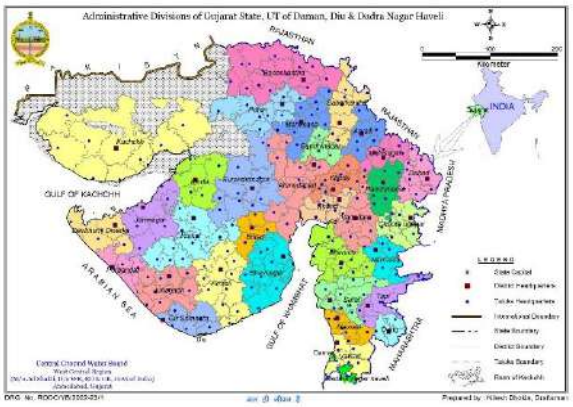
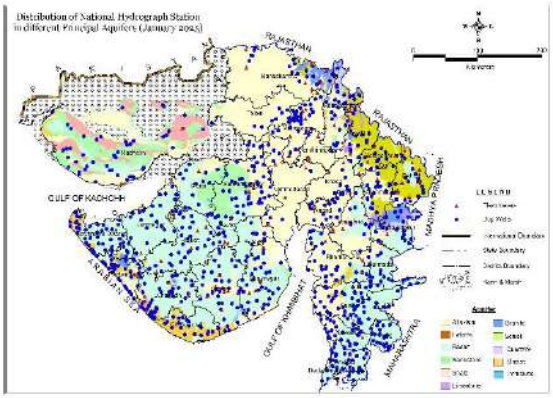
GROUND WATER LEVEL BULLETIN
January 2025
Gujarat





ABSTRACT

Ground water level Scenario during January 2025 highlighting the findings, status of ground water level in different aquifers and its annual and decadal comparison.

CGWB, WEST CENTRAL REGION, GUJARAT

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1. Introduction

Groundwater bulletin is prepared by CGWB, WCR, Ahmedabad 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 pumping 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. Initially, the monitoring commenced in the year 1969 with the establishment of 82 observation wells spread uniformly over the entire state, and since then, the number of stations were added regularly so as to get proper hydrological information of different hydrogeological and geo-morphological units.
A network of observation wells called National Hydrograph Network Stations (NHNS) located all over the Gujarat state is being monitored. Administrative map shown in Fig.-1.

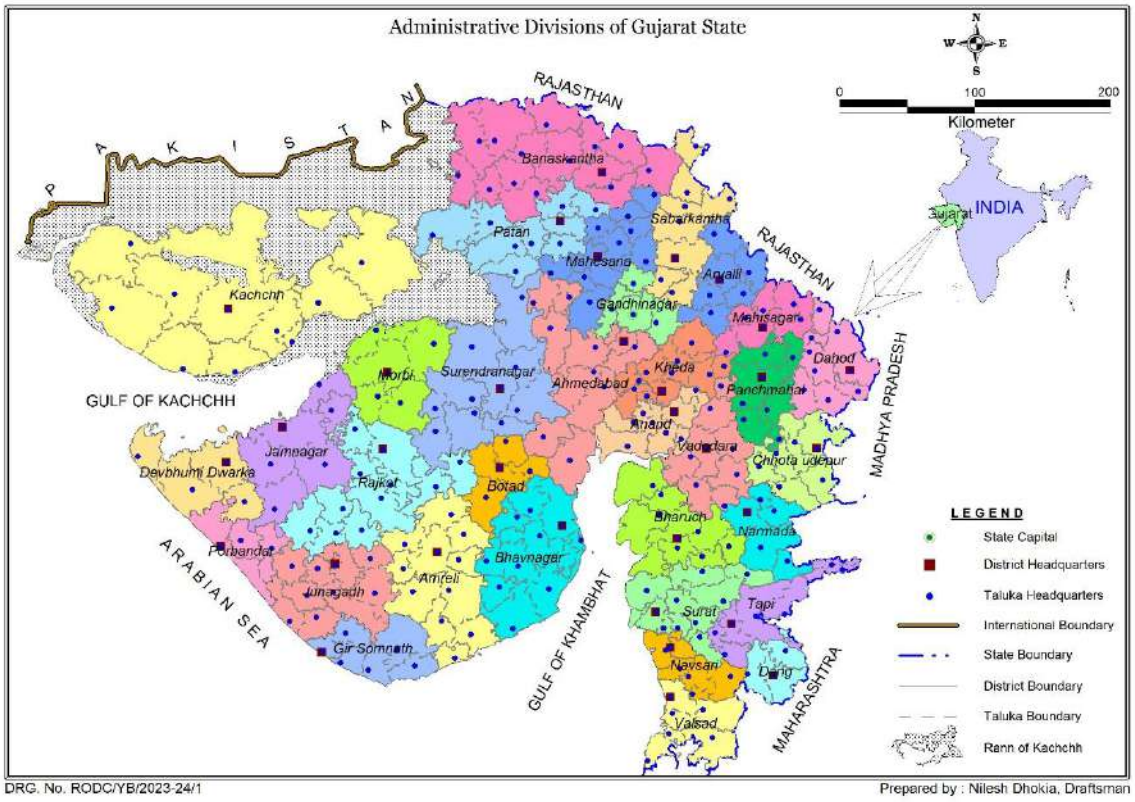

Figure 1: Map showing administrative divisions of Gujarat State

2. Study Area

The Gujarat is one of India's most prosperous states is situated along the western coast of India between North latitudes 20° 06' 00" to 24° 42' 00" and East longitudes 68° 10' 00" to 74° 28' 00" (Figure. 1). It has nearly 1600 km long coastline, which is the longest as compared to any other state in the country. It is extending from Lakhpat in north to Daman in south. The State has common boundaries with the states of Rajasthan, Madhya Pradesh and Maharashtra and shares international border with Pakistan in northwest.

Gujarat is fifth largest state in India by area, covering about 1,96,024 km^2. There are 18,225 villages and 348 towns in Gujarat including 16 towns with more than 1,00,000 populations. The total population is 60,383,628 the state has a sex ratio of 918 females for every 1000 males of which 31,482,282 are males and 28,901,349 are females (2011 census).

Administratively, Gujarat currently has 33 districts. The capital of Gujarat is Gandhinagar, with Ahmedabad as its largest city. Kutch is the largest district of Gujarat while Dang is the smallest. Ahmedabad is the most populated district while Dang is the least. There are 252 Talukas (subdivisions of districts) in Gujarat.

3. Ground Water level monitoring

Central Ground Water Board, as a part of its national program, has established a network of observation wells in the state of Gujarat for periodic monitoring of groundwater levels and to study its quality variation in time and space. WCR, has set up a network of observation wells known as the Ground Water Monitoring Wells (GWMW's) located all over Gujarat. The distributions of monitoring wells in different districts are given in Table 1. Map showing hydrograph stations monitored during the year and their distribution in different basin and the district is presented as Fig. 2.

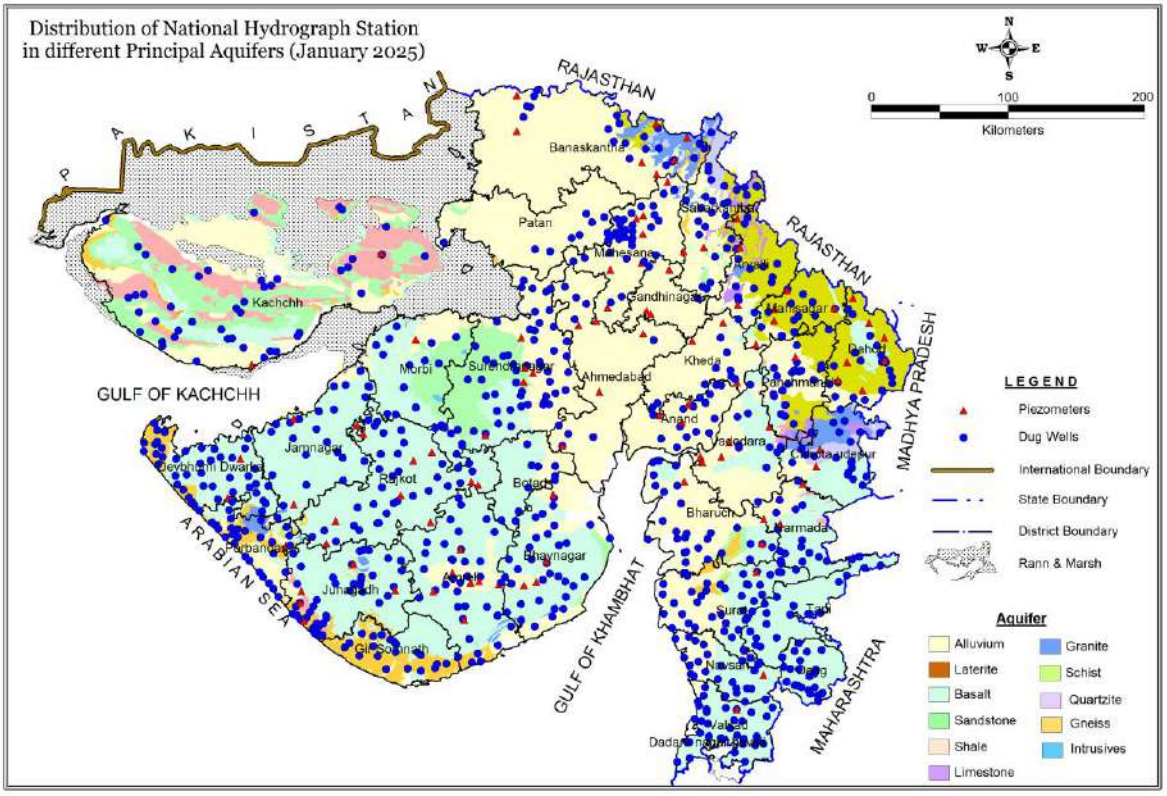

Figure 2 Map showing locations of monitoring wells (NHNS) in Gujarat state

4. Rainfall

Rainfall is the main source of ground water recharge in the Gujarat. However, distribution of rainfall has a wide variation both in space and time. Rain gauge stations are established and maintained by different departments and Undertakings of Central and State governments. The period of seasons varies from place to place, for climatological purposes especially for rainfall, a year is divided into 4 seasons: Winter (January and February), Pre monsoon (March to May), Southwest Monsoon (June to September) and Post Monsoon (October to December). Most part of Gujarat receives rainfall mainly during SW Monsoon season. The rainfall has direct impact on ground water regime. Groundwater table is usually deeper during pre-monsoon

and before the onset of the monsoon and it becomes shallow during monsoon and shortly before the cessation of monsoons.

The annual rainfall shows an erratic rainfall pattern during 2024 which shows high rainfall 3169 mm in south, Valsad District to 665 mm in Banaskatha district, The distribution of rainfall is presented in Isohytal map is presented in Fig:3

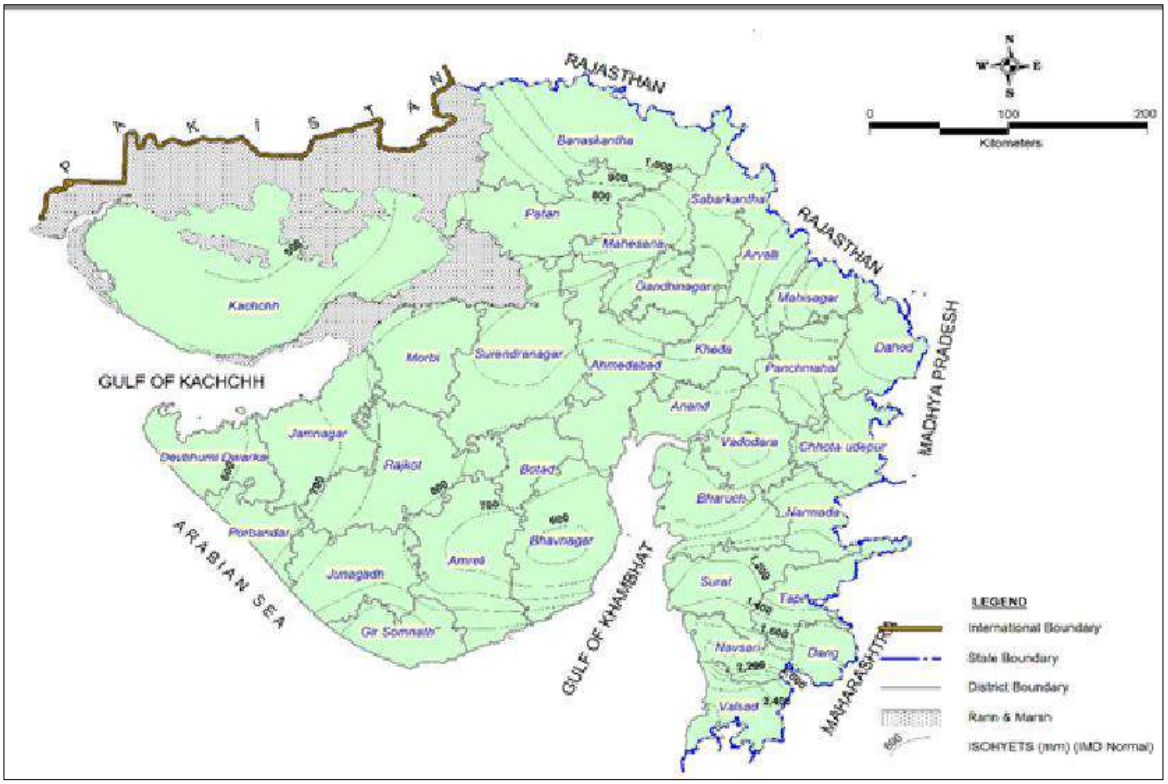

Figure 3 Isohytal Map of Gujarat State

Groundwater Level Scenario

5.1 Unconfined Aquifers

5.1.1 Depth to Water Level in Unconfined Aquifer (January 2025) – Gujarat State

During January 2025 The depth to water level of 877 wells are used for the analysis of unconfined aquifer ranges from 0.12 m bgl to 78.25 m bgl. The perusal of the depth to water map reveals that about 46.6% of the total wells analysed falls in the water level range of 0 to 5 m bgl whereas water level of 5 to 20 m bgl is observed in 49.6% of Gujarat state. Water levels of 20 to 40 m bgl are observed in Anand, Banaskantha, Junagadh, Kheda, Panchmahal, Sabarkantha, Amreli, Bhavnagar, Botad, Narmada, Kachch, Ganhdhinagar Devbhoomi Dwarka and Vadodara districts in isolated patches. The deepest water level more than 40 m bgl is recorded in Banaskantha and Sabarkantha districts of Gujarat State.

Map and graph of Depth to Water Level in Unconfined Aquifer (January 2025) shown in Fig.4 and Fig.5 respectively.

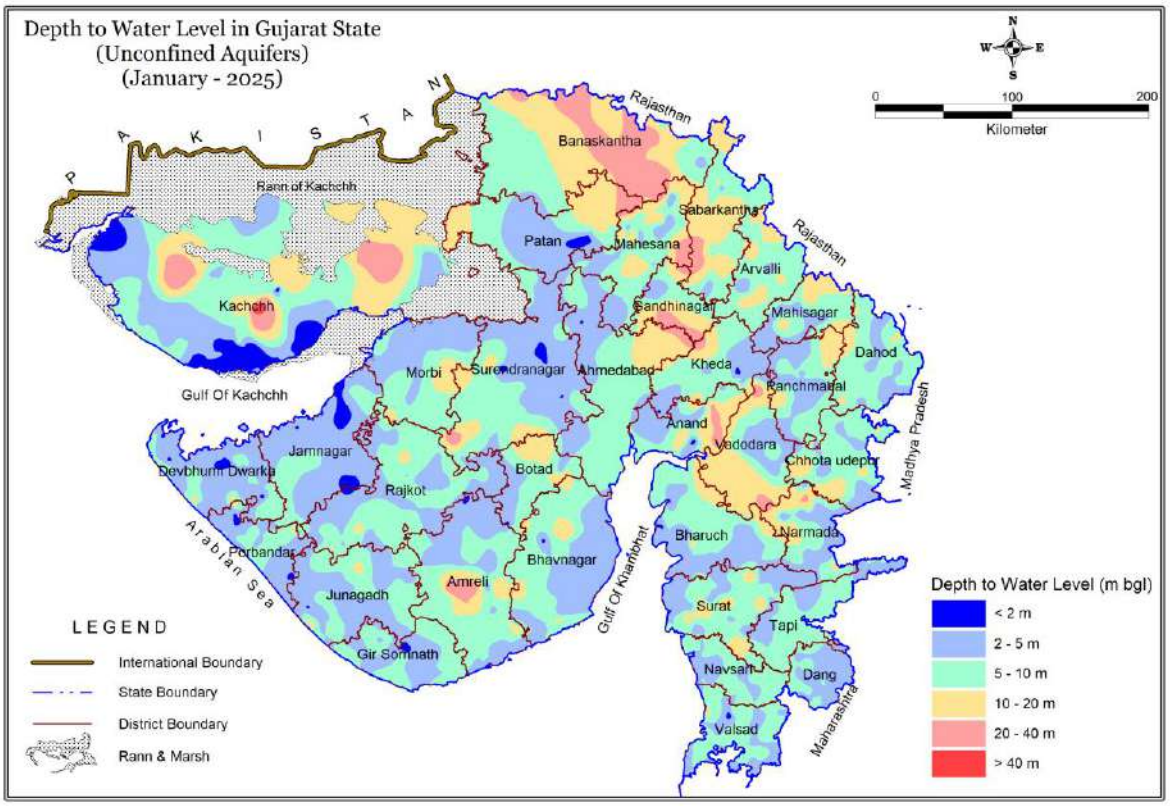

Figure 4: Depth to Water Level in Unconfined Aquifer (January 2025) – Gujarat State

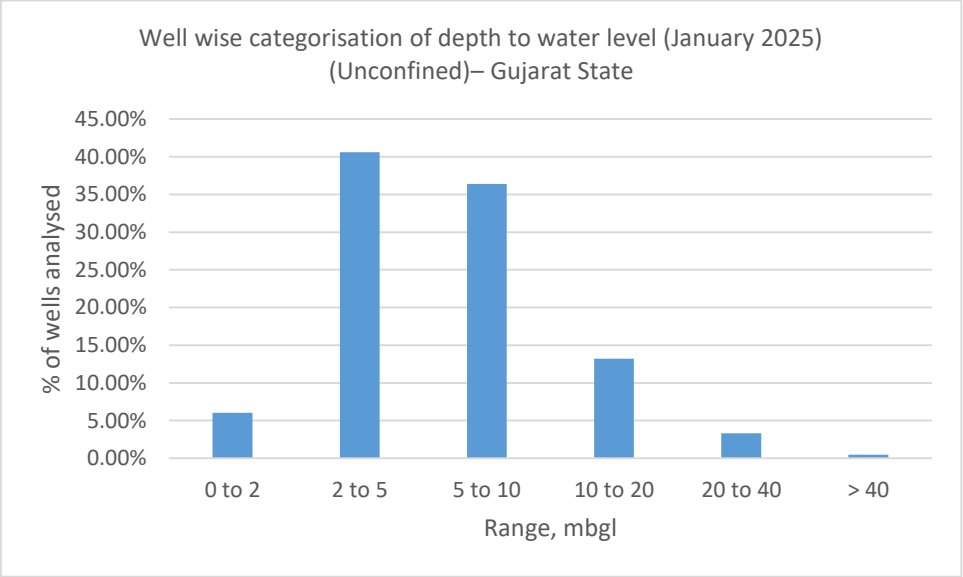

Figure 5: Well wise categorisation of depth to water level (January 2025) (Unconfined) – Gujarat State

5.1.2 Seasonal Water Level Fluctuation

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

In the Gujarat state, seasonal water level fluctuation shows rise in 78% and 21% show fall of the total wells monitored in the Gujarat state area during the May 2024 to January 2025. The maximum rise of 19.42 m is recorded at Junagadh district whereas the maximum decline of 13.19 m is observed in Patan district. Map and graph of Seasonal Water Level Fluctuation (May 2024 to January 2025)- Unconfined Aquifer, Gujarat state shown in Fig.6 and Fig.7 respectively.

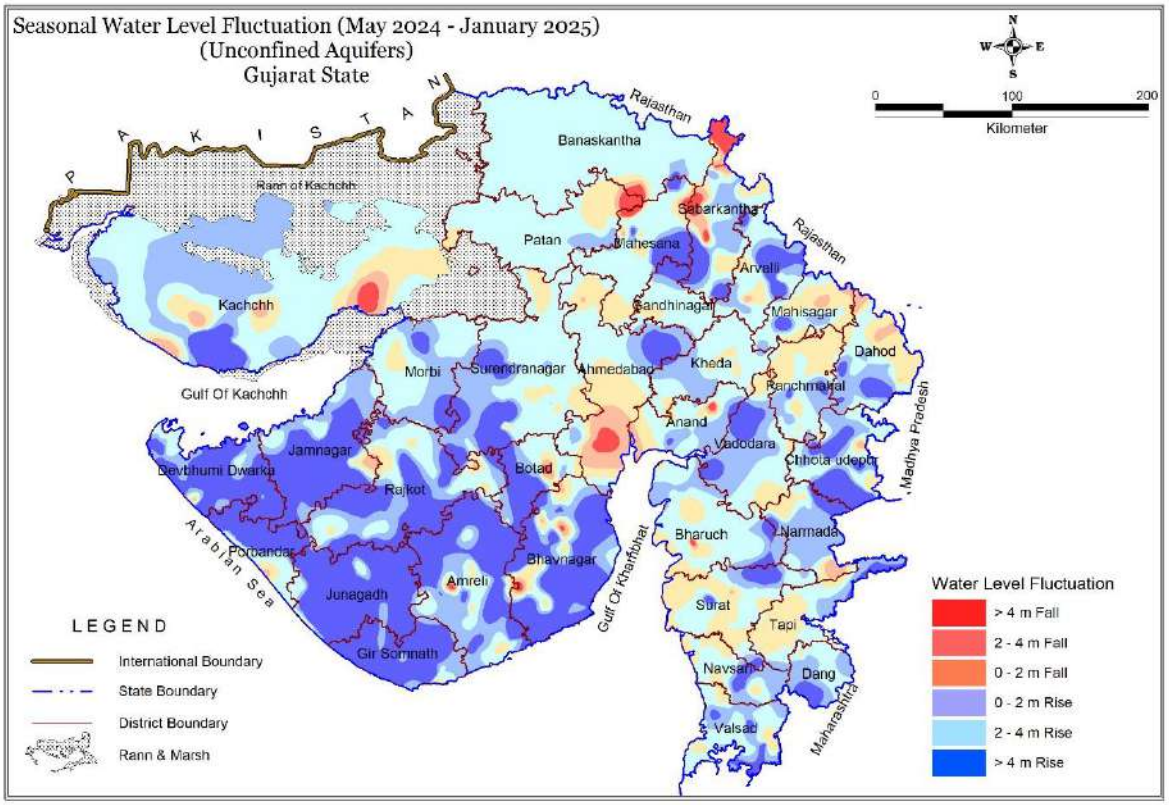

Figure 6: Seasonal Water Level Fluctuation (May 2024 to January 2025)- Unconfined Aquifer, Gujarat state

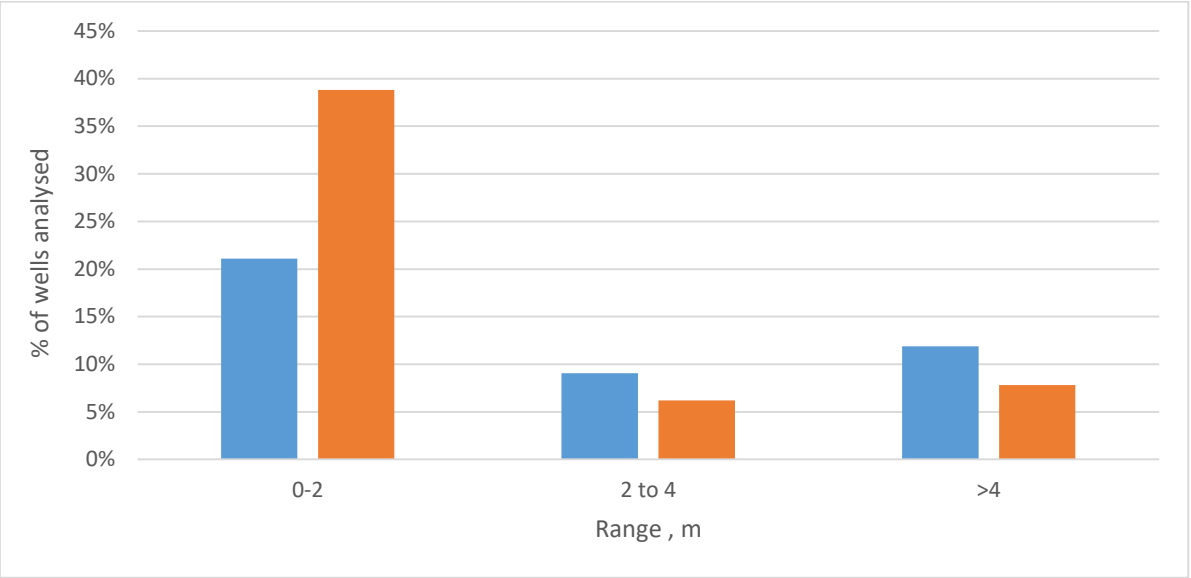

Figure 7: graph of Seasonal Water Level Fluctuation (May 2024 to January 2025)- Unconfined Aquifer, Gujarat state

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

A perusal of Fig. 8 reveals that more than 81.2% of the total wells in Gujarat state show a rise in water level. Rise in water level are observed in the range of 0 to 2 m in 32.9% of wells, 2 to 4 m in 28.3% of well and more than 4 m in 20% of wells monitored in the state of Gujarat. Fall in water level are observed in the range of 0 to 2 m in 11.6% of wells, 2 to 4 m in 3.7% of well and more than 4 m in 3.5% of wells monitored in the state of Gujarat. The maximum rise of 20.58 m is recorded at Anklav2 in Anand district whereas the maximum decline of 24.97 m is recorded at Kewadia_Pz in Narmada district.

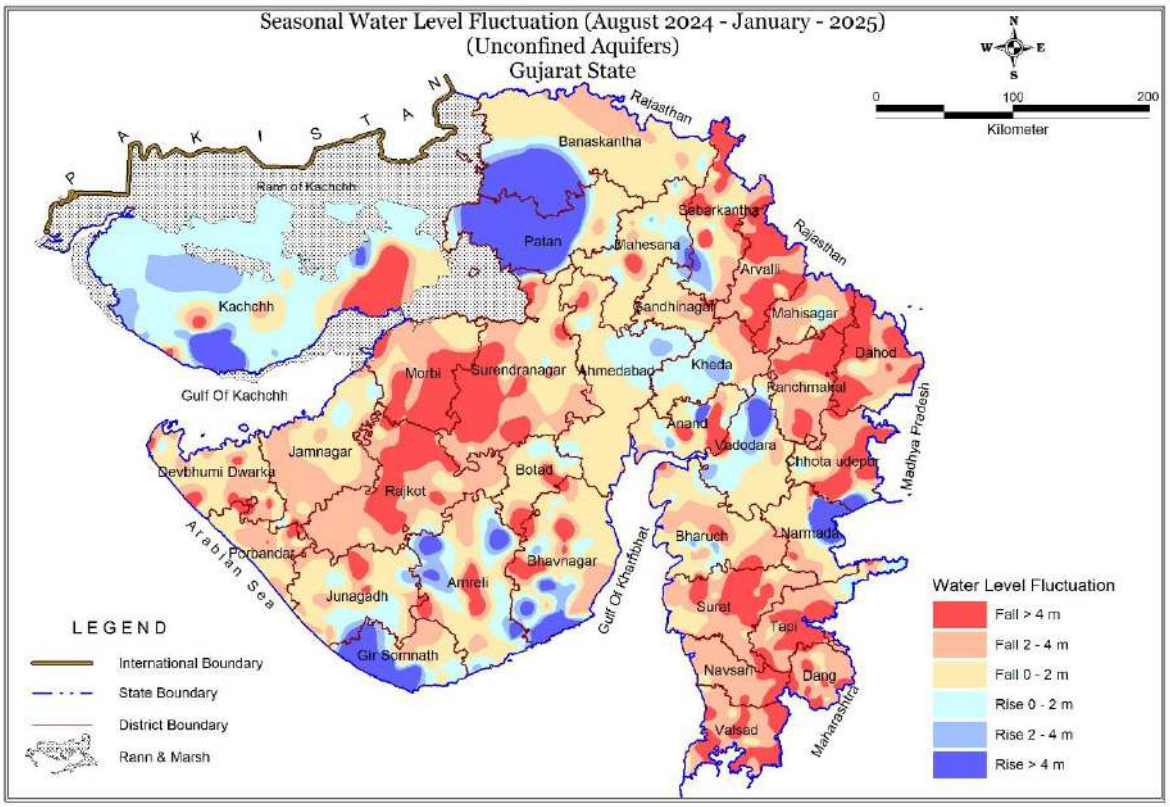

Figure 8: Seasonal Water Level Fluctuation (August 2024 to January 2025) - Unconfined Aquifer

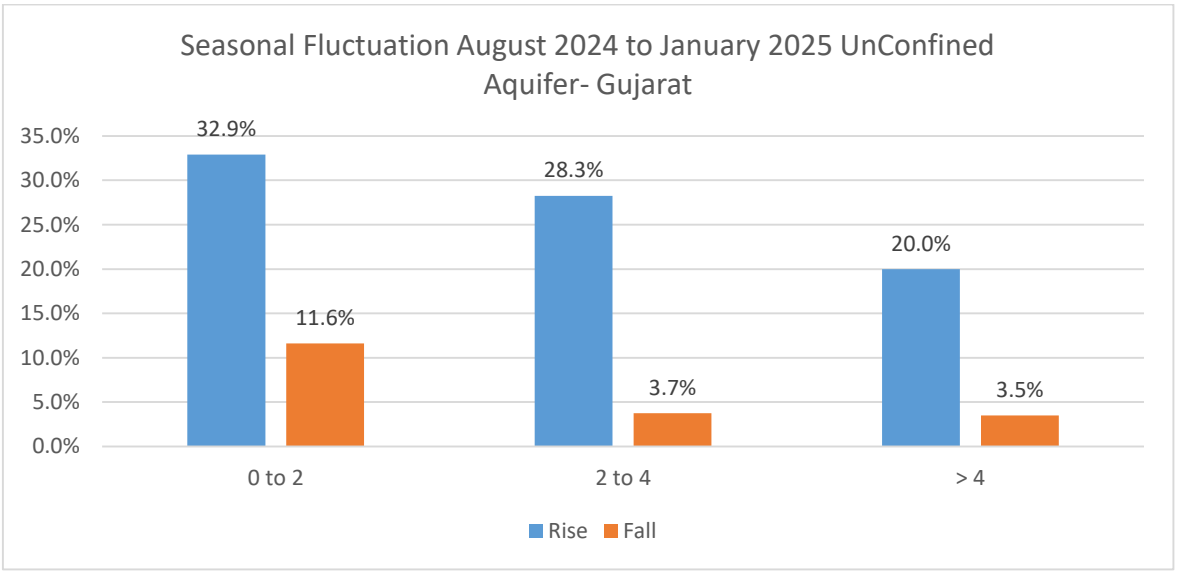

Figure 9 Graph of Seasonal Water Level Fluctuation (August 2024 to January 2025) - Unconfined Aquifer

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

91.8% of the total wells in Gujarat state show a rise in water level. Rise in water level are observed in the range of 0 to 2 m in 51.9% of wells, 2 to 4 m in 23.7% of well and more than 4 m in 16.2% of wells monitored in the state of Gujarat. Fall in water level are observed in the range of 0 to 2 m in 5.6% of wells,

2 to 4 m in 2% of well and more than 4 m in 0.6% of wells monitored in the state of Gujarat. The maximum rise of 15.27 m is recorded at Chokari Pz in Vadodara district whereas the maximum decline of 11.5 m is recorded at Amritvel_Pz in Amerli district. Map and graph shown in Fig.10 and Fig.11 respectively.

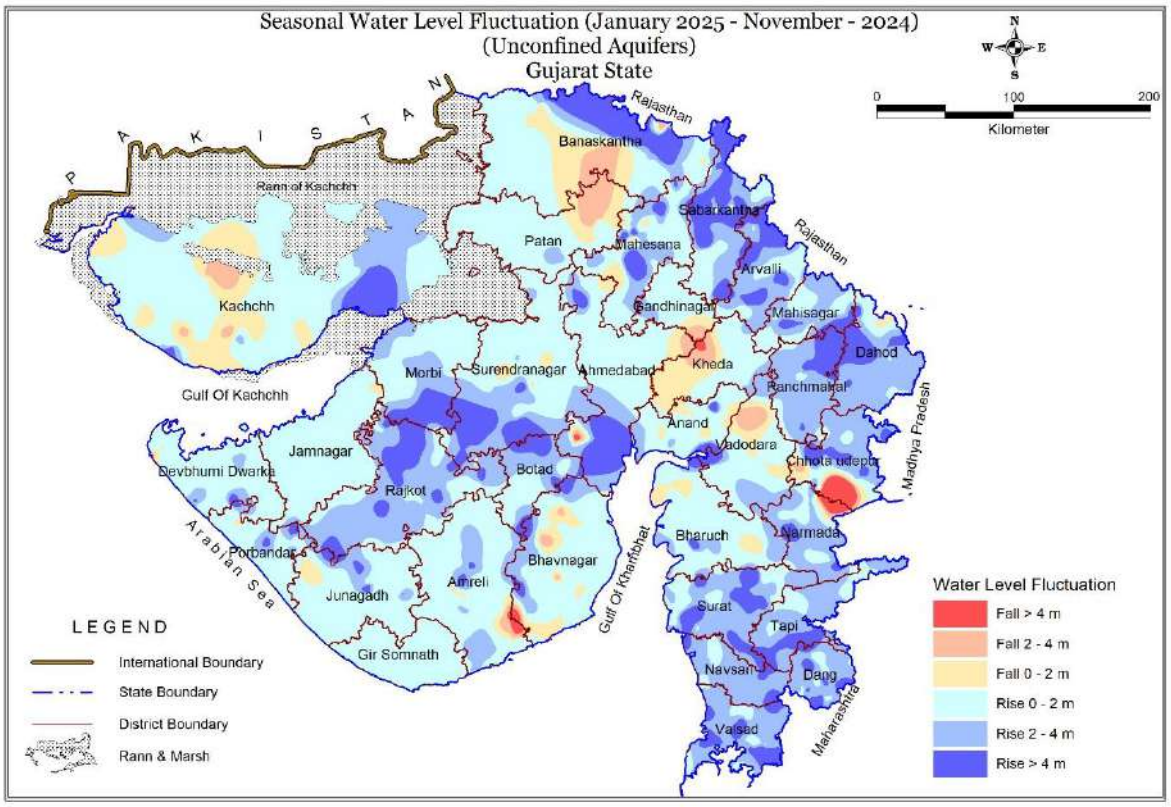

Figure 10 Seasonal Water Level Fluctuation (November 2024 to January 2025) - Unconfined Aquifer

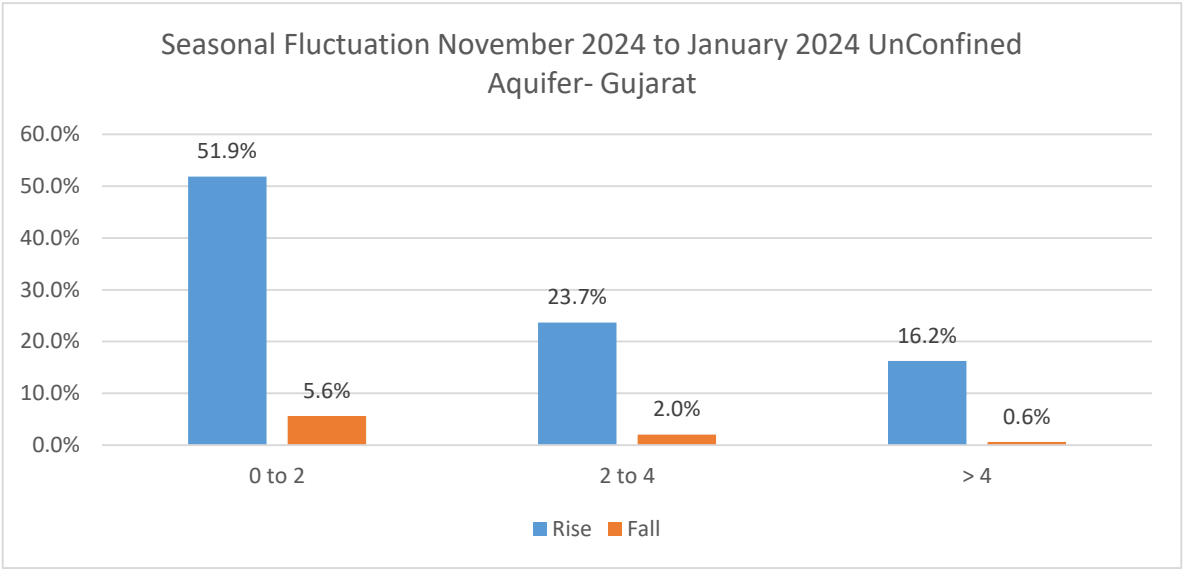

Figure 11 Graph of Seasonal Water Level Fluctuation (November 2024 to January 2025) - Unconfined Aquifer

5.1.3 Annual Water Level Fluctuation

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

Annual Water Level Fluctuation shows, 56% of total monitoring wells show fall and 44% shows rise in water level of the Gujarat state. Rise in water level within the range of 0 to 2 m is observed in about 26.5 %, 2 to 4 m in 7% and more than 4 m in 9% of the total well in the state. Fall in the water level is in the range of less than 2 m and is about 36 % of the total wells. The maximum decline of 23.3 m and the maximum rise of 14.46 m.

Map and graph of Annual Water Level Fluctuation (January 2024 to January 2025)- Unconfined shown in Fig.12 and Fig.13 respectively.

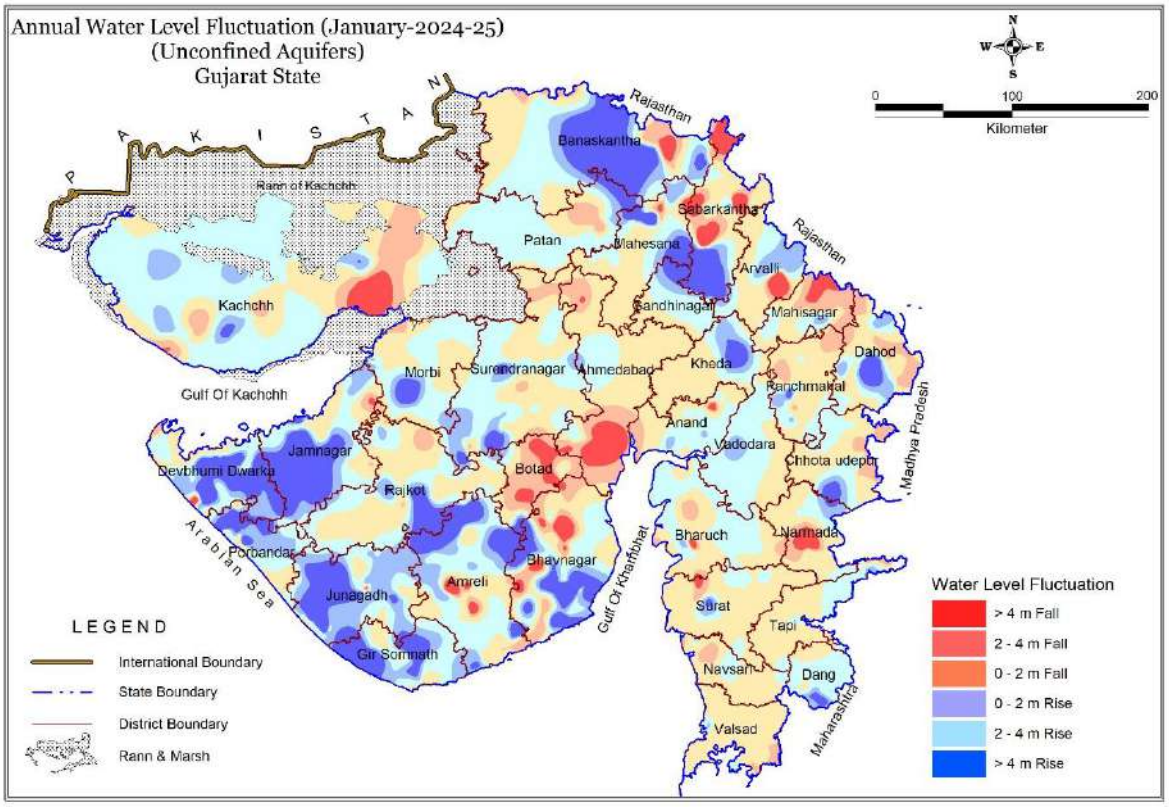

Figure 12; Annual Water Level Fluctuation (January 2024 to January 2025)- Unconfined Aquifer

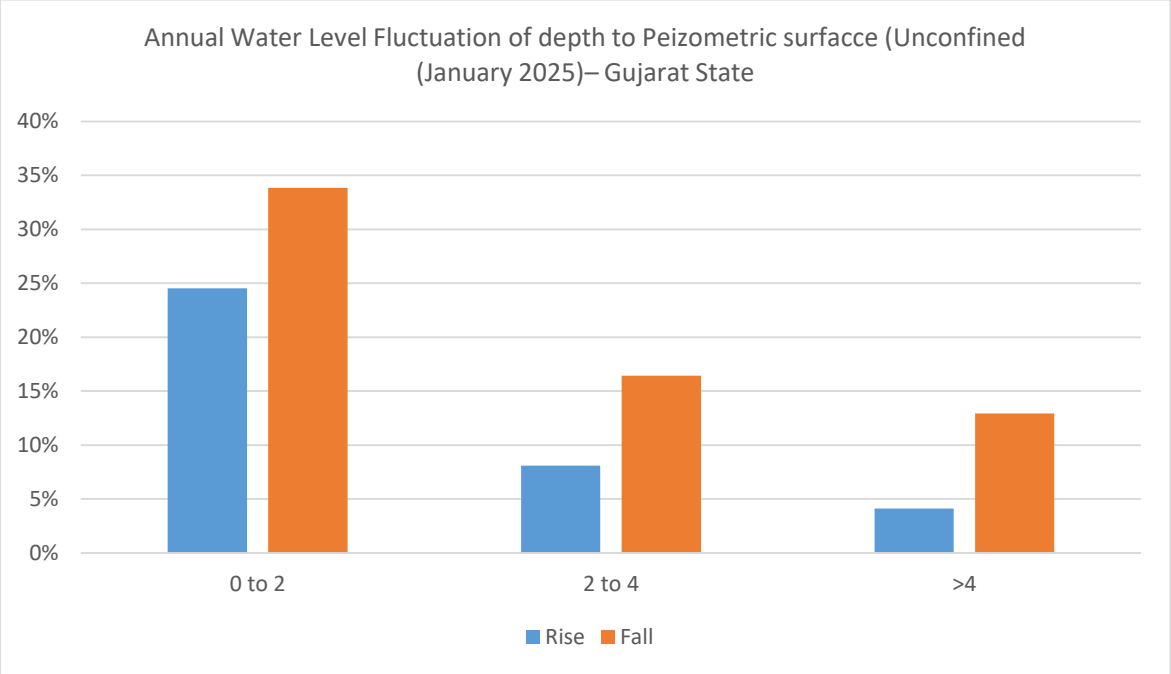

Figure 13 Annual Water Level Fluctuation (Unconfined (January 2024 to January 2025)– Gujarat State

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

About 47.9% of the total monitoring stations of state show a rise in water level. Rise of 0 to 2 m is observed in about 35.8% of total well of the state. More than 4 m rise is observed in 4.5% of total well. Fall in water level is observed mainly in Kachchh, Saurashtra, Northern and Southern part of Gujarat in scattered places. Fall is mainly in the range of 0 to 2 m and covers about 28.3% of total wells of the state. The maximum rise of 13.69 m is recorded in Buhari of Tapi district, whereas the maximum decline of 21.56 m bgl is recorded in Derol Pz-II of Sabar Kantha district.

Map and graph of Annual Water Level Fluctuation (January 2023 to January 2025) - Unconfined Aquifer, Gujarat State shown in Fig.14 and Fig.15 respectively.

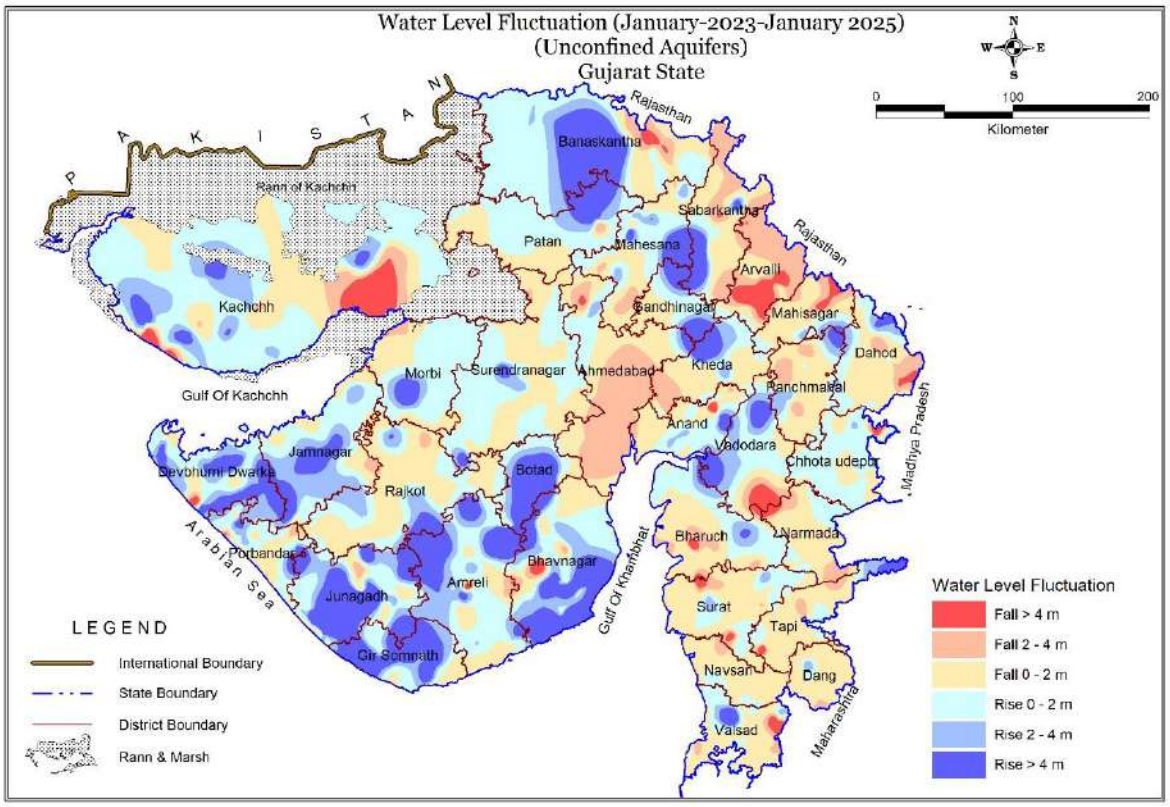

Figure 14 Annual Water Level Fluctuation (January 2023 to January 2025)- Unconfined Aquifer

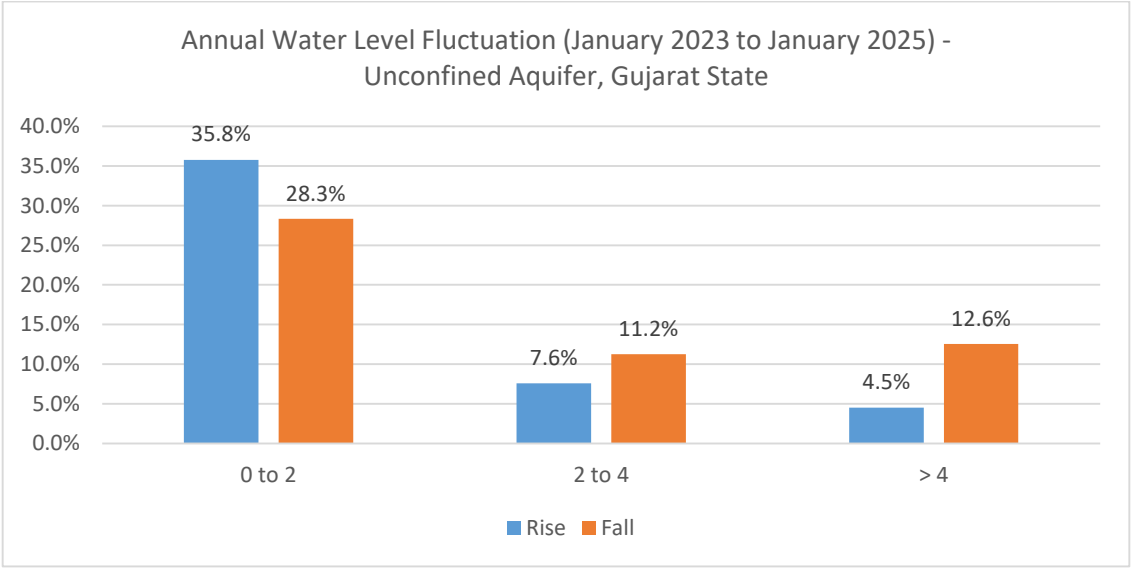

Figure 15 Annual Water Level Fluctuation (Unconfined (January 2023to January 2025)– Gujarat State

5.1.4 Decadal Water Level Fluctuation

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

A comparison of the water level of the January 2025 with the average water level of the January 2025 (2015 to 2024) for last one decade (2014-2023) reveals that there is the rise in 61 % of 819 well analysed. Rise is mostly in the range of 0 to 2 m (30 % of total wells). Fall in water levels is observed in 38.8 % of well analysed. The maximum rise of 19.03 m is recorded in Amreli district whereas the maximum decline of 9.23m is recorded in Kachch district.

Map and graph of Decadal Fluctuation in Unconfined Aquifer Decadal average January (2015 -2024) to January 2025 shown in Fig.16 and Fig.17 respectively.

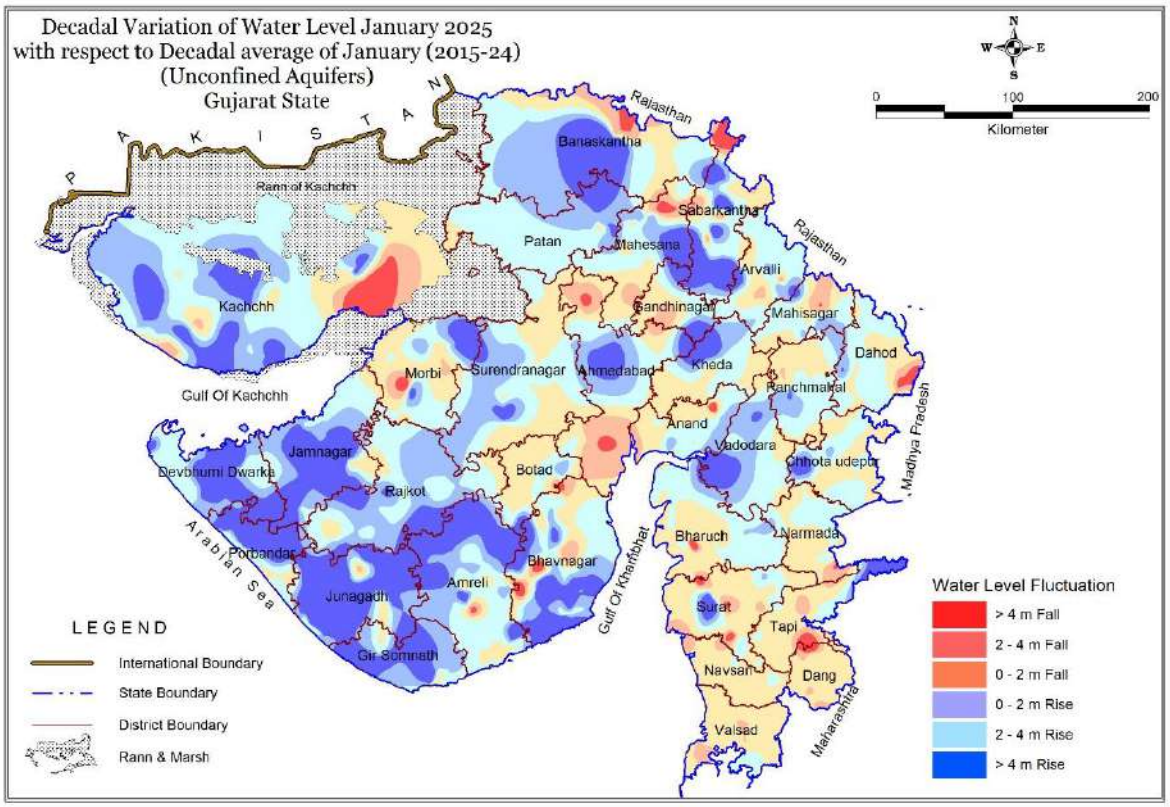

Figure 16: Decadal Fluctuation in Unconfined Aquifer (Decadal average of January (2015 to 2024) to January 2025)

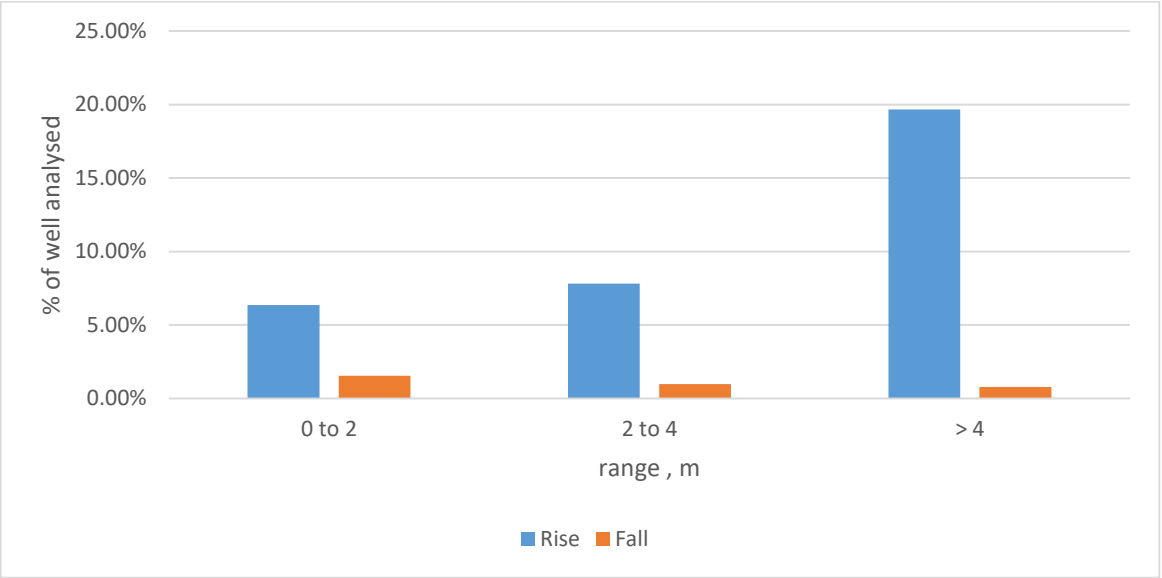

Figure 17: Graph showing Decadal Fluctuation in Unconfined Aquifer (Decadal average of January (2015 to 2024) to January 2025)

5.2 Confined/Semiconfined Aquifer

5.2.1 Depth to Piezometric Level

The depth Peizometric surface shows water levels vary between 0.3 mbgl (Kotaya, Kachchh) to 185.81 m bgl (Takarwada Pz-I, Banaskantha district). Water level of less than 2 m bgl is recorded in 12.1 % of wells, between 2 to 5 m bgl in 16% of wells, between 5 to 10 m bgl in 12.5% of wells, between 10 to 20 m bgl in 8.3 % of wells, between 20-40 m bgl in 10.9% of wells and water level more than 40 m bgl is registered in 40.3 % of wells. Shallow water level of less than 2 m bgl occurs mostly in Chhotaudepur, Surendranagar, Rajkot, Jamnagar, Porbandar, Kachchh district. Water level of 2 to 5 m bgl is observed in Ahmedabad, Chhotaudepur, Bhavnagar, Jamnagar, Junagadh, Panchmahal, Morbi, Rajkot, Surendranagar, and Kachch districts. Water level of 5 to 10 m bgl is observed in Ahmedabad, Anand, Banaskantha, Panchmahal, Narmada, Kachch. Water level of 10 to 20 m bgl significant presence in Ahmedabad, Anand, Banaskantha, Vadodara, Bhavnagar, Kachcha, districts. Water levels of 20-40 m covering mainly Ahmedabad, Anand, Banaskantha, Kheda, Sabarkantha, Vadodara districts. Deeper water level of more than 40 m covering districts of Ahmedabad, Banaskantha, Ghandhinagar, Mahesana, Patan, Kuchch districts. Map and graph of Depth to Peizometric surface in Confined Aquifer (January 2025) shown in Fig.18 and Fig.19 respectively.

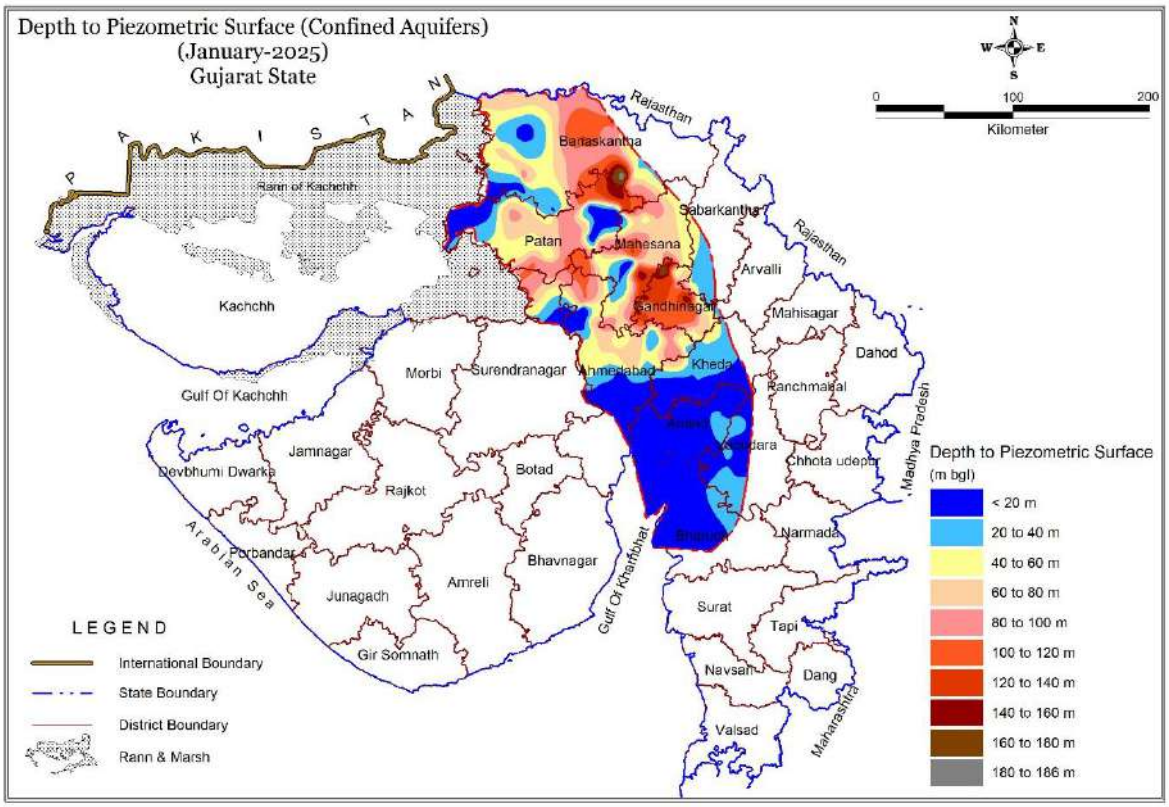

Figure 18: Depth to Peizometric surface in Confined Aquifer (January 2025) - Gujarat State

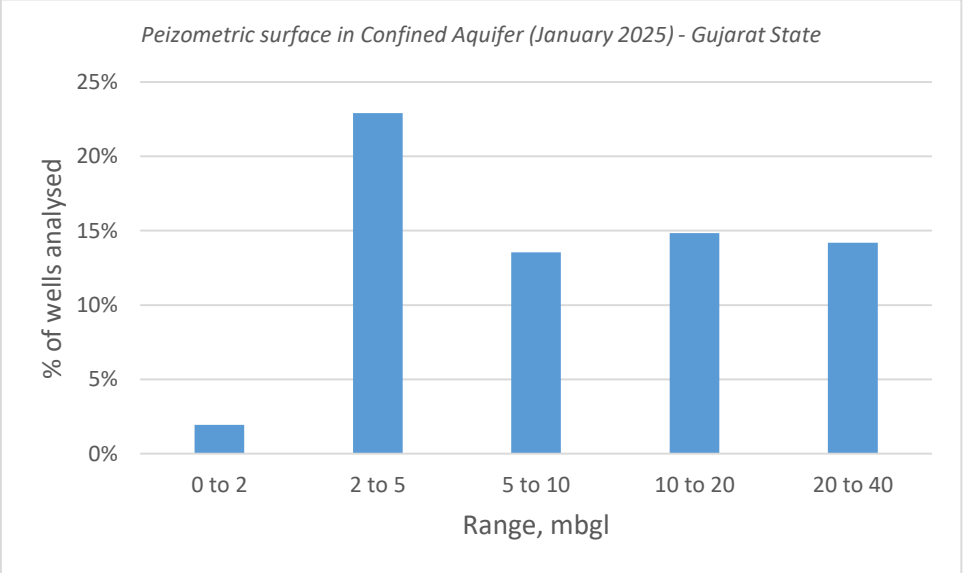

Figure 19 Graph of Depth to Peizometric surface in Confined Aquifer (January 2025) - Gujarat State

5.2.2 Seasonal Fluctuation in Piezometric Level

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

Out of 184 Well analysed in the Gujarat state about 95% area have recorded the rise and 5% have recorded fall in water level between May 2024 to January 2025. Rise in water level is observed in most of districts of Gujarat state. The maximum rise of 20.89 m is recorded at Rajkot district whereas the maximum decline of 12.14 m is observed in Banas Kantha district. Map and graph of Seasonal Water Level Fluctuation (May 2024 to January 2025)- confined Aquifer, Gujarat state shown in Fig.20 and Fig.21 respectively.

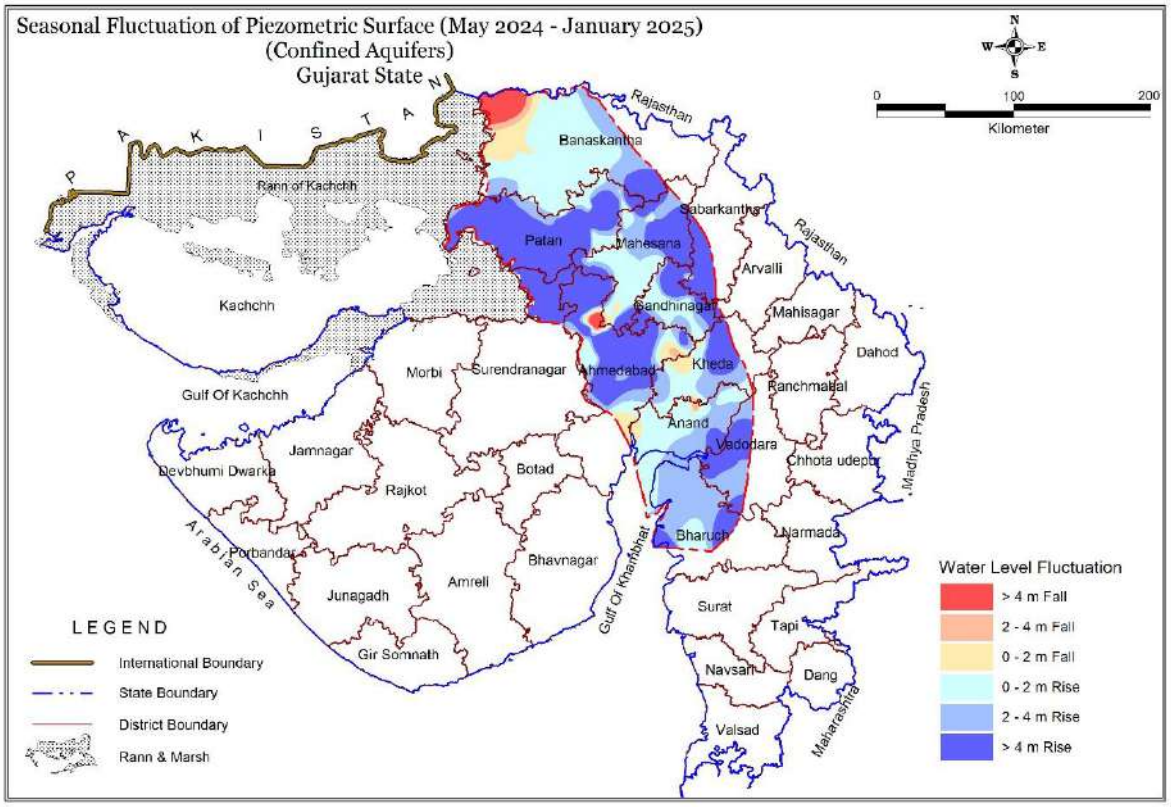

Figure 20: Seasonal Fluctuation in Piezometric surface (May 2024 to January 2025)- Confined and Semi-confined aquifer, Gujarat state

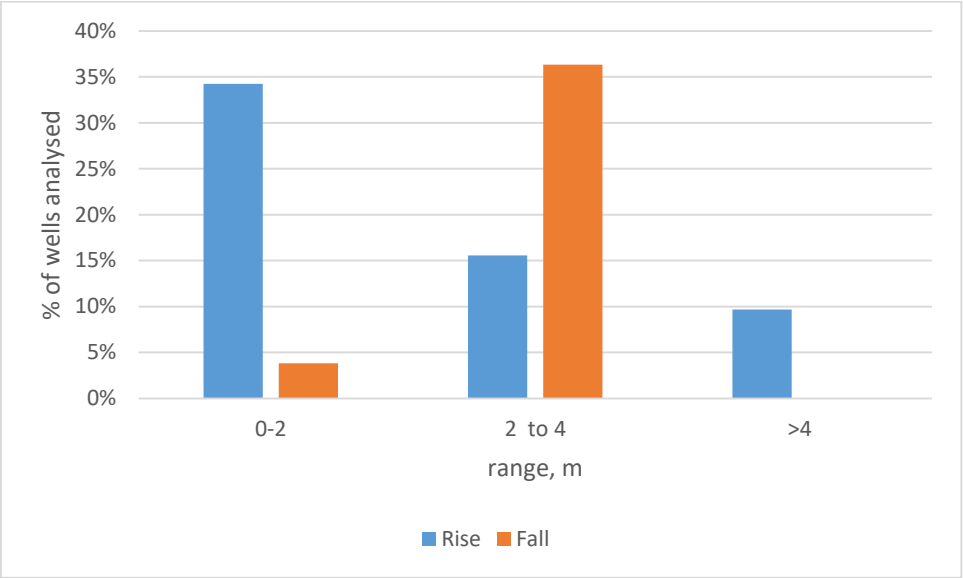

Figure 21: Graph of Seasonal Water Level Fluctuation (May 2024 to January 2025)- Confined and Semi-confined aquifer, Gujarat state

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

A perusal of Fig.22 and 23 reveals that more than 54.8% of the total wells in Gujarat state show a rise in water level. Rise in water level are observed in the range of 0 to 2 m in 24.8% of wells, 2 to 4 m in 10.2% of well and more than 4 m in 19.7% of wells monitored in the state of Gujarat. Fall in water level is mainly observed in parts of Kachchh region and in north Gujarat region and Saurashtra region in small isolated patches scattered in the area. Fall is mainly in the range of 0 to 2 m and recorded in 20.4% of wells in the state. The maximum rise of 25.85 m is recorded at Bilodara in Gandhinagar district whereas the maximum decline of 27.62 m is recorded in Patan district.

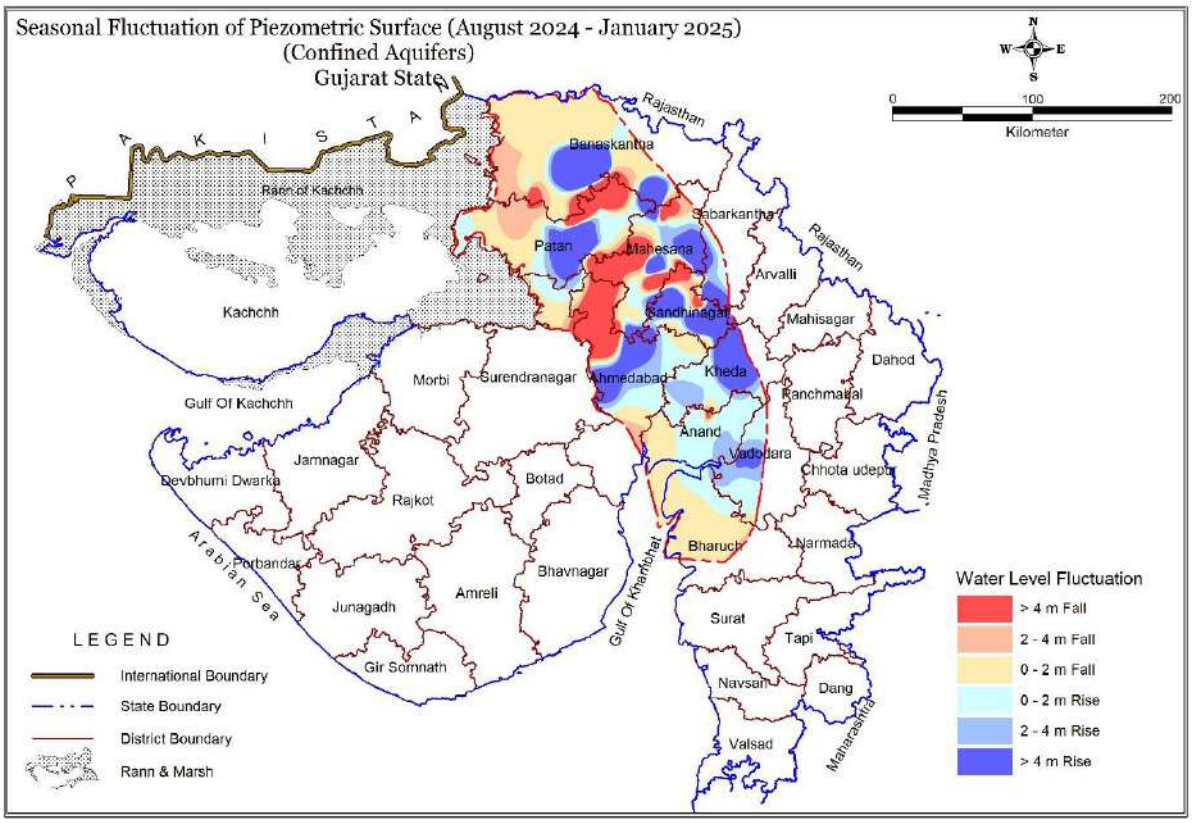

Figure 22 Seasonal Fluctuation in Piezometric surface (August 2024 to January 2025) – Confined and Semi-confined aquifer

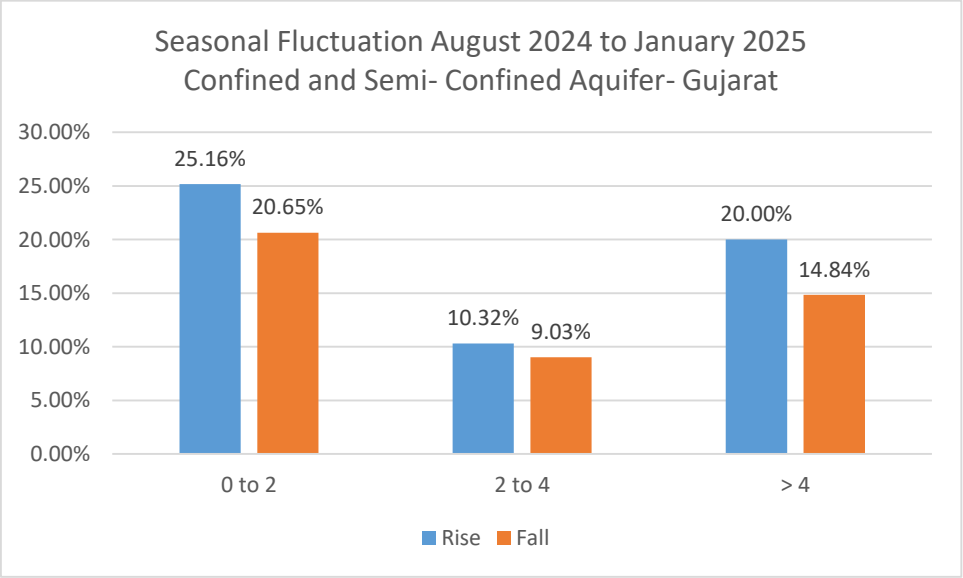

Figure 23 Graph of Seasonal Fluctuation in Piezometric surface (August 2024 to January 2025) – Confined and Semi-confined aquifer

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

A perusal of Fig. 24 reveals that more than 79.8% of the total wells in Gujarat state show a rise in water level. Rise in water level are observed in the range of 0 to 2 m in 44.6% of wells, 2 to 4 m in 14.6% of well and more than 4 m in 20.6% of wells monitored in the state of Gujarat. . Fall in water level are observed in the range of 0 to 2 m in 12.1% of wells, 2 to 4 m in 3% of well and more than 4 m in 4.7% of wells monitored in the state of Gujarat The maximum rise of 32.18 m is recorded at Otala in Morbi district whereas the maximum decline of 29.54 m is recorded at Finchal in Patan district.

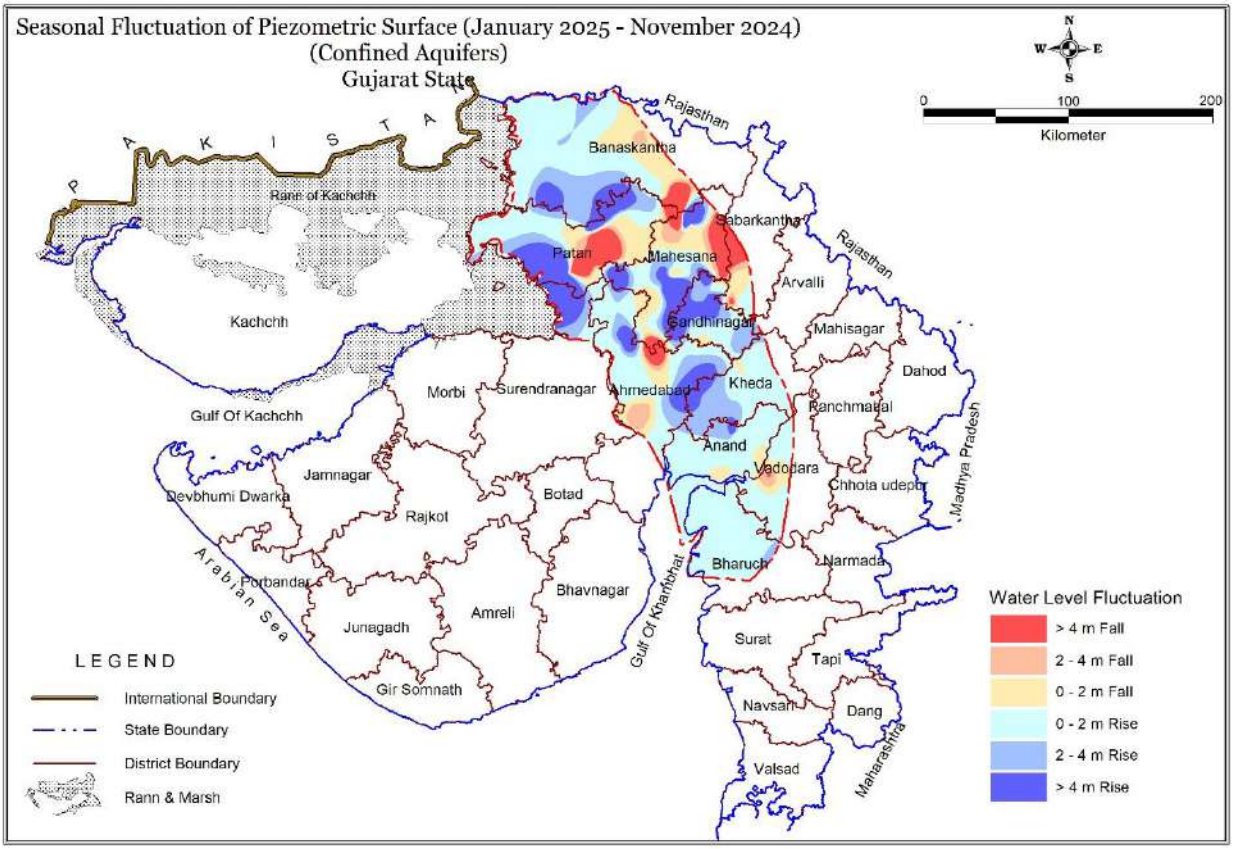

Figure 24 Seasonal Fluctuation in Piezometric surface (November 2024 to January 2025) – Confined and Semi-confined aquifer

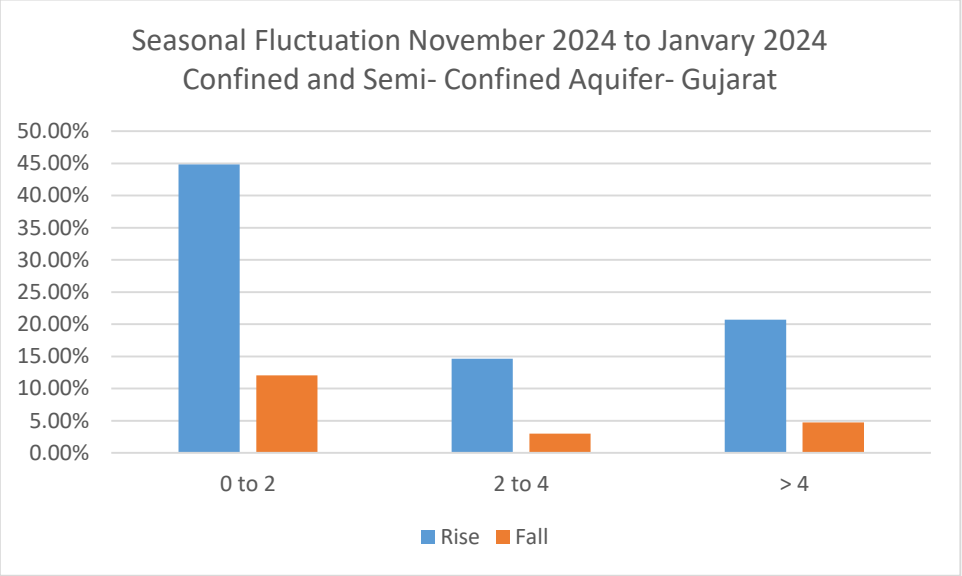

Figure 25 Graph of Seasonal Fluctuation in Piezometric surface (November 2024 to January 2025) – Confined and Semi-confined aquifer

5.2.3 Annual Fluctuation in Piezometric Level

Annual Fluctuation in Piezometric Level (January 2024 to January 2025)- Confined
Rise in Peizometric Level:

Peizometric surface rise of less than 2 m is recorded in 28% wells, 2 to 4 m in 9% wells and more than 4 m in 16% of the wells. Piezometric level rise of less than 2 m is observed in almost all districts. Piezometric level rise of 2 to 4 m is observed mainly in districts such as, Anand, Mahesana, Kachchh districts. Rise of more than 4 m is significantly observed in Ahmedabad, Anand Banaskantha, Gandhinagar, Mahesana, Patan, Kachchh districts.

Fall in Peizometric Level:

Out of 47 wells that mostly have registered fall in Peizometric surface, in range of less than 2 m and 2 to 4 m in 4% wells, no well has shown decline in range of more than 4 m Map and graph of Annual Fluctuation in Peizometric surface (January 2024 to January 2025)- confined shown in Fig.26 and Fig.27 respectively.

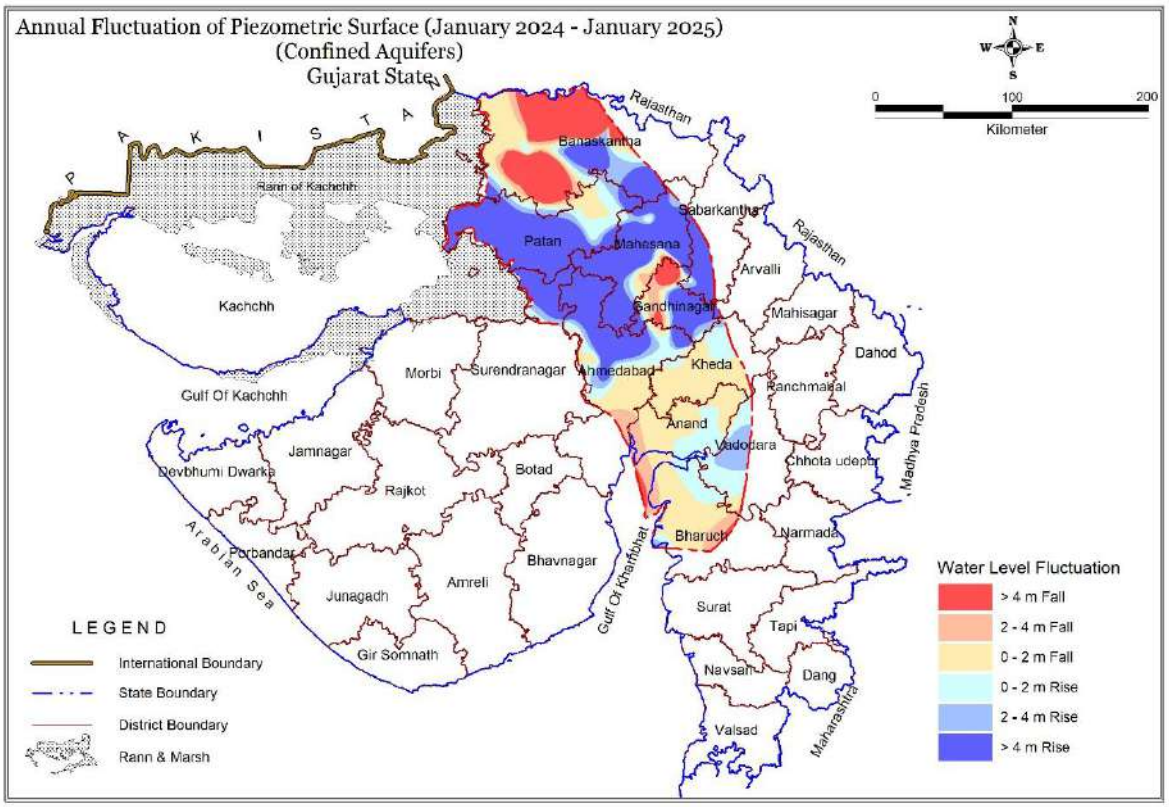

Figure 26: Annual Fluctuation Piezometric surface (January 2024 to January 2025)- Confined

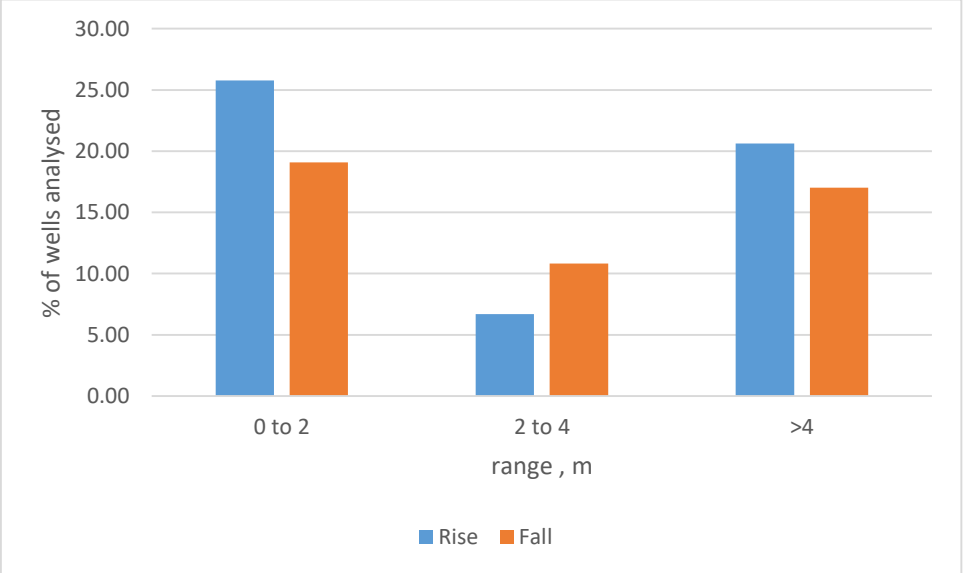

Figure 27: Annual Fluctuation Piezometric surface (January 2024 to January 2025)- Confined

Annual Fluctuation in Piezometric Level (January 2023 to January 2025)- Confined
Rise in Peizometric Level:

About 39.7% of the total monitoring stations of state show a rise in water level. Rise of 0 to 2 m is observed in about 17.8% of total well of the state. More than 4 m rise is observed in 12.3% of total well. The maximum rise of 20.84 m is recorded in Moti Kumad OW II of Ahmedabad district.

Fall in Peizometric Level:

Fall in water level is observed mainly in Kachchh, Saurashtra, and Northern part of Gujarat in scattered places. Fall is mainly in the range of 0 to 2 m and covers about 26% of total wells of the state. the maximum decline of 29.77 m bgl is recorded in Jholapur_Pz_I of Ahmedabad district.

Map and graph of Annual Fluctuation in Peizometric surface (January 2023 to January 2025)- confined shown in Fig.28 and Fig.29 respectively.

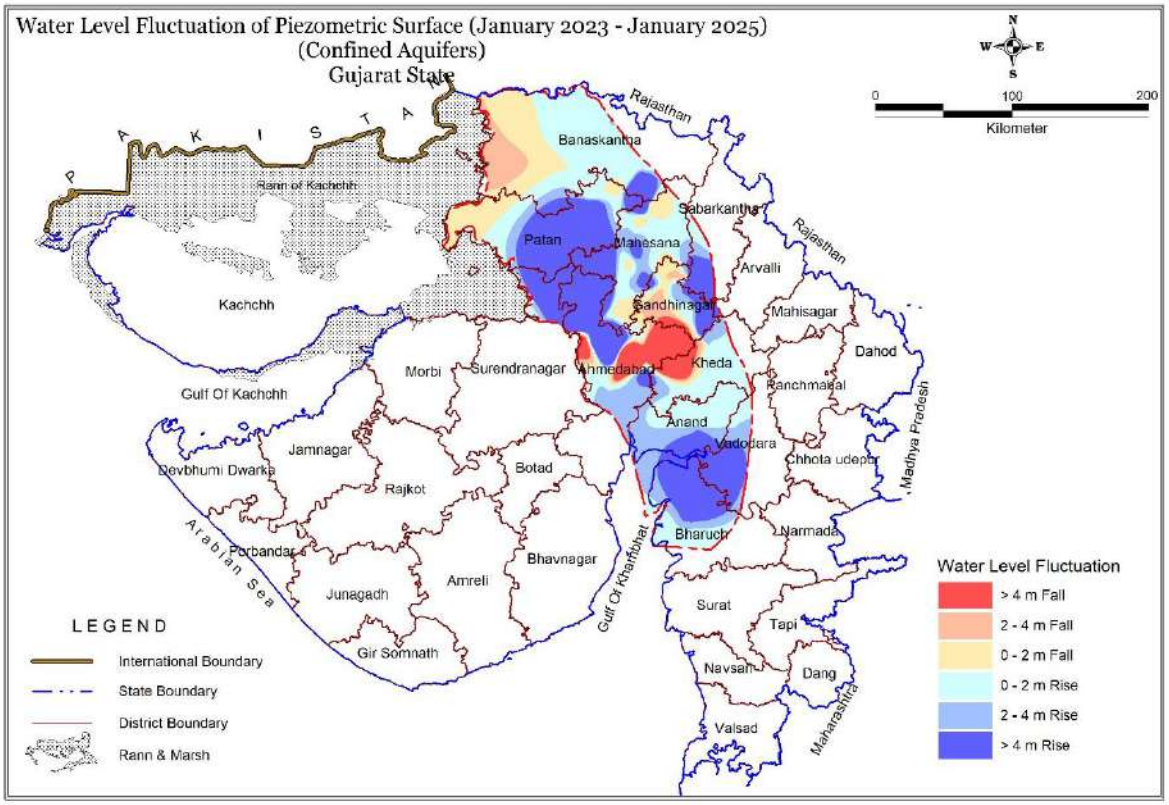

Figure 28;

Annual Water Level Fluctuation (January 2023 to January 2025)- Confined Aquifer

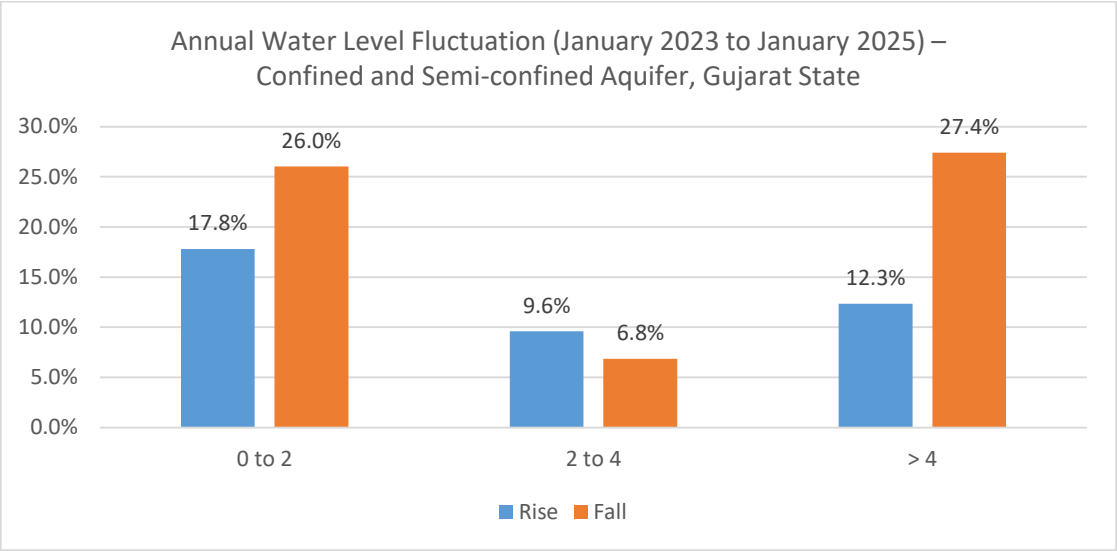

Figure 29 Annual Water Level Fluctuation in Confined (January 2023 to January 2025)– Gujarat State

5.2.4 Decadal Fluctuation in Peizometric Level:

Decadal average of January 2015 to 2024 to January 2025 in confined and Semi-confined Aquifer

A comparison of the Peizometric surface of the January 2025 with the average Peizometric surface of the January 2025 for last one decade (2015 to 2024) reveals that there is the rise in 70 % of well analysed. Rise is mostly in the range greater than 4 m (30.2% % of total wells). Fall in Peizometric surface is observed in 30 % of well analysed. The maximum rise of 15.97 m is recorded in Kachchh district whereas the maximum decline of -17.98 m is recorded in Deesa , Banas Kantha district.

Map and graph of Decadal Fluctuation in Confined Aquifer Decadal average of January 2015 to 2024 to January 2025 shown in Fig.30 and Fig.31 respectively.

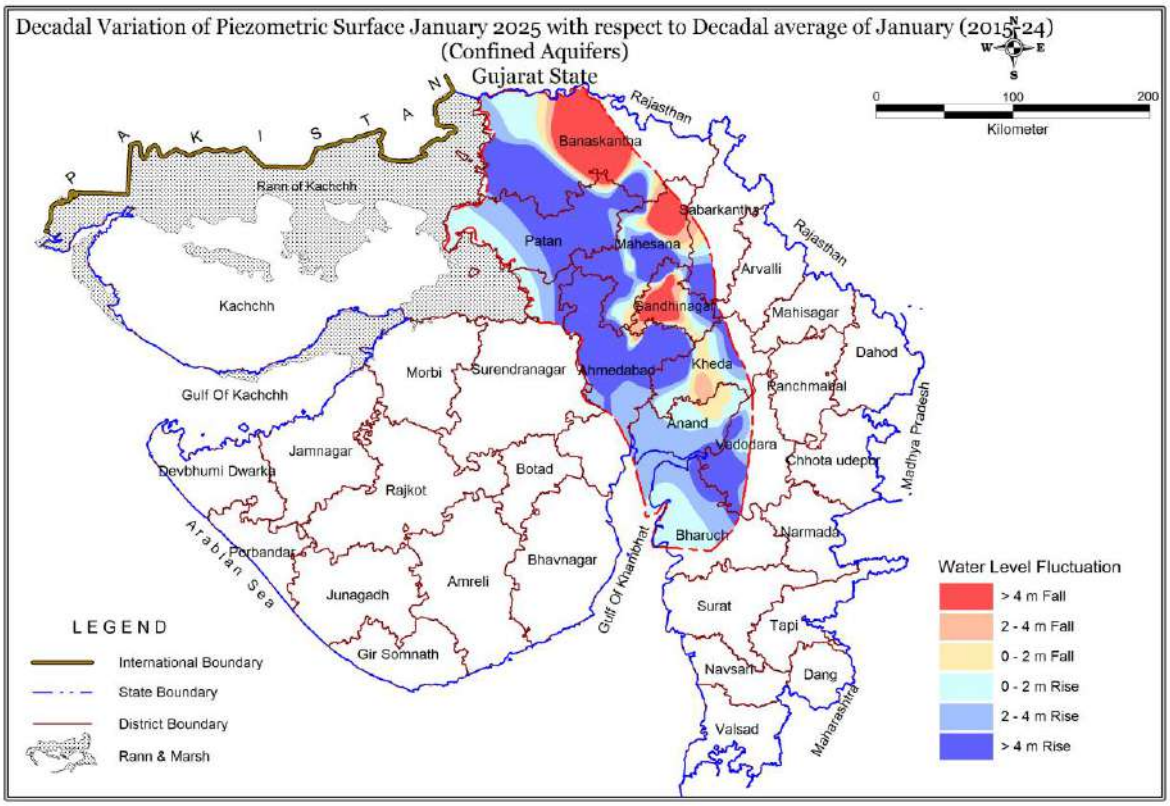

Figure 30: Decadal Fluctuation of Peizometric surface in Confined / Semi- confined Aquifer Decadal average of January (2015 to 2024) to January 2025

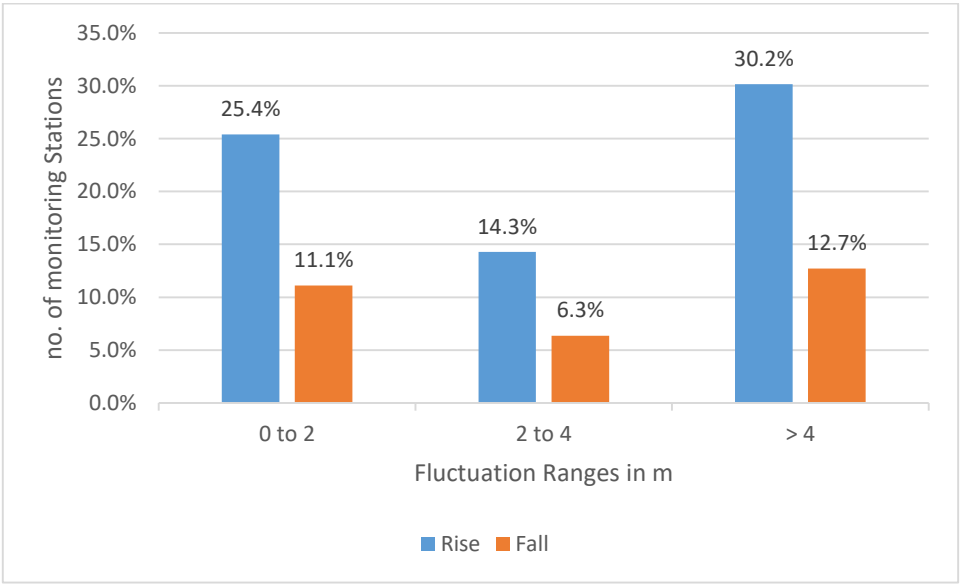

Figure 31: Graph showing Decadal Fluctuation of Peizometric surface in Confined / Semi- confined Aquifer Decadal average of January (2015 to 2024) to January 2025

Summary:

In January 2025, In unconfined aquifer, Water level of ranges from 0.12 mbgl at, Kachchh, to 76.34 mbgl at Mahesana.. The seasonal fluctuation shows maximum rise of 19.42 m is recorded at Junagadh district whereas the maximum decline of 13.19 m is observed in Patan district. During May 2024 to January 2025 maximum rise of 20.58 m is recorded at Anklav2 in Anand district whereas the maximum decline of 24.97 m is recorded at Kewadia_Pz in Narmada district, during August 2024 to January 2025; . The maximum rise of 15.27 m is recorded at Chokari Pz in Vadodara district whereas the maximum decline of 11.5 m is recorded at Amritvel_Pz in Amerli district November 2024 to January 2025; Annual Water Level Fluctuation shows, 56% of total monitoring wells show fall and 44% shows rise in water level of the Gujarat state. Decadal fluctuation shows rise in 61 % of total well analysed.

In confined aquifer, the depth Piezometric surface varies between 0.3 mbgl (Kachchh) to 185.81 m bgl (Banaskantha district); Annual Fluctuation in Piezometric surface 52 % show rise in Peizometric surface. The maximum rise of 20.89 m is recorded at Rajkot; The maximum rise of 25.85 m is recorded at Bilodara in Gandhinagar district whereas the maximum decline of 27.62 m is recorded in Patan district during August 2024 to January 2025, A comparison of the Peizometric surface of the January 2025 with the average Peizometric surface of the January 2025 for last one decade (2015 to 2024) reveals that there is the rise in 70 % of well analysed.

Recommendation:

Alarming declines in groundwater levels of Central Gujarat plains and in select areas of Saurashtra and Kachchh warrant immediate attention for taking-up of recharge schemes to arrest further declines and augment the groundwater resources. Pointed attention of the administrators and policy makers is drawn towards adoption of artificial recharge, public awareness and other appropriate measures for ensuring adequate groundwater availability and sustainability.