BEFORE THE NATIONAL GREEN TRIBUNAL

PRINCIPAL BENCH, NEW DELHI

Original Application No. 694/2023

In re: News item appearing in Hindustan Times dated 26.10.2023 titled **"UN predicts groundwater level in India will reduce to 'low' by 2025"**

Counter affidavit on behalf of Respondent no 5.

I, S.C. SINGH, aged about 59 years, Son of Lt C. P. Singh, presently posted as C.E. (PMG) District - PATNA, Bihar hereby solemnly affirm and declare as follows ;-

1. That I am the 5th Respondent herein and as such well acquainted with the facts and circumstances of the case.

2. That it is humbly stated that the present OA has been registered *suomoto* on the basis of the news item published in 'Hindustan Times' dated 26.10.2023 titled **"UN predicts groundwater level in India will reduce to 'low' by 2025".**

3. That it is further stated that the Hon'ble Bench has observed that the Annual Report of 2022 which has been published by the Central Ground Water Board, Department of Water Resources depicts a different picture then the one which has been presented in the report filed before the Tribunal. The ground water

resource scenario of the State of Bihar which is mentioned in Chapter 7 of the Report is as follows:-

"In case of Bihar out of 90348.70 SqKm of the State of rechargeable area 867.8 SqKm is over exploited, 1354.24 SqKm is critical and 6200.44 SqKm is semi critical."

4. That it is further stated that the State of Bihar is administratively divided into 38 districts and 534 blocks.

5. That it is further stated that Central Ground Water Board, Department of Water Resources,River Development & Ganga Rejuvenation, Ministry of Jal Shakti, Government of India has prepared National Compilation onDynamic Ground Water Resources of India, 2023 wherein State Wise Ground Water Resources Scenario has been presented on Chapter- 7.

A true/photo copy of the National Compilation on Dynamic Ground Water Resources of India, 2023 is being annexed herewith and marked as Annexure-A.

6. That it is further stated that as per the abovementioned report, out of the total 535 assessment units (blocks + Patna Urban), 8 units (1.50 %) are 'Over-exploited', 7units (1.31 %) are 'Critical', 53 units (9.91 %) are 'Semi-Critical', 467 units (87.29 %) units are 'Safe'category. There is no 'Saline' block in the State.

7. That it is further stated that it is also mentioned in the above mentioned report that Similarly out of 90348.70 sq. km recharge worthy area of the State, 867.8 sq km (0.96 %) area areunder 'Over-Exploited', 803.91 sq. km (0.89 %) under 'Critical', 7417.08 sq. km (8.21 %) under 'Semicritical', 81259.91 sq. km (89.94 %) under 'Safe' categories of assessment units. Out of total 30718.81mcm annual extractable ground water resources of the State, 283.46 mcm (0.92 %) are under 'Overexploited', 237.4 mcm (0.77 %) under 'Critical', 2168.92 mcm (7.06 %) under 'Semi-critical' and28029.03 mcm (91.24 %) are under 'Safe' categories of assessment units.

8. That it is further stated that as per the above mentioned report, 89.94% area in the State of Bihar is under the 'Safe' category and only 0.92% are under 'Overexploited' and 0.77% area are 'Critical'.

9. That it is further stated that as per the data of the Ground Water Year Book, Bihar, (2021 - 2022), between the period of May 2021 to January 2022, "*about 59% (123) Hydrograph Network Stations(HNS) has shown rise in water level and rest 41%(86) has shown fall.Majority of HNS (43%) has shown rise in water level in the range of 0 – 2 in major partof the area covered by analysed wells. The localised areas falling in part of Begusarai, Bhojpur,Buxar, Nalanda, Nawada, Samastipur have shown rise in water level between 2 and 4 m. Apatch of more than 4 m rise has been observed in Gaya and Nawada district.Except Begusarai, Majority of districts have shown fall in water level*

down to 2 m. Thefall of water level more than 4 m has been recorded only in 1 HNS located in Jehanabad district."

A true/photo copy of the Ground Water Year Book, Bihar, (2021 - 2022)is being annexed herewith and marked as Annexure-B.

10. That it is further stated that despite of the data above mentioned, keeping in mind the possibility of decline in ground water level as a result of changes in climate in the past years and excessive exploitation of ground water, an important decision was taken after joint deliberations by both the Houses of Bihar Government, the multidimensional program *Water-Life-Greenery Campaign (JalJeevanHaryali)* is being implemented. Whose main components, its objectives and progress report are as follows-

i. **Step 1:-Identifying public water harvesting structures and making them free from encroachment.**

Under this component, public ponds, ponds, streams and ponds located in all the districts of the state will be covered. By identifying important water harvesting structures through remote sensing data and to free them from encroachment by getting them physically verified. So far a total of 18,313 public ponds/ponds/ahars/pons and 11,130 public wells have been made encroachment free.

ii. **Step 2:-Renovation of public water harvesting structures like ponds/ahars/pokhars/pines**

Under this component, the identified and encroachment free public water harvesting structures like ponds/pokhars/ahars/pines are being renovated.

iii. **Step 3:-Identifying and renovating public wells**

Under this component, those public wells which are closed for various reasons are being identified and renovated. A total of 27.293 public wells have been renovated so far.

iv. **Step 4:-Construction of soakaway/recharge/other water harvesting structures along the banks of public wells/pumps.**

Under this component, arrangements for management of residual water near water sources like wells and hand pumps are being ensured. Also, through the process of recharging excess ground water sources work is being done to balance the water usage and water harvesting cycle. Till now, a total of 19.902 public wells and 1,21,405 public hand pumps have been constructed with soakage.

v. **Step 5:-Construction of check dams and other water harvesting structures in small rivers/drains and in hilly areas.**

Under this component, check banks and other water harvesting structures are being constructed in water harvesting areas. Besides, work is being done on the scheme of rain water harvesting by

making garland trench at the foothills of the mountains. Its main objective is to store excess rain water so that it can be used in future. The stored water is also used in fishing and other activities. It is also a useful and powerful means of recharging ground water. So far, a total of 12,642 check dams and other water harvesting structures have been constructed.

vi. **Step 6:-Creation of new water sources and transportation of water from surplus river water areas to water deficit areas.**

Under this component, new water sources like private ponds, fields-ponds, chaur development and other public and private water sources are being developed. Till now, the construction work of a total of 24,435 new water sources has been completed.

Under Component 6 of the Jal-Jeevan-HariyaliAbhiyan, an ambitious plan is being worked on to take the surplus water of Ganga river through pipeline to Rajgir, Nawada, Gaya and Bodh Gaya under the "Ganga Water Supply Scheme". This Bhagiratha effort will ensure uninterrupted drinking water supply in these cities.

vii. **Step 7:-Construction of roof-rain water harvesting structure in buildings.**

Under this component, the work of construction of roof-top rain water harvesting structures is being done by identifying

government buildings. Awareness is being spread among the general public for construction of rooftop rainwater harvesting structures in private buildings. So far, a total of 13,672 government buildings have been covered with rooftop rainwater harvesting structures. Provision has been made for the construction of rooftop rain water harvesting structures in the planning approval of new buildings by the Building Construction Department itself.

viii. **Step 8:-Creation of nurseries and intensive tree plantation**

Under this component, efforts are made to increase green cover, clean the environment and reduce pollution.For this, intensive tree plantation work is being done in private and public sectors across the state. By theEnvironment, Forest and Climate Change Department and Rural Development Department in addition ofDidi's nursery maintained by Bihar Rural Livelihood Promotion Committee (Jeevika), the plantation work is being done in private gardens and other farmer's nurseries. Till now, a total of 488.54 lakh saplings has been planted under 924 nurseries.

ix. **Step 9:-Use of alternative crops, drip irrigation, organic farming and other new techniques**

Under this component, drip irrigation and other techniques with low water consumption are being used and along with promoting

climate-friendly farming, work of crop residue management is also being done. There is a provision of subsidy on many latest agricultural equipment with the aim of encouraging farmers to manage crop residue in the fields and use it as fertilizer instead of burning it. Besides, farmers are also being motivated not to burn crop residues in the fields. At present organic farming is being done in a total of 92.486.49 acres in the state. A total land area of 17,421.32 acres has been covered with drip irrigation. Weather-adapted farming has been implemented in a total area of 1,17,476.95 acres.

x. **Step 10:- Promotion of solar energy use and energy saving**

The main objective of this component is to arrange solar energy in government buildings and to spread awareness about the use of solar energy in private buildings. The use of renewable energy in place of conventional energy is being encouraged through the IRA component. So far, solar power plants have been installed on a total of 2,448 government buildings.

xi. **Step 11:- Jal-Jeevan- Hariyali Awareness Campaign**

Under the Jal-Jeevan-Hariyali campaign, awareness programs are being conducted by various departments at many levels. Its aim is to make every person of the state sensitive towards the environment through awareness programs. Continuous efforts are

being made to make the citizens of the state aware of environmental protection by adopting new and traditional techniques of communication.

In order to increase awareness under the Jal-Jeevan-Hariyali campaign, "Jal-Jeevan-Hariyali Day" is being celebrated on the first Tuesday of every month in all government offices, government colleges and schools from the state level to the Panchayat level. Seminars, workshops, discussions and other awareness related activities are organized on the proposed subject matter.

11. That it is further stated and submitted that due to work being done on such a large scale, despite less rainfall and excessive groundwater exploitation in the past years, the situation in semi-critical, critical and over-exploited units is almost the same in the groundwater assessment year 2020, 2022 and 2023.

12. That the statements made in this counter affidavit are true to my knowledge and information derived from the records of the case.

13. That the annexures are true photo copies of their respective originals.

Subhash Chandra Singh
8.2.2024.
Chief Engineer (PMG)
MNRD Bihar. Patna.

CHAPTER 7

7.0 STATE WISE GROUND WATER RESOURCE SCENARIO

The ground water conditions, its availability and utilization scenario and categorization of assessment units in different states are given in Annexure I, II, III & IV. State wise summaries are given below.

7.1 ANDHRA PRADESH

The State is divided into 667 assessment units (Mandals) .The State is predominantly covered by hard rocks.As much as 80% of the State is underlain by hard rock formations like Archaeans, Pre-Cambrians, Cuddapahs, Kurnools and Deccan traps. The remaining 20% is underlain by soft rocks including Gondwanas, Rajahmundry sandstone and Recent Alluvium.

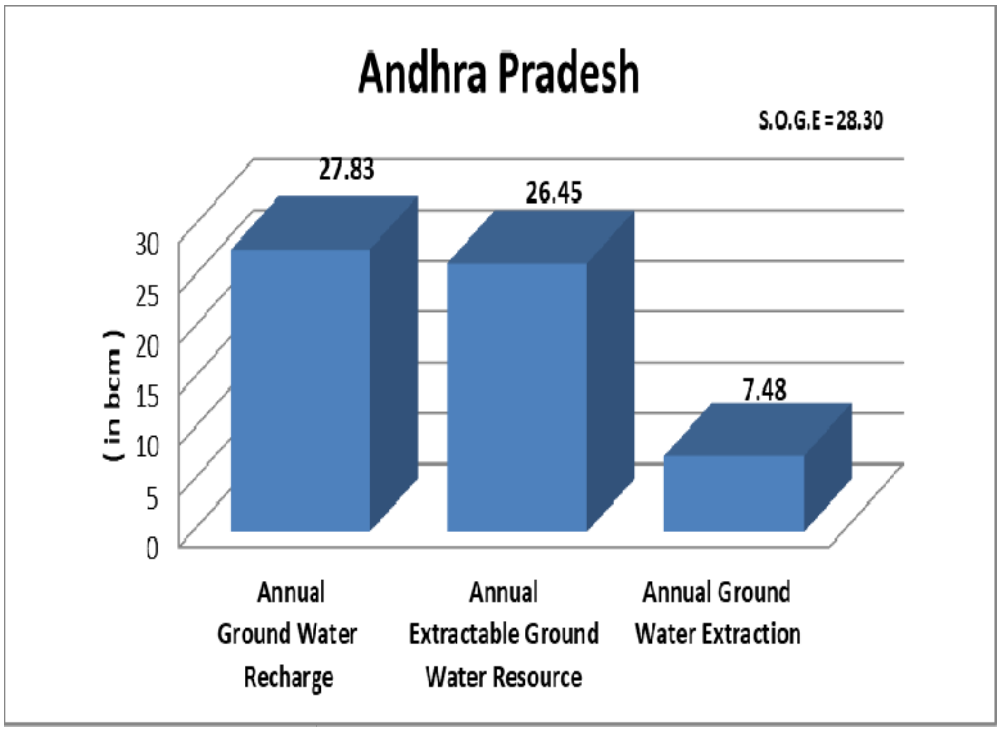
The Ground water resources have been assessed watershed wise and are apportioned to mandals. The Total Annual Ground Water Recharge of the State has been estimated as 27.83 bcm and Annual Extractable Resource is 26.45 bcm. The current Annual Ground Water Extraction for all uses is 7.48 bcm and Stage of Ground Water Extraction is 28.3 %.

Out of 667 assessment units (mandals), 10 (1.5%) units have been categorized, as 'Over-exploited', 03 units (0.45%) as 'Critical', 18 units (2.7%) as 'Semi-Critical', 597 units (89.5 %) as 'Safe' and 39 units categorized as 'Saline' (5.85%).

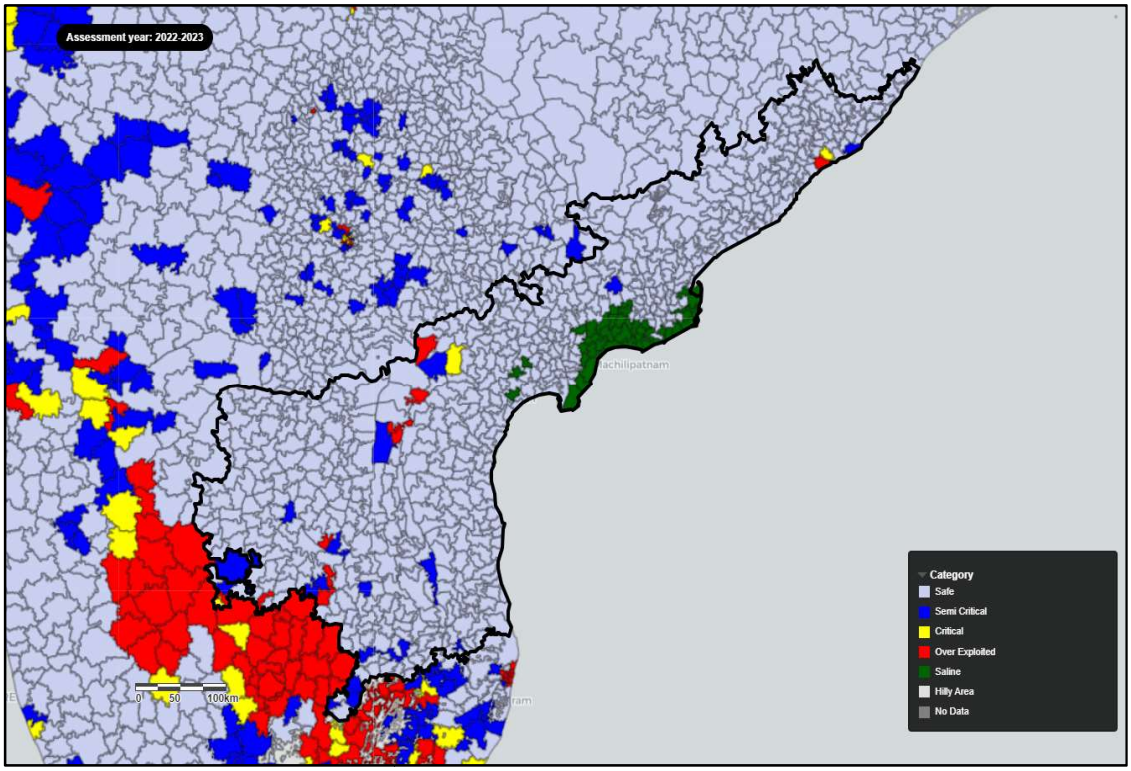
Similarly, out of 139599.85sq km recharge worthy area of the State, 1886.36 sq km (1.35 %) area are under 'Over-Exploited', 775.78 sq km (0.56 %) under 'Critical', 3936.09 sq km (2.82 %) under 'Semi-critical', 126905.3 sq km (90.91 %) under 'Safe' category of assessment units. 6096.33 sq km (4.37%) area is under 'Saline' category of assessment units.

Out of total 26445.91 mcm annual extractable ground water resources of the State, 221.8 mcm (0.84%) are under 'Over-exploited', 77.62 mcm (0.29 %) under 'Critical', 489.85 mcm (1.85 %) under 'Semi-critical' and 25656.64 mcm (97.02 %) are under 'Safe' categories of assessment units.

As compared to 2022 assessment, the total Annual Ground Water Recharge for the State has increased from 27.23 bcm to 27.83 bcm, which is attributed to excess rainfall, increase in surface water impoundments, government interventions, e.g. water conservation activities. Similarly, the annual extractable groundwater resources of the State increased from 25.86 bcm to 26.45 bcm. The annual groundwater extraction has increased marginally from 7.45 to 7.48 bcm in the State. The stage of groundwater extraction of the state decreased marginally from 28.81% to 28.3% in the current assessment indicating overall improvement in ground water scenario.



Dynamic Ground water Recourses Scenario 2023 - Andhra Pradesh



Categorization Map of GWRA 2023 – Andhra Pradesh

7.2 ARUNACHAL PRADESH

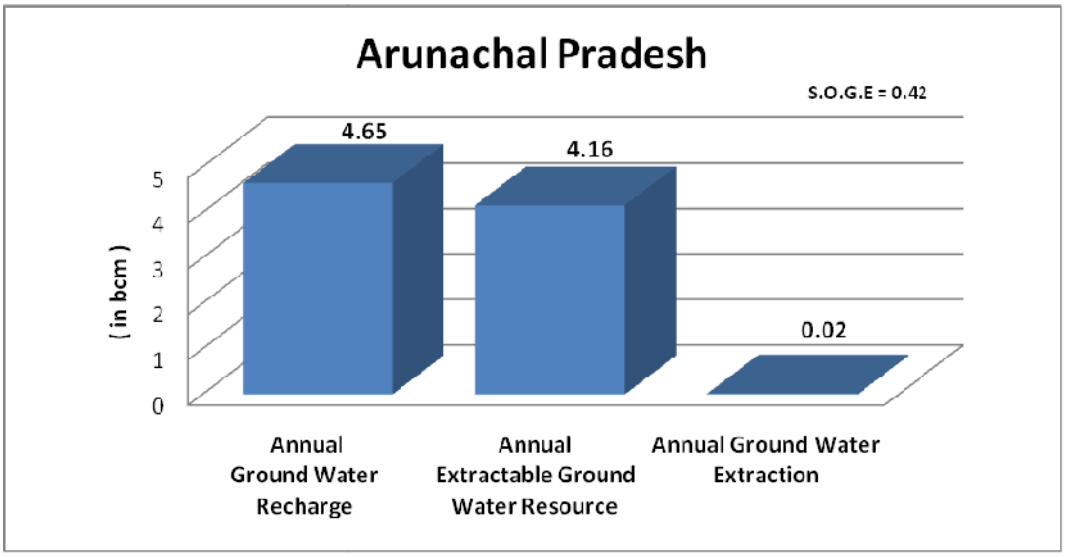
The state of Arunachal Pradesh is underlain by diverse rock types of different geological ages from Pre-Cambrian to Recent. Major part of the state is covered with consolidated crystalline rocks and meta-sediments of Precambrian and Palaeozoic age, while Tertiary sediments consisting of semi-consolidated argillaceous assemblage, represented by the Disang, Barail, Tipam, Siwalik and Dihing groups of rock, occupy periphery areas bordering Assam and behave as run-off and in select patches functions as infiltration zone. In consolidated formations, ground water potential appears to be limited. Semi-consolidated Tertiary formations are likely to give moderate or poor yield and expected to be controlled by aquifer geometry and structural features. Ground water in both consolidated and semi-consolidated formations also manifests as springs and in all geological formation springs occur as both seasonal and perennial in nature.

Unconsolidated Quaternary sediments comprising the terrace deposits of Pleistocene (Bhabar zone) and also the terrace and alluvial fan deposits of Holocene age prevail in the fringe valley areas and as thin carpet in isolated structural valley sand with considerable thickness in open and wide valleys joining Brahmaputra Alluvial plains. The unconsolidated alluvial sediments in the valley areas act as good repositories for ground water development. Valleys adjoining Assam are most promising where good thickness of granular zones is distributed. Discharge of the deep tube wells, tapping mostly unconsolidated Quaternary sediments & at places Upper Tertiary formations, varies from 1.4m^3/hr to 54m^3/hr, while transmissivity ranges from 1 to 661m^2/day. Storativity ranges from $0.35x10^{-3}$ to $6.65x10^{-3}$

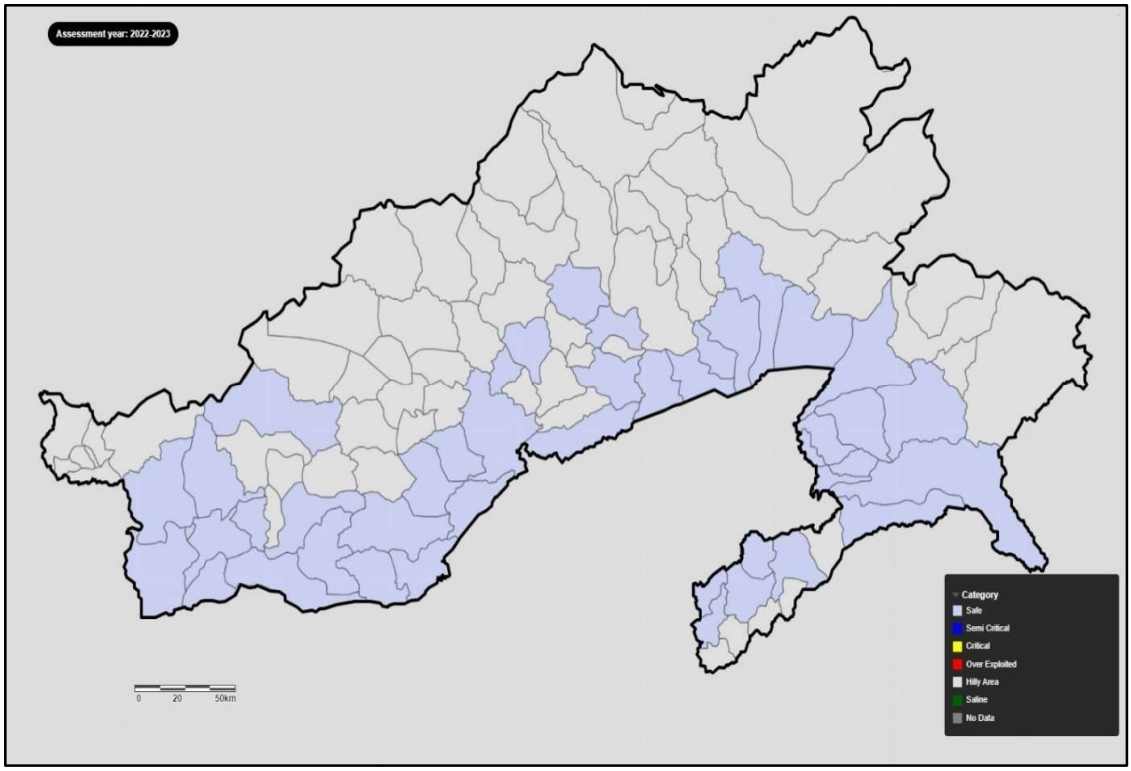
The ground water resource estimation of the state has been done block-wise by considering 42 nos. of groundwater recharge worthy blocks as assessment unit. The Total Annual Groundwater Recharge of the State has been estimated as 4.65 bcm and Annual Extractable Groundwater Resources is 4.16 bcm. The Current Annual Ground Water Extraction for all uses is 0.02 bcm and Stage of Ground Water Extraction is 0.42 %. All the 42 assessment units have been categorized as ‘Safe’. There is no saline area in the state.

Similarly out of 5721.38 sq km recharge worthy area of the State, 5721.38 sq km (100 %) under ‘Safe’ categories of assessment units. Out of total 4163.11 mcm annual extractable ground water resources of the State, 4163.11 mcm (100 %) are under ‘Safe’ categories of assessment units.

As compared to 2022 assessment, the Total Annual Ground Water Recharge for the State has increased from 4.52 bcm in 2022 to 4.65 bcm in 2023, Annual Extractable Ground Water Resources increased from 4.07 bcm in 2022 to 4.16 bcm in 2023 and Total Ground Water Extraction decreased from 0.03bcm in 2022 to 0.02 bcm in 2023. The Stage of Ground Water Extraction decreased from 0.79 % to 0.42 %.



Dynamic Ground water Recourses Scenario 2023 – Arunachal Pradesh



Categorization Map of GWRA 2023 – Arunachal Pradesh

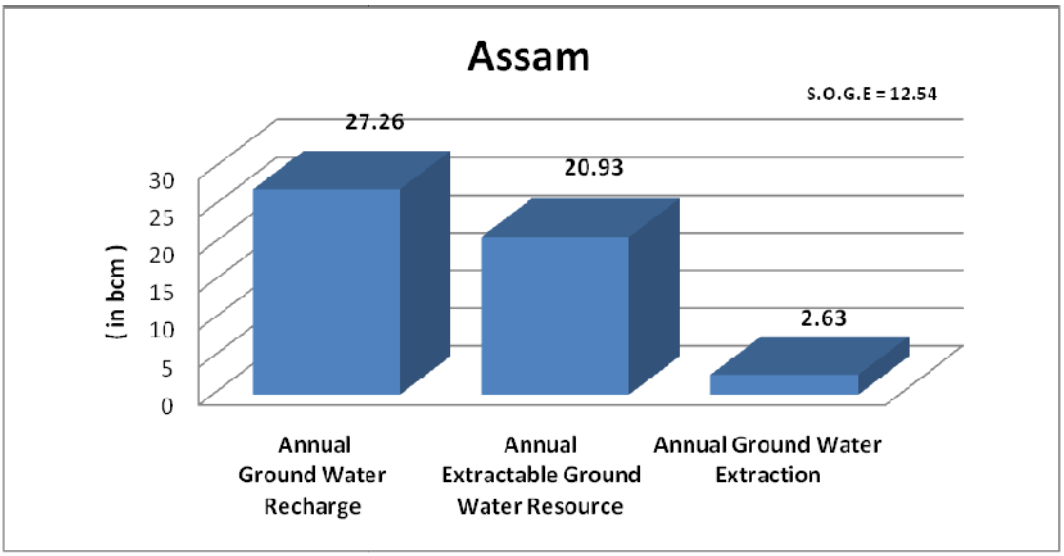
7.3 ASSAM

The State is underlain mainly by unconsolidated Quaternary formation in Brahmaputra valley and potential aquifers lie at shallow as well as deeper zone. The semi-consolidated Tertiary formations are found to occur in the southern part of KarbiAnglong, Cachar, Karimganj and Hailakandi districts and in Upper Assam covering southern fringe of Dibrugarh, Tinsukia, Sibsagar, Jorhat, Golaghatdistricts.The consolidated Precambrian rocks occur mainly in N.C. Hills, Karbi-Anglong, Kamrup, Goalpara, Dhubri, and Nagaon.

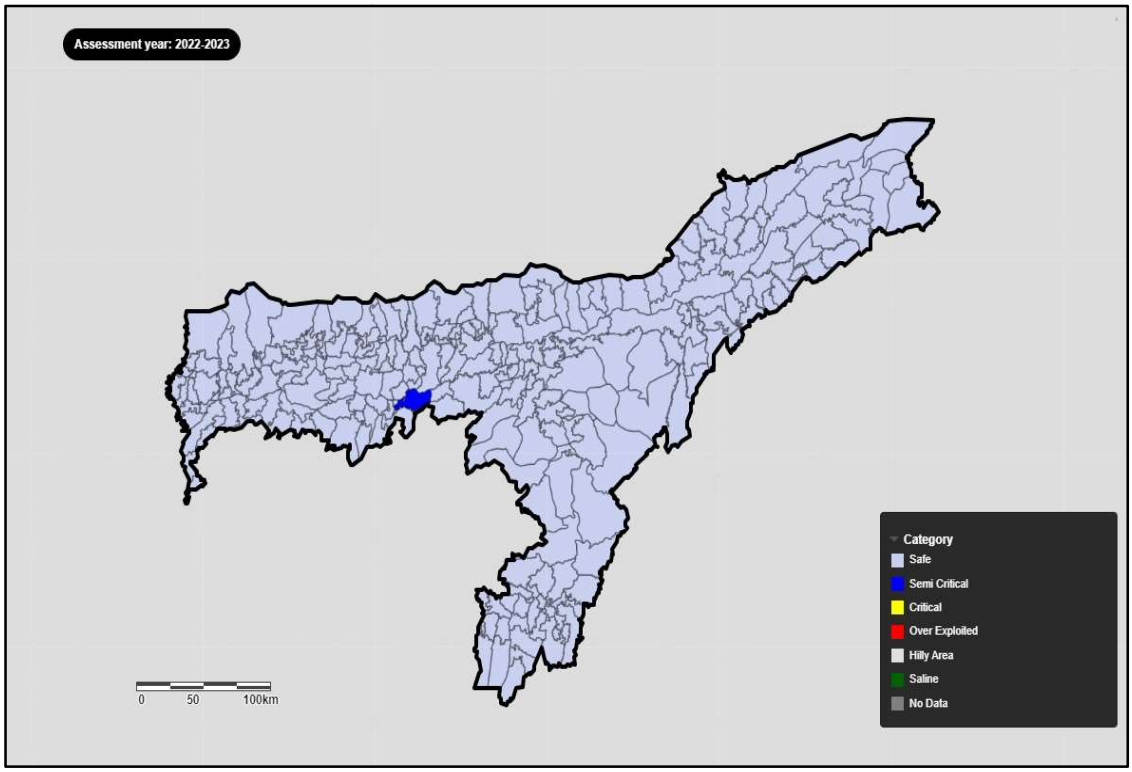
Groundwater resources has been estimated for this year on a block-wise basis for the state. The Total Annual Groundwater Recharge of the State has been estimated as 27.26 bcm and Annual Extractable Groundwater Resources is 20.93 bcm. The Current Annual Ground Water Extraction for all uses is 2.63 bcm and Stage of Ground Water Extraction is 12.54 %. Out of 245 assessment units, 244 have been categorized as 'Safe' and one assessment unit of Kamrup (Metro) Urban is in 'Semi Critical' condition. There is no saline area in the state.

Similarly out of 68817.93 sq km recharge worthy area of the State, 200.42 sq km (0.29 %) under 'Semi-critical', 68617.51 sq km (99.71 %) under 'Safe' categories of assessment units. Out of total 20931.53 mcm annual extractable ground water resources of the State, 41.47 mcm (0.2 %) under 'Semi-critical' and 20890.06 mcm (99.8 %) are under 'Safe' categories of assessment units.

As compared to 2022 assessment, the Total Annual Ground Water Recharge for the State has increased from 26.53 bcm in 2022 to 27.26 bcm in 2023, Annual Extractable Ground Water Resources increased from 21.40 bcm in 2022 to 20.93 bcm in 2023 and Total Ground Water Extraction decreased from 2.65 bcm in 2022 to 2.63 bcm in 2023. Stage of Ground Water Extraction decreased from 12.38 % to 12.54 %.



Dynamic Ground water Recourses Scenario 2023 – Assam



Categorization Map of GWRA 2023 – Assam

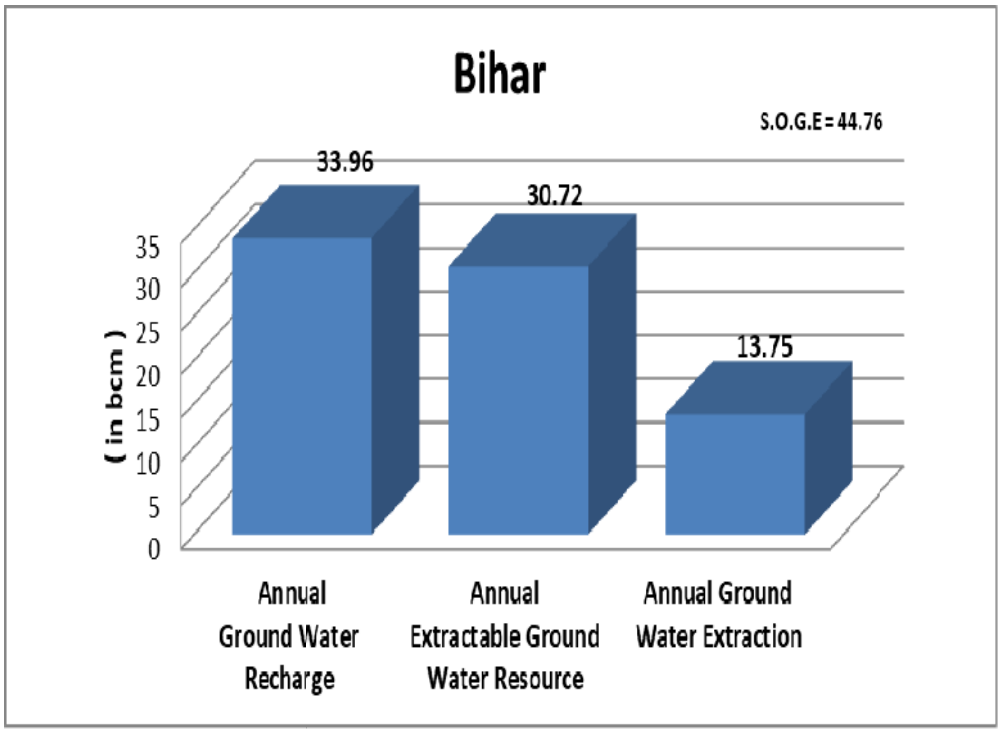
7.4 BIHAR

The State is covered with Gangetic alluvium in more than 89 % of its geographical area. The consolidated formations occupy fringes in the southern parts of the state. Dug wells and shallow tube wells tapping the phreatic zone are the common ground water abstraction structures. The assessment of dynamic ground water resources has been carried out in 535 Assessment Units (534 blocks + Patna Urban) of the State. The Total Annual Ground Water Recharge has been worked out as 33.96 bcm with the Annual Extractable Ground Water Resources as 30.72 bcm. The Current Annual Ground Water Extraction for all uses has been estimated as 13.75 bcm and the Stage of Ground Water Extraction of the State is 44.76 %.

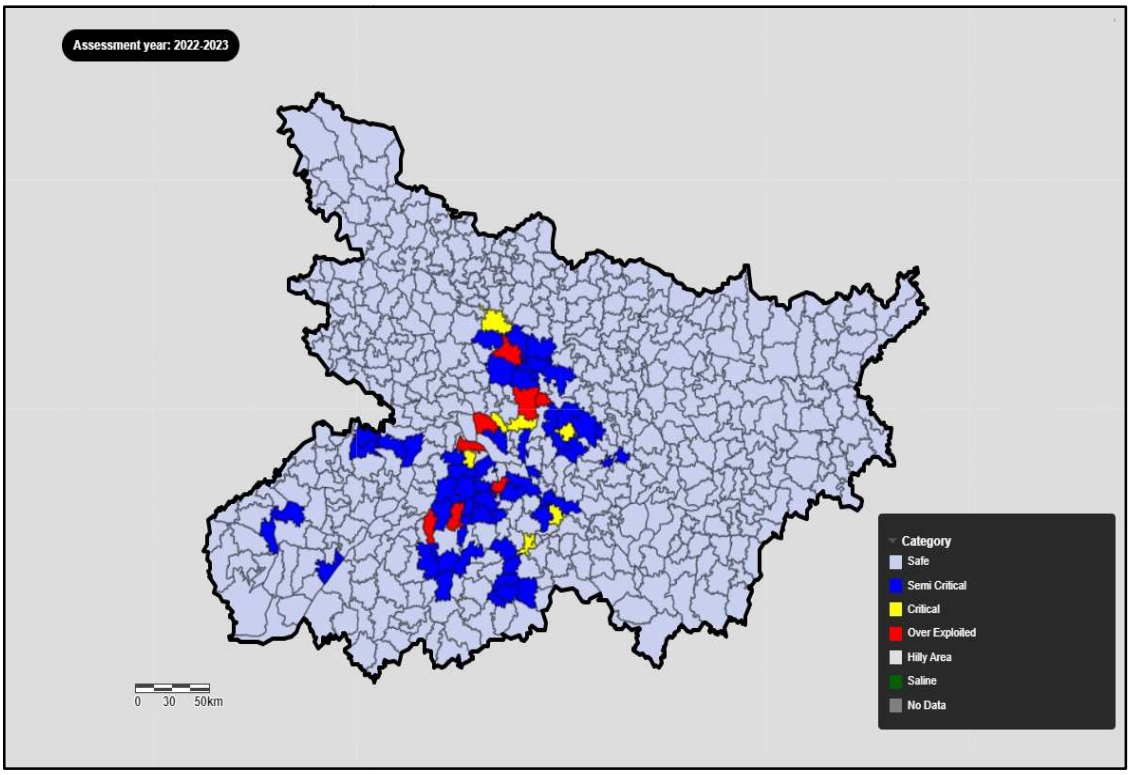
Out of the total 535 assessment units (blocks + Patna Urban), 8 units (1.50 %) are 'Over-exploited', 7 units (1.31 %) are 'Critical', 53 units (9.91 %) are 'Semi-Critical', 467 units (87.29 %) units are 'Safe' category. There is no 'Saline' block in the State.

Similarly out of 90348.70 sq. km recharge worthy area of the State, 867.8 sq km (0.96 %) area are under 'Over-Exploited', 803.91 sq. km (0.89 %) under 'Critical', 7417.08 sq. km (8.21 %) under 'Semi-critical', 81259.91 sq. km (89.94 %) under 'Safe' categories of assessment units. Out of total 30718.81 mcm annual extractable ground water resources of the State, 283.46 mcm (0.92 %) are under 'Over-exploited', 237.4 mcm (0.77 %) under 'Critical', 2168.92 mcm (7.06 %) under 'Semi-critical' and 28029.03 mcm (91.24 %) are under 'Safe' categories of assessment units.

As compared to 2022 assessment, the Total Annual Ground Water Recharge and Annual Extractable Ground Water Resources for the State have increased from 33.15 to 33.96 bcm and 30.04 to 30.72 bcm respectively. The Annual Ground Water Extraction has increased from 13.5 to 13.75 bcm. Stage of Ground Water Extraction decreased from 44.94% to 44.76 %. This year, the dynamic resources of the State have been estimated separately for canal command and non-command areas. Slight variations in recharge, both from canal sources and rainfall has been observed.. The revival and renovation of tanks and water bodies as part of the Jal Jeevan Hariyali Mission, initiated by the Government of Bihar, resulted in a marginal increase in recharge from surface water sources and surface water irrigation.



Dynamic Ground water Recourses Scenario 2023 – Bihar



Categorization Map of GWRA 2023 – Bihar

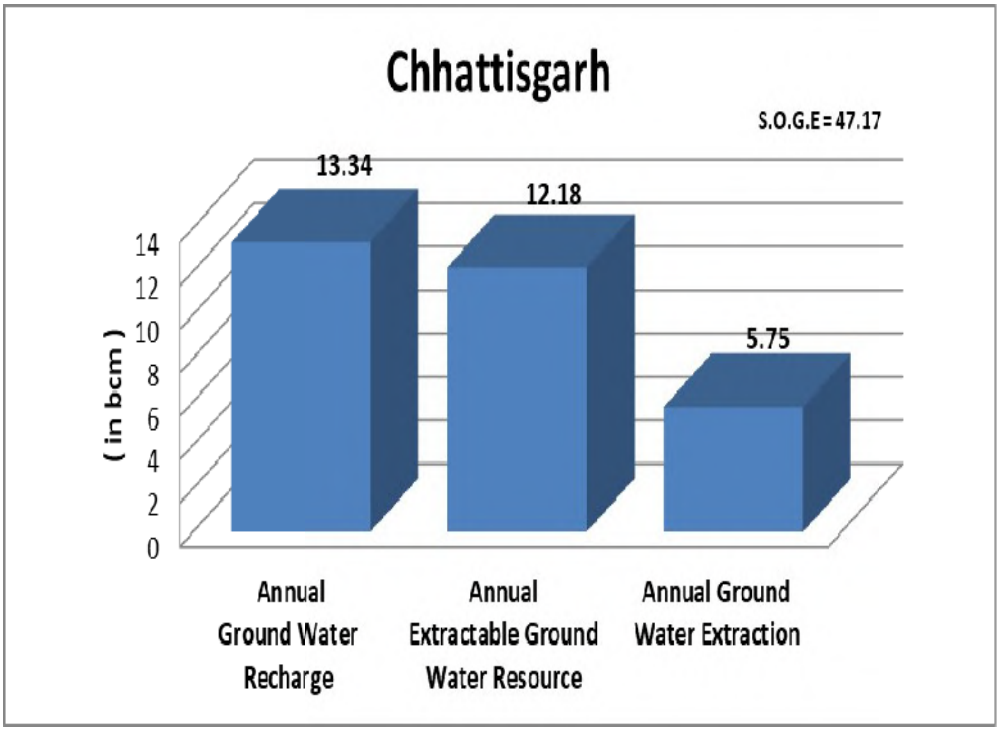
7.5 CHHATTISGARH

The State is underlain by diverse rock types of different geological ages from Pre-Cambrian to Recent. 87% area of the State is underlain by hard rock and the ground water in these areas is being tapped mostly by dug wells constructed in the weathered zone and bore wells tapping the deeper aquifers. The yield of open (dug) wells varies from 1 to 2 lps and the yield of the bore wells ranges from < 1 to 5 lps. About 13 % area of the State is occupied by Semi-consolidated sedimentary rocks where Dug wells & tube wells have yield range of 1 to 10 lps.

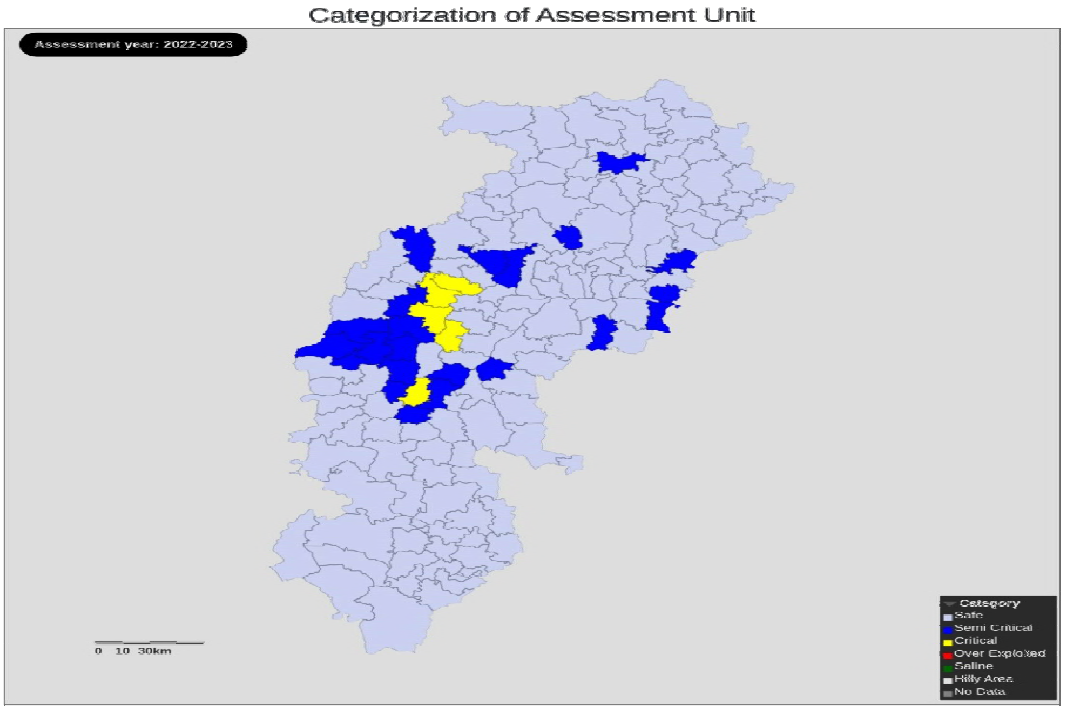
The assessment of ground water resources has been carried out block-wise. The Total Annual Ground Water Recharge of the State has been assessed as 13.34 bcm and Annual Extractable Ground Water Resource is 12.18 bcm. The Total Current Annual Ground Water Extraction is 5.75 bcm and Stage of Ground Water Extraction is 47.17 %.

Out of 146 assessment units (blocks), 5 units (3.42 %) as 'Critical', 22 units (15.07 %) have been categorized as 'Semi-critical' and 119 units (81.51 %) as 'Safe' categories of assessment units. There are no 'Over-exploited' and 'Saline' categories of assessment units in the State. Out of 106078.71 sq. km recharge worthy area of the State, 3119.06 sq km (2.94 %) area are under 'Critical', 13987.35 sq. km (13.19 %) under 'Semi-critical', 88972.30 sq km (83.87 %) under 'Safe' categories of assessment units. Out of total 12183.72 mcm annual extractable ground water resources of the State, 466.98 mcm (3.83 %) under 'Critical', 2288.80 mcm (18.79 %) under 'Semi-critical' and 9427.94 mcm (77.38 %) are under 'Safe' categories.

As compared to 2022 assessment, the Total Annual Ground Water Recharge and Annual Extractable Ground Water Resources for the State have increased from 12.04 to 13.34 bcm and 11.01 to 12.18 bcm respectively. The increase in surface water irrigation area and canal running days along with updated data of ponds and tanks is responsible for increased ground water recharge.There is an increase in ground water extraction from 5.46 to 5.75 bcm. Stage of ground water extraction has decreased from 49.58 % to 47.17 %. Increase in number of irrigation wells resulted in the increase of total extraction.



Dynamic Ground water Recourses Scenario 2023 – Chhattisgarh



Categorization Map of GWRA 2023 – Chhattisgarh

7.6 DELHI

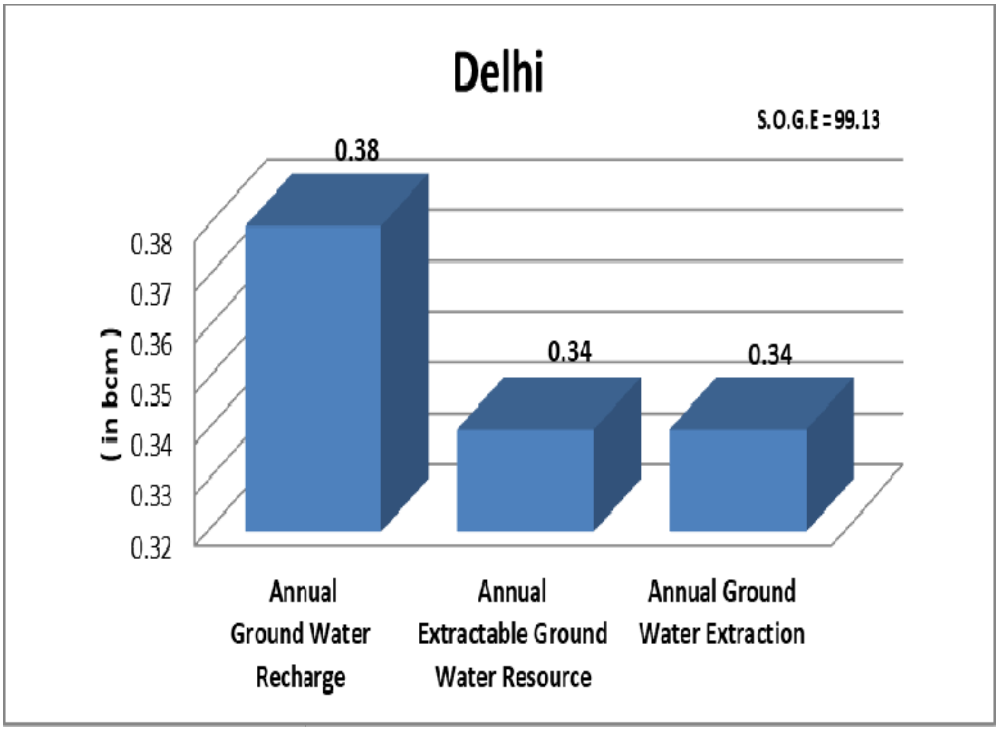
The State is covered by diverse rock types of different geological ages from Pre-Cambrian to Recent. As much as 89% of the State is occupied by alluvium and ground water is being tapped mostly through tube wells. Yields of tube wells vary from 4 to 10 lps in older alluvial deposits and from 25 to 55 lps in newer alluvium. About 11 % of the State is occupied by quartzitic hard rock, where bore wells have yield of 0.6 to 5 lps.

The ground water resources assessment has been carried out tehsil-wise. The Total Annual Ground Water Recharge of the State has been assessed as 0.38 bcm and Annual Extractable Ground Water Resources is 0.34 bcm. The Total Current Annual Ground Water Extraction is 0.34 bcm and Stage of Ground Water Extraction is 99.13 %.

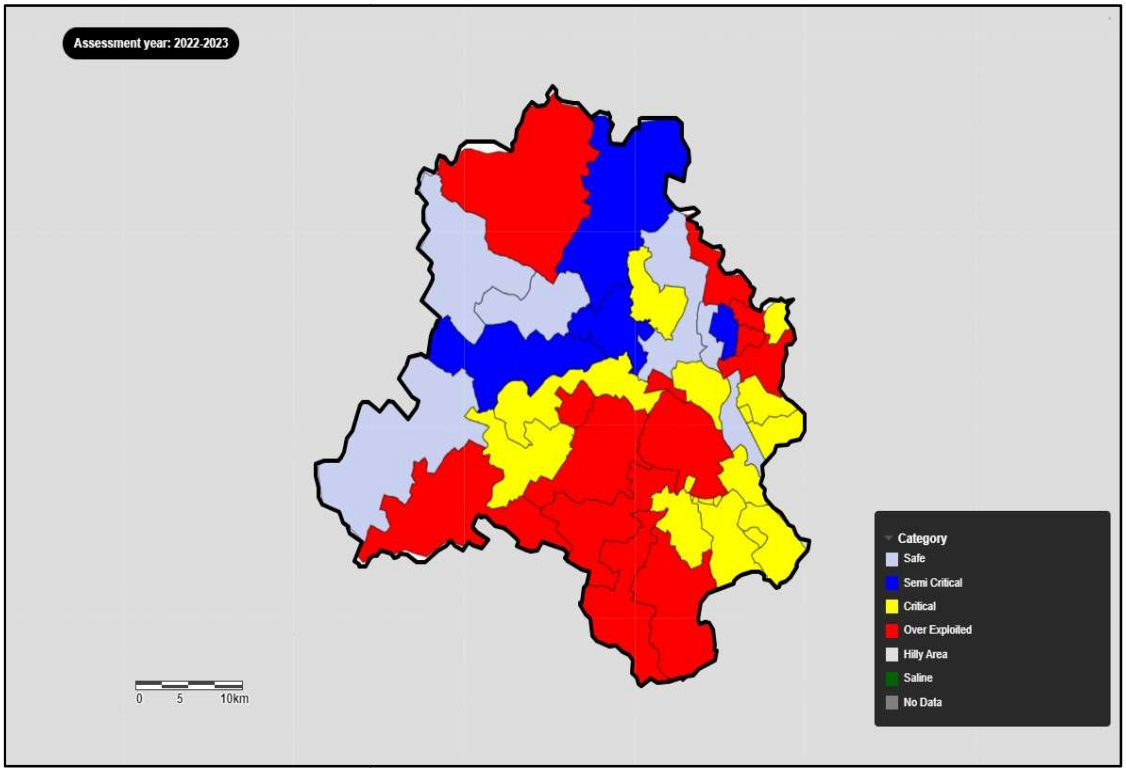
Out of 34 assessment units (tehsils), 13 units (38.24 %) have been categorized as 'Over-exploited', 12 units (35.29 %) as 'Critical', 4 units (11.76 %) as 'Semi-critical', and 5 units (14.71 %) as 'Safe' categories of assessment units.

Similarly, out of 1487.61 sq km recharge worthy area of the State, 617.25 sq km (41.49 %) area are under 'Over-Exploited', 306.4 sq km (20.6 %) under 'Critical', 233.73sq km (15.71 %) under 'Semi-critical', 330.23 sq km (22.2 %) under 'Safe' categories. Out of total 344.49 mcm annual extractable ground water resources of the State, 122.11 mcm (35.45 %) are under 'Over-exploited', 102 mcm (29.61 %) under 'Critical', 46.94 mcm (13.63 %) under 'Semi-critical' and 73.44 mcm (21.32 %) are under 'Safe' categories.

As compared to 2022 assessment, the Total Annual Ground Water Recharge decreased from 0.41 bcm to 0.38 bcm and Annual Extractable Ground Water Resources decreased from 0.37 bcm to 0.34 bcm. The decrease in the total annual groundwater recharge can be attributed to a reduction in recharge from rainfall, resulting from lower precipitation during the current assessment year compared to the previous assessment year. There is decrease in the Annual Ground Water Extraction for the state from 0.36 bcm to 0.34 bcm and the Stage of Ground Water Extraction has increased from 98.16 % to 99.13 %.



Dynamic Ground water Recourses Scenario 2023 – Delhi



Categorization Map of GWRA 2023 – Delhi

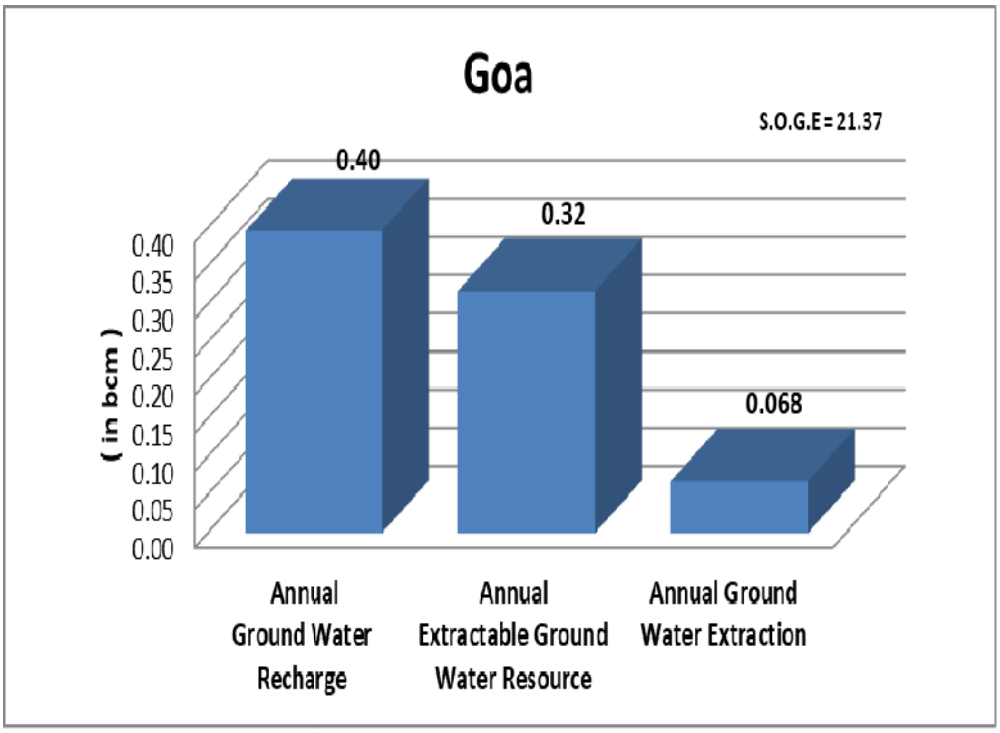
7.7 GOA

Major part of Goa State is covered by consolidated formations of Dharwar Super Group. Ground water occurs under unconfined to semi-confined conditions in beach sands, laterites, weathered and fractured crystalline rocks. The development of ground water from phreatic zone is mostly through dug wells and shallow bore wells.

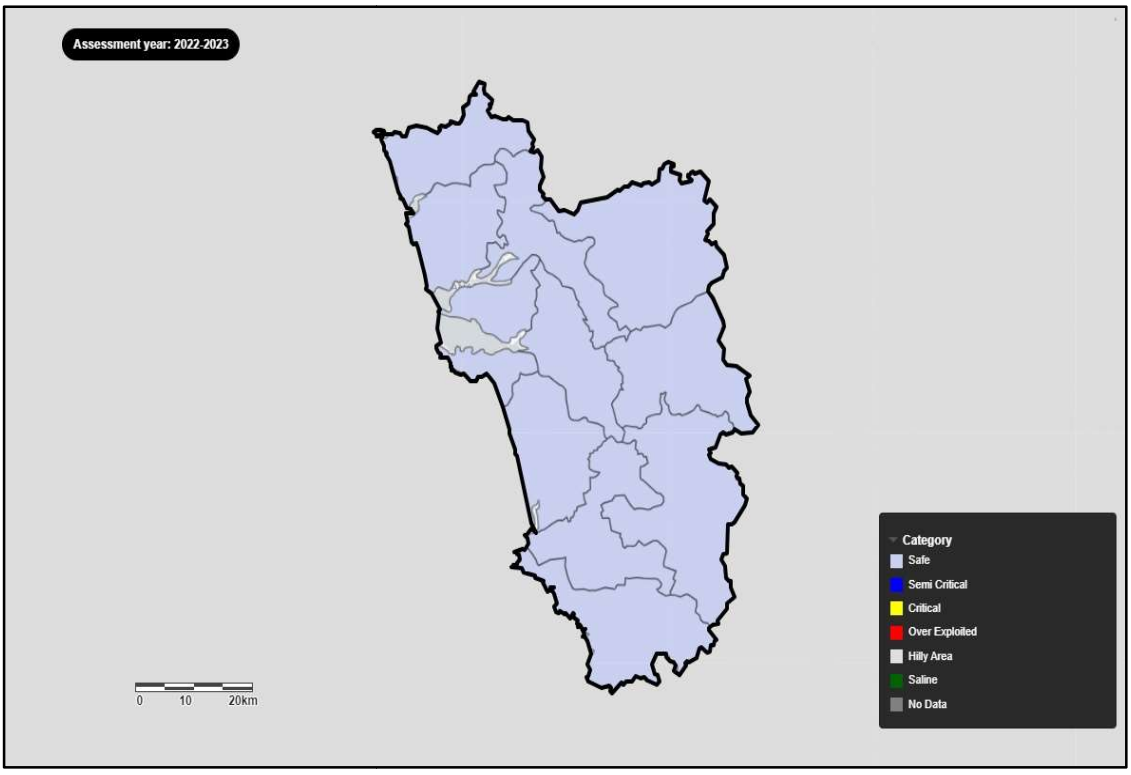
The Ground Water Resources has been assessed taluk-wise. Total Annual Ground Water Recharge has been assessed as 0.396 bcm and Annual Extractable Ground Water Resources as 0.317 bcm. The Annual Ground Water Extraction is 0.068 bcm and Stage of Ground Water Extraction is 21.37 %. All 12 taluks in the State have been categorized as ‘Safe’.

Likewise, within the State's 2209.59 sq km of recharge-worthy areas, the entire expanse, falls within the 'Safe' category of assessment units. Out of the State's total annual extractable groundwater resources 317 mcm, the entirety 100%, falls within the 'Safe' category of assessment units.

As compared to 2022 assessment, the Total Annual Ground Water Recharge decreased from 0.41 bcm to 0.398 bcm and Annual Extractable Ground Water Resources decreased from 0.33 bcm to 0.317 bcm. The Annual Ground Water Extraction has also marginally decreased from 0.078 bcm to 0.068 bcm, owing to reduction in domestic draft due to surface water supply under JJM. The Stage of Ground Water Extraction has marginally decreased from 23.63 % to 21.37 %.



Dynamic Ground water Recourses Scenario 2023 – Goa



Categorization Map of GWRA 2023 – Goa

7.8 GUJARAT

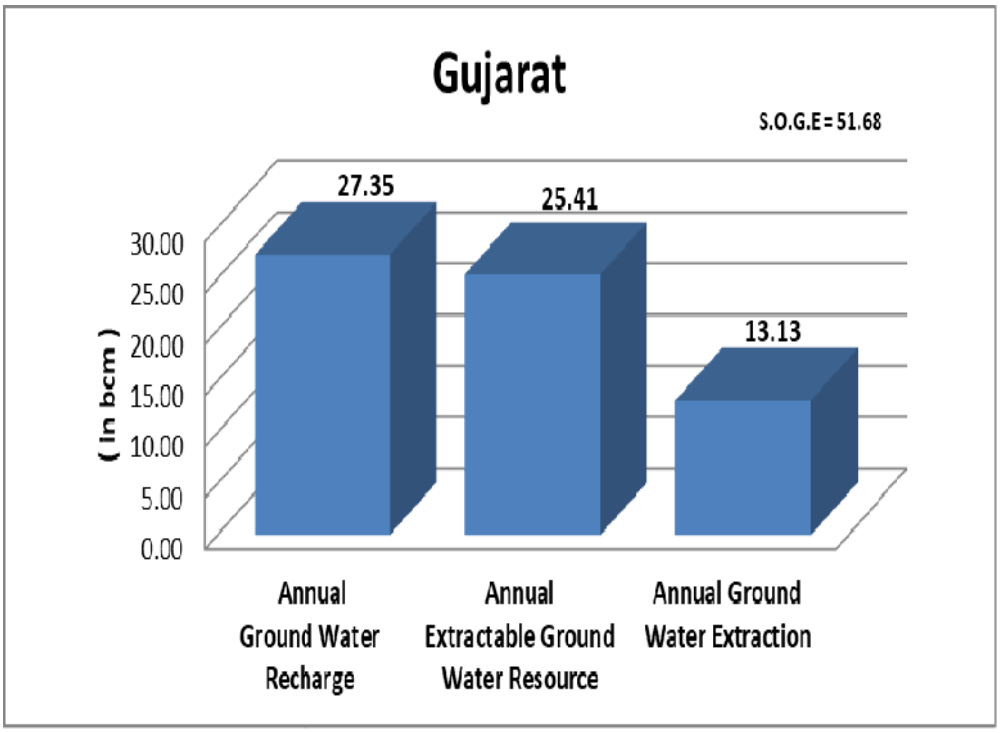
The State is underlain by diverse rock types of different geological ages from Pre-Cambrian to Recent. As much as 60% of the State is underlain by hard rock and rest by soft rock/alluvium formations. In hard rock areas, the ground water is tapped mostly through dug wells constructed in the weathered zone. Dug cum bore wells and deep bore wells are common for irrigation. In alluvium/ soft rock areas, deep tube wells are common for both irrigation and domestic usage. The yield of open (dug) wells varies from 2 to 10 m^3/day, whereas that of tube wells ranges from less than 10 to 100 m3/day.

The assessment of groundwater resources has been carried out Taluka-wise. Total Annual Ground Water Recharge of the State has been assessed as 27.35 bcm and Annual Extractable Ground Water Resources as 25.41 bcm. The Annual Ground Water Extraction has been assessed as 13.13 bcm and Stage of Ground Water Extraction as 51.68 %.

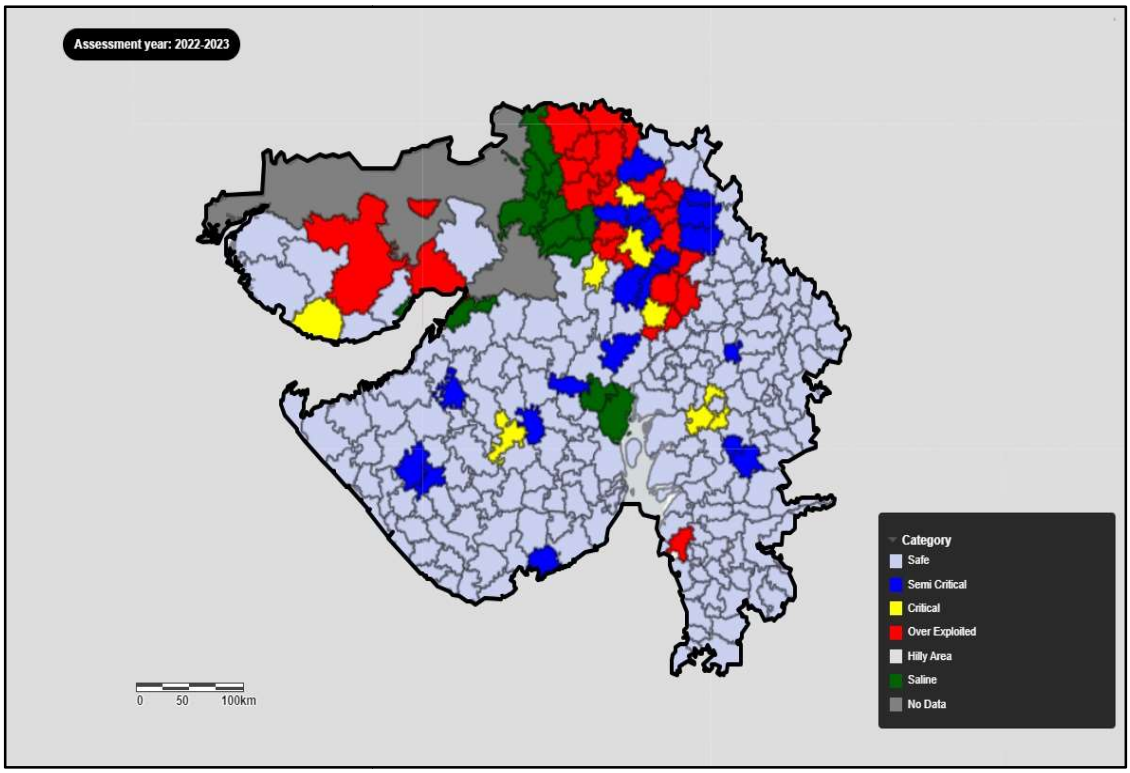
Out of 252 assessment units (talukas), 23 units (9.13 %) have been categorized as 'Over- exploited', 8 units (3.17 %) as 'Critical', 20 units (7.94 %) as 'Semi-critical', 189 units (75.00 %) as 'Safe' and there are 12 units (4.76 %) as 'Saline' categories of assessment units.

Similarly out of 162778.14 sq. km recharge worthy area of the State, 18448.47 sq km (11.33 %) area are under 'Over-Exploited', 5258.1 sq km (3.23 %) under 'Critical', 11487.16 sq km (7.06 %) under 'Semi-critical', 1,18,697.61 sq. km (72.92 %) under 'Safe' and 8886.8 sq. km (5.46 %) area under 'Saline' categories of assessment units. Out of total 25405.18 mcm annual extractable ground water resources of the State, 2105.34 mcm (8.29 %) are under 'Over-exploited', 743.01 mcm (2.92 %) under 'Critical', 2050.16 mcm (8.07 %) under 'Semi-critical' and 20506.66 mcm (80.72 %) are under 'Safe' categories of assessment units.

As compared to 2022 assessment, Total Annual Ground Water Recharge has increased from 26.46 bcm to 27.35 bcm and Annual Extractable Ground Water Resource has increased from 24.58 to 25.41 bcm. The Annual Ground Water Extraction has marginally increased from 13.09 to 13.13 bcm. The Stage of Ground Water Extraction has improved marginally from 53.23 % to 51.68 % indicating overall improvement of ground water scenario.



Dynamic Ground water Recourses Scenario 2023 – Gujarat



Categorization Map of GWRA 2023 – Gujarat

7.9 HARYANA

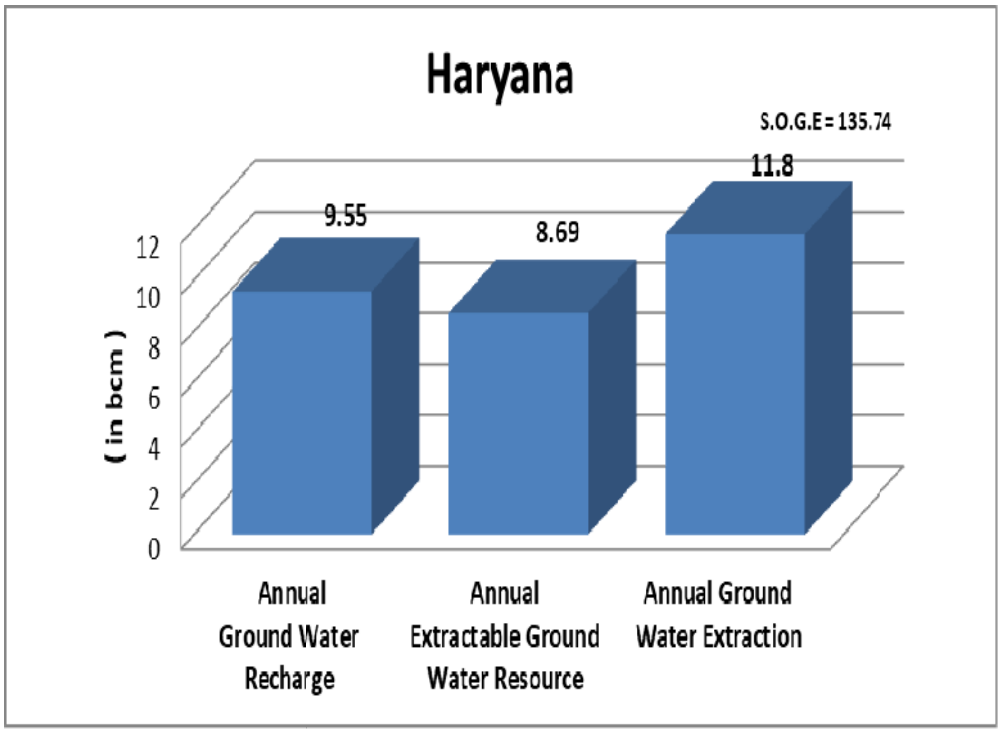
Haryana State is mainly occupied by the alluvial deposits, which cover around 98 % of the State while hardrock covers around 2 %. Alluvial deposits are of Older and Newer types and consist chiefly of clay, silt and fine to medium sand. Other deposits are piedmont deposits, which are confined to a narrow zone, about 2 to 4 km wide, between Siwalik Hills and Alluvial Plains. Sand-dunes are found in the districts of Bhiwani, Mahendragarh, Hissar and Sirsa. Coarse sand, gravels and boulders are found to occur in piedmont areas and in the adjacent alluvial tracts. The hard rock formations belong to the formation of Delhi systems of Pre- Cambrian age and occupy the southern part of the state, while Shivalik system of Tertiary age are occupying the northern most part of the state.

Total Annual Ground Water Recharge of the State has been assessed as 9.55 bcm and Annual Extractable Ground Water Resource is 8.69bcm. The Total Current Annual Ground Water extraction is 11.80bcm and Stage of Ground Water extraction is 135.74 %.

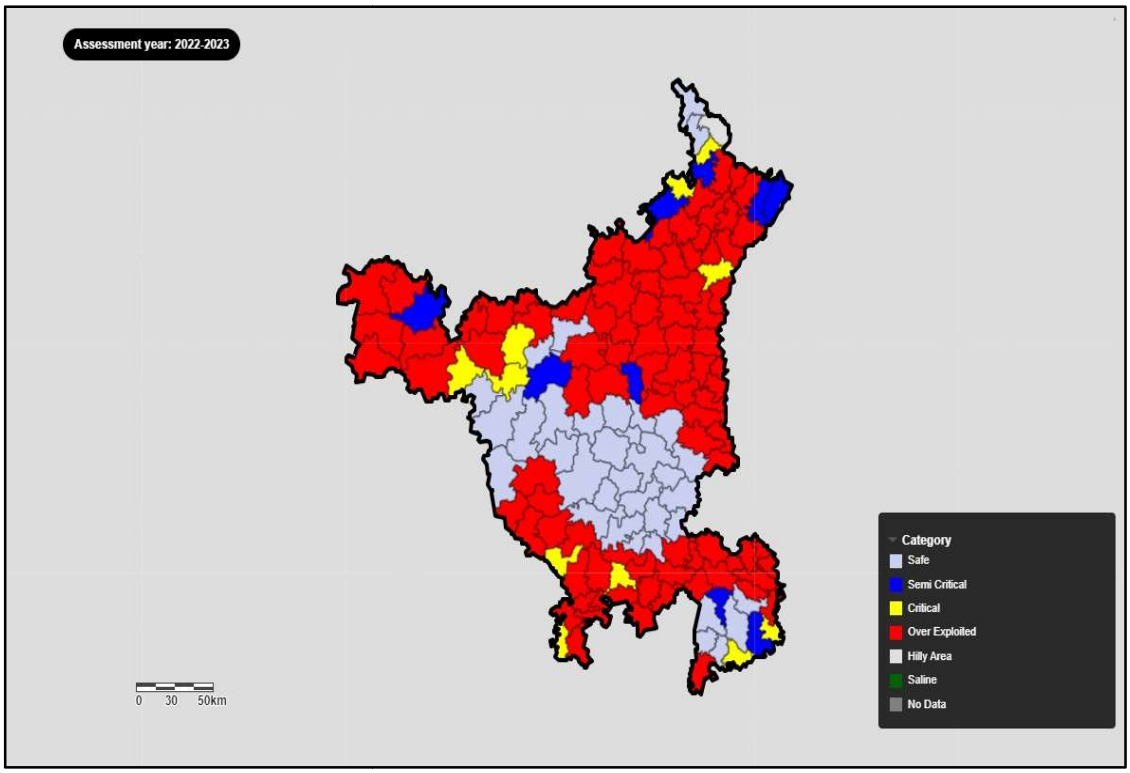
Out of total 143 assessment units (blocks/Urban), 88 units (61.54 %) have been categorized as 'Over-exploited', 11 units (7.69 %) as 'Critical', 9 units (6.29 %) as 'Semi Critical' and 35 units (24.48 %) as 'Safe' categories of assessment units.

Similarly, out of 43205.82 sq. km recharge worthy area of the State, 25959.44 sq. km (60.08 %) area are under 'Over-Exploited', 2590.43 sq. km (6 %) under 'Critical', 2558.1 sq. km (5.92%) under 'Semi-critical', 12097.86 sq. km (28 %) under 'Safe' categories of assessment units. Out of total 8690.53 mcm annual extractable ground water resources of the State, 5488.11 mcm (63.15 %) are under 'Over-exploited', 587.66 mcm (6.76 %) under 'Critical', 697.24 mcm (8.02 %) under 'Semi-critical' and 1917.52 mcm (22.06 %) are under 'Safe' categories of assessment units.

As compared to 2022 assessment, the Total Annual Ground Water Recharge have increased from 9.48 to 9.55 bcm in 2023, Annual Extractable Resources have increased from 8.61 to 8.69 bcm and the Annual Ground Water Extraction from 11.54 to 11.80 bcm. The Stage of Ground Water Extraction has increased from 134.14 % to 135.74 %.



Dynamic Ground water Recourses Scenario 2023 – Haryana



Categorization Map of GWRA 2023 – Haryana

7.10 HIMACHAL PRADESH

The diverse physiographic, climatic, topographic and geologic conditions have given rise to diversified groundwater situation in different parts of the state. The rock formations ranging in age from Archean to Recent occupy the State and control the occurrence and movement of ground water depending upon aquifer composition, structure and deposition. Hilly and mountainous parts with steep slopes mainly constitute the run off areas and have low ground water potential. In valley and low-lying areas, unconsolidated / semi-consolidated formations form potential aquifers.

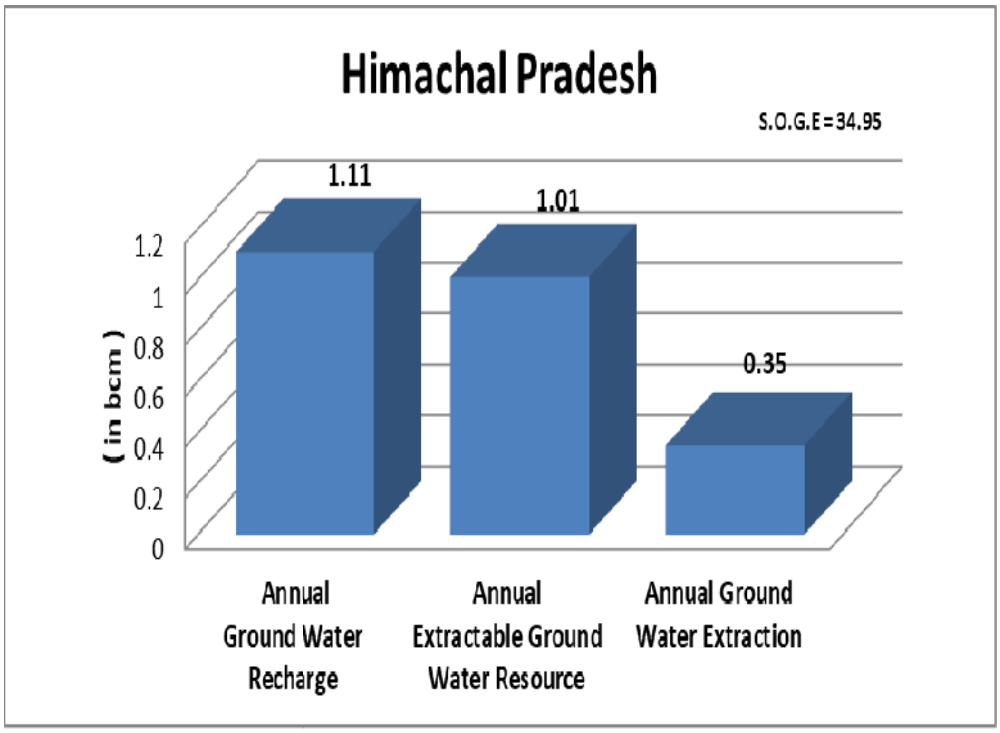
In consolidated formations the water availability is restricted to weathered mantle, joints/fractures, weak planes, bedding planes and limestone caverns. The limestone associated with phyllite and quartzite forms potential aquifers. In granites, potentiality of the aquifer is highly dependable on the fracture intensity. In granitic aquifers the discharge ranges between 1-3 lps. Groundwater in hard rock areas is either developed though bore wells or natural springs are tapped for both drinking and irrigation purposes.

In the unconsolidated formations the occurrence and movement of ground water is highly dependent on lithology particularly the presence of clay content. The unconsolidated formations are confined to valley areas, having good yield prospects that can sustain moderate to high capacity deep tube wells. The yield of the tube wells depends on the thickness of the total granular zones available within the aquifers tapped which ranges from 5-40 lps in different valleys. The Ground water resources have been assessed valley-wise.

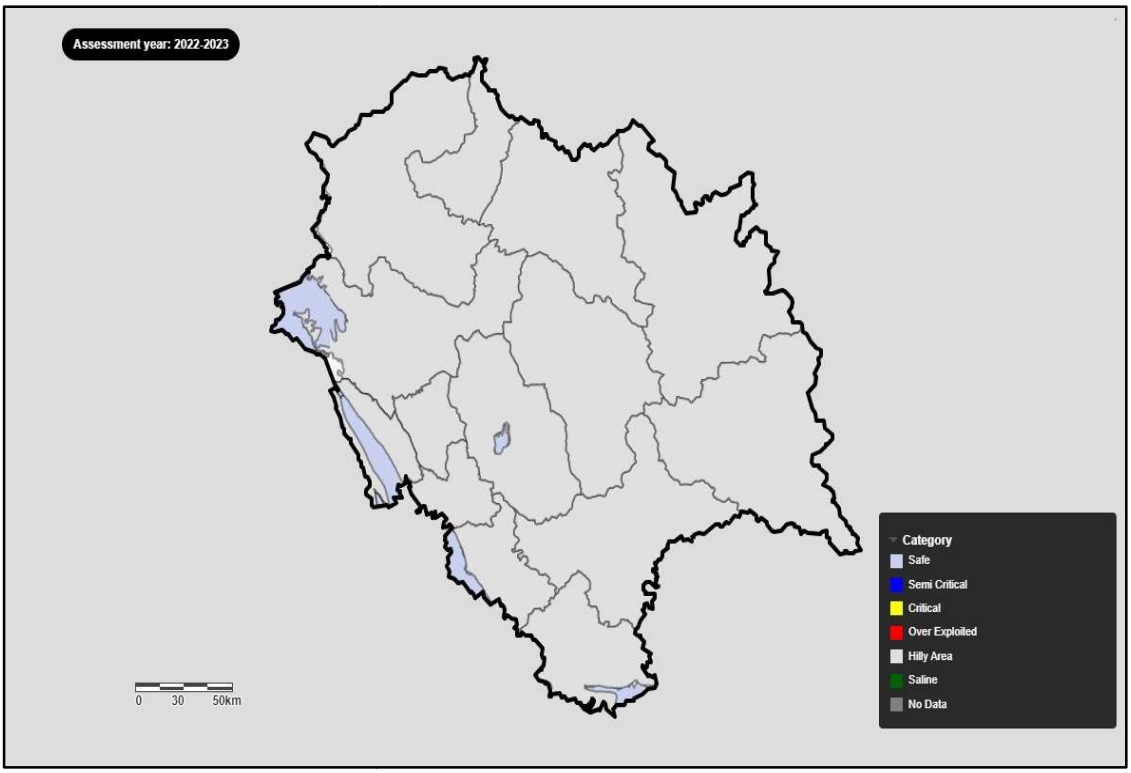
Total Annual Ground Water Recharge of the State has been assessed as 1.11 bcm and Annual Extractable Groundwater Resources is 1.01 bcm. The Current Annual Ground Water Extraction for all uses is 0.35 bcm and Stage of Ground Water Extraction is 34.95 %. Out of the 10 assessment units, all the ten assessment units have been categorized as ‘Safe’ and there is no saline assessment unit in the State.

Similarly, out of 3468 sq. km recharge worthy area of the State, 100 % under ‘Safe’ categories of assessment units. Out of total 1014.53 mcm annual extractable ground water resources of the State, 1014.53 mcm (100 %) are under ‘Safe’ categories of assessment units.

As compared to 2022 assessment, there is increase in the Total Annual Ground Water Recharge from 1.03 to 1.11 bcm and Annual Extractable Ground Water resources from 0.94 to 1.01 bcm. However, there is no change in Ground Water Extraction of the State. The Stage of Ground Water Extraction has decreased from 37.56 % to 34.95 %.



Dynamic Ground water Recourses Scenario 2023 – Himachal Pradesh



Categorization Map of GWRA 2023 – Himachal Pradesh

7.11 JHARKHAND

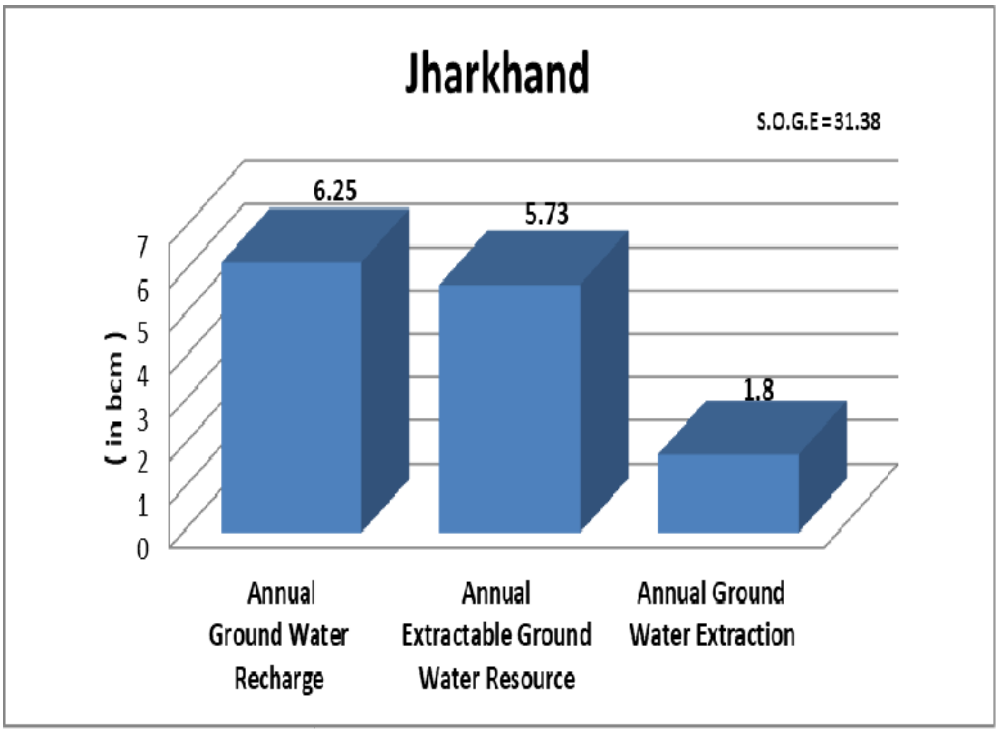
The State is underlain by diverse rock types of different geological ages ranging from Archaean to Recent. The major rock types are igneous and metamorphic rocks covering nearly 85 percent of the geographical area of the state. The weathered zone ranging between 10-30 m acts as a good repository of ground water. However, the secondary porosities in the form of fracture zones below the weathered zones also form potential aquifers. The yield of the exploratory wells ranges from upto 151 m^3/hr. The yield of the dugwells ranges from 0.5 to 0.75 m^3/hr. The dug wells tapping the weathered zone have an average yield of 0.5 to 1.2 m^3/hr. In Gondwana Super group, bore well discharge ranges between 7 to 15 m^3/hr and in Tertiary formations, yield ranges from 18 to 78 m^3/hr. The Younger Alluvium deposits are confined to patches. The depth of dug wells in general ranges between 10 to 15m bgl and that of shallow tube wells varies between 25 to 50 mbgl.

Ground Water Resource of the State has been assessed block-wise and identified urban area. The Total Annual Ground Water Recharge of the State has been assessed as 6.25 bcm and Annual Extractable Ground Water Resources is 5.73 bcm. The Annual Ground Water Extraction is 1.8 bcm and Stage of Extraction is 31.38 %.

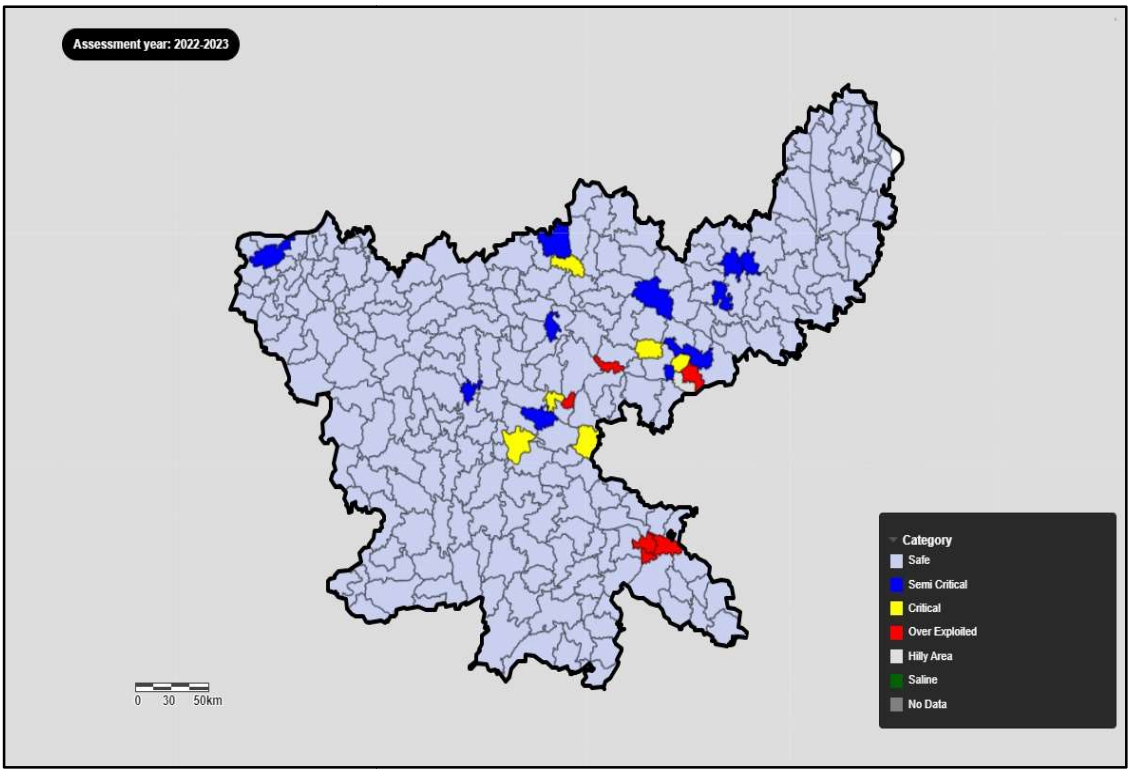
Out of 263 assessment units (blocks-259, Urban area-04), 5 units (1.90 %) have been categorized as ‘Over-exploited’, 6 units (2.28 %) as ‘Critical’, 11 units (4.18 %) as ‘Semi-critical’ and rest 241 units (91.63 %) are under ‘Safe’ category and there is no saline assessment unit in the State.

Similarly, out of 60646.73 sq km recharge worthy area of the State, 463.92 sq km (0.76 %) area are under ‘Over-Exploited’, 1068.48 sq km (1.76 %) under ‘Critical’, 2169.13 sq km (3.58 %) under ‘Semi-critical’ and 56945.20 sq km (93.90 %) under ‘Safe’ categories of assessment units. Out of total 5730.94 mcm annual extractable ground water resources of the State, 61.08 mcm (1.07%) are under ‘Over-exploited’, 133.06 mcm (2.32%) under ‘Critical’, 221.95 mcm (3.87%) under ‘Semi-critical’ and 5314.85 mcm (92.74%) are under ‘Safe’ categories of assessment units.

As compared to 2022 assessment, Total Annual Ground Water Recharge and Annual Extractable Ground Water Resources have increased from 6.21 to 6.25 bcm and 5.69 to 5.73 bcm respectively. The Annual Ground Water Extraction for the State has increased from 1.78 to 1.8 bcm and the Stage of Ground Water Extraction has increased from 31.35 % to 31.38%.



Dynamic Ground water Recourses Scenario 2023 - Jharkhamd



Categorization Map of GWRA 2023 – Jharkhand

7.12 KARNATAKA

Karnataka State is underlain by rock types ranging in age from Archaean to Recent. Major portion of the State is covered by Peninsular Gneisses, Granites and Dharwar Schists of Archaean age. Substantial area in the northern part of Karnataka is underlain by basalts, which form a continuation of the Deccan Traps occurring in Maharashtra. The sedimentary formations comprising Bhima and Kaladgis occupy a small area in the northern districts. The recent alluvium is restricted to a narrow belt in the coastal area and along stream courses.

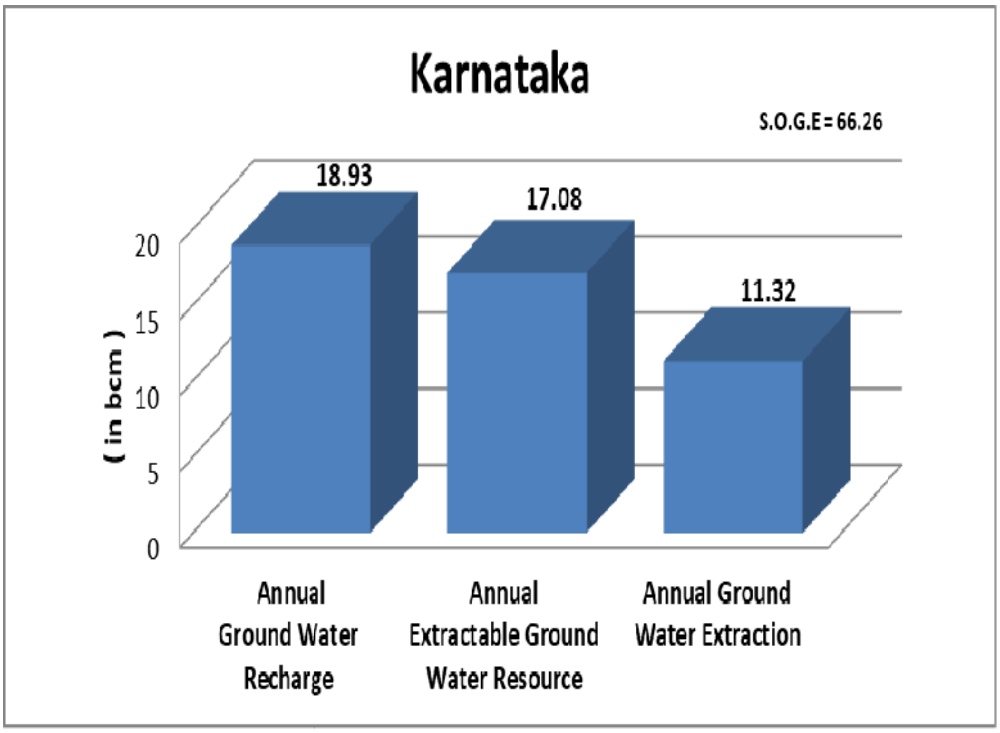
The aquifer systems are classified into nine major groups depending upon their characteristics and are Banded Gneissic Complex (BGC), Basalt, Schists, Granites, Charnockites, Limestones, Laterites, Sandstones and Alluvium.

Ground Water Resource of the State has been assessed taluk-wise The Annual Ground Water Recharge has been assessed as 18.93 bcm and the Annual Extractable Ground Water resource is 17.08 bcm. The present Annual Ground Water Extraction is 11.32 bcm and the Stage of Ground Water Extraction is 66.26%.

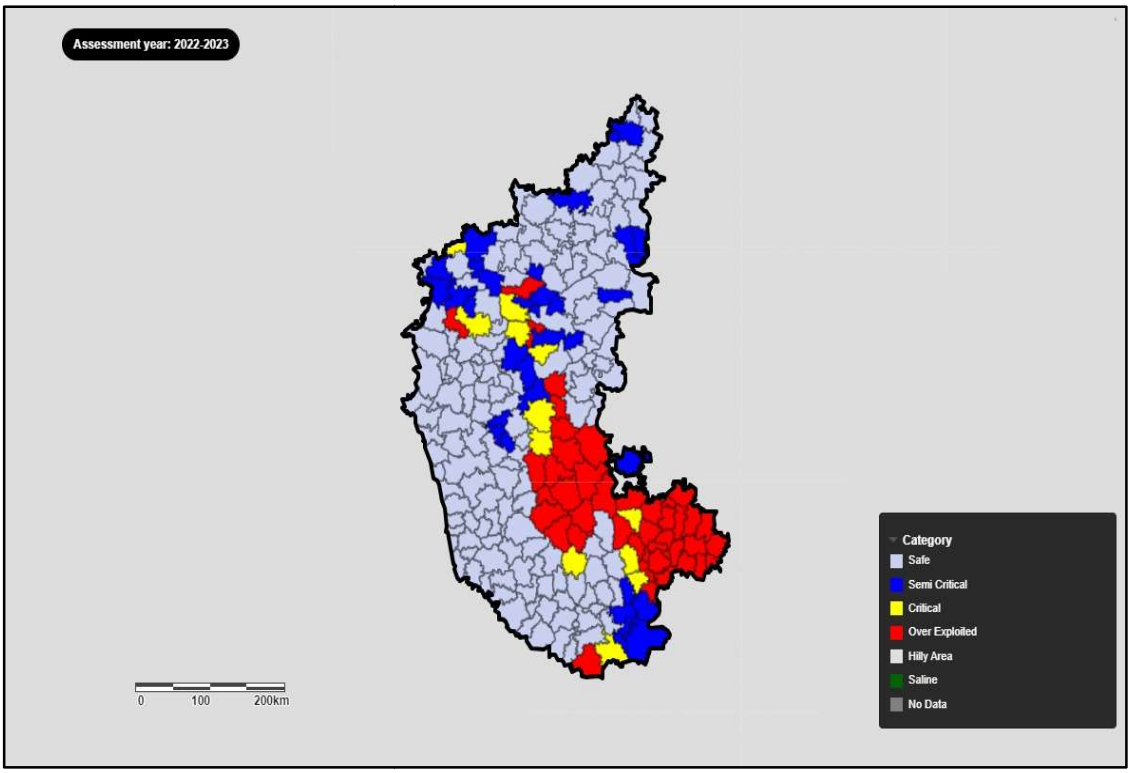
Out of the 234 assessment units (taluks), 44 units (18.8 %) have been categorized as 'Over exploited', 12 units (5.13 %) as 'Critical', and 32 units (13.68 %) as 'Semi critical' and 146 units (62.39 %) have been categorized as 'Safe'. There is no taluk under "Saline" category.

Similarly, out of 170463.35 sq km recharge worthy area of the State, 34281.35 sq km (20.11%) area are under 'Over-Exploited', 10443.17 sq km (6.13 %) under 'Critical', 22695.74 sq km (13.31 %) under 'Semi-critical' and 103043.09 sq km (60.45%) under 'Safe' categories of assessment units. Out of total 17080.79 mcm annual extractable ground water resources of the State, 2721.54 mcm (15.93 %) are under 'Over-exploited', 948.56 mcm (5.55%) under 'Critical', 2245.55 mcm (13.15%) under 'Semi-critical' and 11165.14 mcm (65.37%) are under 'Safe' categories of assessment units.

As compared to 2022 assessment, there is increase in Annual Ground Water Recharge from 17.74 bcm to 18.93 bcm, Annual Extractable Ground Water Resources from 16.04 bcm to 17.08 bcm. This is mainly due to increase in rainfall recharge, recharge from surface water irrigation, recharge from water conservation structures and recharge from tanks and ponds. There is marginal increase in the Current Annual Ground Water Extraction for all uses from 11.22 to 11.32 bcm during this period. Hence overall, the Stage of Ground Water Extraction has decreased from 69.93% in 2022 to 66.26 % in 2023 indicating improvement in overall ground water scenario .As compared to 2022, 17 assessment units (taluks) have improved mainly due to increase in rainfall recharge and recharge from other sources, whereas 1 assessment unit has deteriorated due to reduction in rainfall recharge and slight increase in draft. The ground water quality tagging has also been done, wherein 17 taluks has been tagged for salinity and 14 taluks for fluoride.



Dynamic Ground water Recourses Scenario 2023 – Karnataka



Categorization Map of GWRA 2023 – Karnataka

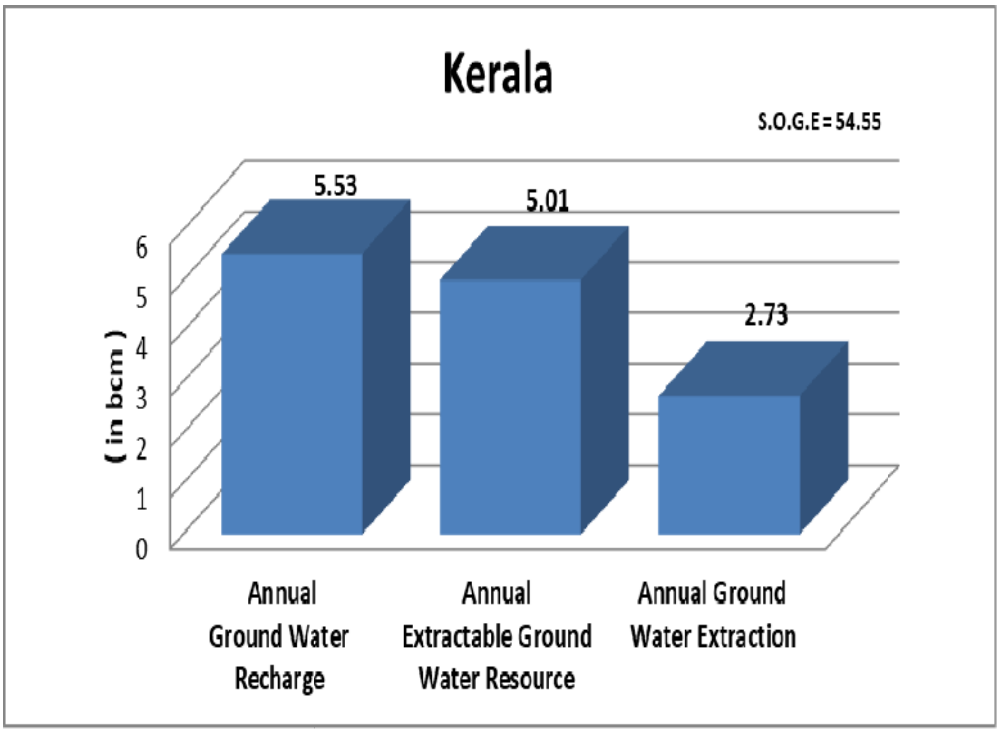
7.13 KERALA

The State of Kerala is underlain by diverse rock types of different geological ages from Pre- Cambrian to Recent. Nearly, 88% of the State is underlain by crystalline rocks of Archaean age comprising Schistose formations, Charnockites, Khondalites and Gneisses. All these formations are intruded by dykes of younger age. The sedimentary formations of Tertiary age occurring along the western parts of the State comprise four distinct beds viz. Alleppey, Vaikom, Quilon and Warkali. The crystalline and the Tertiary formations are lateritized along the midland area. Yields of open (dug) wells in these areas vary from 0.02 to 0.12 lps, whereas that of bore wells ranges from less than 1 to 35 lps. About 12% of the State is underlain by Semi-consolidated and unconsolidated sedimentary formations where dug wells and filter points have yields of 0.02 to 0.4 lps, whereas deep tube wells have yields in the range of 1 to 57 lps. Laterites, which cover most of the geological formations in the major part of the state also forms an important aquifer in the state with dug wells having yields in the range of 0.005 to 0.069 lps.

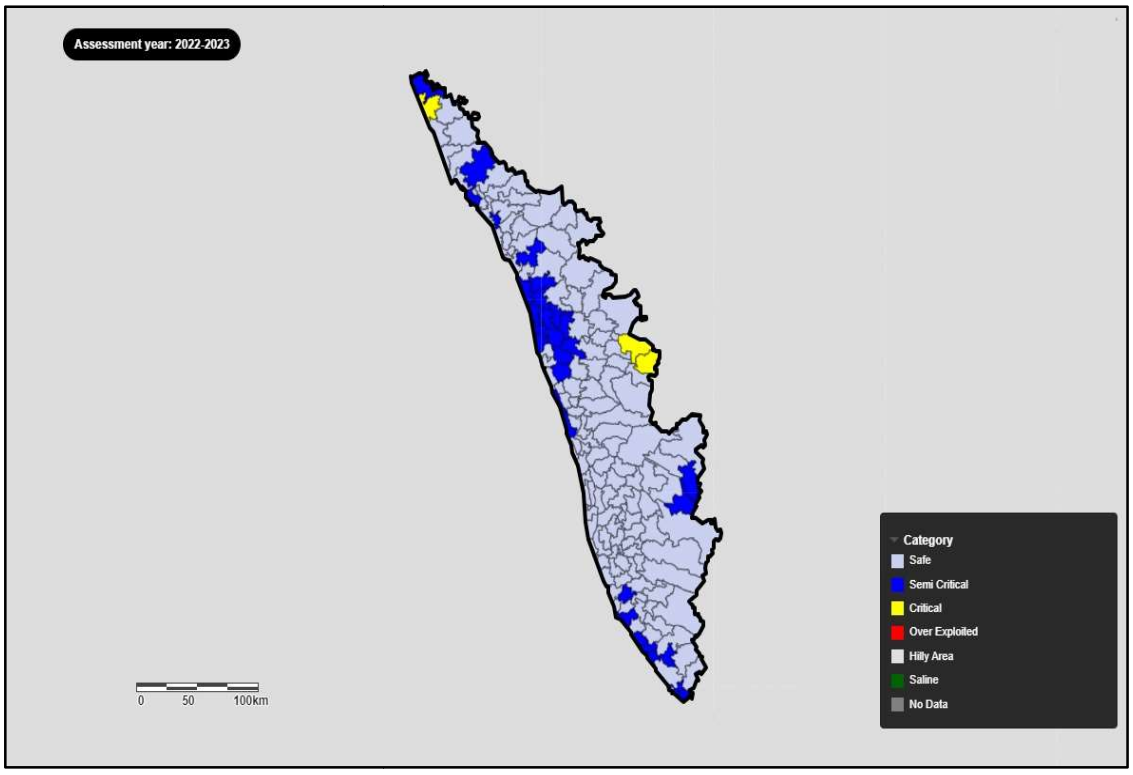
The ground water resources for the state have been assessed block-wise. Total Annual Ground Water Recharge has been estimated as 5.53bcm and Annual Extractable Ground Water Resource is 5.01 bcm. The Annual Ground Water Extraction is 2.73 bcm and Stage of Ground Water Extraction is 54.55 %.

Out of total 152 assessment units (blocks), 3 units (1.97 %) have been categorized as ‘Critical’, 30 units (19.74 %) as ‘Semi-Critical’ and 119 units (78.29 %) as ‘Safe’ categories of assessment units. There is no ‘Over- exploited’ and ‘Saline’ assessment unit in the State. Similarly, out of 27047.53 sq km recharge worthy area of the State, 777.38 sq km (2.87 %) area are under ‘Critical’, 4211.15 sq km (15.57 %) under ‘Semi-critical’ and 22059.01 sq km (81.56 %) area are under ‘Safe’ categories of assessment units. Out of total 5005.27 mcm annual extractable ground water resources of the State, 136.74 mcm (2.73 %) are under ‘Critical’, 761.3 mcm (15.21%) under ‘Semi-critical’ and 4107.22 mcm (82.06 %) are under ‘Safe’ categories of assessment units.

As compared to 2022 assessment, Total Annual Ground Water Recharge of the State has decreased from 5.74 to 5.53bcm and Annual Extractable Ground Water Resources from 5.19 to 5.01bcm. The annual ground water extraction has consistently remained at 2.73 bcm, with no notable change from the previous 2.73 bcm.and the Stage of Ground Water Extraction has increased from 52.56 % to 54.55 %.. Three blocks have deteriorated its category from Safe to Semi-critical viz. Kozhikode (Kozhikode district), Sasthamcotta (Kollam district) and Varkala (Thiruvananthapuram district).



Dynamic Ground water Recourses Scenario 2023 – Kerala



Categorization Map of GWRA 2023 – Kerala

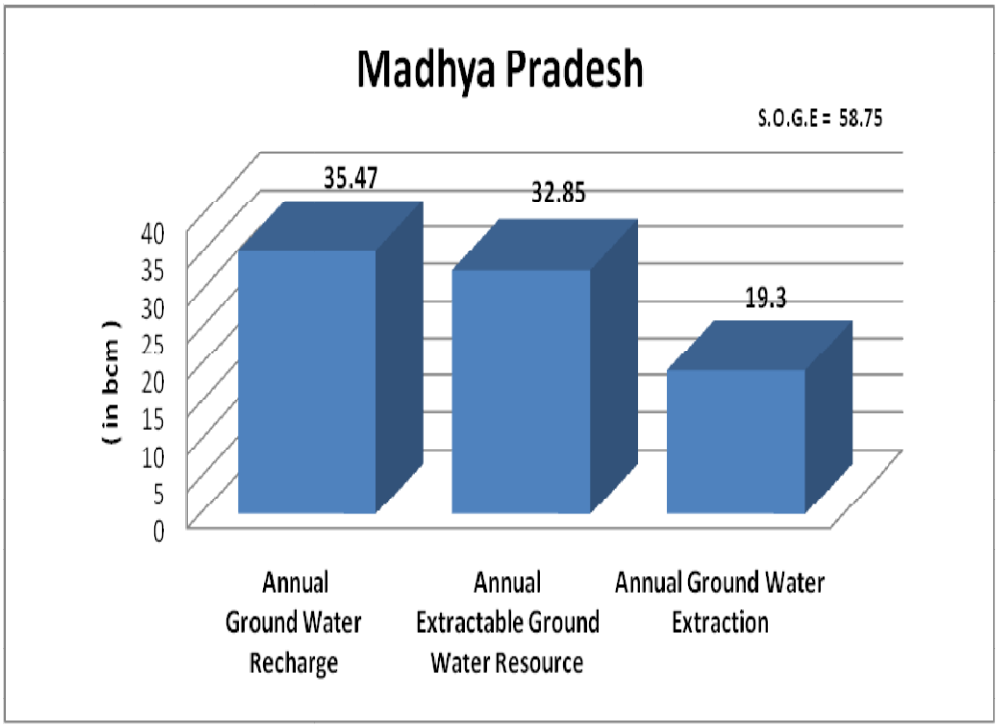
7.14 MADHYA PRADESH

The State of Madhya Pradesh has varied hydrogeological characteristics due to which ground water potential differs from place to place. The State is underlain by various Geological formations ranging in age from the Archaean to the Recent. Hard rock areas cover more than 80% of total land area of the State. These hard-rock areas show wide variations and complexities in nature and composition of rocks, geological structures, geomorphological set up and hydro meteorological conditions. The crystalline rocks of Archaean age like granite, gneiss, granulites, schist, quartzite and granitoids occupy about 15% of geographical area of the State. The basaltic rocks of Deccan lava flows are the predominant formations and occupy nearly 45% of total geographical area. The consolidated sedimentary rocks of Vindhyan Super Group and Mahakoshal (Cuddapah) Super Group of Proterozoic age occupy about 19% of total geographical area and the semi consolidated (Gondwana Formation) occupies about 7%. Recent unconsolidated alluvial sediments occupy about 14% of total geographical area.

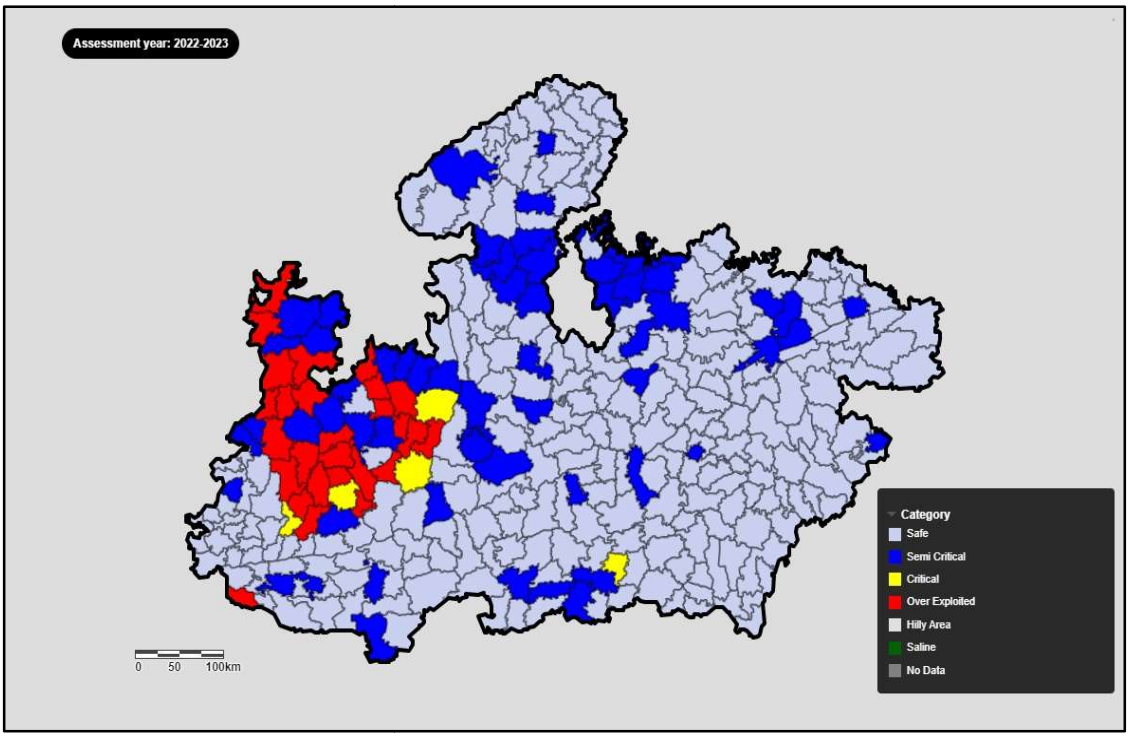
Total Annual Ground Water Recharge of the State has been assessed as 35.47 bcm and Annual Extractable Ground Water Resources is 32.85 bcm. The Annual Ground Water Extraction is 19.30 bcm and Stage of Ground Water Extraction is 58.75 %.

Out of 317 assessment units (313 blocks and 4 urban areas), 26 units (8.2 %) has been categorized as ‘Over Exploited’, 5 units (1.58 %) as ‘Critical’, 60 units (18.93 %) as ‘Semi-Critical’ and 226 units (71.29 %) as ‘Safe’ categories of assessment units and there are no saline assessment unit. Similarly, out of 269333.27 sq km recharge worthy area of the State, 22554.86 sq km (8.37%) area is under ‘Over-Exploited’, 4249.07 sq km (1.58 %) under ‘Critical’, 51803.76 sq km (19.23 %) under ‘Semi-critical’ and 190725.58 sq km (70.81 %) under ‘Safe’ categories of assessment units. Out of total 32853.75 mcm annual extractable ground water resources of the State, 3424.26 mcm (10.42%) are under ‘Over-exploited’, 537.1 mcm (1.63 %) under ‘Critical’, 6119.62 mcm (18.63 %) under ‘Semi-critical’ and 22772.77 mcm (69.32%) are under ‘Safe’ categories of assessment units.

In the assessment year 2023, there has been a shift in the dynamics of groundwater resources compared to the 2022 assessment. Notably, there has been an increase in both groundwater recharge and groundwater extraction. The rise in groundwater recharge can be attributed to increased rainfall recharge and the implementation of water conservation structures, Simultaneously, a discernible escalation in groundwater extraction has transpired, propelled by the recalibration of well census data, escalating water demands due to burgeoning population growth. Total Annual Ground Water Recharge of the State has increase from 35.23 bcm to 35.47 bcm and Annual Extractable Ground Water Resources from 32.58 to 32.85 bcm. The Annual Ground Water Extraction has increased from 19.25 to 19.3 bcm and the Stage of Ground Water Extraction has decreased from 59.1 % to 58.75 %.



Dynamic Ground water Recourses Scenario 2023 – Madhya Pardesh



Categorization Map of GWRA 2023 – Madhya Pradesh

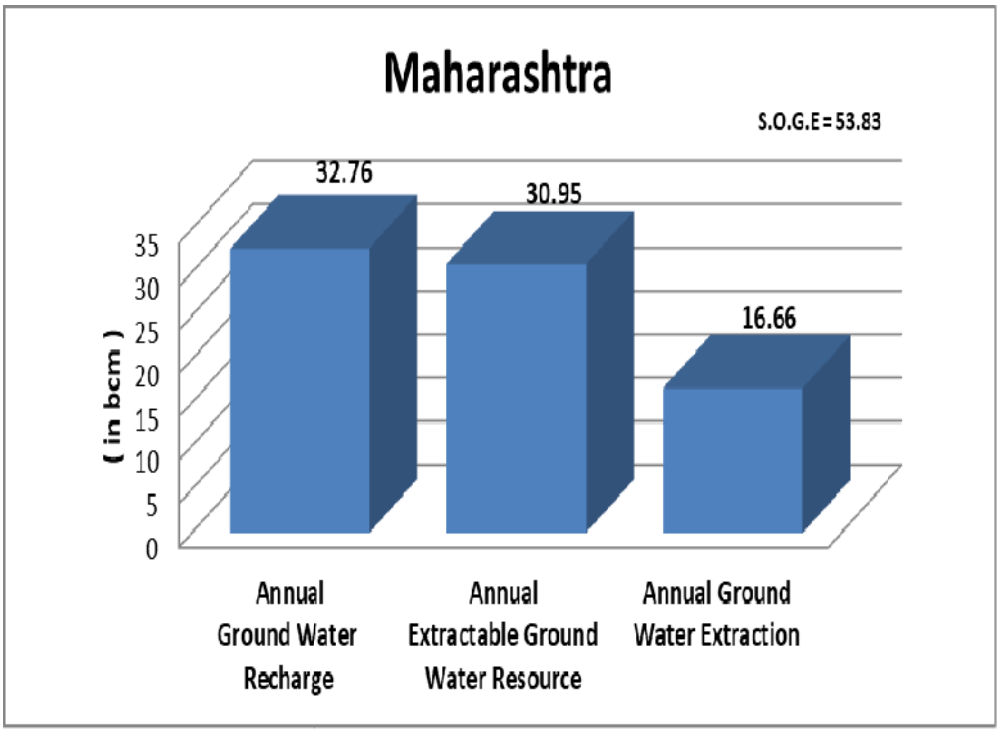
7.15 MAHARASTRA

The State is underlain by diverse rock types of different geological ages from Pre-Cambrian to Recent. The state is mostly covered by Deccan Traps. The other geological formations, older and younger than Deccan Traps, occur in the northeast and as isolated patches in the Sindhudurg and Ratnagiri districts. Large part of the State is underlain by Basaltic hard rock's where dug wells are predominant. They mostly tap the weathered zone and fractures/joints. The yield of dug wells varies from 3 to 5 lps. A small part of the State is occupied by Semi- consolidated sedimentary rocks where tube wells have a yield of 5 to 45 lps. The central part of Maharashtra which is a drought prone area, receives very less rainfall i.e. from 400 to 700 mm, but the geology is favorable for the ground water recharge. Hence, in this area the dependency on groundwater is very high. Two-third of irrigation wells are from this area only. This primarily includes parts from Dhule, Nashik, Jalgaon, Ahmednagar, Pune, Satara, Sangli, Solapur, Osmanabad, Beed and Aurangabad districts.

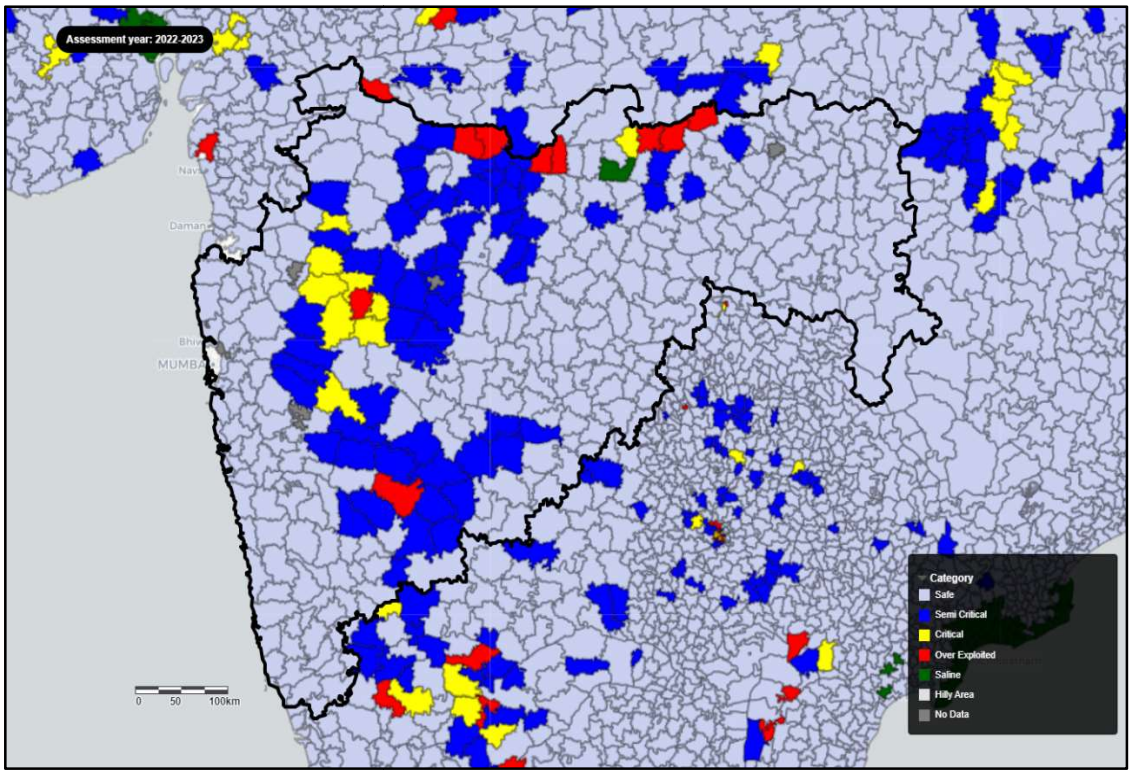
The Ground water resources have been assessed for 1534 watersheds in the state and subsequently apportioned to taluk level. Total Annual Ground Water Recharge of the State has been estimated as 32.76 bcm and Annual Extractable Ground Water Resources is 30.95 bcm. The Annual Ground Water Extraction is 16.66 bcm and Stage of Ground Water Extraction is 53.83 %.

Out of 353 assessment units (taluks), 9 units (2.55%) have been categorized as 'Over-exploited', 9 units (2.55 %) as 'Critical', 57 units (16.15 %) as 'Semi-critical' and remaining 277 units (78.47 %) as 'Safe' and 1 unit (0.28 %) as 'Saline' categories of assessment units. Similarly, out of 259914.03 sq. km recharge worthy area of the State, 7034.69 sq. km (2.71 %) area is under 'Over-Exploited', 8857.49 sq. km (3.41 %) under 'Critical', 56959.42 sq. km (21.91 %) under 'Semi-critical', 186285.52 sq. km (71.67 %) under 'Safe' and 776.89 sq. km (0.30 %) area under 'Saline' categories of assessment units. Out of total 30949.23 mcm annual extractable ground water resources of the State, 816.52 mcm (2.64 %) are under 'Over-exploited', 1037.96 mcm (3.35 %) under 'Critical', 6283.84 mcm (20.3 %) under 'Semi-critical' and 22810.91 mcm (73.7 %) are under 'Safe' categories of assessment units.

As compared to 2022 assessment, the Annual Ground Water Recharge and annual extractable ground water resources in 2023 has increased marginally from 32.29 bcm to 32.76 bcm and 30.45 to 30.95 bcm and Annual Ground Water Extraction remain more or less same. The Stage of Ground Water Extraction has decreased marginally from 54.68 % to 53.83%.



Dynamic Ground water Recourses Scenario 2023 – Maharashtra



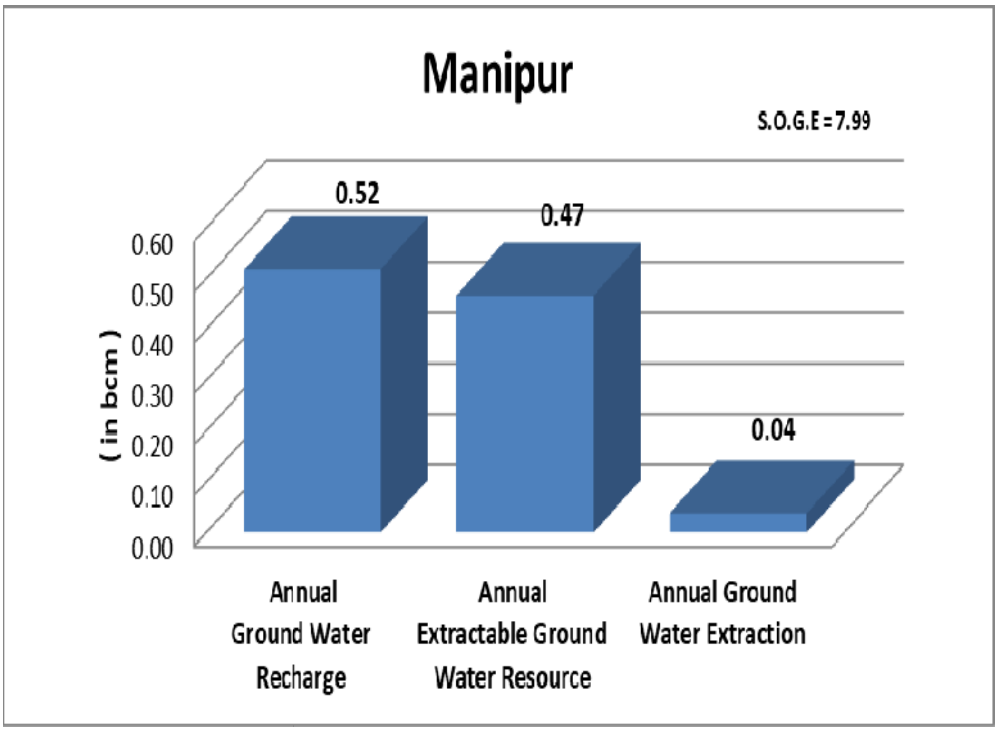
Categorization Map of GWRA 2023 – Maharashtra

7.16 MANIPUR

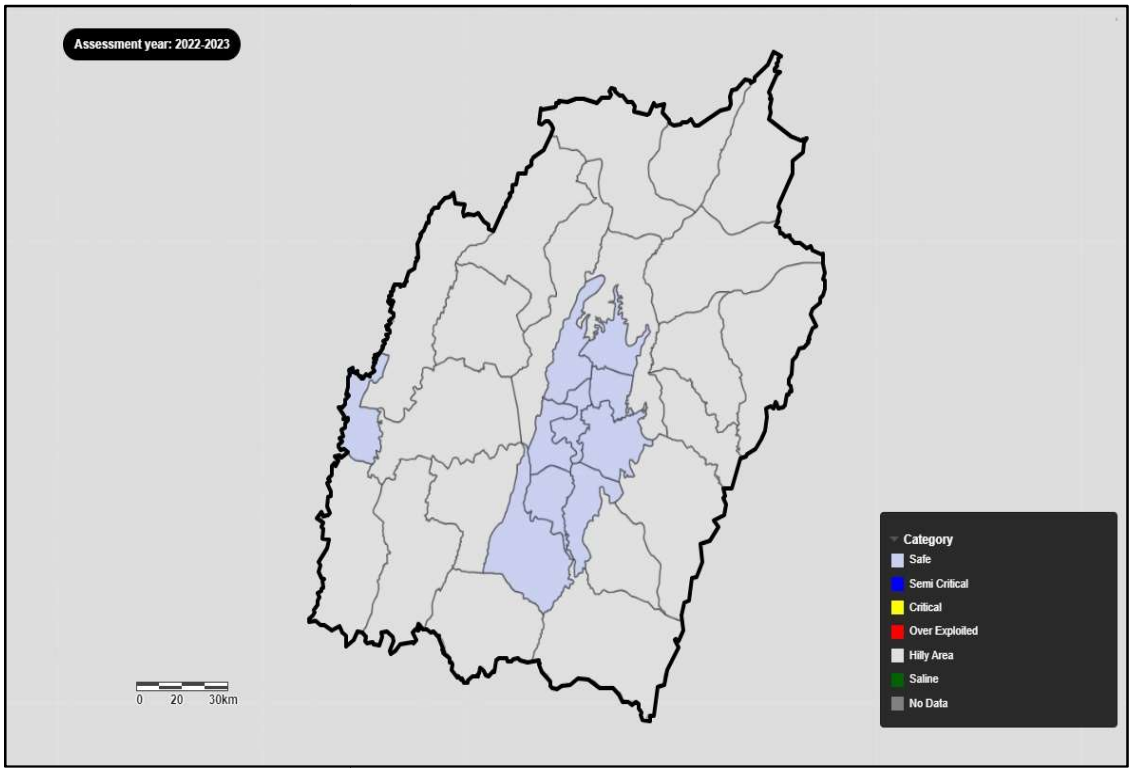
The State of Manipur is occupied by mostly North South parallel hill ranges made up of consolidated and semi-consolidated rocks ranging in age from pre-Mesozoic to Miocene. The consolidated rocks confined to the eastern part of the state along the Myanmar border. The semi-consolidated formations, which cover almost the entire state, comprise shale, siltstone, sandstone, and conglomerate. These formations belong to Disang, Barail, Surma and Tipam group of rocks. In the western and central part of the State, unconsolidated alluvium of quaternary age occurs in the valleys and topographical lows. Ground water is restricted to secondary porosity in joints, fissures, fractures and weathered residuum of consolidated and semi-consolidated rocks and inter-granular pore spaces of alluvial deposits. In the valley, ground water is utilized through tube wells, tapping granular zones with 10 to 20 m thickness, and the yield of the tube well varies from 10 to 30 m3/hr.

The Ground Water Resources of Manipur as in 2023 have been assessed block-wise for the recharge worthy area. Total Annual Ground Water Recharge of the State has been assessed as 0.52 bcm and Annual Extractable Ground Water Resources as 0.47 bcm. The Annual Ground Water Extraction is 0.04 bcm and Stage of Ground Water extraction is 7.99 %. All the assessment units and districts have been categorized as ‘Safe’ and there is no saline area in the state. Out of 9 assessment units 9 units (100 %) as ‘Safe’ categories of assessment units and there is no saline assessment unit.

Similarly, out of 2559 sq km recharge worthy area of the State, 2559 sq km (100 %) under ‘Safe’ categories of assessment units. Out of total 466.07 mcm annual extractable ground water resources of the State, 466.07 mcm (100 %) are under ‘Safe’ categories of assessment units. The comparison with previous assessment shows there is no major changes in the Ground Water Resources of Manipur.



Dynamic Ground water Recourses Scenario 2023 – Manipur



Categorization Map of GWRA 2023 – Manipur

7.17 MEGHALAYA

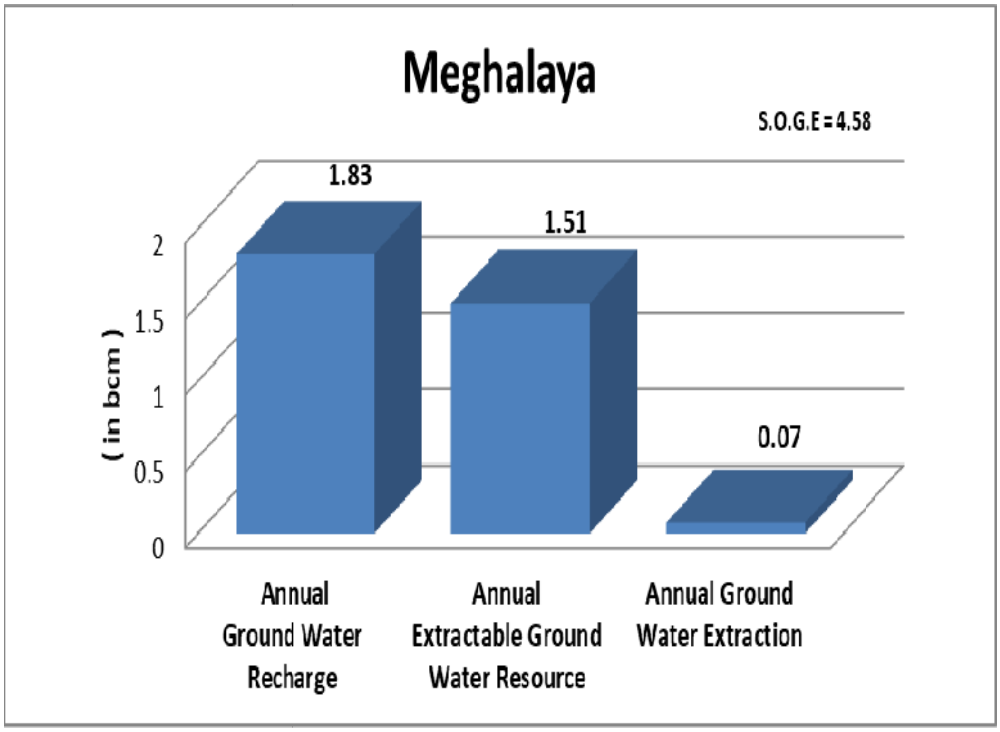
The Meghalaya State is essentially occupied by hard rocks belonging to the Archean gneissic complex with acidic and basic intrusives and Precambrian Shillong Group of rocks. The aquifer system in the state can be divided as a two aquifer systems, viz., first aquifer (shallow) and second aquifer (deeper). Shallow or first aquifer consists of weathered residuum where ground water occurs under water table condition and is mainly developed through construction of dug wells. The second aquifer is the deeper aquifer which tapped the fractured zone and is mainly developed through borewells. Based on the study of litholog and analysis of depth of construction of dug wells and bore wells, it is found that the first aquifer occur within depth of 20 to 40 m. Ground water in the second aquifer occurs under semi-confined to confined condition in the fractures upto the maximum explored depth of 280m. The south-western, southern and south-eastern parts of the state is covered by semi- consolidated formations comprising sandstones, shales, conglomerates, limestones etc. belonging to Cretaceous – Tertiary age. The aquifers are formed by rock strata that are granular/porous, fissured/fractured or cavernous. These aquifers are thick and discontinuous in nature. The unconsolidated sediments comprising sand, gravel, silt, clay, etc. are found to occur as thin veneer along rivulets and as valley-fills.

The Ground water resources have been assessed block-wise. Total Annual Ground Water Recharge of the State has been assessed as 1.83 bcm and Annual Extractable Ground Water Resources as 1.51 bcm. The Annual Ground Water Extraction is 0.07 bcm and Stage of Ground Water Extraction is 4.58 %. All the 39 assessment units have been categorized as ‘Safe’.

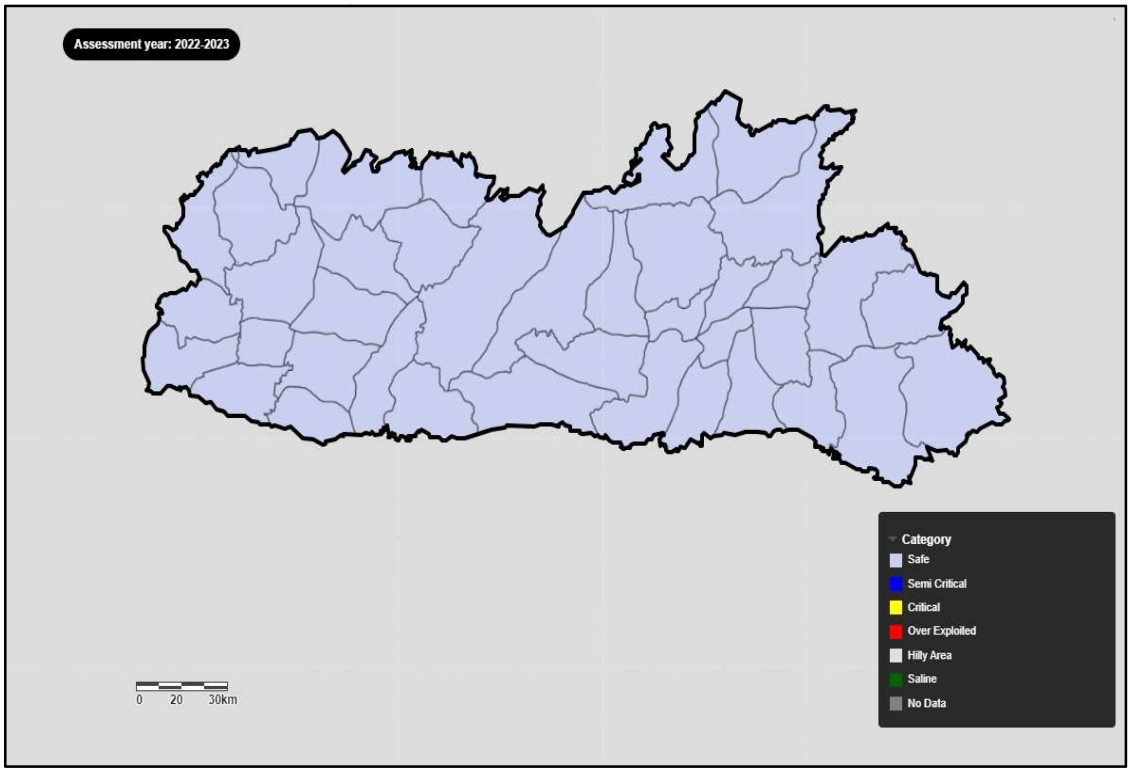
Out of 39 assessment units, all are categorized as‘Safe’ assessment units and there are no saline assessment unit.

Similarly, out of 8171.35 sq km recharge worthy area of the State, 8171.35 sq km (100 %) under ‘Safe’ categories of assessment units. Out of total 1507.61 mcm annual extractable ground water resources of the State, 1507.61 mcm (100 %) are under ‘Safe’ categories of assessment units.

As compared to 2022 assessment, the Annual Ground Water Recharge has increased from 1.72 to 1.83 bcm. The reasons can be attributed to increase in recharge from other sources. The Ground Water Extraction has increased minutely. Therefore, Stage of ground water extraction has slightly increased from 3.55 % to 4.58 %.



Dynamic Ground water Recourses Scenario 2023 – Meghalaya



Categorization Map of GWRA 2023 – Meghalaya

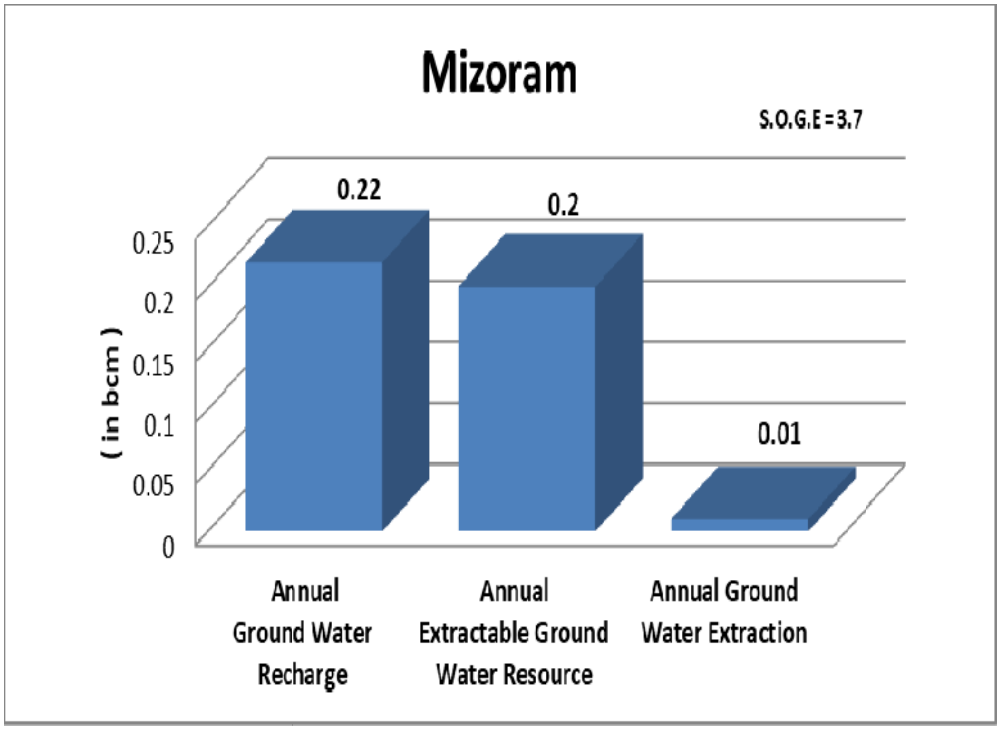
7.18 MIZORAM

The State is occupied mainly by the rocks of the Tertiary formation ranging in age from Oligocene to Miocene to Recent. The Barail formation the lowermost rock units comprising siltstone and bands of soft and hard fine-grained sandstone with strings of carbonaceous material and occur in the north eastern part of the state. The Surma is divided into two formations, Bhuban and Bokabil. The Bhuban is made up of grey sandstone and shale and occupies the major part of the State along the length of the state. The Bokabil, predominantly argillaceous, mostly occurs along the western part of the State. The Tipam sandstone is of semi- consolidated nature comprising medium to coarse grained sandstone with subordinate shale and occurs in limited extent in the north western part of the state. The alluvial deposits comprising silt, clay and sands occur in the valley fill area with very limited thickness. Ground water is restricted only to valley filled areas and secondary porosities of semi-consolidated rocks. These aquifers are the main source for springs. Ground water stored in the hill slopes emanates in the form of springs, which are being used as a source for water supply. In the valley area, the yield potential of tube wells within the depth range of 200 m tapping Tertiary sandstone ranges from 120 to 330 liters per minute (lpm) for drawdown of 13 to 20 m. The transmissivity and Storativity are to the tune of 11 to 46 m^2/day and 4.28 x 10^{-4}respectively.

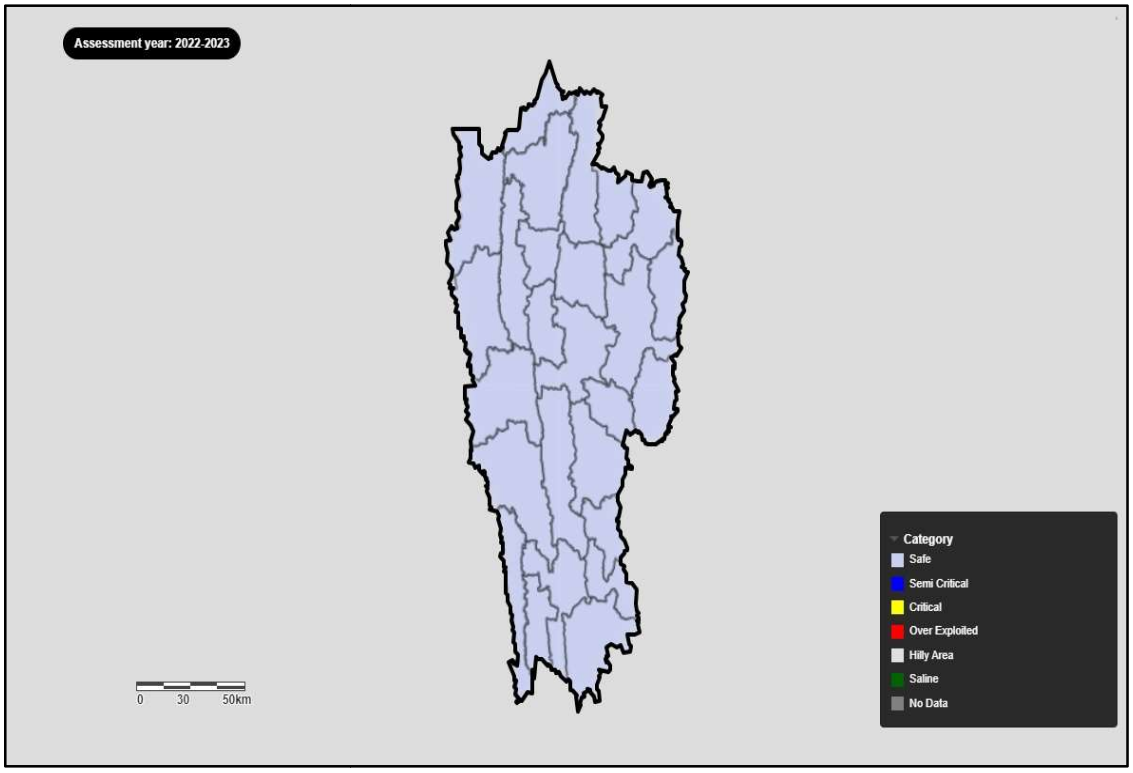
The ground water resources for the state have been assessed block-wise. Total Annual Ground Water Recharge has been assessed as 0.22 bcm and Annual Extractable Ground Water Resource is 0.2 bcm. The Annual Ground Water Extraction is 0.007 bcm and Stage of Ground Water Extraction is 3.7 %. All the 26 assessed blocks have been categorized as ‘Safe’. There are no saline areas in the state.

Similarly, out of 3149.41 sq km recharge worthy area of the State, 100 % of the area under ‘Safe’ categories of assessment units. All the total 199.56 mcm annual extractable ground water resources of the State, are under ‘Safe’ categories of assessment units. The comparison with previous assessment shows there is no major changes in the Ground Water Resources of Mizoram.

As compared to 2022 assessment, there is no major change in Annual Groundwater Recharge, Annual Groundwater Extractable Resources and Groundwater Extraction. Stage of GW Extraction has decreased marginally from 3.96 % in 2022 to 3.7 % 2023.



Dynamic Ground water Recourses Scenario 2023 – Mizoram



Categorization Map of GWRA 2023 – Mizoram

7.19 NAGALAND

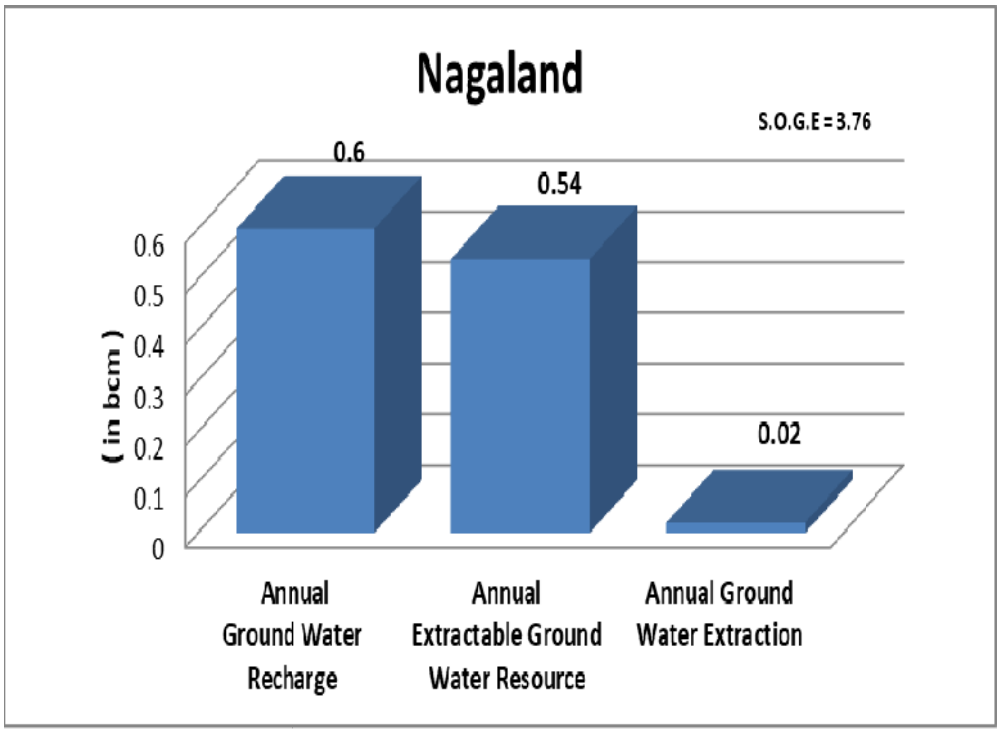
The State is covered by rocks ranging in age from Pre-Cretaceous to Recent. The rock sequences comprise the geosynclinals facies, represented by Disang Group, Barail Group, Surma Group, Tipam Group, Namsang formation and Dihing Group. While the Disang and Surma Group of rocks are mainly argillaceous, the Barail and Tipam groups are Arenacious. The Girujan clay formation overlying the Tipam sandstones is characterized by typical blue, mottled clay and argillaceous sandstone beds. Older rocks occupy southern parts of the State, where as younger rocks are exposed in the northern parts. The unconsolidated alluvial plains, comprising clay, sand pebble, cobble and boulder assemblages, occupy the narrow, intermountain and open valleys in the northern part of the state bordering upper reaches of Brahmaputra flood plains of Assam. The consolidated formations are confined to the south eastern part of the State along the Burma (Myanmar) border.

Ground water development potentiality in valley fill and alluvial deposits are restricted to construction of open wells having depth of 15 to 20 meters and deep tube well down to 100 m depth which yield to the tune of 10 to 45m^3/day with more than 5m drawdown. Water bearing formations pertaining to Tertiary deposits are found to have moderate potentials which can sustain deep tube wells having yield prospects varying from 10 to 20m3/hr. The valleys underlain by Tipam sandstones form good aquifers with yield prospects varying from 30 to 80m^3/hr. In the consolidated formations, ground water abstraction structures can be constructed in structurally weak zones. Ground water emerges as perennial springs which are the main source of water supply for domestic needs in the state.

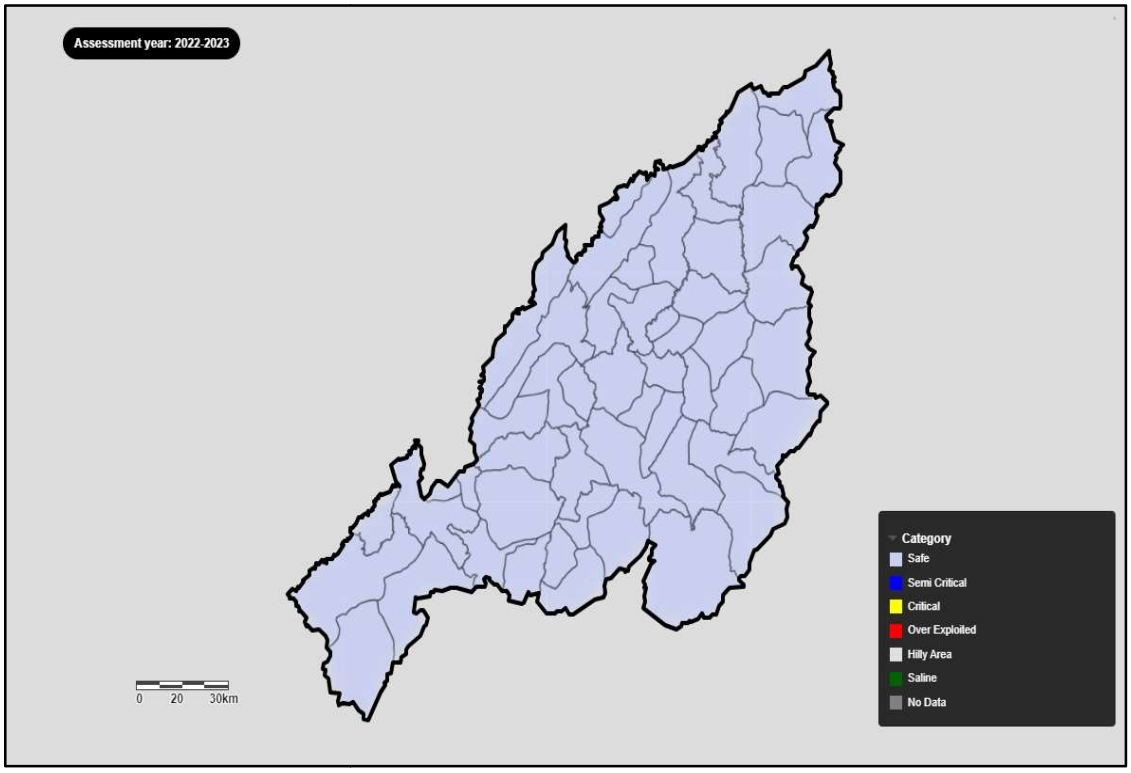
The ground water resources for the state have been assessed block-wise. Recharge worthy area of Nagaland has been reassessed and hilly areas are demarcated where the slope is more than 20% using Shuttle Radar Topographic Mission (SRTM) Digital Elevation Model (DEM) with 30m resolution data and geomorphological maps. The total Annual Ground Water Recharge of the State has been assessed as 0.60 bcm and Annual Extractable Ground Water Resource as 0.54 bcm. Annual Ground Water Extraction is 0.02 bcm and Stage of Ground Water Development is 3.76%. All the 52 Assessment Units have been categorized as ‘Safe’. There is no saline area in the state.

Similarly, out of 3855.07 sq km recharge worthy area of the State, 100 % of the area is under ‘Safe’ categories of assessment units. The entire 543.76 mcm annual extractable ground water resources of the State is under ‘Safe’ categories of assessment units.

As compared to 2022 assessment, Annual Ground Water Recharge of the State has decreased from 0.79 bcm to 0.60 bcm. The Annual Extractable Ground Water Resource has decreased from 0.71 bcm to 0.54 bcm and there is no significant change in annual ground water extraction. The Stage of Ground Water Extraction has increase from 2.89 % to 3.76 %.



Dynamic Ground water Recourses Scenario 2023 – Nagaland



Categorization Map of GWRA 2023 – Nagaland

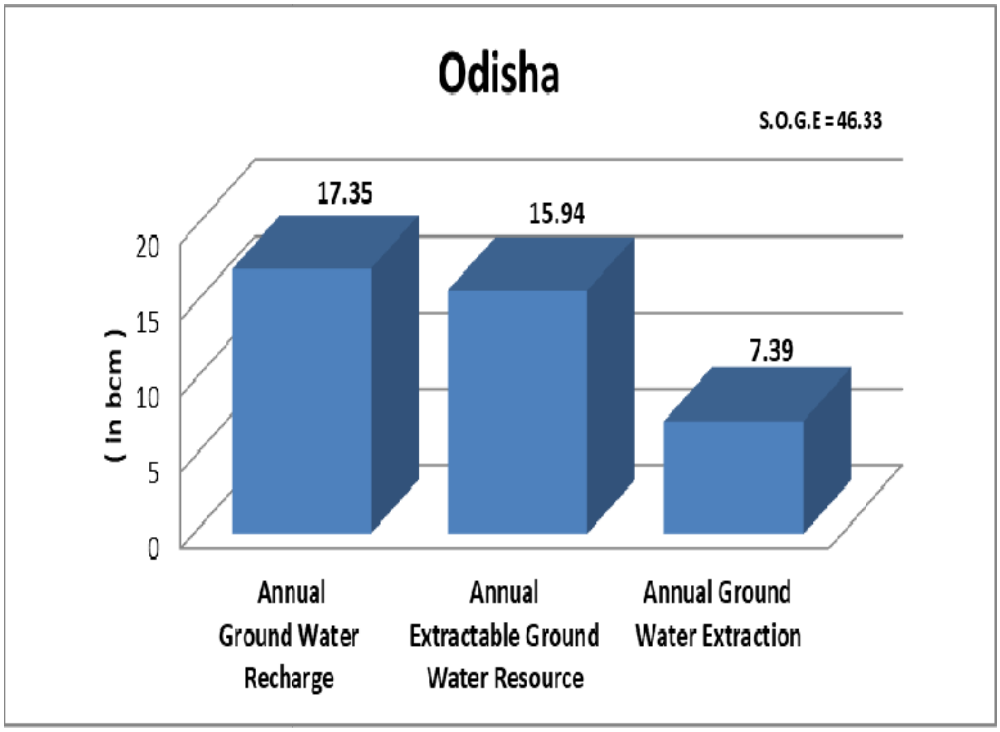
7.20 ODISHA

The State is underlain by diverse rock types, which range in age from Precambrian to Cenozoic era. The Precambrian occupy nearly 80 % of the total geographical area of the State. The Tertiary and the Quaternary Alluvial formations are restricted mainly to the narrow coastal tracts. The Gondwana group of rocks belonging to Paleozoic and Mesozoic era occurs in isolated patches in different parts of the State. These formations occur in Talcher area of Angul district and in river valley area of Sambalpur and Sundargarh districts. Ground water abstraction in the state is mostly done by dug wells constructed in the weathered zone in hard rock areas and in shallow phreatic aquifers in alluvial areas. The yield of open (dug) wells varies from 1 to 5 lps. However, at present, bore wells, shallow to medium deep tube wells, filter point tube wells are also in use for ground water abstraction both for domestic and irrigational purpose. The yield of bore wells varies from 2 to 5 lps in general depending on the occurrence of saturated fractures at depths. The yield from shallow and medium deep tube wells may vary from 6 to 10 lps in general depending on the aquifer disposition.

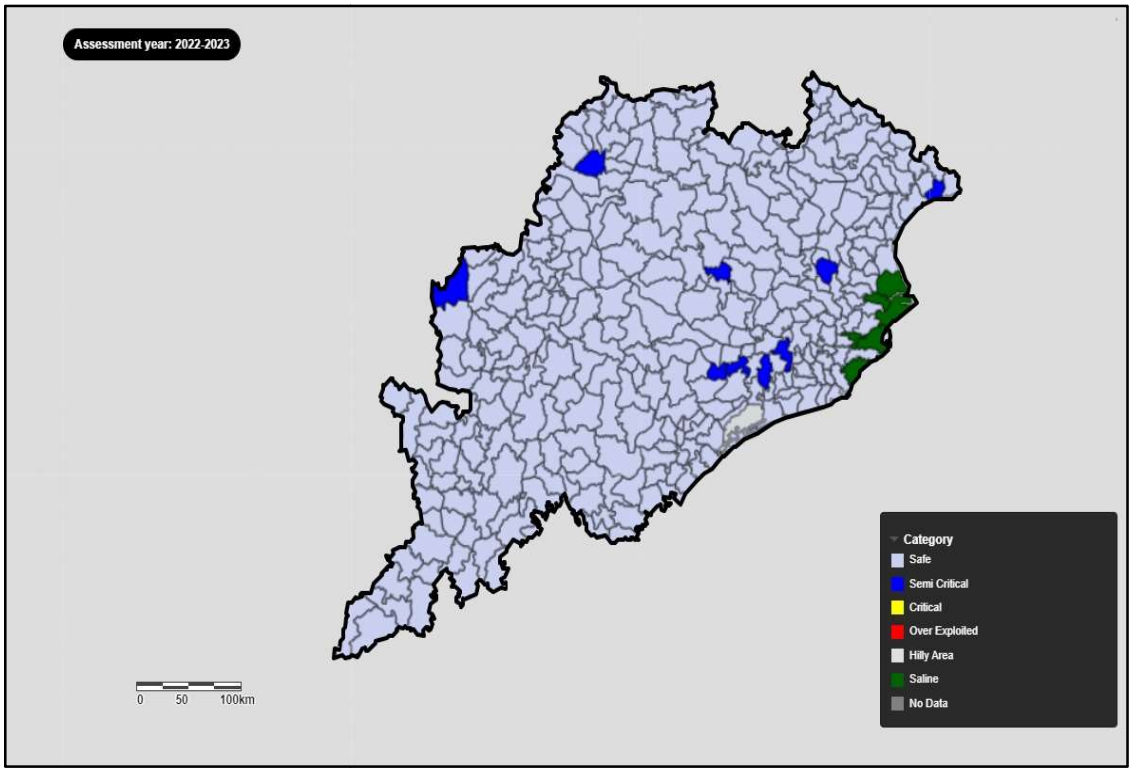
The Ground water resources in the state have been assessed block-wise. Total Annual Ground Water Recharge of the State has been assessed as 17.35 bcm and Annual Extractable Ground Water Resource as 15.94 bcm. The Annual Ground Water Extraction is 7.39 bcm and Stage of Ground Water Extraction is 46.33 %.

Out of the total of 314 assessment units (blocks), 9 units (2.87 %) have been categorized as 'Semi-critical', 299 units (95.22 %) as 'Safe' and 6 units (1.91 %) as 'Saline' categories of assessment units. Similarly out of 121593.15 sq km recharge worthy area of the State, 3339.96 sq km (2.75 %) area are under 'Semi-critical', 116071.86 sq km (95.46 %) under 'Safe' and 2181.33 sq km (1.79 %) area under 'Saline' categories of assessment units. Out of total 15933.74 mcm annual extractable ground water resources of the State, 499.73 mcm (3.14 %) are under 'Semi-critical' and 15434.01mcm (96.86 %) are under 'Safe' categories of assessment units.

As compared to 2022 assessment, the Annual Ground Water Recharge has decreased from 17.79 to 17.35 BCM. Similarly Annual Extractable Ground Water Resource has decreased from 16.34 to 15.94 bcm and total annual ground water extraction for all uses has increased from 7.23 to 7.39 bcm. The stage of ground water extraction has increased to 46.33 % in 2023 as compared to 44.25 % in 2022.



Dynamic Ground water Recourses Scenario 2023 – Odisha



Categorization Map of GWRA 2023 – Odisha

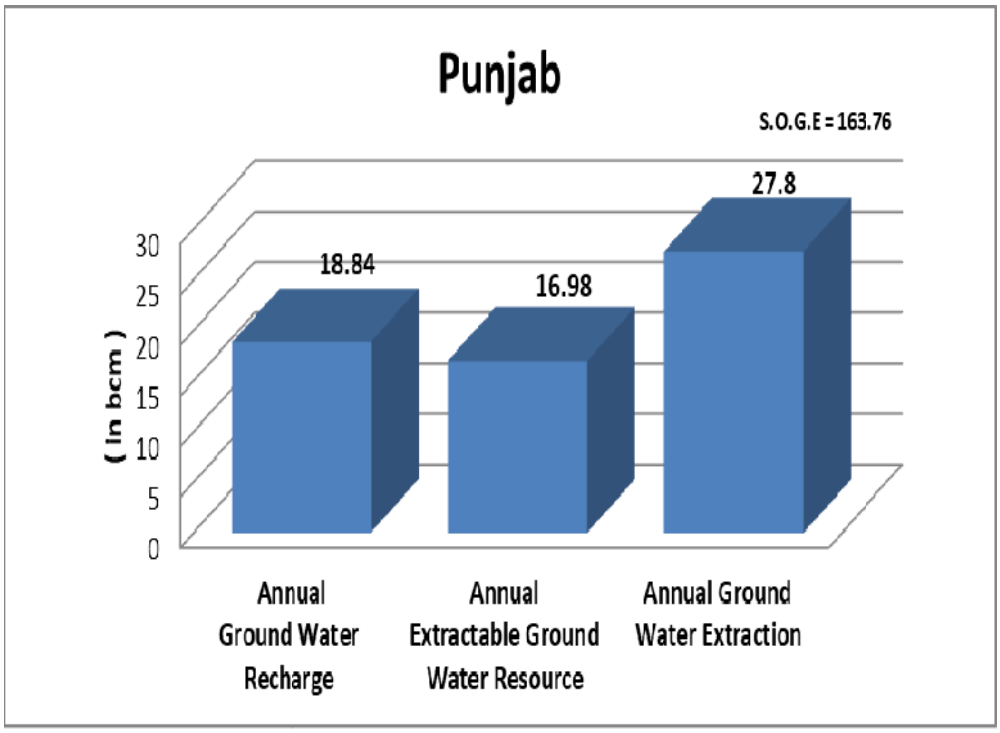
7.21 PUNJAB

Punjab is one of the smallest states of India having 3 perennial rivers namely Sutlej, Beas and Ravi and one non- perennial river Ghaggar. The Punjab State is a flat alluvial plain having a thin belt of mountains along north eastern border and stable sand dunes are seen dotting the landscape in the south western parts. The alluvial deposits in the State comprise sand, silt and clays often mixed with kankar. Sandy zones of varying grade constitute abundant ground water resources & act as a reservoir. The alluvial plain towards the hills is bordered by the piedmont deposits comprising Kandi and Sirowal. Immediately south-west of the hills, Kandi belt is 10 to 15 km wide followed by Sirowal which imperceptibly merges with the alluvial plain. Kandi deposit explored up to 450 m depth show gradation from boulders to clays and at places an admixture of various grades in different proportions. The Sirowal deposit is essentially composed of finer sediments but occasional gravel beds are also encountered in them.

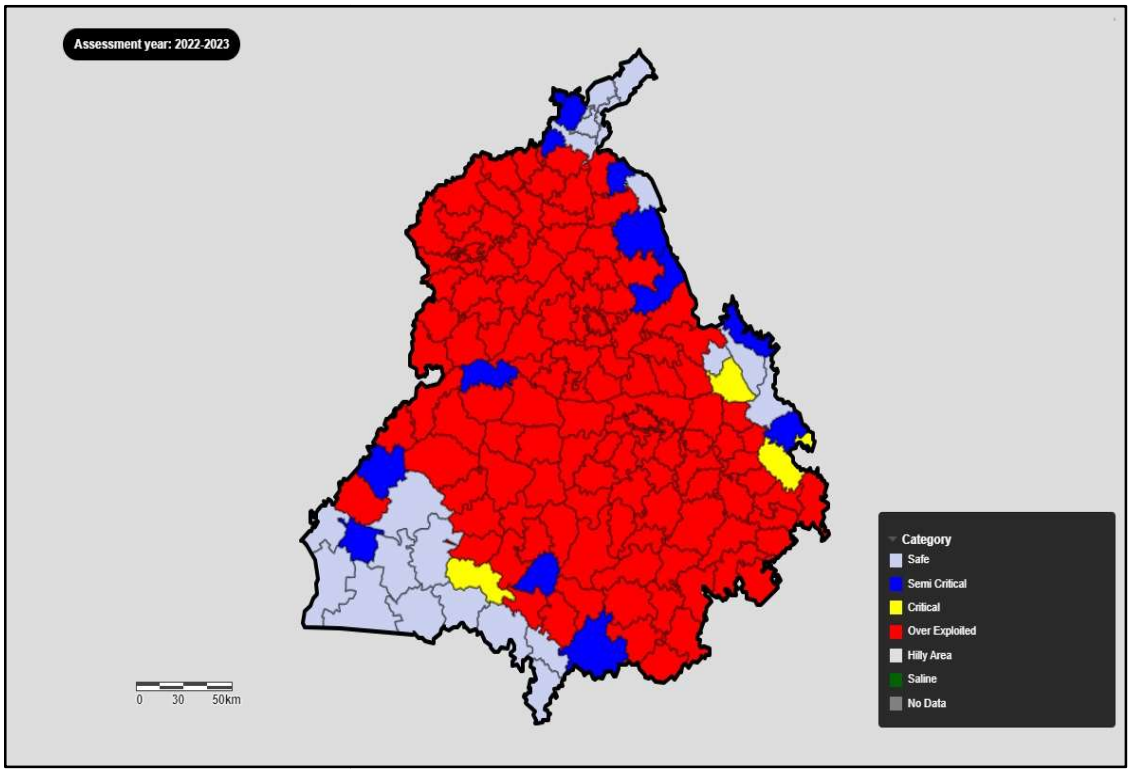
The ground water resources for the state have been assessed block-wise. Total Annual Ground Water Recharge of the State has been assessed as 18.84 bcm and Annual Extractable Ground Water Resource as 16.98 bcm. The Annual Ground Water Extraction is 27.8 bcm and Stage of Ground Water Extraction is 163.76 %.

Out of total 150 assessed blocks and 03 Urban area taken for study, 114 blocks and 03 Urban Areas (total 76.47 %) have been categorized as 'Over-exploited', 03 blocks (1.96%) as 'Critical', 13 blocks (8.5%) as 'Semi Critical' and 20 blocks (13.07%) as 'Safe'. Similarly out of 50175.27 sq. km recharge worthy area of the State, 36515.30 sq km (72.8 %) area are under 'Over-Exploited', 1192.98 sq. km (2.38%) under 'Critical', 4307.45 sq km (8.58%) under 'Semi-critical' and 8159.54 sq km (16.26 %) under 'Safe'. Out of total 16978.36 mcm annual extractable ground water resources of the State, 12794.57 mcm (75.36 %) are under 'Over-exploited', 309.67 mcm (1.82 %) under 'Critical', 1360.17 mcm (8.01 %) under 'Semi-critical' and 2513.95 mcm (14.81 %) are under 'Safe' categories of assessment units.

As compared to 2022 estimates, the Annual Ground Water Recharge has decreased from 18.94 to 18.84 bcm and similarly, Annual Extractable Ground Water Resource decreased from 17.07 to 16.98 bcm and total current annual ground water extraction decreased 28.02 to 27.8 bcm (excluding Poor Quality 1.24bcm). The stage of ground water extraction has increased from 165.99% to 163.76 %. The reduction in recharge is due to less rainfall, lining of unlined canals, reduced recharge from ponds & tanks and decreased extraction is due to decrease in irrigation draft.



Dynamic Ground water Recourses Scenario 2023 - Punjab



Categorization Map of GWRA 2023 – Punjab

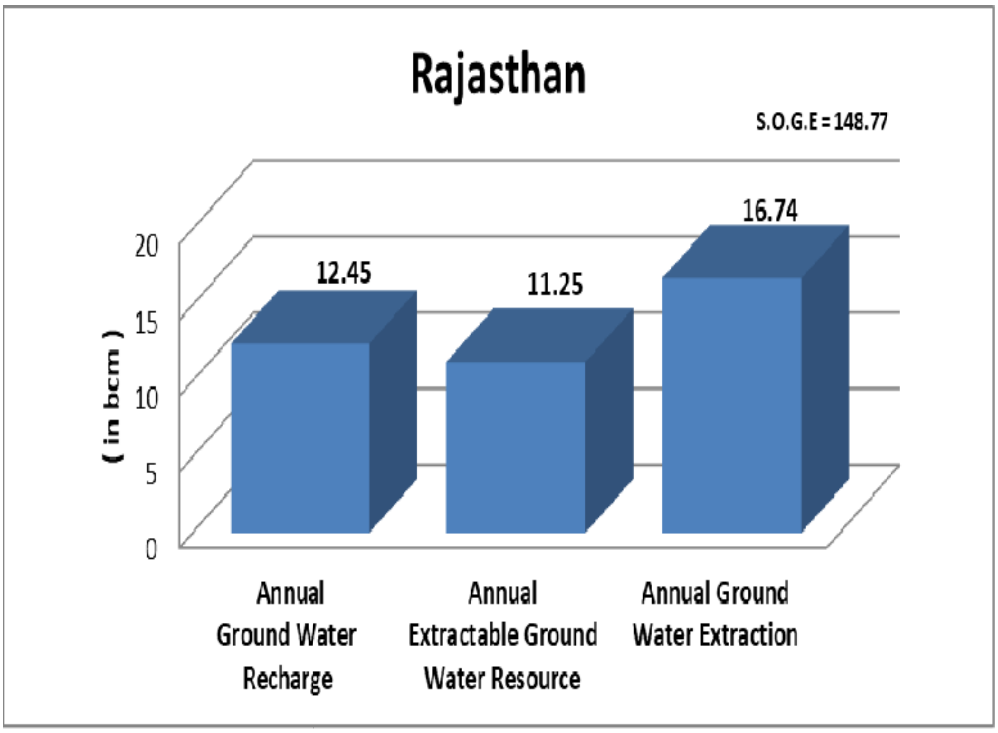
7.22 RAJASTHAN

The State of Rajasthan has diversified geology, ranging from Archean metamorphic to recent alluvial sediments. Based upon geological diversities, geomorphological setup and ground water potentialities, the state of Rajasthan can be divided into three broad hydrogeological units. (i) Unconsolidated formation (ii) Semi-consolidated formation (iii) Consolidated (Fissured formation). Large part of the State is underlain by Quaternary sediments (Thar Desert) consisting of clay, silt, sand and gravel of various grades. Exploratory drilling data reveals that the yield vary from meager to 10 m^3/day, transmissivity ranges between 80 to 300 m^2/day and storage co-efficient vary from $1.1x\ 10^{-5}$ to $3.9x\ 10^{-6}$ in the state. Ground Water occurs within the weathered residue and in the secondary porosity in Sandstone belonging to the Vindhyan formation. Yield potential is limited due to compact nature of the formation. The limestone is also having low ground water potential. The yields of dug wells vary from 0.25 to 0.75 m^3/day. The yield of the wells drilled in Vindhayan formation has been observed to be 15 m^3/day, tapping fractures between 50-75 m bgl. In consolidated formation (Fissured) the thickness of the weathered zone varies from 5 to 50 m. Ground Water occurs under unconfined condition within the weathered zone. The results of the exploratory drilling carried out by CGWB in hard rock are as indicate presence of productive fractures down to the depth of 100 m and yield varies from 3 to 15 m^3/day, whereas transmissivity varies from 3 to 30 m^2/day.

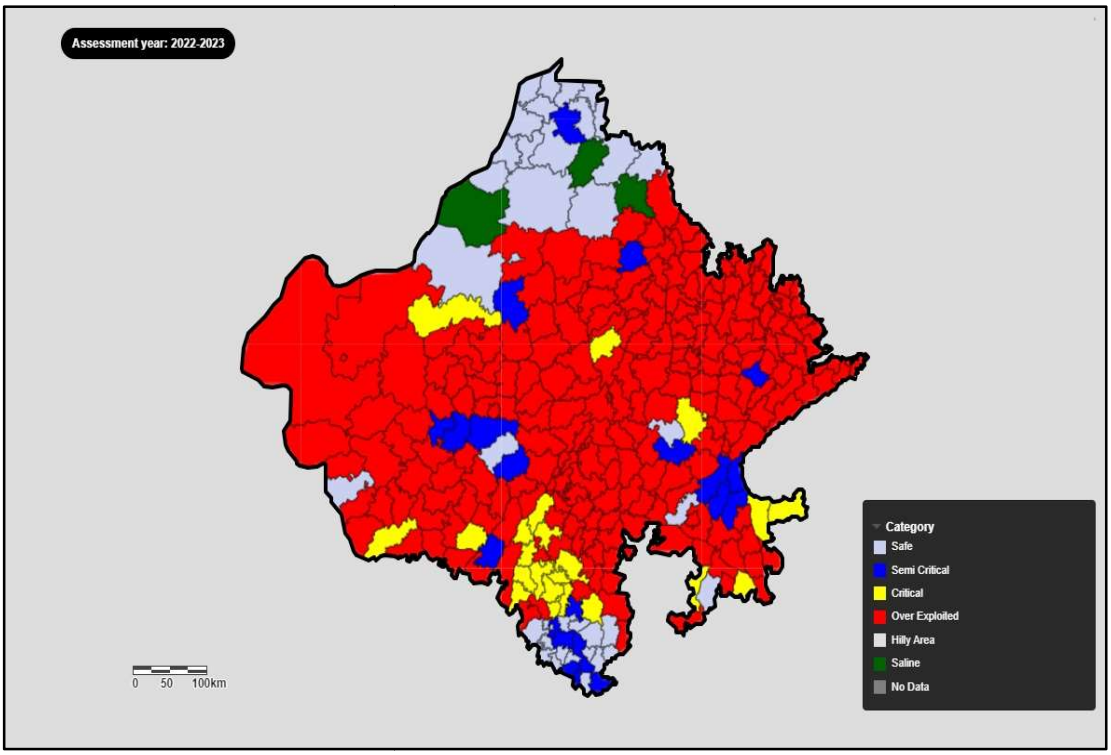
The dynamic ground water resources for the state have been assessed block-wise. Total Annual Ground water Recharge of the State has been assessed as 12.45 bcm and Annual Extractable Ground Water Resource as 11.25 bcm. The Annual Ground Water Extraction is 16.74 bcm and the Stage of ground water extraction in the state is 148.77 %.

In the year 2023, 07 (seven) new urban assessment units have been added apart from 295 assessment units. This year also assessment has been done for 302 units. Out of the 302 assessment units (blocks and urban areas), 216 units (71.52 %) have been categorized as ‘Over Exploited’, 23 units (7.62 %) as ‘Critical’, 22 units (7.28 %) as ‘Semi-Critical’, 38 units (12.58 %) blocks as ‘Safe’ and 3 units (0.99 %) as ‘Saline’. Similarly out of 317010.74 sq km recharge worthy area of the State, 222734.36 sq km (70.26 %) area are under ‘Over-Exploited’, 19808.7sq km (6.25 %) under ‘Critical’, 19080.79 sq km (6.02 %) under ‘Semi-critical’, 46451 sq km (14.65 %) under ‘Safe’ and 8935.89 sq km (2.82 %) area under ‘Saline’ categories of assessment units. Out of total 11251.35 mcm annual extractable ground water resources of the State, 8235.03 mcm (73.19 %) are under ‘Over-exploited’, 857.87mcm (7.62 %) under ‘Critical’, 935.81mcm (8.32%) under ‘Semi-critical’ and 1222.65mcm (10.87 %) are under ‘Safe’ categories of assessment units.

As compared to 2022 assessment, the Annual Ground Water Recharge and Annual Extractable Ground Water Resource have increased from 12.13 bcm to 12.45 bcm and from 10.96 bcm to 11.25 bcm respectively. Annual ground water extraction has increases from 16.56 bcm to 16.74 bcm. The stage of ground water extraction has decreased from 151.07 % to 148.77 %. The change in Annual Ground Water recharge is because of change in rainfall for recharge and area under irrigation (both by surface water and ground water).



Dynamic Ground water Recourses Scenario 2023 – Rajasthan



Categorization Map of GWRA 2023 – Rajasthan

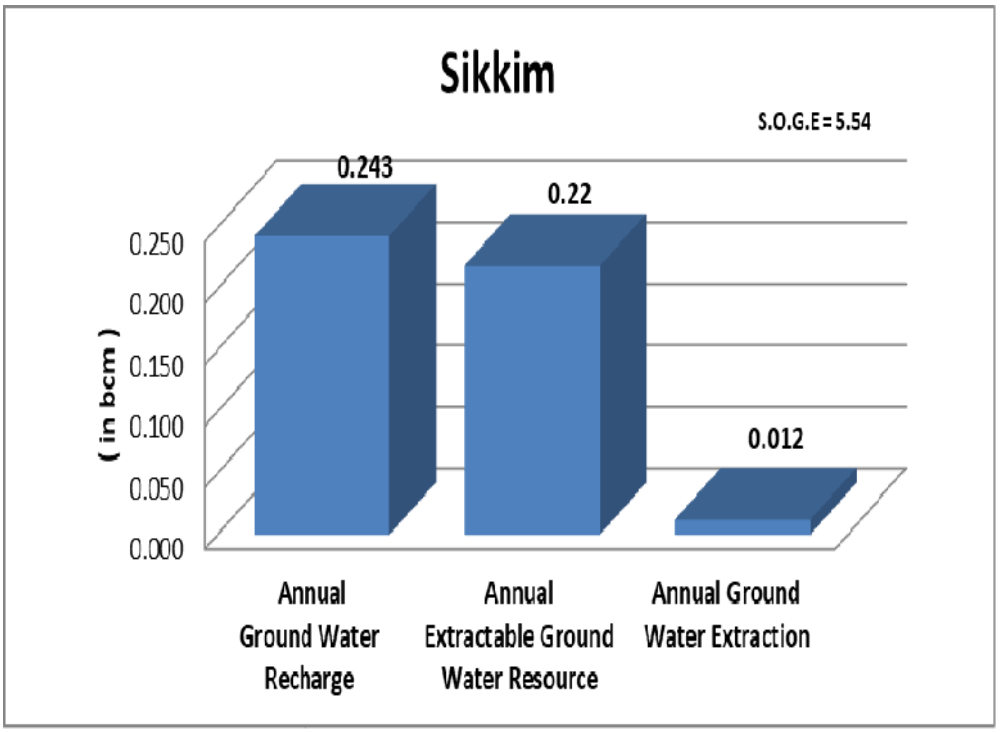
7.23 SIKKIM

Sikkim is a small mountainous State characterized by rugged undulating topography with series of ridges and valleys. The various rock types prevalent in the state are pelitic and carbonate rocks and Gondwanas over a gneissic basement and occasional colluviums and valley fill deposits, as well as alluvial terraces along higher order streams and river courses. The formations reveal an intense tectonic-structurally complex deformational history. Ground water occurs largely in disconnected localized pockets and in deeper fractures zones. Springs are the main source and conduits of water.

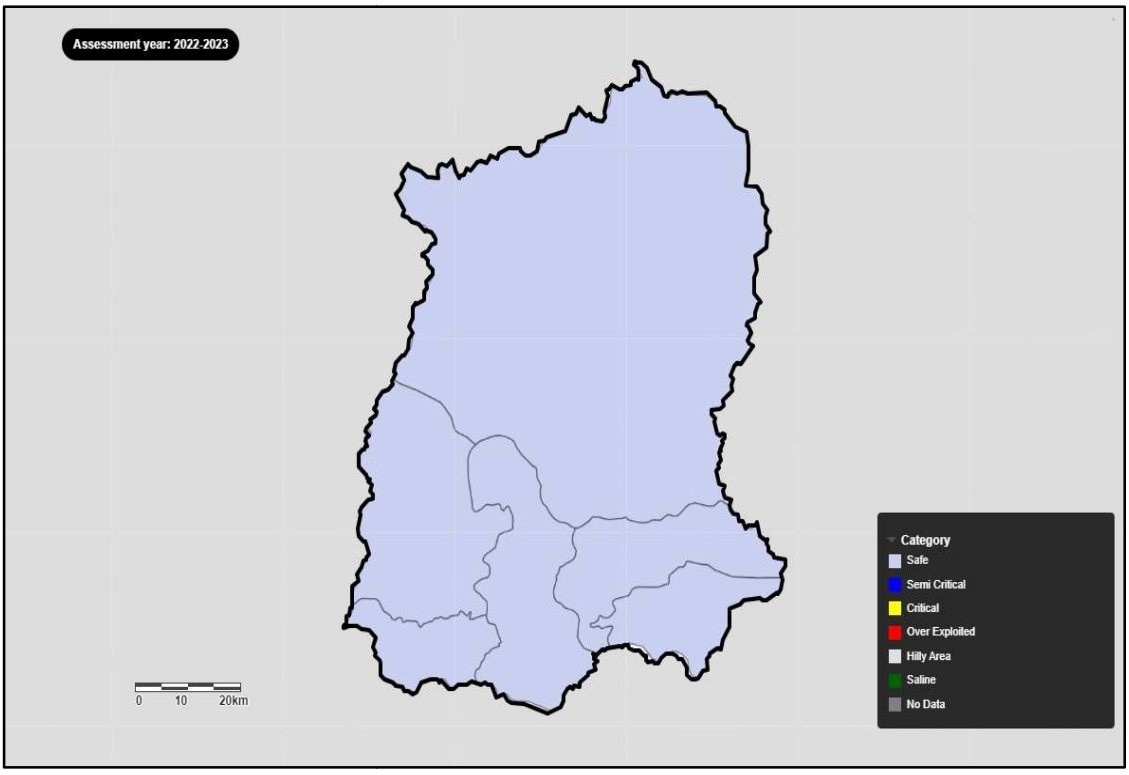
The ground water resource assessment (in 2023) for the State of Sikkim has been carried out as per GEC 2015 guidelines through 'IN-GRES', with Districts as primary assessment units. Total Annual Ground Water Recharge has been estimated at 0.243 bcm and Annual Extractable Ground Water Resource has been estimated at 0.219 bcm. Current Annual Ground Water Extraction for all uses has been estimated at 0.012 bcm, which translates into a Stage of Ground Water Extraction at 5.54 %, and as per the present assessment all the six assessment units (Six Districts – Gangtok, Gyalshing, Mangan, Namchi, Pakyong, Soreng) are in 'Safe' category.

All of the recharge worthy area (1496 sq km) and Total Annual Extractable Resource (218.68 mcm) is under 'Safe' category.

As compared to 2022 assessment, Total Annual Ground Water Recharge of the State has decreased from 0.27 bcm to 0.24 bcm. Annual Extractable Ground Water Resource reduced from 0.24 bcm to 0.22 bcm. The Annual Ground Water Extraction from all sources though marginally decreased from 0.014 bcm to 0.012 bcm. Stage of Ground Water Extraction decreased from 6.04 % to 5.54 %. Decrease in annual rainfall resulted in decrease in recharge, which is reflected in marginal decrease in Annual Extractable Resource.



Dynamic Ground water Recourses Scenario 2023 - Sikkim



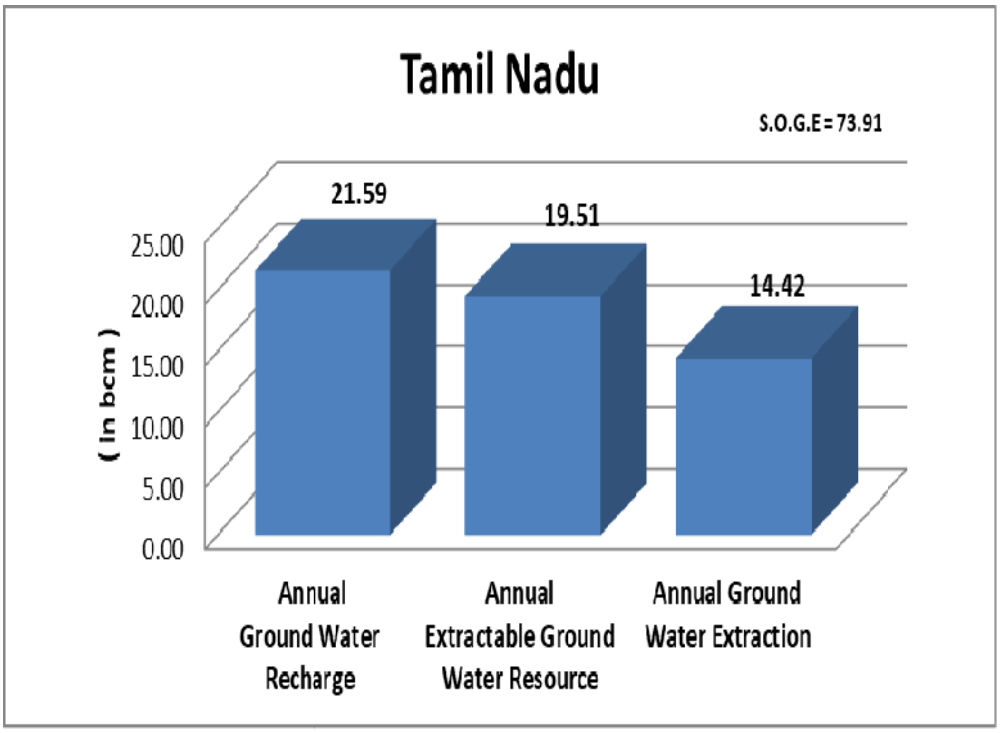
Categorization Map of GWRA 2023 – Sikkim

7.24 TAMIL NADU

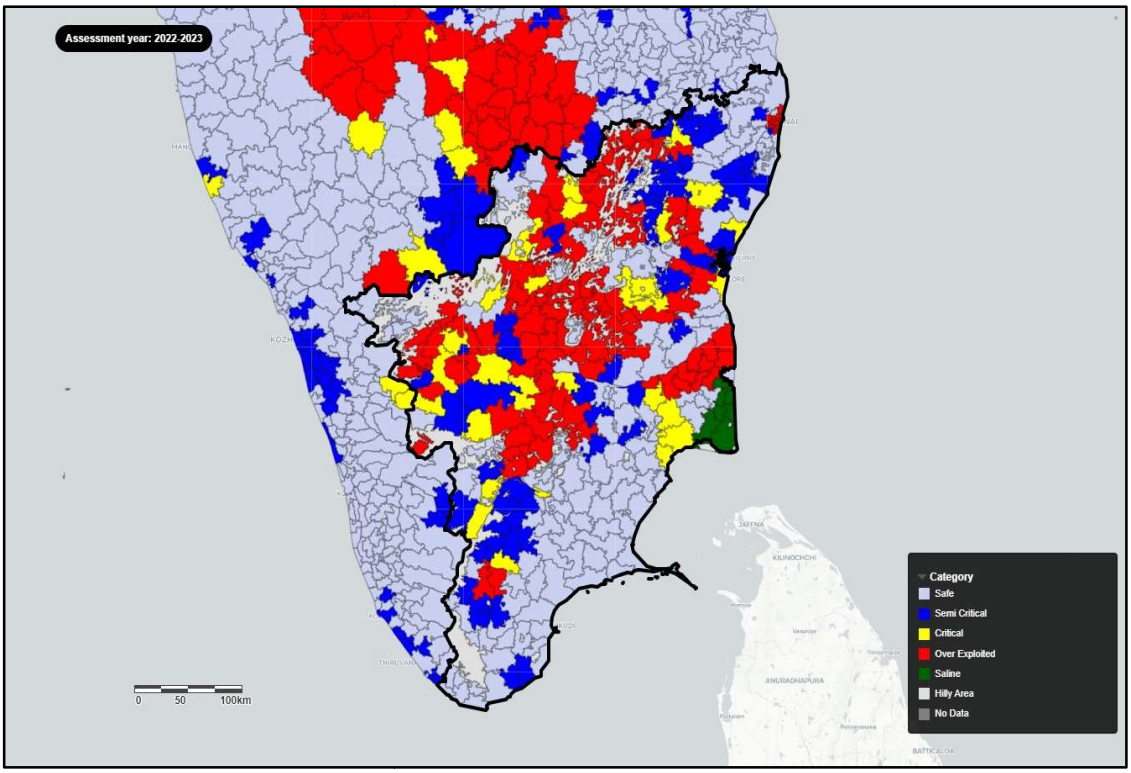
Tamil Nadu state is underlain by diverse hydrogeological formations. Nearly 73 % of the state is occupied by hard rocks (consolidated), semi-consolidated and unconsolidated formations which are mainly confined to the eastern part including the coastal tract. In the hard rock areas, groundwater is developed through dug wells tapping the weathered zone and dug cum bore wells and bore wells tap the deeper fractures down to a depth of 300 m. In semi consolidated and unconsolidated formation, shallow zones are tapped by filter points and shallow tube wells and deeper zones through deeper tube wells. The yield of open wells vary from 1 to 3 lps, where as in dug wells tapping soft rocks including sedimentary formations, the yield is up to 10 lps. The yield from unconsolidated and semi consolidated formations are in general 10 to 20 lps and also as high as 40 lps are also noticed at select places.

The ground water resources for the State have been assessed Block-wise and for the 2023 Ground Water Resource Assessment, 1202 Firkas were assessed. The Firka wise resources assessed were sum up to taluk level. Total Annual Ground Water Recharge of the State has been assessed as 21.59 bcm and Annual Extractable Ground Water resources as 19.51 bcm. The Annual Ground Water Extraction is 14.42 bcm and Stage of Ground Water Extraction as 73.91 %.

Out of 313 assessment units (taluka), 100 units (31.95 %) have been categorized as ‘Over Exploited’, 27 units (8.63 %) as ‘Critical’, 56 units (17.89 %) as ‘Semi-Critical’, 125 units (39.94 %) as ‘Safe’ and 5 units (1.60 %) have been categorized as ‘Saline’. Similarly out of 108691 sq km recharge worthy area of the State, 31130 sq km (28.64 %) area are under ‘Over-Exploited’, 11774 sq km (10.83 %) under ‘Critical’, 19483 sq km (17.92 %) under ‘Semi-critical’, 44393 sq km (40.84 %) under ‘Safe’ and 1911 sq km (1.76 %) area under ‘Saline’ categories of assessment units. Out of total 19505.70 mcm annual extractable ground water resources of the State, 4772.59 mcm (24.47 %) are under ‘Over-exploited’, 2029.09 mcm (10.4 %) under ‘Critical’, 3776.06 mcm (19.36 %) under ‘Semi-critical’ and 8927.94 mcm (45.77 %) are under ‘Safe’ categories of assessment units.
As compared to 2022 assessment, Total Annual Ground Water Recharge has marginally increased minutely from 21.11 to 21.59 bcm. The Annual Extractable Ground Water Resources has also marginally increased from 19.09 to 19.51 bcm and the annual ground water extraction has decreased marginally from 14.43 to 14.42 bcm. Consequently, there is a decrease in the stage of ground water extraction from 75.59 % to 73.91 % indicating overall improvement in ground water scenario. The increase in ground water recharge is due to changes in rainfall pattern and decreased extraction is due to decrease in the load on ground water resources in irrigation and domestic sector.



Dynamic Ground water Recourses Scenario 2023 – Tamil Nadu



Categorization Map of GWRA 2023 – Tamil Nadu

7.25 TELENGANA

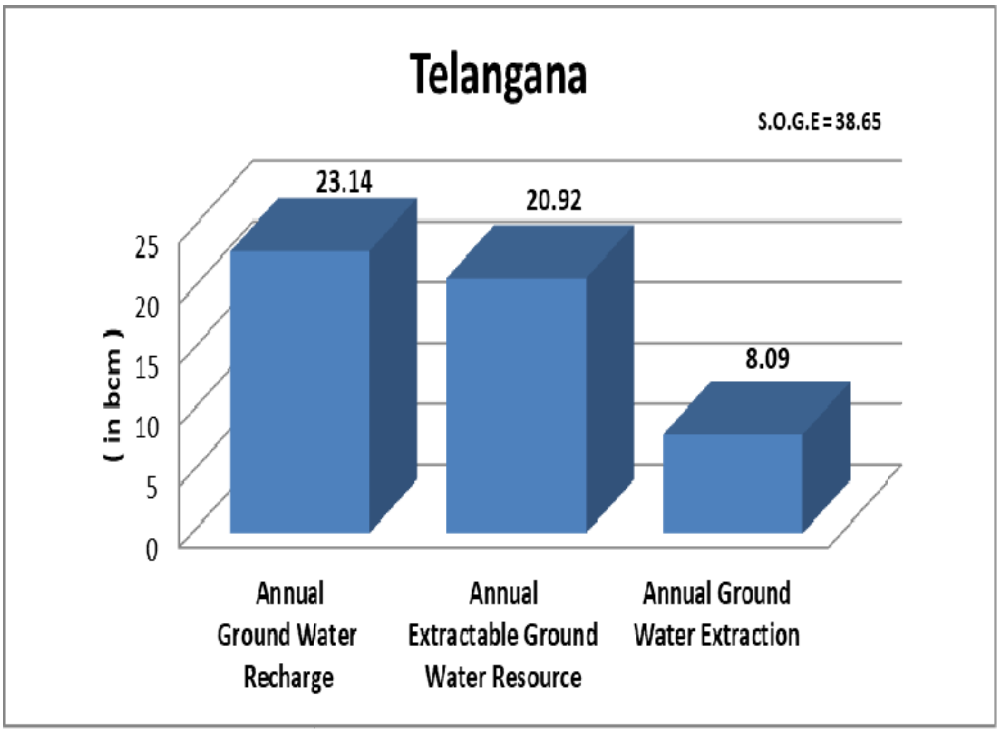
Telangana state is characterized by wide range of geological formations from Archaean to Recent age. Nearly 85% of the state is underlain by hardrocks (consolidated formations) belonging to the Peninsular Gneissic Complex, Dharwar and Eastern Ghats of Archaean to Middle Proterozoic age, Pakhal Group of rocks belonging to Middle to Upper Proterozoic age and Deccan Traps. In hardrocks average well yields are around 50 to 125 lpm. The rest of the state is underlain by semi consolidated sedimentary formations encompassing Gondwanas, Tertiary group of formations and Sub-Recent to Recent unconsolidated sediments. Transmissivity of these aquifers varies between 28 and 950m^2/day. The unconsolidated formations are represented by inland river alluvium.

The Ground water resources for the state have been assessed watershed-wise and apportioned to Mandal-wise. Total Annual Groundwater recharge of the State has been assessed as 23.14 bcm and Annual extractable Ground Water resource as 20.92 bcm. The Annual Ground Water Extraction is 8.09 bcm and Stage of Ground Water Extraction is 38.65 %.

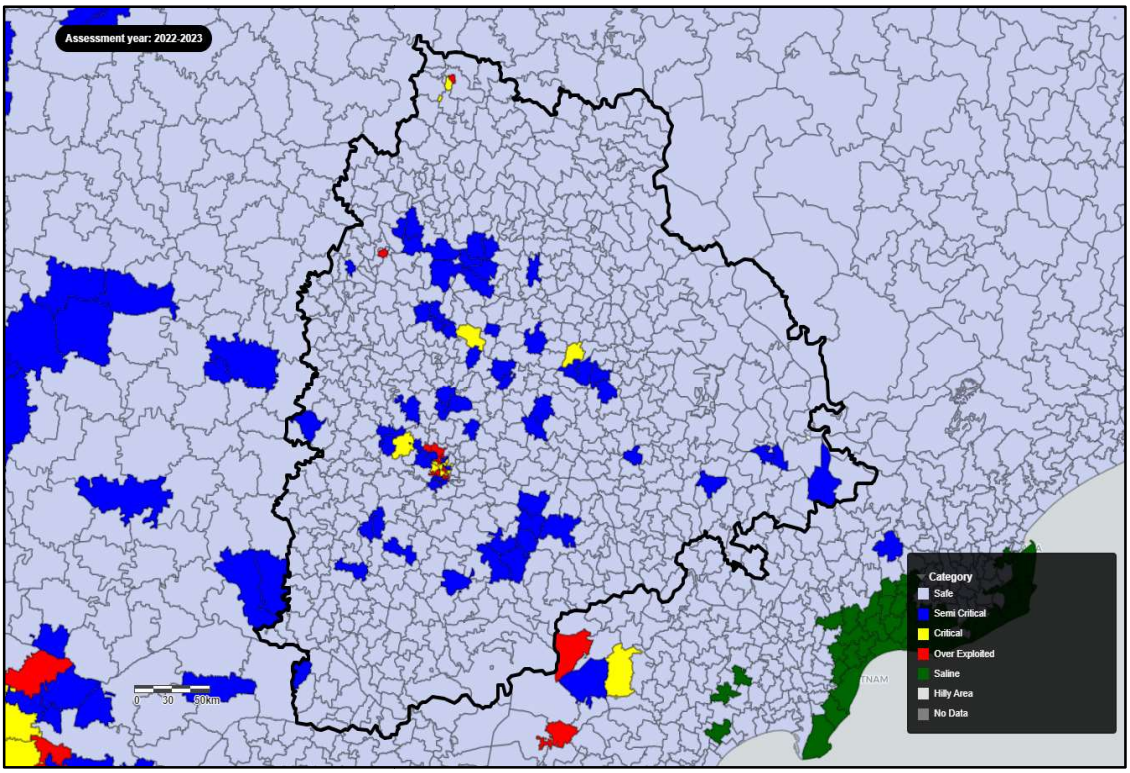
Out of 612 assessment units (Mandals), 11 units (1.8 %) have been categorized as 'Over Exploited', 10 units (1.63 %) as 'Critical', 61 units (9.97 %) as 'Semi-Critical' and 530 units (86.6 %) as 'Safe'. There is no 'Saline' category of assessment unit in the state.

Similarly out of 105777.24 sq km recharge worthy area of the State, 156.44 sq km (0.15 %) area are under 'Over-Exploited', 605.7sq km (0.57 %) under 'Critical', 8510.64 sq km (8.05 %) under 'Semi-critical', 96504.46 sq km (91.23%) under 'Safe' categories of assessment units. Out of total 20920.92 mcm annual extractable ground water resources of the State, 20.08 mcm (0.1 %) are under 'Over-exploited', 97.23 mcm (0.46 %) under 'Critical', 1268.76 mcm (6.06%) under 'Semi-critical' and 19534.85 mcm (93.37 %) are under 'Safe' categories of assessment units.

As compared to 2022 assessment, Total Annual Ground Water Recharge of the State has increased from 21.27 to 23.14 bcm. This is mainly due to increase in recharge from 'Other sources'. The Annual Extractable Ground Water Resources has increased from 19.25 to 20.92 bcm. The overall Stage of Ground Water Extraction decreased from 41.6 % to 38.65%. This can be attributed to government interventions like water conservation activities under Mission Kakatiya, improvement in surface water irrigation and drinking water supply under Mission Bhagiratha and copious rainfall received by the state during last year.



Dynamic Ground water Recourses Scenario 2023 – Telangana



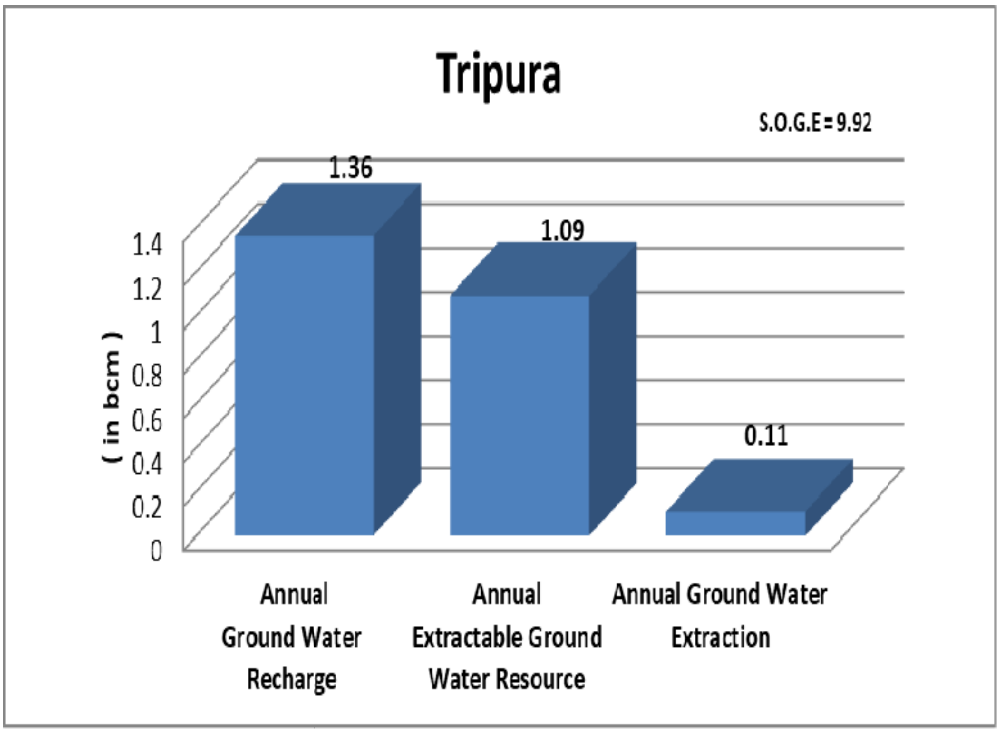
Categorization Map of GWRA 2023 – Telangana

7.26 TRIPURA

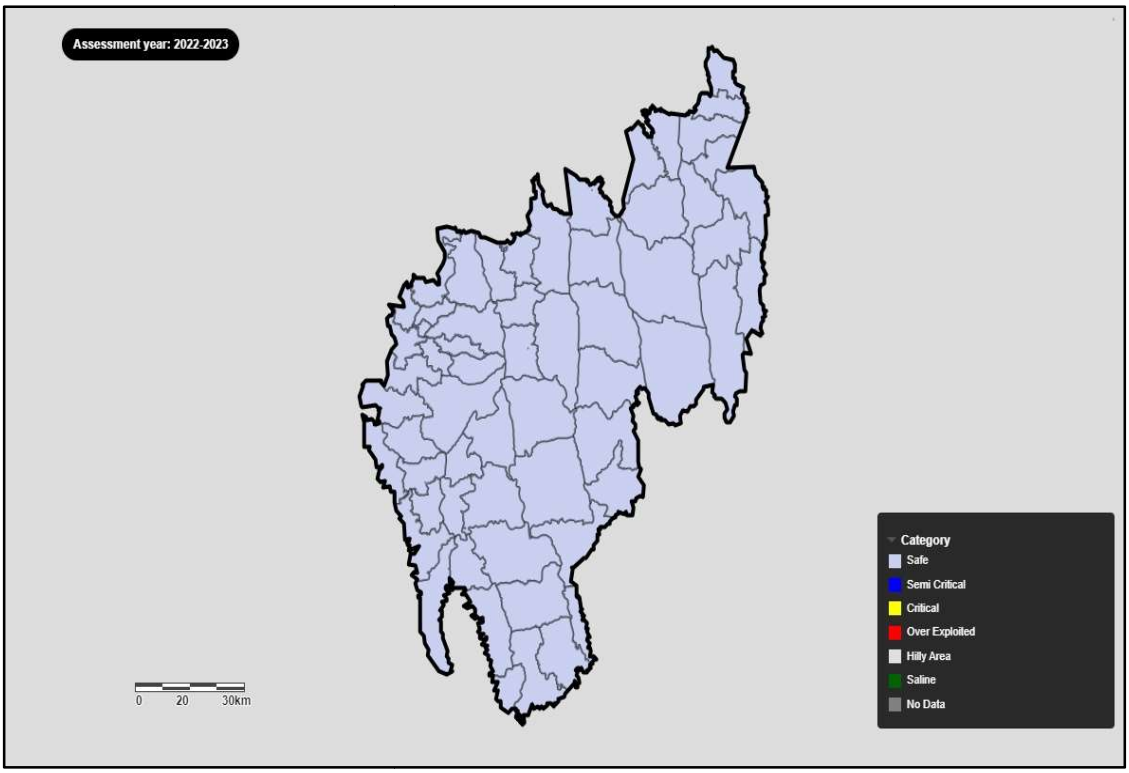
The State of Tripura is occupied by the rocks ranging in age from Upper Tertiary to Quaternary. Mobile trough geosynclinal deposition of Barail group followed by flysch type of Surma &Tipam sediments, overlain by Dupitila formation, is noticed in the State. Most of the longitudinal synclinal valleys of the state are the basins of deposition of recent formation. Recent alluvium occurs along the streams and the flood plains of major rivers.

Ground water occurs under unconfined condition in Dupitila, Recent &Tipam formations. Besides, it also occurs under confined to semi-confined conditions in Tipam formation at considerable depth. Recharge areas for the deeper aquifer lies in the adjacent anticlinal hills. Wherever a good thickness of impermeable clay beds underlie & overlie the saturated granular zones, auto flow artesian conditions have been found in the valleys, which are the discharge area. The artesian flowing conditions occur in patches both at shallow depth and at deeper depth. The auto discharge of the flowing wells in the State ranges from 100 to 6000 lph, the maximum auto discharge from deep tube well to the extent of 54000 lph has been found in Khowai valley near Khowai town, where the piezometric head rose up to 7 m above ground level.

Ground water resources have been assessed block-wise for recharge worthy area. Total Annual Ground Water Recharge of the State has been assessed as 1.36 bcm and Annual Extractable Ground Water Resource as 1.09 bcm. The Annual Ground Water Extraction is 0.11 bcm and Stage of Ground Water Extraction is 9.92 %. All the 59 assessment units have been categorized as ‘Safe’.
The state has Recharge worthy area of 6197.84 Sq. Km and Total Annual Extractable Resource is of 1094.05 mcm is under ‘safe’ categories of assessment units.
As compared to 2022 assessment, there is no significant change in ground water recharge and ground water extraction in the State.



Dynamic Ground water Recourses Scenario 2023 – Tripura



Categorization Map of GWRA 2023 – Tripura

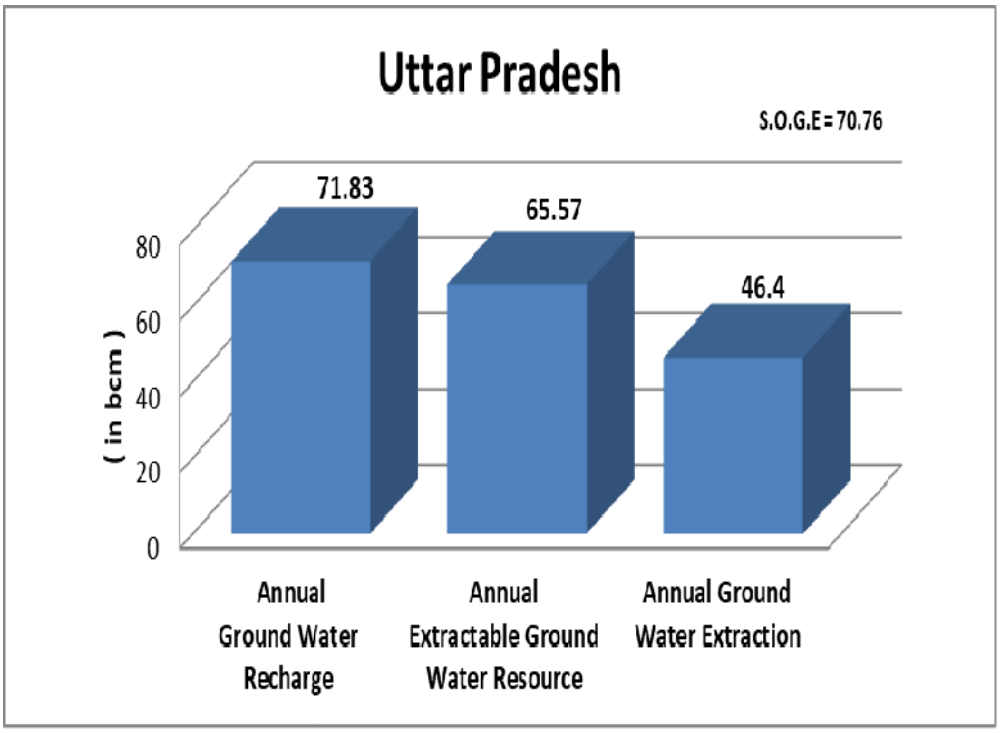
7.27 UTTAR PRADESH

The State of Uttar Pradesh is categorized with five distinct hydrogeological units – Bhabar, Terai, Central Ganga Plains, Marginal Alluvial Plain, Southern Hardrock area. Bhabar is mainly the recharge zone having deeper water levels. Ground water extraction in phreatic aquifer is through hand pumps, dug wells, dug cum bore wells and shallow tube wells. The yield from these wells has been generally found to be in the range of 40 to 60 lps. Terai zone lies between Bhabar in the North and Central Ganga Plain in the South. It is characterized by fine grained sediments with occasional pebbles and boulders. The average yield of tube wells constructed in this zone varies from 30 to 60 lps with moderate drawdown. Central Ganga Plain constitutes the most promising ground water repository characterized by multi-layered aquifer systems. The yield of the open wells and hand pumps constructed in the phreatic aquifer vary from 5 to 10 lps. The tube wells in the phreatic aquifer yield between 20 to 28 lps at 6 to 8 m drawdown. Marginal alluvial plain consists of kankar mixed clay-silt beds intercalated with sand and gravel lenses. The aquifer in this area is capable of yielding 15 to 40 lps at moderate drawdown. Southern part mainly occupied by Hard rocks comprising of Granite/ Granitic Gneiss and Marginal Alluvium in Bundelkhand Region and Vindhyan Sedimentary formations in Mirzapur and Sonebhadra Districts. The wells tapping these formations generally recorded yield between 2 to 8 lps. The Ground water resources of the State have been assessed block-wise.

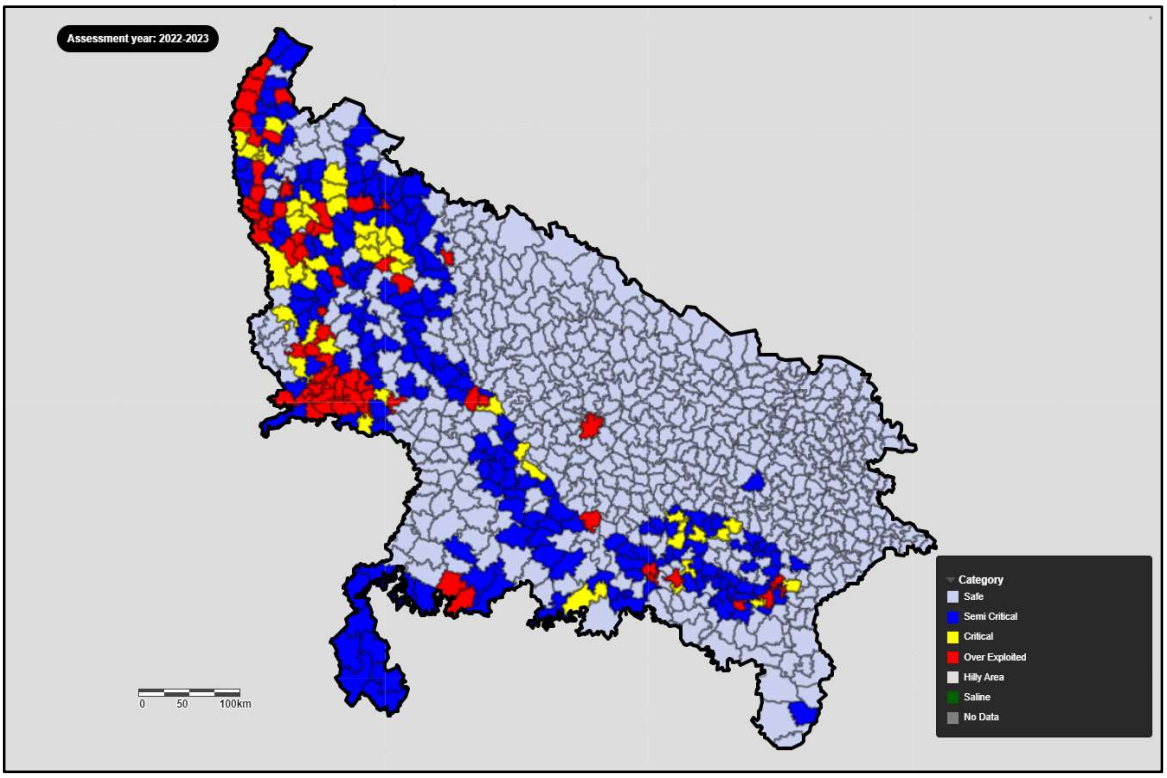
Total Annual Ground Water Recharge of the state has been assessed as 71.83 bcm and Annual Extractable Ground Water Resource as 65.57 bcm. The Annual Ground Water Extraction is 46.40 bcm and average Stage of Ground Water Extraction of the State is 70.76%.

Out of the 836 assessment units consisting 826 blocks and 10 cities, 62 units (7.42 %) have been categorized as ‘Over- exploited’, 43 units (5.14 %) as ‘Critical’, 172 units (20.57 %) as ‘Semi-critical’ and 559 units (66.87 %) as ‘Safe’. Similarly, out of 229555.18 sq km recharge worthy area of the State, 14952.13 sq km (6.51 %) area are under ‘Over-Exploited’, 11777.16 sq km (5.13 %) under ‘Critical’, 51620.24 sq km (22.49 %) under ‘Semi-critical’, 151205.64 km (65.87 %) under ‘Safe’ categories of assessment units. Out of total 65571.79 mcm annual extractable ground water resources of the State, 3917.31 mcm (5.97 %) are under ‘Over-exploited’, 3276.41 mcm (5.00%) under ‘Critical’, 12977.06 mcm (19.79 %) under ‘Semi-critical’ and 45401.02 mcm (69.24 %) are under ‘Safe’ categories of assessment units.

As compared to 2022 assessment, ground water recharge and ground water extraction figure increased minutely. The stage of ground water extraction has also marginally increased from 70.66 % to 70.76%.



Dynamic Ground water Recourses Scenario 2023 – Uttar Pradesh



Categorization Map of GWRA 2023 – Uttar Pradesh

7.28 UTTARAKHAND

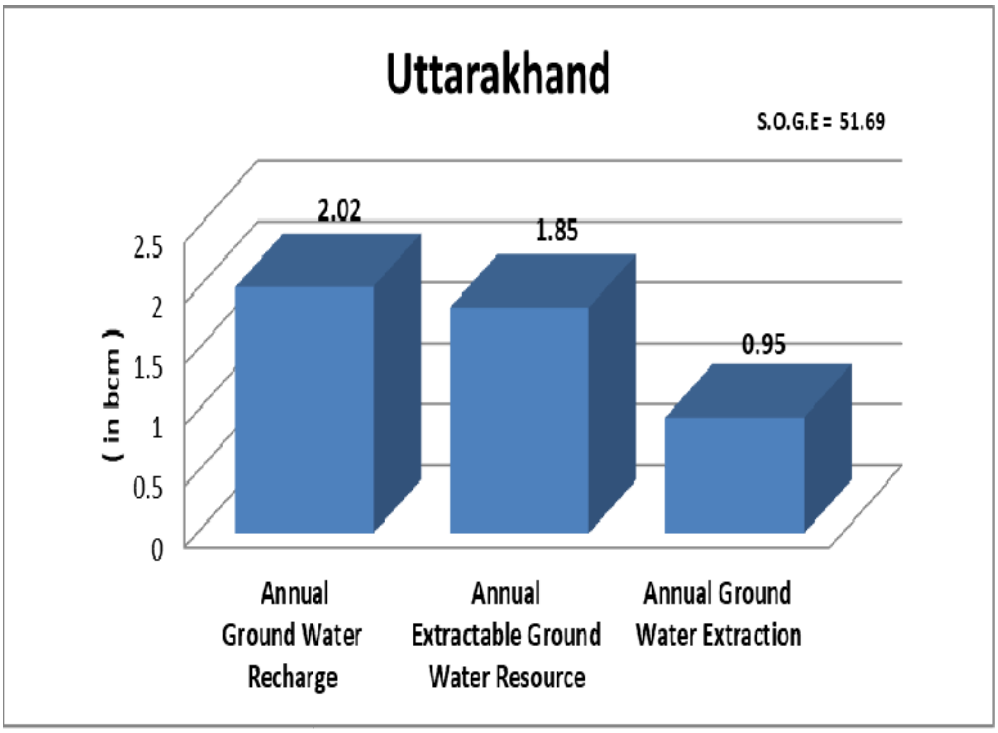
Uttarakhand State, a predominantly hilly state, covers a total geographical area of 53,483 km^2 and is situated between 28°43'20" – 31°28'00" N Latitude and 77°34'06" – 81°01'31" E Longitude. Most of the northern part of the state is covered by high Himalayan peaks and glaciers. The state shares international boundaries with China (Tibet) in the north and Nepal in the East. The assessment of dynamic ground water resources has been carried out in 18 assessment units (blocks) of the state.

Total Annual Ground Water Recharge in the State (2023) has been assessed as 2.02 bcm. Ground water resources are replenished through rainfall and other sources like return flow from irrigation, canal seepage etc. The main source of annual ground water recharge is rainfall, which contributes nearly 69.93 % of the Total Annual Ground Water Recharge. The Total Annual Extractable Ground Water Resource of the State has been assessed as 1.85 bcm. The Annual Ground Water Extraction of the State (2023) is 0.95 bcm, the largest user being irrigation sector. The Stage of ground water extraction for the entire State, is 51.69 %.

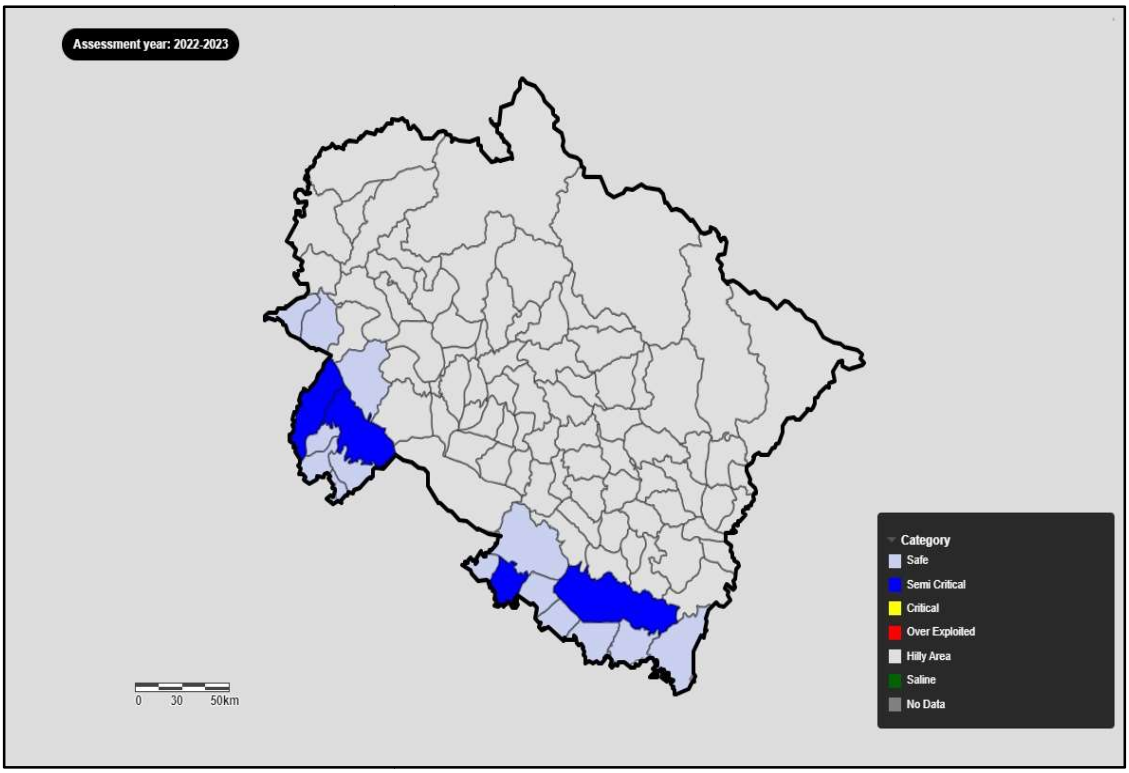
Out of the 18 assessed blocks of Uttarakhand State, 14 blocks (77.78%) are 'Safe', whereas remaining 4 blocks (22.23%) are categorised as 'Semi Critical'.There are no issues related to groundwater quality in the assessment units and hence there is no poor quality or saline block in the State.

Out of 4993.04 sq km recharge worthy area of the State, 950.94 sq km (19.05 %) under 'Semi-critical', 4042.1 sq km (80.95 %) under 'Safe' category of assessment units. Out of total 1846.93 mcm annual extractable ground water resources of the State, 360.87 mcm (19.54 %) under 'Semi-critical' and 1486.07 mcm (80.46 %) are under 'Safe' categories of assessment units.

As compared to 2022 estimate, there is negligible changes in Annual Ground Water Recharge, Annual Extractable Ground Water Resources and Annual Ground Water Extraction. The stage of groundwater extraction has increased marginally from 48.04% to 51.69%.



Dynamic Ground water Recourses Scenario 2023 – Uttarakand



Categorization Map of GWRA 2023 – Uttarakand

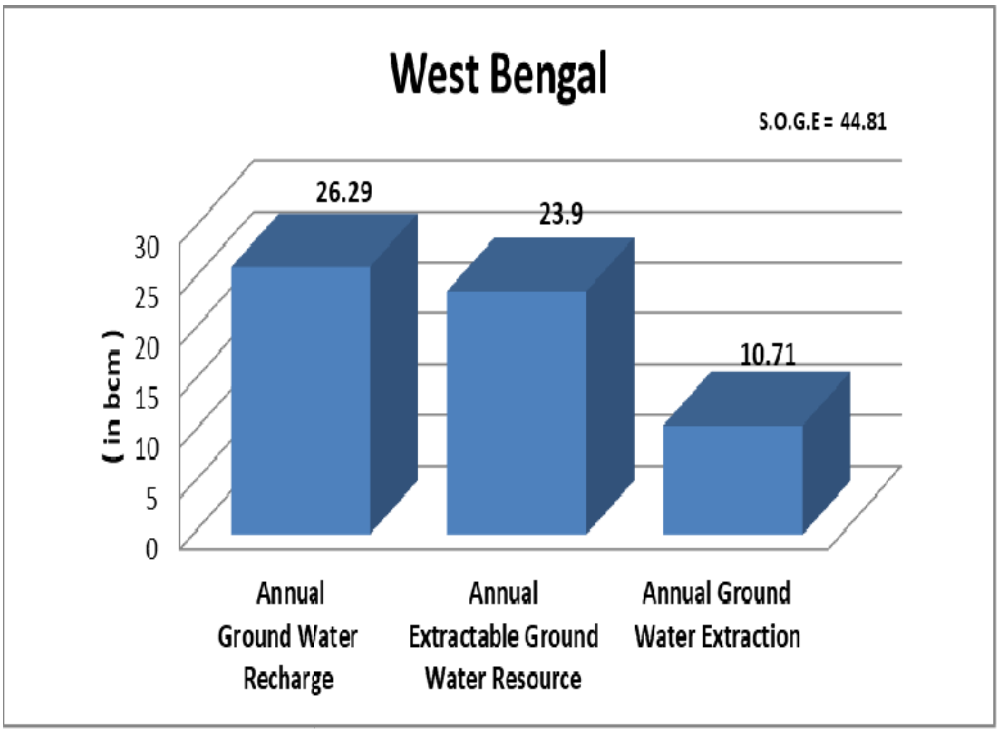
7.29 WEST BENGAL

Nearly two third area of the State is occupied by unconsolidated sediments; the western part of the state is partly occupied by the hard rocks. Phreatic aquifer is generally developed through dug well, dug cum bore well and shallow tube well. Yield potential of these wells varies from 1 to 5 lps.

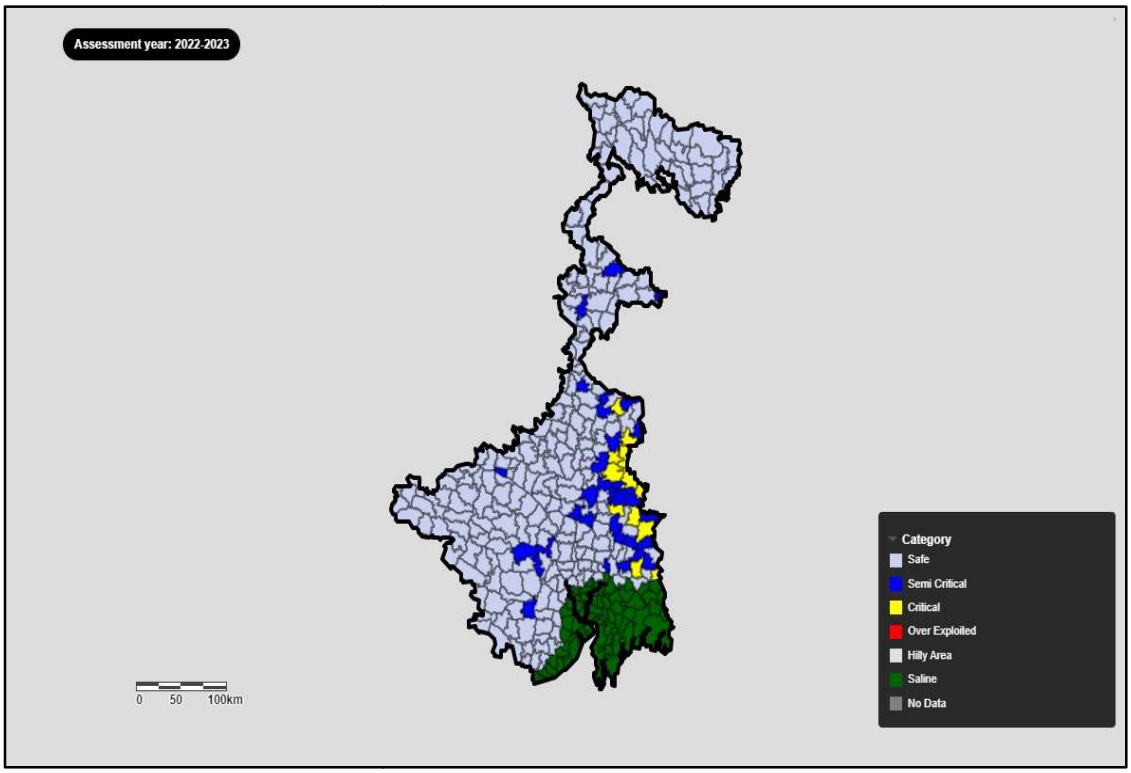
The ground water resource assessment (in 2023) for the State of West Bengal has been carried out as per GEC-2015 guidelines through 'IN-GRES', with blocks as primary assessment units. All 344 blocks of the State of West Bengal and one (01) urban area as Kolkata Municipal Corporation is assessed.. Total Annual Ground Water Recharge has been estimated at 26.29 bcm and Annual Extractable Ground Water Resource has been estimated at 23.9 bcm. Current Annual Ground Water Extraction for all uses has been estimated at 10.71 bcm, which translates into a Stage of Ground Water Extraction at 44.81 %. As per present assessment categorization scheme, out of 345 assessed units, 241 AUs (69.86%) are 'Safe', 32 AUs (9.28%) are 'Semi-Critical', 12 AUs (3.48%) are 'Critical' and 60 AUs (17.39%) are of poor groundwater quality (Saline). There is no Over-Exploited Blocks in the State.

Similarly, out of 79765.77 sq km recharge worthy area of the State, 2737.02 sq km (3.43 %) under 'Critical', 5886.51 sq km (7.38 %) under 'Semi-critical', 61634.14 sq km (77.27 %) under 'Safe' category of assessment units. 9508.1 sq km (11.92%) area is under 'Saline' category of assessment units. Out of total 23900.68 mcm annual extractable ground water resources of the State, 1336.84 mcm (5.59 %) under 'Critical', 2488.15 mcm (10.41 %) under 'Semi-critical' and 20075.68 mcm (84 %) are under 'Safe' categories of assessment units.

As a whole for the State, compared to earlier assessment (2022), Stage of Ground Water Extraction is decreased from 47.01 % to 44.81 % indicating improvement in overall ground water scenario.



Dynamic Ground water Recourses Scenario 2023 – West Bengal



Categorization Map of GWRA 2023 – West Bengal

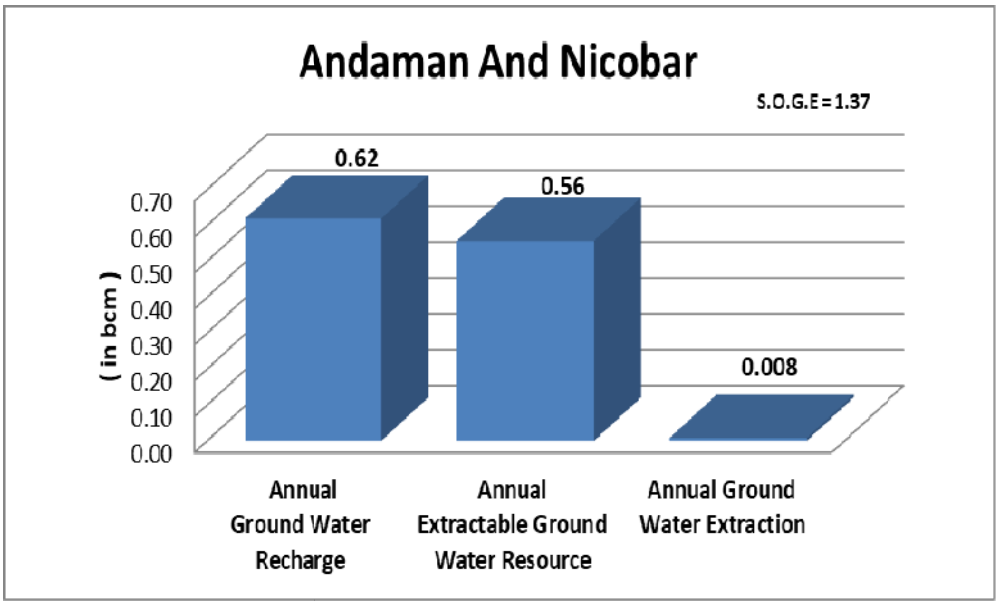
7.30 ANDAMAN AND NICOBAR ISLANDS

Andaman & Nicobar Islands comprise an arc-shaped chain of islands in the Bay of Bengal and are characterized by rugged topography, steep slope, low infiltration capacity and close proximity of hills to the sea. Marine sedimentary group of rocks comprising shale, sandstone, grit and conglomerate; extrusive and intrusive igneous rocks (volcanics and ultramafics) and limestone occupy the entire geographical area. Amongst these, the Sedimentary Group is most pervasive and occupy nearly 70% of the entire area of the islands while the igneous group covers nearly 15% while the rest of 15% goes to the coralline and limestone formations. All these rock formations have been subjected to many tectonic activities, evident from the occurrence of shallow and deep focus earthquakes in the islands.

Marine sedimentary rocks are developed only through dug wells having meager yield of 0.1 to 0.5 lps. The igneous Ophiolite suite of rocks in the area although restricted in occurrence, are observed to yield moderate to high both in shallow and deeper locales and they are developed by dug wells and bore wells with yield ranging from 1 to 10 lps. Area covered by Coralline Limestone contains appreciable quantity of groundwater with yield ranging from 5 to 25 lps.

The Ground Water Resources (in 2023), following GEC 2015 guidelines, have been assessed block-wise. Total Annual Ground Water Recharge of the A&N Islands have been assessed as 0.618 bcm and Annual Extractable Ground Water Resource is assessed as 0.557bcm. The Annual Ground Water Extraction is 0.008 bcm which translates to a Stage of Ground Water Extraction of 1.37 %. Out of 9 assessment units (Blocks), all the assessment units are under 'Safe' category. Similarly, out of 2120.07 sq km recharge worthy area of the UT, the entire recharge worthy area is under 'Safe' category of assessment units and the total 556.96 mcm annual extractable ground water resources of the UT, is under 'Safe' categories of assessment units.

As compared to previous assessment (2022), there is no significant changes in annual ground water recharge, annual extractable groundwater resources, annual groundwater extraction and stage of groundwater extractionin 2023.



Dynamic Ground water Recourses Scenario 2023 – Andaman and Nicobar

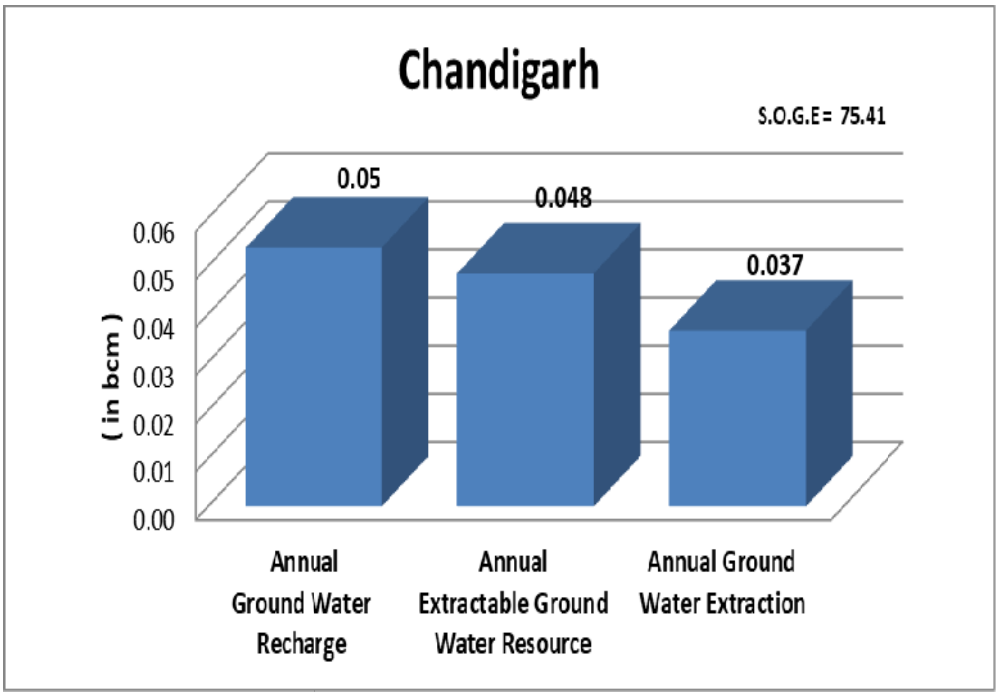
7.31 CHANDIGARH

Chandigarh is underlain by the Quaternary alluvial deposits and comprises layers of fine sand and clay. Coarser sediments occur along the Sukhna Choe and Patialiki Rao, whereas relatively finer sediments underlie the area between these two streams. Fair to good aquifer horizons occur in most part of Chandigarh comprising medium to coarse sand, to a depth of 180 m bgl below which they become finer. Ground water in the area occurs under confined as well as semi-confined conditions. In Manimajra, ground water occurs under unconfined conditions down to about 80 m. In other areas, the semi-confined conditions prevail below 20 to 30 m. The depth of the shallow aquifer system is less than 30 m bgl, where as the depth of the deeper aquifer system ranges from 40 to 450 m bgl of explored depth. The transmissivity values for the deeper aquifer system ranges between 74 and 590 m^2/day. The transmissivity values of shallow aquifers up to 100 m depth ranges from 70 to 466 m^2/day. Ground water is found to be fresh and suitable for drinking as well as irrigation purposes.

UT of Chandigarh has very small area of 114 sq km and whole UT has been taken as an assessment unit. Total Annual Ground Water Recharge has been assessed as 0.054 bcm and Annual Extractable Ground Water Resources as 0.048 bcm. The UT of Chandigarh has been categorized as 'Semi Critical' with Total Extraction of 0.037 bcm and stage of ground water extraction at 75.41 %.

Out of 114 sq km recharge worthy area of the UT, 100 % of the area is under 'Semi-critical'. The entire 48.41 mcm annual extractable ground water resources of the UT, is under 'Semi-critical' categories of assessment units.

In comparison to 2022 assessment, Total annual recharge has increased marginally from 0.05 bcm to 0.054 bcm owing to increased rainfall recharge. The current ground water extraction also decreased minutely from 0.04 bcm to 0.036 bcm due to increased surface water supply. The groundwater extraction in Chandigarh is completely governed by Government and only Government extracts groundwater for public water supply.



Dynamic Ground water Recourses Scenario 2023 - Chandigarh

7.32 DAMAN & DIU AND DADRA & NAGAR HAVELI

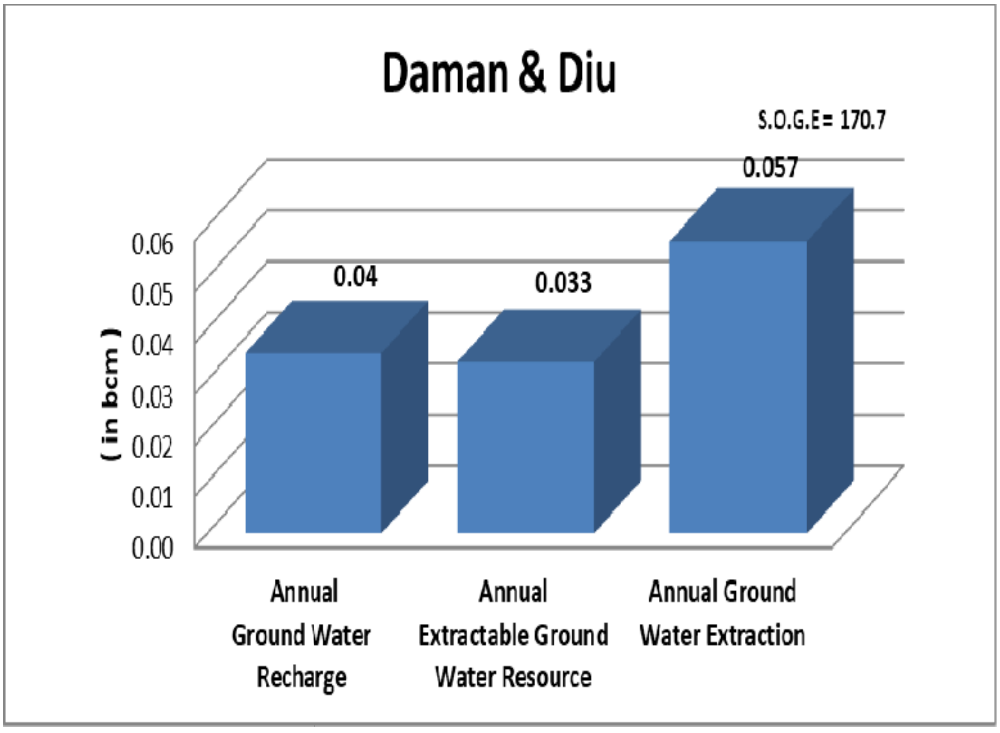
Daman & Diu

The entire island area of Diu is about 40 sq. km and is underlain by Alluvium and Milliolite soft rock formation. The Daman has about 72 sq km area out of which 30 % is covered by alluvium and the rest is underlain by Basalt rocks. In UT of Daman & Diu, dug well as well as dug cum bore wells are common for irrigation and domestic use. The yields of open dug wells varies from less than 1 to 5 m^3/day, where as that of Dug cum Bore wells ranges from less than 2 to 10 m^3/day.

The ground water resources have been assessed district-wise. The total Annual Ground Water Recharge has been assessed as 0.035 bcm and Annual Extractable Ground water Resources as 0.033 bcm. The total current Annual Ground Water Extraction has been assessed as 0.057 bcm and Stage of Ground Water Extraction as 170.7 %. Both Daman and Diu districts are categorized as 'Over Exploited'.

Out of 110.9 sq km recharge worthy area of the UT, the entire area is under 'Over-Exploited'. Total 33.47 mcm annual extractable ground water resources of the UT, 100% is under 'Over-exploited' categories of assessment units.

As compared to 2022 assessment, the annual groundwater recharge has decreased from 0.038 to 0.035 bcm. The annual extractable groundwater resources decreased marginally from 0.036 bcm to 0.033 bcm. Whereas, the annual ground water extraction remains same. The stage of ground water extraction has increased 157.92% to 170.7 %.



Dynamic Ground water Recourses Scenario 2023 – Daman and Diu

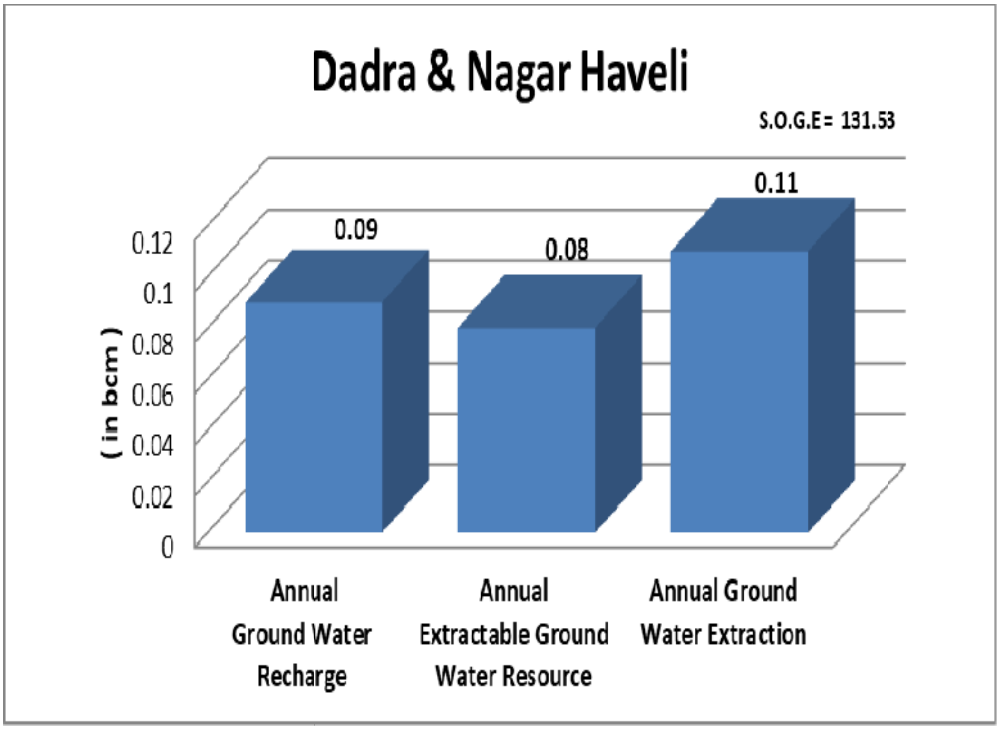
Dadra & Nagar Haveli

The entire area of UT of Dadra and Nagar Haveli is underlain by hard rock terrain (Deccan basalts). The thickness of vesicular units, ranges from 2 to 8 m. Ground water is developed by means of dug wells and dug cum bore wells. The sustainable yield of dug wells for 3 to 4 hours of pumping is 30 m^3/day. The transmissivity of shallow aquifer ranges from 5.5 to 305 m^2/day.

The entire D & NH has been considered as a single assessment unit. Total Annual Ground Water Recharge of the UT of DNH has been assessed as 0.09 bcm and Annual Extractable Ground Water Resources as 0.08 bcm. The Current Annual Ground Water Extraction for all uses is 0.11 bcm and Stage of Ground Water Extraction is 131.53 %. The entire UT of D&NH has been categorized as 'Over Exploited'.

Out of 416 sq km recharge worthy area of the UT, the entire area is under 'Over-Exploited' category. The total 81.71 mcm annual extractable ground water resources of the UT, is under 'Over-exploited' category.

As compared to 2022 estimate, there is no significant change in annual ground water recharge, annual extractable ground water resources and annual ground water extraction. The stage of ground water extraction has decreased marginally from 133.2% to 131.53% in 2023.



Dynamic Ground water Recourses Scenario 2023 – Dadra and Nagar Haveli

7.33 JAMMU & KASHMIR

Jammu & Kashmir Union Territory comprises two Administrative Divisions viz-Jammu, Kashmir with 10 districts each, representing different ground water regimes. In Jammu Region, the ground water occurs in the outer plains (3000 sq km) extending between Munawar Tawi in the north-west to River Ravi in the south-east. The ground water occurs in piedmont deposits belonging to upper Pleistocene to Recent age, comprising unconsolidated sediments in the form of terraces and coalescent alluvial fans developed by the streams debauching out of Siwalik Hills. There are several isolated valleys in the middle Himalayas where ground water occurs in valley fill deposits under unconfined conditions.

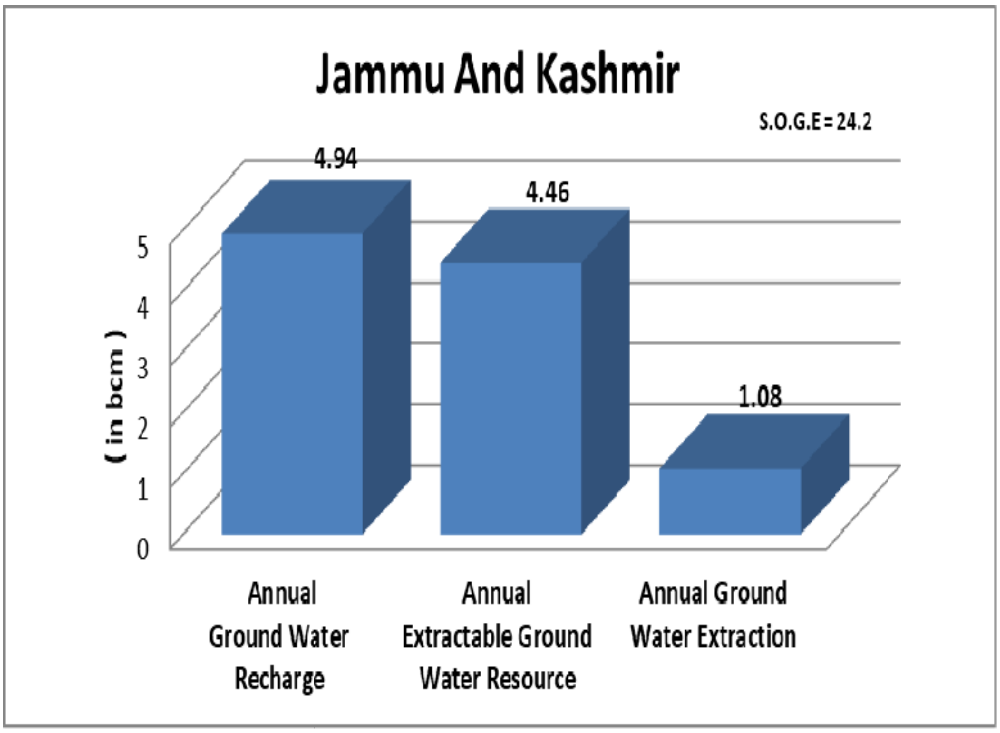
Kashmir valley covers an area of 5600 sq km and is occupied by Karewas which consist of a huge pile of alternating bands of sand, silt, and clay interspersed by glacial boulder beds. The sands are mostly fine to very fine-grained and there is considerable lateral facies variation of sediments with an aggregate thickness of 2500-3000 m. Ground water in the Karewas of Kashmir valley occurs under both confined as well as unconfined conditions.

The Ground water resources of the J&K UT have been assessed for ground water worthy areas and outer plains in 20 districts. These 20 assessment units include the Srinagar urban area (with a population of more than 10 Lakhs). Srinagar Urban Area comprises ground water worthy area of Srinagar district as well as parts of Ganderbal, Baramulla, Budgam, Pulwama and Bandipora districts.

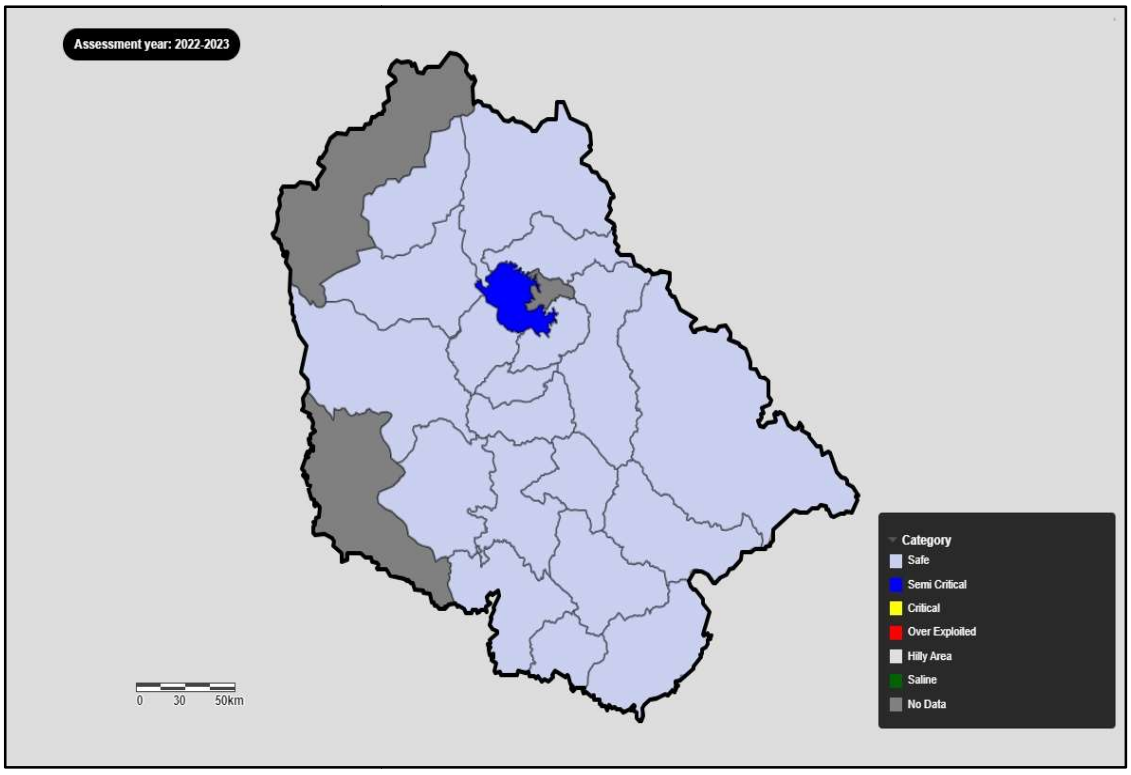
The total Annual Groundwater Recharge of the UT has been estimated as 4.94 bcm and Annual Extractable Ground Water Resources is 4.46 bcm. The Total Current Annual Ground Water Extraction is 1.08 bcm and the Stage of Ground Water Extraction is 24.20 %. Out of 20 assessment units, 19 assessment units have been categorized as ‘Safe’ whereas 1 assessment unit i.e. Srinagar Urban Area comes under the ‘Semi-critical’ category.

Out of 8664.25 sq km recharge worthy area of the State, 875 sq km (10.1 %) under ‘Semi-critical’, 7789.25 sq km (89.9 %) under ‘Safe’ category of assessment units. Out of total 4463.26 mcm annual extractable ground water resources of the State, 104.35 mcm (2.34 %) under ‘Semi-critical’ and 4358.92 mcm (97.66 %) are under ‘Safe’ categories of assessment units.

As compared to the 2022 assessment, the Total Annual Groundwater Recharge and Annual Extractable Ground Water Resources have increased slightly from 4.90 bcm to 4.94 bcm and 4.44 bcm to 4.46 respectively. The Annual Ground Water Extraction has also increased minutely from 1.07 bcm to 1.08 bcm. The Stage of Ground Water Extraction has increased marginally from 24.18 % to 24.20.



Dynamic Ground water Recourses Scenario 2023 – Jammu and Kashmir



Categorization Map of GWRA 2023 – Jammu and Kashmir

7.34 LADAKH

Ladakh Union Territory comprises of two districts viz-Leh and Kargil. The Topography of the region is extremely rugged, mountainous and highly inaccessible. The altitude of the area varies from 3000-8000 m amsl. In Leh district, the Indus and Shyok are the main valleys and the Leh plain, More plain, Hanle Plain, Depsang plain and soda plain are some important plains. Leh plain is underlain by morainic deposits consisting of boulders, cobbles, pebbles embedded in an arenaceous matrix and the lake deposits comprising predominantly of clays, sandy- Clays and silt. The sediments are overlain by varved clays and silts of lacustrine origin again succeeded by morainic boulders and cobbles in disintegrated loose sandy matrix and alluvial deposits. Ground water in the valleys occurs in porous formations. This includes moraines and fluvio-glacial deposits of Ladakh.

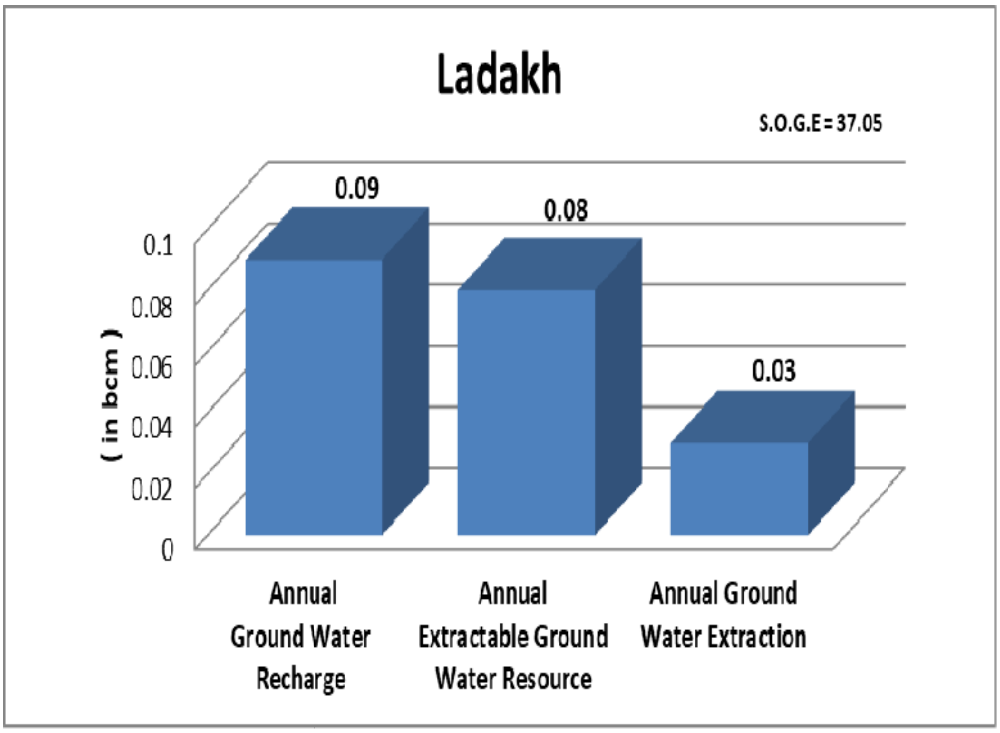
Kargil district comprises of 15 blocks out of which 9 blocks were found ground water recharge worthy areas. Bimbat, Drass, GM Pora, Kargil, Shankoo, Pashkum, Karsha, Zanskar and Shargole blocks are taken as Assessment Units for GWRE 2023.

Similarly, Leh district comprises of 16 blocks out of which 9 blocks were found ground water recharge worthy areas. Diskit, Panamik, Durbuk, Saspol, Nimoo, Leh, Chuchot, Kharu and Thickey are taken as Assessment Units for GWRE 2023. Ground water occurs mainly in the porous formations of morainic deposits comprising of Talus and Scree formations.

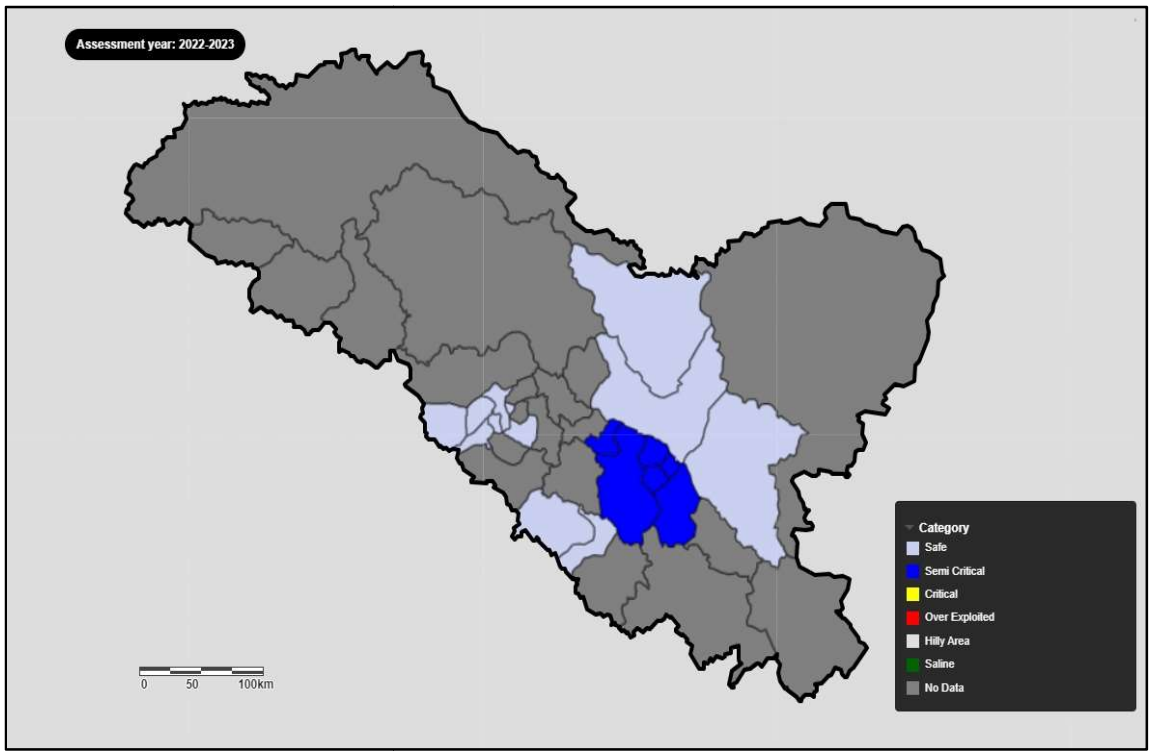
The Ground Water Resources of the Ladakh UT have been assessed for valley areas in 2 districts. The total recharge of ground water involves several components like rainfall/ snowfall being the major one. The other components are seepage from canal, kuhls and return flow from surface water and ground water irrigation. Total Annual Ground Water Recharge of the UT has been estimated as 0.0888 bcm and Annual Extractable Ground Water Resources is 0.0799 bcm. The Total Current Annual Ground Water Extraction is 0.0296 bcm. The Stage of Ground Water extraction in Ladakh is 37.05 %. Out of total 20 Assessment Units, 6 AUs (33.33%) of Leh are categorized as ‘Semi Critical’ and 12 AUs (66.67%) are categorized as ‘Safe’.

Out of 963 sq km recharge worthy area of the UT, 331 sq km (34.37 %) under ‘Semi-critical’, 632 sq km (65.63 %) under ‘Safe’ category of assessment units. Out of total 79.97 mcm annual extractable ground water resources of the State, 23.56 mcm (29.46 %) under ‘Semi-critical’ and 56.41 mcm (70.54 %) are under ‘Safe’ categories of assessment units.

As compared to the 2022 assessment, the Total Annual Ground Water Recharge and Annual Extractable Ground Water Resources have increased marginally from 0.0813 bcm to 0.0888 bcm and 0.0731 bcm to 0.0799 bcm respectively. The Annual Ground Water Extraction has decreased minutely from 0.0302 bcm to 0.0296 bcm. The Stage of Ground Water Extraction has decreased from 41.36 % to 37.05 %.



Dynamic Ground water Recourses Scenario 2023 - Ladakh



Categorization Map of GWRA 2023 – Ladakh

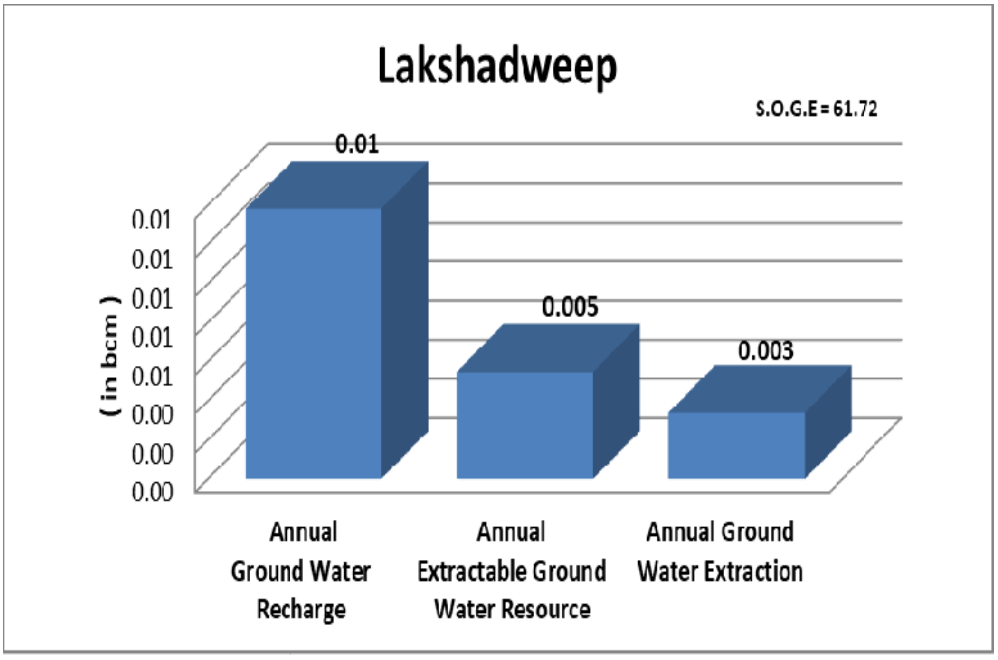
7.35 LAKSHADWEEP

Lakshadweep islands are composed of calcareous sand and materials derived from coral atolls. Alternate layers of loose sand, moderately cemented calc-arenites and well cemented, hard and compact limestone underlie the islands. In these islands, fresh ground water occurs under phreatic conditions as lens floating over the saline water and is in hydraulic continuity with sea water. Water levels in wells are strongly influenced by tides. Dug wells are the common ground water abstraction structures in the islands. The major draft component of these islands is for the domestic consumption. Irrigation draft is negligible in the islands as almost all the crops are rainfed.

Lakshadweep is a unidistrict state wherein the dynamic ground water resources have been assessed for individual islands and the output is generated block wise. The total Annual Ground Water Recharge in the UT has been estimated as 0.013 bcm and Annual Extractable Ground Water Resources works out as 0.0051 bcm. The total current Annual Ground Water Extraction has been assessed as 0.0033 bcm and the Stage of Ground Water Extraction as 61.7%. Out of the 5 assessment units, 4 blocks (80%) are categorized as 'Safe' and 1 block (20%) Kavaratti, as 'Semi Critical'.

Similarly, out of 26.21 sq km recharge worthy area of the State, 6.31 sq km (24 %) under 'Semi-critical', 19.87 sq km (76 %) under 'Safe' category of assessment units. Out of total 5.47 mcm annual extractable ground water resources of the State, 1.335 mcm (24 %) under 'Semi-critical' and 4.135 mcm (76 %) are under 'Safe' categories of assessment units.

As compared to the 2022 assessment, there is no significant changes in the Total Annual Ground Water Recharge, Annual Extractable Ground Water Resources, annual ground water extraction and stage of ground water extraction of the UT in 2023.



Dynamic Ground water Recourses Scenario 2023 - Lakshadweep

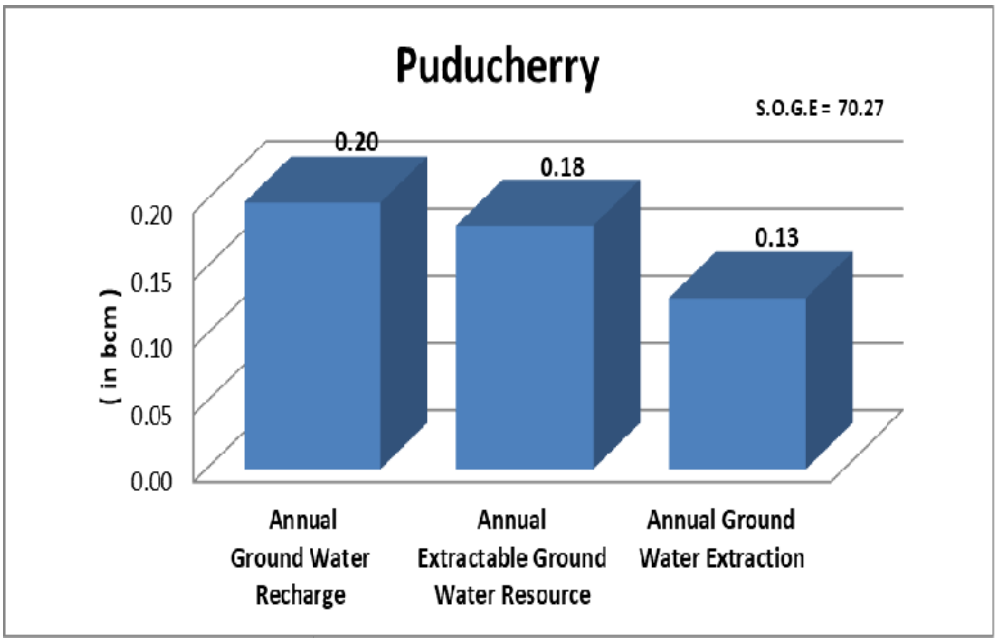
7.36 PUDUCHERRY

The Union Territory of Puducherry is underlain by the semi-consolidated and unconsolidated sedimentary formations, which mainly sustain dug wells, shallow and deep tube wells. The yield of the wells generally varies between 3 to 15 lps. High yielding wells in the range of 10 to 40 lps exists in the Tertiary sandstones.

The Dynamic ground water resources for Union Territory of Puducherry have been assessed Taluk wise i.eOzhukarai, Villianur, Puducherry, Bahour, Mahe and Yanam taluks comes under Puducherry District and Thirunallar and Karaikal taluks comes under Karaikal District. The Annual Ground Water Recharge of the UT of Puducherry has been assessed as 0.198 bcm, Annual Extractable Ground Water Resources is 0.181 bcm and the Annual Ground Water Extraction is 0.127 bcm. The overall Stage of Ground Water Extraction of Union Territory of Puducherry is 70.27 %. Out of 8 taluks assessed, 3 taluks (37.5%) (Mahe, Karaikal &Thirunallar) falls under 'Safe' category, 3 taluks (37.50%) (Ozhukarai, Villianur&Bahour) has been categorized as 'Semi-Critical', 1 taluk (12.50%) (Puducherry) as 'Over-exploited' and 1 taluk (12.50%) (Yanam) as 'Saline'.

Similarly, out of 483 sq km recharge worthy area of the UT, 40.65 sq km (8.42 %) area are under 'Over-Exploited', 252.35 sq km (52.25 %) under 'Semi-critical', 170 sq km (35.20 %) under 'Safe' category of assessment units. 20 sq km (4.14%) area is under 'Saline' category of assessment units. Out of total 180.99 mcm annual extractable ground water resources of the State, 24.06 mcm (13.30 %) are under 'Over-exploited', 116.03 mcm (64.11 %) under 'Semi-critical' and 40.89 mcm (22.59 %) are under 'Safe' categories of assessment units.

As compared to 2022 assessment, there is no significant change in annual ground water recharge, extractable ground water resources & ground water extraction. The Stage of Ground Water Extraction of the UT has increased marginally from 69.17 % to 70.27 %.



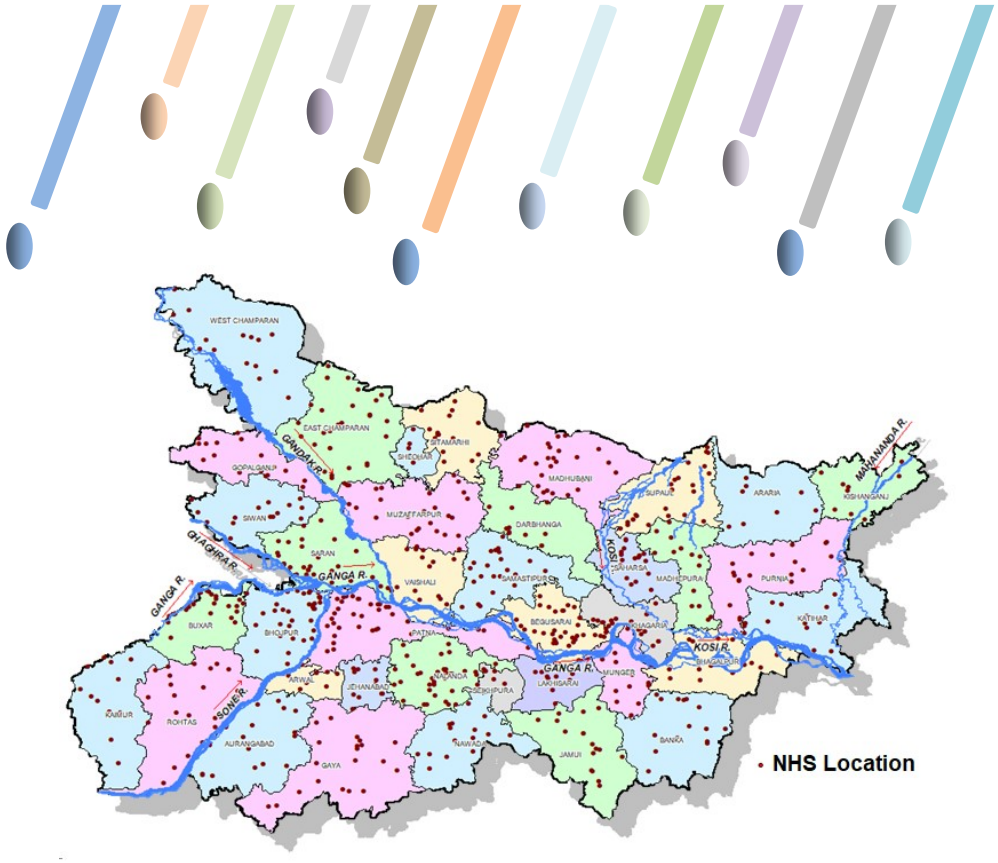
Dynamic Ground water Recourses Scenario 2023 – Puducherry

भारत सरकार
जल शक्ति मंत्रालय
जल संसाधन, नदी विकास और गंगा संरक्षण विभाग
केंद्रीय भूमि जल बोर्ड

Government of India
Ministry of Jal Shakti
Department of Water Resources, River Development and Ganga Rejuvenation
Central Ground Water Board

वार्षिक भूजल पुस्तिका, बिहार

Ground Water Year Book, Bihar



Year 2021- 22

मध्य पूर्वी क्षेत्र
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सितंबर 2022
September 2022

भारत सरकार
Government of India
जल शक्ति मंत्रालय
Ministry of JAL Shakti
केंद्रीय भूमि जल बोर्ड
Central Ground Water Board

वार्षिक भूजल पुस्तिका, बिहार
(2021-2022)

GROUND WATER YEAR BOOK, BIHAR
(2021 - 2022)

मध्य पूर्वी क्षेत्र, पटना
MID-EASTERN REGION, PATNA

September 2022

GROUND WATER YEAR BOOK, BIHAR

(2021-22)

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GROUND WATER YEAR BOOK, BIHAR
(2021 –2022)

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GROUND WATER YEAR BOOK, BIHAR
(2021-2022)

ABSTRACT

Monitoring of ground water levels from 768 (745+23) Hydrograph Network Stations (HNS) were carried out in the year 2021-2022 with an objective to assess ground water regime of phreatic aquifer. The water level monitoring was carried out manually in the months of May'19, August'19, November'19, and January'20. The ground water samples from the HNS were collected in the month of May'21 for chemical analysis. The water level in the HNS represented phreatic aquifer. **During the year 2021-2022, water level monitoring has been badly affected by Covid-19 pandamic**.

The observed water level data had been grouped into four categories viz. 0-2 m, 2-5 m, 5-10 m and >10 m. Thematic maps depicting ground water levels measured in different periods, has been prepared. The water levels has been further analysed for study of its change with respect to measurement of pre-monsoon period of the same year, previous year water level data of the same period and decadal mean water level data of the same period. The fluctuation had been grouped under rise and fall categories. In each category there are three groups viz. 0-2 m, 2-4 m and >4 m. Thematic maps had been prepared for each category of fluctuation.

During pre-monsoon 2021 the ground water levels were found to vary between 0.74 and 11.00 m bgl. The depth to water level rests in range of 2-5 m bgl is 49% of HNS, which spatially covered the major part of the area monitored. The depth to water level rests in range up to 2 m bgl spatially covered mainly southern part of North Bihar Plains (NBP) and at disseminated locations in (SBP). During post-monsoon 2021, water level rested in the range up to 2 m bgl in 55% of the HNS which covers major part of the Bihar State. The fluctuation of water level between pre and post-monsoon 2021 indicated rise in water level in 72% of the HNS. Annual change of water level of May 2021 with respect to May 2020 indicated rise in water level in 85% of the HNS, and during November 2019 with respect to November 2018 indicated rise in 72% of the HNS. The change in water level of May 2019 with respect to the decadal mean of May (May 2011 to May 2020) indicated rise in 89% of the HNS and during November 2019 with respect to the decadal mean of November (November 2011 to November 2020) indicated rise in 82% of HNS.

GROUND WATER YEAR BOOK, BIHAR
(2021-2022)

1. INTRODUCTION

Bihar state lies between 83º 20' and 88º 00' E Longitudes and 24º 15' and 27º 23' N Latitudes. 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 is divided into 38 districts and 534 community development blocks. The population of the State is 10.41 crores (2011 census). Population density is 881persons/Sq.km. The urban population is 11,758,016 and rural population is 92,341,436. There are 150 small and large towns in the state. The distribution of urban population is highly skewed as only three towns namely Gaya, Bhagalpur, and Muzaffarpur are having population of more than 3 lakhs, besides urban population of Patna urban agglomeration which is having 1,683,200.

2. HYDROGEOLOGY

Generalized stratigraphic succession of the state is presented in **Table 1**. The hydrogeological map of Bihar is depicted in ***Fig 2.***

Table 1: ***Generalized Geological Succession of Bihar.***

Age	*Formation*	*Broad Lithology*
Quaternary	Alluvial Deposits	Sand, clay, silt and occasional gravel
Tertiary	Siwaliks	Sandstone, conglomerate, clay stone, gravel
L-Cambrian	Vindhyan Super Group	Sandstone, limestone.
Proterozoic	Chotanagpur Granite Gneiss	Granite, granitic-gneiss, schist, phyllites, dolomites, basic rocks, amphibolites.
Archean	Bihar Mica belt	Gneiss, Pegmatites etc.,

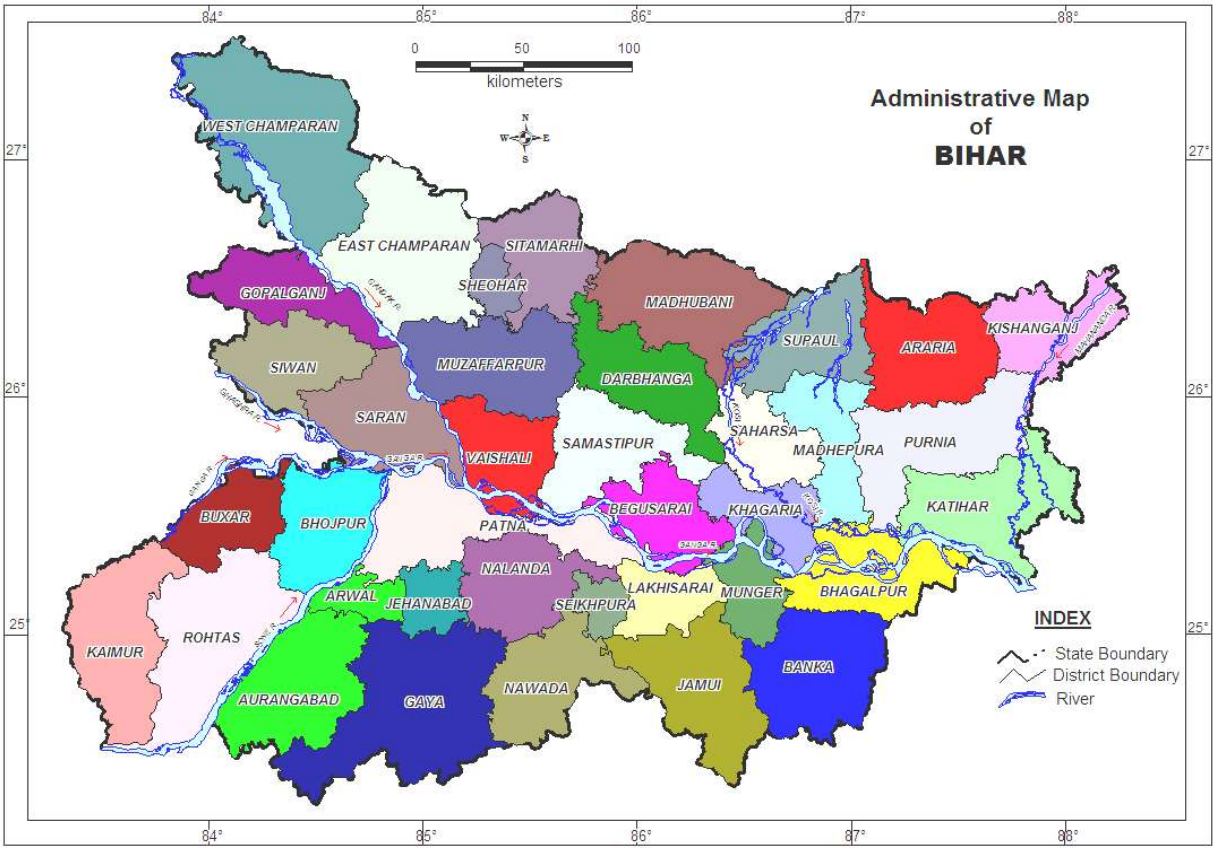

Figure 1: ***Administrative Map of Bihar state***

Pre-cambrians

The rocks belonging to Proterozoic and Archean age are granite, granitic-gneiss, quartzite, phyllites, slates, and metabasics. Rocks of Chhotanagpur Granite Gneissic Complex (CGGC) suit occur in the form of small strip in the districts bordering Jharkhand state. Meta-basic rocks intrude the Chhotanagpur Granite Gneiss Complex suit of rocks. Mica bearing pegmatite of Bihar Mica Belt has been found in Gaya, Nawada and Munger districts. In parts of Munger, Gaya and Nawada districts the meta-sedimentary rocks (viz. phyllite, schist and quartzite) of Pre-cambrian age are also found.

The occurrence and movement of ground water is controlled by the thickness and nature of weathered mantle and saprolite zone (a transition zone between weathered residuum and fresh basement), besides fractures lying underneath the weathered residuum. Thickness of the weathered zone usually ranges from 5 to 20 m. Thickness of weathered zone are more in schist and other meta-sedimentary rocks in comparison to the granite-gneiss. The weathered product of granite and granite-gneiss is marked by presence of coarse granular materials composed of quartz and feldspar, whereas those of schist and phyllite by clayey materials.

Ground water occurs under unconfined condition within the weathered mantle and saprolite zone. In the secondary porosities imparted by joints, cracks and fractures, ground water occurs under confined to semi-confined conditions.

Vindhyans

Rocks of Vindhyan Super-group are confined in the west and north of the river Sone and forms eastern end of the Kaimur Plateau. It occurs in the parts of Rohtas, Kaimur and Aurangabad districts. The width of the Vindhyan rocks becomes less than 3 km near Sasaram in Rohtas district. Rocks found under this super-group are mainly sandstone, limestone, quartzite and schist. These rocks behave as consolidated formation and have remained unaffected by any large-scale tectonic disturbances, except faulting at a few places in the geological past. Vindhyan sandstones are compact and have low primary porosity. Ground water in this occurs within the weathered residuum and in the secondary porosity below them. Ground water occurs under unconfined condition in the weathered mantle. The thickness of the weathered residuum varies from 5 to 10 m.

Siwaliks

The Siwaliks of Upper Tertiary age occur as small patches in northwestern corner of the state in West Champaran district bordering Nepal. It consists of sandstone, conglomerate, red clay and spongy limestone and forms structural hills with a number of faults crisscrossing them. Ground water occurs under confined conditions in sandstones disposed at depth.

Quaternary alluvium

Quaternary sediments of Recent to Sub-Recent age cover about 89 percent of the geographical area of the state. They occupy entire north Bihar plain, and a vast stretch of land between south of the river Ganga and the Chhotanagpur Plateau. Deep exploratory drilling by Central Ground Water Board has confirmed thickness of sedimentary deposits in north Bihar plain as more than three hundred meter. In the south of the river Ganga, the alluvial thickness gradually decreases to as low as 50 m or even less, towards the area bordering the Jharkhand state. The sedimentary deposit consists of alternate sequences of sand and clay layers representing multi-cyclic nature of sedimentation. The Quaternary alluvial deposit spread over south and north of the river Ganga is a part of Mid-Ganga Plain. The Terai belt, which is demarcated by auto-flow wells, occurs as a narrow strip in the bordering areas in Madhubani, Darbhanga, and West Champaran districts. It is an extension of Terai belt of Nepal which coalesces with alluvial plain. Ground water occurs under unconfined conditions in the phreatic aquifer, which is generally disposed within 70 m below ground. Aquifers situated at deeper levels have ground water levels under confined condition.

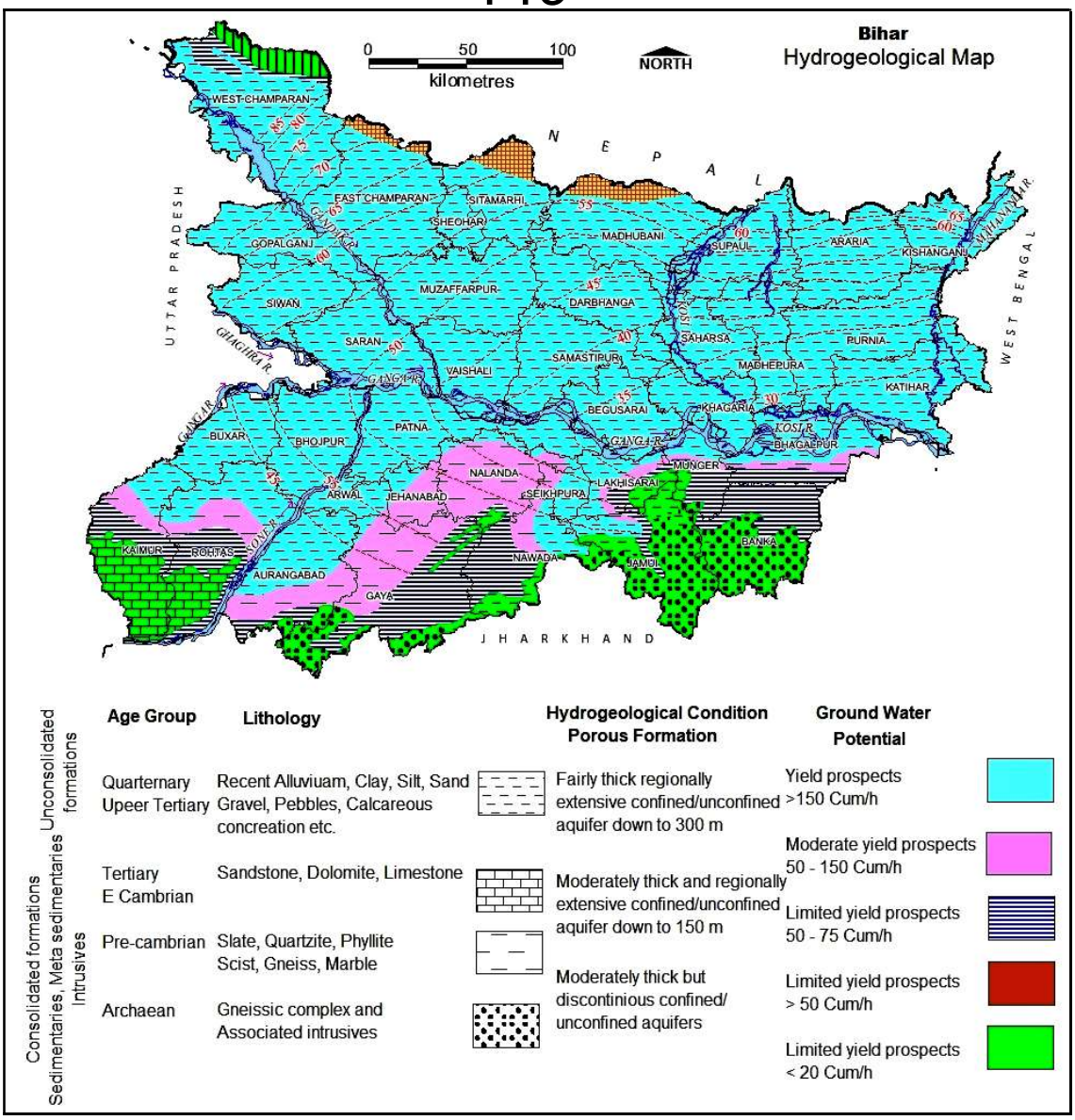

Figure 2*: Hydrogeological Map of Bihar state*

3. GROUND WATER SCENARIO

A total of 733 Hydrograph Network Stations (HNS) which are dug wells tapping phreatic aquifer have been monitored as a part of ground water regime monitoring in the state of Bihar. Majority of the wells represent phreatic alluvial aquifer. The district wise location and distribution of the HNS are given in **Fig 3** and **Table 2** respectively.

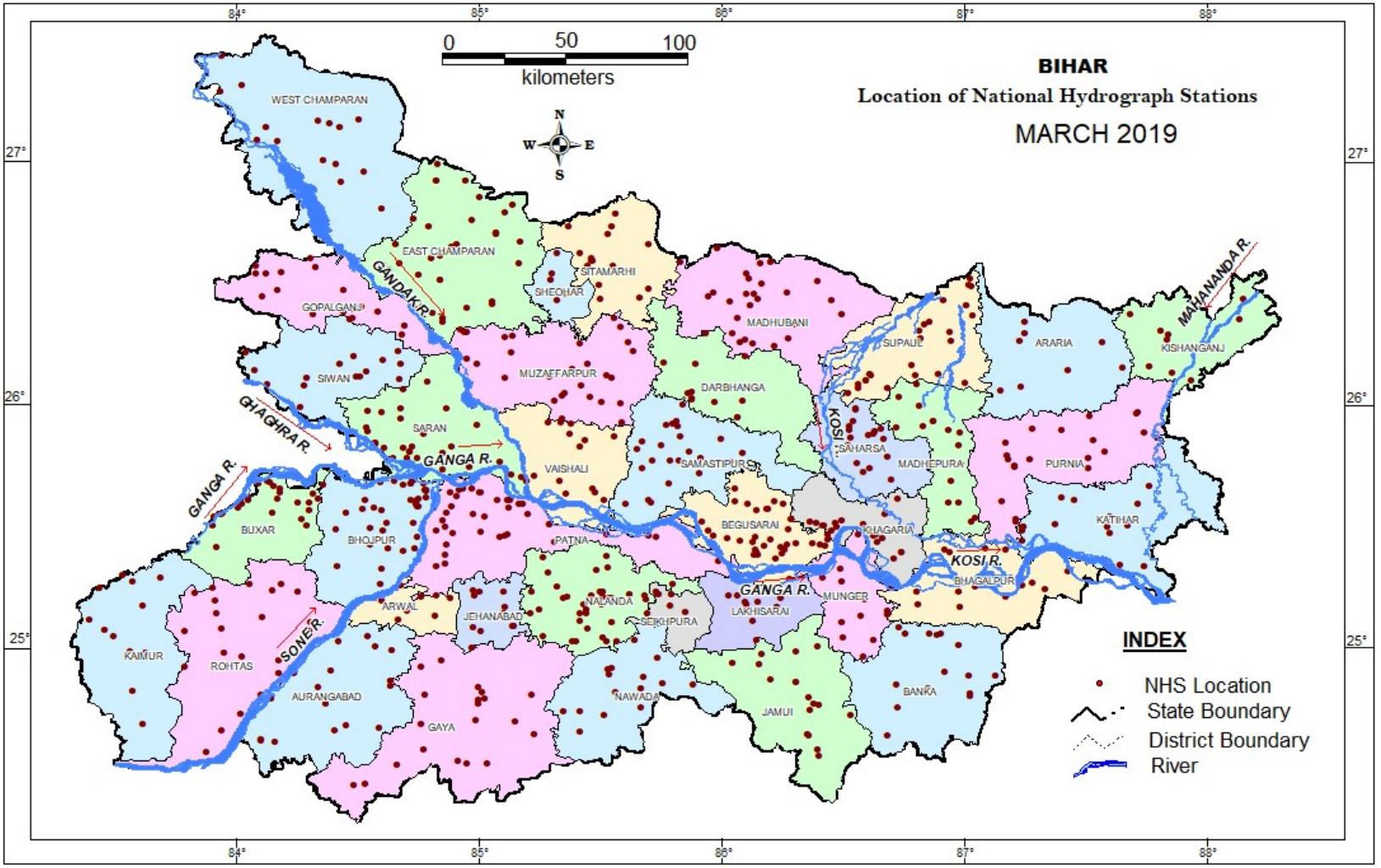

Figure 3*: Location of Hydrograph Network Stations in Bihar State, 2021*

Table 2: ***District wise distribution of the HNS as on March 31.03.21***

SN	District	DW*	Pz
1	Araia	8	3
2	Aurangabad	16	
3	Banka	16	
4	Begusarai	36	
5	Bhagalpur	14	
6	Bhojpur	36	
7	Buxar	25	
8	Darbhanga	11	
9	Gaya	21	
10	Gopalganj	22	
11	Jamui	17	
12	Jehanabad & Arwal	18	
13	Kaimur/Bhabhua	12	
14	Katihar	20	
15	Khagaria	19	
16	Kishanganj	9	
17	Lakhisarai	9	
18	Madhepura	22	
19	Madhubani	26	
20	Munger	10	
21	Muzaffarpur	26	
22	Nalanda	39	
23	Nawada	16	
24	W Champaran	14	
25	Patna	35	20
26	E Chamaparan	34	
27	Purnia	22	
28	Rohtas	19	
29	Saharsa	18	
30	Samastipur	24	
31	Saran	30	
32	Sheikhpura	10	
33	Sheohar	5	
34	Sitamarhi	16	
35	Siwan	20	
36	Supaul	25	
37	Vaishali	25	
Total		**745**	**23**

**DW=Dug well*
Pz = Peizometer

The numbers of HNS monitored in the state as per the following monitoring schedules:

Table 3: ***HNS monitoring schedule***

Sl. N.	Month	Date	Period
1	May	20 – 30	Pre-monsoon
2	August	20 – 30	Mid-monsoon
3	November	1 – 10	Post-monsoon
4	January	1 – 10	Recession

The Number of HNS monitored during the various monitoring period is given in **Table-4.** The water level data of HNS are presented in the Annexure I. The monitoring work has been badly affected by the **Covid-19 pandamic** during the month of May 2021. The observed data were analysed for each set of measurement and the thematic presentation of depth to water level and its fluctuations have been prepared in the range of 0 – 2 m, 2 – 5 m, 5 – 10 m and more than 10 m using GEMS software. Bihar state has been broadly divided into North Bihar Plain (NBP) consisting of areas falling to the north of the river Ganga and South Bihar Plain (SBP) consisting of areas falling to the south of the river Ganga and bordering Jharkhand state.

Table 4: ***Number of HNS monitored/analysed during different months***

State	May'21	August'21	November'21	January'22
Bihar	225	560	615	640

3.1 DEPTH TO WATER LEVEL

3.1.1 May 2021

During Pre- Monsoon period (May 2021), 225 HNS were analysed. The water level data observed has been ranged from 0.02 (Patna) to 11.00 m bgl (Nawada) m bgl. The Major part of the area covered under monitoring has shown depth to water level within 2 to 5 m. Shallowest category of upto 2 m has been observed in northern part and as patches in SBP also. Majority of the NHS in deepest category of 10-20 m depth to water level has been recorded in Bhojpur, Buxar and Nawada district.

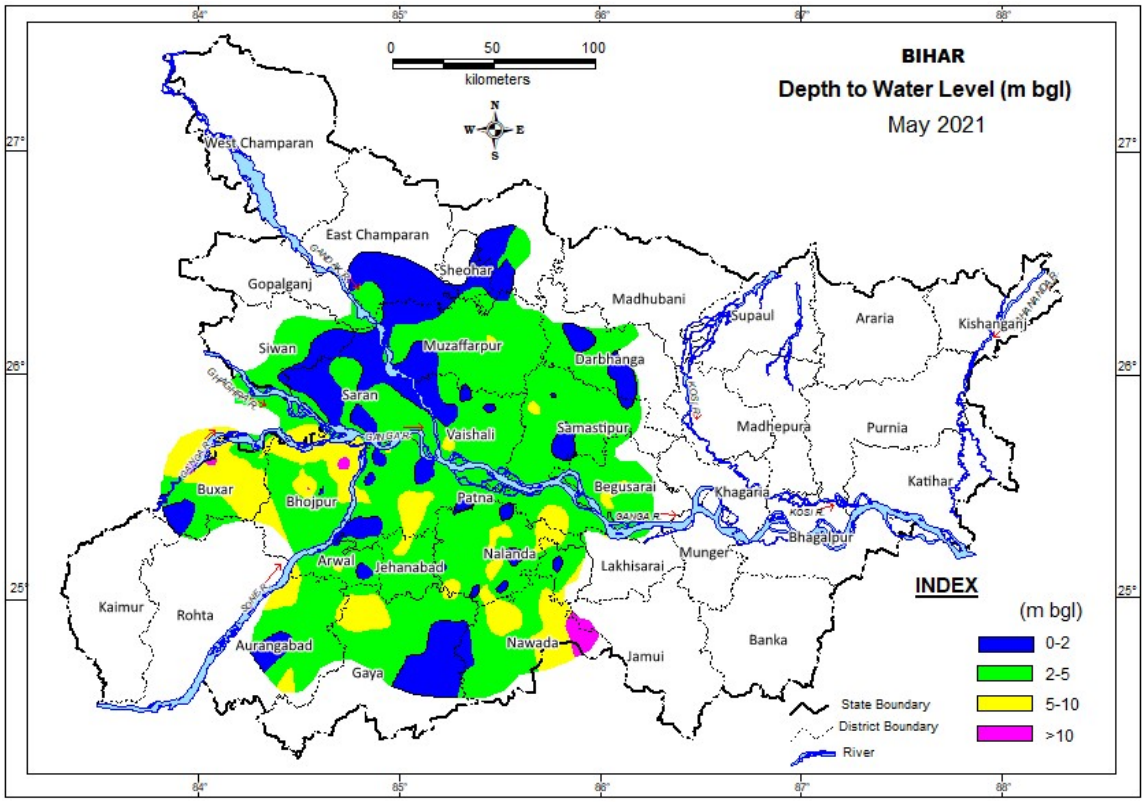

Figure 4: ***Depth to water level in May 2021***

Table 5: District wise well frequency for different ranges of depth to water level of HNS in **May. 2021** in Bihar state

SN	District	No. of Wells analysed	Depth to water level (m bgl)		0-2 m		2-5 m		5-10 m		10-20 m	
			Min.	Max.	No.	%	No.	%	No.	%	No.	%
1	Aurangabad	5	0.60	5.60	1	20	2	40	2	40	0	0
2	Begusarai	8	2.89	6.16	0	0	6	75	2	25	0	0
3	Bhojpur	23	1.80	10.15	2	9	8	35	11	48	2	9
4	Buxar	20	1.75	10.75	1	5	8	40	9	45	2	10
5	Darbhanga	6	0.30	3.88	2	33	4	67	0	0	0	0
6	Gaya	6	0.80	10.00	2	33	2	33	2	33	0	0
7	Jehanabad	10	1.43	5.25	3	30	5	50	2	20	0	0
8	Muzaffarpur	15	0.61	5.15	4	27	10	67	1	7	0	0
9	Nalanda	32	0.30	7.50	7	22	17	53	8	25	0	0
10	Nawada	14	1.59	11.00	1	7	6	43	6	43	1	7
11	Patna	26	0.02	6.17	11	42	9	35	6	23	0	0
12	E Champaran	3	0.64	2.83	2	67	1	33	0	0	0	0
13	Samastipur	14	1.33	5.50	3	21	9	64	2	14	0	0
14	Saran	11	0.20	4.22	6	55	5	45	0	0	0	0
15	Sheikhupura	5	1.54	5.93	1	20	3	60	1	20	0	0
16	Sitamarhi	6	0.94	2.10	4	67	2	33	0	0	0	0
17	Siwan	3	1.36	2.35	1	33	2	67	0	0	0	0
18	Vaishali	18	0.74	5.75	5	28	12	67	1	6	0	0
	Total	225	0.02	11.00	56	25	111	49	53	24	5	2

3.1.2 August 2021

Total 560 NHS has been analysed where depth to water level ranged from 0.05 (Gopalganj) to 11.4 m bgl (Bhagalpur). Except for a few locations in Muzaffarpur district, the depth to water level has been observed less than 2 m bgl in which covered major part of the monitored area in western part of NBP. Major part of the monitored area in eastern part of NBP and SBP has shown water level between 2 and 5 m bgl. However, deeper water level has also been observed a few locations in SBP, notably Jamui, Nawada, Rohtas and Kaimur.

In Nawada and Jamui district, deeper water level category (> 5 m bgl) has been recorded in 20% and 27% of the NHS respectively. Three wells, located in Aurangabad, Bhagalpur, Rohtas has shown water level > 10 m bgl.**(Fig. 5; Table 6)**

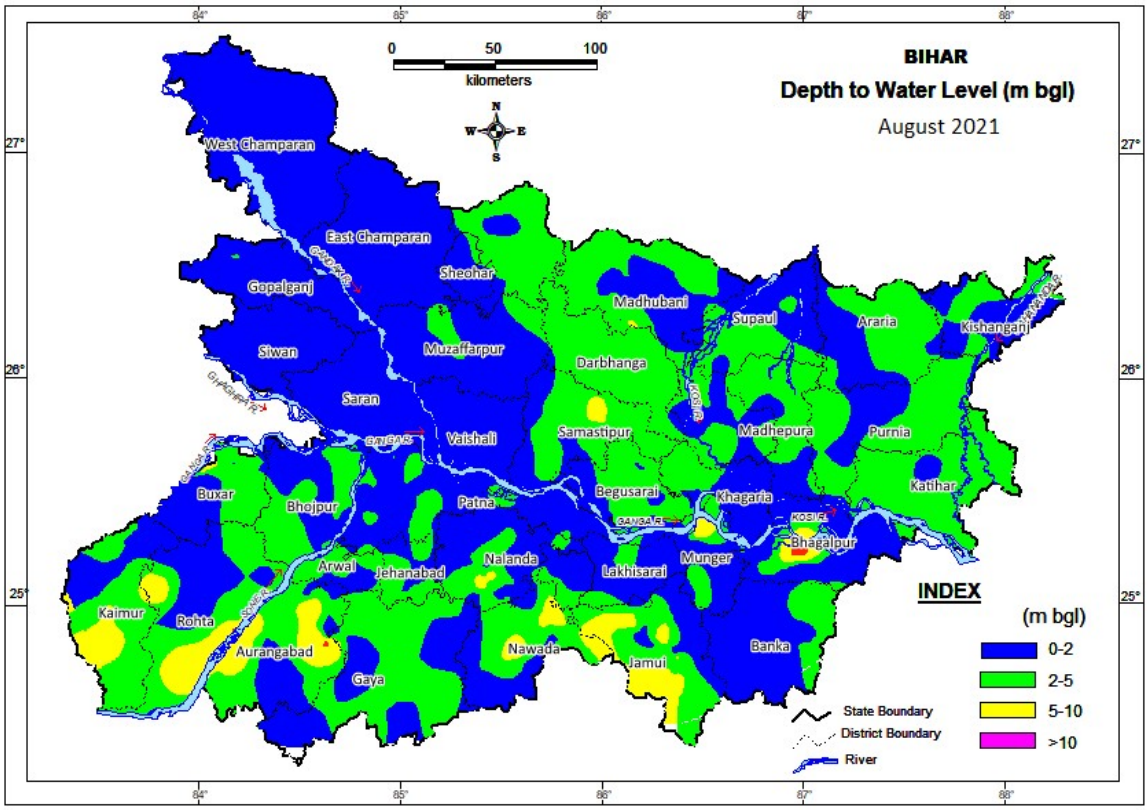

Figure 5*: Depth to water level in August 2021*

Table 6: District wise well frequency for different ranges of depth to water level of HNS in August. 2021 in Bihar state

SN	District	No. of Wells analysed	Depth to water level (m bgl)		0-2 m		2-5 m		5-10 m		10-20 m	
			Min.	Max.	No.	%	No.	%	No.	%	No.	%
1	Araria	8	1.63	2.55	3	38	5	63	0	0	0	0
2	Aurangabad	17	0.3	10.25	8	47	6	35	2	12	1	6
3	Banka	13	0.58	4.27	10	77	3	23	0	0	0	0
4	Begusarai	33	0.85	3.96	13	39	20	61	0	0	0	0
5	Bhagalpur	11	0.34	11.4	7	64	2	18	1	9	1	9
6	Bhojpur	35	0.57	4.5	15	43	20	57	0	0	0	0
7	Buxar	20	0.59	6.41	9	45	9	45	2	10	0	0
8	Darbhanga	7	2.05	4.16	0	0	7	100	0	0	0	0
9	Gaya	16	0.3	4.71	8	50	8	50	0	0	0	0
10	Gopalganj	18	0.05	2.29	17	94	1	6	0	0	0	0
11	Jamui	15	0.58	9.67	5	33	6	40	4	27	0	0
12	Jehanabad	18	1.1	3.87	8	44	10	56	0	0	0	0
13	Kaimur	11	0.98	6.27	5	45	4	36	2	18	0	0
14	Katihar	14	1.45	3.47	2	14	12	86	0	0	0	0
15	Khagaria	18	0.6	3.63	12	67	6	33	0	0	0	0
16	Kishanganj	9	1.55	2.96	6	67	3	33	0	0	0	0
17	Lakhisarai	7	0.69	6.95	5	71	1	14	1	14	0	0
18	Madhepura	14	0.69	3.12	5	36	9	64	0	0	0	0
19	Madhubani	20	0.24	5.11	7	35	12	60	1	5	0	0
20	Munger	9	0.45	7.43	5	56	3	33	1	11	0	0
21	Muzaffarpur	11	0.49	2.16	9	82	2	18	0	0	0	0
22	Nalanda	36	0.1	7.3	21	58	13	36	2	6	0	0
23	Nawada	15	0.54	9.32	6	40	6	40	3	20	0	0
24	W champaran	6	0.36	1.46	6	10	0	0	0	0	0	0
25	Patna	30	0.14	4.35	23	77	7	23	0	0	0	0
26	E champaran	4	0.32	1.36	4	10	0	0	0	0	0	0
27	Purnia	11	1.56	3.18	3	27	8	73	0	0	0	0
28	Rohtas	18	0.35	10.1	9	50	5	28	3	17	1	6
29	Saharsa	14	0.69	3.87	7	50	7	50	0	0	0	0
30	Samastipur	13	0.95	6.27	3	23	9	69	1	8	0	0
31	Saran	13	0.23	1.73	13	10	0	0	0	0	0	0
32	Seikhpura	7	0.24	2.35	4	57	3	43	0	0	0	0
33	Sheohar	2	1.18	1.88	2	10	0	0	0	0	0	0
34	Sitamarhi	16	1.07	3.87	3	19	13	81	0	0	0	0
35	Siwan	7	0.49	1.49	7	10	0	0	0	0	0	0
36	Supaul	23	0.2	3.69	15	65	8	35	0	0	0	0
37	Vaishali	21	0.22	1.88	21	10	0	0	0	0	0	0
	Total	560	0.05	11.4	306	55	228	41	23	4	3	1

3.1.3 November 2021

Total 615 HNS wells were analysed during post-monsoon period (November 2021). The minimum and the maximum depth to water levels have been recorded to be 0.10 m bgl (Darbhanga district) and 16.00 m bgl (Rohtas district) respectively. In major area of the State (56%) water level rests in range of 2 – 5 m bgl which covers almost entire SBP and major part of NBP of Bihar State. The depth to water level in the range of >10 m bgl occurs in 2 locations, which covers Bhagalpur,Jamui.The water level in the range of 5-10 m bgl has been observed in only 6% of HNS wells, spatially covers as small patches at many locations in SBP. The shallowest category of >2 m bgl has been shown by Sitamarhi, Sheohar,Gopalganj, Darbhange district and many localised areas mostly in NBP.

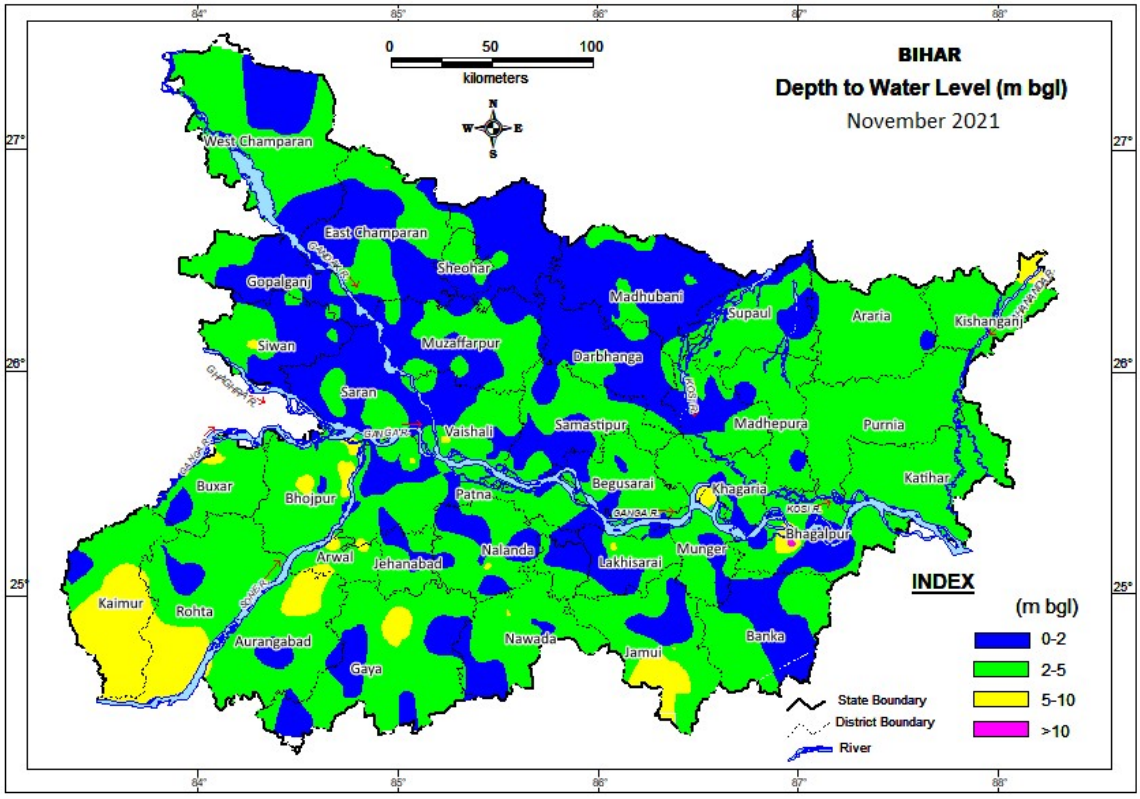

Figure 6*: Depth to water level in November 2021*

Table 7: District wise well frequency for different ranges of depth to water level of HNS in **Nov. 2021** in Bihar state

SN	District	No. Of Wells analysed	Depth to water level (m bgl)		0-2 m		2-5 m		5-10 m		10-20 m	
			Min.	Max.	No.	%	No.	%	No.	%	No.	%
1	Araria	8	1.93	3.40	1	13	7	88	0	0	0	0
2	Aurangabad	10	0.78	4.93	1	10	9	90	0	0	0	0
3	Banka	14	0.98	4.75	8	57	6	43	0	0	0	0
4	Begusarai	36	0.76	5.20	5	14	28	78	3	8	0	0
5	Bhagalpur	14	0.97	10.69	4	29	8	57	1	7	1	7
6	Bhojpur	26	1.38	7.84	5	19	16	62	5	19	0	0
7	Buxar	16	0.78	5.68	5	31	9	56	2	13	0	0
8	Darbhanga	9	1.20	2.67	7	78	2	22	0	0	0	0
9	Gaya	17	1.08	7.00	7	41	7	41	3	18	0	0
10	Gopalganj	20	1.24	3.30	12	60	8	40	0	0	0	0
11	Jamui	14	0.18	10.56	4	29	7	50	2	14	1	7
12	Jehanabad	19	1.05	5.88	4	21	12	63	3	16	0	0
13	Kaimur	5	0.94	9.30	1	20	2	40	2	40	0	0
14	Katihar	14	2.15	4.15	0	0	14	100	0	0	0	0
15	Khagaria	18	1.00	4.40	4	22	14	78	0	0	0	0
16	Kishanganj	9	2.12	5.85	0	0	8	89	1	11	0	0
17	Lakhisarai	9	1.00	8.27	5	56	2	22	2	22	0	0
18	Madhepura	16	1.12	3.47	3	19	13	81	0	0	0	0
19	Madhubani	23	0.60	3.60	15	65	8	35	0	0	0	0
20	Munger	8	1.31	7.04	3	38	4	50	1	13	0	0
21	Muzaffarpur	24	0.63	3.27	12	50	12	50	0	0	0	0
22	Nalanda	31	0.30	6.27	17	55	13	42	1	3	0	0
23	Nawada	13	1.39	5.22	5	38	7	54	1	8	0	0
24	W champaran	11	1.50	3.65	2	18	9	82	0	0	0	0
25	Patna	32	0.12	5.40	18	56	12	38	2	6	0	0
26	E champaran	27	0.71	5.02	12	44	14	52	1	4	0	0
27	Purnia	18	2.15	4.58	0	0	18	100	0	0	0	0
28	Rohtas	14	0.10	8.96	2	14	10	71	2	14	0	0
29	Saharsa	18	1.06	3.15	9	50	9	50	0	0	0	0
30	Samastipur	20	0.27	4.46	10	50	10	50	0	0	0	0
31	Saran	16	0.14	5.04	11	69	4	25	1	6	0	0
32	Seikhpura	7	0.60	2.81	4	57	3	43	0	0	0	0
33	Sheohar	4	1.45	2.86	1	25	3	75	0	0	0	0
34	Sitamarhi	16	0.75	2.51	14	88	2	13	0	0	0	0
35	Siwan	15	0.78	5.26	9	60	5	33	1	7	0	0
36	Supaul	22	1.14	3.08	6	27	16	73	0	0	0	0
37	Vaishali	22	0.86	5.60	9	41	12	55	1	5	0	0
	Total	615	0.10	10.69	235	38	343	56	35	6	2	0

3.1.4 January 2022

During the recession period (Jan. 2022), total 640 HNS were analysed. The minimum depth to water level of 0.47 m bgl has been observed in Muzaffarpur district, and maximum water level of 15.8 m bgl in the Rohtas district. During Jan. 2022, depth to water level rests within the range of 2–5 m bgl in major part (67% area) of Bihar State. The shallowest water level category of < 2 m bgl has been found in many localised areas, mostly in NBP. A patch, comprising major part of Kaimur, Rohtas and Buxar district and a strip covering part of Jamui, Lakhisarai, Munger, Begusarai, Khagaria and Bhagalpur have shown water level between 5 and 10 m bgl. The water level of more than 10 m bgl has been observed at many locations such as southern part of Kaimur, Banka, Jamui and eastern part of Katihar.

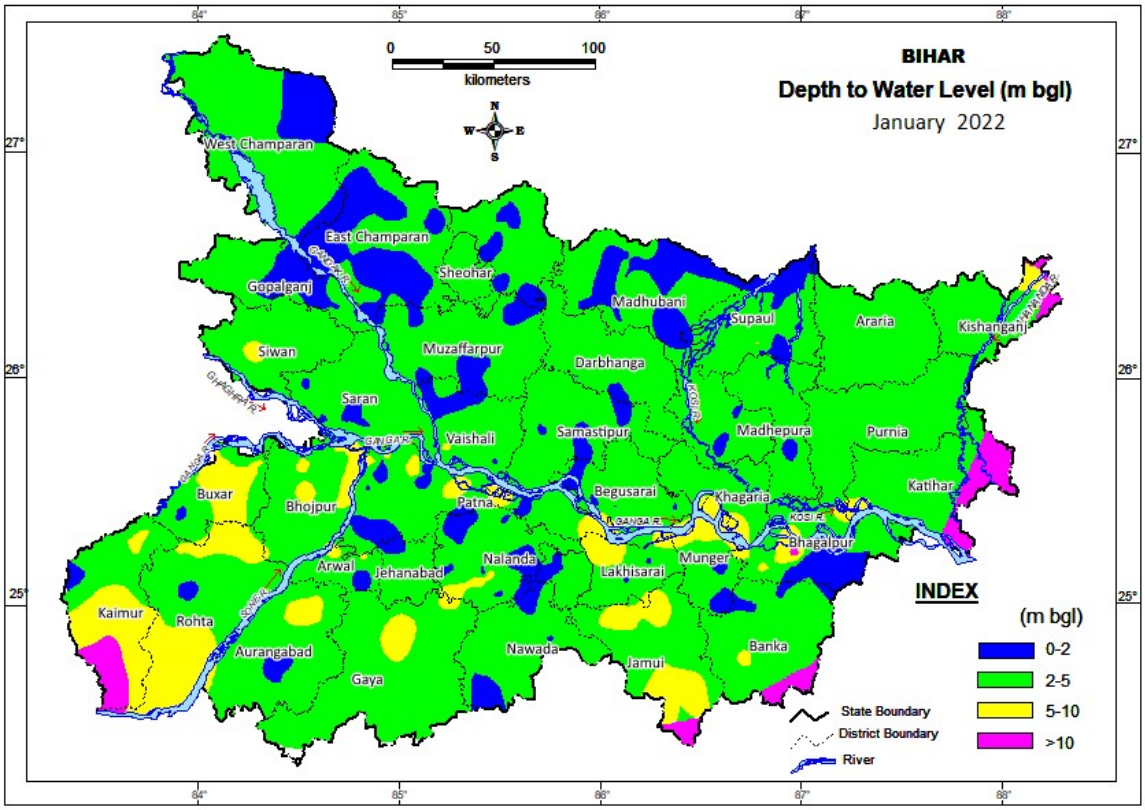

Figure 7*: Depth to water level in January 2022*

Table 8: District wise well frequency for different ranges of depth to water level of HNS in **Jan. 2021** in Bihar state

SN	District	No. of Wells analysed	Depth to water level (m bgl)		0-2 m		2-5 m		5-10 m		10-20 m	
			Min.	Max.	No.	%	No.	%	No.	%	No.	%
1	Araria	7	2.62	3.85	0	0	7	100	0	0	0	0
2	Aurangabad	11	0.80	4.90	2	18	9	82	0	0	0	0
3	Banka	12	1.79	5.19	2	17	9	75	1	8	0	0
4	Begusarai	35	0.90	5.06	5	14	29	83	1	3	0	0
5	Bhagalpur	14	0.97	10.76	3	21	8	57	2	14	1	7
6	Bhojpur	31	2.17	8.72	0	0	17	55	14	45	0	0
7	Buxar	17	1.78	8.30	1	6	7	41	9	53	0	0
8	Darbhanga	10	1.52	3.01	2	20	8	80	0	0	0	0
9	Gaya	18	2.04	7.10	0	0	14	78	4	22	0	0
10	Gopalganj	19	1.50	3.83	9	47	10	53	0	0	0	0
11	Jamui	11	2.26	9.97	0	0	7	64	4	36	0	0
12	Jehanabad	18	1.15	5.88	2	11	14	78	2	11	0	0
13	Kaimur	8	1.35	10.24	1	13	2	25	4	50	1	13
14	Katihar	14	3.28	5.65	0	0	13	93	1	7	0	0
15	Khagaria	19	3.15	6.90	0	0	18	95	1	5	0	0
16	Kishanganj	8	2.45	6.65	0	0	7	88	1	13	0	0
17	Lakhisarai	9	1.33	8.78	3	33	2	22	4	44	0	0
18	Madhepura	17	1.45	5.02	1	6	15	88	1	6	0	0
19	Madhubani	24	1.05	4.23	10	42	14	58	0	0	0	0
20	Munger	7	1.42	7.85	2	29	3	43	2	29	0	0
21	Muzaffarpur	25	0.01	3.92	7	28	18	72	0	0	0	0
22	Nalanda	36	0.60	6.34	13	36	20	56	3	8	0	0
23	Nawada	16	0.63	6.26	4	25	11	69	1	6	0	0
24	W champaran	13	0.41	4.18	2	15	11	85	0	0	0	0
25	Patna	26	0.28	6.95	8	31	13	50	5	19	0	0
26	E champaran	29	0.45	4.81	15	52	14	48	0	0	0	0
27	Purnia	15	2.98	4.92	0	0	15	100	0	0	0	0
28	Rohtas	17	0.80	9.84	1	6	9	53	7	41	0	0
29	Saharsa	17	1.17	4.55	6	35	11	65	0	0	0	0
30	Samastipur	23	0.75	5.47	3	13	19	83	1	4	0	0
31	Saran	26	1.56	5.35	8	31	17	65	1	4	0	0
32	Seikhpura	7	0.77	3.47	4	57	3	43	0	0	0	0
33	Sheohar	4	2.35	3.50	0	0	4	100	0	0	0	0
34	Sitamarhi	15	0.86	2.50	6	40	9	60	0	0	0	0
35	Siwan	13	2.11	5.71	0	0	12	92	1	8	0	0
36	Supaul	24	1.00	5.10	9	38	14	58	1	4	0	0
37	Vaishali	25	1.21	5.44	9	36	15	60	1	4	0	0
	Total	640	0.45	10.76	138	22	428	67	72	11	2	0

3.2 SEASONAL FLUCTUATION

3.2.1 May 2021 to August 2021

A total of 189 wells have been analysed to study the monsoon fluctuation during August 2021. Rise in water level has been recorded in 158 (approx. 84%), whereas the fall is observed only in 28 (approx. 16%) of HNS analysed. The area covered by the analysed wells has been depicted on **fig. 7.** Fluctuation has been further categorised in different ranges. Majority of HNS have shown rise of water level in the range of 2 to 4 m and 0-2 m which constitutes 29% and 43% of the total wells analysed respectively. These ranges of water level rise have been observed in almost entire area covered in monitoring.

The category of > 4 m water level rise has been observed as patches in Aurangabad, Begusarai, Bhojpur, Buxar, Gaya, Nalanda, Patna district.

Total 28 wells located in parts of Darbhanga, Nalanda, Nawada, Patna, Samastipur, Saran, Sitamarhi district have shown fall in water level due to some local reason. (**Table 9).**

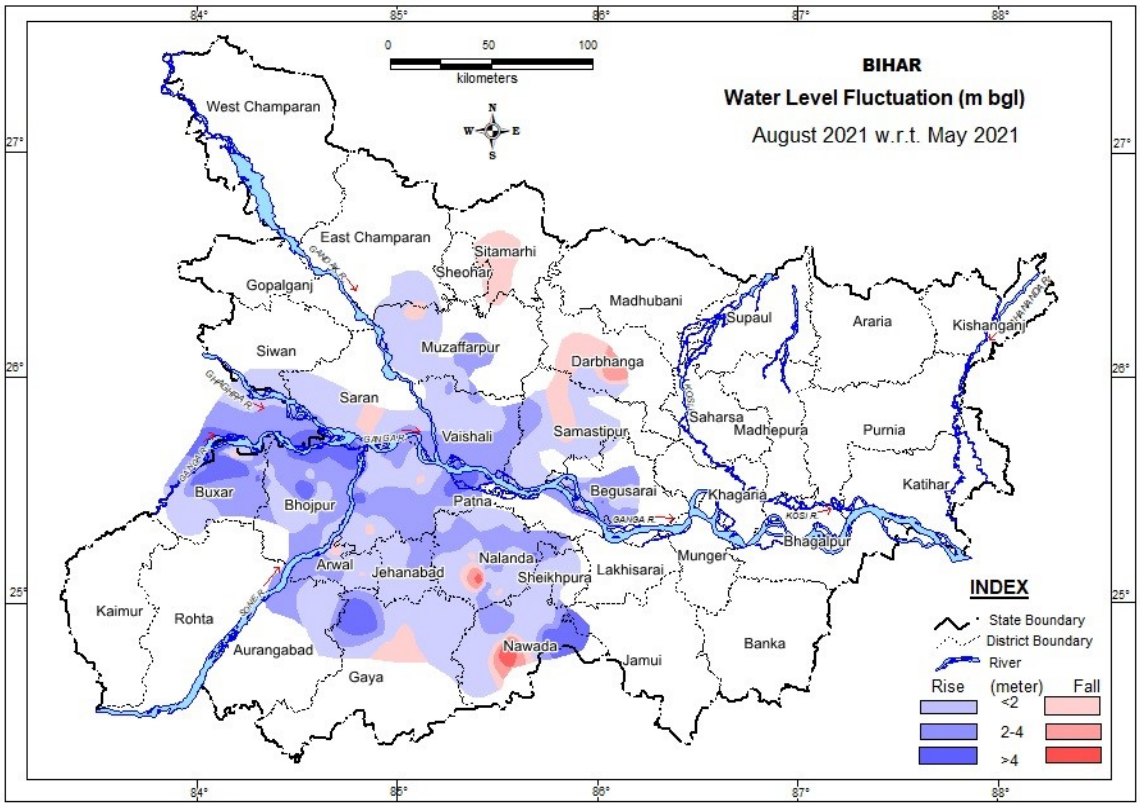

Figure 8: ***Water level Fluctuation between May 2021 and August 2021***

Table 9: District wise categorization of fluctuation and their frequency of water levels of HNS in **Aug. 2021 w.r.t. May 2021**

SN	District	No. of wells analysed	Range of fluctuation (m)				No. of wells showing fluctuation in the range of												Total	
									Rise						Fall					
			Rise		Fall		0 to 2		2 to 4		> 4		0 to 2		2 to 4		> 4			
			Min.	*Max.*	*Min.*	*Max.*	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*	*Rise*	*Fall*
1	Aurangabad	5	0.26	4.10	-	-	2	40	1	20	1	20	0	0	0	0	0	0	4	0
2	Begusarai	7	0.79	4.14	-	-	3	43	3	43	1	14	0	0	0	0	0	0	7	0
3	Bhojpur	23	0.68	6.92	-	-	5	22	10	43	8	35	0	0	0	0	0	0	23	0
4	Buxar	18	0.85	7.07	0.88	0.88	6	33	5	28	6	33	1	5.6	0	0	0	0	17	1
5	Darbhanga	4	0.71	1.30	0.72	3.86	2	50	0	0	0	0	1	25	1	25	0	0	2	2
6	Gaya	4	0.50	7.05	0.26	1.25	1	25	0	0	1	25	2	50	0	0	0	0	2	2
7	Jehanabad	9	0.34	2.70	0.03	2.00	5	56	2	22	0	0	2	22	0	0	0	0	7	2
8	Muzaffarpur	7	0.12	2.35	0.13	0.13	5	71	1	14	0	0	1	14	0	0	0	0	6	1
9	Nalanda	32	0.14	4.47	0.10	4.59	14	44	12	38	1	3	4	13	0	0	1	3	27	5
10	Nawada	13	0.55	6.10	5.72	5.72	7	54	3	23	2	15	0	0	0	0	1	8	12	1
11	Patna	25	0.20	4.94	0.02	0.28	11	44	5	20	3	12	4	16	0	0	0	0	19	4
12	E Champaran	1	0.32	0.32	-	-	1	100	0	0	0	0	0	0	0	0	0	0	1	0
13	Samastipur	8	0.25	3.65	0.35	0.45	5	63	1	13	0	0	2	25	0	0	0	0	6	2
14	Saran	5	1.03	2.05	0.27	0.66	2	40	1	20	0	0	2	40	0	0	0	0	3	2
15	Seikhpura	5	0.54	3.76	-	-	3	60	2	40	0	0	0	0	0	0	0	0	5	0
16	Sitamarhi	6	-	-	0.55	1.94	0	0	0	0	0	0	6	100	0	0	0	0	0	6
17	Siwan	1	1.28	1.28	-	-	1	100	0	0	0	0	0	0	0	0	0	0	1	0
18	Vaishali	16	0.34	3.90	-	-	8	50	8	50	0	0	0	0	0	0	0	0	16	0
	Total	189	1.28	0.32	0.02	5.72	81	43	54	29	23	12	25	13	1	1	2	1	158	28

3.2.2 May 2021 to November 2021

Water level of 194 HNS were analysed as to compare with the water level during May 2021. As per the comparison between Nov. 2021 and May 2021, rise of water level observed in 140 (72%) up to 7.35 m (Nawada) whereas, only 54 (28%) HNS have shown fall in water. The majority of HNS (91 well, 47%) have shown rise in the range of 0-2 m, whereas the 37 (19%) and 12 (6%) NHS have shown rise in water level rise 2 to 4 and > 4m m respectively.

The water level fluctuation has been depicted in **Fig. 9**. Almost entire area covered by analysed wells has shown rise in water level. An area covering parts of Bhojpur, Buxar, Gaya, Nalanda, Nawada, Samastipur district has shown rise in water level in the range of > 4 m.

The localised areas covering part of Sitamarhi, Muzaffarpur, Vaishali, Darbhanga, Jehanabad, Nalanda, Nawada and Gaya district have also shown fall in water level. (**Table 10).**

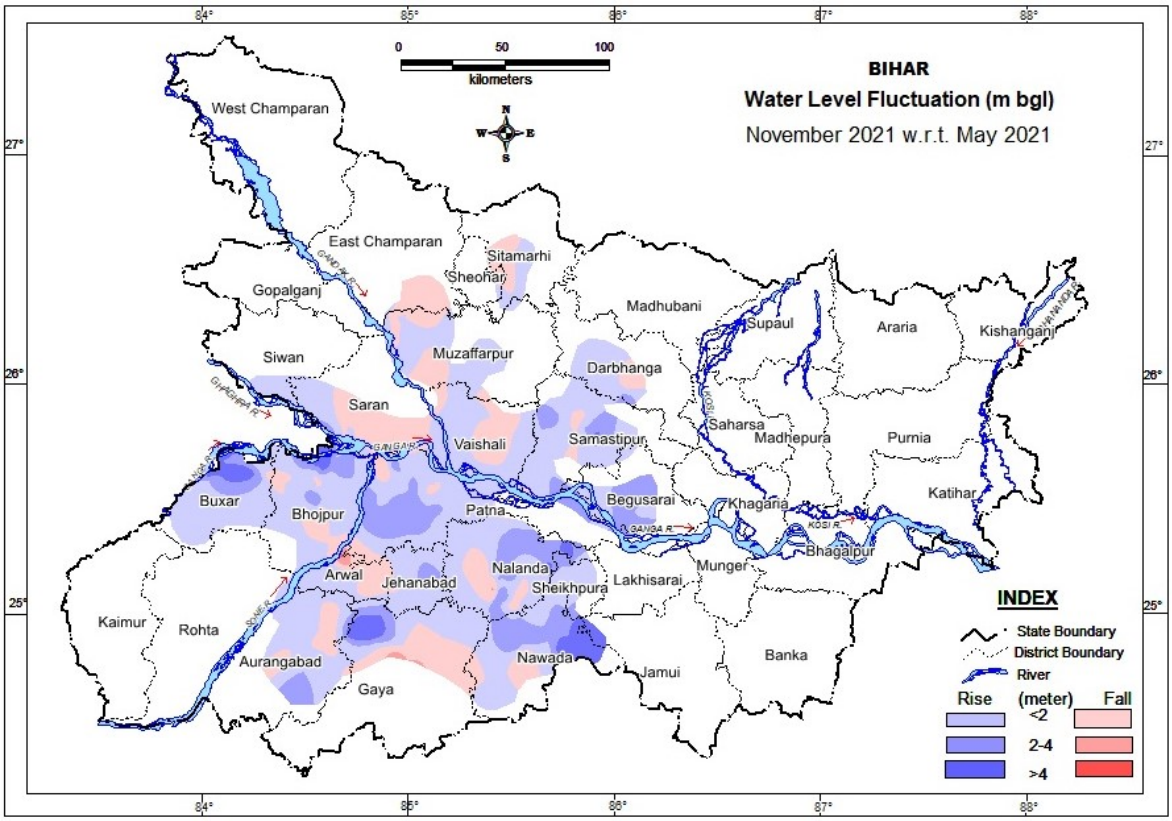

Figure 9*: Fluctuation in ground water level between May 2021 and Nov. 2021.*

Table 10: District wise categorization of fluctuation and their frequency of water levels of HNS in **Nov. 2021 w.r.t. May 2021**

SN	District	No. of wells analysed	Range of fluctuation (m)				No. of wells showing fluctuation												Total	
							Rise						Fall							
			Rise		Fall		0 to 2		2 to 4		> 4		0 to 2		2 to 4		> 4			
			Min.	*Max.*	*Min.*	*Max.*	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*	*Rise*	*Fall*
1	Aurangabad	5	1.00	3.08	0.18	0.27	1	20	1	20	0	0	3	60	0	0	0	0	2	3
2	Begusarai	8	0.44	3.82	-	-	3	38	5	63	0	0	0	0	0	0	0	0	8	0
3	Bhojpur	19	0.07	6.05	0.55	0.74	13	68	3	16	1	5	2	11	0	0	0	0	17	2
4	Buxar	12	0.65	5.84	1.46	1.46	6	50	1	8	4	33	1	8	0	0	0	0	11	1
5	Darbhanga	6	0.01	2.17	1.88	1.88	4	67	1	17	0	0	1	17	0	0	0	0	5	1
6	Gaya	5	4.85	6.43	0.28	3.55	0	0	0	0	2	40	2	40	1	20	0	0	2	3
7	Jehanabad	10	0.04	2.65	0.61	4.17	4	40	1	10	0	0	4	40	0	0	1	10	5	5
8	Muzaffarpur	14	0.02	2.39	0.09	0.85	9	64	1	7	0	0	4	29	0	0	0	0	10	4
9	Nalanda	27	0.18	4.54	0.33	2.04	12	44	6	22	2	7	6	22	1	4	0	0	20	7
10	Nawada	12	0.60	7.35	0.26	0.96	5	42	3	25	2	17	2	17	0	0	0	0	10	2
11	Patna	20	0.34	3.80	0.17	1.46	7	35	9	45	0	0	4	20	0	0	0	0	16	4
12	E Champaran	3	1.26	1.26	0.41	2.07	1	33	0	0	0	0	1	33	1	33	0	0	1	2
13	Samastipur	14	0.77	4.13	0.04	0.53	6	43	4	29	1	7	3	21	0	0	0	0	11	3
14	Saran	8	0.63	1.42	0.35	1.77	3	38	0	0	0	0	5	63	0	0	0	0	3	5
15	Seikhpura	5	0.08	3.12	-	-	3	60	2	40	0	0	0	0	0	0	0	0	5	0
16	Sitamarhi	6	0.27	0.27	0.07	1.05	1	17	0	0	0	0	5	83	0	0	0	0	1	5
17	Siwan	3	0.19	1.45	0.14	0.14	2	67	0	0	0	0	1	33	0	0	0	0	2	1
18	Vaishali	17	0.15	1.97	0.12	1.60	11	65	0	0	0	0	6	35	0	0	0	0	11	6
	Total	194	4.85	0.27	0.00	4.17	91	47	37	19	12	6	50	26	3	2	1	1	140	54

3.2.3 May 2021 to January 2022

Water level data of January 2022 has been compared with the Water level data of May 2021. Total 209 HNS have been analysed to study seasonal fluctuation in the different depth range and depicted in **Fig. 10**. About 59% (123) HNS has shown rise in water level and rest 41% (86) has shown fall.

Majority of HNS (43%) has shown rise in water level in the range of 0 – 2 in major part of the area covered by analysed wells. The localised areas falling in part of Begusarai, Bhojpur, Buxar, Nalanda, Nawada, Samastipur have shown rise in water level between 2 and 4 m. A patch of more than 4 m rise has been observed in Gaya and Nawada district.

Except Begusarai, Majority of districts have shown fall in water level down to 2 m. The fall of water level more than 4 m has been recorded only in 1 HNS located in Jehanabad district **(Table 11).**

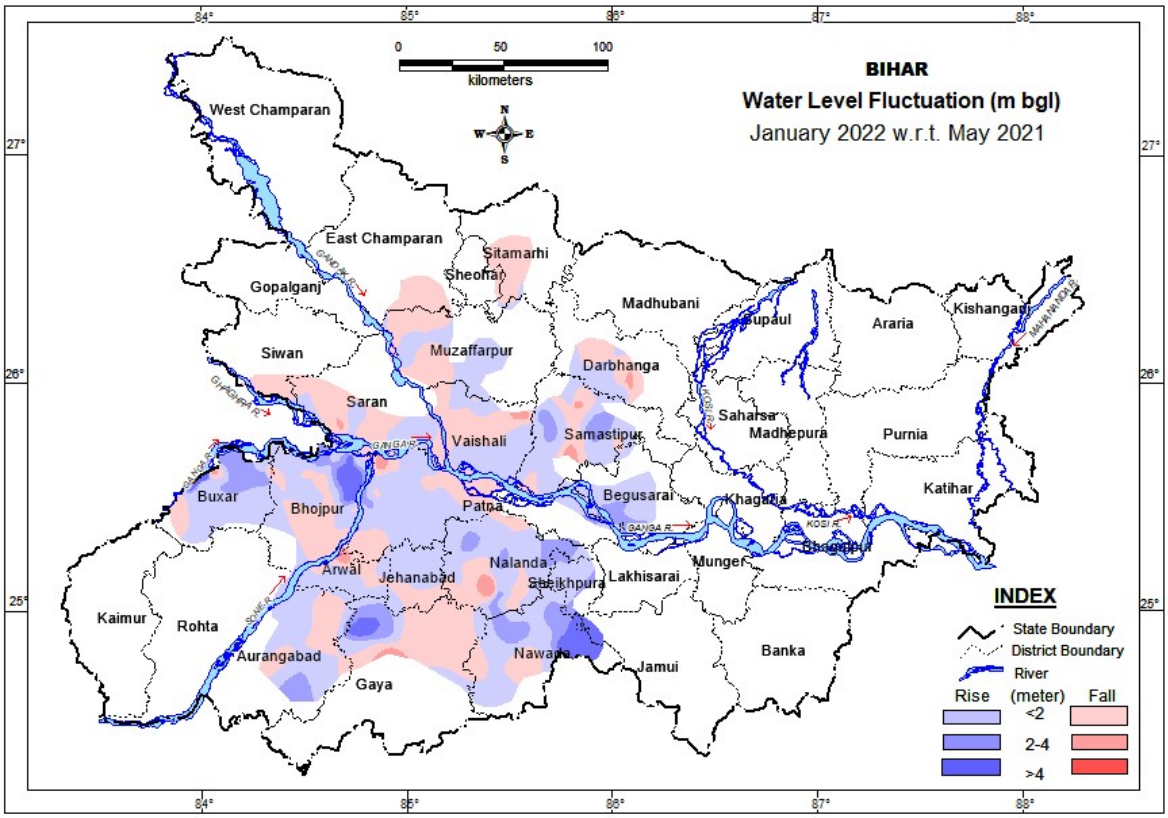

Figure 10*: Fluctuation in ground water level between May 2021 and Jan. 2022.*

Table 11: District wise categorization of fluctuation and their frequency of water levels of HNS in **Jan. 2022 w.r.t. May 2021**

SN	District	No. of wells analysed	Range of fluctuation (m)				No. of Wells / Percentage showing fluctuation in the range of												Total	
							Rise						Fall							
			Rise		Fall		0 to 2		2 to 4		> 4		0 to 2		2 to 4		> 4			
			Min.	*Max.*	*Min.*	*Max.*	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*	*Rise*	*Fall*
1	Aurangabad	5	1.00	2.76	0.20	1.17	1	20	1	20	0	0	3	60	0	0	0	0	2	3
2	Begusarai	8	0.41	2.60	-	-	5	63	3	38	0	0	0	0	0	0	0	0	8	0
3	Bhojpur	20	0.20	4.42	0.03	1.41	9	45	2	10	1	5	8	40	0	0	0	0	12	8
4	Buxar	14	0.59	4.37	0.03	2.23	4	29	4	29	1	7	4	29	1	7	0	0	9	5
5	Darbhanga	6	0.61	1.87	0.91	2.34	4	67	0	0	0	0	1	17	1	17	0	0	4	2
6	Gaya	5	4.15	5.31	1.05	3.97	0	0	0	0	2	40	2	40	1	20	0	0	2	3
7	Jehanabad	10	0.17	1.60	0.17	4.17	4	40	0	0	0	0	5	50	0	0	1	10	4	6
8	Muzaffarpur	15	0.26	1.47	0.38	1.24	10	67	0	0	0	0	5	33	0	0	0	0	10	5
9	Nalanda	32	0.14	3.54	0.14	3.83	15	47	6	19	0	0	9	28	2	6	0	0	21	11
10	Nawada	14	0.23	6.93	0.85	1.10	6	43	4	29	2	14	2	14	0	0	0	0	12	2
11	Patna	22	0.01	2.40	0.21	3.28	11	50	1	5	0	0	8	36	2	9	0	0	12	10
12	E Champaran	3	1.04	1.69	0.53	0.53	2	67	0	0	0	0	1	33	0	0	0	0	2	1
13	Samastipur	14	0.83	3.65	0.24	3.01	5	36	3	21	0	0	5	36	1	7	0	0	8	6
14	Saran	10	0.17	1.18	0.02	2.30	3	30	0	0	0	0	6	60	1	10	0	0	3	7
15	Seikhpura	5	1.20	2.58	0.01	0.01	2	40	2	40	0	0	1	20	0	0	0	0	4	1
16	Sitamarhi	6	-	-	0.19	0.74	0	0	0	0	0	0	6	100	0	0	0	0	0	6
17	Siwan	2	-	-	0.65	0.75	0	0	0	0	0	0	2	100	0	0	0	0	0	2
18	Vaishali	18	0.23	2.03	0.02	0.80	9	50	1	6	0	0	8	44	0	0	0	0	10	8
	Total	209	4.15	1.18	0.00	4.17	90	43	27	13	6	3	76	36	9	4	1	0	123	86

3.3.0 ANNUAL FLUCTUATION

3.3.1 May 2020 to May 2021

Fluctuation of ground water level between May 2020 and May 2021 of only 122 HNS could be analysed due to Covid-19 pandemic. These HNS represents limited area of the State as shown in **Fig. 11**. The analysis indicates rise in water level in 104 wells (85%) of the HNS covering major part of the area monitored. Out of which rise of 0 – 2 m has been recorded in 51% (62) of the HNS monitored. About 7% of the well monitored has shown rise in water level more than 4 m.

Fall in water level has been observed only in 15 % of the well analysed which covered the localised areas in parts of Bhojpur, Gaya, Nalanda, Nawada, Patna, Samastipur. Fall of water level from 2 to 4 m in only one HNS location. Fall of water level more than 4 m has not been observed in wells analysed.

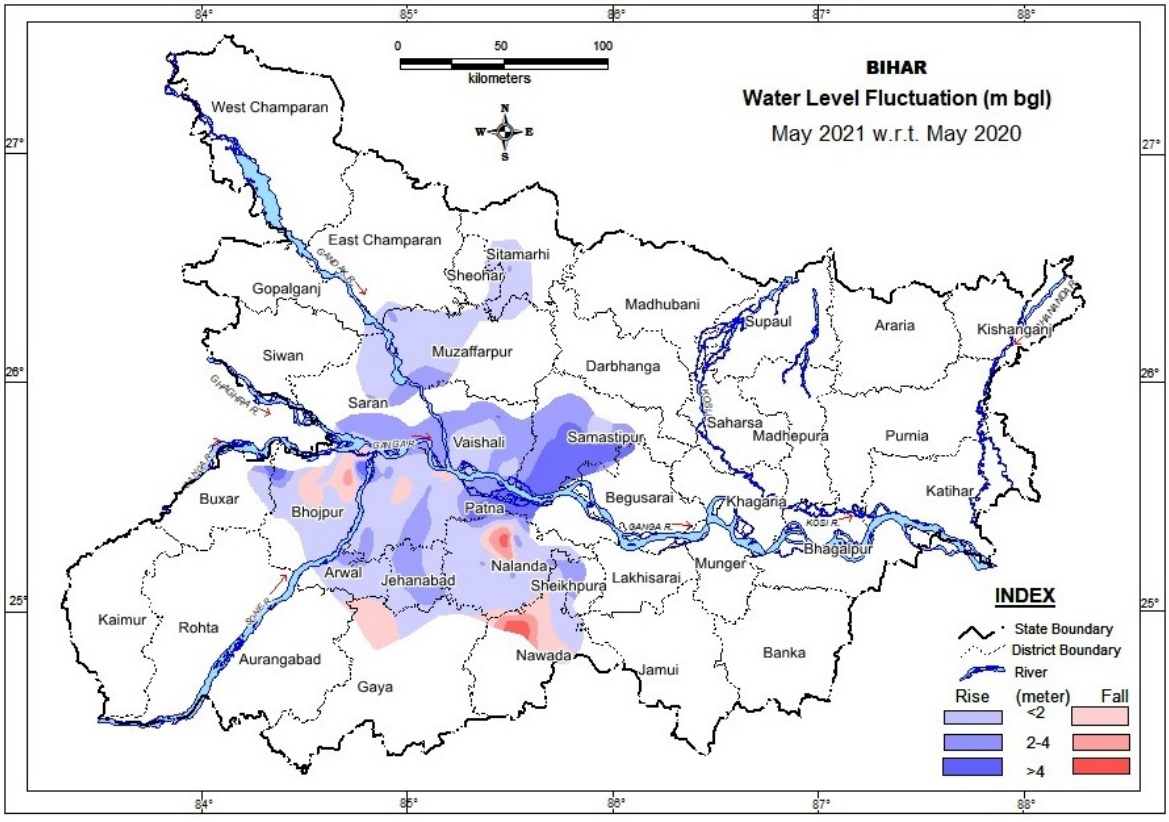

Figure 11*: Fluctuation in ground water level between May 2020 and May 2021.*

Table 12: District-wise categorization of frequency and fluctuation water levels of HNS of **May. 2021 w.r.t. May. 2020** for Bihar State

SN	District	No. of HNS	Range of fluctuation (m)				No. of Wells / Percentage showing fluctuation in the range of												Total	
			Rise		Fall		Rise						Fall							
			Min.	Max.	Min.	Max.	<2m	%	2-4m	%	>4m	%	<2m	%	2-4m	%	>4m	%	Rise	Fall
1	Begusarai	2	0.22	1.74	-	-	2	100	0	0	0	0	0	0	0	0	0	0	2	0
2	Bhojpur	17	0.20	1.43	0.03	1.95	9	53	0	0	0	0	8	47	0	0	0	0	9	8
3	Buxar	2	0.83	5.53	-	-	1	50	0	0	1	50	0	0	0	0	0	0	2	0
4	Gaya	3	0.54	1.95	1.82	1.82	2	67	0	0	0	0	1	33	0	0	0	0	2	1
5	Jehanabad	9	0.42	3.87	-	-	5	56	4	44	0	0	0	0	0	0	0	0	9	0
6	Muzaffarpur	5	0.19	3.11	-	-	4	80	1	20	0	0	0	0	0	0	0	0	5	0
7	Nalanda	19	0.11	4.27	2.70	2.70	13	68	4	21	1	5	0	0	1	5	0	0	18	1
8	Nawada	4	0.62	0.62	0.12	0.66	1	25	0	0	0	0	3	75	0	0	0	0	1	3
9	Patna	20	0.74	5.89	0.14	0.84	10	50	4	20	2	10	4	20	0	0	0	0	16	4
10	E champaran	2	0.53	1.47	-	-	2	100	0	0	0	0	0	0	0	0	0	0	2	0
11	Samastipur	10	2.30	7.07	1.20	1.20	0	0	6	60	3	30	1	10	0	0	0	0	9	1
12	Saran	7	0.78	3.85	-	-	2	29	5	71	0	0	0	0	0	0	0	0	7	0
13	Seikhpura	5	0.03	3.72	-	-	2	40	3	60	0	0	0	0	0	0	0	0	5	0
14	Sitamarhi	4	0.15	2.10	-	-	3	75	1	25	0	0	0	0	0	0	0	0	4	0
15	Vaishali	13	1.00	4.05	-	-	6	46	6	46	1	8	0	0	0	0	0	0	13	0
	Total	122	2.30	0.62			62	51	34	28	8	7	17	14	1	1	0	0	104	18

3.3.2 August 2020 to August 2021

Water level fluctuation between August 2020 and August 2021 has been done for 254 HNS locations. The covered area for annual fluctuation has been shown in **Fig. 12.** The comparison indicates the rise of water level in 72% of the HNS analysed which covered major part of the area. About 4% wells have shown rise > 4 m which located in Aurangabad, Begusarai, Nalanda, Nawada, Seikhpura district.

Total 71 wells have shown fall in water level. Out of which fall less than 2 m has been found in 61 wells. No water level fall is reported from Begusarai, Gopalganj, Purbi Champaran and Vaishali district.

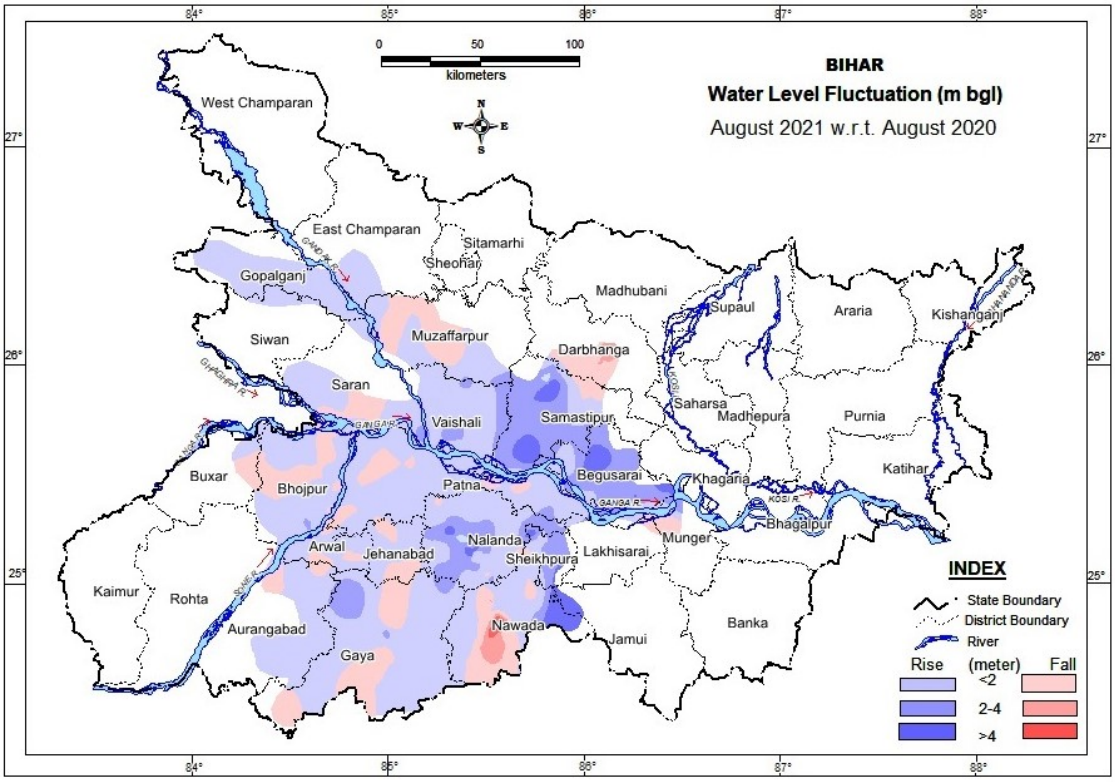

Figure 12*: Fluctuation in ground water level between Aug. 2020 and Aug. 2021*

Table 13: District-wise categorization of frequency and fluctuation water levels of HNS of **Aug. 2021 w.r.t. Aug. 2020** for Bihar State

SN	District	No. of HNS	Range of fluctuation (m)				No. of Wells / Percentage showing fluctuation in the range of												Total	
			Rise		Fall		Rise						Fall							
			Min.	Max.	Min.	Max.	<2m	%	2-4m	%	>4m	%	<2m	%	2-4m	%	>4m	%	Rise	Fall
1	Aurangabad	8	0.16	6.73	0.07	0.07	6	75	0	0	1	13	1	1	0	0	0	0	7	1
2	Begusarai	19	1.43	5.78	-	-	1	5	14	74	4	21	0	0	0	0	0	0	19	0
3	Bhojpur	31	0.09	2.24	0.05	1.56	22	71	1	3	0	0	8	2	0	0	0	0	23	8
4	Buxar	4	1.47	1.47	0.08	0.32	1	25	0	0	0	0	3	7	0	0	0	0	1	3
5	Darbhanga	6	-	-	0.78	2.10	0	0	0	0	0	0	4	6	2	33	0	0	0	6
6	Gaya	15	0.21	3.55	0.03	1.10	7	47	3	20	0	0	5	3	0	0	0	0	10	5
7	Gopalganj	8	0.02	0.96	-	-	8	##	0	0	0	0	0	0	0	0	0	0	8	0
8	Jehanabad	16	0.03	2.02	0.06	0.43	7	44	1	6	0	0	8	5	0	0	0	0	8	8
9	Muzaffarpur	11	0.03	2.23	0.83	1.83	6	55	1	9	0	0	4	3	0	0	0	0	7	4
10	Nalanda	36	0.20	6.70	0.05	0.34	15	42	14	39	4	11	3	8	0	0	0	0	33	3
11	Nawada	11	0.30	6.10	0.02	7.13	6	55	1	9	1	9	2	1	0	0	1	9	8	3
12	Patna	28	0.04	1.23	0.04	0.46	20	71	0	0	0	0	8	2	0	0	0	0	20	8
13	E Champaran	2	0.23	0.58	-	-	2	100	0	0	0	0	0	0	0	0	0	0	2	0
14	Samastipur	8	0.90	3.50	0.07	0.07	3	38	4	50	0	0	1	1	0	0	0	0	7	1
15	Saran	7	0.04	1.14	0.71	0.75	5	71	0	0	0	0	2	2	0	0	0	0	5	2
16	Seikhpura	7	1.23	6.18	0.30	0.30	1	14	3	43	1	14	1	1	0	0	0	0	5	1
17	Sheohar	2	-	-	0.73	1.33	0	0	0	0	0	0	2	#	0	0	0	0	0	2
18	Sitamarhi	16	-	-	0.10	3.60	0	0	0	0	0	0	9	5	7	44	0	0	0	16
19	Vaishali	19	0.02	3.29	-	-	16	84	3	16	0	0	0	0	0	0	0	0	19	0
	Total	254	1.47	0.58			126	50	45	18	11	4	61	2	9	4	1	0	182	71

3.3.3 November 2020 to November 2021

Water level fluctuation between November 2020 and November 2021 has been analysed for 549 HNS after carrying out monitoring in entire State. The analysis indicates that there is a fall of water level in about 26% of the HNS. About 25% NHS has shown water level fall less than 2 m. Water level rise of upto 2 m is shown by majority of NBP, central and western part of SBP. Only 5% NHS locations has shown rise more than 2 m which are scattered in Central part of NBP and southern part of SBP. About 25% NHS has also shown fall in water level less than 2 m, mostly located in northern part of NBP and eastern part of SBP.

(Fig.13, Table 14).

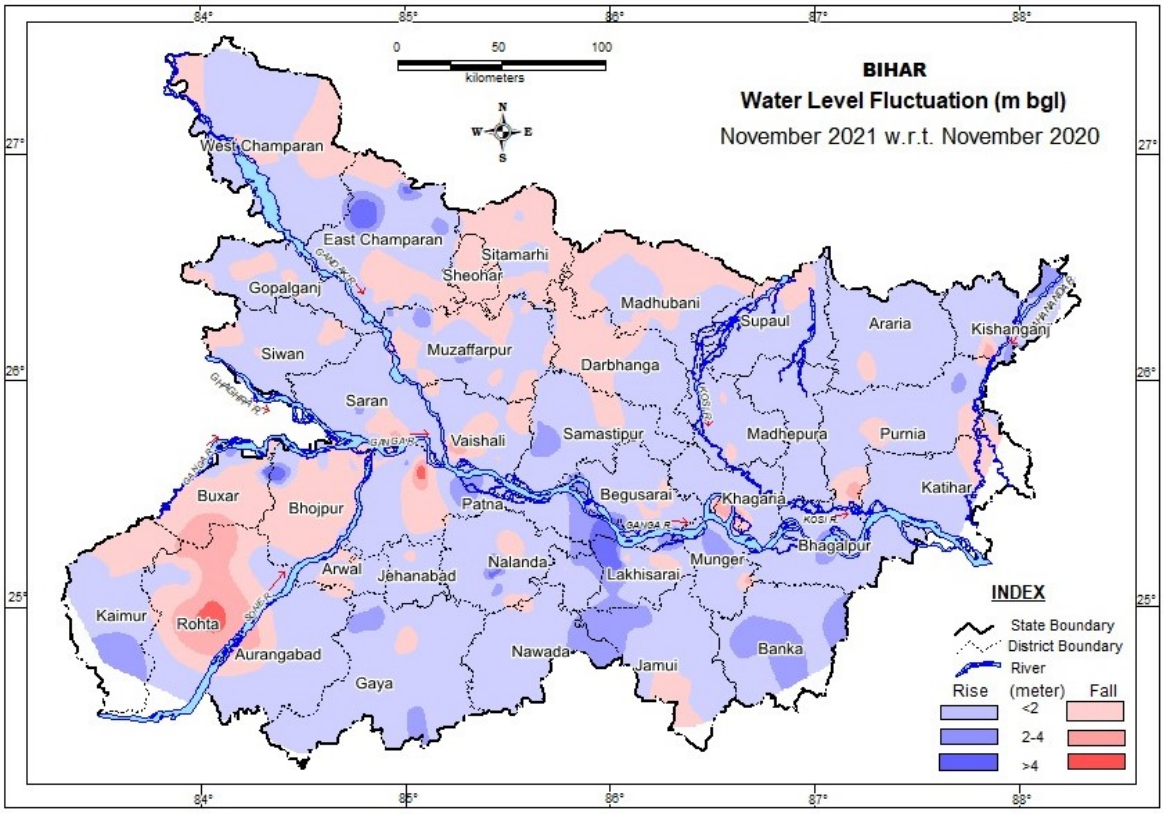

Figure 13*: Fluctuation in ground water level between Nov 2020 and Nov. 2021.*

Table 14: District-wise categorization of frequency and fluctuation water levels of HNS of **Nov. 2021 w.r.t. Nov. 2020** for Bihar State

SN	District	No. of HNS	Range of fluctuation (m)				No. of Wells / Percentage showing fluctuation in the range of												Total	
			Rise		Fall		Rise						Fall							
			Min.	Max.	Min.	Max.	<2m	%	2-4m	%	>4m	%	<2m	%	2-4m	%	>4m	%	Rise	Fall
1	Araria	8	0.67	1.60	0.41	0.41	7	88	0	0	0	0	1	13	0	0	0	0	7	1
2	Aurangabad	9	0.15	7.80	1.93	1.93	7	78	0	0	1	11	1	11	0	0	0	0	8	1
3	Banka	11	0.86	3.69	-	-	9	82	2	18	0	0	0	0	0	0	0	0	11	0
4	Begusarai	36	0.07	2.22	0.32	1.20	29	81	1	3	0	0	6	17	0	0	0	0	30	6
5	Bhagalpur	9	0.14	11.23	-	-	7	78	1	11	1	11	0	0	0	0	0	0	9	0
6	Bhojpur	24	0.05	0.92	0.07	2.16	3	13	0	0	0	0	18	75	2	8	0	0	3	20
7	Buxar	13	0.09	7.77	0.06	1.24	4	31	0	0	2	15	7	54	0	0	0	0	6	7
8	Darbhanga	9	0.16	0.60	0.04	0.48	3	33	0	0	0	0	6	67	0	0	0	0	3	6
9	Gaya	17	0.10	2.40	0.04	0.35	11	65	3	18	0	0	3	18	0	0	0	0	14	3
10	Gopalganj	19	0.02	13.35	0.06	0.45	13	68	0	0	1	5	5	26	0	0	0	0	14	5
11	Jamui	11	0.17	7.43	0.07	0.07	8	73	1	9	1	9	1	9	0	0	0	0	10	1
12	Jehanabad	16	0.07	1.76	0.30	1.86	13	81	0	0	0	0	3	19	0	0	0	0	13	3
13	Kaimur	5	0.04	3.00	0.21	0.21	3	60	1	20	0	0	1	20	0	0	0	0	4	1
14	Katihar	10	0.27	1.77	0.24	0.24	9	90	0	0	0	0	1	10	0	0	0	0	9	1
15	Khagaria	18	0.17	1.91	2.02	2.02	17	94	0	0	0	0	0	0	1	6	0	0	17	1
16	Kishanganj	8	0.52	3.77	0.13	0.13	5	63	2	25	0	0	1	13	0	0	0	0	7	1
17	Lakhisarai	9	0.74	5.22	0.30	2.09	5	56	1	11	1	11	1	11	1	11	0	0	7	2
18	Madhepura	16	0.04	1.18	-	-	16	100	0	0	0	0	0	0	0	0	0	0	16	0
19	Madhubani	22	0.05	1.15	0.05	0.90	12	55	0	0	0	0	8	36	0	0	0	0	12	8
20	Munger	8	0.05	3.05	3.34	3.34	5	63	2	25	0	0	0	0	1	13	0	0	7	1
21	Muzaffarpur	23	0.09	5.13	0.02	0.45	9	39	2	9	1	4	10	43	0	0	0	0	12	10
22	Nalanda	31	0.10	5.65	0.56	0.92	24	77	3	10	2	6	2	6	0	0	0	0	29	2
23	Nawada	12	0.18	2.90	0.01	0.29	9	75	1	8	0	0	2	17	0	0	0	0	10	2
24	W champaran	11	0.02	1.28	0.02	0.32	6	55	0	0	0	0	5	45	0	0	0	0	6	5
25	Patna	10	0.15	7.12	0.01	1.15	3	30	2	20	3	30	2	20	0	0	0	0	8	2
26	E champaran	25	0.02	4.60	0.33	1.76	15	60	1	4	1	4	8	32	0	0	0	0	17	8
27	Purnia	14	0.47	2.20	0.01	0.54	9	64	1	7	0	0	4	29	0	0	0	0	10	4
28	Rohtas	9	0.25	16.10	0.09	3.47	3	33	0	0	1	11	3	33	2	22	0	0	4	5
29	Saharsa	18	0.10	0.81	0.28	0.33	16	89	0	0	0	0	2	11	0	0	0	0	16	2
30	Samastipur	16	0.04	2.91	0.50	0.50	12	75	2	13	0	0	1	6	0	0	0	0	14	1
31	Saran	16	0.27	2.26	0.86	2.38	12	75	1	6	0	0	2	13	1	6	0	0	13	3
32	Seikhpura	7	0.58	2.37	0.06	0.06	5	71	1	14	0	0	1	14	0	0	0	0	6	1
33	Sheohar	4	-	-	0.08	1.36	0	0	0	0	0	0	4	##	0	0	0	0	0	4
34	Sitamarhi	16	0.01	0.60	0.10	0.78	5	31	0	0	0	0	11	69	0	0	0	0	5	11
35	Siwan	15	0.14	1.20	0.01	1.03	10	67	0	0	0	0	4	27	0	0	0	0	10	4
36	Supaul	22	0.05	1.80	0.07	0.83	18	82	0	0	0	0	3	14	0	0	0	0	18	3
37	Vaishali	22	0.12	1.78	0.21	3.80	13	59	0	0	0	0	8	36	1	5	0	0	13	9
	Total	549	0.86	0.60	0.00	3.80	355	65	28	5	15	3	135	25	9	2	0	0	398	144

3.3.4 January 2021 to January 2022

Water level fluctuation between January 2021 and January 2022 has been analysed for 588 HNS. The rise in water level within the range from 0.01 to 15.20 m as shown by 426 (72%) wells whereas the fall of water level between 0.01 to 5.57 m observed in 161 (about 28%) wells. About 26% of NHS locations has shown fall in water level less than 2 m. The localised areas of Bhojpur, Buxar, Khagaria, Rohtas, Saharsa, Supaul districts, represented by 1% of NHS monitored, has shown fall in water level between 2 and 4 m. Only 2 NHS, one each in Jamui, Khagaria district has shown fall of water level >4 m.

About 37% area of the State has shown rise of water level upto 2 m which covered central part of NBP and major part of Rohtas, Nawada, Patna, Nalanda, Jehanabad and Jamui in SBP. Water level rise of 2 to 4 m has been observed in total 59 wells mostly located in Aurangabad, Banka, Begusarai, Bhagalpur, Bhojpur, Gaya, Kaimur, Khagaria, Madhepura, Nalanda, Supaul district. A total of 26 HNS has shown rise in water level > 4m, mainly in Begusarai, Nalanda and Rohtas.

(Fig. 14, Table 15).

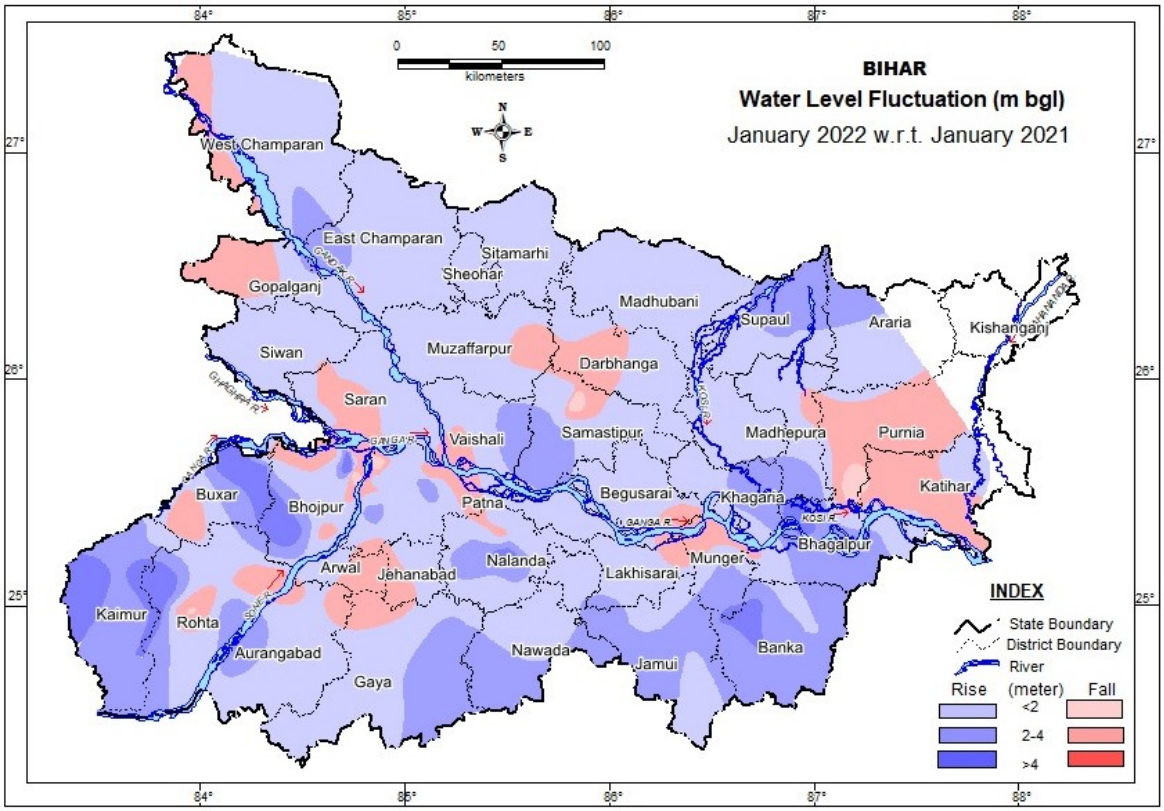

Figure 14*: Fluctuation in ground water level between Jan. 2021 and Jan. 2022.*

Table 15: District-wise categorization of fluctuation and their frequency of water levels of HNS of **Jan 2022 w.r.t. Jan 2021** for Bihar State

SN	District	No. of HNS analysed	Range of fluctuation (m)				No. of Wells / Percentage showing fluctuation in the range of												Total	
			Rise		Fall		Rise						Fall							
			Min.	Max.	Min.	Max.	<2m	%	2-4m	%	>4m	%	<2m	%	2-4m	%	>4m	%	Rise	Fall
1	Araria	7	0.05	0.44	0.07	0.70	4	57	0	0	0	0	3	43	0	0	0	0	4	3
2	Aurangabad	8	0.04	6.38	0.22	0.22	5	63	1	13	1	13	1	13	0	0	0	0	7	1
3	Banka	12	0.51	4.79	-	-	9	75	1	8	2	17	0	0	0	0	0	0	12	0
4	Begusarai	34	0.53	5.18	0.59	0.59	16	47	12	35	5	15	1	3	0	0	0	0	33	1
5	Bhagalpur	13	0.20	9.50	0.16	0.16	6	46	4	31	2	15	1	8	0	0	0	0	12	1
6	Bhojpur	30	0.01	2.92	0.02	2.58	13	43	1	3	0	0	15	50	1	3	0	0	14	16
7	Buxar	15	0.16	10.09	0.10	2.02	2	13	0	0	3	20	9	60	1	7	0	0	5	10
8	Darbhanga	10	0.04	0.44	0.05	0.82	6	60	0	0	0	0	4	40	0	0	0	0	6	4
9	Gaya	10	0.16	2.56	-	-	9	90	1	10	0	0	0	0	0	0	0	0	10	0
10	Gopalganj	19	0.03	1.37	0.06	0.83	14	74	0	0	0	0	5	26	0	0	0	0	14	5
11	Jamui	11	0.69	3.31	0.02	4.19	6	55	1	9	0	0	3	27	0	0	1	9	7	4
12	Jehanabad	18	0.24	1.32	0.03	1.18	10	56	0	0	0	0	8	44	0	0	0	0	10	8
13	Kaimur	8	0.68	5.48	1.36	1.36	2	25	3	38	2	25	1	13	0	0	0	0	7	1
14	Katihar	13	0.23	0.52	0.10	0.55	3	23	0	0	0	0	10	77	0	0	0	0	3	10
15	Khagaria	18	0.12	3.92	2.55	5.57	6	33	10	56	0	0	0	0	1	6	1	6	16	2
16	Kishanganj	7	3.33	3.33	0.14	0.59	0	0	1	14	0	0	6	86	0	0	0	0	1	6
17	Lakhisarai	9	0.32	1.90	-	-	9	100	0	0	0	0	0	0	0	0	0	0	9	0
18	Madhepura	16	0.07	3.60	0.26	1.26	9	56	2	13	0	0	5	31	0	0	0	0	11	5
19	Madhubani	24	0.01	1.44	0.08	0.75	18	75	0	0	0	0	6	25	0	0	0	0	18	6
20	Munger	7	0.66	2.08	0.55	1.59	4	57	1	14	0	0	2	29	0	0	0	0	5	2
21	Muzaffarpur	24	0.20	1.97	0.02	1.36	17	71	0	0	0	0	7	29	0	0	0	0	17	7
22	Nalanda	34	0.01	8.10	0.06	0.87	21	62	5	15	4	12	4	12	0	0	0	0	30	4
23	Nawada	13	0.16	4.19	0.33	0.33	9	69	2	15	1	8	1	8	0	0	0	0	12	1
24	W champaran	11	0.32	1.80	0.09	0.45	7	64	0	0	0	0	4	36	0	0	0	0	7	4
25	Patna	17	0.06	2.68	0.15	1.74	10	59	1	6	0	0	6	35	0	0	0	0	11	6
26	E champaran	24	0.14	6.28	1.89	1.89	18	75	4	17	1	4	1	4	0	0	0	0	23	1
27	Purnia	13	0.20	0.20	0.22	0.97	1	8	0	0	0	0	12	92	0	0	0	0	1	12
28	Rohtas	16	0.25	15.20	0.24	2.16	6	38	2	13	5	31	2	13	1	6	0	0	13	3
29	Saharsa	17	0.64	1.95	0.16	2.65	9	53	0	0	0	0	6	35	2	12	0	0	9	8
30	Samastipur	20	0.16	3.82	0.11	0.96	13	65	2	10	0	0	4	20	0	0	0	0	15	4
31	Saran	26	0.11	2.22	0.02	1.06	16	62	1	4	0	0	9	35	0	0	0	0	17	9
32	Seikhpura	6	0.39	2.65	-	-	5	83	1	17	0	0	0	0	0	0	0	0	6	0
33	Sheohar	4	0.41	0.41	0.61	1.06	1	25	0	0	0	0	3	75	0	0	0	0	1	3
34	Sitamarhi	15	0.09	0.45	0.22	0.50	13	87	0	0	0	0	2	13	0	0	0	0	13	2
35	Siwan	13	0.04	1.34	0.01	0.63	10	77	0	0	0	0	3	23	0	0	0	0	10	3
36	Supaul	23	0.05	2.77	0.27	2.40	14	61	3	13	0	0	5	22	1	4	0	0	17	6
37	Vaishali	23	0.08	1.82	0.19	0.65	20	87	0	0	0	0	3	13	0	0	0	0	20	3
	Total	588	3.33	0.20	0.00	5.57	341	58	59	10	26	4	152	26	7	1	2	0	426	161

3.4 DECADAL FLUCTUATION

3.4.1 Decadal Mean of May to May 2021

Fluctuation in water level of May 2021 with respect to decadal mean of May has been analysed for 223 HNS, which indicates rise in 89% and fall in remaining 11% HNS. The rise of water level in the range of 0 – 2 m is observed in 28% of the HNS monitored. The range of water level rise between 2 and 4 m has been observed in many localised areas including bordering area of East Champaran and Muzaffarnagar, Vaishali, Aurangabad, Gaya. Total 37 HNS have shown rise of water level > 4m with majority of the areas in Patna, Samastipur, Saran, Vaishali districts.

Majority of the well showing fall, are within the range of 2m observed in many localised areas. In Buxar district 7 HNS have shown fall within this category out of 20 well monitored. Only 2 HNS locations, one located in Buxar district and another one located in Nawada has been categorised within the range of 2 to 4 m. No well has shown fall > 4 m. (**Table – 16)**

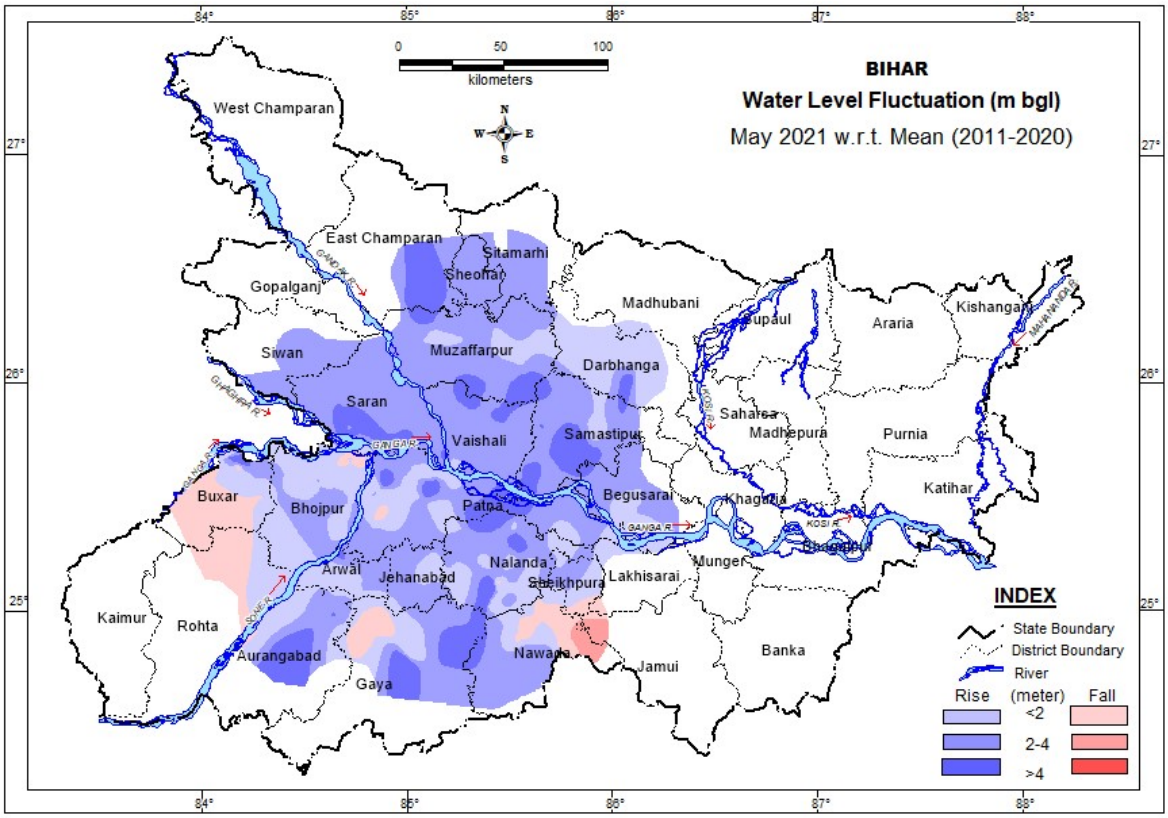

Figure 15*: Fluctuation in water level between May (mean) and May 2021.*

Table 16: District-wise categorization of fluctuation and their frequency of water levels of HNS of **May. 2021 w.r.t. May mean (2011-2020)** for Bihar State

SN	District	No. of HNS	Range of fluctuation (m)				No. of Wells / Percentage showing fluctuation In the range of												Total	
			Rise		Fall		Rise						Fall							
			Min.	Max.	Min.	Max.	<2m	%	2-4m	%	>4m	%	<2m	%	2-4m	%	>4m	%	Rise	Fall
1	Aurangabad	5	0.65	5.75	0.06	0.06	1	20	1	20	2	40	1	20	0	0	0	0	4	1
2	Begusarai	8	0.62	3.44	-	-	3	38	5	63	0	0	0	0	0	0	0	0	8	0
3	Bhojpur	23	0.02	3.60	0.26	1.86	10	43	8	35	0	0	5	22	0	0	0	0	18	5
4	Buxar	20	0.57	7.57	0.01	2.31	4	20	5	25	3	15	7	35	1	5	0	0	12	8
5	Darbhanga	6	0.36	5.81	-	-	5	83	0	0	1	17	0	0	0	0	0	0	6	0
6	Gaya	6	0.86	5.70	0.77	1.41	1	17	1	17	2	33	2	33	0	0	0	0	4	2
7	Jehanabad	10	0.64	4.67	-	-	2	20	7	70	1	10	0	0	0	0	0	0	10	0
8	Muzaffarpur	15	1.07	4.80	-	-	5	33	7	47	3	20	0	0	0	0	0	0	15	0
9	Nalanda	32	0.01	5.99	0.33	0.33	14	44	14	44	3	9	1	3	0	0	0	0	31	1
10	Nawada	14	0.93	3.82	0.20	3.10	3	21	5	36	0	0	5	36	1	7	0	0	8	6
11	Patna	26	0.39	7.60	0.41	0.41	10	38	9	35	6	23	1	4	0	0	0	0	25	1
12	E Champaran	3	1.71	4.21	-	-	1	33	1	33	1	33	0	0	0	0	0	0	3	0
13	Samastipur	14	0.22	5.94	-	-	1	7	7	50	6	43	0	0	0	0	0	0	14	0
14	Saran	11	2.45	5.38	-	-	0	0	6	55	5	45	0	0	0	0	0	0	11	0
15	Seikhpura	5	0.52	2.80	-	-	1	20	4	80	0	0	0	0	0	0	0	0	5	0
16	Sitamarhi	6	1.72	3.49	-	-	1	17	5	83	0	0	0	0	0	0	0	0	6	0
17	Siwan	3	2.34	3.35	-	-	0	0	3	100	0	0	0	0	0	0	0	0	3	0
18	Vaishali	16	2.13	5.30	-	-	0	0	12	75	4	25	0	0	0	0	0	0	16	0
	Total	223	2.80	2.45		3.10	62	28	100	45	37	17	22	10	2	1	0	0	199	24

3.4.2 Decadal Mean of August to August 2021

Fluctuation in water level of August 2021 with respect to decadal mean of August has been analysed for 556 HNS, covering the entire state of Bihar State. **(Fig 16).** About 79% of the HNS analysed, are categorised under rise in water level and remaining under fall. The rise to the tune of up to 2 m has covered major part of the area (53%) monitored. The rise between 2 and 4 m has been observed in 23% of the HNS analysed. Only 3 HNS have shown rise in water level > 4 m.

The fall up to 2 m has been observed in many localised areas in NBP and SBP including major part of Sitamarhi, Madhubani, Araria, Supaul, Buxar, Bhojpur district. Total 5 HNS have shown fall in the range of 2 to 4 m out of which 3 are located in Sitamarhi district and 1 each in Aurangabad and Munger district. Only 2 HNS have shown fall of water level > 4 located in Aurangabad and Nawada district. **(Table 17).**

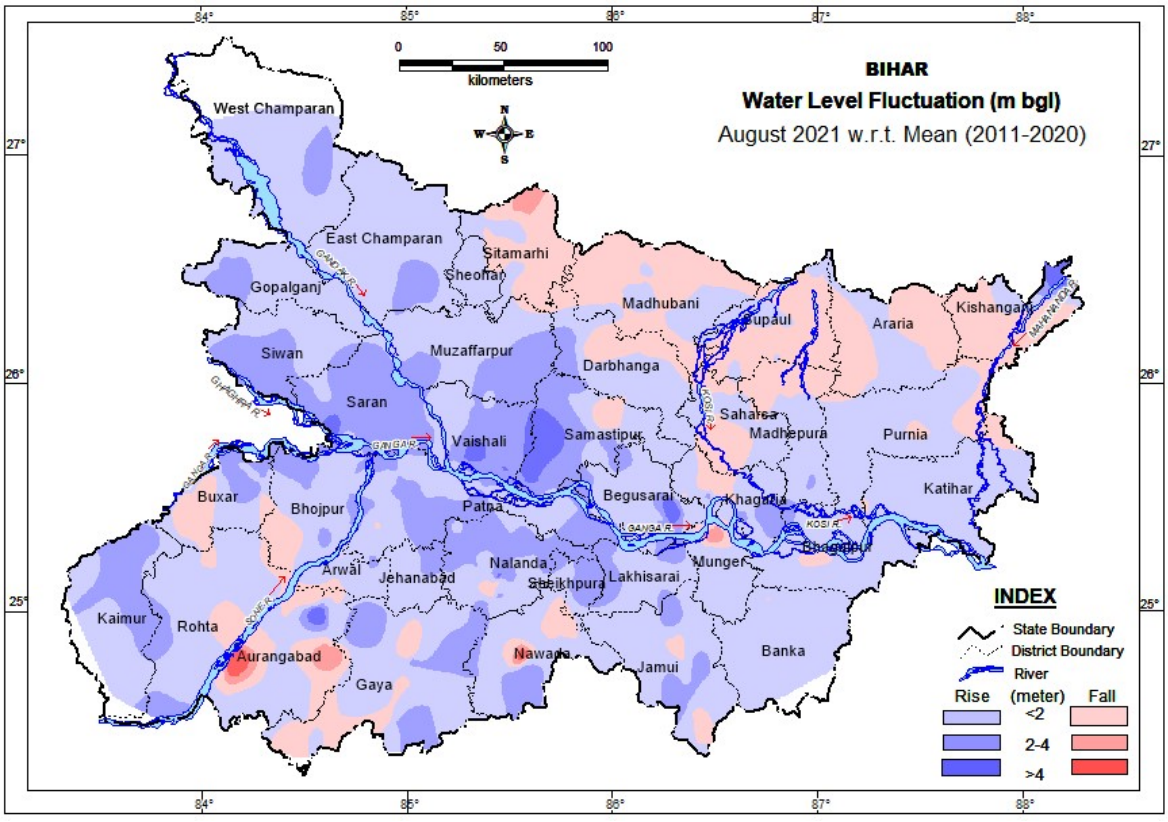

Figure 16*: Fluctuation in water level between Aug. (mean) and Aug. 2021*

Table 17: District-wise categorization of fluctuation and their frequency of water levels of HNS of **Aug. 2021 w.r.t. Aug. mean (2011-2020)** for Bihar

SN	District	No. of HNS	Range of fluctuation (m)				No. of Wells / Percentage showing fluctuation In the range of												Total	
			Rise		Fall		Rise						Fall							
			Min.	Max.	Min.	Max.	<2m	%	2-4m	%	>4m	%	<2m	%	2-4m	%	>4m	%	Rise	Fall
1	Araria	8	0.08	0.38	0.06	0.91	3	38	0	0	0	0	5	63	0	0	0	0	3	5
2	Aurangabad	17	0.15	5.99	0.05	6.36	8	47	0	0	1	6	6	35	1	6	1	6	9	8
3	Banka	13	0.25	2.00	0.03	0.03	12	92	0	0	0	0	1	8	0	0	0	0	12	1
4	Begusarai	33	0.08	5.92	-	-	21	64	9	27	3	9	0	0	0	0	0	0	33	0
5	Bhagalpur	11	0.36	1.86	0.57	0.57	10	91	0	0	0	0	1	9	0	0	0	0	10	1
6	Bhojpur	35	0.46	2.99	0.84	0.84	25	71	9	26	0	0	1	3	0	0	0	0	34	1
7	Buxar	21	0.69	4.17	0.49	0.92	8	38	9	43	1	5	3	14	0	0	0	0	18	3
8	Darbhanga	7	0.19	1.19	0.00	0.65	5	71	0	0	0	0	2	29	0	0	0	0	5	2
9	Gaya	16	0.09	3.99	0.12	0.58	6	38	5	31	0	0	5	31	0	0	0	0	11	5
10	Gopalganj	17	0.45	3.38	0.12	0.12	13	76	3	18	0	0	1	6	0	0	0	0	16	1
11	Jamui	15	0.21	3.41	0.19	0.68	8	53	5	33	0	0	2	13	0	0	0	0	13	2
12	Jehanabad	18	0.64	2.36	0.02	0.69	11	61	3	17	0	0	4	22	0	0	0	0	14	4
13	Kaimur	11	0.89	3.55	-	-	4	36	7	64	0	0	0	0	0	0	0	0	11	0
14	Katihar	14	0.01	1.80	0.08	1.10	12	86	0	0	0	0	2	14	0	0	0	0	12	2
15	Khagaria	18	0.47	3.60	0.08	0.68	9	50	5	28	0	0	4	22	0	0	0	0	14	4
16	Kishanganj	9	4.20	4.20	0.02	1.18	0	0	0	0	1	11	8	89	0	0	0	0	1	8
17	Lakhisarai	7	0.32	2.48	0.23	0.23	5	71	1	14	0	0	1	14	0	0	0	0	6	1
18	Madhepura	14	0.08	2.09	0.09	0.66	7	50	1	7.1	0	0	6	43	0	0	0	0	8	6
19	Madhubani	20	0.05	1.33	0.03	1.62	6	30	0	0	0	0	14	70	0	0	0	0	6	14
20	Munger	8	1.05	2.87	3.26	3.26	6	75	1	13	0	0	0	0	1	13	0	0	7	1
21	Muzaffarpur	11	0.47	3.78	-	-	8	73	3	27	0	0	0	0	0	0	0	0	11	0
22	Nalanda	36	0.41	4.67	0.09	1.79	15	42	17	47	1	3	3	8	0	0	0	0	33	3
23	Nawada	15	0.35	2.93	0.02	5.39	8	53	3	20	0	0	3	20	0	0	1	7	11	4
24	E champaran	6	0.37	2.16	-	-	5	83	1	17	0	0	0	0	0	0	0	0	6	0
25	Patna	30	0.20	3.15	0.26	0.26	19	63	10	33	0	0	1	3	0	0	0	0	29	1
26	E champaran	4	0.77	2.62	-	-	3	75	1	25	0	0	0	0	0	0	0	0	4	0
27	Purnia	11	0.13	0.93	0.48	0.60	9	82	0	0	0	0	2	18	0	0	0	0	9	2
28	Rohtas	18	0.07	3.03	0.07	1.15	13	72	2	11	0	0	3	17	0	0	0	0	15	3
29	Saharsa	14	0.02	0.63	0.02	1.57	7	50	0	0	0	0	7	50	0	0	0	0	7	7
30	Samastipur	13	1.22	5.22	1.38	1.38	3	23	6	46	3	23	1	8	0	0	0	0	12	1
31	Saran	13	0.21	4.67	-	-	2	15	9	69	2	15	0	0	0	0	0	0	13	0
32	Seikhpura	7	0.59	3.71	-	-	3	43	4	57	0	0	0	0	0	0	0	0	7	0
33	Sheohar	2	0.54	0.54	-	-	2	100	0	0	0	0	0	0	0	0	0	0	2	0
34	Sitamarhi	16	0.01	0.75	0.06	2.43	3	19	0	0	0	0	10	63	3	19	0	0	3	13
35	Siwan	6	1.40	2.78	-	-	2	33	4	67	0	0	0	0	0	0	0	0	6	0
36	Supaul	23	0.01	1.13	0.03	1.25	8	35	0	0	0	0	15	65	0	0	0	0	8	15
37	Vaishali	19	0.62	5.12	-	-	4	21	11	58	4	21	0	0	0	0	0	0	19	0
	Total	556	0.38	4.20		6.36	293	53	129	23	16	3	111	20	5	1	2	0	438	118

3.4.3 Decadal Mean of November to November 2021

Fluctuation in water level during November 2021 with respect to decadal mean of November has been analysed for 615 HNS, which shows Rise of water level in 82% of the HNS and remaining fall. Major part (68%) of the State has shown water level rise in the range of 0 to 2m. The rise between 2 and 4 m has been observed in 12% of NHS analysed which covered an elongated area in central NBP and many localised areas in SBP. 14 HNS have shown water level rise > 4 m.

Distinct area of the state has shown fall in water level which cover major part of the districts located in Kosi mega fan and also West Champaran, East Champaran, Buxar, Bhojpur, Kaimur, Aurangabad, Rohtas and Arwal district. Only 5 HNS have shown fall of water level in the range of 2 to 4 m including areas in Aurangabad, Bhojpur, Rohtas district. No location has reported the water level fall of > 4m in the state. **(Fig. 17, Table 18.)**

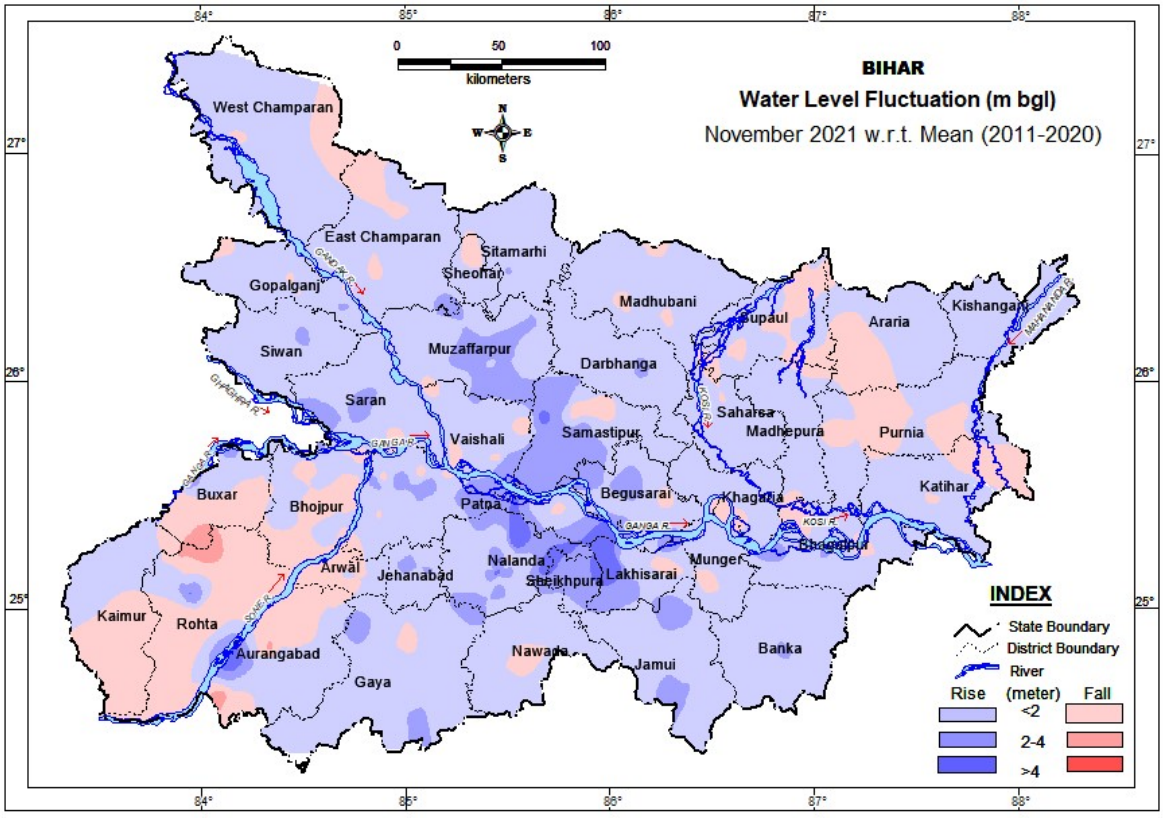

Figure 17*: Fluctuation in water level between Nov. (mean) and Nov. 2021*

Table 18: District-wise categorization of fluctuation and their frequency of water levels of HNS of **Nov. 2021 w.r.t. Nov. mean (2011-2020)** for Bihar State

SN	District	No. of HNS analysed	Range of fluctuation (m)				No. of Wells / Percentage showing fluctuation In the range of												Total	
			Rise		Fall		Rise						Fall							
			Min.	Max.	Min.	Max.	<2m	%	2-4m	%	>4m	%	<2m	%	2-4m	%	>4m	%	Rise	Fall
1	Araria	8	0.10	0.46	0.03	0.68	5	63	0	0	0	0	3	38	0	0	0	0	5	3
2	Aurangabad	10	0.09	4.94	0.21	2.67	4	40	0	0	1	10	3	30	2	20	0	0	5	5
3	Banka	14	0.57	8.60	-	-	12	86	1	7	1	7	0	0	0	0	0	0	14	0
4	Begusarai	36	0.43	3.56	0.11	1.47	29	81	5	14	0	0	2	6	0	0	0	0	34	2
5	Bhagalpur	14	0.09	2.70	0.34	0.70	9	64	2	14	0	0	3	21	0	0	0	0	11	3
6	Bhojpur	26	0.11	2.21	0.11	2.10	14	54	1	4	0	0	10	38	1	4	0	0	15	11
7	Buxar	16	0.03	4.33	0.79	1.09	11	69	2	13	1	6	2	13	0	0	0	0	14	2
8	Darbhanga	9	0.20	2.16	-	-	8	89	1	11	0	0	0	0	0	0	0	0	9	0
9	Gaya	17	0.33	3.48	0.06	0.24	13	76	2	12	0	0	2	12	0	0	0	0	15	2
10	Gopalganj	20	0.04	2.57	0.13	0.22	16	80	1	5	0	0	3	15	0	0	0	0	17	3
11	Jamui	14	0.05	3.38	-	-	10	71	4	29	0	0	0	0	0	0	0	0	14	0
12	Jehanabad	19	0.04	2.41	0.79	1.62	11	58	3	16	0	0	5	26	0	0	0	0	14	5
13	Kaimur	5	0.47	1.72	0.26	1.54	3	60	0	0	0	0	2	40	0	0	0	0	3	2
14	Katihar	14	0.06	1.09	0.13	0.44	11	79	0	0	0	0	3	21	0	0	0	0	11	3
15	Khagaria	18	0.26	1.78	0.85	0.85	17	94	0	0	0	0	1	6	0	0	0	0	17	1
16	Kishanganj	9	0.08	1.96	0.06	0.50	4	44	0	0	0	0	5	56	0	0	0	0	4	5
17	Lakhisarai	9	0.56	4.52	0.12	1.36	4	44	2	22	1	11	2	22	0	0	0	0	7	2
18	Madhepura	16	0.02	1.26	-	-	16	##	0	0	0	0	0	0	0	0	0	0	16	0
19	Madhubani	23	0.07	1.93	0.04	0.26	21	91	0	0	0	0	2	9	0	0	0	0	21	2
20	Munger	8	0.72	1.53	0.35	1.60	6	75	0	0	0	0	2	25	0	0	0	0	6	2
21	Muzaffarpur	24	0.07	2.97	-	-	14	58	10	42	0	0	0	0	0	0	0	0	24	0
22	Nalanda	31	0.35	6.06	0.05	0.40	16	52	8	26	5	16	2	6	0	0	0	0	29	2
23	Nawada	13	0.29	1.91	0.36	0.54	11	85	0	0	0	0	2	15	0	0	0	0	11	2
24	Pashchim champaran	11	0.03	1.49	0.22	0.22	10	91	0	0	0	0	1	9	0	0	0	0	10	1
25	Patna	32	0.27	5.88	0.08	1.79	19	59	5	16	3	9	5	16	0	0	0	0	27	5
26	Purba champaran	27	0.08	2.58	0.06	1.06	19	70	1	4	0	0	7	26	0	0	0	0	20	7
27	Purnia	18	0.05	0.99	0.13	1.12	12	67	0	0	0	0	6	33	0	0	0	0	12	6
28	Rohtas	14	0.31	4.08	0.02	2.66	1	7	1	7	1	7	9	64	2	14	0	0	3	11
29	Saharsa	18	0.01	1.04	0.14	0.21	16	89	0	0	0	0	2	11	0	0	0	0	16	2
30	Samastipur	20	1.35	4.30	0.44	0.75	4	20	13	65	1	5	2	10	0	0	0	0	18	2
31	Saran	16	0.54	3.22	0.67	0.67	13	81	2	13	0	0	1	6	0	0	0	0	15	1
32	Seikhpura	7	0.38	3.37	-	-	5	71	2	29	0	0	0	0	0	0	0	0	7	0
33	Sheohar	4	0.36	1.72	0.20	0.37	2	50	0	0	0	0	2	50	0	0	0	0	2	2
34	Sitamarhi	16	0.01	2.06	0.12	0.12	14	88	1	6	0	0	1	6	0	0	0	0	15	1
35	Siwan	15	0.08	2.38	-	-	14	93	1	7	0	0	0	0	0	0	0	0	15	0
36	Supaul	22	0.03	1.38	0.04	0.40	10	45	0	0	0	0	12	55	0	0	0	0	10	12
37	Vaishali	22	0.28	3.06	0.21	1.06	13	59	4	18	0	0	5	23	0	0	0	0	17	5
38	**Total**	615	0.46	1.35	0.00	2.67	417	68	72	12	14	2	107	17	5	1	0	0	503	112

3.4.4 Decadal Mean of January to January 2022

Fluctuation in water level of January 2021 with respect to decadal mean of January has been analysed for 640 HNS. In 82% of the HNS, rise in water level is recorded and remaining in fall. The rise up to 2 m has covered major part (61%) of the state. Few Patches mostly in central part of the State has shown rise in the range of 2 to 4 m. Total 20 HNS have shown more than 4 m rise in water level, out of which 7 wells are located in Nalanda while rest are in Aurangabad, Begusarai, Rohtas, Patna, Samastipur, Saran, East Champaran and West Champaran.

Water level fall of 0 to 2 m is seen in eastern part of NBP including major part of Araria, Purnia, Kishanganj, Katihar district. Few localised areas, mostly in Bhojpur, Buxar, Munger, Rohtas, Saharsa district have shown fall between 2 and 4 m. The fall of water level >4 m is reported at only one HNS location in Khagaria. (**Fig. 18, Table 19).**

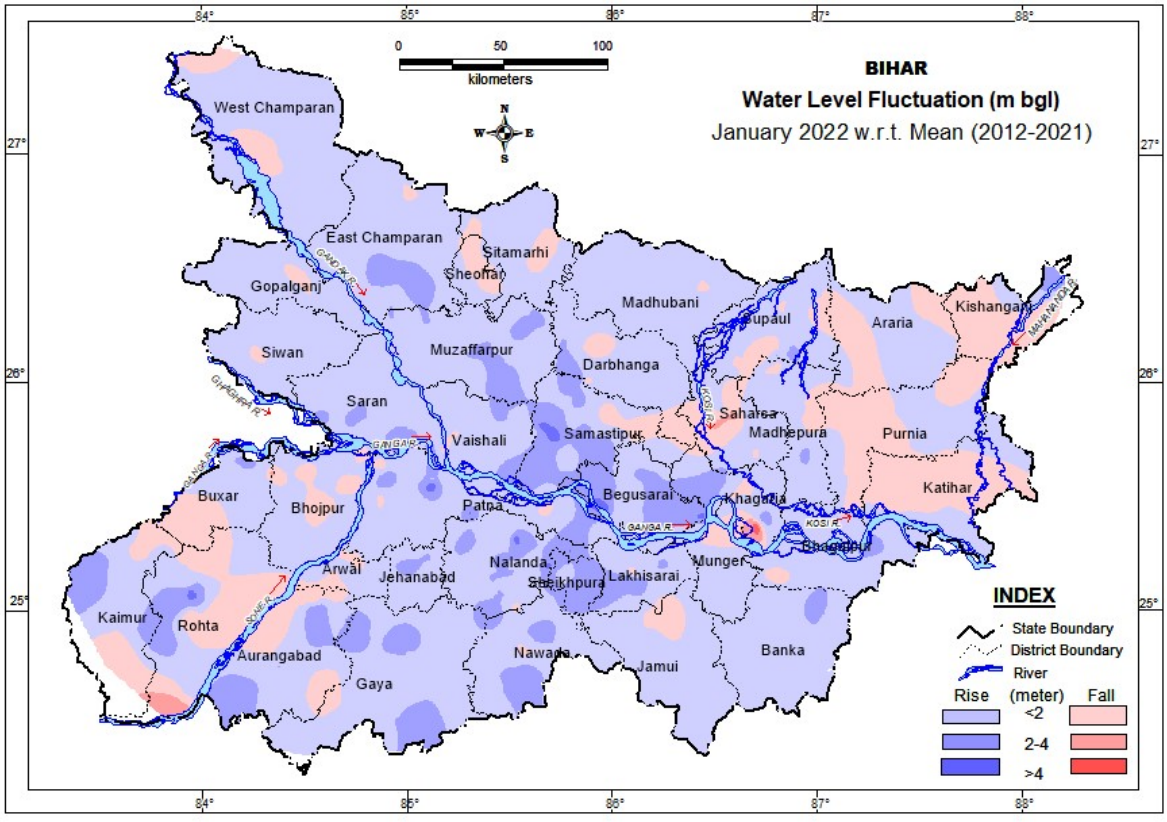

Figure 18: ***Fluctuation in water level between Jan. (mean) and Jan. 2022***

Table 19: District-wise categorization of fluctuation and their frequency of water levels of HNS of **Jan. 2022 w.r.t. Jan. mean (2012-2021)** for Bihar State

SN	District	No. of HNS analysed	Range of fluctuation (m)				No. of Wells / Percentage showing fluctuation in the range of												Total	
			Rise		Fall		Rise						Fall							
			Min.	Max.	Min.	Max.	<2m	%	2-4m	%	>4m	%	<2m	%	2-4m	%	>4m	%	Rise	Fall
1	Araria	7	0.07	0.56	0.28	0.30	5	71	0	0	0	0	2	29	0	0	0	0	5	2
2	Aurangabad	11	0.75	4.02	0.22	1.45	3	27	3	27	1	9	4	36	0	0	0	0	7	4
3	Banka	12	0.15	2.98	-	-	11	92	1	8	0	0	0	0	0	0	0	0	12	0
4	Begusarai	35	1.05	5.00	-	-	11	31	20	57	4	11	0	0	0	0	0	0	35	0
5	Bhagalpur	14	0.01	3.09	0.32	0.32	12	86	1	7	0	0	1	7	0	0	0	0	13	1
6	Bhojpur	31	0.02	3.04	0.18	2.44	23	74	1	3	0	0	6	19	1	3	0	0	24	7
7	Buxar	17	0.16	3.72	0.27	2.34	10	59	3	18	0	0	3	18	1	6	0	0	13	4
8	Darbhanga	10	0.17	1.84	0.43	0.55	8	80	0	0	0	0	2	20	0	0	0	0	8	2
9	Gaya	18	0.24	3.59	0.09	0.09	13	72	4	22	0	0	1	6	0	0	0	0	17	1
10	Gopalganj	19	0.03	1.78	0.17	0.21	17	89	0	0	0	0	2	11	0	0	0	0	17	2
11	Jamui	11	0.05	3.69	0.43	1.08	8	73	1	9	0	0	2	18	0	0	0	0	9	2
12	Jehanabad	18	0.11	2.58	0.15	0.92	12	67	2	11	0	0	4	22	0	0	0	0	14	4
13	Kaimur	8	0.73	2.98	1.07	1.10	4	50	2	25	0	0	2	25	0	0	0	0	6	2
14	Katihar	14	0.04	1.42	0.05	0.38	3	21	0	0	0	0	11	79	0	0	0	0	3	11
15	Khagaria	19	0.37	3.80	0.20	4.73	6	32	10	53	0	0	2	11	0	0	1	5	16	3
16	Kishanganj	8	2.66	2.66	0.02	0.54	0	0	1	13	0	0	7	88	0	0	0	0	1	7
17	Lakhisarai	9	0.16	3.78	1.60	1.60	6	67	2	22	0	0	1	11	0	0	0	0	8	1
18	Madhepura	17	0.04	2.47	0.27	1.43	12	71	1	6	0	0	4	24	0	0	0	0	13	4
19	Madhubani	24	0.11	1.30	0.02	0.60	21	88	0	0	0	0	3	13	0	0	0	0	21	3
20	Munger	7	0.20	1.94	2.01	2.01	6	86	0	0	0	0	0	0	1	14	0	0	6	1
21	Muzaffarpur	25	0.27	3.64	-	-	16	64	9	36	0	0	0	0	0	0	0	0	25	0
22	Nalanda	36	0.14	5.02	0.04	0.86	19	53	6	17	7	19	4	11	0	0	0	0	32	4
23	Nawada	16	0.04	3.03	0.05	0.07	11	69	3	19	0	0	2	13	0	0	0	0	14	2
24	W champaran	13	0.04	4.14	0.08	0.46	9	69	0	0	1	8	3	23	0	0	0	0	10	3
25	Patna	26	0.02	4.94	0.21	0.41	18	69	3	12	2	8	3	12	0	0	0	0	23	3
26	E champaran	29	0.07	4.09	0.37	0.44	25	86	1	3	1	3	2	7	0	0	0	0	27	2
27	Purnia	15	0.03	0.27	0.03	0.78	5	33	0	0	0	0	10	67	0	0	0	0	5	10
28	Rohtas	17	0.07	4.56	0.04	3.15	6	35	3	18	1	6	6	35	1	6	0	0	10	7
29	Saharsa	17	0.45	1.40	0.08	2.23	8	47	0	0	0	0	7	41	2	12	0	0	8	9
30	Samastipur	23	0.11	5.19	0.21	0.43	6	26	13	57	2	9	2	9	0	0	0	0	21	2
31	Saran	26	0.01	4.05	0.66	0.66	18	69	6	23	1	4	1	4	0	0	0	0	25	1
32	Seikhpura	7	0.76	3.70	-	-	1	14	6	86	0	0	0	0	0	0	0	0	7	0
33	Sheohar	4	0.16	0.16	0.18	0.80	1	25	0	0	0	0	3	75	0	0	0	0	1	3
34	Sitamarhi	15	0.07	1.59	0.05	0.05	14	93	0	0	0	0	1	7	0	0	0	0	14	1
35	Siwan	13	0.28	1.56	0.10	0.10	12	92	0	0	0	0	1	8	0	0	0	0	12	1
36	Supaul	24	0.06	2.23	0.01	1.34	15	63	2	8	0	0	7	29	0	0	0	0	17	7
37	Vaishali	25	0.44	3.16	0.04	0.04	17	68	7	28	0	0	1	4	0	0	0	0	24	1
	Total	640	0.16	2.66	0.00	4.73	392	61	111	17	20	3	110	17	6	1	1	0	523	117

4. HYDROCHEMISTRY

In order to assess the chemical quality of ground water of phreatic aquifers of Bihar, 252 ground water samples have been collected during May 2020 and analysed for 16 major parameters viz. pH, EC, TDS, TH, Ca^{2+}, Mg^{2+}, Na^{+}, K^{+}, CO_3^{-}, HCO_3^{-}, Cl^{-}, SO_4^{2-}, NO_3^{-}, F^{-}, PO_4^{3-}, SiO_2. The ground water sampling in the year 2021 is badly affected by Covid-19 pandemic. Results of the complete chemical analysis of the ground water samples are given in Annexure-II. A perusal of the **Annexure-II** indicates that the water is by and large suitable for domestic and drinking purposes. The pH of ground water mostly lies between 7.09 and 8.2. Majority of the ground water samples are mildly alkaline in nature. The EC ranged from 252 to 2670 µS/cm with the average value of 799 µS/cm @ 25°C.

Table 20: ***Calculated Minimum & Maximum and Median value of Chemical Parameters***

Chemical Parameter	No of sample	Min.	Q1	Median	Q3	Max.	Mean	Std. Dev
Ca^{2+}	277	8	24	34	50	254	41.84	30.00
Mg^{2+}	277	1	15	34	57	208	39.20	30.69
$Na^{+}+K^{+}$	277	8	25	44	80	297	63.16	53.43
HCO_3^{-}	277	67	189	256	336	933	277.86	126.76
Cl^{-}	277	7	25	46	110	440	75.44	75.98
SO_4^{2-}	277	1	14	28	56	233	41.09	39.50
NO_3^{-}	277	0	3.73	16	35	105	22.01	21.74

The Box and Whisker plot shows the central tendency, dispersion and outliers within a data set for individual cation and anion. The mean value has been shown as small circle and median value as a line within the box. The box represents 50% of the total data. The data for each parameter as shown in **figure** are skewed. Comparatively higher value of bicarbonate ions was found as shown in the figure whereas nitrate values are comparatively very less.

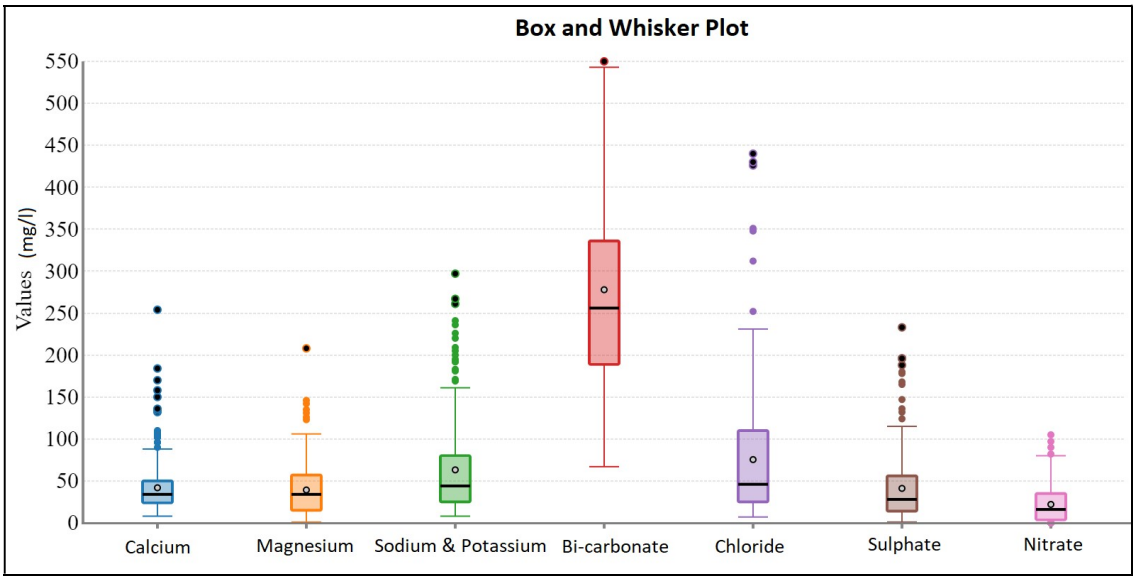

Figure 19: ***Box and Whiskar Plot***

Electrical Conductivity

The **map** has been prepared by using Mapinfo^{TM} software by interpolation method to show the spatial variation of EC values. The area has been categorized based on the USSL diagram, About 50% of the area covered ha showed the EC value less than 750 µS/cm and rest are within 750 to 2250 µS/cm @25°C. In two samples collected from Sheikhpura and Nalanda district, EC value has been found to be >2250 µS/cm @25°C, due to some localised anthopogenic activities.

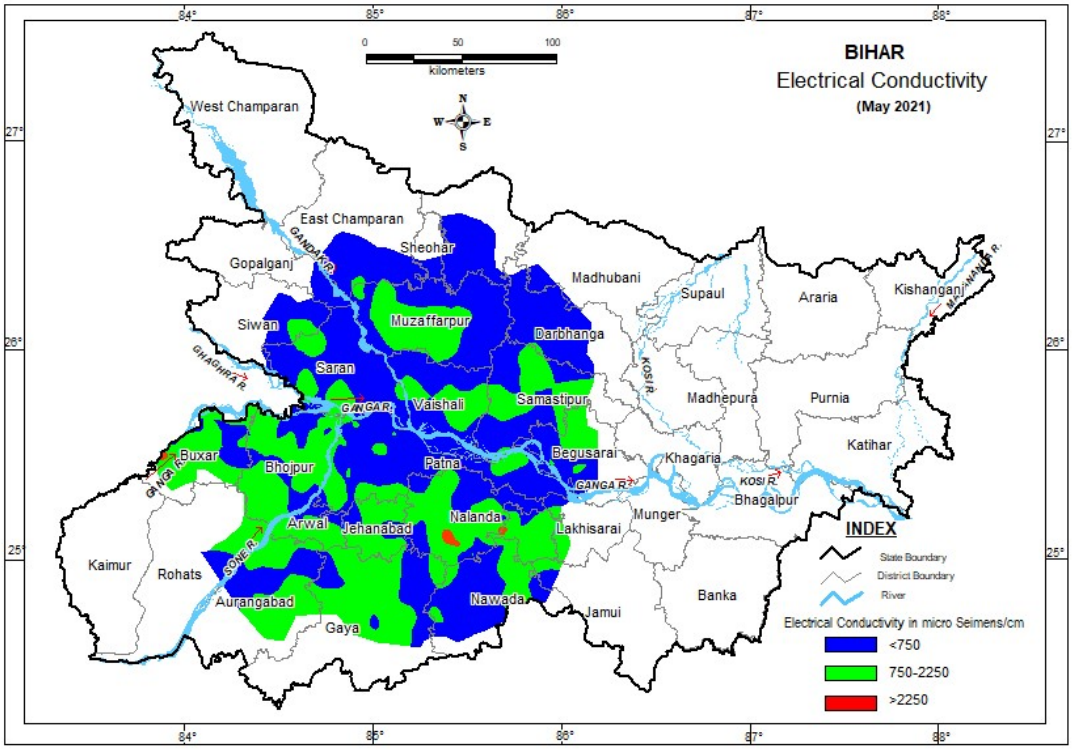

Figure 20: ***Electrical Conductivity Map***

Bi-carbonate

The bicarbonate values ranged from 63 to 933 mg/l. Similar to the EC map, Bi-carbonate map has been prepared in which the area has been categorized based on the permissible limit and acceptable limit of BIS 2012. The **Figure** reveals that almost entire area covered is within the perssible limit of 600 mg/l. There are some localized areas where bicarbonate value has been found within the acceptable limit of 200 mg/l. In total five locations in Nalanda, Nawada, Sheikhpura and Buxar district Bicarbonate values were greater than 600 mg/l.

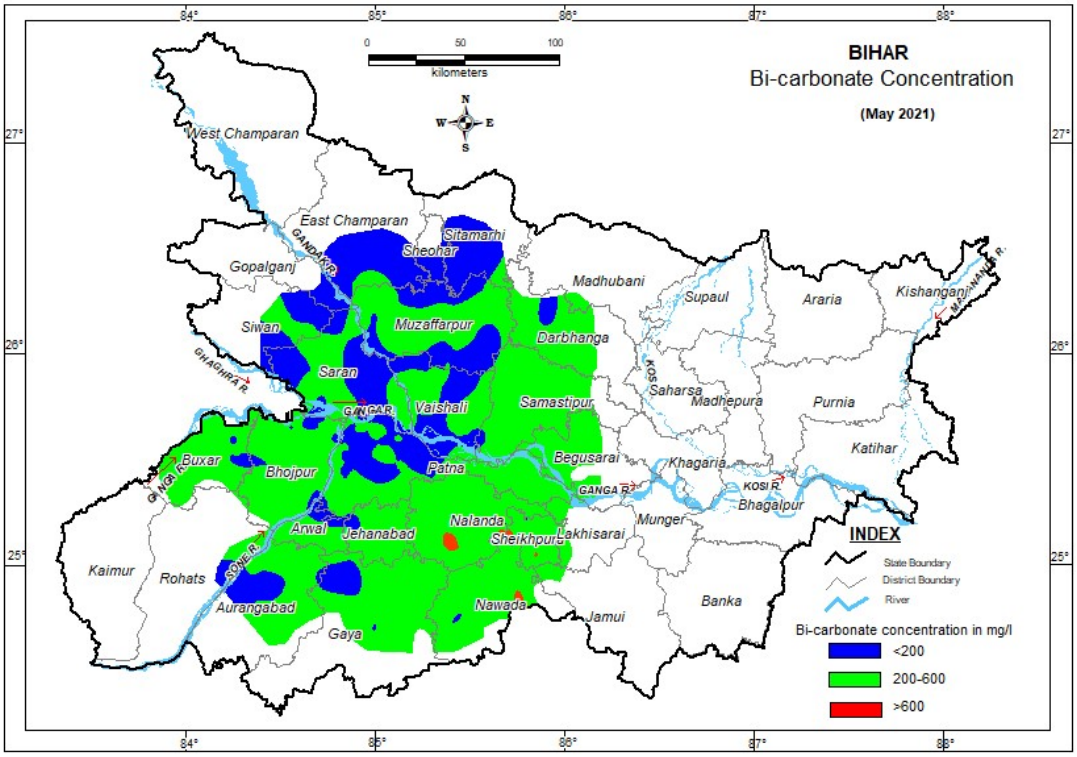

Figure 21: ***Bi-carbonate Map***

5. RAINFALL DATA ANALYSIS

Bihar experiences rainfall mainly during Southwest monsoon season (June to September). Fig.4 shows the annual departure of rainfall in different districts of Bihar. The anomalies were computed based on the LPA period of 1961-2010. Out of 38 districts of the state, 1 received deficient rainfall (-20% to -59% of its 1961-2010 period LPA), 16 districts received normal rainfall (-19% to +19% of its LPA), 18 received excess rainfall (20% to 59% of its LPA), 3 received large excess (60% or more of its LPA) rainfall.

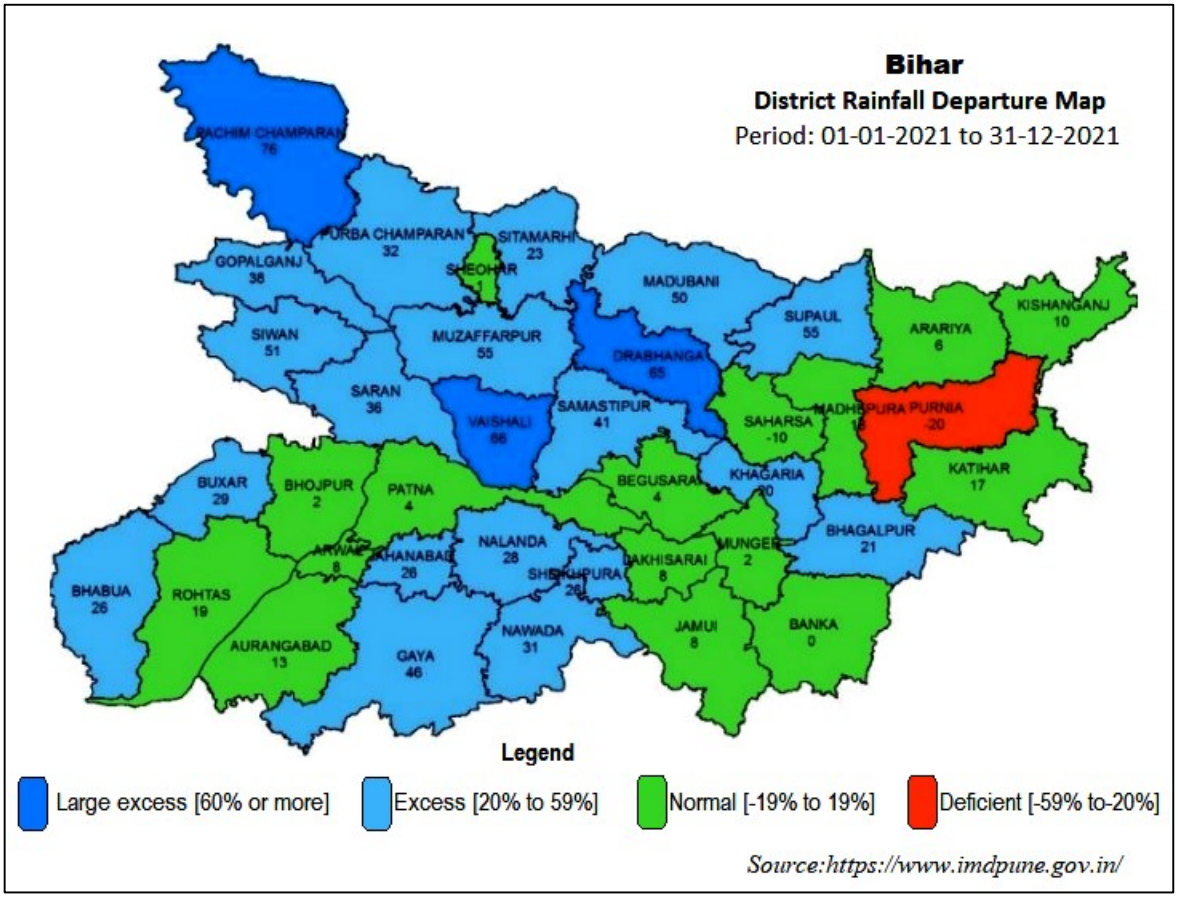

Figure 22: ***District Rainfall Departure Map***

Standardized Precipitation Index (SPI): The SPI is based on precipitation and used for measuring drought. This index is negative for drought and positive for wet conditions. As the wet and dry conditions become more severe, the index becomes more positive or negative. Extremely wet/severely wet conditions were observed over parts of Champaran.West, Darbhanga, Gaya, Gopalganj, Madhubani, Muzaffarpur, Samastipur, Siwan, Vaishali districts while mildly /moderately wet conditions were observed over other districts of the state except Purnea district which observed mildly dry condition.

Source: https://www.imdpune.gov.in/

6. TREND ANALYSIS DURING PRE AND POST MONSOON

Trend of the ground water level for the last ten year (2012-2021) have been analyzed. District wise percentage of well showing rise, fall and no significant trend during Pre- Monsoon and Post Monsoon season has been prepared and given in the Annexure – III. It has been observed from long term water level trend data that more than 50% NHS wells have shown rising trend in 24 districts in premonsoon period and 30 districts in Postmonsoon period.

7. Piezometric Head

Total 10 wells has been taken for the preparation of map for piezometric head. These wells are located in and around Patna urbon area. The other wells are located in different district. Their mutual distance is not suficient enough for interpolation by natural neighbouring method. The maps for piezometric head have been prepared for the pre-monsoon and post monsoon period 2021. In general, the peizometric head has been oberved to be deeper than the depth to water level of the area.

7.1 May 2021

The area covered under mapping is shown in **figure 23**. The piezometric head ranged from 12.7 (Gandhi maidan) to 6.9 (Bikram) m bgl. The figure indicates that southeastern part of the area is deeper in the category of more than 10 m bgl. The piezometric head in other part of the area is between 5 to 10 m bgl.

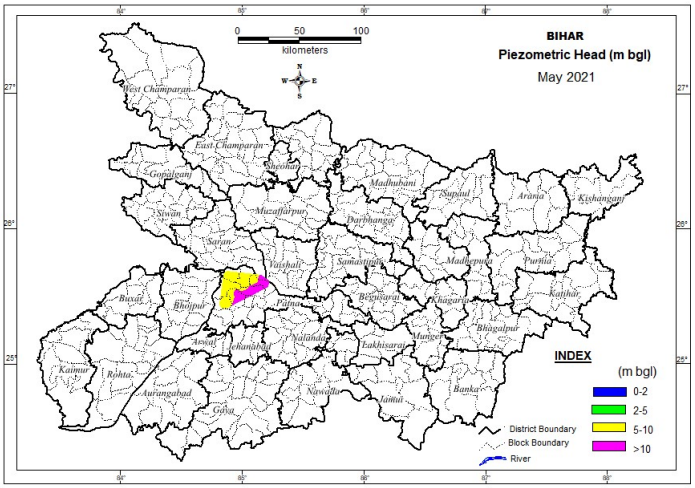

Figure 23: Piezometric head in May 2021

7.2 November 2021

Piezometric head during November 2021 has been observed between 3 (Bikram) to 9.05 (Gandhi Maidan) m bgl and shown in **figure 24**. Figure reveals that only eastern part of the area has shown deeper piezometric head between 5 and 10 m bgl. In rest of the area, piezometric head has been found within the category of 5 to 10 m bgl.

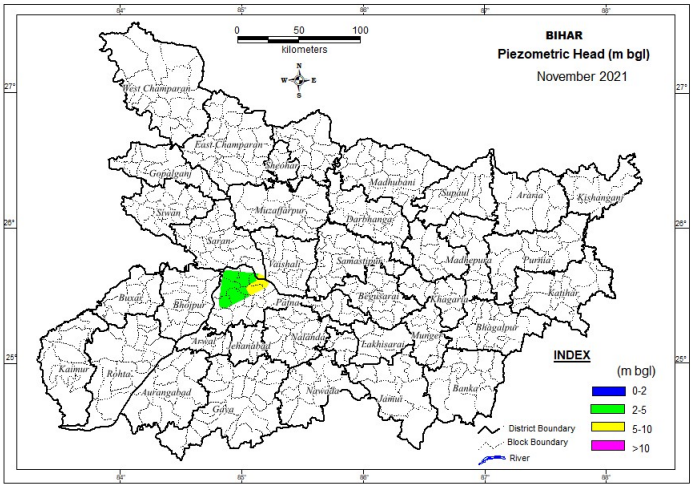

Figure 24: **Piezometric head in November 2021**

Anneure-I

Depth to Water Level (m bgl) in Various Seasons:- 2021-22

State : Bihar

District	Location	May 2021	Aug. 2021	Nov. 2021	Jan. 2022
Araria	Araria		2.29	3.4	3.62
Araria	Bhargama		2.04	2.85	2.68
Araria	Bathnaha 1		2.51	2.65	3.42
Araria	Haripur		1.63	2.32	3.02
Araria	Matiyari		2.01	2.43	3.05
Araria	Jokihat1		1.93	1.93	2.62
Araria	Palasi		2.55	2.22	
Araria	Raniganj		1.68	3.33	3.85
Aurangabad	Aurangabad	0.6	0.6	0.78	0.8
Aurangabad	Pandrawan		1.69	4.35	4.9
Aurangabad	Barun		8.18	Partially filled	Partially filled
Aurangabad	Narari Kala		9.04	3.7	
Aurangabad	Daudnagar	5.6	3.25	4.6	4.6
Aurangabad	Deo1	5.1	1	2.02	2.34
Aurangabad	Deohara_goh		7.73	9.82	9.48
Aurangabad	Dhobi Tola_Goh	2.39	2.13	2.66	3.56
Aurangabad	Etwan		1.8	3.81	2.9
Aurangabad	Madanpur		2.9	Partially filled	4.7
Aurangabad	Pataya		0.72	Could not be located	2
Aurangabad	Dhanibar		3.72	Could not be located	4.3
Aurangabad	Mahauli		2.8	4.05	
Aurangabad	Nabinagar dbib		0.3	3.52	
Aurangabad	Obra		3.4	4.93	
Aurangabad	Rafiganj		10.25	Dry	Dry
Aurangabad	Tineri Morh	2.35	0.94	2.57	2.6
Banka	English More		0.75	1.59	1.79
Banka	Rampur		0.78	1.79	2.2
Banka	Banka ps		0.58	1.54	2.69
Banka	Barahat		0.91	1.62	2.54
Banka	Baunsi		2.35	3.75	4.44
Banka	Chandan		1.64	2.57	3.47
Banka	Panjwara		3.57	3.58	
Banka	Katoria		1.88	3.59	5.19
Banka	Rajaun ps		4.27	4.75	3.51
Banka	Fulidumer		0.67	1.24	3.3
Banka	Kharharia		1.14	1.56	1.9
Banka	Mirjapur		1.99	1.89	2.83
Banka	Sambhuganj		1.37	2.02	3.14
Begusarai	Baraun mile	3.16	1.8	2.72	0.9
Begusarai	Kumharson		1.24	2.04	1.61
Begusarai	Naya Nagar Dularpur	2.89	0.85	1.08	2.24
Begusarai	Teghra		1.8	4.93	2.24
Begusarai	Bagrash		3.69	3.96	2.58
Begusarai	Bakhari_salauna		3.47	3.45	3.12
Begusarai	Manjaul	4.2	1.98	1.8	3.79
Begusarai	Peernagar		3.23	3.76	2.47

District	Location	May 2021	Aug. 2021	Nov. 2021	Jan. 2022
Begusarai	Simri		1.92	3.05	3.01
Begusarai	Badi Balia		2.31	4.04	3.05
Begusarai	Bariarpur		1.92	2.7	1.45
Begusarai	Chhoti Balia		2.65	2.34	4.03
Begusarai	Laxminia		0.98	5.2	2.45
Begusarai	Parihara		3.1	4.4	2.7
Begusarai	Rahatpur		2.01	2.84	2.7
Begusarai	Begusarai	6.02	1.88	2.2	3.42
Begusarai	Harpur	3.3	2.51	0.76	1.93
Begusarai	Barieghu		3.02	3.61	4.53
Begusarai	Begusarai fc_ib	4.8	1.52	1.5	2.65
Begusarai	Gopalpur		2.32	2.49	2.01
Begusarai	Haridia	3.6	2.21	2.66	2.5
Begusarai	Kaithma		3.68	3.43	3.82
Begusarai	Lakho		2.68	2.58	2.08
Begusarai	Matihani		1.96	4.45	Damaged
Begusarai	Mohanpur Usrai	6.16	Could not be located	2.56	4.7
Begusarai	Pokharia		2.1	3.4	2.59
Begusarai	Aghara		3.42	3.85	3.89
Begusarai	Cheriabariarpur		3.96	1.53	3.28
Begusarai	Kumbhidera		2.1	2.2	2.37
Begusarai	Badalpura		3.51	3.81	5.06
Begusarai	Dariarpur		Garbage	4	3.28
Begusarai	Bintoli		2.93	3.34	4.05
Begusarai	Heera Tola		Garbage	5.03	3.65
Begusarai	New Jafar Nagar		2.68	2.1	1.7
Begusarai	Raghunathpur		1.92	4.07	2.7
Begusarai	Sabdalpur		1.95	5.05	3.15
Bhagalpur	Bihpur ib		Temp. non-approachable	3.02	4.42
Bhagalpur	Marwa		0.88	3.45	4.35
Bhagalpur	Ghoga rly stn		1.33	1.15	1.35
Bhagalpur	Harchandpur		1.28	2.18	1.99
Bhagalpur	Jagnathpur		Temp. non-approachable	Temp. non-approachable	3.64
Bhagalpur	Madrauni Chowk		0.71	2.34	3.05
Bhagalpur	Bhagalpur city		11.4	10.69	10.76
Bhagalpur	Jagadishpur		0.34	1.02	0.97
Bhagalpur	Naugachhia h.s		0.88	2.04	4.65
Bhagalpur	Pirpainti db.ib		Temp. non-approachable	Temp. non-approachable	4.18
Bhagalpur	Sabaur		1.42	1.61	2.07
Bhagalpur	Shahkund db.ib		2.37	3.84	5.23
Bhagalpur	Akbarnagar stn		1.07	0.97	2.7
Bhagalpur	Asarganj		1.22	2.85	3.11
Bhagalpur	Sultanganj		2.05	2.9	6.46
Bhojpur	Birampur	10.8	Could not be located	Could not be located	3.69
Bhojpur	Farhda		2.34	3.11	4.2
Bhojpur	Jarawarpur Milki	5.01	1.84	4.84	5.6
Bhojpur	Bakhorapur	7.31	3.15	4.32	4.84
Bhojpur	Balua	10.15	4.15	7.53	8.27
Bhojpur	Barahara	9.33	3.5	4.72	4.91
Bhojpur	Dhusaria	8.63	2.53	7.24	8.43
Bhojpur	Ekauna	10.1	3.18	7.84	8.72

District	Location	May 2021	Aug. 2021	Nov. 2021	Jan. 2022
Bhojpur	Farhda	6.68	2.51	4.71	5.5
Bhojpur	Jagatpur	7.84	1.9	1.79	4.3
Bhojpur	Milki		1.53	1.82	3.05
Bhojpur	Simariya	7.6	2.8	Partially filled	Partially filled
Bhojpur	Bihiya	4.1	1.1	2.78	3.15
Bhojpur	Garhani	3.19	1.35	3.93	4.6
Bhojpur	Jagadishpur1	3.07	2.02	2.83	3.1
Bhojpur	Birampur		3.26	Could not be located	Dry
Bhojpur	Giddha		2.97	4.82	5.38
Bhojpur	Inglishpur		3.15	5.17	5.6
Bhojpur	Kulharia		Damaged	Damaged	5.27
Bhojpur	Lodhipur	6.3	3.42	Concrete Seal.	Concrete Seal.
Bhojpur	Mokhlisa		3.98	4.92	5.35
Bhojpur	Muhammadpur		4.25	4.69	6.1
Bhojpur	Pachrukhiya		3.24	6.33	6.7
Bhojpur	Sakkadi		2.13	6.89	8.1
Bhojpur	Songhata		4.5	3.6	6.35
Bhojpur	Pirro		3.38	Partially filled	Partially filled
Bhojpur	Baruna		0.88	2.43	3.25
Bhojpur	Guljarpur	4.06	1.72	3.91	4.45
Bhojpur	Kori	4.71	2.22	3.79	4.33
Bhojpur	Nasratpur	6.14	3.02	5.42	6.42
Bhojpur	Pauna		0.9	3.64	3.84
Bhojpur	Sandesh	3.1	0.77	1.38	2.17
Bhojpur	Karnempur	5.15	1.52	3.64	3.75
Bhojpur	Chandawa	3.11	0.57	2.38	3.25
Bhojpur	Harnath Kundi	2.13	1.45	2.68	3.26
Bhojpur	Kasap	1.8	0.58	1.73	2.64
Bhojpur	Sasaram Chota	5.23	1.86	3.56	4.4
Bhojpur	Udwantnagar	1.97	1	1.66	2.25
Buxar	Bagen Bazar	6.82	4	Damaged	Damaged
Buxar	Barhampur	3.32	1.8	Damaged	Damaged
Buxar	Hathilpur	5.22	2.1	4.16	5.27
Buxar	Jugia Dera		3.65	4.74	5.43
Buxar	Mharajgunj	2.1	1.22	3.56	4.33
Buxar	Raghunathpur	7.25	2.95	Dry	Dry
Buxar	Buxar	6.12	0.93	4.62	5.31
Buxar	Chausa	3.27	1.8	2.62	3.68
Buxar	Churamanpur DW	8.46	6.15	Damaged	Damaged
Buxar	Danikutia	4.27	1.34	2.27	2.36
Buxar	Dudharchak	10.7	6.41	5.68	7.41
Buxar	Kamarpur		Could not be located	2.52	Could not be located
Buxar	Kritpur	2.18	1.26	1.48	2.49
Buxar	Mishrvalia	3.84	1.1	1.52	2.51
Buxar	Thodagaon	10.75	Damaged	Damaged	Damaged
Buxar	Dumraon	8.41	Dry	Dry	6.11
Buxar	Rajpur	1.75	0.59	0.78	1.78
Buxar	Barka Rajpur	9.6	2.53	3.76	5.23
Buxar	Dumri	7.6	1.81	2.17	3.65
Buxar	Durasan		2.1	4.96	6.15
Buxar	Karathar	2.45	3.33	Could not be located	Could not be located
Buxar	Manikpur	9.2	4.94	5.05	5.63

District	Location	May 2021	Aug. 2021	Nov. 2021	Jan. 2022
Buxar	Neazipur	3.16	2.31	1.23	2.57
Darbhanga	Darbhanga	1.41	2.13	1.4	2.32
Darbhanga	Bithauli	0.3	4.16	2.18	2.64
Darbhanga	Jorja	3.88	3.17	2.67	3.01
Darbhanga	Bahera		2.95	1.2	2.7
Darbhanga	Baheri1	3.39	2.09	1.22	1.52
Darbhanga	Pouram		2.75	1.92	2.47
Darbhanga	Rustampur		Could not be located	Could not be located	1.91
Darbhanga	Keoti		2.05	1.42	2.02
Darbhanga	Sakari1	3.08	1.24	1.9	2.47
Darbhanga	Simri	3.19	1.68	1.57	2.17
Gaya	Akauna		1.15	1.35	2.96
Gaya	Banke Bazar		2.13	2.88	3.88
Gaya	Bhadeya		0.3	1.14	2.4
Gaya	Dobhi		3.7	3.5	4.5
Gaya	Bodh Gaya		3.24	3.3	3.4
Gaya	Magra		1.2	1.7	3.17
Gaya	Baraila More	1.38	Partially filled	Partially filled	Partially filled
Gaya	Fatehpur		2.8	3.15	4.4
Gaya	Bitho Sharif 1		Dry	7	7
Gaya	Chand Chowra Chowk		1.83	4.53	5.63
Gaya	Ram Kund	4.45	4.71	5.06	5.5
Gaya	Sangat Gali	2.1	3.35	5.65	6.07
Gaya	Guraru		0.7	1.42	2.85
Gaya	Raghunath Khap		0.98	1.55	2.9
Gaya	Baseta		1.03	1.73	2.49
Gaya	Konch	10	2.95	3.57	4.69
Gaya	Manpur		2.6	Partially filled	Partially filled
Gaya	Dangra More		1.74	1.74	2.04
Gaya	Tekari	7	Dry	2.15	2.85
Gaya	Wazirganj	0.8	0.3	1.08	2.1
Gopalganj	Manjwalia		Could not be located	2.23	2.28
Gopalganj	Barauli		1.08	1.38	1.69
Gopalganj	Bhojpurwa		Could not be located	1.65	1.92
Gopalganj	Bhore		0.05	1.8	Partially filled
Gopalganj	Rampur2		0.45	1.75	2.09
Gopalganj	Turkaha		0.24	1.24	1.5
Gopalganj	Yadavpur Dubeytola		0.3	1.64	1.64
Gopalganj	Hathua1		0.65	1.6	2
Gopalganj	Jamunaha	3.59	2.11	3.58	4.06
Gopalganj	Katiya		1.32	2.66	2.42
Gopalganj	Lala Pachmawa		0.7	2.7	2.1
Gopalganj	Misirbatha1		1.05	3.3	3.1
Gopalganj	Jalalpur2		1	2.02	2.56
Gopalganj	Kuchaikot		Damaged	1.64	Damaged
Gopalganj	Bangra		1.16	1.9	2.1
Gopalganj	Bangra Deoria		0.92	1.58	1.84
Gopalganj	Bishambarpur		1.95	2.33	2.53
Gopalganj	Lachchwar		0.94	1.8	1.82
Gopalganj	Manjhwa1		2.29	2.53	2.4
Gopalganj	Nunachapra		0.72		1.79
Gopalganj	Phulwariya		0.89	1.71	1.81

District	Location	May 2021	Aug. 2021	Nov. 2021	Jan. 2022
Jamui	Chakai		3.77	4.14	4.6
Jamui	Chakai B		3.39	4.02	Dry
Jamui	Tarakhakhar		Could not be located	8.36	9.97
Jamui	Aghara		2.59	2.83	5.7
Jamui	Jamui		7.07	Could not be located	8.76
Jamui	Manjhwe		1.05	1.35	4.21
Jamui	Ambedkar Nagar		1.33	1.82	2.39
Jamui	Chandramanita		1.53	2.02	2.79
Jamui	Harna		2.22	2.51	4.34
Jamui	Jhajha		7.87	8.52	Dry
Jamui	Gidhaur O		7.07	Dry	Dry
Jamui	Purna Khaira		1.05	1.53	2.26
Jamui	Lalmatia		2.42	3.4	7.64
Jamui	Laxmipur		0.58	0.97	2.91
Jamui	Batia1		9.67	10.56	Dry
Jamui	Sono		3.15	3.78	4.73
Arwal	Arwal1	1.71	3.71	5.88	5.88
Arwal	Dirpal Bigha	1.83	1.3	3.71	3.5
Arwal	Madhubani		2.43	4.38	3.97
Jehanabad	Dholakpur		2.65	2.93	3.55
Jehanabad	Ghoshi	4.3	1.6	1.65	2.7
Jehanabad	Hulasganj	3.29	2.35	2.92	3.75
Jehanabad	Kako		2.6	2.67	2.8
Jehanabad	Lakhwar		1.35	1.62	2.45
Jehanabad	Gaurakhini	5.07	3.87	3.84	4.47
Jehanabad	Jahanabad hosp.		1.1	1.18	Damaged
Jehanabad	Teni Bigha		1.15	1.05	1.15
Arwal	Bairbigha	5.25	2.63	4.29	3.75
Arwal	Bansi Surajpur		1.58	5.22	3.1
Arwal	Imamganj	3.12	2.03	4.17	4.22
Arwal	Kinjer		2.88	5.45	5.33
Arwal	Jhunathi	3.91	Water Logged	4.52	3.74
Arwal	Kurtha bdo	1.43	1.46	2.4	1.6
Jehanabad	Alubikha	2.3	1.96	2.26	2.56
Jehanabad	Makhdumpur		2.6	2.8	3.3
Kaimur	Adhaura		3	Could not be located	Temp. non-approachabe
Kaimur	Bhabhua		6.27	9.3	10.24
Kaimur	Saraiya		5.6	7.97	9.12
Kaimur	Tori f.ck.post		2.67	5.11	5.3
Kaimur	Chainpur		1.84	4.5	5.27
Kaimur	Khariava		1.52	3.67	3.82
Kaimur	Chand in p.s.		0.98	0.94	1.35
Kaimur	Nuawan		2.59	Could not be located	Could not be located
Kaimur	Mohania		1.9	Locked premises	Locked premises
Kaimur	Bandipur		1.8	4.06	5.38
Kaimur	Bevnaliya		2.4	3.85	3.92
Katihar	Barari-1			2.76	4.84
Katihar	Dumaria		2.79	4.15	4.95
Katihar	Kursela		2.26	3.35	5.65
Katihar	Paranpur		2.7	2.15	
Katihar	Mahendrapur		1.71	2.92	3.77

District	Location	May 2021	Aug. 2021	Nov. 2021	Jan. 2022
Katihar	Narahaiya		2.5	2.65	3.7
Katihar	Kadwa		2.1	3.9	4.23
Katihar	Sonauli	3.14	2.8	2.83	3.23
Katihar	Hafla1		2.27	2.67	3.28
Katihar	Katihar		1.45	2.63	4.02
Katihar	Khiria		3.47	3.23	4.37
Katihar	Korha		3.25	3.2	4.15
Katihar	Manihari		3.25	4.1	4.48
Katihar	Basantpur		3.09	2.5	3.75
Katihar	Bastaul1		2.55	Could not be located	3.74
Khagaria	Pirnasara		Could not be located	3.07	3.25
Khagaria	Basantpur		0.72	1	4.1
Khagaria	Chautham		0.8	2.33	4.64
Khagaria	Maheshkhunt 1		3.01	Blocked	3.35
Khagaria	Gandhinagar		1.21	1.2	3.15
Khagaria	Jamalpur		0.6	3.33	4.5
Khagaria	Maheshkhunt _Lohiya		0.96	2.7	3.55
Khagaria	Maheshkunt		2.1	1.78	3.55
Khagaria	Durgapur		2	3.95	3.35
Khagaria	Gangaut		3.01	3.83	3.25
Khagaria	Ismailpur		1.92	4.11	3.35
Khagaria	Kasimpur		1.73	3.53	3.3
Khagaria	Khagaria		1.4	2.94	3.85
Khagaria	Labhgaon		2.06	4.4	3.35
Khagaria	Ranko		2.32	2.9	3.25
Khagaria	Sabalpur		3.63	3.9	3.6
Khagaria	Sonhauli		1.92	4.37	3.62
Khagaria	Dewri		1.1	1.01	6.9
Khagaria	Mohaddipur		0.65	3.55	3.18
Kishanganj	Bahadurganj B	3.72	2.28	2.58	3.84
Kishanganj	Gunsagar		1.83	2.43	3.25
Kishanganj	Kishanganj		1.96	2.37	3.1
Kishanganj	Bhagalbari		2.54	3.1	4.02
Kishanganj	Kochadhamin		1.58	2.25	3.45
Kishanganj	Kaswa Kaliganj		1.55	2.12	2.45
Kishanganj	Teragachhi		1.8	3.01	3.67
Kishanganj	Thakurganj		2.96	5.85	6.65
Lakhisarai	Dariyapur		1.83	5.44	6.92
Lakhisarai	Barhaiya		1.18	1.81	6.32
Lakhisarai	Kiul_1		1.18	1	1.33
Lakhisarai	Lakhisarai		6.95	8.27	8.78
Lakhisarai	Surajgarha1		0.99	1.12	1.81
Lakhisarai	Arma		1.31	4.19	1.79
Lakhisarai	Kajra		Temp. non-approachable	1.96	2.56
Lakhisarai	Rishi Paharpur		0.69	1.15	5.63
Lakhisarai	Saidpur		2.09	2.83	3.74
Madhepura	Abhiyatola		3.12	3.47	2.9
Madhepura	Chausa1		1.8	2.4	2.6
Madhepura	Ganeshpur		0.69	1.12	2.8
Madhepura	Bhimpura		1.67	2.3	3
Madhepura	Hatkora bazar		1.73	2.04	2.2
Madhepura	Madhepura		3.1	Dry	4.4

District	Location	May 2021	Aug. 2021	Nov. 2021	Jan. 2022
Madhepura	Surajganj		2.13	1.29	2.08
Madhepura	Gaushala Chowk		Temp. non-approachable	2.8	2.8
Madhepura	Murliganj		Temp. non-approachable	2.01	2.46
Madhepura	Rajui Rajni		Temp. non-approachable	2.27	3.09
Madhepura	Rampur		2.09	2.87	5.02
Madhepura	Barahari		2.02	2.44	3.82
Madhepura	Jiwachhapur		2.83	3.08	3.52
Madhepura	Singeswar		2.93	2.87	3.46
Madhepura	Gwalpara			2.1	2.25
Madhepura	Kusthan		2.1	2.59	2.19
Madhepura	Uda Kishanganj		2.87	3.12	1.45
Madhubani	Harri		Could not be located	Could not be located	2
Madhubani	Babubarhi		1.75	Damaged	Damaged
Madhubani	Narar		2.44	1.14	1.05
Madhubani	Dhakjari		2.37	1.86	2.18
Madhubani	Kapasia		1.1	1.05	1.47
Madhubani	Baurahar Chowk		3.5	2.33	3
Madhubani	Harlakhi		2.55	2.21	1.94
Madhubani	Jaynagar		2.12	1.91	2.26
Madhubani	Bideshwar Asthan		4.84	3.44	3.75
Madhubani	Jhanjharpur		0.24	0.6	1.23
Madhubani	Bentadih		2.02	1.22	1.96
Madhubani	Karmauli		Garbage	1.7	2.11
Madhubani	Khajauli		1.05	1.07	1.7
Madhubani	Thantola		2.32	1.98	2.6
Madhubani	Jogiya		Garbage	2.4	2.33
Madhubani	Ambedkar Nagar		2.12	1.16	1.33
Madhubani	Bihari		Garbage	1.21	Garbage
Madhubani	Madhubani		2.73	1.33	1.43
Madhubani	Bhawanipur		5.11	3.6	4.23
Madhubani	Pandaul		Garbage	2.13	3.2
Madhubani	Phulparas1		1.92	1.05	1.22
Madhubani	Shambhuar		3.2	1	2.58
Madhubani	Kapileshwar		1.97	1.83	2.47
Madhubani	Siswar		2.23	2.15	3.2
Madhubani	Karmnali		Could not be located	Could not be located	3.31
Madhubani	Pariharpur		1.07	2.34	2.78
Munger	Bariarpur		0.65	2	4.02
Munger	Singhiyachawk		1.47	2.51	Temp. non-approachabe
Munger	Jamalpur1		7.43		7.85
Munger	Gangta Morh		2.77	4.02	Could not be located
Munger	Gobadda		0.81	1.31	1.42
Munger	Tarapur		2.51	3.38	3.59
Munger	Purabsarai		2.35	7.04	5.69
Munger	Rampur2		0.45	1.43	1.66
Munger	Asarganj		1.22	2.85	3.11
Muzaffarpur	Aurai		Temp. non-approachable	0.63	0.01
Muzaffarpur	Rajkhand		Temp. non-approachable	1.95	2.57
Muzaffarpur	Bhagwanpur Chowk	0.8	0.93	1.01	1.3
Muzaffarpur	Jaffarpur	3.14	1.99	2.6	2.88

District	Location	May 2021	Aug. 2021	Nov. 2021	Jan. 2022
Muzaffarpur	Mahammadpur Balmi		2.16	2.19	2.88
Muzaffarpur	Bochaha	5.15	Water logged	3.27	3.92
Muzaffarpur	Shukrahat	4.65	Water logged	2.26	3.18
Muzaffarpur	Barkurwa	3.52	Water logged	2.57	3.04
Muzaffarpur	Surfuddinpur	3.75	Garbage	3.54	3.1 filled
Muzaffarpur	Muzaffarpur		2.1	1.86	2.05
Muzaffarpur	Katra1	3.78	Water logged	3.02	3.4
Muzaffarpur	Ramnagar	3.14	Water logged	1.57	1.94
Muzaffarpur	Sakri chatti		Partially filled	Partially filled	1.03
Muzaffarpur	Wazitpur		Water logged	2.32	2.53
Muzaffarpur	Gargaliya	3.34	Water logged	2.09	2.63
Muzaffarpur	Digra		0.9	1.1	1.53
Muzaffarpur	Japaha	4.19	1.84	2.75	2.98
Muzaffarpur	Dewaria	2.95	1.96	1.83	2.22
Muzaffarpur	Paro	0.93	0.56	1.7	2.17
Muzaffarpur	Daha Chhapra	1.75	1.1	1.84	2.13
Muzaffarpur	Parwalpatti Barauna	0.61	0.49	1.46	1.65
Muzaffarpur	Rajwara	2.65	Water logged	2.63	3.78
Muzaffarpur	Sahebganj		Water logged	2.07	1.5
Muzaffarpur	Dholi		1.1	3.14	3.85
Muzaffarpur	Mahantmanihari		Water logged	1.66	2.26
Muzaffarpur	Seho			1.81	2.19
Nalanda	Asthwan	2.06	0.74	1	1.4
Nalanda	Jangipur	3.05	0.5	0.8	1.27
Nalanda	Sare	6.07	1.6	1.53	2.53
Nalanda	B Sharif Rly Stn	0.3	0.4	0.8	0.82
Nalanda	Biharsharif	3.3	0.4	1.4	1.93
Nalanda	Maghra	3.44	1.3	2.5	2.55
Nalanda	Muraura	1.63	1	1.45	1.49
Nalanda	Ranabigha	5.83	2.2	2.97	4.1
Nalanda	Sohdh		2.4	3.44	3.48
Nalanda	Chandi	5.07	0.77	2.23	3.28
Nalanda	Nagarnausa		Damaged	2.45	Damaged
Nalanda	Ekangarsarai	3.05	1	2.4	2.68
Nalanda	Parwalpur	2.73	3.2	3.4	3.5
Nalanda	Parwalpur 1	2.5	1.75	3.51	3.55
Nalanda	Giriak	4.13	2.78	Could not be located	4.78
Nalanda	Pawapuri	2.19	2.05	2.52	2.69
Nalanda	Harnaut1	0.7	0.2	1.5	1.5
Nalanda	Hilsa	4.69	0.7	1.25	1.88
Nalanda	Karaiparsurai	2.01	0.9	1.39	1.58
Nalanda	Nischalganj		0.8	1.2	2.15
Nalanda	Ankuri Bazar	6.1	4.1	4.4	6.34
Nalanda	Islampur	1.58	1.4	1.62	1.72
Nalanda	Sherpur	2.07	1.75	1.45	1.85
Nalanda	Daudpur	5.6	2.65	1.6	2.66
Nalanda	Doiya	3.1	1.52	1.35	2.62
Nalanda	Heganpura		2.4	2.27	3.04
Nalanda	Paparnhosa	2.74	1.54	1.7	2.23
Nalanda	Vena	6.21	2.68	3.06	4.46
Nalanda	Bhui	2.31	6.9	4.35	6.14
Nalanda	Kundalpur	5.2	2.7	2.85	3.5

District	Location	May 2021	Aug. 2021	Nov. 2021	Jan. 2022
Nalanda	Nalanda	7.5	7.3	6.27	6.3
Nalanda	Nirpur		2.9	0.7	1.28
Nalanda	Pilkhi	1.17	0.1	0.3	0.6
Nalanda	Rajgir	6.88	4.1	3.71	4.3
Nalanda	Silao	5	2.5	1.1	2.66
Nalanda	Sithaura	0.64	0.96	1.2	1.6
Nalanda	Sarmera	5.85	2.35	1.78	2.8
Nawada	Tungi	3.6	9.32	4.56	4.7
Nawada	Bishunpur		1.69	2.59	2.75
Nawada	Hisua	5.1	3.85	3.99	4.87
Nawada	Roh1	3.8	Flooded	1.8	2.4
Nawada	Kawakol ashram	11	4.9	3.65	4.07
Nawada	Rupau	6.82	1.6	1.49	1.91
Nawada	Khanwa	3.46	2.4	2.68	3.07
Nawada	Garhpar	6.11	3.41	2.77	3.6
Nawada	Gonama	5.64	2.3	Could not be located	3.53
Nawada	Nawada2	9.1	7	5.22	6.26
Nawada	Pakribrawan Pond	6.85	6.3	4.21	4.03
Nawada	Dopata		2.87	Could not be located	2.97
Nawada	Meskaur	1.59	1.04	1.85	2.44
Nawada	Nawabganj	2.72	0.79	1.39	1.42
Nawada	Shahpur Morh	2.59	1	1.99	1.97
Nawada	Warshaliganj	2.46	0.54	Garbage	0.63
W Champaran	Bagaha		1.1	2.7	3.3
W Champaran	Belwa		Water logged	2.25	2.88
W Champaran	Mangalpur		Water logged	2.7	3.3
W Champaran	Chanpatia		0.36	3.65	4.18
W Champaran	Gurwalia		Water logged	2.3	Damaged
W Champaran	Banspur pipra	2.84	Water logged	Damaged	Damaged
W Champaran	Lauria		1.04	2.85	3.01
W Champaran	Shishwania		1.1	2.9	2.95
W Champaran	Korigawa Chowk		0.5	1.5	0.99
W Champaran	Sabuni Pokhra		Garbage	Garbage	3.7
W Champaran	Taulaha		1.46	1.5	2.84
W Champaran	Harnatanr		Temp. non-approachable	Garbage	3.38
W Champaran	Naurangia		Temp. non-approachable	2.8	3.55
W Champaran	Valmikinagar		Temp. non-approachable	2.55	2.65
Patna	Bakhtiarpur	2.89	2.89	4.35	6.17
Patna	Agwanpur			2.42	3.36
Patna	Barh1		0.2	0.92	3.7
Patna	Rajpura			4.1	1.35
Patna	Shahri			0.83	Could not be located
Patna	Amhara	1.17	0.67	1.07	1.57
Patna	Bishambharpur		0.4	0.65	1.1
Patna	Gyaspur Purvatola		0.75	1.25	1.75
Patna	Raghopur		4.25	1.6	3.25
Patna	Bharatpura	0.61	0.83	1.05	0.9
Patna	Dina Bigha_nhs	5.45	0.65	1.65	3.05
Patna	Dulhin Bazar		3.5	Partially filled	Partially filled
Patna	Mariyawa	3.3	1.4	1.7	3.23
Patna	Noniatola	4.98	1.54	2.09	3.44

District	Location	May 2021	Aug. 2021	Nov. 2021	Jan. 2022
Patna	GoptalNHS	1.41	0.5	0.65	1.4
Patna	Khaspur	6.17	2.62	3.25	5.32
Patna	Daniyawan	1.68	0.14	Garbage	1.07
Patna	Fatuha	5.99	1.05	3.29	6.3
Patna	Mokama	0.43	0.43	0.6	Partially filled
Patna	Darbeshpur_NHS	6.04	1.55	2.62	6.35
Patna	Gyaspur	0.73	0.75	1.25	1.75
Patna	Lalbegam	4.22	2.05	3.6	4.15
Patna	Maner	1.38	0.75	2.3	4.25
Patna	Nagwa_nhs	Partially filled	Partially filled	Partially filled	Partially filled
Patna	Maranchi		1.26	1.08	6.95
Patna	Faridpur_nhs	3.12	1.3	1.55	Could not be located
Patna	Snehitola	3.96	1.26	1.76	2.56
Patna	Bali Pakar	1.21	0.98	1.53	Could not be located
Patna	Khazpura_nhs	7.8	4.35	5.4	7.99
Patna	Mithapur_NHS	0.68	0.72	0.12	0.62
Patna	Patna-City	2.46	1.12	2.12	2.67
Patna	Bishambharpur_NHS	2.2	0.4	0.65	1.1
Patna	Etwarpur	1.1	0.9	0.4	2.5
Patna	Hulas Chak	3.5	2	1.23	3.1
Patna	Parsa Bazar_nhs	0.02	0.3	0.67	0.28
Patna	Deokali	5.54	1.97	3.45	Could not be located
Patna	Nima Halt	5.61	3.2	3.4	4.17
E Champaran	Shyampur		Water logged	5.02	4.81
E Champaran	Dumaria		Water logged	2.98	3.41
E Champaran	Radia		Water logged	1.17	1.2
E Champaran	Chakia1	0.64	0.32	1.05	1.17
E Champaran	Uttari Gavandra		Water logged	1.58	Could not be located
E Champaran	Belai		Water logged	1.1	0.86
E Champaran	Chatia		Water logged	3.33	4.07
E Champaran	Chiraiya		Water logged		1.71
E Champaran	Mohabbatpur		Water logged	Partially filled	1.72
E Champaran	Bhakatiy Tola		Water logged	3.23	3.01
E Champaran	Ghorashan		Water logged	1.75	2.05
E Champaran	Murarpur		Water logged	1.92	2.79
E Champaran	Sheoraha		Water logged	Partially Filled	Partially Filled
E Champaran	Dharampur		Water logged	2.49	1.83
E Champaran	Dipau		0.75	2.49	0.67
E Champaran	Rajpur	1.24	Water logged	3.31	0.45
E Champaran	Dubey Tola		Water logged	1.59	1.97
E Champaran	Husaini		1.36	2.14	2.6
E Champaran	Kizerpura		Water logged	2.2	3.05
E Champaran	Lala Chapra	2.83	Water logged	1.57	1.79
E Champaran	Rampur Kajuria		Water logged	2.32	2.75
E Champaran	Lakhwara		Water logged	1.46	1.23
E Champaran	Motihari		1.31	Damaged	Damaged
E Champaran	Chhauradanu		Water logged	2.49	2.88
E Champaran	Bishunpur		Water logged	1.23	1.67
E Champaran	Gobindganj		Water logged	0.71	1.3
E Champaran	Patahi		Water logged	2.2	2.96
E Champaran	Raghunathpur		Water logged	2.26	1.53
E Champaran	Raxaul		Water logged	3.68	3.36
E Champaran	Chhapwa		Water logged	Dry	4.05

District	Location	May 2021	Aug. 2021	Nov. 2021	Jan. 2022
E Champaran	Bairiya Bazar		Water logged	3.23	3.55
E Champaran	Nawada1		Water logged	1.86	2.64
Purnia	Amour		2.45	2.83	4.85
Purnia	Baisi2		2.24	3.51	3.4
Purnia	Chadia			2.95	Damaged
Purnia	Budhia Gola		1.78	3.09	3.65
Purnia	Mangujan		2.68	3.34	4.29
Purnia	Dargaha		3.09	2.65	3.35
Purnia	Amri Kukran E		3.18	3.63	4.24
Purnia	Amri Kukran W		Could not be located	3.75	4.38
Purnia	Banmankhi		1.69	2.35	3.29
Purnia	Dhamdaha		Could not be located	3.52	4.85
Purnia	Kajha		3.65	3.11	2.98
Purnia	Jalalgarh		2.25	2.4	3.86
Purnia	Kasba		4.49	4.58	4.92
Purnia	Khata Hat		1.56	2.72	3.09
Purnia	Barsoni		2.48	3.31	3.73
Purnia	Purnia		2.81	2.15	3
Purnia	Ranipatra		2.48	2.85	3.95
Purnia	Tikapatti Chowk		2.28	3.2	3.83
Rohta	Bikramganj pp		3.41	4.51	5.27
Rohta	Chenari hospita		2	5.11	5.35
Rohta	Maliabagh		2.35	5	5.51
Rohta	Anikut		10.1	Damaged	Damaged
Rohta	Karbindia		3.87	3.57	4.26
Rohta	Dinara1		1.68	4.85	5.35
Rohta	Kochas		1.43	4.12	5.27
Rohta	Nokha in temple		1.32	2.57	3.3
Rohta	Bahaura		1.33	4.32	4.45
Rohta	Ambwalia		Garbage	0.65	0.8
Rohta	Belthari		1.5	3.2	4.28
Rohta	Sirisiyan		1.8	2.03	4.8
Rohta	Jahanabad		6.87	4.45	4.62
Rohta	Rajandih		1	1.97	2.45
Rohta	Nasriganj		3.65	Dry	3.89
Rohta	Auraiya		3.84	7.69	8.78
Rohta	Akbarpur in bdo		8.33	8.96	9.84
Rohta	Sasaram p.o.		Garbage	4.32	4.82
Rohta	Tilothu bustand		7.3	Dry	4.82
Rohta	Amawan		0.35	2.46	3.03
Saharsa	Bangaon		1.4	1.2	3
Saharsa	Basudeva		0.69	1.06	3.86
Saharsa	Chainpur		1.48	1.41	4.55
Saharsa	Kharakuti		3.11	2.4	3.95
Saharsa	Niralatola		Could not be located	2.17	4.1
Saharsa	Panchgachhi		1.87	1.9	3.1
Saharsa	Patodi Bazar		2.1	2.23	1.9
Saharsa	Patodibazar		Temp. non-approachable	2.08	1.93
Saharsa	Potwaha		1.9	1.52	1.17
Saharsa	Saharsa1		2.47	2.23	2.4
Saharsa	Tulsiyahi		1.2	1.57	2.8
Saharsa	Sonbarsaraj1		Temp. non-	3.15	3.94

District	Location	May 2021	Aug. 2021	Nov. 2021	Jan. 2022
			approachable		
Saharsa	Jamunia		2.68	1.9	2.75
Saharsa	Semribaktiarpur		Temp. non-approachable	1.95	1.55
Saharsa	Simri Bakhtiyarpur		3.87	2.38	1.45
Saharsa	Adrahch		1.89	2.2	2.51
Saharsa	Baidnathpur		2.09	2.24	Temp. non-approachabe
Saharsa	Chandaur Purbi		2.34	1.49	1.69
Samastipur	Kalyanpur	2.29	2.04	0.71	1.46
Samastipur	Patapara	4.4	Water logged	0.27	0.75
Samastipur	Singhia Ghat		2.09	2.57	3.8
Samastipur	Dalsinghsarai	1.33	Could not be located	1.62	4.34
Samastipur	Malipur	3.14	2.40	1.26	2
Samastipur	Basudebpur	1.85	2.2	1.01	2.22
Samastipur	Jakhra		2.29	2.28	2.81
Samastipur	Kishanpur2	4.21	Garbage	2.4	3
Samastipur	Madudabad	4.5	2.66	2.46	3.45
Samastipur	Bajidpur	2.51	0.95	1.74	2.87
Samastipur	Kerian		6.27	4.46	4.98
Samastipur	Rosera	5.23	3.32	4.18	5.47
Samastipur	Harpur Aloth		New well	New well	2.91
Samastipur	Sarai Ranjan	3.82	2.18	2.96	1.63
Samastipur	Motipur	5.5	1.85	2.17	2.67
Samastipur	Tajpur1	4.13	Garbage	1.95	2.39
Samastipur	Vikrampur		1.37	1.19	2.9
Samastipur	Dandia Asadpur	4.09	Could not be located	1.86	2.39
Samastipur	Raipur		New well	New well	3.38
Samastipur	Ujiarpur	1.5	1.95	1.54	2.68
Samastipur	Jathmalpur	3.79	Could not be located	4.32	4.67
Samastipur	Kuseya		New well	New well	3.17
Samastipur	Raghunathpur		2.12	2.49	3.28
Saran	Manopali	2.45	Well could not be located	Well could not be located	2.74
Saran	Chhapra	1.26	1.53	1.85	Damaged
Saran	Chirand	3.39	Well could not be located	1.97	3.22
Saran	Daldali Bazar A		0.64	1.59	3.22
Saran	Nagra	2.13	0.7	3.02	1.7
Saran	Taraiya		Water logged	0.82	2.2
Saran	Ammi	3.78	1.73	5.04	2.6
Saran	Bishunpur	1.31	Well could not be located	Well could not be located	2.65
Saran	Ekma	1.83	0.8	1.06	1.85
Saran	Garkha	4.22	Well could not be located	4.57	4.9
Saran	Minapur	0.73	1.39	2.5	1.85
Saran	Bisunpur		1.03	2.67	3.29
Saran	Rampur Kala		Well could not be located	0.04	1.56
Saran	Breja		Well could not be located	Well could not be located	2.82
Saran	Madansath		Well could not be located	Well could not be located	2.92
Saran	Majhanpura		0.31	Well could not be located	5.35
Saran	Manjhi		1.55	1.47	2.28
Saran	Marhaura	1.88	Temp. non-approachable	1.25	2.25

District	Location	May 2021	Aug. 2021	Nov. 2021	Jan. 2022
Saran	Masrakh		Temp. non-approachable	0.99	1.9
Saran	Saguni		Temp. non-approachable	1.88	3.53
Saran	Baleshara	0.2	Temp. non-approachable	Well could not be located	2.5
Saran	Sanghar Tola		0.88	Well could not be located	3.56
Saran	Chausia			Well could not be located	3.98
Saran	Nayagaon		0.23	1.75	3.4
Saran	Sonepur1		0.4	Well could not be located	1.56
Sheikhpura	Ambari	3.47	2.35	2.15	1.7
Sheikhpura	Barbigha	5.93	2.17	2.81	3.35
Sheikhpura	Keoti1	2.98	0.24	0.6	0.77
Sheikhpura	Koeri Bigha	2.68	0.85	1.33	1.48
Sheikhpura	Sherpar		2.22	2.64	3.47
Sheikhpura	Nemdarganj	1.54	1	1.46	1.55
Sheikhpura	Seikhpura		1.11	1.88	2.72
Sheohar	Belsand		1.18	2.27	2.67
Sheohar	Sarbarpur		1.88	1.45	2.35
Sheohar	Purnhaiya Bazar		Garbage	2.86	3.5
Sheohar	Sasaula Khurd		Garbage	2.61	2.6
Sitamarhi	Dheng		2.09	1.84	2.35
Sitamarhi	Bangaon		3.72	1.58	2.3
Sitamarhi	Jagwanabazar		1.07	1.62	2.03
Sitamarhi	Bhpbhana Khaptola	2.1	3.21	1.83	2.31
Sitamarhi	Kodwara Tola	0.94	2.15	1.04	1.32
Sitamarhi	Panaura	1.11	3.05	1.24	1.3
Sitamarhi	Sitamarhi	2.1	2.65	2.35	2.49
Sitamarhi	Sursand	1.46	3.25	2.51	2.2
Sitamarhi	Nanpur		2.92	1.37	Temp. non-approachabe
Sitamarhi	Khairwa		2.48	1.47	2.5
Sitamarhi	Pupri		3.84	1.87	2.12
Sitamarhi	Karahniya Chowk		3.38	1.5	1.55
Sitamarhi	Kushmari		2.07	1.82	2.25
Sitamarhi	Thumba	1.07	1.92	1.14	1.52
Sitamarhi	Bhutahi		1.98	0.75	0.86
Sitamarhi	Dastiya		3.87	1.76	2
Siwan	Andar		Water logged	5.26	5.71
Siwan	Chimanpur		Temp. non-approachable	1.9	2.52
Siwan	Hardia		Temp. non-approachable	1.81	2.61
Siwan	Malmalia Chowk		Temp. non-approachable	2.18	2.83
Siwan	Sarripatti	1.36	Temp. non-approachable	1.5	2.11
Siwan	Darauli		0.49	4.7	Damaged
Siwan	Tarwara	2.35		0.9	Damaged
Siwan	Chitakhal		1.28	2.25	3
Siwan	Deoria		0.49	3.15	3.3
Siwan	Maharajganj		1.28	0.78	2.24
Siwan	Patrehi		Water logged	1.6	2.4
Siwan	Guthani More		0.85	Could not be located	2.65
Siwan	Sadikpur		1.2	1.6	2.25
Siwan	Jamanpura		Water logged	1.42	Damaged
Siwan	Murarpatti	2.07	0.79	1.88	2.72

District	Location	May 2021	Aug. 2021	Nov. 2021	Jan. 2022
Siwan	Bhagar		1.49	2.7	3.94
Supaul	Balua		1.15	Blocked	2.55
Supaul	Bhawanipur1		1.99	2.27	1.39
Supaul	Bhimnagar		0.2	1.4	1.48
Supaul	Birpur		1.12	2.26	2.55
Supaul	Ratanpura1		1.8	1.97	1.4
Supaul	Balua 1		1.89	2.7	1.9
Supaul	Balua Bazar		1.56	1.93	3.15
Supaul	Bhasanpatti		0.91	1.14	2.80
Supaul	Andauli		1.09	1.3	4.1
Supaul	Hardi		Could not be located	2.59	3.18
Supaul	Kario		2.62	2.39	3.73
Supaul	Malhani		1.93	2.42	2.97
Supaul	Malhani New		1.87	1.77	1.52
Supaul	Supaul		2.43	2.1	1.35
Supaul	Thumba		2.32	2.99	2.19
Supaul	Pipra chowk		3.69	2.58	5.1
Supaul	Shyam Nagar		2.1	2.97	1.45
Supaul	Ganpatganj1		1.37	Blocked	2.48
Supaul	Kaithtola		2.68	3.08	2.6
Supaul	Karjain		1.12	Dry	2.4
Supaul	Norha		1.97	2.1	1
Supaul	Parsarma		1.89	2.12	3.45
Supaul	Pratapganj		2.13	2.5	2.85
Supaul	Jadia		Could not be located	2.27	2.4
Supaul	Tribeniganj		2.75	3	1.44
Vaishali	Chak Sikandar		0.22	4.02	3.82
Vaishali	Kachanpur	3.41	1.62	4.18	4.12
Vaishali	Mathura		0.94	2.3	3.73
Vaishali	Baksama	2.28	0.9	1.75	2.05
Vaishali	Bhaluhia		0.92	1.05	1.37
Vaishali	Chandpur Kala	2.11	0.45	1.61	1.7
Vaishali	Garaul	0.74	0.4	0.86	1.21
Vaishali	Garaul Rly Stn		0.53	Could not be located	1.87
Vaishali	Harpur	3.78	0.57	Could not be located	1.75
Vaishali	Nonepur	1.9	0.8	1.5	2.7
Vaishali	Hajipur	5.75	1.85	5.6	5.44
Vaishali	Sahjadpur	4.19	0.61	3.26	4.36
Vaishali	Silautha Bisnupur		1.88	1.65	2.98
Vaishali	Namidh	1.91	0.23	1.3	1.93
Vaishali	Chakiyai	2.68	0.23	1.2	1.61
Vaishali	Kumharkal	3.71	1.05	2.37	2.2
Vaishali	Mahnar	4.77	1.13	2.8	2.78
Vaishali	Mahua1	2.46	1.43	3.5	3.12
Vaishali	Tariya Supaul	1.77	1.2	3.14	2.42
Vaishali	Mushari tola	3.78	Water logged	3.28	3.05
Vaishali	Sahdei Bujurg	3.21	0.23	3.35	2.84
Vaishali	Chintawanpur	2.66	0.6	1.55	2.43
Vaishali	Thukaiya		Could not be located	2.35	1.84
Vaishali	Vaishali High School	1.02	Could not be located	2.62	1.81

**During May 2021 limited areas have been covered by NHS monitoring due to Covid-19 pandamic.*

Anneure-II

Piezometric Head in m bgl

SN	District	Location	May_21	Aug_21	Nov_21	Jan_22
1	Aurangabad	Deo EW	3.25	4.48	Cap Jam	5.8
2	Katihar	Balrampur		3.28	3.95	4.75
3	Patna	Bikram	6.9	2.6	3	4.7
4	Patna	Khagaul EW1	9.08	5.1	5.4	7.2
5	Patna	Maner EW		Tape struck	5.25	Tape struck
6	Patna	Naubatpur	10	5.65	4.7	Cap jam
7	Patna	A N College_EW	6.74	10.65	5.38	5.75
8	Patna	Gandhi Maidan	12.7	9	9.05	2.6
9	Patna	Kankarbagh	11.4	7.6	8.5	11.3
10	Patna	Kumhrar	11.45	7.2	8.2	Tape struck
11	Patna	Anisabad	10.08	6.34	Pz Room locked	8.5
12	Patna	Phulwari Thana	9.87	6.27	6.89	9.17

Annexure III

Major Chemical Parameters of Ground Water Samples of HNS Collected During in Bihar State

SN	District	Block	Location	pH	EC (µs@ 25°C)	TDS	TH as ($CaCO_3$)	Ca^{2+}	Mg^{2+}	Na^{+}	K^{+}	CO_3^{-}	HCO_3^{2-}	Cl^{-}	SO_4^{2-}	NO_3^{-}	F^{-}	PO_4^{3-}	SiO_2
1	Saran	Dighwara	Aami	8.01	372	241.8	115	38	4.86	27	11.2	0	128.1	21.3	30	25	0.26	0	0
2	Saran	Baniapur	Baleshra	8.08	1176	764.4	290	96	12.15	131	4.3	0	292.8	127.8	82	90	0.53	0	0
3	Saran	Ekma	Bishunpur	8.2	650	422.5	170	50	10.94	65	12.8	0	170.8	53.25	53	65	0.38	0	0
4	Saran	Chapra	Chapra	8.19	476	309.4	150	54	3.65	34	12	0	146.4	46.15	4.93	58	0.29	0.09	0
5	Saran	Chapra	Chirand	8.18	642	417.3	190	66	6.08	52	15	0	195.2	81.65	23	30	0.71	0	0
6	Saran	Ekma	Ekma	8.2	461	299.65	120	28	12.15	46	6.95	0	128.1	67.45	14	12	0.53	0	0
7	Saran	Garkha	Garkha	8.19	398	258.7	110	30	8.51	35	7.25	0	115.9	42.6	11	33	0.34	0	0
8	Saran	Baniapur	Manopali	8.12	929	603.85	285	106	23.09	76	12	0	262.3	106.5	37.13	71.18	0.68	0	0
9	Saran	Marhaura	Marhaura	8.14	617	401.05	200	60	12.15	45	11	0	189.1	35.5	94	10.02	0.41	0.32	0
10	Saran	Garkha	Minapur	7.97	1470	955.5	415	136	18.23	121.71	18.3	0	329.4	191.7	95	75.44	0.38	0	0
11	Saran	Jalalpur	Nagra	8.13	511	332.15	170	50	10.94	32	12	0	244	10.65	11.4	31	0.47	0	0
12	Siwan	Bhagwanpur	Malmalia Chowk	8.14	320	208	130	40	7.29	4.69	13.65	0	91.5	24.85	23	30.57	0.63	0	0
13	Siwan	Bhagwanpurhat	Sarripatti	7.87	1805	1173.25	435	150	14.58	182.64	53.65	0	384.3	230.75	168	105	0.21	0	0
14	Siwan	Barharia	Tarwara	8.13	678	440.7	215	72	8.51	52	6.5	0	231.8	74.55	24.3	20.79	0.75	0	0
15	Vaishali	Goraul	Baksama	8.14	404	262.6	145	54	2.43	25	2.1	0	201.3	14.2	4.23	10.78	0.39	0	0
16	Vaishali	Mahnar	Chakiyai	8.16	999	649.35	325	102	17.01	75	8.4	0	250.1	106.5	101	47.22	0.63	0.42	0
17	Vaishali	Goraul	Chandpur Kala	8.17	607	394.55	205	70	7.29	42	6.3	0	244	53.25	17	12.21	0.21	0	0
18	Vaishali	Patedi Belsar	Chintawanpur	8.19	439	285.35	115	34	7.29	41	9.95	0	176.9	28.4	25.5	10.47	0.13	0	0
19	Vaishali	Garaul	Garaul	8.2	693	450.45	220	66	10.94	51	12	0	158.6	124.25	17.02	26	0.87	0	0
20	Vaishali	Vaishali	Hajipur	8.16	556	361.4	205	70	7.29	30	5.5	0	189.1	28.4	35	51.14	0.61	0	0
21	Vaishali	Goraul	Harpur	8.13	560	364	215	64	13.37	29	4.62	0	207.4	21.3	47	42	0.72	0	0
22	Vaishali	Bidupur	Kachanpur	8.16	426	276.9	140	44	7.29	31	6.25	0	225.7	14.2	4.81	9.54	0	0.09	0
23	Vaishali	Mahnar	Kumharkal	8.07	1089	707.85	360	132	7.29	71.28	9.27	0	378.2	46.15	132	14.2	0	0	0
24	Vaishali	Mahnar	Mahnar	8.15	438	284.7	105	32	6.08	46	10.4	0	115.9	24.85	35	65	0	0	0
25	Vaishali	Mahua	Mahua 1	8.14	855	555.75	245	80	10.94	78	10.2	0	146.4	152.65	41	56.69	0	0	0

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26	Vaishali	Bidupur	Mathura	8.12	517	336.05	155	38	14.58	44	6.25	0	176.9	10.65	31	82	0	0	0
27	Vaishali	Patepur	Mushari Tola	8.13	834	542.1	285	108	3.65	58	3.1	0	250.1	49.7	58	97	0	0	0
28	Vaishali	Lalganj	Namidh	8.15	850	552.5	300	110	6.08	53	9.78	0	311.1	71	34.17	44	0	0	0
29	Vaishali	Bhagwanpur	Nonepur	8.14	769	499.85	275	96	8.51	47	5.4	0	274.5	28.4	58	75	0	0	0
30	Vaishali	Sahdei Bujurg	Sahdei Bujurg	8.02	1245	809.25	395	134	14.58	98.49	8.2	0	329.4	74.55	179.5	75	0	0	0
31	Vaishali	Hajipur	Sahjadpur	8.16	565	367.25	200	54	15.8	34	7.52	0	268.4	17.75	5.49	43	0	0	0
32	Vaishali	Mahua	Tariya Supaul	8.19	508	330.2	210	70	8.51	12	11.2	0	140.3	42.6	20.52	67.39	0	0	0
33	Vaishali	Vaishali	Thukaiya	8.12	452	293.8	150	46	8.51	28	10.55	0	158.6	10.65	40	50	0	0	0
34	Vaishali	Vaishali	Vaishali	8.16	661	429.65	210	70	8.51	53	5.7	0	189.1	28.4	82	68	0	0	0
35	Muzaffarpur	Sahebganj	Daha Chapra	8.14	567	368.55	200	72	4.86	34	8.1	0	231.8	10.65	17.62	72	0	0	0
36	Muzaffarpur	Paroo	Dewaria	8.19	798	518.7	340	102	20.66	23	5.7	0	189.1	152.65	17.24	10.38	0	0	0
37	Muzaffarpur	Paroo	Jaffarpur	8.16	384	249.6	125	36	8.51	26	6.85	0	176.9	24.85	2.85	9.45	0	0	0
38	Muzaffarpur	Baruraj	Muhammadpur Balmi	8.14	459	298.35	135	36	10.94	35	13.4	0	146.4	17.75	36	58	0	0	0
39	Muzaffarpur	Paroo	Paroo	7.87	1870	1215.5	540	184	19.44	165	30	0	463.6	220.1	188	59	0	0	0
40	Muzaffarpur	Sahebganj	Parwal Patti Baraun	7.89	1381	897.65	465	158	17.01	95	16	0	500.2	159.75	24.56	43	0	0	0
41	Muzaffarpur	Sahebganj	Rajwara	8.14	630	409.5	220	68	12.15	39	6.65	0	292.8	10.65	46.08	9.48	0	0.12	0
42	E. Champaran	Chakia	Chakia 1	8.12	561	364.65	185	60	8.51	40	5.8	0	189.1	21.3	29	80	0.74	0	0
43	E. Champaran	Kesaria	Lala Chapra	8.13	535	347.75	135	42	7.29	50	18.25	0	140.3	39.05	36	75	0.63	0	0
44	E. Champaran	Kalyanpur	Rajpur	8.16	558	362.7	150	32	17.01	59	17	0	128.1	110.05	27.41	10.15	0.42	0	0
45	Patna	Danapur	Gobhtal	8.08	914	594.1	325	90	24.3	50.63	13.52	0	329.4	71	41.02	39.63	0.19	0	0
46	Patna	Danapur	Khaspur	8.19	356	231.4	125	40	6.08	19.65	1.95	0	176.9	14.2	6.66	2.82	0.19	0	0
47	Patna	Danapur	Darbespur	8.18	434	282.1	175	56	8.51	15.74	2.95	0	231.8	7.1	3.72	1.46	0.61	0	0
48	Patna	Maner	Lalbegum	8.13	444	288.6	175	60	6.08	17.32	1.93	0	213.5	21.3	9.75	5.24	0.24	0	0
49	Patna	Maner	Gyaspur	7.89	1333	866.45	330	86	27.95	134.25	24	0	378.2	181.05	75.58	23.42	0.24	0	0
50	Patna	Maner	Nagwa	8.17	318	206.7	130	46	3.65	9.82	2.01	0	152.5	14.2	9.75	1.03	0.24	0	0
51	Patna	Bhita	Bishambharpur	8.14	310	201.5	135	32	13.37	6.22	1.94	0	134.2	17.75	8.19	0.94	0.36	0	0
52	Patna	Bihta	Amhara	8.14	349	226.85	140	48	4.86	12.42	1.76	0	158.6	17.75	8.54	1.04	0	0	0
53	Patna	Bikram	Mariyawa	8.16	256	166.4	95	32	3.65	12.21	1.46	0	103.7	14.2	5.19	19.9	0	0	0

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54	Patna	Bikram	Din Bigha	8.13	425	276.25	170	56	7.29	14.05	1.18	0	225.7	10.65	2.29	6.89	0.21	0	0
55	Patna	Patna Sadar	Patna-City	8.1	1054	685.1	305	54	41.31	75.63	36.31	0	317.2	120.7	54.13	45.63	0.45	0	0
56	Patna	Fatwa	Fatuha	8.16	507	329.55	170	62	3.65	35.21	2.21	0	189.1	42.6	19.66	20.22	0	0	0
57	Patna	Bakhtiarpur	Bakhtiarpur	8.11	677	440.05	250	24	46.17	33.67	4.63	0	305	46.15	15.46	2.22	0	0	0
58	Patna	Mokama	Mokama	8.17	373	242.45	120	40	4.86	24.13	3.51	0	128.1	28.4	34.13	1.12	0.34	0	0
59	Patna	Naubatpur	Snehitola	8.06	808	525.2	270	68	24.3	55.38	6.77	0	201.3	95.85	51.7	59.51	0	0	0
60	Patna	Mokama	Maranchi	8.01	673	437.45	200	56	14.58	58.46	3.08	0	231.8	60.35	41.26	9.07	0	0	0
61	Patna	Maner	Maner	7.99	687	446.55	270	44	38.88	31.36	2.32	0	176.9	95.85	32.61	27.93	0.09	0	0
62	Patna	Naubatpur	Faridpur	8.05	430	279.5	175	44	15.8	16.29	2.01	0	158.3	53	2.29	1.97	0.16	0	0
63	Patna	Bikram	Noniatola	7.91	954	620.1	340	62	44.96	55.69	5.63	0	317.2	95.85	41.26	39.95	0.31	0	0
64	Patna	Dulhin Bazar	Dulhin Bazar	8.04	689	447.85	260	24	48.6	33.84	7.12	0	219.6	71	31.62	27.71	0.06	0	0
65	Patna	Paliganj	Bharatpura	8.14	719	467.35	195	66	7.29	68.41	6.95	0	323.3	42.6	11.33	19.59	0.81	0	0
66	Patna	Bhita	Bali Pakar	8.11	1524	990.6	500	102	59.54	89.66	45.93	0	506.3	142	75.58	58.93	1.28	2.08	0
67	Patna	Punpun	Deokali	8.16	375	243.75	150	32	17.01	14.63	1.99	0	164.7	21.3	11.23	3.06	0	0	0
68	Patna	Dhanrua	Nima halt	8.17	423	274.95	160	22	25.52	18.22	1.6	0	201.3	21.3	8.19	4.32	0.43	0	0
69	Patna	Patna Sadar	Mithapur	8.09	690	448.5	270	34	44.96	29.84	2.76	0	231.8	92.3	18.57	4.28	0	0	0
70	Patna	Bikram	Andhra Chowki	8.16	355	230.75	155	54	4.86	7.36	1.4	0	164.7	21.3	6.66	3.1	0.48	0	0
71	Patna	Phulwari Sharif	Hulas Chak	8.04	1102	716.3	300	14	64.39	110.28	6.5	0	402.6	117.15	41.23	6.94	0	0	0
72	Patna	Phulwari Sharif	Etwarpur	8.16	536	348.4	210	34	30.38	22.31	3.02	0	164.7	53.25	21.25	29.46	0.18	0	0
73	Patna	Phulwari Sharif	Parsa Bazar	8.15	429	278.85	170	44	14.58	15.98	2.3	0	140.3	46.15	19.89	3.6	0.23	0	0
74	Patna	Patna Sadar	Khazpura	8.07	718	466.7	260	68	21.87	41.1	2.56	0	164.7	71	71.28	58.5	0.23	0	0
75	Patna	Maner	Simri	8.01	481	312.65	190	22	32.81	17.52	1.36	0	128.1	63.9	21.73	21.33	0.1	0	0
76	Patna	Bikram	Bikram	8.03	307	199.55	120	36	7.29	11.23	1.09	0	79.3	24.85	36.26	16.4	0.14	0	0
77	Patna	Patna rural	Kankarbagh	8.03	694	451.1	285	42	43.74	24.02	2.59	0	164.7	120.7	23.31	4.08	0.77	0	0
78	Patna	Patna rural	Kumhrar	8.14	364	236.6	140	34	13.37	14.77	2.91	0	140.3	31.95	16.87	1.76	0.31	0	0
79	Patna	Patna rural	Gandhi maidan	8.04	308	200.2	115	34	15.12	14.63	1.95	0	152.5	10.65	5.17	1.13	0.31	0	0
80	Patna	Patna rural	B N College	8.09	384	249.6	140	38	10.94	21.03	2.41	0	201.3	10.65	3.72	0.8	0	0	0
81	Patna	Patna rural	A N College	7.98	295	191.75	110	22	13.37	14.31	1.15	0	134.2	17.75	8.98	1.05	0	0	0

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82	Patna	Danapur cum Khagaul	Khagaul1	8.07	519	337.35	205	28	32.81	20.12	6.12	0	189.1	46.15	25.58	7.09	0.11	0	0
83	Patna	Phulwari Sharif	Phulwari	8.11	409	265.85	160	26	23.09	17.62	1.56	0	152.5	21.3	36.26	4.22	0.48	0	0
84	Patna	Patna rural	B V College	8.1	512	332.8	195	22	34.02	21.36	2.16	0	122	60.35	54.22	5.08	1.7	0	0
85	Patna	Naubatpur	Naubatpur	8.08	336	218.4	130	32	12.15	14.03	3.68	0	134.2	24.85	14.36	1.29	0	0	0
86	Patna	Patna Sadar	Kurji	8.04	374	243.1	145	28	18.23	15.13	2.31	0	164.7	14.2	18.85	1.69	0.63	0	0
87	Patna	Bhita HQ	Bhita	8.07	845	549.25	320	16	68.04	41.36	4.83	0	219.6	92.3	65.21	35.36	0.48	0	0
88	Patna	Bhita	Arap	8.06	400	260	135	30	14.58	25.07	1.05	0	170.8	24.85	17.36	4.09	0.44	0	0
89	Arwal	Arwal	Dirpal Bigha	7.99	261	169.65	110	32	7.29	8.34	0.98	0	91.5	10.65	25.31	11.71	0.16	0	0
90	Arwal	Arwal	Arwal 1	8.07	283	183.95	85	24	6.08	21.03	0.82	0	85.4	24.85	15.85	17.86	0.23	0	0
91	Arwal	Karpi	Bairbigha	8.04	1184	769.6	260	24	48.6	142.36	12.36	0	347.7	142	61.32	38.64	0.08	0	0
92	Arwal	Arwal	Imamganj	7.98	684	444.6	280	30	49.82	25.13	1.4	0	158.6	113.6	21.36	25.31	0.62	0	0
93	Arwal	Ratni Faridpur	Jhunathi	8.04	411	267.15	160	54	6.08	17.23	1.84	0	164.7	28.4	25.31	3.19	0.24	0	0
94	Arwal	Kurtha	Kurtha bdo	8.09	836	543.4	345	60	47.39	26.12	4.63	0	280.6	110.05	20.41	6.15	0.44	0	0
95	Jehanabad	Modanganj	Kako	8.02	1579	1026.35	420	58	66.83	126.84	65.32	0	597.8	131.35	71.63	42.36	0.6	0	0
96	Jehanabad	Ghoshi	Ghoshi	8.13	532	345.8	225	50	24.3	15.67	0.92	0	195.2	39.05	21.63	22.36	0.6	0	0
97	Jehanabad	Hulasgunj	Hulasganj	7.98	787	511.55	290	38	47.39	41.36	2.12	0	219.6	110.05	35.87	21.51	0.49	0	0
98	Jehanabad	Makhdumpur	Alubikha	8.06	833	541.45	300	40	48.6	49.32	3.02	0	292.8	99.4	16.31	11.63	0.57	0.93	0
99	Jehanabad	Jehanabad	Gaurakhini	8.03	1049	681.85	375	20	78.97	63.2	2.61	0	305	131.35	71.61	13.33	0.45	0	0
100	Jehanabad	Jehanabad	Jahanabad hosp.	8.16	1300	845	465	30	94.77	74.52	11.3	0	353.8	191.7	38.63	57.64	0.28	0	0
101	Gaya	Konch	Konch	8.1	381	247.65	150	46	8.51	14.63	1.77	0	152.5	24.85	11.56	19.34	0.21	0	0
102	Gaya	Tekari	Tekari	8.17	946	614.9	355	60	49.82	48.47	6.92	0	152.5	181.05	35.63	53.52	0.29	0	0
103	Aurangabad	Aurangabad	Aurangabad	8.05	1388	902.2	495	54	87.48	75.31	12.63	0	335.5	230.75	30.36	59.22	0.39	0	0
104	Aurangabad	Daudnagar	Daudnagar	8.11	1133	736.45	425	30	85.05	51.36	18.34	0	280.6	202.35	21.98	31.05	0.48	0	0
105	Aurangabad	Obra	Obra	8.13	360	234	135	38	9.72	15.36	1.3	0	73.2	42.6	22.01	39.29	0.39	0	0
106	Aurangabad	Barun	Barun	8.1	511	332.15	210	26	35.24	19.3	1.63	0	140.3	39.05	49.28	27.86	0.39	0	0
107	Aurangabad	Deo	Deo1	7.91	1013	658.45	355	24	71.69	62.36	9.63	0	396.5	60.35	55.23	36.91	0.84	0	0
108	Aurangabad	Goh	Dhobi Tola_Goh	8.16	544	353.6	180	26	27.95	36.25	1.75	0	225.7	28.4	12.97	31.3	1.79	0	0
109	Aurangabad	Aurangabad	Patrava	8.17	276	179.4	100	22	10.94	15.42	2.58	0	67.1	24.85	23.63	22.55	0.42	0	0

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110	Aurangabad	Rafiganj	Tineri Morh	8.01	947	615.55	270	26	49.82	85.12	9.85	0	268.4	134.9	42.01	18.56	0.63	0	0
111	Patna	Daniyawan	Daniyawan	7.23	480	312	160	26	23.09	35.3	1.1	0	189.1	46.15	13.9	1.03	0.24	0	15.62
112	Nalanda	Neemchak	Ankuri Bazar	8.01	606	393.9	210	16	41.31	38.12	1.26	0	274.5	46.15	5.64	3.73	0.57	0	14.82
113	Nalanda	Asthawan	Asthawan	7.85	1007	654.55	250	12	53.46	107.45	4.97	0	457.5	60.35	30.23	6.1	0.88	0	17.55
114	Nalanda	Bihar Sharif	Bihar Sharif	7.67	1063	690.95	230	22	42.53	124.02	20.63	0	366	110.05	47.76	21.81	0.33	0	16.59
115	Nalanda	Silao	Bhui	8.01	2670	1735.5	890	14	207.76	168.12	41.23	0	695.4	347.9	233.3	29.06	0.36	0	15.1
116	Nalanda	Bihar Sharif	Bihar Sharif	7.53	1468	954.2	300	18	61.97	170.26	35.03	0	427	188.15	86.43	29.46	0.24	0	16.06
117	Nalanda	Chandi	Chandi	7.46	720	468	205	12	42.53	67.33	2.57	0	372.1	17.75	14.44	1.79	0.81	0	16.5
118	Nalanda	Noorsarai	Daudpur	8.13	615	399.75	215	12	44.96	38.3	4.48	0	298.9	28.4	8.9	13.88	0.28	0	15.78
119	Nalanda	Rahui	Doiya	8.06	638	414.7	140	18	23.09	75.63	4.17	0	262.3	35.5	45.36	3.5	0.17	0	15.28
120	Nalanda	Ekangarsarai	Ekangarsarai	7.95	1357	882.05	280	12	60.75	150.26	49.63	0	585.6	60.35	86.43	27.82	0.96	0	14.72
121	Nalanda	Giriak	Giriak	7.5	760	494	285	20	57.11	38.15	3.9	0	372.1	24.85	22.22	19.88	0.39	0	19.02
122	Nalanda	Harnaut	Harnaut 1	7.35	669	434.85	245	18	48.6	36.65	2.45	0	323.3	31.95	10.74	4.1	0.18	0	15.28
123	Nalanda	Hilsa	Hilsa	7.6	847	550.55	305	16	64.39	50.12	6.8	0	372.1	63.9	15.46	5.6	0.29	0	13.02
124	Nalanda	Islampur	Islampur	7.7	599	389.35	160	18	27.95	58.31	4.93	0	317.2	17.75	10.12	1.84	0.3	0	1.2
125	Nalanda	Asthawan	Jangipur	7.97	472	306.8	160	20	26.73	31.25	2.16	0	183	35.5	17.25	21.36	0.03	0	11.56
126	Nalanda	Hilsa	Karaiparsurai	7.62	494	321.1	165	12	32.81	32.17	3.24	0	225.7	28.4	16.58	1.12	0.1	0	16.45
127	Nalanda	Silao	Kundalpur	7.92	926	601.9	140	20	21.87	140.32	11.32	0	481.9	21.3	20.09	8.27	0.54	0	16.85
128	Nalanda	Bihar Sharif	Maghra	7.53	1267	823.55	350	16	75.33	98.63	47.61	0	414.8	131.35	81.25	29.26	0.21	0	13.02
129	Nalanda	Bihar Sharif	Muraura	7.8	1359	883.35	335	20	69.25	135.48	35.71	0	536.8	106.5	54.2	26.57	0.32	0	14.28
130	Nalanda	Rajgir	Nalanda	7.91	1223	794.95	285	14	60.75	140.23	11.7	0	481.9	60.35	108.91	21.3	0.61	0	14.42
131	Nalanda	Ekangarsarai	Nishchalganj	7.62	817	531.05	195	16	37.67	94.12	1.69	0	396.5	31.95	16.92	24.1	0.28	0	15.05
132	Nalanda	Noorsarai	Papanhosa	7.5	723	469.95	230	18	44.96	55.71	5.36	0	311.1	56.8	13.84	0.93	0.33	0	14.82
133	Nalanda	Ekangarsarai	Parwalpur 1	7.96	1577	1025.05	395	50	65.61	150.3	41.28	0	536.8	181.05	62.9	29.4	1.01	0	13.4
134	Nalanda	Giriak	Pawapuri	7.86	741	481.65	210	20	38.88	67.13	5.55	0	341.6	53.25	10.1	4.61	0.73	0	12.53
135	Nalanda	Rajgir	Pilkhi	7.7	1112	722.8	285	44	42.53	108.7	14.23	0	463.6	92.3	35.21	2.86	0.4	0	12.78
136	Nalanda	Rajgir	Rajgir	7.5	825	536.25	315	20	64.39	36.71	9.51	0	305	78.1	25.28	30.28	0.11	0	17.95
137	Nalanda	Bihar Sharif	Ranabigha	7.41	1639	1065.35	440	14	98.42	150.23	32.31	0	414.8	213	136.1	41.02	0.4	0	13.83

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138	Nalanda	Asthawan	Sare	7.7	777	505.05	295	44	44.96	39	3.7	0	323.3	42.6	48.84	4.62	0.2	0	13.51
139	Nalanda	Sarmera	Sarmera	8.12	486	315.9	180	16	34.02	25.36	2.84	0	250.1	17.75	9.95	1.01	0.24	0	18.45
140	Nalanda	Islampur	Sherpur	8.13	552	358.8	190	8	41.31	36.61	1.51	0	292.8	21.3	4.34	0.84	0.81	0	15.84
141	Nalanda	Silao	Silao	7.9	2420	1573	645	42	131.22	224.18	42.36	0	591.7	351.45	165.29	28.72	0.01	0	16.14
142	Nalanda	Rajgir	Sithuara	7.97	497	323.05	205	16	40.1	16.36	1.81	0	256.2	14.2	7.8	9.72	0.21	0	14.52
143	Nalanda	Rahui	Vena	7.73	607	394.55	165	18	29.16	59.52	3.62	0	286.7	31.95	20.12	0.65	0.31	0	15.28
144	Nalanda	Nagarnausa	Nagarnausa	7.55	850	552.5	320	26	61.97	45.3	2.66	0	305	102.95	31.65	3.26	0.15	0	13.33
145	Nawada	Nawada	Mirjapur	7.75	440	286	175	18	31.59	21.65	1.88	0	250.1	14.2	5.65	9.67	0.25	0	13.93
146	Nawada	Nawada	Gonama	7.25	620	403	225	18	43.74	34.5	1.68	0	250.1	56.8	11.34	13.91	0.19	0	15.67
147	Nawada	Hisua	Hisua	7.5	542	352.3	190	26	30.38	32.5	1.66	0	256.2	31.95	11.69	12.72	0.21	0	14.79
148	Nawada	Kawakol	Kawakol ashram	7.73	252	163.8	80	18	8.51	16.29	0.3	0	97.6	24.85	10.95	0.08	0.67	0	9.97
149	Nawada	Narhat	Khanwa	7.55	453	294.45	165	22	26.73	21.6	0.98	0	189.1	35.5	16.58	10.35	0.72	0	14.66
150	Nawada	Meskaur	Meskaur	7.91	804	522.6	330	26	64.39	23.6	13.35	0	408.7	39.05	11.59	0	0.1	0.07	25.65
151	Nawada	Sirdala	Nawabganj	8.16	680	442	195	8	42.53	61.8	2.5	0	378.2	17.75	8	0	1.01	0	14.86
152	Nawada	Nawada	Nawada 2	7.65	505	328.25	205	16	40.1	17.56	2.01	0	250.1	28.4	4.99	5.24	0.11	0	15.59
153	Nawada	Pakribarwan	Pakribarwan	7.65	2180	1417	490	84	68.04	260	1.08	0	445.3	426	54.93	31.5	0.28	0	15.02
154	Nawada	Pakribarwan	Roh	7.95	419	272.35	195	36	25.52	11.5	2.04	0	219.6	28.4	3.75	5.77	0.14	0	16.31
155	Nawada	Kauakol	Rupau	7.99	1980	1287	510	80	75.33	196.5	29.5	0	652.7	227.2	112.8	31.77	0	0	17.28
156	Nawada	Warshaliganj	Shahpur Morh	7.94	490	318.5	140	18	23.09	42.8	1.67	0	256.2	17.75	5.6	0	0.28	0	15.36
157	Nawada	Hisua	Tungi	8.02	580	377	195	32	27.95	35.8	4.18	0	250.1	39.05	18.9	12.65	0.35	0	21.87
158	Nawada	Warshaliganj	Warshaliganj	7.79	439	285.35	165	28	23.09	24.65	1.91	0	213.5	21.3	5.87	7.98	0.19	0	16.71
159	Seikhpura	Barbigha	Ambari	8.16	2500	1625	725	50	145.8	238.5	2.5	0	732	312.4	178.32	31.45	0.93	0	12.63
160	Seikhpura	Barbigha	Barbigha	7.85	1030	669.5	320	20	65.61	76.58	14.11	0	311.1	110.05	82.87	23.49	0.19	0	14.94
161	Seikhpura	Barbigha	Keoti	7.96	683	443.95	260	26	47.39	34.5	2.99	0	189.1	81.65	65.79	9.45	0.06	0	14.81
162	Seikhpura	Barbigha	Koeri Bigha	8.01	870	565.5	255	18	51.03	59.65	31.2	0	286.7	78.1	49.08	26.89	0.18	0	15.1
163	Seikhpura	Seikhpura	Nemdarganj	7.89	743	482.95	245	36	37.67	54.55	4.3	0	359.9	46.15	17.99	0	0.76	0	12.74
164	Seikhpura	Seikhpura	Danibigha	8.15	840	546	255	18	51.03	69.88	0.96	0	396.5	31.95	44.17	0	0.47	0	14.69
165	Seikhpura	Chewara	Chewara	7.79	992	644.8	305	22	60.75	78.5	2.74	0	335.5	117.15	43.2	14.56	0.62	0	14.69

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166	Seikhpura	Ariari	Ariari	8.18	1800	1170	555	48	105.71	155.65	5.8	0	603.9	205.9	101.13	8.69	0.89	0	12.91
167	Gaya	Fatehpur	Baraila More Powa	7.8	2102	1366.3	580	24	126.36	208.65	11.5	0	494.1	429.55	7.01	31.48	0.06	0	15.87
168	Gaya	Gaya	Bitho Sharif	7.21	1890	1228.5	680	38	142.16	95.8	28.1	0	298.9	440.2	50.13	29.35	0.08	0	14.84
169	Gaya	Bodhgaya	Bodhgaya	7.75	463	300.95	185	22	31.59	19.8	4.16	0	189.1	31.95	14.92	22.94	0.15	0	20.43
170	Gaya	Gaya sadar	Chand Chowra Chowk	7.4	1060	689	305	26	58.32	80.54	16.54	0	280.6	127.8	71.7	31.73	0.79	0	20.7
171	Gaya	Fatehpur	Fatehpur	7.92	480	312	145	22	21.87	36.8	0.64	0	122	53.25	41.73	29.48	0.39	0	18.01
172	Gaya	Manpur	Manpur	7.51	1140	741	395	12	88.69	56.44	25.64	0	353.8	134.9	55.65	31.01	0.1	0	15.15
173	Gaya	Gaya sadar	Ram kund	7.35	1204	782.6	405	26	82.62	78.8	14.77	0	292.8	166.85	96.31	32.51	1.4	0	18.47
174	Gaya	Gaya sadar	Sangat gali	7.4	810	526.5	295	26	55.89	50.67	0.73	0	268.4	92.3	38.13	27.88	0.74	0	17.85
175	Gaya	Wazirganj	Wazirganj	8.05	590	383.5	185	24	30.38	37.5	11.35	0	274.5	35.5	15.16	5.32	0.38	0	14.84
176	Bhojpur	Barhara	Bakhorapur	7.34	363	235.95	150	30	18.23	9.45	3.12	0	134.2	24.85	15.36	18.63	0.5	0.63	7.01
177	Bhojpur	Barhara	Balua	7.44	440	286	180	38	20.66	15.23	3.47	0	195.2	14.2	22.01	9.12	0.62	0	5.65
178	Bhojpur	Barhara	Barahara	7.36	712	462.8	255	64	23.09	39.3	5.26	0	183	60.35	82.29	40.67	0.3	0	5.8
179	Bhojpur	Bihiya	Bihiya	7.25	799	519.35	285	40	44.96	41.59	15.14	0	305	42.6	46.92	31.25	0.31	0	5.78
180	Bhojpur	Koilwar	Birampur	7.22	954	620.1	345	42	58.32	51.02	14.23	0	347.7	74.55	65.32	7.63	0.35	0	8.87
181	Bhojpur	Arrah	Chandawa	7.3	634	412.1	205	58	14.58	46.07	1.79	0	298.9	24.85	19.33	15.67	0.43	0	10.97
182	Bhojpur	Barhara	Dhusaria	7.31	1448	941.2	360	42	61.97	135.6	45.36	0	451.4	159.75	87.21	40.23	0.25	0	8.76
183	Bhojpur	Barhara	Ekauna	7.67	434	282.1	165	26	24.3	17.26	6.04	0	189.1	14.2	22.15	17.83	0.3	0.67	7.95
184	Bhojpur	Barhara	Farhda	7.9	281	182.65	105	26	9.72	13.46	1.25	0	122	10.65	11.6	3.94	0.09	0	6.71
185	Bhojpur	Garhani	Garhani	8.03	596	387.4	210	54	18.23	35.23	0.73	0	256.2	21.3	36.53	17.26	0.83	0.66	12.94
186	Bhojpur	Koilwar	Giddha	7.5	1213	788.45	350	54	52.25	100.7	17	0	329.4	177.5	41.23	42.31	0.3	0.54	8.64
187	Bhojpur	Sahar	Guljarpur	7.53	617	401.05	250	34	40.1	24.24	1.16	0	274.5	17.75	28.17	20.63	0.66	0.79	11.11
188	Bhojpur	Udwantnagar	Harnath Kundi	7.3	1240	806	420	24	87.48	67.56	40.2	0	469.7	117.15	41.23	22.56	0.35	0.93	9.68
189	Bhojpur	Jagdishpur	Jagdishpur 1	7.69	744	483.6	195	28	30.38	75.28	7.2	0	195.2	88.75	58.63	21.25	0.48	0	13.02
190	Bhojpur	Barhara	Jagatpur	7.73	536	348.4	205	22	36.45	25.36	1.21	0	237.9	28.4	21.98	6.07	0.72	0.66	9.67
191	Bhojpur	Ara	Jarawarpur Milki	7.53	634	412.1	210	26	35.24	44.38	2.66	0	262.3	49.7	20.83	10.25	0.44	0	12.18
192	Bhojpur	Shahpur	Karnempur	7.09	1673	1087.45	500	34	100.85	125.63	43.68	0	530.7	220.1	50.52	41.03	0.41	0.76	8.09
193	Bhojpur	Udwantnagar	Kasap	7.1	1643	1067.95	495	40	95.99	119.31	42.02	0	518.5	198.8	78.81	35.31	0.67	1.21	8.92

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194	Bhojpur	Sandesh	Kori	7.4	976	634.4	340	40	58.32	60.12	10.33	0	280.6	106.5	68.39	41.23	0.26	1	10.51
195	Bhojpur	Koilwar	Kulharia	7.64	572	371.8	200	38	25.52	35.32	2.47	0	128.1	74.55	68.1	3.56	0.18	0.86	10.59
196	Bhojpur	Koilwar	Lodhipur	7.36	1443	937.95	470	104	51.03	98.36	26.34	0	372.1	191.7	98.32	41.32	0.08	1.09	11.41
197	Bhojpur	Koilwar	Mokhlisa	7.5	608	395.2	235	26	41.31	25.36	7.13	0	231.8	17.75	51.7	30.01	0.31	0	11.65
198	Bhojpur	Koilwar	Muhammadpur	7.53	762	495.3	285	56	35.24	40.2	3.34	0	170.8	102.95	65.63	25.02	0.14	0	14.66
199	Bhojpur	Sandesh	Nasratpur	7.32	1190	773.5	370	48	60.75	78.41	35.02	0	384.3	124.25	64.14	41.23	0.27	1.28	14.84
200	Bhojpur	Koilwar	Pachrukhiya	7.29	1142	742.3	355	48	57.11	80.32	29.87	0	396.5	95.85	67.26	42.36	0.14	0	8.79
201	Bhojpur	Sandesh	Pauna	7.29	1428	928.2	470	34	93.56	84.18	42.38	0	469.7	156.2	71.03	40.36	0.81	0	9.86
202	Bhojpur	Pirro	Pirro	7.28	1453	944.45	435	28	88.69	110.23	39.32	0	445.3	184.6	58.63	39.27	0.58	1.48	10.95
203	Bhojpur	Koilwar	Rajapur Bazar	7.54	447	290.55	170	28	24.3	15.2	6.7	0	152.5	53.25	9.01	10.36	0.21	0	9.52
204	Bhojpur	Sandesh	Sandesh	7.37	1519	987.35	475	66	75.33	109.11	35	0	500.2	163.3	81.3	34.02	0.14	0	14.1
205	Bhojpur	Udwantnagar	Sasaram Chota	7.33	1087	706.55	295	24	57.11	90.12	38.2	0	451.4	63.9	43.48	35.01	0.12	0	9.43
206	Bhojpur	Barhara	Simariya	7.25	1310	851.5	480	44	89.91	65.23	20.12	0	469.7	131.35	61.23	7.17	0.27	0	7.77
207	Bhojpur	Koilwar	Songhata	7.37	666	432.9	260	26	47.39	28.39	2.46	0	335.5	24.85	13.21	7.41	0.35	0	9.4
208	Bhojpur	Udwantnagar	Udwantnagr	7.34	793	515.45	245	18	48.6	61.3	11.32	0	311.1	81.65	7.66	10.35	0.56	0	11.74
209	Buxar	Barhampur	Bagen Bazar	7.83	337	219.05	120	14	20.66	18.23	2.3	0	158.6	14.2	7.66	7.76	0.53	1.45	14.16
210	Buxar	Brahmpur	Brahmpur	7.54	635	412.75	240	36	36.45	28.69	6.84	0	311.1	24.85	10.24	2.65	0.25	1.29	10.08
211	Buxar	Simri	Barka Rajpur	7.25	1304	847.6	425	32	83.83	98.63	8.61	0	542.9	102.95	22.45	38.18	0.13	1.39	9.12
212	Buxar	Buxar	Buxar	7.26	945	614.25	275	46	38.88	81.36	10.63	0	353.8	85.2	48.08	8.69	0.36	1.36	11.65
213	Buxar	Chausa	Chausa	7.21	2380	1547	625	48	122.72	198.64	98.02	0	933.3	188.15	89.26	61.04	0	1.07	11.54
214	Buxar	Buxar	Churamanapur DW	7.4	919	597.35	290	16	60.75	67.32	12.84	0	451.4	21.3	24.11	38.24	0.49	0.94	8.47
215	Buxar	Buxar	Danikutia	7.41	870	565.5	235	12	49.82	84.03	10.57	0	439.2	28.4	23.21	8.19	0.5	0.83	9.84
216	Buxar	Buxar	Dudharchak	7.29	579	376.35	245	20	47.39	15.23	2.69	0	305	14.2	10.79	2.31	0.35	0.72	11.91
217	Buxar	Dumraon	Dumraon	7.38	855	555.75	290	24	55.89	55.71	10.23	0	268.4	74.55	56.3	43.21	0.62	0.68	14.5
218	Buxar	Simri	Dumri	7.37	758	492.7	320	28	60.75	21.3	4.71	0	396.5	28.4	7.53	2.85	0.26	0.77	10.56
219	Buxar	Simri	Durasan	7.43	1130	734.5	340	22	69.25	77.85	32.8	0	317.2	127.8	84.48	37.23	0.2	0	13.14
220	Buxar	Barhampur	Hathilpur	7.67	467	303.55	200	36	26.73	12.36	3.31	0	219.6	14.2	11.56	17.32	0	0	9.67
221	Buxar	Buxar	Jugia Dera	7.66	424	275.6	150	24	21.87	25.88	2.1	0	189.1	14.2	15.55	10.02	0.59	1.41	11.64

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222	Buxar	Simri	Karathar	7.43	625	406.25	275	36	44.96	11.72	2.5	0	305	28.4	15.55	1.85	0.32	1.15	15.93
223	Buxar	Barhampur	Khochariwan	7.46	505	328.25	220	26	37.67	12.62	1.38	0	237.9	21.3	14.17	3.76	0.64	0	14.81
224	Buxar	Buxar	Kritpur	7.47	645	419.25	275	22	53.46	16.96	2.72	0	317.2	24.85	15.55	11.62	0.25	0	15.84
225	Buxar	Simri	Manikpur	7.41	695	451.75	295	38	48.6	19.62	4.3	0	372.1	17.75	8.7	2.9	1.38	0	11.2
226	Buxar	Barhampur	Mharajgunj	7.44	739	480.35	260	22	49.82	40.99	8.96	0	311.1	28.4	26.47	52.08	0.5	0	10.79
227	Buxar	Buxar	Mishravalia	7.16	1769	1149.85	660	42	134.87	78.63	32.26	0	439.2	252.05	124.15	43.52	0.64	0	12.52
228	Buxar	Simri	Neazipur	7.39	779	506.35	295	24	57.11	35.6	6.13	0	402.6	21.3	7.41	21.75	0.37	0	8.24
229	Buxar	Barhampur	Raghunathpur	7.69	929	603.85	325	24	64.39	51.5	12.3	0	231.8	117.15	65.31	38.12	0.55	1.32	9.43
230	Buxar	Rajpur	Rajpur	7.51	1312	852.8	525	40	103.28	50.36	15.78	0	372.1	159.75	85.41	37.33	0.57	1.44	10.86
231	Buxar	Buxar	Ramobariya	7.5	903	586.95	390	28	77.76	24.66	2.47	0	457.5	24.85	18.47	20.56	0.6	2.16	9.43
232	Buxar	Simri	Sohiar	7.34	1419	922.35	440	46	78.97	97.51	41.3	0	463.6	131.35	98.01	42.36	0	1.01	8.97
233	Buxar	Buxar	Thodagaon	7.48	743	482.95	340	28	65.61	12.04	1.48	0	329.4	28.4	31.02	25.42	0.05	1.16	11.56
234	Darbhanga	Baheri 1	Baheri	7.7	436	283.4	90	28	4.86	56.3	2.08	0	231.8	10.65	2.85	0	0.51	0	9.66
235	Darbhanga	Baheri	Bithauli	7.85	392	254.8	100	26	8.51	43.65	2.02	0	207.4	14.2	1.98	0	0.09	0.02	9.46
236	Darbhanga	Darbhanga	Darbhanga	7.95	371	241.15	65	24	1.22	55.78	1.49	0	189.1	17.75	3.69	0	0.35	0.1	7.73
237	Darbhanga	Baheri	Jorja	7.8	567	368.55	200	42	23.09	37.25	1.59	0	305	17.75	1.55	0	0.69	0.17	9.31
238	Darbhanga	Sakri	Sakri 1	7.86	548	356.2	155	40	13.37	52.6	1.67	0	311.1	10.65	1	0	0.68	0.21	10.92
239	Darbhanga	Simri	Simri (Bithauli)	8	428	278.2	120	28	12.15	40.78	1.71	0	244	7.1	3.58	0	0.67	0.31	7.65
240	Samstipur	Vidyapatinagar	Sahit (Bajidpur)	7.72	541	351.65	200	52	17.01	30.52	4.03	0	213.5	28.4	53.41	0.27	0.83	0.42	7.52
241	Samstipur	Kalyanpur	Basudebpur	7.66	582	378.3	250	48	31.59	19.4	3.11	0	286.7	14.2	35.75	0	0.65	0.22	9.76
242	Samstipur	Ujiarpur	Dandia Asadpur	7.78	731	475.15	295	88	18.23	31.85	4.52	0	329.4	31.95	35.19	10.3	0.87	0.11	11.11
243	Samstipur	Jitwarpur	Harpur Aloth	7.89	548	356.2	230	42	30.38	20.5	1.38	0	280.6	17.75	11	2.66	0.75	0.12	7.44
244	Samstipur	Jitwarpur	Jathmal pur	7.63	1446	939.9	510	46	95.99	79.05	29.6	0	390.4	173.95	99.43	58.87	0.77	0.1	5.02
245	Samstipur	Vibhutipur	Kalyanpur	7.9	609	395.85	220	54	21	35.65	3.45	0	317.2	14.2	18.67	4.57	0.92	0.41	9.17
246	Samstipur	Warisnagar	Kishanpur	7.76	1125	731.25	485	34	97.2	45.32	6.66	0	268.4	184.6	100.27	0.73	0.69	0.04	6.34
247	Samstipur	Mohiuddinagar	Madudabad 1	7.7	600	390	245	28	42.53	21.52	8.33	0	256.2	39.05	33.47	8.54	0	0.06	6.72
248	Samstipur	Tajpur Morwa	Motipur	7.75	615	399.75	240	36	36.45	34.88	2.44	0	262.3	31.95	48.08	0	0.78	0.02	9.57
249	Samstipur	Vibhutipur	Patpara	7.74	687	446.55	255	34	41.31	41.65	2.84	0	280.6	28.4	61.54	0	0.71	0.01	10.21

SN	District	Block	Location	pH	EC (µs@ 25°C)	TDS	TH as ($CaCO_3$)	Ca^{2+}	Mg^{2+}	Na^{+}	K^{+}	CO_3^{-}	HCO_3^{2-}	Cl^{-}	SO_4^{2-}	NO_3^{-}	F^{-}	PO_4^{3-}	SiO_2
250	Samstipur	Rosera	Rosera	7.65	1093	710.45	445	46	80.19	41.98	7.25	0	329.4	110.05	109.52	0	0.59	0.02	5.59
251	Samstipur	Sarai Ranjan	Sarai Ranjan	7.98	1047	680.55	375	34	70.47	65.9	2.28	0	317.2	149.1	36.83	0.14	0.85	0.4	7.72
252	Samstipur	Tajpur Morwa	Tajpur	7.73	1963	1275.95	750	254	27.95	103.76	8.05	0	463.6	223.65	196.23	51.55	0.41	0	11.05
253	Samstipur	Ujiarpur	Bhagwanpur Kamla	7.94	908	590.2	370	18	78.97	39.2	2.71	0	262.3	99.4	92.11	0	0.61	0	6.94
254	Sitamarhi	Dumra	Bhupbhairo khaptola	8.1	382	248.3	173.5	44	15.43	9.5	3.9	0	195.2	10.65	8.78	0	0.42	0.08	4.42
255	Sitamarhi	Sitamarhi	Kodwara Tala	8.12	314	204.1	140	52	2.43	11.12	1.85	0	183	10.65	3.23	0	0.22	0.44	4.63
256	Sitamarhi	Sitamarhi	Punaura	8.18	443	287.95	200	68	7.29	12.6	2.1	0	189.1	49.7	5.4	0.73	0.47	0.23	4.01
257	Sitamarhi	Sitamarhi	Sitamarhi	8.16	319	207.35	135	52	1.22	16.55	2.38	0	164.7	10.65	2.18	0	0.4	0.39	2.76
258	Sitamarhi	Sursand	Sursand	8.1	293	190.45	135	46	4.86	7.78	1.78	0	146.4	10.65	6.5	0	0.66	0.44	4.05
259	Sitamarhi	Runi saidpur	Thumba	8.15	279	181.35	125	46	2.43	9.56	1.64	0	128.1	7.1	17.35	0	0.56	0.17	4.32
260	Begusarai	Barauni	Bihat	7.85	750	487.5	280	42	42.53	41.1	7.52	0	256.2	67.45	61.54	2.83	0.29	0.1	7.16
261	Begusarai	Barauni	Begusarai	7.93	507	329.55	215	36	30.38	11.34	3.3	0	225.7	31.95	18.67	0	0	0	0.37
262	Begusarai	Begusarai	Begusarai Fc/ib	7.87	637	414.05	245	42	34.02	31.22	4.72	0	250.1	53.25	40.38	5.89	0	0.33	5.92
263	Begusarai	Begusarai	Hardia	7.84	748	486.2	350	46	57.11	11.56	5.68	0	176.9	99.4	72.2	35.38	0	0.37	3.47
264	Begusarai	Begusarai	Harpur	7.9	791	514.15	295	40	47.39	31.25	9.15	0	128.1	92.3	114.65	39.09	0.01	0.31	1.41
265	Begusarai	Cheria Bariarpur	Manjaul	7.95	1151	748.15	410	40	75.33	69.32	3.21	0	213.5	170.4	100.27	57.9	0.37	0.21	2.43
266	Begusarai	Begusarai	Mohanpur Usrahi	8.1	617	401.05	245	22	46.17	24.55	2.05	0	250.1	46.15	20.01	21.22	0.18	0.15	5.81
267	Begusarai	Teghra	Naya nagar, dularpur	7.96	645	419.25	290	26	54.68	11.22	4.72	0	237.9	49.7	46.08	0.19	0	0.17	2.3
268	Begusarai	Teghra	Teghra	8.01	755	490.75	325	24	64.39	19.25	5	0	231.8	67.45	72.2	4.4	0.06	0.24	2.85
269	Muzaffarpur	Turki	Barkurwa morh	7.75	1770	1150.5	610	170	44.96	118.13	19.86	0	176.9	347.9	196.23	59.03	0.06	0.21	7.1
270	Muzaffarpur	Mushhari	Bhagwanpur chowk	7.95	1077	700.05	370	36	68.04	57.35	20.45	0	256.2	110.05	147.11	6.03	0.7	1.15	7.58
271	Muzaffarpur	Bochaha	Bochaha	8.01	1190	773.5	420	34	81.4	71.95	5.13	0	298.9	131.35	114.65	56.97	0	0.19	3.17
272	Muzaffarpur	Minapur	Garagalia	8.01	443	287.95	195	36	25.52	9.58	5.88	0	189.1	21.3	46.08	3.84	0	0.26	0.8
273	Muzaffarpur	Mushari	Japaha	7.86	1287	836.55	305	24	59.54	28.65	31.56	0	341.6	163.3	75.15	45.32	0.02	0.03	5.71
274	Muzaffarpur	Katra 1	Katra 1	8.1	546	354.9	200	28	31.59	34.87	2.86	0	237.9	42.6	16.06	0.25	0	0.09	0.07
275	Muzaffarpur	Gaighat	Ramnagar	8	480	312	205	20	37.67	17.44	3.75	0	219.6	35.5	4.3	0	0	0.36	2.7
276	Muzaffarpur	Bochaha	Shukrahat	7.93	654	425.1	255	12	54.68	31.25	8.16	0	268.4	42.6	28.61	0	0	0.02	4.85
277	Muzaffarpur	Bochaha	Sarfuddinpur	8	468	304.2	205	28	32.81	15.55	5.32	0	189.1	28.4	30.25	1.98	0	0	5.66

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Annexure IV

District wise percentage of well showing Rise, fall or no significant decline trend (2012-2021) during Pre-Monsoon and Post-Monsoon Season

SN	District	Pre-monsoon (in percent)			Post-monsoon (in percent)		
		Rise	Fall	*No Significant trend*	Rise	Fall	*No Significant trend*
1	Araria	100	0	100	29	0	100
2	Aurangabad	56	44	56	24	44	71
3	Banka	30	70	60	67	70	67
4	Begusarai	86	14	79	96	14	58
5	Bhagalpur	50	50	50	53	50	67
6	Bhojpur	89	11	68	79	11	55
7	Buxar	83	17	67	82	17	36
8	Darbhanga	50	50	83	89	50	78
9	Gaya	57	43	29	78	43	61
10	Gopalganj	36	64	91	71	64	90
11	Jamui	13	88	88	75	88	63
12	Jehanabad	82	18	64	50	18	75
13	Kaimur	33	67	50	50	67	80
14	Katihar	100	0	69	93	0	100
15	Khagaria	56	44	78	87	44	80
16	Kishanganj	67	33	100	25	33	88
17	Lakhisarai	33	67	33	71	67	57
18	Madhepura	86	14	86	73	14	100
19	Madhubani	100	0	63	92	0	76
20	Munger	33	67	17	78	67	67
21	Muzaffarpur	62	38	76	79	38	63
22	Nalanda	70	30	50	53	30	63
23	Nawada	11	89	67	36	89	0
24	E Champaran	50	50	83	54	50	85
25	Patna	37	63	40	54	63	71
26	W Champaran	60	40	80	63	40	93
27	Purnia	43	57	71	53	57	94
28	Rohtas	9	91	55	47	91	74
29	Saharsa	44	56	78	69	56	94
30	Samastipur	92	8	33	88	8	25
31	Saran	63	38	69	81	38	62
32	Seikhpura	50	50	83	71	50	71
33	Sheohar	0	100	0	33	100	0
34	Sitamarhi	90	10	50	94	10	75
35	Siwan	13	88	63	71	88	76
36	Supaul	46	54	92	33	54	100
37	Vaishali	92	8	67	88	8	44

Disclaimer

The Water Level Data has been analysed by using GEMS (**G**round **W**ater **E**stimation and **M**anagement **S**ystem) software. This software is designed to register the value of total depth as water level in case of dry-well. The well may dry by various reasons.

These dry wells sometimes give errortic information. As these wells are not observed in a group to represent an area, these well are kept intact in this report.

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बिहार सरकार
लघु जल संसाधन विभाग,
मुख्यालय अनुश्रवण

संचिका संख्याः–ल0सिं0(मो0) NGT–23/2019 35(मो0) /पटना,दिनांकः–09.1.24

प्रेषक,

ई0 राजेश कुमार,
अधीक्षण अभियंता (मु0),
अनुश्रवण,
लघु जल संसाधन विभाग, पटना।

सेवा में,

मुख्य अभियंता,
(यो0+अनु0+भूगर्भ),
लघु जल संसाधन विभाग, पटना।

विषयः– **NGT में दायर आवेदन O.A No-694/2023 के अन्तर्गत उत्तर प्रतिवेदन तैयार कर दायर करने के संबंध में।**

महाशय,

उपर्युक्त विषयक के संदर्भ में सूचित करना है कि माननीय राष्ट्रीय हरित अधिकरण, नई दिल्ली द्वारा हिन्दुस्तान टाईम समाचार पत्र में "UN predicts ground water level in India will reduce to low by 2023" शीर्षक अन्तर्गत प्रकाशित समाचार के आधार पर स्वतः संज्ञान से आवेदन संख्या O.A No-694/2023 पंजीकृत किया गया है। समाचार पत्र रिर्पोट के अनुसार भारत के गंगा तट के कुछ क्षेत्र, पहले ही भूजल की कमी के चरम विन्दु को पार कर चुका है। यह समाचार भूजल स्तर में गिरावट के संबंध में एक बहुत ही गंभीर चिंता पैदा करता है।

मुद्दे की गंभीरता को देखते हुए अधिकरण 19 राज्यों के जल संसाधन विभाग के साथ–साथ केन्द्रीय भूमिजल प्राधिकरण, जल शक्ति मंत्रालय एवं पर्यावरण एवं जलवायु परिवर्तन मंत्रालय को प्रतिवादी बनाया गया है। सभी प्रतिवादी को अगली तारीख 09.02.2024 से कम से कम एक सप्ताह पहले अपना उत्तर प्रतिवेदन दायर किया जाना है।

निदेशानुसार NGT के उक्त मामलों में उत्तर प्रतिवेदन तैयार कर दायर करने हेतु भवदीय प्राधिकृत है।

अतः अनुरोध है कि विषयांकित मामले में आवश्यक एवं अग्रेत्तर कार्रवाई करना चाहेंगे।

अनु0–यथावत्।

विश्वासभाजन

09/01/2024.

अधीक्षण अभियंता (मु0)
अनुश्रवण
लघु जल संसाधन विभाग, पटना।

ज्ञापांक– 35(मो0) /पटना, दिनांक– 09.1.24

प्रतिलिपिः– अभियंता प्रमुख, लघु जल संसाधन विभाग बिहार, पटना को सूचनार्थ प्रेषित।

09/01/2024.

अधीक्षण अभियंता
मुख्यालय अनुश्रवण
लघु जल संसाधन विभाग, पटना।

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ज्ञापांक– 35(10) /पटना, दिनांक– 09.1.24

प्रतिलिपिः– विशेष सचिव, लघु जल संसाधन विभाग बिहार, पटना को सादर सूचनार्थ ।

09/01/24.

अधीक्षण अभियंता
मुख्यालय अनुश्रवण
लघु जल संसाधन विभाग, पटना।

ज्ञापांक– 35(10) /पटना, दिनांक– 09.1.24

प्रतिलिपिः– अपर मुख्य सचिव, लघु जल संसाधन विभाग बिहार, पटना के आप्त सचिव को सूचनार्थ प्रेषित।

09/01/24.

अधीक्षण अभियंता
मुख्यालय अनुश्रवण
लघु जल संसाधन विभाग, पटना।