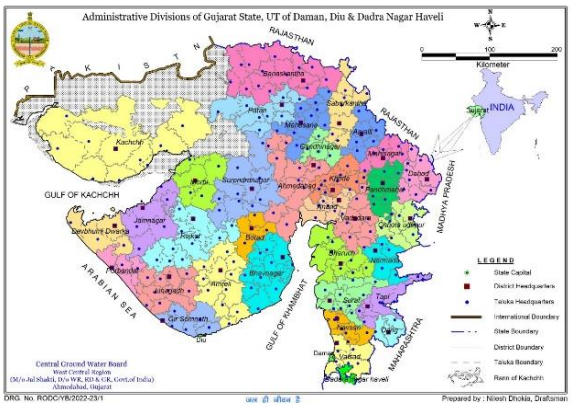
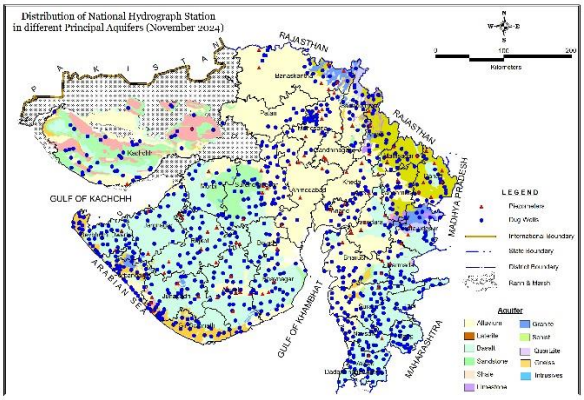
GROUND WATER LEVEL BULLETIN

November 2024

Gujarat





ABSTRACT

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

CGWB, WEST CENTRAL REGION, GUJARAT

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 1293 observation wells called National Hydrograph Network Stations (NHNS), as on 30.11.2024, located all over the Gujarat state is being monitored. Administrative map shown in Fig.-1.

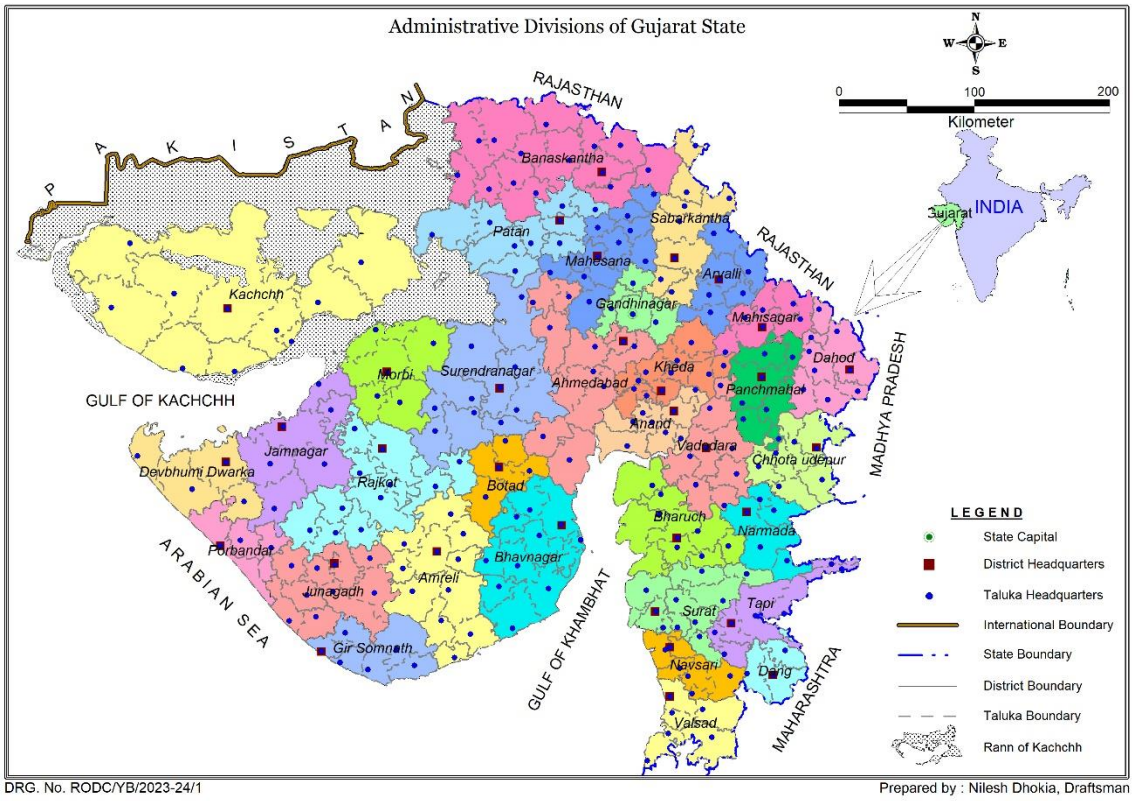


Figure 1: Map showing administrative divisions of Gujarat State

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.

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 which comprises 1293 GWMWs. 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.

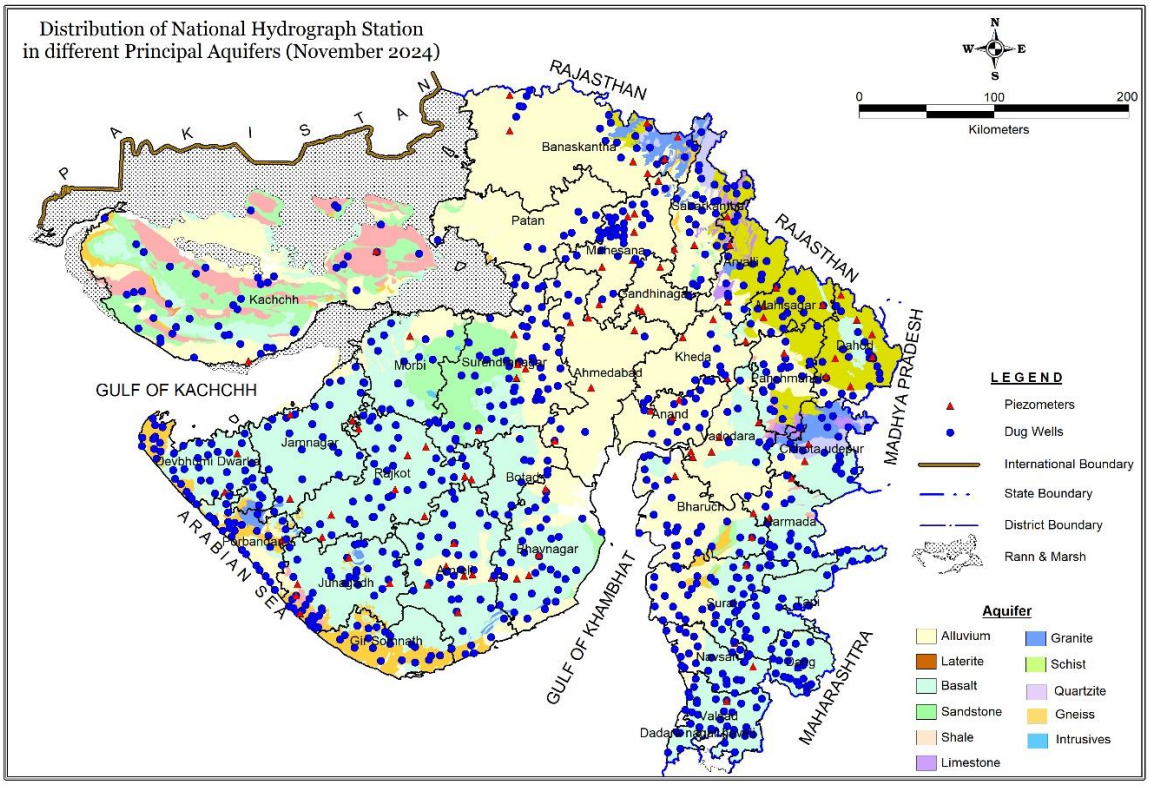


Figure 2 Map showing locations of monitoring wells (NHNS) in Gujarat state

Table 1. The distributions of monitoring wells in districts.

S.N.	District	Number of Water Level Monitoring Stations 2024		
		Pz	Dug Well	Total
1	Ahmedabad	40	19	56
2	Amreli	11	43	54
3	Anand	21	13	33
4	Arvalli	8	15	20
5	Banas Kantha	42	19	52
6	Bharuch	7	30	34
7	Bhavnagar	17	35	48
8	Botad	3	7	10
9	Chhotaudepur	13	16	28
10	Dahod	15	24	33
11	Dangs	1	20	21
12	Devbhumi Dwarka	2	43	44
13	Gandhinagar	27		13
14	Gir Somnath	5	20	24
15	Jamnagar	8	21	25
16	Junagadh	11	39	49
17	Kachchh	51	44	86
18	Kheda	14	12	24
19	Mahesana	54	35	79
20	Mahisagar	5	12	16
21	Morbi	1	17	17
22	Narmada	11	8	19
23	Navsari	2	17	18
24	Panch Mahals	21	20	33
25	Patan	37	11	39
26	Porbandar	6	29	34
27	Rajkot	25	35	50
28	Sabar Kantha	10	26	35
29	Surat	6	39	45
30	Surendranagar	12	52	60
31	Tapi	1	17	17
32	Vadodara	16	15	29
33	Valsad	1	36	37
	Total	504	789	1293

GROUNDWATER SCENARIO (November 2024)

Depth to Water Level

Depth to Water Level in Unconfined Aquifer (November 2024) – Gujarat State

The depth to water level of 921 wells are used for the analysis. Analysis of depth to water level data of 921 wells show that water levels vary between 0.04 mbgl (Wadia, Dahod) to 107.54 m bgl (Kukrana, Patan district).

Water level of less than 2 m bgl is recorded in 28.1 % of wells, between 2 to 5 m bgl in 43.3% of wells, between 5 to 10 m bgl in 17.8% of wells, between 10 to 20 m bgl in 7.7 % of wells, between 20-40 m bgl in 2.3% of wells and water level more than 40 m bgl is registered in 0.8 % of wells. Shallow water level of less than 2 m bgl occurs as isolated patches in all the districts of Gujarat except Banas Kantha, Gandhinagar. Water level of 2 to 5 m bgl is observed in all the districts of Gujarat state except in Gandhinagar. depth to water level of 5 to 10 m bgl is observed throughout the state except in Gandhinagar. Water level of 10 to 20 m bgl is covered mostly in Ahmedabad, Anand, Banaskantha, Mahesana, Patan, Sabarkantha, Vadodara, Amreli, Bhavnagar, Kachch, districts. Water levels of 20-40 m covering mainly Banaskantha, Vadodara, Amrelli, Kachch districts. Deeper water level of more than 40 m covering districts of Ahmedabad, Banaskantha, Gandhinagar, Mahesana, Patan and Kachchh. Map and graph of Depth to Water Level in Unconfined Aquifer (November 2024) shown in Fig.3 and Fig.4 respectively.

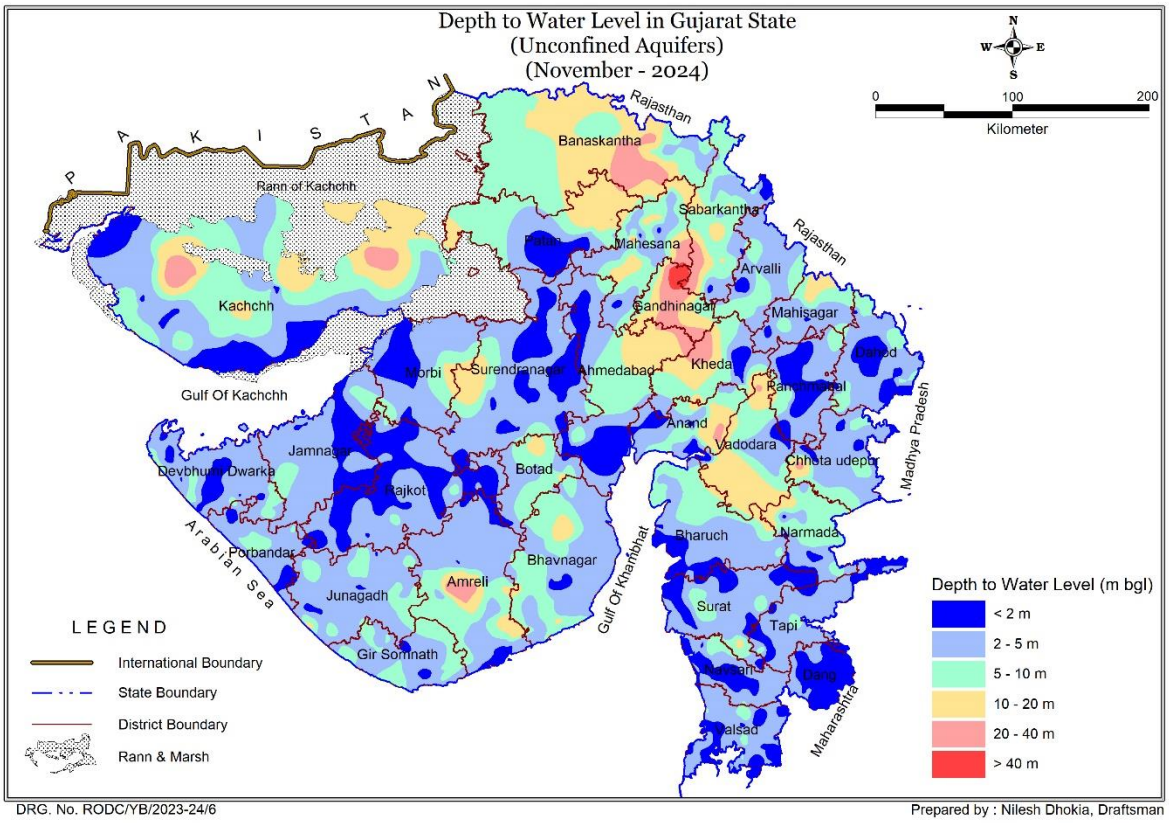


Figure 3: Depth to Water Level in Unconfined Aquifer (November 2024) – Gujarat State

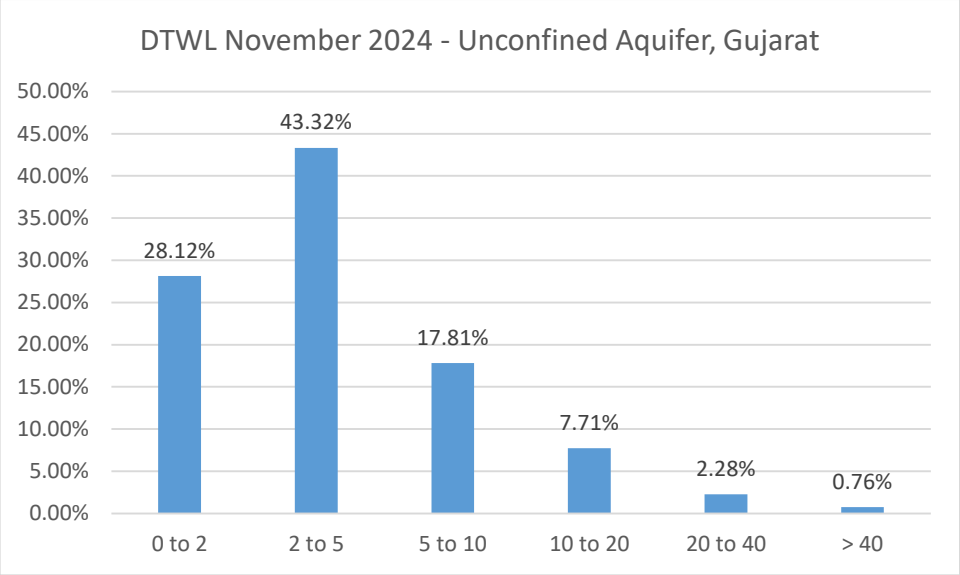


Figure 4: Well wise categorisation of depth to water level (November 2024) (Unconfined)– Gujarat State

Depth to Peizometric surface in confined Aquifer (November 2024) – Gujarat State

The depth Peizometric surface of 313 wells is used for the analysis. Analysis of depth to Peizometric surface data of 313 wells shows water levels vary between 0.25 mbgl (Asambia mota_Pz, Kachchh and Hajnali OW, Morbi) to 187.27 m bgl (Nanota, 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 Ahmedabad, Banaskantha, Panchmahal, Chhotaudepur, Rajkot, Porbander district. Water level of 2 to 5 m bgl is observed in Aravalli, Ahmedabad, Panchmahal, Morbi, Rajkot, Surendranagar, and Kachch districts. water level of 5 to 10 m bgl is observed in Ahmedabad, Anand, Banaskantha, Panchmahal, Chhotaudepur, 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 (November 2024) shown in Fig.5 and Fig.6 respectively.

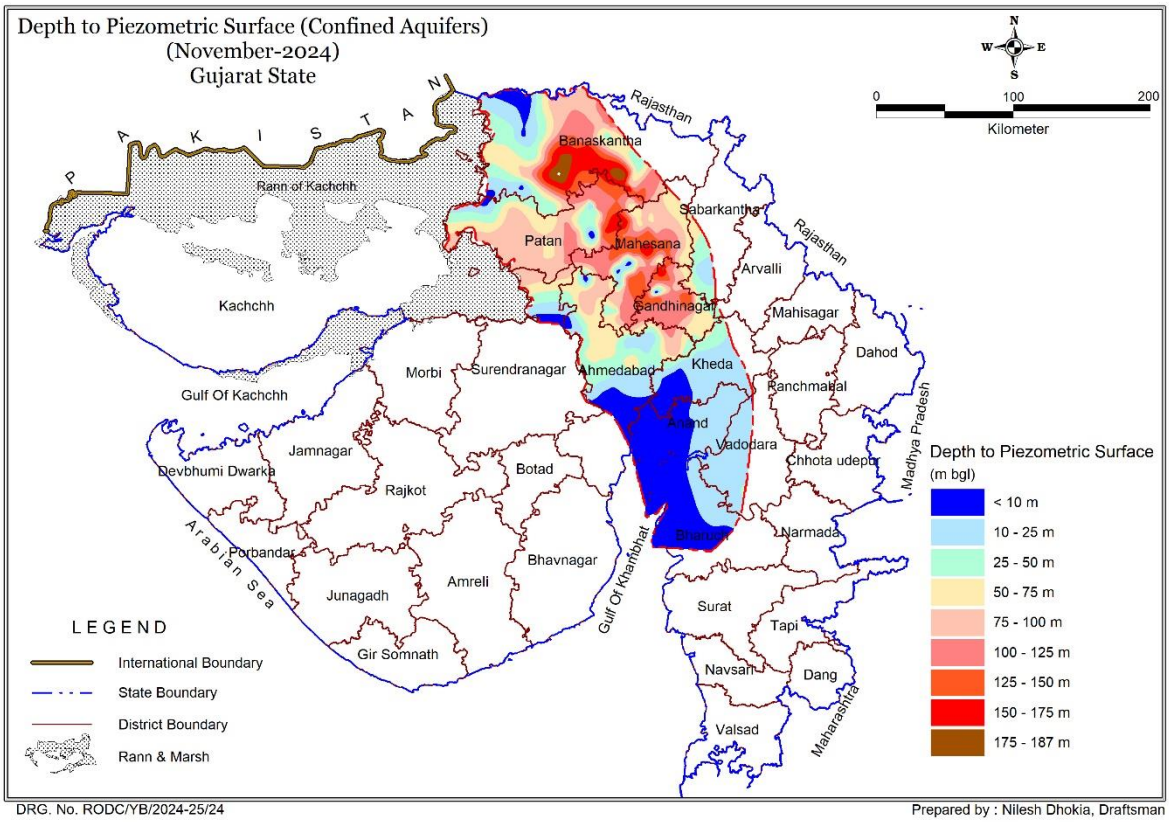


Figure 5: Depth to Peizometric surface in Confined Aquifer (November 2024) - Gujarat State

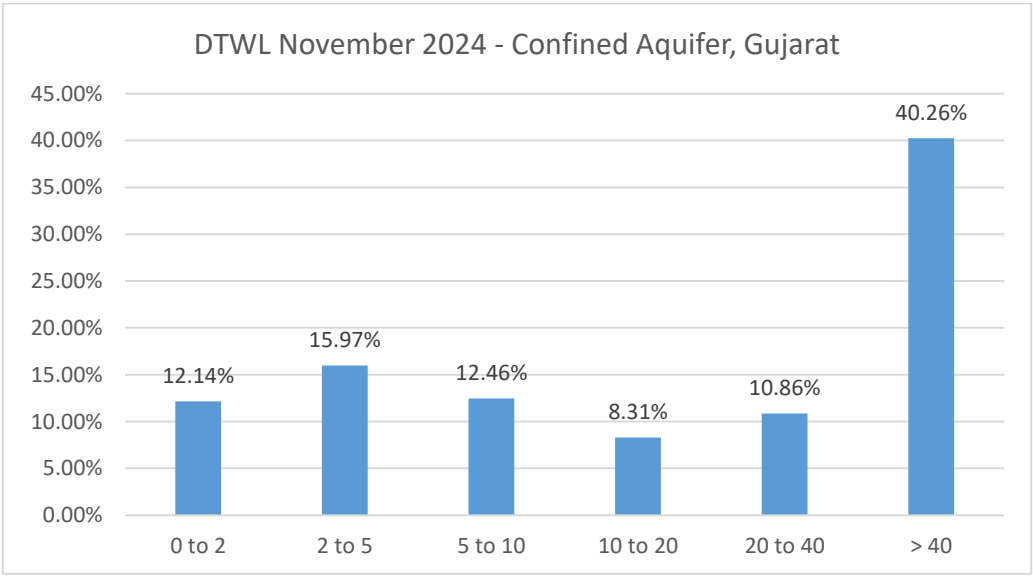


Figure 6: Well wise categorisation of depth to Peizometric surfacce *(confined (November 2024)– Gujarat State*

Annual Water Level Fluctuation (November 2023 to November 2024)- Unconfined

Rise in Water Level:

Out of 559 wells, Water level rise of less than 2 m is recorded in 47.4% wells, 2 to 4 m in 19.7% wells and more than 4 m in 14.3% of the wells. Piezometric level rise of less than 2 m is seen in all the

districts except in Ahmedabad district. Piezometric level rise of 2 to 4 m is seen in mostly all the districts except in Kheda, Bharuch, Narmada, Dangs, Vadodara and Botad region. Rise of more than 4 m is significantly observed in Banas Kantha, Kheda, Panchmahal, Sabarkantha, Vadodara, Amreli, Bhavnagar, Junagarh, Devbhumi Dwarka, Gir Somnath, Jamnagar, Morbi, Rajkot, Surendranagar, Kachchh districts.

Fall in Water Level:

Out of 131 wells that have registered fall in Water level, 14.1% have recorded less than 2 m while 2.8% in the range of 2 to 4 m and remaining 2% wells registered piezometric level fall of more than 4 m. Fall of less than 2 m is seen in is significantly observed Anand, BanasKantha, Dahod, Mahesana, Mahisagar, Bharuch, Surat, Amreli, Bhavnagar, Junagarh, Devbhumi Dwarka, Gir Somnath, Jamnagar, Surendranagar, Kachchh districts. Fall of 2 to 4 m is seen significantly observed in Amreli, Bhavnagar and Kachchh region. Fall of beyond 4 m is observed in Amerli and Bhavnagar districts. Map and graph of Annual Water Level Fluctuation (November 2023 to November 2024)- Unconfined shown in Fig.7 and Fig.8 respectively.

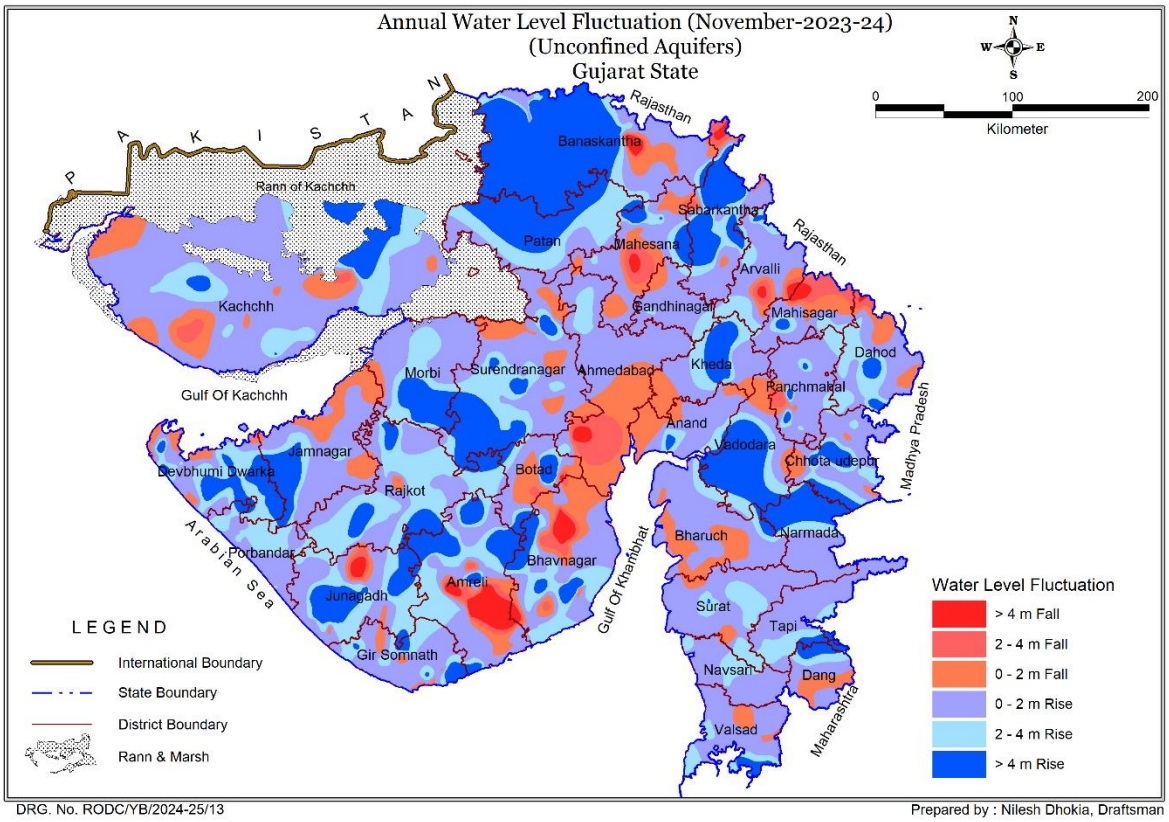


Figure 7: Annual Water Level Fluctuation (November 2023 to November 2024)- Unconfined Aquifer

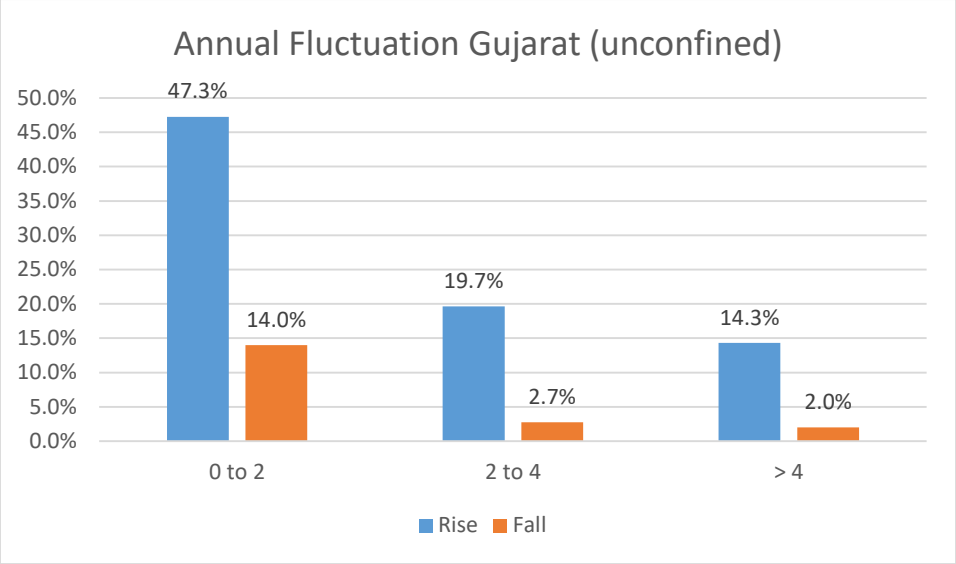


Figure 8: Annual Water Level Fluctuation (November 2023 to November 2024) - Unconfined

Annual Fluctuation in Piezometric surface (November 2023 to November 2024)- Confined

Rise in Peizometric surface:

Out of 129 wells, Peizometric surface rise of less than 2 m is recorded in 29% wells, 2 to 4 m in 14.8% wells and more than 4 m in 30.7% of the wells. Piezometric level rise of less than 2 m is Significantly observed mainly in districts such as Anand, Banaskantha, Gandhinagar, Bharuch, Chhotaudepur, Narmada, Surat, Vadodara, Rajkot, Kachch 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, Banaskantha, Gandhinagar, Mahesana, Patan, Kachchh districts.

Fall in Peizometric surface:

Out of 47 wells that have registered fall in Peizometric surface, 13.1% have recorded less than 2 m, 2 to 4 m in 4% wells and more than 4 m in 9.7% of the wells. Fall of less than 2 m is mainly observed in Banaskantha, Gandhinagar, Mahesana, Kachchh districts. Fall of 2 to 4 m is observed mainly in Banaskantha and Mahesana region. Fall of beyond 4 m is observed in Ahmedabad, Gandhinagar, Patan, Bhavnagar, Kachch districts. Map and graph of Annual Fluctuation in Peizometric surface (November 2023 to November 2024)- confined shown in Fig.9 and Fig.10 respectively.

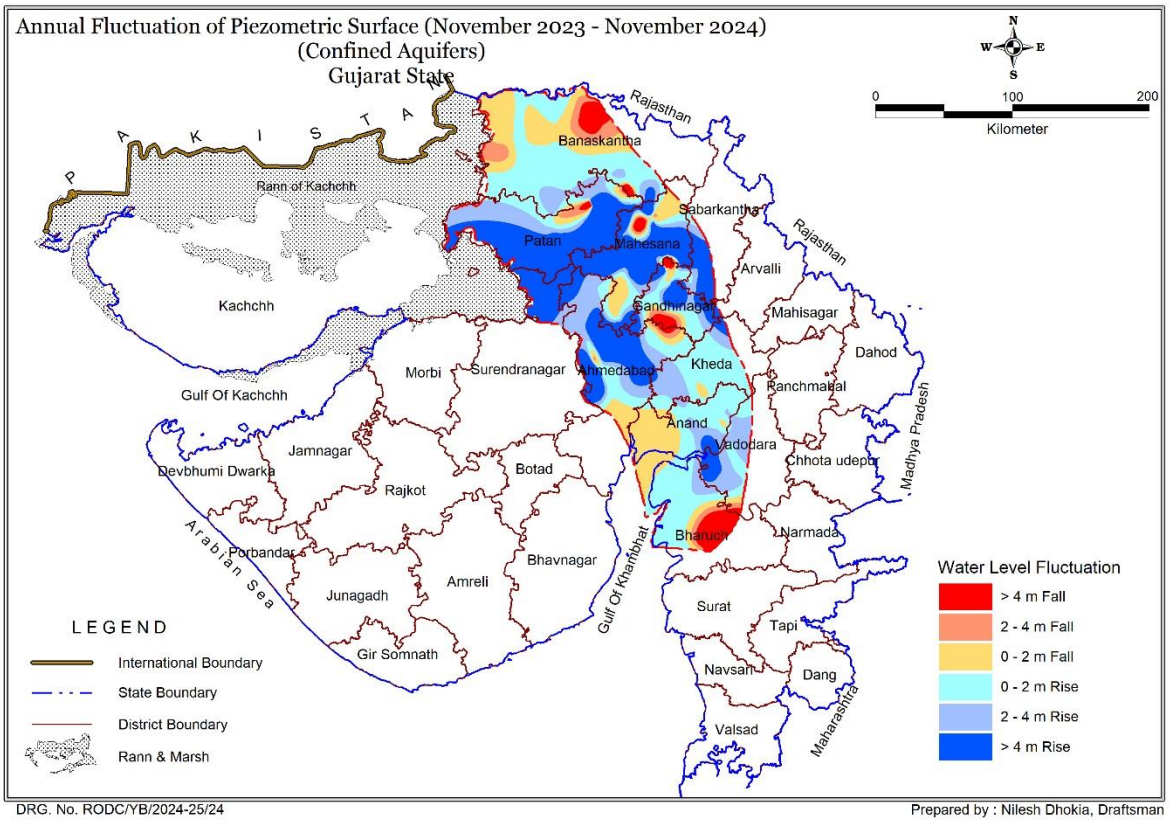


Figure 9: Annual Fluctuation Peizometric surface (November 2023 to November 2024)- Confined

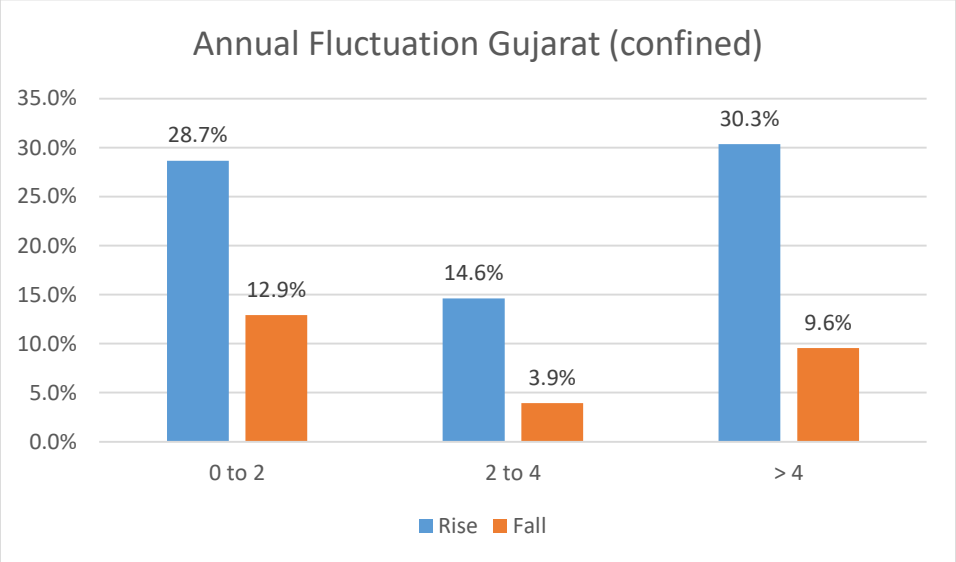


Figure 10: Annual Fluctuation Peizometric surface (November 2023 to November 2024)- Confined

Seasonal Water Level Fluctuation

Seasonal Water Level Fluctuation (May 2024 to November 2024)- Unconfined Aquifer, Gujarat state

Out of 775 Well analysed in the Gujarat state about 95.1% wells have recorded the rise and 5.2% have recorded fall in water level between May 2024 to November 2024. Rise in water level is observed in all districts of Gujarat state.

In North Gujarat region, water level rises mainly observed in 94.4% of the total well analysed and maximum rises (37.4%) are in the range greater than 4m. The fall of water level observed in 6.6% of wells analysed.

The 96.3% of the total wells in the area of south Gujarat have recorded rise and maximum (45.7%) in the range greater than 4 m of rise in the region in November 2024 as compared to May 2024. The fall is 3.7% of total well and maximum (3.7%) in the range of 0 to 2 m.

Over all 95.5% of total well analysed are shown rise in water level in the entire Saurashtra region. About 59.2% of areas have shown rise of water level greater than 4 m all the districts of Saurashtra region. Fall of water level is observed in 4.5% of wells analysed all over the region. The fall > 4 m is observed only in Amerli and Surendranagar district of Saurashtra region

In Kachchh, 90% of the total well analysed recorded rise in water level. The rise is mostly in the range 0 to 2m and is observed in 42.5% of the total well. The total fall of water level has been observed in 10% of the total well in the region. Map and graph of Seasonal Water Level Fluctuation (May 2024 to November 2024)- Unconfined Aquifer, Gujarat state shown in Fig.11 and Fig.12 respectively.

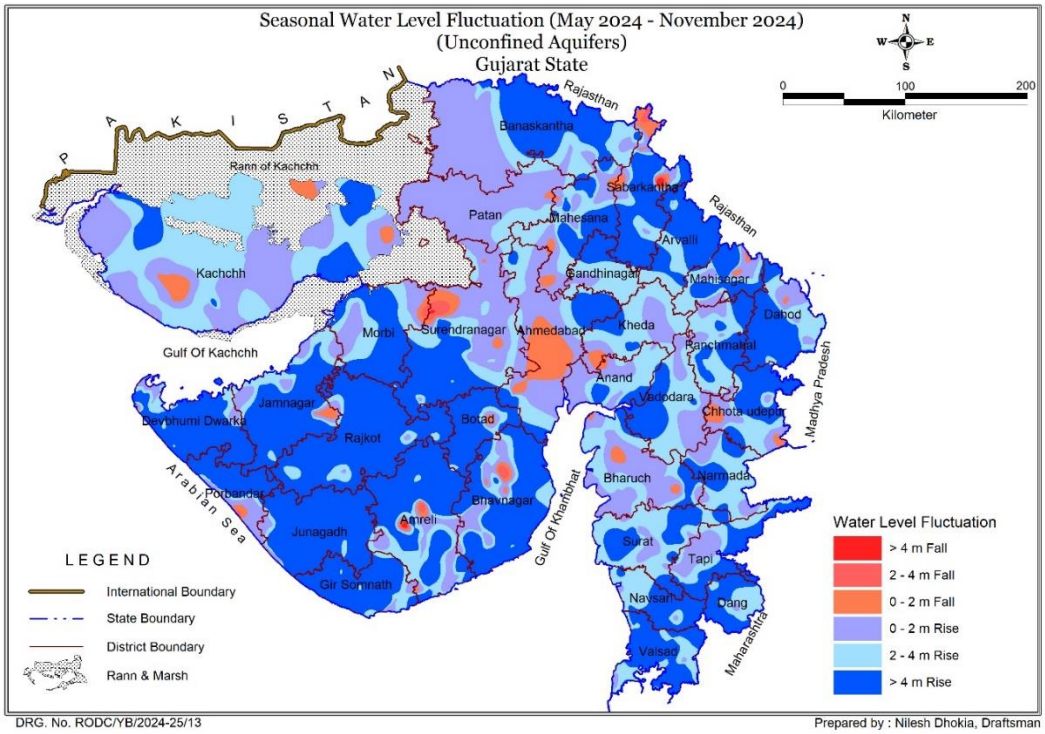


Figure 11: Seasonal Water Level Fluctuation (May 2024 to November 2024)- Unconfined Aquifer, Gujarat state

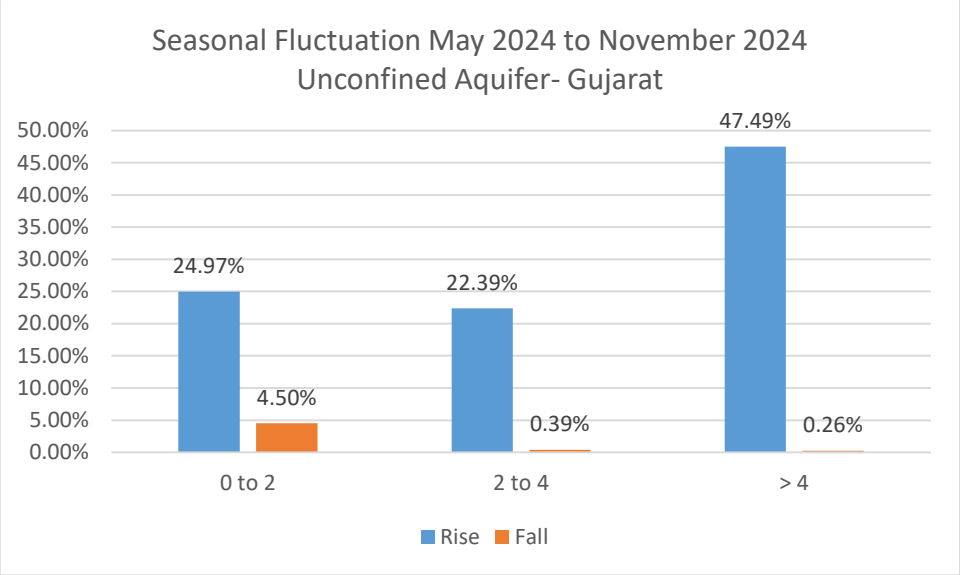


Figure 12: Seasonal Water Level Fluctuation (May 2024 to November 2024)- Unconfined Aquifer, Gujarat state

Seasonal Fluctuation in Peizometric surface (May 2024 to November 2024) – Confined and Semi-confined aquifer, Gujarat state

Out of 184 Well analysed in the Gujarat state about 91.3% area have recorded the rise and 10.33% have recorded fall in water level between May 2024 to November 2024. Rise in water level is observed in most of districts of Gujarat state.

In North Gujarat region, water level rises mainly observed in 93.5% of the total well analysed and maximum rises (56.1%) are in the range greater than 4m. The fall of water level observed in 9.3% of wells analysed.

The 100% of the total wells in the area of south Gujarat have recorded rise and maximum (52.4%) in the range greater than 4 m of rise in the region in November as compared to May 2024.

Over all 89.7% of total well analysed are shown rise in water level in the entire Saurashtra region. About 58.6% of well have shown rise of water level greater than 4 m. Fall of water level is observed in 10.3% of wells analysed all over the region. The fall > 4 m is observed only in Amerli and Junagadh district of Saurashtra region

In Kachchh, 77.8% of the total well analysed recorded rise in water level. The rise is mostly in the range 0-2 m and is observed in 33.3% of the total well. The total fall of water level has been observed in 22.2% of the total well in the region. Map and graph of Seasonal Water Level Fluctuation (May 2024 to November 2024)- Confined and Semi-confined aquifer, Gujarat state shown in Fig.13 and Fig.14 respectively.

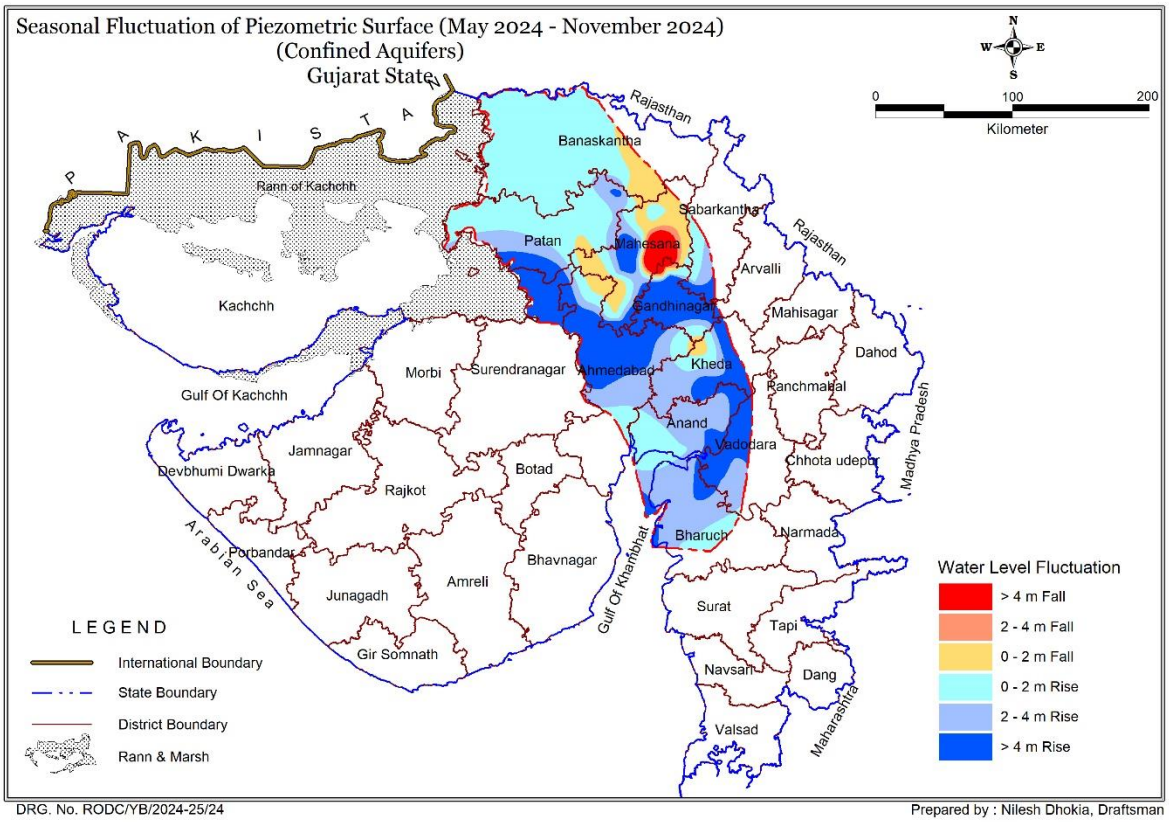


Figure 13: Seasonal Fluctuation in Peizometric surface (May 2024 to November 2024)- Confined and Semi-confined aquifer, Gujarat state

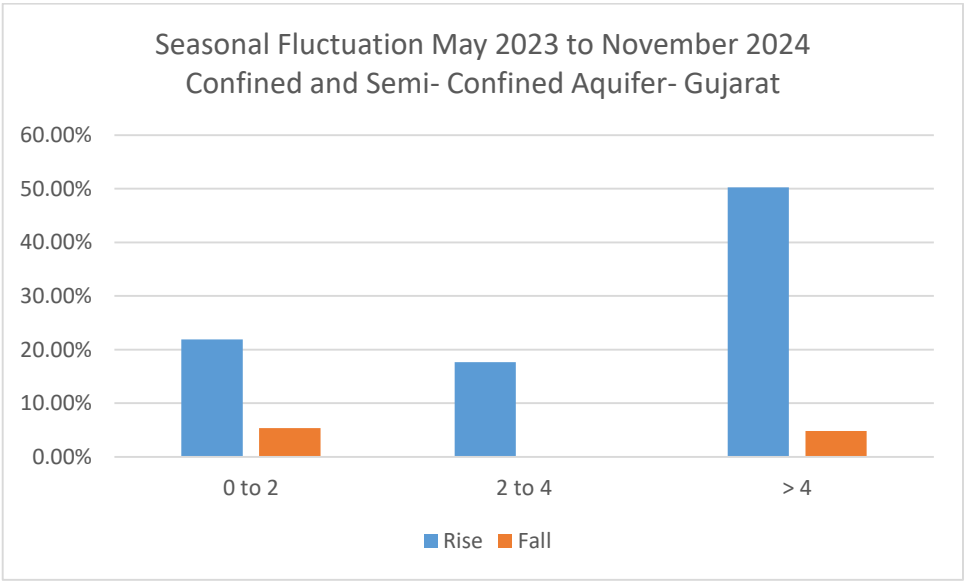


Figure 14: Seasonal Fluctuation in Peizometric surface (May 2024 to November 2024)- Confined and Semi-confined aquifer, Gujarat state

Decadal Water Level Fluctuation

Decadal Water Level Fluctuation: Decadal average of November (2014 to 2023) to November 2024 in Unconfined Aquifer

A comparison of the water level of the November 2024 with the average water level of the November for last one decade (2014-2023) reveals that there is the rise in 85.3% of 819 well analysed. Rise is mostly in the range of 0 to 2 m (42.5% of total wells). Fall in water levels is observed in 14.7% of well analysed. The maximum rise of 16.18 m is recorded in Amreli district whereas the maximum decline of 39.32 m is recorded in Banas Kantha district.

In North Gujarat, 85.8% of wells have shown rise and mostly in range of 0 to 2 m (42.9 % of wells). The fall of 14.2% in water level is observed in the almost all area of north Gujarat where > 4m observed in Ahmedabad and Banas Kantha districts.

South Gujarat has experienced the rise in 85.9% of wells analysed whereas 14.1% shows fall. In the range of 0 to 2 m, 13.6% of well shows the fall while 60.1 % of wells shows the rise. More than 4 m of fall in water level shows only in Valsad district of South Gujarat region.

In Saurashtra region, 84.7% of total well shows the rise in water level where as 15.3% shows the fall. The fall of water level mainly observed in range of 0-2 m (32.1%). The rise in water level is observed in all districts of the Saurashtra region and rise of more than 4 m in water level is observed 25.4% wells of Saurashtra region.

In Kachchh, 85.4% of the wells analysed have recorded the rise in water levels whereas 14.6% shows the fall. Fall is only (14.6% of wells) in the range of 0 to 2 m. Rise is observed mostly in the range of 0-2 meter (36.6 % wells) and more than 4-meter rise is shown in 22% wells analysed. Map and graph of Decadal Fluctuation in Unconfined Aquifer Decadal average of November (2014 to 2023) to November 2024 shown in Fig.15 and Fig.16 respectively.

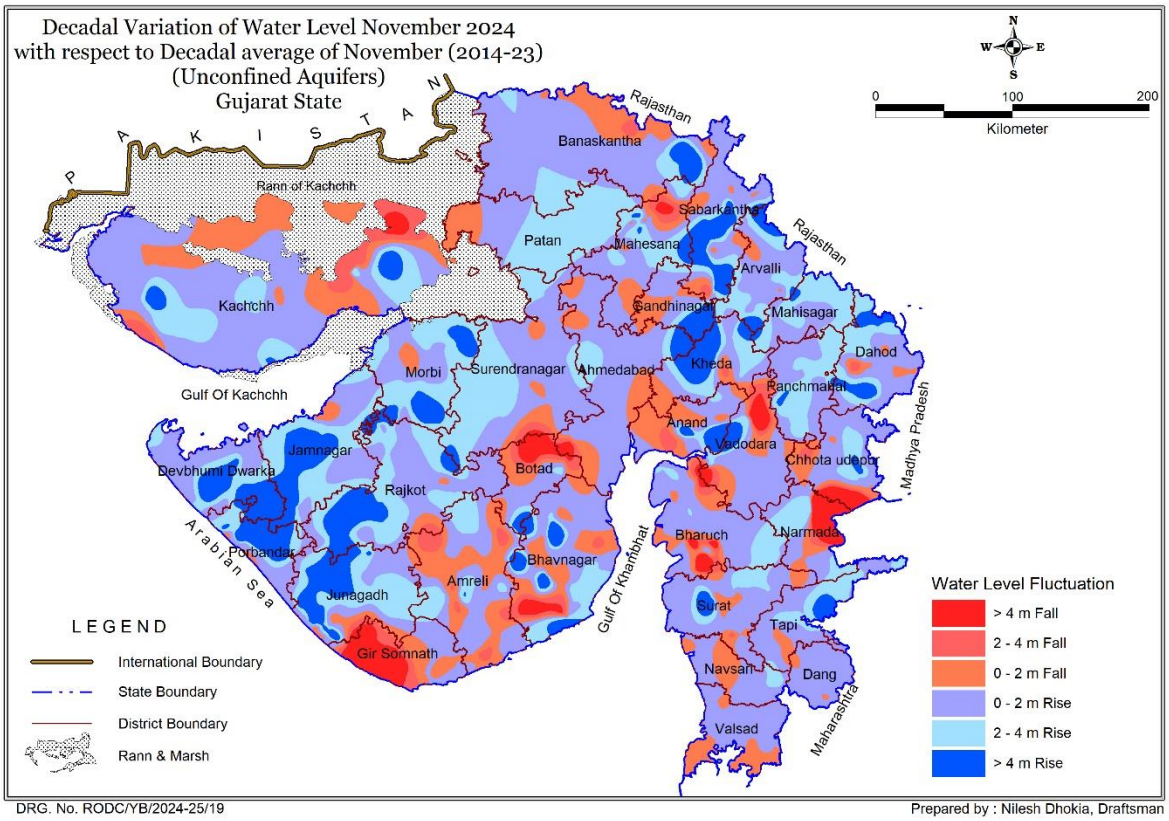


Figure15: Decadal Fluctuation in Unconfined Aquifer (Decadal average of November (2014 to 2023) to November 2024)

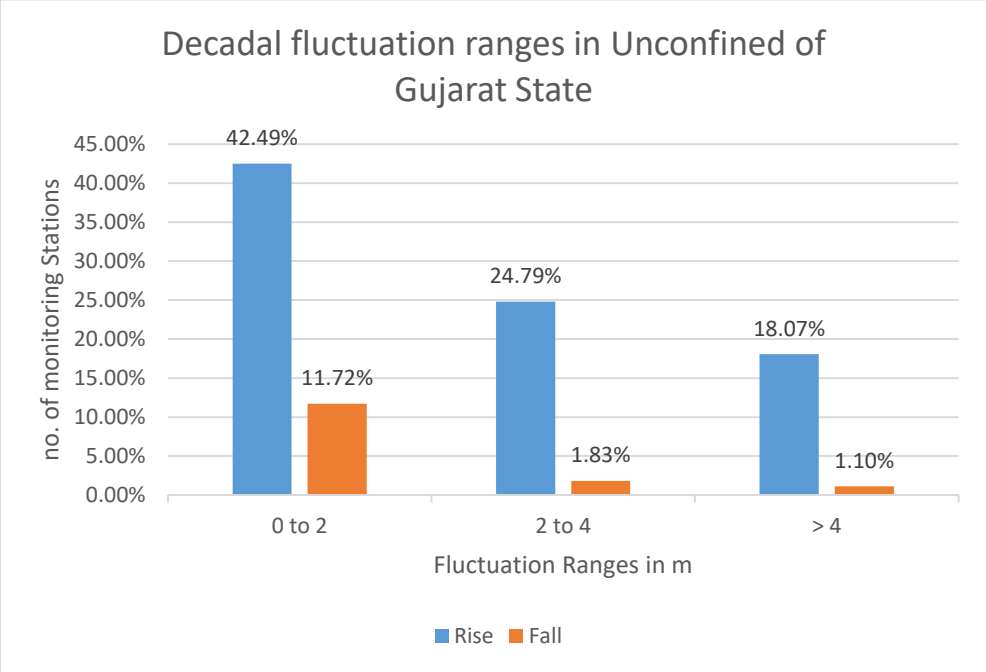


Figure 16: Decadal Fluctuation in Unconfined Aquifer (Decadal average of November (2014 to 2023) to November 2024)

Decadal Fluctuation in Peizometric surface: Decadal average of November (2014 to 2023) to November 2024 in confined and Semi-confined Aquifer

A comparison of the Peizometric surface of the November 2024 with the average Peizometric surface of the November for last one decade (2014-2023) reveals that there is the rise in 71.6% of well analysed. Rise is mostly in the range greater than 4 m (33.7% of total wells). Fall in Peizometric surface is observed in 28.4% of well analysed.

In North Gujarat, 71.3 % of wells have shown rise and mostly in range greater than 4 m (44.2 % of wells). The fall of 28.7% in Peizometric surface is observed in the almost all area of north Gujarat where > 4m observed in Ahmedabad, Banas Kantha, Gandhinagar and Mehesana.

South Gujarat has experienced the rise in 92.3% of wells analysed whereas 7.7% shows fall. In the range of 0 to 2 m, 65.4% of wells the rise.

In Saurashtra region, 58.6% of total well shows the rise in Peizometric surface where as 41.4% shows the fall. The fall of water level mainly observed in range of 0-2 m (17.2%). Rise of more than 4 m in water level is observed in Bhavnagar, Rajkot and Surendranagar district of Saurashtra region.

In Kachchh, 66.7% of the wells analysed have recorded the rise in water levels whereas 33.3% shows the fall. Rise is observed mostly in the range of greater than 4 meter (29.2 % wells). Map and graph of Decadal Fluctuation in Confined Aquifer Decadal average of November (2014 to 2023) to November 2024 shown in Fig.17 and Fig.18 respectively.

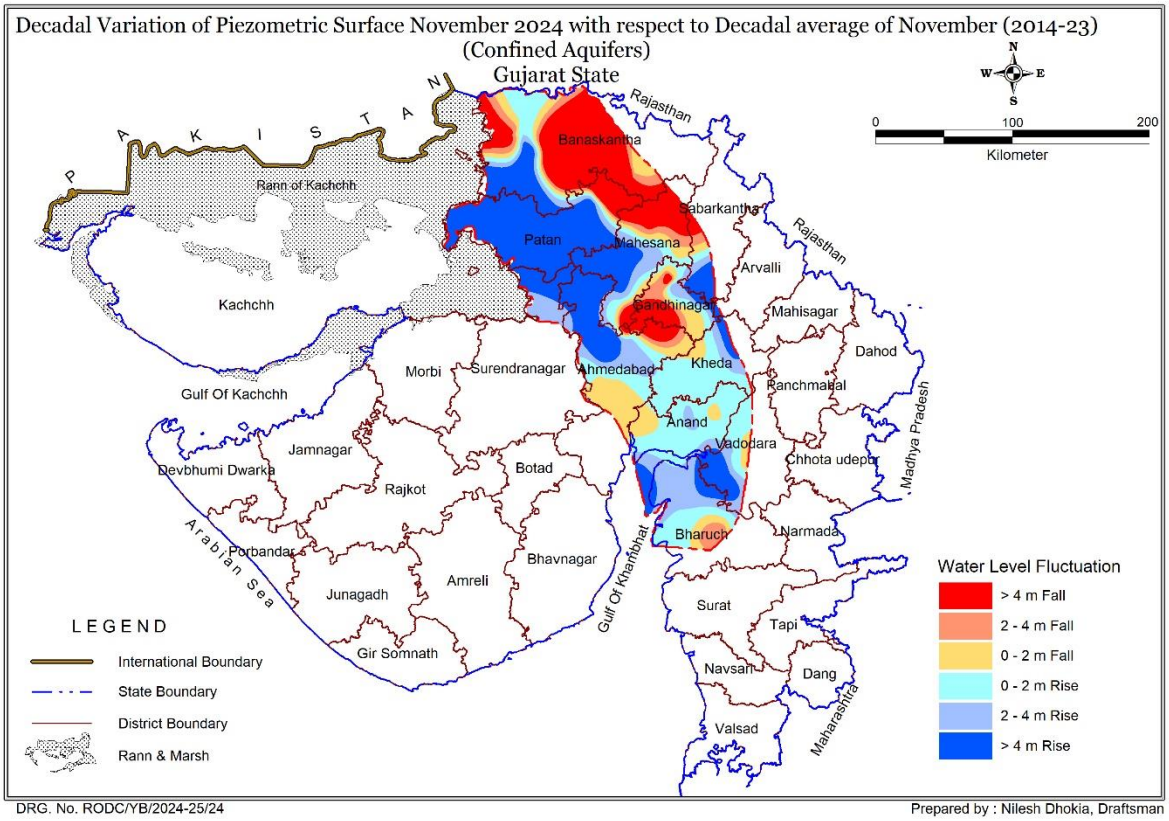


Figure 17: Decadal Fluctuation of Peizometric surface in Confined / Semi- confined Aquifer Decadal average of November (2014 to 2023) to November 2024

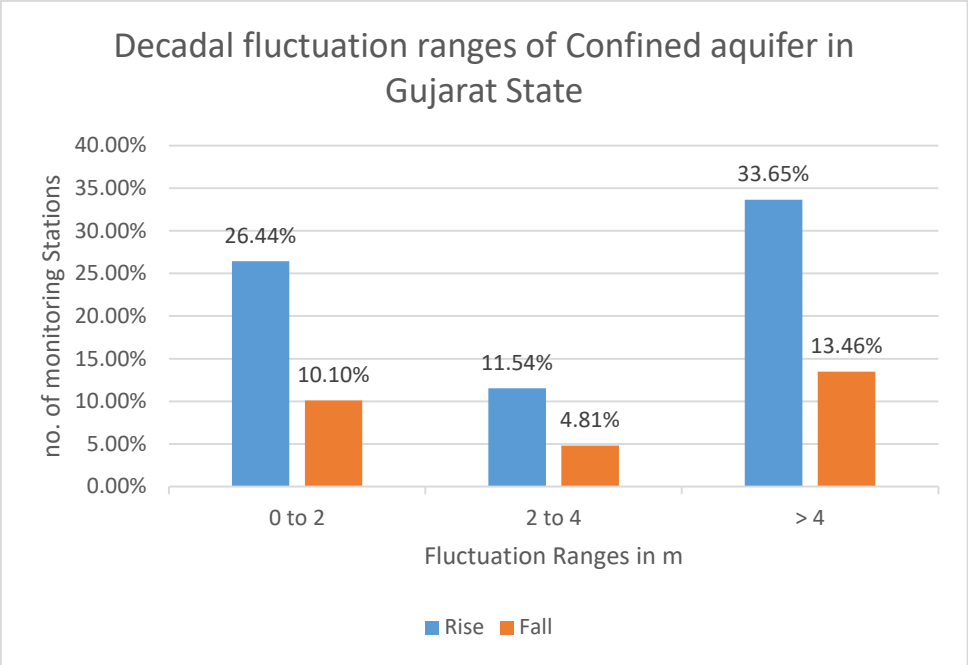


Figure 18: Decadal Fluctuation of Peizometric surface in Confined / Semi- confined Aquifer Decadal average of November (2014 to 2023) to November 2024

Summary:

As a component of the National Ground Water Monitoring Programme, the CGWB, WCR, Ahmedabadconducts monitoring of the ground water conditions on a quarterly basis: in January, pre-monsoon May, post monsoon August, and November. As of November 30, 2024, the WCR of the Central Ground Water Board supervises 789 dug wells and 504 piezometers. This comprehensive effort aims to portray the variations in the state's ground water conditions across different aquifers.

In November 2024, In unconfined aquifer, Water level of 2 to 5 m bgl in 43.3% of wells is observed in all the districts of Gujarat state except in Gandhinagar. During November 2024, decadal fluctuation In North Gujarat, in confined aquifer, 71.3 % of wells have shown rise and mostly in range greater than 4 m (44.2 % of wells). The fall of 28.7% in Peizometric surface is observed in the almost all area of north Gujarat where > 4m observed in Ahmedabad, Banas Kantha, Gandhinagar and Mehesana. Seasonal fluctuation in unconfined aquifer In Kachchh, 90% of the total well analysed recorded rise in water level. The rise is mostly in the range 0 to 2m and is observed in 42.5% of the total well. The total fall of water level has been observed in 10% of the total well in the region.