 tube wells considered for analysis, none showed a rise in water levels.

Fall in Water Levels:

Out of 8 tube wells considered for analysis, all recorded a fall in water levels. Six wells showed a fall of less than 2 meters, while the remaining two wells recorded a fall between 2 to 4 meters.

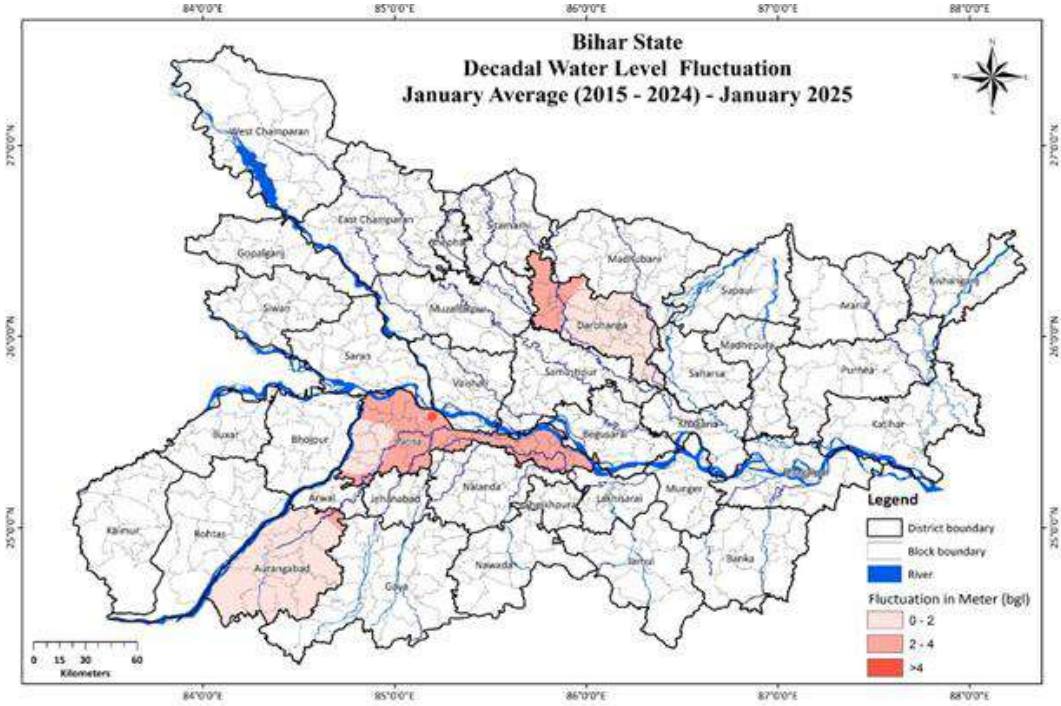

Figure 30 Map showing Decadal Fluctuation of Piezometric Level in Confined/Semiconfined Aquifer (Decadal Mean January (2015-2024) to January 2025)

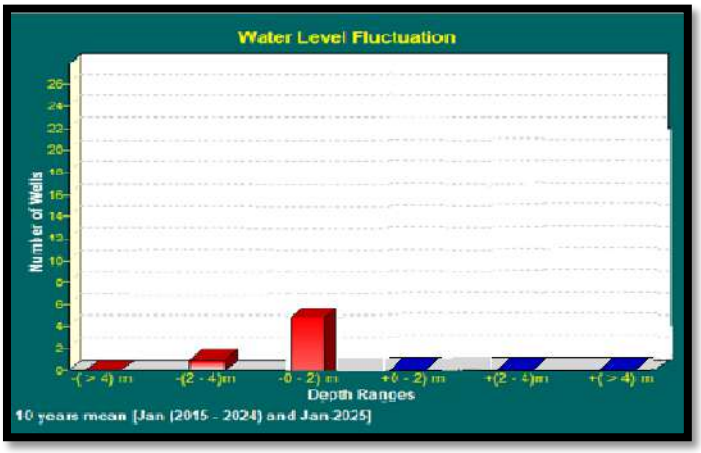

Figure 31 Graph showing Decadal Fluctuation of Piezometric Level in Confined/Semiconfined Aquifer (Decadal Mean January (2015-2024) to January 2025)

Summary

The groundwater monitoring data for Bihar indicates significant seasonal, annual, and decadal fluctuations in both unconfined and confined aquifers. Across 705 monitored dug wells, water levels range from 0.2 mbgl in Nalanda to 15.6 mbgl in Bhagalpur, with the majority (62%) falling between 2 to 5 mbgl in January 2025. Seasonal fluctuations (May 2024–January 2025) show that 77% of wells recorded a rise of less than 2 meters, While 91% of wells show an average decline in water level of less than 2 meters. Similar trends persist in subsequent seasonal and annual analyses, with a predominant rise and fall within the 2-meter range, affecting different districts.

In confined aquifers, Piezometric level monitored through 68 tube wells, Piezometric levels range from 2.6 mbgl in Munger to 15.7 mbgl in Gaya. Seasonal and annual trends indicate a general decline, with most wells showing a fall of less than 2 meters, particularly over the past decade. The analysis highlights localized variations and minor fluctuations in ground water level regime in Bihar.

Recommendations:

Based on the observed groundwater level fluctuations across Bihar, the following recommendations are proposed to ensure sustainable water resource management:

- Encourage rainwater harvesting in urban and rural areas to improve groundwater recharge.
- Conduct awareness campaigns on water conservation techniques for farmers and local communities.
- Provide training programs on sustainable groundwater management and recharge techniques.
- To mitigate water scarcity year-round in areas with low groundwater potential, the conjunctive use of surface water and groundwater should be encouraged.