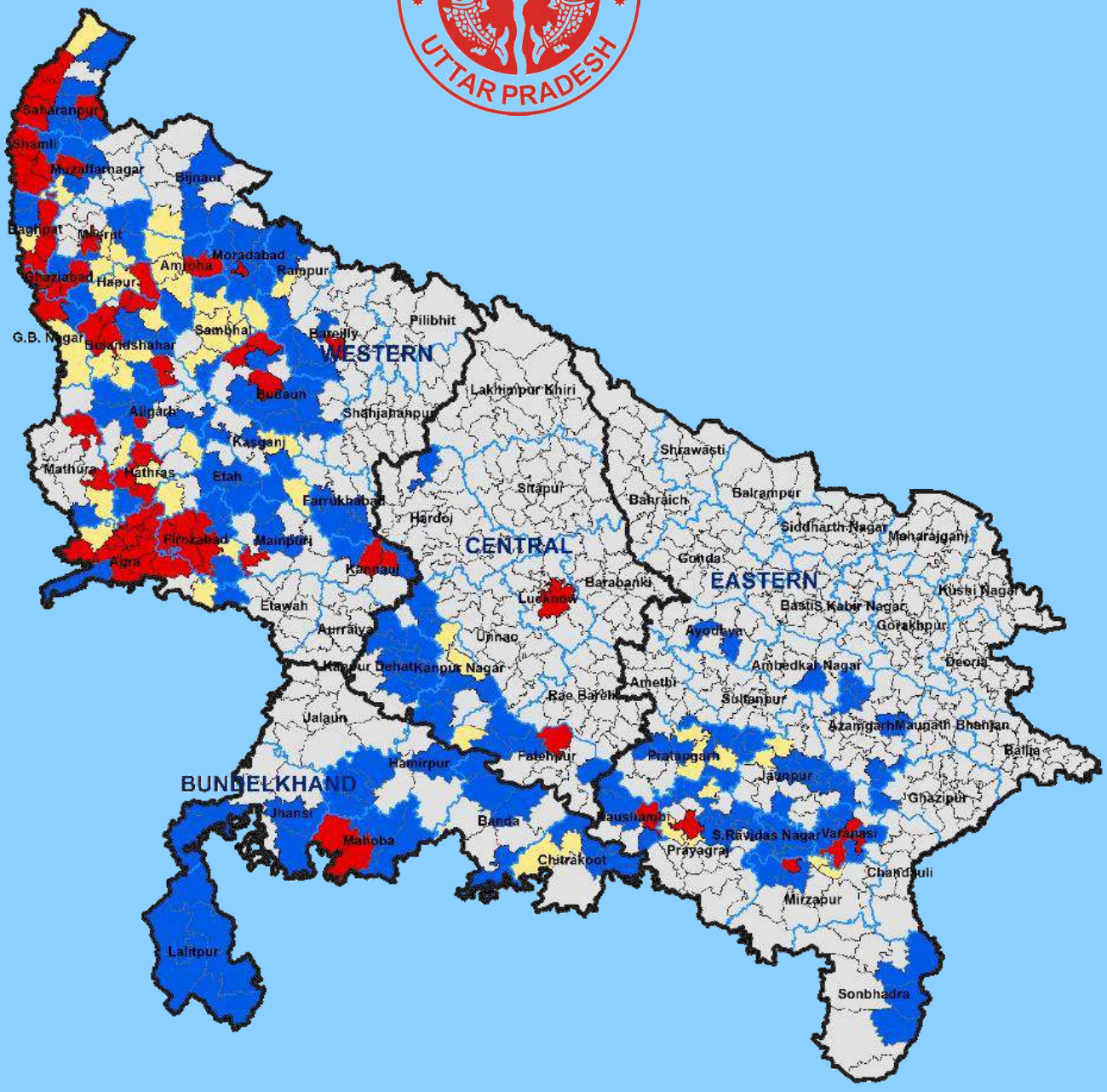
DYNAMIC GROUND WATER RESOURCES OF UTTAR PRADESH

(as on 31 March, 2020)



GROUND WATER DEPARTMENT U.P

AND

CENTRAL GROUND WATER BOARD

Northern Region, Lucknow

LUCKNOW, July – 2021

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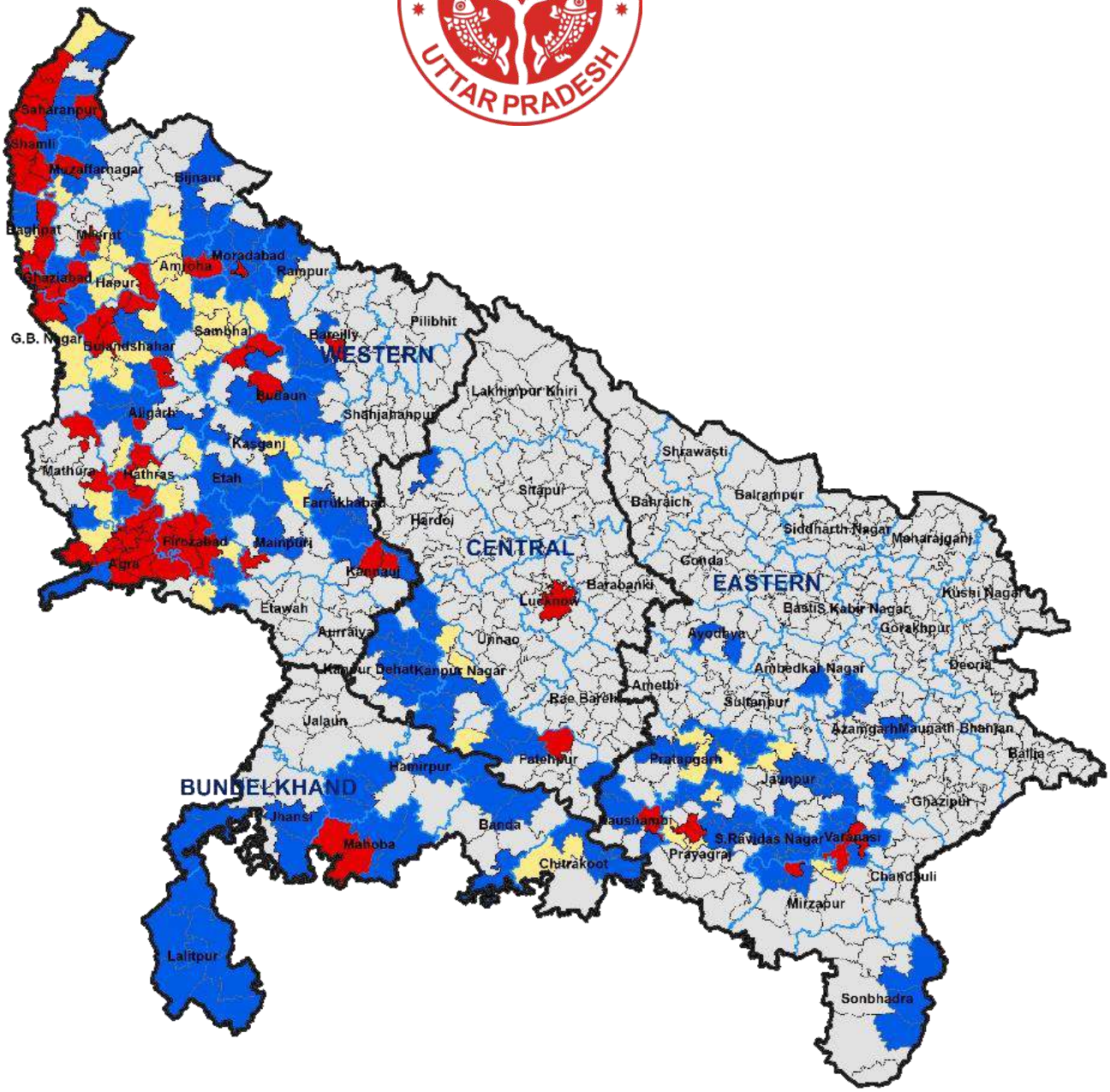
(as on 31 March, 2020)



GROUND WATER DEPARTMENT U.P

AND

CENTRAL GROUND WATER BOARD

Northern Region, Lucknow

LUCKNOW, July – 2021

Anandiben Patel
Governor, Uttar Pradesh

सत्यमेव जयते

Raj Bhavan
Lucknow - 226 027

Date: 21 July 2021

Foreword

Groundwater is a very important natural resource and has a significant role in the economy. It is the main source of water for agricultural, industrial and domestic users. As we aware that more than 85% of irrigation depends directly or indirectly upon groundwater. Thus it plays a very crucial role in the development of the economy as well as food security. Most important point to consider about using groundwater is to find the right balance between withdrawing and recharging to avoid overexploitation and pollution of this vital resource. Water policymakers, users, researchers, and citizens must focus on sustainable management of this invisible water resource and ensure its judicious, efficient and equitable use before it gets polluted or depleted.

Dynamic Ground Water Resources of Uttar Pradesh has been assessed by Ground Water Department, Government, Uttar Pradesh with the objective to identify ground water stressed areas. After identification of ground water stressed areas, groundwater management activities shall be planned at field level.

I am hopeful that this report will be beneficial for all the stakeholders of groundwater in the sustainable use and management of this finite and important resource.

Anandi Patel

(Anandiben Patel)

Telephone : 0522-2236497 Fax : 0522-2239488 Email : hgovup@nic.in Website : www.upgovernor.gov.in

Yogi Adityanath

CHIEF MINISTER
UTTAR PRADESH

No :

Lok Bhawan,
Lucknow - 226001

Date : 21.07.2021

Foreword

I am happy to know that Ground Water Department, Government of Uttar Pradesh has prepared a report 'Dynamic Ground Water Resources of Uttar Pradesh' with the objective of identifying ground water stressed areas. After identification of ground water stressed areas, ground water management activities shall be planned at field level.

The importance of ground water for the existence of human society cannot be overemphasized. Ground water is the major source of drinking water in both urban and rural India. It is one of the most vital and widely used natural resources. It plays very crucial role in the development of states and Uttar Pradesh is no exception.

Non-judicious and un-regulated withdrawal of ground water over the years has resulted in water stressed areas and declining water table especially in Western Uttar Pradesh. Besides, poor ground water quality zones have also been identified in some places of Uttar Pradesh. For the sustainable management of the ground water resources, judicious, efficient and equitable use of ground water resources is very much needed now.

I am sure that this report will be very useful in formulating area efficient ground water management plan and will benefit ground water users, scientific community as well as planners in Uttar Pradesh. I am also hopeful that this report will encourage all ground water professionals to join hands for optimal development of the ground water resources with the objective to conserve water for future generations to come.

My best wishes for the entire endeavour.

(Yogi Adityanath)

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डा. महेन्द्र सिंह
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दिनांक :.....

Foreword

Ground Water, is one of the most widely used natural resources. It has played a pivotal role towards development of Uttar Pradesh state. The unprecedented withdrawal of ground water has resulted in water stressed areas and lowering of the water table and also deterioration of ground water quality at some places particularly in Western Uttar Pradesh. It is essential to seek ways of achieving the most efficient and equitable use of ground water resources at the same time making their use sustainable. Considering how precious this resource is, it is extremely important that it should be well managed and used judiciously.

Dynamic Ground Water Resources of Uttar Pradesh was earlier estimated jointly by Central Ground Water Board, Northern Region and Ground Water Department, Government of Uttar Pradesh in 2004, 2009, 2011, 2013 and 2017. Once again with the combined effort of officers of both department the report on "*Dynamic Ground Water Resources of Uttar Pradesh as on March-2020*" is prepared. The present report shows that out of 836 assessment units, 177 assessment units (177 blocks) are falling under the "Semi-Critical" category, 49 assessment units (48 blocks and 1 urban area) under the "Critical" category and 66 assessment units (57 blocks and 9 urban area) under the "Over exploited" category.

I am confident that this report will be very useful for all users working in the water sector, in formulating area efficient management plan for development of ground water resources in Uttar Pradesh, and will benefit ground water users, scientific community as well as planners in Uttar Pradesh. I am also hopeful that this report will motivate all groundwater professionals to join hands for optimal development of the groundwater resources so as to conserve water for future generations to come.

(Dr. Mahendra Singh)

Anurag Srivastava
I.A.S.

Principal Secretary
Namami Gange & Rural
Water Supply

Lucknow, U.P.

Message

Availability of water, especially groundwater has been crucial for the development activities. Uttar Pradesh though located on a vast reservoir of ground water i.e. Indo-Gangetic plain, has also started experiencing decline in ground water levels and deterioration in its quality due to excessive use in agriculture, industries and domestic life. In the past, there has not been adequate effort for water conservation, efficient use, reuse and recycling of water and Groundwater recharge. This calls for dedicated plans and schemes to manage this scarce resource.

The precise assessment of availability of groundwater, being an invisible source, is critical to plan the future development of the state. The assessment of ground water is a complex task which involves computation and estimation of different parameters associated with the inflow and the outflow of this natural resource in the shallow aquifers that gets annually recharged. The methodology developed is also being refined continuously and currently follows the methodology recommended by the Ground Water Resource Estimation Committee 2015. Ground water assessment is being done periodically by Ground Water Department, Government of Uttar Pradesh in association with Central Ground Water Board, Ministry of Water Resources, River Development and Ganga Rejuvenation.

I hope that this report "Dynamic Ground Water Resources of Uttar Pradesh, 2020" will help users, planners and other stakeholders to prepare and finalize their plans as per latest assessment of ground water resources.

(Anurag Srivastava)

V.K. Upadhyay
Director

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PREFACE

Ground water, the precious natural resource, has played pivotal role in development of India's economy, environment and standard of living. Besides being the primary source of water supply for domestic and industrial uses, it is the single largest and most productive source of irrigation water in Uttar Pradesh. For sustainable ground water management and regulations, periodic assessment of the ground water resources is essential. The GEC 1997 has been the basis of ground water assessment in the country for last two decades. Currently, The Ground Water resource of Uttar Pradesh are assessed through an online portal IN-GRES (India Groundwater Resource Estimation System) following the Ground Water Estimation methodology 2015 which takes care of all the relevant parameters contributing to the net annual Ground Water recharge and extractions for various uses. The database thus generated plays a significant role in Ground Water management and planning. The report "Dynamic Ground Water Resources of Uttar Pradesh as on March, 2020 is jointly prepared by Ground Water Department, Uttar Pradesh and Central Ground Water Board, Northern Region in 836 assessment units (826 blocks and 10 urban areas) under the supervision of State Level Committee (SLC) and overall guidance of Central Level Expert Group (CLEG).

I express my sincere thanks to Sri. Anurag Srivastava, IAS, Principal Secretary, MI & GW Government of U.P and Chairperson of State Level Committee of Ground Water Resources Estimation and committee members for the approval of the report **"Dynamic Ground Water Resources of Uttar Pradesh as on March, 2020".** I want to express my gratitude to Shri Dr. Mahendra Singh, Hon'ble Minister, Jal Shakti, Uttar Pradesh for his constant support. I acknowledge the efforts of Shri Ravikant Singh, Senior Hydrogeologist, Ground Water Department for coordinating the work at state level. I also acknowledge Dr. P.K.Tripathi, Regional Director, Central Ground Water Board, Northern Region, Lucknow and Dr. Vikas Ranjan, Scientist C, Central Ground Water Board, Lucknow who made sincere and dedicated efforts in guiding my officers in the exercise, reconciliation of data and compilation of assessment and finally bringing out this report. I acknowledge all the officers of State Ground Water Department, Government of Uttar Pradesh and Central Ground Water Board, Northern Region who were associated with this extensive exercise.

(V.K. Upadhyay)

P.K. Tripathi
Head of Office

Government of India
Ministry of Jal Shakti
Central Ground Water Board
Northern Region, Bhujal Bhawan
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Preface

Ground water in India is a precious resource to meet irrigation, drinking water and industrial requirements. Increase in population, industries and government's efforts to increase the food grain production by bringing un-irrigated land under irrigation has led to stress on aquifers under unsustainable levels of exploitation. It is likely to lead to decline in ground water levels, deterioration of ground water quality, drying up of wells and diminishing supplies to various uses. It needs to be managed judiciously to ensure its long term sustainability. A proper understanding of the status of availability and utilization of ground water resources is essential for its management. It is in this context that periodic assessment of ground water resources assumes significance.

The report titled 'Dynamic Ground Water Resources of Uttar Pradesh-2020' is a compilation of block and city-wise dynamic ground water assessment, carried out jointly by Central Ground Water Board, Northern Region, Lucknow and Ground Water Department U.P. under the supervision of State Level Committee, under overall guidance of Central Level Expert Group. The dynamic ground water resources of Uttar Pradesh is assessed following the Groundwater Estimation Methodology, 2015 (GEC–2015), which takes into account all the relevant parameters contributing to ground water recharge and extraction. For the first time, all computations for the assessment of ground water resources have been automated and done in a GIS environment through a web based application namely "INDIA GROUND WATER RESOURCE ESTIMATION SYSTEM (IN-GRES)". This application provides a common and standardized platform for the assessment of dynamic Ground Water Resource for the entire state. The database thus generated will have a significant role in planning and scientific management of ground water.

I express my sincere gratitude to Sh. Anurag Srivastava, IAS, Principal Secretary, Namami Gange & Rural Water Supply, Govt. of UP as Chairperson of State Level Committee for timely completion and approval of the report for Uttar Pradesh State. I also acknowledge Sh. V.K. Upadhyay, Director, Ground Water Department, UP for his dedicated efforts towards fulfillment of the assessment. I wish to place on record my appreciation of the untiring efforts of Sh. Ravikant Singh, Senior Hydrologist, UPGWD, Dr. Vikas Ranjan, Scientist-C, CGWA, New Delhi, Sh Sujatro Ray Chowdhuri, Scientist-B, CGWB, NR, Lucknow and their whole team of CGWB and UPGWD.

(P.K. Tripathi)
Head of Office

DYNAMIC GROUNDWATER RESOURCES OF UTTAR PRADESH (As on March, 2020)

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ABBREVIATIONS

BCM, bcm	Billion cubic meter
C	Command
CGWB	Central Ground Water Board
Cm	Centimetre
GEC-1984	Ground Water Estimation Committee, 1984
GEC-1997	Ground Water Resources Estimation Committee, 1997
GEC-2015	Ground Water Resources Estimation Committee, 2015
Ham	Hectare Meter
IMD	India Meteorological Department
lps	Litres per second
m	Meter
m bgl	Meter below ground level
m ham	Million-hectare meter
mm	Millimeter
DOWR	Department of Water Resources, River Development and Ganga Rejuvenation,
RD & GR	Government of India
NABARD	National Bank for Agriculture and Rural Development
NC	Non-command
MW	Monitoring Well
OW	Open Well, Dug Well
P.S.	Private Tubewell Shallow
P.T.W (deep)	Private Tubewell
GWD	Ground Water Department
S. T.W	State Tubewell
Sq.m	Square meter

DYNAMIC GROUNDWATER RESOURCES OF UTTAR PRADESH
(As on March, 2020)

AT A GLANCE

UTTAR PRADESH (2020)		(in Bcm)
Ground Water Recharge	Recharge from rainfall	39.05
	Recharge from other sources	33.15
	Total Annual Ground Water Recharge	72.20
Total Natural Discharges		5.32
Annual Extractable Ground Water Resource		66.88
Current Annual Ground Water Extraction	Irrigation	41.29
	Domestic	4.74
	Total	46.03
Annual GW Allocation for Domestic Use as on 2025		5.38
Net Ground Water Availability for future use		21.53
Stage of Ground Water Extraction (%)		68.83%

CATEGORIZATION (2020)	UTTAR PRADESH
Total No. of Assessed Units	836
Safe	544
Semi-Critical	177
Critical	49
Over-Exploited	66

Note: 10 Urban cities (more than 10 lakh population) are also included in the Assessment Units

EXECUTIVE SUMMARY

Uttar Pradesh occupies Upper and Middle Ganga Plain and is confined between Himalaya in the north, plateau region of Bundelkhand in the South, the river Yamuna forming western limit. The state is surrounded by states of Uttarakhand & Nepal in the north, Madhya Pradesh & Rajasthan in the south, Bihar & Jharkhand in the cast and Haryana and Delhi in the west. The state lies between North latitude 23°52'12" & 30°24'30" and East longitude 77°05'38" & 84°38'30" covering an area of 2, 41,710 sq km. Administratively the state has been divided into 18 divisions, 75 districts, 340 tehsils and 826 blocks. State is also divided into four economic regions i.e. Western Region, Eastern Region, Central Region and Bundelkhand Region. The Western Region comprises of 30 districts and the Eastern Region 28 districts. Ten districts constitute the Central Region whereas the Bundelkhand Region has only 7 districts. The total population of the state (census report, 2011) is 199.58 million out of which the males are 104.60 million and females are 94.99 million. The urban population is 39.9 million and rural is 159.7 million. The decadal growth from 2001-2011 was 20.8%. The population density is highest in Kanpur City followed by Lucknow and Ghaziabad. The average population density is 828 per square Kilometer. Agriculture is the main stay of the people of Uttar Pradesh State. About 67% of the population is rural and dependent on agricultural production for their livelihood with farm income accounting for more than 20% of the income of rural households.

The State experiences a sub-humid and tropical climate with three distinct seasons namely summer, monsoon & winter. The rainy season commences by late June when south western monsoon sets in over the State. The humidity gradually increases and reaches above 80%. August is the peak rainy season. The bulk of annual rainfall about 85% occurs during monsoon period (June to September). The normal rainfall of the State is 952 mm and the average annual rainfall for the year 2020 is 735.5 mm.

The larger part of the State is underlain by soft rocks of fluvial sediments laid down in the fore deep between Plateau region in south and Himalayas in north during the Quaternary period by the Indus-Ganga system of drainage over the Precambrian topography existing during geological past. These deposits owe their origin to riverine activity. The southern part of the State has entirely different geological conditions being underlain by hard rock of Precambrian

formations under a thin alluvial cover. The State can be divided into two hydrogeological formations shown as Unconsolidated soft rock and Consolidated hard rock.

The GEC 1997 has been the basis of ground water assessment in the country for last two decades. Ground Water Estimation Committee revised its methodology in the year 2015. The Committee suggested the modified methodology for computation of ground water resource estimation, which was refined on the basis of studies of State Government agencies and CGWB. This revised methodology is known as GEC-2015. The recommendation of National Water policy 2012 and the changes in the GEC-15, Central Ground Water Board (CGWB) and Ground Water Department, Government of U.P. has jointly estimated Dynamic Ground Water Resources of Uttar Pradesh in 836 assessment units (826 blocks and 10 Urban area) for the base year 2019-20 (As on March-2020).

Total recharge from Rainfall in the state is of the order of 3905130.69 Ham with Lakhimpur district having the highest recharge of 134549.73 Ham and Mahoba district has minimum recharge of the order of 9639.68 Ham. Component of recharge from other sources is highest in Barabanki district (129168 ham) where maximum canal irrigation facility is available. Lowest value of recharge from other source is recorded in Sonbhadra (8479.76 ham) and Sambhal (8787.36ham) where use of ground water as well surface water for irrigation purpose is very low. Total recharge from rainfall is 3905130.69ham) whereas from other sources is 3312561.32 ham.

Total annual recharge from all sources in the State is of the order of 7219940 Ham, with Sitapur district having the highest recharge of 224591 ham and Mahoba district has minimum recharge of the order of 21472 ham.

Total unaccounted natural discharge in the State is of the order of 531696 ham with Sitapur district having the highest discharge of 18030 ham and Mahoba with lowest of 1,388 ham. The Annual Extractable Ground Water Resources in the state is 6688244 ham with Sitapur district having the highest net ground water availability of 206561 ham and Sonbhadra with lowest of 23373 ham.

Total extraction of ground water for all uses in state is calculated as 4603205.95 Ham. The maximum ground water withdrawal for all uses is 138676.25 ham in Bulandshahar district and minimum extraction of ground water for all uses is 15115.34 ham in Sonbhadra district at eastern part of Uttar Pradesh. Comparison of ground water extraction for various uses reveals that extraction for irrigation accounts for almost 90 % of total ground water extraction, whereas

extraction for domestic & industrial supply accounts for meager 10% of the total ground water extraction in the state.

After successful upload of data on the online portal of IN-GRES (India Groundwater Resource Estimation System) and computation based on GEC 2015 methodology, 544 blocks are Safe, 177 blocks are falling in semi-critical category, 49 assessment units in critical category and 66 assessment unit of the state are categorized as over-exploited. The ground water resources of the individual block /assessment unit show wide variation in the resource available and stage of ground water extraction. In Uttar Pradesh, the ground water extraction concentrates mainly in the Western Uttar Pradesh, Bundelkhand Region and south eastern part of the of the State. The stage of ground water extraction of the State is 68.83%.

DYNAMIC GROUND WATER RESOURCES OF UTTAR PRADESH (As on March, 2020)

1. INTRODUCTION

1.1 Background

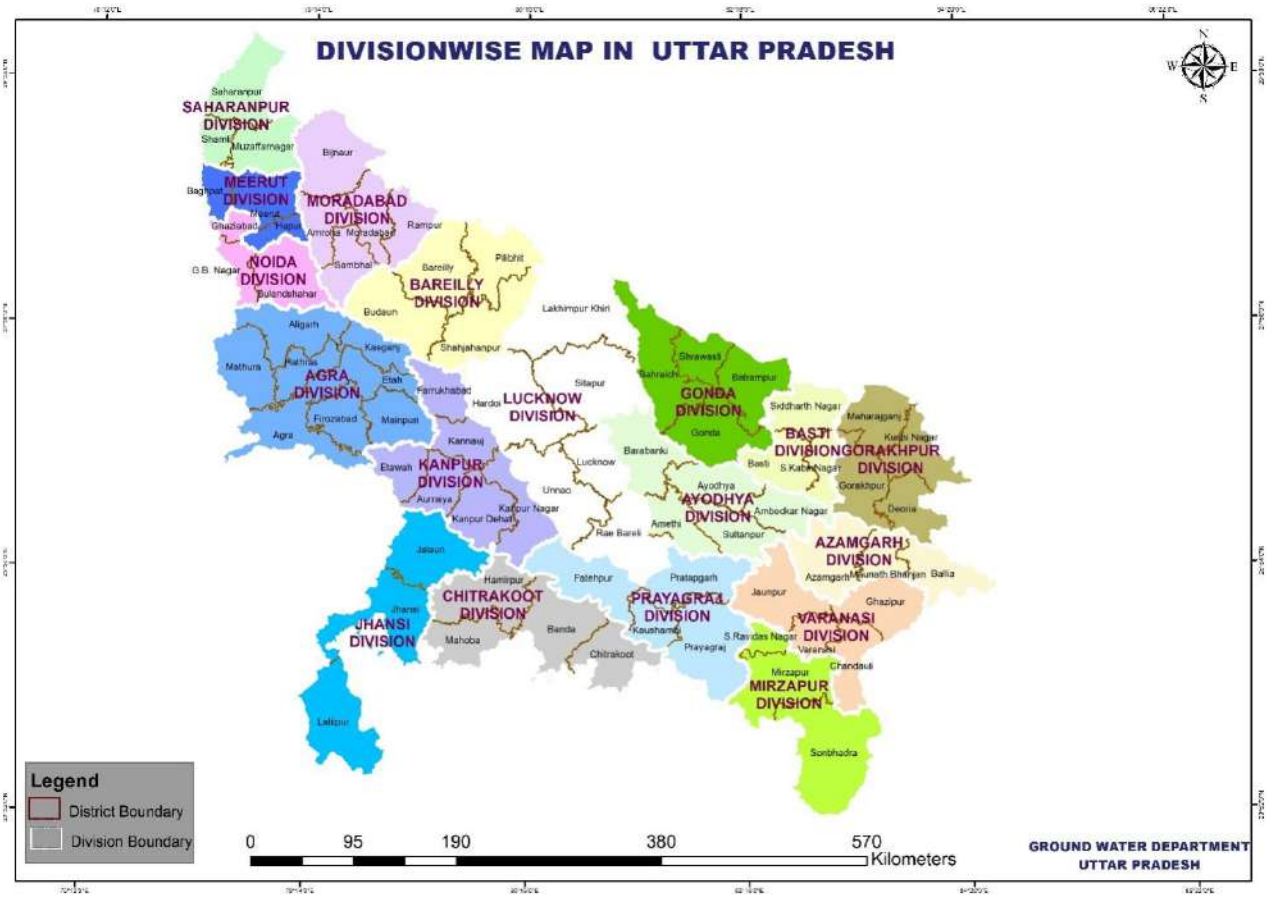
Uttar Pradesh occupies upper and middle Ganga Plain and is confined between Himalaya in the north, plateau region of Bundelkhand in the South, the river Yamuna forming western limit. The state is surrounded by states of Uttarakhand & Nepal in the north, Madhya Pradesh & Rajasthan in the south, Bihar & Jharkhand in the east and Haryana and Delhi in the west (Fig.-1). The state lies between North latitude 23°52'12" & 30°24'30" and East longitude 77°05'38" & 84°38'30" covering an area of 2,41,710 sq km. It is well connected by Air, Railway and Road network to all metros in the country. The district and tehsil headquarter are well connected by state highways. Administratively the state has been divided into 18 divisions, 75 districts, 340 tehsils and 826 blocks. The total number of villages is 55,903 (as per census 2011) out of which 52,117 habited. The total number of Gram Panchayat are 1,06,774 (sources Directorate of Economics and Statistics Government of Uttar Pradesh). State is also divided into four economic regions i.e. Western Region, Eastern Region, Central Region and Bundelkhand Region. The Western Region comprises of 30 districts and the Eastern Region 28 districts. Ten districts constitute the Central Region whereas the Bundelkhand Region has only 7 districts.

The total population of the state (census report, 2011) is 199.58 million out of which the males are 104.60 million and females are 94.99 million. The urban population is 39.9 million and rural is 159.7 million. A review of decadal population growth indicates regular increase after year 1921. The population growth is rather alarming. The decadal growth from 2001-2011 was 20.8%. The population density is highest in Kanpur City followed by Lucknow and Ghaziabad. The average population density is 828 per square Kilometer. The minimum density is in Lalitpur.

Agriculture is the mainstay of the people of Uttar Pradesh State. About 67% of the population is rural and dependent on agricultural production for their livelihood with farm income accounting for more than 20% of the income of rural households. To feed the growing population, requirement of food and water naturally has increased manifolds. Water is essential for irrigation purposes, but its indiscriminate use can lead not only to shortages, but also to the deterioration of crop yields and soils. Ground water resource of a region is one of the building

blocks for balanced economic development of the area, especially in an agriculture based society. Dependence on ground water for irrigation and increasing water requirements in urban areas in State has necessitated judicious and planned uses of ground water resources in order to reach sustainability. Also due to industrialization, urbanization and modern farming practices, freshness of ground water is also at stake. The food production in U.P. is commensurate with the self-sufficiency of the country. One of the major contributors for this sufficiency is irrigation. To meet this high irrigational requirement, water resources are being increasingly developed. Ground water contributes to about 77% of the irrigation needs of the State. The indiscriminate development of ground water has resulted in depletion of groundwater storage and lowering of water table in certain areas on one hand. On other side the surface water development in areas having shallow water table area has resulted water logging and oil salination. The unscientific development and utilisation of the ground water resource as also led to serious problems of water logging and soil salination in many parts of the state which has forced the planners for conjunctive use of both surface and ground resources.

For better planning and management of ground water resources, Central Ground Water Board (CGWB) and Ground Water Department (GWD), Government of U.P. has jointly estimated Dynamic Ground Water Resources of Uttar Pradesh in 836 assessment units (826 blocks and 10 Urban area) as per GEC-2015 methodology recommended by the Ground Water Estimation Committee constituted by Government of India. The Present report quantifies the Dynamic Ground Water Resources of Uttar Pradesh State for the base year 2019-20 (As on March-2020).



ADMINSTRATIVE DIVISION OF UTTAR PRADESH (Fig. 1)

1.2 Constitution of State Level Technical Committee for Ground Water Resource Estimation

Ground Water Resources Estimation of the country was done for the first time in the year 1979. A committee known as Ground Water Exploitation Committee was constituted by Agriculture Refinance and Development Corporation (ARDC) of Government of India. Based on the methodology and norms recommended by the above committee ground water resources were assessed. Subsequently, necessity was felt to refine the methodologies and the "Ground Water Estimation Committee (GEC)" headed by the Chairman, CGWB came into existence. Based on the detailed Surveys and Studies carried out by the different Regions and under Projects of CGWB, the committee recommended the revised methodology in 1982 (GEC-84) for estimation of ground water resources. In 1996, Government of India again constituted "Ground Water Estimation Committee" (GEC) with the members taken from various organizations engaged in hydrogeological studies and ground water development. This Committee, after reviewing the data collected by central and state agencies, research organisations, universities, etc. recommended the methods for ground water resource estimation in 1997. The popularly known as GEC 1997 has been the basis of ground water

assessment in the country for last two decades. This methodology was in vogue for the assessment till the Dynamic Ground Water Resources -2013.

The Dynamic Ground Water Resources of all the 803 assessments units of Uttar Pradesh were assessed based on GEC-97 methodology by Central Ground Water Board, Northern Region, Lucknow and Ground Department, Uttar Pradesh in 2004. Later, the estimation was done in the year 2008/09, 2010/11& 2012/13 in 820 blocks. After approval by the State Level Technical Committee and the recommendations of the standing Committee on R&D Advisory Committee, New Delhi final reports were released as on March 2004, 2009, 2011 and 2013. After reviewing methodology as recommended by the GEC 1997, both on its merits and limitations, Ground Water Estimation Committee revised its methodology in the year 2015. The Committee suggested the modified methodology for computation of ground water resource estimation, which was refined on the basis of studies of State Government agencies and CGWB. This revised methodology is known as GEC-2015

The recommendation of National Water policy 2012 and the changes in the GEC 15, Dynamic Ground Water Resources of Uttar Pradesh for the base year 2019-20 has been presently estimated in 836 assessment units (826 blocks and 10 Urban area).

The last assessment of state-wise annual ground water recharge for the entire country has been made as on 31stMarch 2017 based on the methodology finalized by Ground Water Resources Estimation Committee (GEC) 2015. Since then there have been changes in ground water scenario in many places of the country and accordingly, a Central Level Expert Group (CLEG) is constituted for over-all supervision of the re assessment of ground water resources (as on 31 March 2020) in the entire country. Also, a State Level Committee under the Chairmanship of the Principal Secretary, Minor Irrigation and Ground Water Department, Government of U.P for Dynamic Ground Water Resource Estimation 2020 has been constituted vide office memorandum of Minor Irrigation and Ground Water Division-1 Govt. of Uttar Pradesh issued under letter No.763/76-3-2020-04R/2009 dated- 03-09-2020 to monitor the overall assessment and progress (Annexure-la & b).

1.3 Proceedings of the Ground Water Resource Estimation Committee

The 1st meeting of State LevelCommittee of the Ground Water Resource Estimation was held on 14-10-2020under the chairmanship of the Principal Secretary, Namami Gange & Drinking Water Supply, Government of UP in the Conference Room of State Drinking Water & Sanitation Mission, UP Jal Nigam premises to discuss the working plan of task. It was decided in the meeting to provide all the data related to ground water assessment using GEC-

2015 till 31-03-2020 after validation of data and thereby preparation of draft report by the divisions of the Ground Water Department (Annexure Ila).

A Meeting was held between CGWB and GWD on 25.01.2021 to discuss the status of Estimation of GW Resources as on 31.03.2020 in the chamber of the Director, GWD, UP. There was a discussion regarding the challenges faced in the completion of the exercise of GW Resource Estimation, 2020. Shri V K Upadhyay, Director, GWD, UP, Shri PK Tripathi, Regional Director (I/C), CGWB, NR, Lucknow, Dr Vikas Ranjan, Scientist-C, CGWB (Northern Region), Lucknow, Shri Sujatro Ray Chowdhari, Scientist-B, CGWB (Northern Region), Lucknow, Shri Ravikant Singh, Senior Hydrogeologist, GWD UP, Shri Awadhesh Kumar, Executive Engineer(Civil), GWD UP and officers of GWD UP were present in the meeting. Discussions were held on various aspects, particularly in the light of reconstitution of blocks and automation of estimation exercise through IN-GRES Software developed by IIT, Hyderabad with Technical Partner, M/s Vassar Labs.

The 2nd meeting of State LevelCommittee was convened on 30.03.2021 through online mode duly following all COVID 19 precautions in the chamber of Principal Secretary, Namami Gange and rural water supply, which was attended by officers from Ground Water Department and Central Ground Water Board, Northern Region. Shri V. K. Upadhyay, Director, GWD, UP informed that for the first time, the Resource Estimation was being conducted in a fully online mode through IN-GRES Software developed by IIT, Hyderabad with Technical Partner, M/s Vassar Labs which adopts GEC-15 methodology in the assessment of Ground Water Resources of Uttar Pradesh as on 31st March-2020.

It was also conveyed that the resource estimation for all 826 blocks were complete and successfully uploaded on the portal. Also, approval was given to the categorization of the 6 newly created blocks, analysis of which was conducted manually.

The Principal Secretary desired and directed to make available and share the data to all concerned departments of state using ground water resources, all Commissioners, District Magistrates, District Development Officers and all concerned department at district level involved ground water activities so that they could incorporate in their planning for ground water related propjets. If data is available on website then link or website (www.upgwd.gov.in, www.cgwb.gov.in, www.india wris.nrse.gov.in) should be known to all concerned departments. After detailed discussions and deliberations, the "Dynamic Ground Water Resources of Uttar Pradesh as on March 2020" was approved by State Level Committee (Annexure-II d) on 30.03.2021 and forwarded to Central Level Expert Group (CLEG) New Delhi. The report was finally approved by Ministry of Jal Shakti, Govt of India on 18th June 2021.

2. HYDROGEOLOGY

2.1 Hydrometeorology

The State experiences a sub-humid and tropical climate with three distinct seasons: summer, monsoon & winter. The intervening periods are transitional period on the basis of IMD long term normal data. The summer is hot and dry with maximum daily temperature ranging between 38°C. to 43°C. There is large variation in temperature both in time and space. The lowest temperature is observed during January when night temperature ranges between 2°C & 6°C over the state. With the start of summer, the temperature starts rising with maximum during May when the mercury may touch 45°C in central and eastern parts of the State. Gradually with the beginning of rainy season the temperature drops which again shows a mild rising trend during the intervening period before winter (October, November). The wind speed varies between 8-10 km/hr during summer season and 4-6 km/hr during winter and rainy seasons. The Normal annual potential Evapotranspiration of state is 1491.5 mm. The Normal annual potential Evapotranspiration of Eastern part is 1484.0 mm and of Western part is 1499.0 mm Normal Potential Evapotranspiration is highest in the month of May with value of 217.8 mm followed by June with value of 201.6 mm. The normal potential Evapotranspiration is lowest in the month of December with value of 50.7 mm followed by January with value of 55.6 mm. The humidity during this season is lowest ranging between 30% to 53% at 08.30 hrs and 18% to 42% at 17.30 hrs. Summer seasons ends by May and transition period starts.

The rainy season commences by late June when south western monsoon sets in over the State. The humidity gradually increases and reaches above 80%. August is the peak rainy season. The bulk of annual rainfall about 85% occurs during monsoon period (June to September). The monsoon starts retreating from the State in late September or early October. Then commences another transitional period followed by winter from late November till February January is the coldest month of the period. Another transitional period follows between winter and summer. Monsoon rainfall is the sole source of natural recharge to ground water and rainfall pattern has an important impact on groundwater levels in the phreatic aquifer. There are about 75 rain gauge stations at district head quarter maintained by IMD. Rain gauges stations also exist at block headquarter which are maintained by State Revenue Board. The long term normal rainfall of all these stations is available. The rainfall data of IMD Stations and State station of U.P have been analyzed. The annual rainfall data of the year 2019-2020 is presented in the Table 1. Isohyetal Rainfall map of 2019 is presented in Fig 2. The rainfall is variable over the State ranging from maximum 1347 to minimum of 382 mm at Shrawasti and G.B Nagar district

respectively. The normal rainfall of the State is 955.93 mm and the average annual rainfall for the year 2020 is 740.11 mm. The amount of monsoonal rainfall received during 2019-2020 is 838.88 mm. The data of the monsoon rainfall annual and normal is given in Table-1. Monsoon rainfall within ±19% of the normal monsoon rainfall is considered normal. Monsoon rainfall above 19% of the normal monsoon rainfall is considered excess and monsoon rainfall less than -19% and more than -59% of the normal monsoon rainfall is considered deficit and if the monsoon rainfall is below 59% of the normal monsoon rainfall, it is considered scanty.

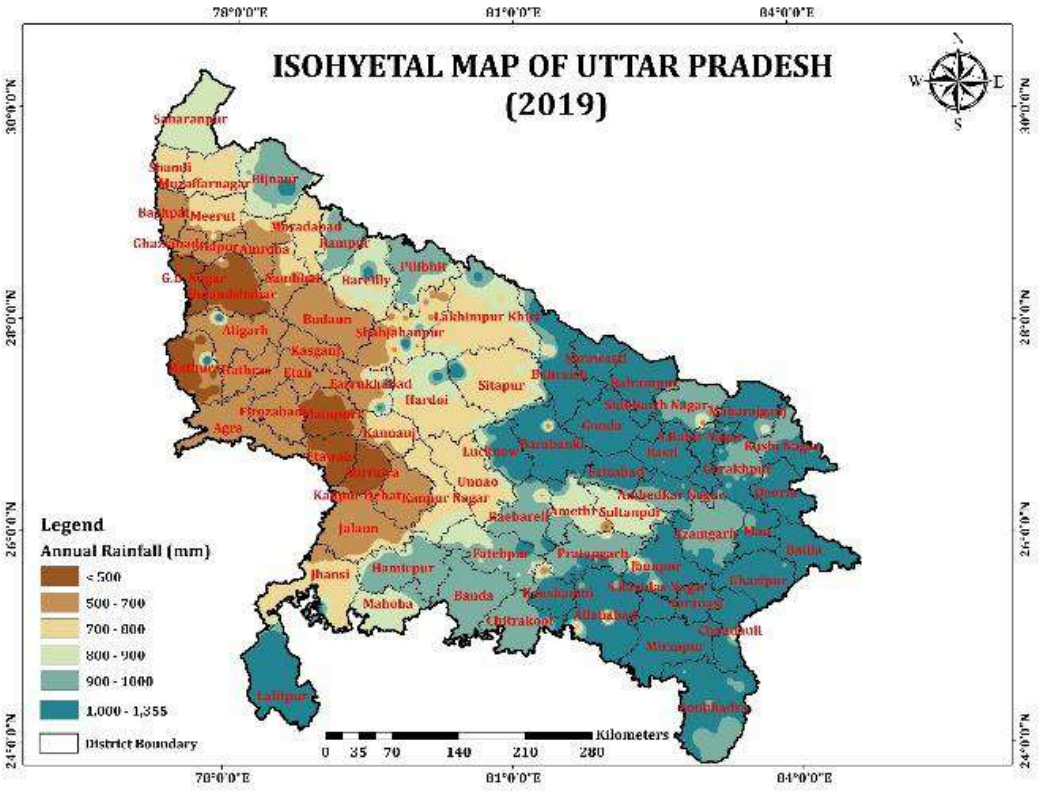


Fig 2: Isohyetal Maps of Uttar Pradesh for the year 2019

Table1: Average Rainfall data of the year 2019-2020

S.No.	District	Year	Monsoon		Non-Monsoon	
			Actual (mm)	Normal (mm)	Actual (mm)	Normal (mm)
1	AGRA	2019-2020	565.10	682.36	82.30	87.40
2	ALIGARH	2019-2020	424.90	655.70	91.60	115.30
3	AMBEDKARNAGAR	2019-2020	925.80	904.80	61.00	108.50
4	AMETHI	2019-2020	776.10	750.30	64.70	102.70
5	AMROHA	2019-2020	525.50	783.00	152.20	134.40
6	AURRAIYA	2019-2020	360.40	700.00	52.80	111.90
7	AYODHYA	2019-2020	999.20	989.70	65.40	124.30
8	AZAMGARH	2019-2020	1081.40	616.16	28.96	28.96
9	BAGHPAT	2019-2020	406.73	545.30	140.51	100.80
10	BAHRAICH	2019-2020	1173.85	993.80	119.88	154.80
11	BALLIA	2019-2020	1099.99	827.20	73.82	101.00
12	BALRAMPUR	2019-2020	1055.60	832.62	48.30	187.09
13	BANDA	2019-2020	870.40	840.40	125.10	102.80
14	BARABANKI	2019-2020	1211.40	930.50	77.00	124.90
15	BAREILI	2019-2020	714.00	1111.70	125.00	162.60
16	BASTI	2019-2020	865.82	943.60	51.97	119.10
17	BIJNAUR	2019-2020	710.60	914.20	194.80	168.90
18	BUDAUN	2019-2020	447.80	831.05	101.80	103.58
19	BULANDSHAHAR	2019-2020	329.42	670.70	98.30	108.30
20	CHANDAULI	2019-2020	989.90	918.71	113.10	61.90
21	CHITRAKOOT	2019-2020	776.80	840.40	158.40	102.80
22	DEORIA	2019-2020	1162.20	950.09	65.50	136.10
23	ETAH	2019-2020	414.08	616.16	99.11	28.96
24	ETAWAH	2019-2020	425.10	728.00	43.60	101.60
25	FARRUKHABAD	2019-2020	467.50	737.40	89.60	109.90
26	FATEHPUR	2019-2020	529.81	975.49	43.49	151.59
27	FIROZABAD	2019-2020	445.10	676.30	69.10	89.00
28	FIROZABAD	2019-2020	242.68	572.80	139.29	96.50
29	GHAZIABAD	2019-2020	398.35	641.70	115.01	124.60
30	GHAZIPUR	2019-2020	1018.00	883.00	88.60	112.80

S.No.	District	Year	Monsoon		Non-Monsoon	
			Actual (mm)	Normal (mm)	Actual (mm)	Normal (mm)
31	GONDA	2019-2020	1001.50	696.80	77.00	109.60
32	GORAKHPUR	2019-2020	926.90	1175.50	65.80	162.80
33	HAMIRPUR	2019-2020	865.60	796.90	117.60	84.90
34	HAPUR	2019-2020	406.72	641.70	140.51	124.60
35	HARDOI	2019-2020	635.00	787.90	103.30	130.30
36	HATHRAS	2019-2020	463.76	625.40	52.37	85.40
37	JALAUN	2019-2020	574.90	774.90	58.50	96.60
38	JAUNPUR	2019-2020	978.00	874.10	80.10	94.00
39	JHANSI	2019-2020	775.00	837.90	17.60	93.60
40	KANNAUJ	2019-2020	667.50	776.70	91.50	125.60
41	KANPURDEHAT	2019-2020	470.90	765.00	76.90	92.20
42	KANPURNAGAR	2019-2020	668.36	696.80	100.65	109.60
43	KASGANJ	2019-2020	412.63	616.16	112.37	28.96
44	KAUSHAMBI	2019-2020	1005.70	832.62	179.40	187.09
45	KUSHINAGAR	2019-2020	916.20	1158.40	81.00	168.20
46	LAKHIMPURKHIRI	2019-2020	681.50	926.10	161.10	158.20
47	LALITPUR	2019-2020	1004.80	939.30	53.20	95.30
48	LUCKNOW	2019-2020	760.50	772.50	113.10	112.80
49	MAHARAJGANJ	2019-2020	941.50	1214.10	94.10	175.00
50	MAHOBA	2019-2020	753.20	776.40	103.10	76.70
51	MAINPURI	2019-2020	337.79	616.16	105.37	28.96
52	MATHURA	2019-2020	326.23	616.16	105.81	28.96
53	MAU	2019-2020	950.31	832.62	85.72	187.09
54	MEERUT	2019-2020	557.79	778.50	167.70	139.50
55	MIRZAPUR	2019-2020	724.20	901.10	13.86	102.10
56	MORADABAD	2019-2020	576.70	855.20	131.80	137.70
57	MUZAFFARNAGAR	2019-2020	517.40	736.80	903.20	132.30
58	PILIBHIT	2019-2020	806.90	988.60	164.90	166.80
59	PRATAPGARH	2019-2020	893.10	851.80	96.90	91.80
60	PRAYAGRAJ	2019-2020	1090.50	808.70	116.60	109.60
61	RAEBARELI	2019-2020	702.90	750.30	84.20	102.70
62	RAMPUR	2019-2020	852.30	915.50	145.50	142.10
63	S.KABIRNAGAR	2019-2020	992.90	990.70	66.50	119.90

S.No.	District	Year	Monsoon		Non-Monsoon	
			Actual (mm)	Normal (mm)	Actual (mm)	Normal (mm)
64	BHADOI	2019-2020	734.50	846.10	134.80	103.50
65	SAHARANPUR	2019-2020	780.90	804.69	602.50	159.30
66	SHAHJAHANPUR	2019-2020	558.40	967.00	112.60	158.20
67	SHAMBHAL	2019-2020	576.70	855.20	131.80	137.70
68	SHAMLI	2019-2020	517.40	736.80	903.20	132.30
69	SHRAWASTI	2019-2020	1262.40	832.62	84.70	187.09
70	SIDDHARTHNAGAR	2019-2020	865.80	1000.90	52.00	135.80
71	SITAPUR	2019-2020	564.00	864.80	102.60	138.50
72	SONBHADRA	2019-2020	661.20	852.83	172.50	56.95
73	SULTANPUR	2019-2020	776.10	840.70	64.70	103.80
74	UNNAO	2019-2020	525.20	790.30	108.58	116.90
75	VARANASI	2019-2020	997.30	923.50	128.00	114.10

2.2 Physiography and Drainage

The State of Uttar Pradesh can broadly be divided into 2 physiographic units, the Central Ganga Plain and the Bundelkhand and Vindhyan Plateau. The Ganga Plain covering 85% of the State is a vast, flat expanse of alluvium having a gentle south easterly regional slope. The highest elevation is around 350 m amsl in the north western parts and lowest 60 m amsl in extreme south eastern part of the state. The land slope is variable, being steep in the north western parts and gradually diminishing south east wards. The slope ranges between less than a meter per kilometer to 5 m/km. This Plain has three sub divisions the Terai in the northwest, the Central Ganga Plain the center and the Marginal alluvial Plain in the south. The southern part of the state south of the Marginal Alluvial Plain is a part of Bundelkhand and Vindhyan plateau. This plateau region slopes northerly and is represented by undulating hilly terrain. The land slope varies from 550-130 m amsl in the western part and 650-100 mamsl in the eastern part with steeper gradients than those in the northern Ganga plain. The State forms a part of Ganga basin. The master drainage of the state is river Ganga and its tributaries. The Ramganga, Ghagra and Gomti are the main left bank tributaries, while the Yamuna is the main right bank tributary. All these rivers except Gomti originate from Himalayan ranges and are snow fed. Initially the rivers flow southward in the northwestern part of the State, then turn south eastward and finally leave the State in an easterly direction.

2.3 Hydrogeological Units and Aquifer Parameters

The hydrogeological framework of the state consists of both porous and fractured formations. The larger part of the State is underlain by soft rocks of fluvial sediments laid down in the fore deep between Plateau region in south and Himalayas in north during the Quaternary period by the Indus-Ganga system of drainage over the Precambrian topography existing during geological past. These deposits owe their origin to riverine activity. The southern part of the State has entirely different geological conditions being underlain by hard rock of Precambrian formations under a thin alluvial cover. Thus broadly, the State can be divided into two hydrogeological formations

1. Unconsolidated, soft rock.

2. Consolidated, hard rock.

The hydrogeological conditions of the above two formations widely differ and are discussed subsequently in brief.

2.3.1 Unconsolidated Formation:

This unit covers nearly 85% of the State area. The unconsolidated formations comprising the area have been deposited through mighty rivers originating from great Himalayan Mountains. These sediments are an admixture of pebble, gravel, sand, silt, clay and kankar. The sediments are generally coarser in the north and gradually become finer in south east ward along downstream of the drainage which is a typical feature of fluvial deposits.

Bhabar Zone

The piedmont deposits consisting of numerous coalescent fans occupy narrow tract, 10 to 20 Km. in width along the foot hill region south of Sub Himalayan zone. This belt is south sloping (10-20 m./Km.) plain merging with Tarai belt in the south. and extends from Saharanpur in the west to Bijnore in the east. It gradually narrows down eastward. The fans have been formed by accumulation of debris brought down by heavily charged streams on their emergence from the hills. The fans consist of poorly sorted material of all sizes. The percentage of granular material is much higher. The clay occurrence is further south. The presence of thick clay layer over coarser sediment with abrupt reduction of slope marks the southern limit of Bhabar. The ground water occurs under unconfined state and the level is deep in this belt. Occasionally it goes down as deep as 130 m. bgl. The elevation of water table varies from 250 m. to 300 m.a.m.s.l. The hydraulic gradient is around 3m/Km. The Bhabars are capable of yielding 1700 to 3800 lpm of water at a drawdown of 3 m to 10 m. The hydraulic conductivity as per test result ranges between 31 and 378 m/day.

Tarai Zone

This occupies a narrow belt south of Bhabar and its contact with Bhabar is well marked by a spring line. It's southern boundary is not pronounced and it gradually and imperceptibly merges with Central Ganga plain. It is characterised by moist, water logged area which is gently sloping south-ward (2.5 m/Km). Luxuriant growth of dense forest is characteristic feature. The Tarai deposits are dominantly fine sediments with well sorted material. In Tarai belt the ground water occurs under unconfined, confined and semi-confined conditions. The depth to water level in shallow aquifer ranges between 2 m. and 6 m. below ground with average seasonal fluctuation of 2 m to 4 m. The water table slopes southward. In deeper aquifer (below 50 m. depth) the ground water occurs in confined state. The autoflow conditions are common in this belt. The exploratory results have shown strong confining condition in parts of Saharanpur, Bijnor and Mahrajganj district. The flowing condition is associated with nature and size of fan deposit. The piezometric head of flowing aquifer ranges between 1 & 5.3 m.agl while in non-flowing condition it rest between 2 and 12 m bgl. The tubewells tapping deeper flowing aquifer yield 1400 to 3400 lpm of fresh groundwater for a drawdown of 2 to 8 m. In case of non-flowing wells the yield varies between 600 and 2400 lpm for a drawdown of 4m to 9m. The coefficient of permeability ranges between 20 and 120 m/day.

Central Ganga Plain

The vast alluvial tract covering nearly two third of the state occupies the area south of Terai and can further be divided in two sub units Younger Alluvium and Older Alluvium. This forms one of the richest ground water repository of the world. It is characterized by plain of low relief and numerous fluvial features such as abandoned channel, natural levee and meander scrolls. The presence of different erosional and depositional fluvial features indicates shifting nature of the rivers. In the process of shifting of the river course, Older flood plains were left off as extensive high lands that act as present day interfluves. The rivers have degraded their own alluvial plains and carved new meander belts at lower elevation, where younger flood plain deposition took place. Thus this region presents two distinct sub units, the high land or composite flood plain area and low meander flood plains. The physiographic depressions frequented by over bank flow from adjoining river during high flood period act as back swamp area. The low lying riparian area occupied by present day meander belts form the meander flood plain. Such meander flood plains are usually underlain by coarser sediments. The Younger Alluvium occurs mostly along the present day flood plain area. The continuous shifting of the drainage network with time caused reworking of their earlier deposits giving rise to the younger alluvium. The Older alluvium occupying comparatively high area covers major part of the Plain. A typical characteristic of Older alluvium is formation of kankar within itself

due to leaching of calcium carbonate under favourable climatic conditions. The kankar occasionally forms pans restricting downward movement of water. The alluvial sediments is variable and generally goes upto 500 m below which occurs, the ckness of semi-consolidated Upper Siwalik formations. The Shallower basement occurs in isolated areas which are known as "Basement highs."
This unconsolidated zone is porous and permeable with primary intergranular porosity and has good ground water potential. The sub-surface correlation of formations in the state has shown presence of several aquifers down to a depth of 750 m below the ground. These aquifers mainly encountered in Central Ganga Plain have been grouped on the basis of lithological characters as well as based on interpretation of electrical logs of Borcholes drilled.

The upper part of first aquifer down to 50 mbgl is the main source of drinking water through hand pumps and dug wells and is unconfined in nature. The first aquifer as a whole which is under unconfined to semi-confined conditions is the most potential aquifer group which is the main source of ground water in the State extensively exploited through private as well as Government tube wells to meet the drinking water and irrigation needs. The deeper aquifers are confined in nature and are being exploited to a very limited extent. The shallow and phreatic aquifers are under heavy stress.

Marginal Alluvial Plain

The transition zone between Ganga plain in the north and plateau region in the south forms the Marginal Alluvial Plain region. This zone is characterized by gently north-east sloping plain, comprising abandoned channel, meander scars and ravines. The fluvial sediments present in this belt have been deposited partly by the fluvial action of the river Yamuna and partly by the Ganga river. The average thickness of alluvial material varies from 70m to 200m, overlying Pre Cambrian basement. Lithologically the Marginal Alluvium consist of clay and silt interbeded with sand lenses of variable thickness and extension. While in Mathura - Agra area the sandy horizons are thin and persist over a few hundreds of meter, these have wider extension in Jalaun. The subsurface data for Jalaun arca indicate 10 to 50m., sandy horizon lying between 30 to 100 m. depth. The sediments are poorly sorted consisting sands of different grade interbeded with clays. The ground water occurs mostly in unconfined state, but occasionally under semi confined to confined state. The water table is. generally shallow in southern part and gradually deepens close to Yamuna river. The deeper aquifers are under confined state. The aquifer material tapped (25-40m. thickness) in Agra - Mathura area have yielded 720 to 1200 lpm for a drawdown of 8 to 12m., while similar thickness of aquifer in Jalaun, Hamirpur, Banda area yield better discharge (3000-3600 lpm) for a drawdown of 3 to 5m. The hydraulic conductivity has large variation in this area ranging between 20 and 100 m/day. The ground water quality deteriorates with depth in Agra - Mathura area.

2.3.2 Consolidated Formation:

The plateau like terrain of Kaimur range and Bundelkhand Massif forms the Southern Peninsular region. The region is characterised by bare rocky terrain punctuated with variety of land forms such as mesas, buttes, insellberg etc. Isolated patches of residual soil and laterites of varying thickness and extension are present. The area is underlain by Bijawar and Vindhyan group of rocks. Depending upon rock types, four sub hydrogeological units are identifiable in this region which is briefly discussed below.

The crystalline rocks of Budelkhand Granite Complex (BGC) group occupy Jhansi, Jalaun, Hamirpur, Lalitpur, Mahoba and Banda districts. The groundwater occurs within the secondary porosity (joints, fractures, weak plains) as well as in the weathered residuum or sandy clay depending upon texture and composition of the rocks under water table conditions. The weathered residuum may be granular parent rock. Hydrogeologically it behaves similar to alluvial formation. The vertical and lateral extension of weathered zone varies from place to place. The depth to water level varies between 2 and 16 mbgl with an average value of 4 to 8 m. The seasonal fluctuation is of the order of 2 to 4 m with exceptional value of high fluctuation Large number of tubewells was constructed in this region, tapping Sm to 20m of aquifer material and yielding <60 to 600 lpm of fresh ground water. The water level in these wells lies between 3.5 and 18.5 m. bgl

The Vindhayan sandstone/shale occupies considerable area of Peninsular region. Generally, the sandstones are compact except for Shankargarh sandstone occurring in Allahabad Mirzapur and Chitrakoot area. The ground water occurs in the joints and fractures of compact sandstone under water table condition. The depth to water table depends on the morphology and varies between 2 and 25 mbgl. The discharge of tubewells has been found low ranging between 120 and 300 lpm strong confining conditions have been found in Vindhyachal area (Mirzapur district) where flowing condition is present. The contact zone of shale sandstone exists at a depth of 60 to 80 m and the yield is 1000 to 1200 lpm. The piczometric head of 2.5 magl. has been observed. The Shankargarh sandstone in Allahabad are capable of yielding 300 to 600 lpm of fresh ground water. The Vindhyan limestone, exposed in central parts of Mirzapur, southern part of Banda and Lalitpur districts, form moderately good ground water repository. The cavernous limestone of Banda (Chitrakoot area, Biradh Kund area) has yielded reasonably good discharge. The limestone area remains to be thoroughly explored.

2.4 Scenario of Ground Water Levels in Uttar Pradesh

2.4.1 Depth to Water Levels

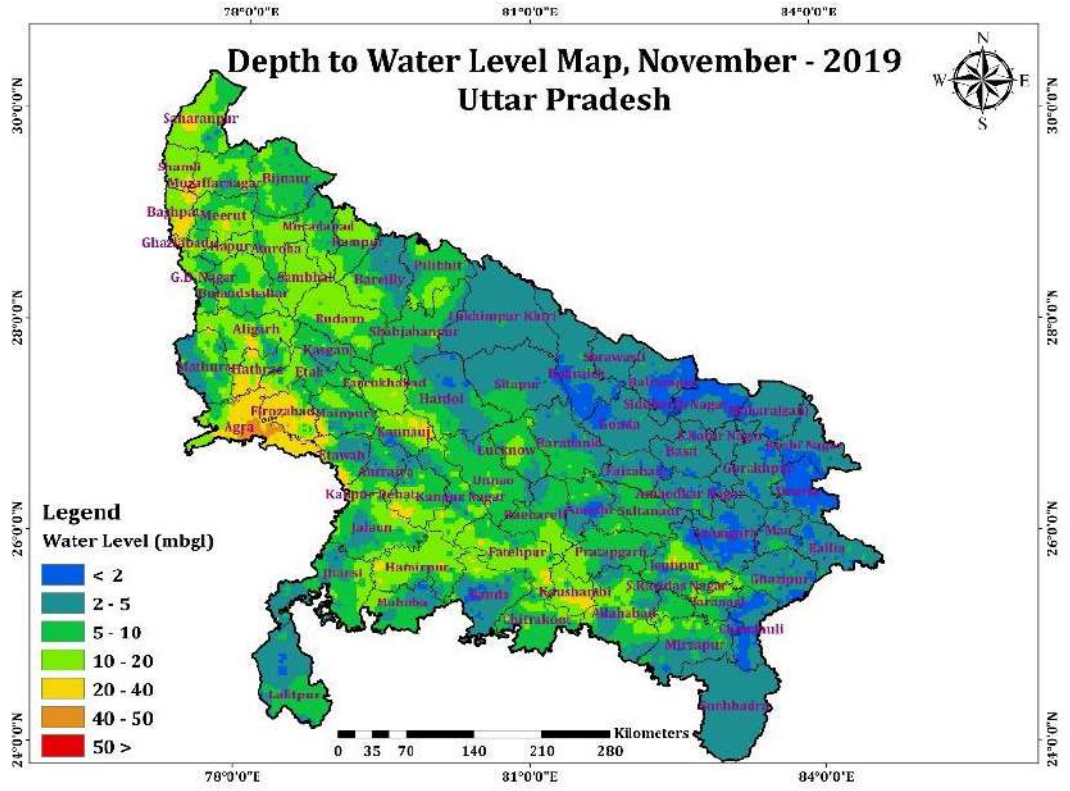
Ground water level refers to underground surface below which the ground is wholly saturated with water. The upper surface of the zone of saturation is the water table. In case of wells penetrating confined aquifers, the water level represents the pressure or piezometric head at the point. The configuration of the water table depends upon topography, geology, climate water yielding and water bearing of rocks in the zones of aeration and saturation which control ground water recharge. The chief source of recharge to storage is rainfall which is highly variable over space and time. The main source of discharge is ground water abstraction which is also varying and also growing exponentially. The regions having ground water as the main source for irrigation always remain under heavy stress. The imbalance between the recharge and discharge expresses itself in terms of variations in the ground water levels. Thus, the water level is a very important parameter for ground water studies. The groundwater level data of Ground Water Observation wells monitored during March 2016, and March 2020, have been compiled and analysed.

Table 2: District wise Water level data of pre-monsoon and post-monsoon of the year 2019.

S.No	District	Assessment Sub-Unit (Command, Non Command, Poor Quality)	Year	Water Level (m)	
				Pre-monsoon	Post-Monsoon
1	AGRA	Command	2019	22.29	21.50
2	ALIGARH	Command	2019	8.92	8.25
3	AMBEDKAR NAGAR	Command	2019	5.69	4.58
4	AMETHI	Command	2019	5.78	4.65
5	AMROHA	Command	2019	11.44	11.10
6	AURRAIYA	Command	2019	7.77	6.31
7	AYODHYA	Command	2019	6.06	4.63
8	AZAMGARH	Command	2019	5.96	4.23
9	BAGHPAT	Command	2019	18.21	17.70
10	BAHRAICH	Command	2019	4.76	3.35
11	BALLIA	Command	2019	5.67	4.11
12	BALRAMPUR	Command	2019	3.75	2.40
13	BANDA	Command	2019	11.14	9.45
14	BARABANKI	Command	2019	6.61	5.06

S.No	District	Assessment Sub-Unit (Command, Non Command, Poor Quality)	Year	Water Level (m)	
				Pre-monsoon	Post-Monsoon
15	BAREILI	Command	2019	6.96	6.26
16	BASTI	Command	2019	5.30	3.86
17	BIJNAUR	Command	2019	8.81	7.66
18	BUDAUN	Command	2019	11.62	11.28
19	BULANDSHAHAR	Command	2019	11.08	10.46
20	CHANDAULI	Command	2019	6.46	3.61
21	CHITRAKOOT	Command	2019	12.49	9.81
22	DEORIA	Command	2019	3.81	1.57
23	ETAH	Command	2019	9.06	8.24
24	ETAWAH	Command	2019	13.25	12.11
25	FARRUKHABAD	Command	2019	12.97	11.82
26	FATEHPUR	Command	2019	10.37	8.07
27	FIROZABAD	Command	2019	19.19	18.47
28	G.B. NAGAR	Command	2019	9.28	8.83
29	GHAZIABAD	Command	2019	15.23	14.80
30	GHAZIPUR	Command	2019	5.65	4.48
31	GONDA	Command	2019	3.73	2.86
32	GORAKHPUR	Command	2019	4.93	2.60
33	HAMIRPUR	Command	2019	16.44	15.00
34	HAPUR	Command	2019	13.38	12.90
35	HARDOI	Command	2019	7.07	6.29
36	HATHRAS	Command	2019	10.89	9.98
37	JALAUN	Command	2019	7.95	6.41
38	JAUNPUR	Command	2019	6.94	5.36
39	JHANSI	Command	2019	8.50	4.37
40	KANNAUJ	Command	2019	14.81	13.62
41	KANPUR DEHAT	Command	2019	13.03	11.61
42	KANPUR NAGAR	Command	2019	13.32	12.27
43	KASGANJ	Command	2019	7.54	6.72
44	KAUSHAMBI	Command	2019	10.06	8.59
45	KUSHI NAGAR	Command	2019	2.73	1.21

S.No	District	Assessment Sub-Unit (Command, Non Command, Poor Quality)	Year	Water Level (m)	
				Pre-monsoon	Post-Monsoon
46	LAKHIMPUR KHIRI	Command	2019	5.24	4.35
47	LALITPUR	Command	2019	10.24	4.49
48	LUCKNOW	Command	2019	15.66	14.98
49	MAHARAJGANJ	Command	2019	4.21	2.04
50	MAHOBA	Command	2019	8.75	6.29
51	MAINPURI	Command	2019	9.76	8.53
52	MATHURA	Command	2019	6.69	5.77
53	MAU	Command	2019	5.07	3.52
54	MEERUT	Command	2019	12.72	12.28
55	MIRZAPUR	Command	2019	10.95	8.08
56	MORADABAD	Command	2019	8.94	8.26
57	MUZAFFARNAGAR	Command	2019	14.72	13.86
58	PILIBHIT	Command	2019	4.40	3.18
59	PRATAPGARH	Command	2019	7.88	6.12
60	PRAYAGRAJ	Command	2019	7.87	5.99
61	RAE BARELI	Command	2019	6.34	5.23
62	RAMPUR	Command	2019	6.78	5.73
63	S.KABIR NAGAR	Command	2019	5.61	4.24
64	S.RAVIDAS NAGAR	Command	2019	8.69	7.01
65	SAHARANPUR	Command	2019	10.22	9.45
66	SHAHJAHANPUR	Command	2019	7.18	5.77
67	SHAMBHAL	Command	2019	12.13	11.52
68	SHAMLI	Command	2019	17.03	16.51
69	SHRAWASTI	Command	2019	3.92	2.61
70	SIDDHARTH NAGAR	Command	2019	4.64	3.43
71	SITAPUR	Command	2019	6.30	5.44
72	SONBHADRA	Command	2019	9.69	4.86
73	SULTANPUR	Command	2019	7.09	5.97
74	UNNAO	Command	2019	8.39	6.63
75	VARANASI	Command	2019	10.20	8.44



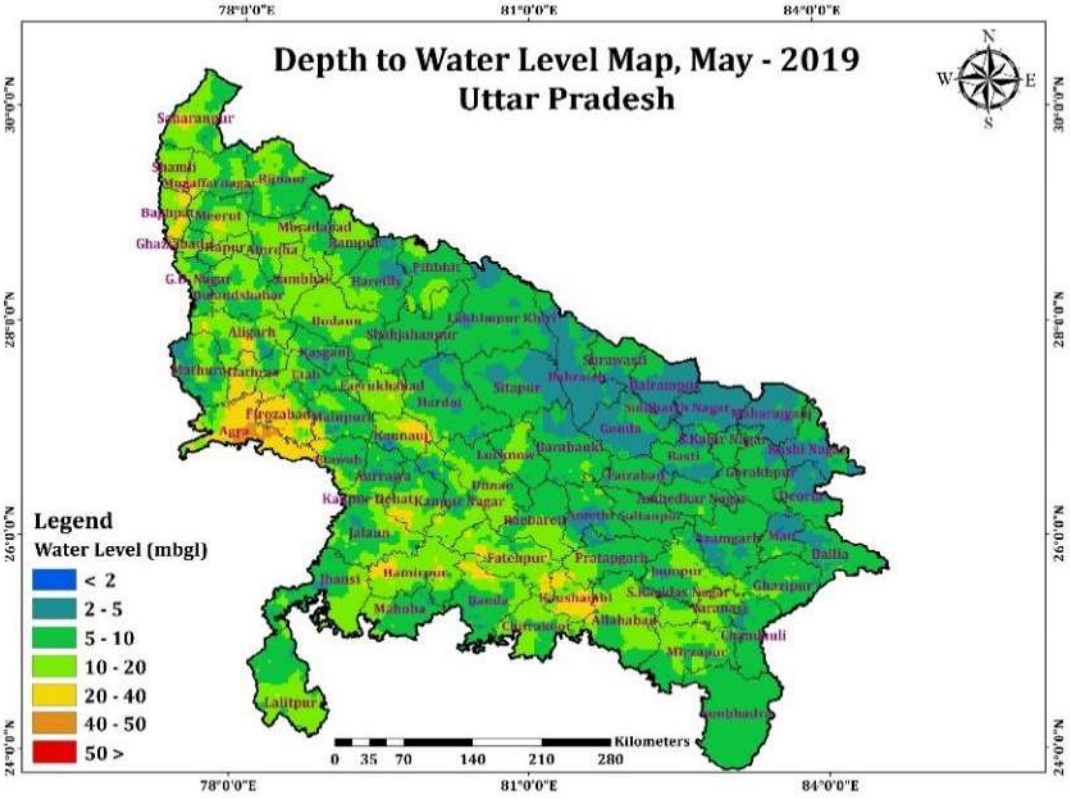


Fig:3 Pre and Post Monsoon Depth to water level maps of Uttar Pradesh of 2019

3. GROUND WATER RESOURCES ESTIMATION METHOLOGY, 2015

The earlier ground water resources assessment of the State was done based on the recommendations of Ground Water Estimation Committee 1984 (GEC 84). The GEC 84 methodologies was subsequently modified in the light of enhanced database and new findings of experimental studies in the field of hydrogeology. The Ground Water Estimation Committee- 1997 has been the basis of ground water assessment in the country for last two decades. The National Water Policy (2012) also enunciates periodic assessment of ground water potential on scientific basis. The Ministry of Water Resources, Govt. of India, therefore, constituted a committee consisting of experts in the field ground water to recommend a revised methodology. The revised methodology as recommended has incorporated number of changes compared to the recommendations of Ground Water Estimation Committee-1997. The revised methodology GEC 2015 recommends aquifer wise ground water resource assessment to which demarcation of lateral as well as vertical extent and disposition of different aquifers is pre-requisite.

3.1 IN-GRES (INDIA- Groundwater Resource Estimation System)

Automation of Estimation of Dynamic Ground Water Resources using GEC-2015 methodology. Ground Water is the back bone of India's agriculture and drinking water security in urban and rural areas. However, it is important to realize that groundwater is not a resource that could be utilized in discriminately. India being a home to more than 1.3billion people, the increasing population, urbanization and non-uniform extraction have accelerated depletion of ground water resources. This is reflected in falling ground water levels trends and contamination of aquifers. A serious groundwater crisis prevails currently in India due to excessive over-extraction and groundwater contamination covering nearly 60 percent of all districts in India and posing a risk to drinking water security of the population. In addition to over-extraction and biological/chemical contamination of water, excess groundwater and water logging is also a serious problem in many regions, impacting livelihood security of large sections of society.

Groundwater estimation committee (GEC) 2015 gives guidelines to classify assessment units (largely administrative units such as blocks/talukas/mandals/firkas, and in some cases hydrological units such as watersheds/aquifers) into SAFE, SEMI-CRITICAL, CRITICAL AND OVER-EXPLOITED categories for a region. This classification is based on the amounts of Ground Water Recharge, Draft, Flux happened in a particular year.

GEC system takes Data Input through Excel as well as through Forms, computer various Ground water components (recharge, draft, flux, etc.), classify assessment unit into appropriate categories, develop visibility dashboards for each of the components. System allows user to view the data in both MIS as well as GIS view. User can also download the reports in formats like CGWB, etc.

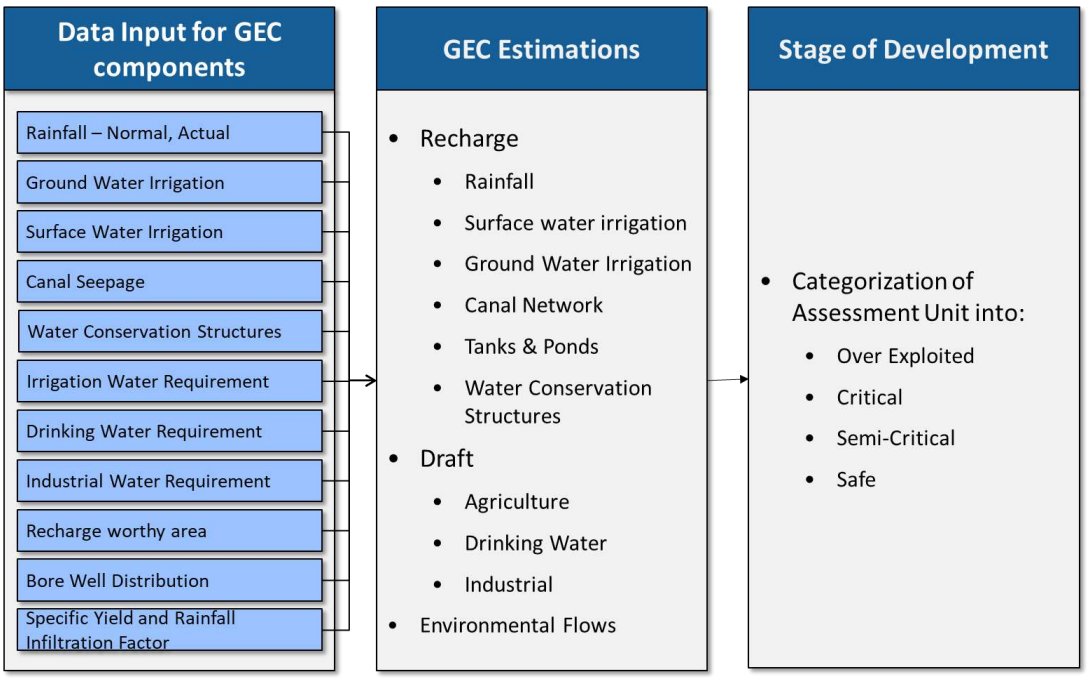


Figure 5: Overview of Ground Water Resource Estimation Platform – GEC 2015

3.2 Methodology Used

The system is based on GEC 2015 methodology for ground water resources estimation for 3 types of Aquifers: Unconfined Aquifer, Semi-Confined Aquifer and Confined Aquifer. The resource estimation for an Unconfined Aquifer is based on the principle of water balance:

Inflow – Outflow = Change in Storage (of an aquifer) This equation can be further elaborated as:

$$\Delta S = R_{RF}+R_{STR}+R_C+R_{SWI}+R_{GWI}+R_{TP}+R_{WCS} \pm VF \pm LF - GE - T - E - B$$

Where,

ΔS – Change is storage

R_{RF} – Rainfall recharge

R_{STR} – Recharge from stream channels R_C – Recharge from canals

R_{SWI} – Recharge from surface water irrigation

R_{GWI} – Recharge from ground water irrigation R_{TP} – Recharge from tanks & ponds

R_{WCS} – Recharge from water conservation structures VF – Vertical inter aquifer flow

LF – Lateral flow along the aquifer system (through flow) GE – Ground Water Extraction

T – Transpiration

E – Evaporation B – Base flow

India GEC system is divided into 3 modules – Input, Computation and Output.

1. **Input module** – Input Module refers to the Data Entry module at an Assessment Unit level. Data Input is done via 2 methods i.e.
    a. **Excel based input** – In this, the user needs to download District level data sheet template where he/she can fill the data at an Assessment Unit level. User now needs to upload their fully filled excel sheet into the system.
    b. **Form based input** – In this, the user is shown a form and he/she can fill/edit the data in data sheet in an online mode. Once user is done with editing online, he/she can Submit the data file.

2. **Computation module** – Computation Module refers to the ground water calculations for an assessment unit. These computations are based on GEC2015 methodology and are used to calculate Annual Extractable Ground Water Resource, Total Current Annual Ground Water Extraction (utilization) and the percentage of ground water utilization with respect to recharge (stage of Ground Water Extraction) for an assessment unit. Based on these percentages an assessment unit is categorized into SAFE, SEMI-CRITICAL, CRITICAL AND OVEREXPLOITED categories.

3. **Output module** Once categorized the data is shown in two views:

   a. **MIS Dashboard** – MIS dashboard shows the results of the assessment for the entire India, and also State wise in tabular form. The MIS dashboard shows all type of recharges, extractions, inflows and outflows computed for both monsoon and non-monsoon periods of the year and then reflect the overall stage of extraction at the selected Geo – Zoom Level.

   b. **GIS Dashboard** – GIS dashboard shows the data in Web Geo-Server format, implemented in interactive GIS platform allowing user to all GEC related information in the map itself. GIS view represents the data on India map and colour codes each District/Assessment unit based on the categorization.

4. Ground Water Recharge

The Ground Water Recharge for an Unconfined Aquifer is calculated as:

$$Recharge = R_{RF}+R_{STR}+R_{C}+R_{SWI}+R_{GWI}+R_{TP}+R_{WCS}$$

Where,

R_{RF} – Rainfall recharge

R_{STR} – Recharge from stream channels R_C

– Recharge from canals

R_{SWI} – Recharge from surface water irrigation

R_{GWI} – Recharge from ground water irrigation R_{TP}

– Recharge from tanks & ponds

R_{WCS} – Recharge from water conservation structures

4.1.1 Annual Rainfall Recharge

Monsoon Rainfall is the major source of ground water recharge. About 58% of the annual replenish able resources are contributed by monsoon rainfall. This recharge is estimated using Ground

Water Level Fluctuation method (for Monsoon season only) and Rainfall Infiltration Factor method (for both Monsoon and Non-Monsoon). User is allowed to enter data at Assessment Unit level, Rain Gauge level data, IMD Grid level, etc.

Data Elements Used

Component	Parameter	Unit
Rainfall Infiltration Factor Method	Rainfall	Millimeter
Water Table Fluctuation Method	Water Level	Meter

Data computation methodology

The Rainfall Recharge estimations based on Water Level Fluctuation method, reflects actual field conditions as it considers the response of ground water level. However, this estimation is often subject to uncertainties. In the regions, where adequate data on ground water level fluctuations is not available, ground water recharge is estimated using rainfall infiltration factor method. Therefore, it is recommended to compare the rainfall recharge obtained from water level fluctuation approach with that estimated using rainfall infiltration factor method.

Ground Water Level Fluctuation Method

The Ground Water Level Fluctuation method is to be used for assessment of rainfall recharge in the monsoon season only. It considers following factors for recharge calculation:

- Change in storage
- Rise/Fall in water level in the monsoon season
- Specified yield (based on Aquifer Norms)

R_{RF} (wtfm) = ((Change in Ground Water Storage + Gross Ground Water Extraction for all uses in Command/Non-Command Area during Monsoon) - Recharge from “Other Sources” during Monsoon Season))1000

Where,

Change in Ground Water Storage = Rise/Fall in water level in the monsoon season * Area * Specific Yield

Recharge from "Other Sources" = Recharge due to seepage from Canals + Recharge from Surface Water Irrigation + Recharge from Ground Water Irrigation + Recharge from Tanks and Ponds + Recharge from Water Conservation Structures

Rainfall recharge during monsoon season for normal monsoon rainfall condition, R_{RF} (Normal, wtfm) is calculated as:

R_{RF} (Normal, wtfm) = (Rainfall Recharge * Monsoon Normal Rainfall) / Monsoon Actual Rainfall

Rainfall Infiltration Factor Method

The Rainfall Infiltration Factor method is used for rainfall recharge assessment in both monsoon and non-monsoon season. It considers following factors for recharge calculation:

- Area
- RFIF - Rainfall Infiltration Factor (based on Aquifer Norms)
- Normal Monsoon Rainfall

R_{RF} (Normal, rifm) = (Area*(Normal Rainfall during Monsoon-Rainfall threshold) * Rainfall Infiltration Factor)/1000

Where, Rainfall Threshold = 10% of annual rainfall

Method selection for Monsoon

Once the rainfall recharge is estimated using both the methods, Percent Deviation (PD) is calculated. PD is the difference between the two methods i.e. R_{RF} (wtfm) and R_{RF} (rifm) expressed as a percentage of the R_{RF}(rifm)

PD = (R_{RF} (Normal, wtfm) - R_{RF} (Normal, rifm)) / R_{RF} (Normal, rifm) * 100

Where,

R_{RF} (wtfm) = Rainfall Recharge for normal monsoon season rainfall estimated using Water Table Fluctuation method

R_{RF} (rifm) = Rainfall Recharge for normal monsoon season rainfall estimated using Rainfall Infiltration Factor method

The criteria for adoption are:

- If -20% < PD<+20% Final Rainfall Recharge =R_{rf}(wtfm)
- If PD <-20% Final Rainfall Recharge = R_{rf}(rifm)*0.8
- If PD>+20% Final Rainfall Recharge = R_{rf}(rifm)*1.2

4.1.2 Recharge from Other Sources – Ground Water Irrigation

In recharge through ground water irrigation, the ground water which was earlier extracted for agricultural irrigation purposes is now contributing to the ground water recharge. This recharge is calculated based on the return flow factor for paddy as well as non-paddy fields.

Data Elements Used

Component	Parameter	Unit
Recharge due to Ground Water Irrigation	Cropping Pattern	Acres

Data computation methodology

RechargeduetoappliedGroundWaterIrrigationisestimatedbasedonthefollowingformula: $R_{GWI} = GD_I$ *RFF

Where:

R_{GWI} = Recharge due to applied ground water irrigation GD_I

= Gross Ground Water Draft for Irrigation

RFF = Return Flow Factor and is calculated as [(Irrigated Area Under Paddy * Return Flow Factor for Paddy) + (Irrigated Area Under Non-Paddy * Return Flow Factor for Non-Paddy)] / (Irrigated Area Under Paddy + Irrigated Area Under Non-Paddy)

4.1.3 Recharge from Other Sources - Surface Water Irrigation

Surface Water Irrigation is done to irrigate crops through the canal water. This water also contributestogroundwaterrechargeandiscalculatedusingReturnFlowFactorandnumber of days the water was discharged to fields.

Data Elements Used

Component	Parameter	Unit
Recharge due to Surface Water Irrigation	Design Discharge of the Outlet	Cusecs
	Number of Days	Number
	Cropping Pattern	Acres

Data computation methodology

Recharge due to Applied Surface Water Irrigation: Recharge due to applied surface water irrigation is estimated based on the following formula:

R_{SWI} = AD * Days * RFF

Where:

R_{SWI} = Recharge due to applied surface water irrigation AD = Average Discharge

Days = Number of days water is discharged to the Fields RFF = Return Flow Factor

In case discharge data is not available below formula is used to calculate R_{SWI}:

R_{SWI} = [((Irrigation Area Under Paddy * Crop Water Requirement for Paddy) + (Irrigation Area under Non-Paddy * Crop Requirement for Non-Paddy)) *RFF

Where,

RFF = [(Irrigated Area under Paddy * Return Flow Factor for Paddy) + (Irrigated Area under Non-Paddy * Return Flow Factor for Non-Paddy)] /(Irrigated Area under Paddy + Irrigated Area under Non-Paddy)

4.1.4 Recharge from Other Sources – Canal Seepage

Canals store water till the time it is disbursed for irrigation, industrial and domestic purposes. During this time the water seeps down the ground, contributing to the ground water recharging. Canals are of two types – Lined and Unlined.

Data Elements Used

Component	Parameter	Unit
Recharge from Canal Seepages	Reach Length	Meters
	Full Supply Length	Meters
	Side Angle	Degrees
	Base Width	Meters
	Number of Days	Number

Data computation methodology

Recharge due to canals is estimated based on the following formula:

$$R_C = WA * SF * Days$$

Where:

R_C = Recharge Due to Canals

WA = Wetted Area (calculated as Wetted Perimeter X Length of Canal Reach)

SF = Seepage Factor

Days = Number of Canal Running Days

4.1.5 Recharge from Other Sources - Tanks and Ponds

During monsoon season, water get stored in Tank Sand Ponds. This stored water contributes to the ground water recharge based on the amount of waters to red and number of days water is stored in the restructures.

Data Elements Used

Component	Parameter	Unit
Recharge from Tanks and Ponds	Water Spread Area	Hectares
	Number of Days	Numbers

Data computation methodology

Recharge due to Tanks & Ponds is estimated based on the following formula:

$$R_{TP} = AWSA * R * RF$$

Where:

R_{TP} = Recharge due to Tanks & Ponds

AWSA= Average Water Spread Area

N = Number of days Water is available in the Tank/Pond

RF = Recharge Factor (As per GEC 2015, recommended RF = 1.4 mm / day)

4.1.6 Recharge from Other Sources - Water Conservation Structures

Similarly, like Tanks and Ponds, Artificial Structures for Water Conservation, stores water in monsoon season which then contributes to ground water recharge.

Data Elements Used

Component	Parameter	Unit
Recharge due to Water Conservation Structure	Gross Storage	Hectare Meters
	Number of Refills	Number

Data computation methodology

RechargeduetoWaterConservationStructuresisestimatedbasedonthefollowingformula: $R_{WCS} = GS * RF$

Where:

R_{WCS} = Recharge due to Water Conservation Structures GS = Gross Storage = Storage Capacity * No. of Fillings

RF = Recharge Factor (As per GEC 2015 recommendations, RF = 40% of Gross Storage during a year which means 20% during monsoon season and 20% during non-monsoon Season)

4.1.7 Recharge from Other Sources – Stream Channels

Streams following through an area also contributes to the Ground Water recharge.

Data computation methodology

Recharge from Stream Channels is estimated using Darcy's Law.

$$Q = K * [(h2-h1)/L] * A$$

Where:

K = Coefficient of Permeability / Hydraulic Conductivity

h1 = Head of the river

h2 = Head at the Ground Water level

L = Length of the river which contribute to recharge A

= Area of cross-section

4.1.8 Recharge from Other Sources - Pipelines

Because of the water supply schemes, Pipe lines are used for transporting water for domestic and industrial purpose in Urban area. Leakages from these pipe lines are huge in some areas and contribute to ground water recharge.

Data Elements Used

Component	Parameter	Unit
Pipelines	Water supply through pipeline	Hectare Meters
	Number of days water is supplied	Number

Data computation methodology

Recharge from pipelines ($P_{ipelines}$) is estimated based on the description given in GEC 2015:

$R_{Pipelines}$ = 0.5 * (Water Supply through pipelines * Percentage losses/100) * Weighted Infiltration factor * Number of Days water is supplied through pipelines

4.1.9 Recharge from Other Sources - Sewage/Flashfloods

Seepages from the sewerages also contribute to recharge. Water which gets logged due to flash floods (happening due to heavy rainfall in a short period of time) also contribute to ground water

recharge.

Data computation methodology

Recharge from Sewage/Flash Floods($R_{Sewage/FlashFloods}$) is estimated based on the description given in GEC2015:

$$R_{Sewage/Flash\ Floods} = WP * SF * Length * Days$$ Where:

WP = Wetted Perimeter

SF = Seepage Factor Days

= Number of Days

4.2 Inflows and Outflows

Environmental Flows consists of Vertical inter Aquifer Flow, Lateral Flow along the aquifer system, Transpiration, Evaporation and Base flow.

4.2.1 Vertical Inter Aquifer Flow

In areas where more than one aquifer is present, there is a possibility that either of ground water flow between the aquifers which is known as Vertical Inter Aquifer Flow. Vertical aquifer interflow is calculated using Darcy's law

Data computation methodology

This is calculated using Darcy's Law:

$$Q = HC * [\Delta h/T] * A$$

Where,

HC = Hydraulic Conductivity

Δh = Average Change in Head T

= Thickness of Aquitard

A = Area of the zone

4.2.2 Lateral flow along the aquifer system (through flow)

In Unless and until the assessment unit is a hydrological unit with sealed boundaries, there is always a possibility of ground water movement across the boundaries. Wherever the assessment unit are blocks, there will be a ground water flow across the boundaries. This flow of ground water between the aquifers is known as Lateral Flow Lateral Flow is calculated using Darcy's law.

Data computation methodology

This is calculated using Darcy's Law:

$$Q = T * [\Delta h/Distance] * L$$

Where,

T = Transmissivity

Δh = Up Contour - Down Contour

Distance = Distance between two contours on ground L = Length of the section

4.2.3 Transpiration

Transpiration normally takes place from the ground water reservoir if the roots reach the ground water table. If the water table is deep below, ground water cannot be lost through transpiration. But in situations where the roots extend up to the capillary rise of ground water levels, it will lead to transpiration.

Data computation methodology

This is calculated as:

$$Transpiration = A * TR * Days * (RD + CR - GWL) / (RD + CR)$$

Where,

A = Area

TR = Transpiration Rate RD = Average Root Depth CR = Capillary Rise

GWL = Ground Water Level

4.2.4 Evaporation

Evaporation normally takes place from surface water bodies. As the ground water is not exposed to surface, there is a less possibility for evaporation from ground water bodies. But in situations where the ground water levels are less than the capillary rise of the aquifer material, it will lead to evaporation.

Data computation methodology

Evaporation = A * ER * Days * (CR - GWL)/CR Where,

A = Area

ER = Evaporation Rate

CR = Capillary Rise

GWL = Ground Water Level

4.2.5 Evapotranspiration

Sometimes it will be difficult to get evaporation and transpiration rates separately. It may be possible to get a single rate of evapotranspiration which is the cumulative effect of evaporation and transpiration. In these situations, instead of using two terms viz. evaporation and transpiration in the equation only one term is used i.e. Evapotranspiration.

Data computation methodology

Evapotranspiration = A * ETR * Days * (RD + CR - GWL) / (RD + CR)

Where,

A = Area

ETR = Evapotranspiration Rate

RD = Average Root Depth

CR = Capillary Rise

GWL = Ground Water Level

4.2.6 Base flow

Even though the aquifers are underdeveloped, the water levels will not rise to ground level. The reason for this is base flow.

Data computation methodology

Base flow is calculated at Stream Gauge discharge:

If Spell Number is 0, then.

Base flow = Stream Discharge

Else

Base flow = Discharge at Start day in the spell + Day Number in the Spell * Slope of Discharge
Straight line of the Spell

Where,

Stream Discharge = Average of 5 years of Daily Stream Discharge data

Slope of Discharge Straight line of the Spell = (Discharge at End day – Discharge at State day) / (Number of Days)

4.2.7 Environmental Flows

The Unaccounted Natural Discharges are estimated based on the method used for calculating rainfall recharge in monsoon season. If the rainfall recharge is computed using water table fluctuation method,5% of the Total Annual Ground Water Recharge is taken as unaccounted Natural discharges else it is 10%of the Total Annual Ground Water Recharge.

4.3 Annual Extractable Ground Water Resource

The Total Annual Ground Water Recharge cannot be utilized for human consumption as there are some ecological commitments to be fulfilled before the extractable resources is defined. Therefore, ground water base flow contribution limited to the ecological flow of the river should be determined which will be deducted from Annual Ground Water Recharge to determine Annual Extractable Ground Water Resources (AEGR).

Data computation methodology

$$AEGR = TGWR - ND$$

Where,

AEGR = Annual Extractable Ground Water Resources
TGWR = Total Ground Water Recharge
ND = Natural Discharges

4.4 Ground Water Extraction

Ground water draft or extraction can be assessed as follows:

$$GE_{ALL} = GE_{DOM} + GE_{IRR} + GE_{IND}$$

Where,

GE_{ALL} = Ground water extraction for all uses

GE_{DOM} = Ground water extraction for domestic uses GE_{IRR} = Ground water extraction for irrigation uses GE_{IND} = Ground water extraction for industrial uses

4.4.1 Extraction for Domestic Use

Ground water which is extracted for domestic use can be estimated based on well census method or requirement method.

Data Elements Used

Component	Parameter	Unit
Ground Water Extraction	Well Census	Number
	Number of days	Number
	Population	Number
	Consumptive Requirement	Litres per capita per day

Data computation methodology

Ground Water Extraction for Domestic Use can be calculated in 2 ways:

Unit Draft Method: Formula for Unit Draft Method is:

$$GE_{DOM} = \text{Unit Draft} * \text{Wells}$$

Where,

Unit Draft = Draft per well

Wells = Number of Wells used for domestic purpose

Consumptive Use Method: Formula for Consumptive Use Method is: GE_{DOM} = Population * Consumptive Requirement * Lg

Where,

Consumptive Requirement = Per Capita Daily Water Requirement (lpcd)

Lg = Fractional Load on Ground Water for Domestic Water Supply

4.4.2 Extraction for Irrigation Use

One of the main sources of water is ground water on which many farmers depends for irrigation. This can be estimated based on Well Census Method, Crop Water Requirement Method or Power Consumption Method.

Data Elements Used

Component	Parameter	Unit
Ground Water Extraction	Well Census	Number
	Number of days	Number
	Cropping Pattern	Acres
	Power Consumed	Kilo Watt Hours

Data computation methodology

Ground Water Extraction for Irrigation Use can be calculated in 3 ways:

Unit Draft Method: Formula for Unit Draft Method is:

$$GE_{IRR} = \text{Unit Draft} * \text{Wells}$$

Where,

Unit Draft = Unit Draft per well

Wells = Number of Wells used for irrigation purpose

Crop Water Requirement Method: Formula for Crop Water Requirement Method is: GE_{IRR} = (Crop Water Requirement * Crop Area) / 1000

Power Consumption Method: Formula for Power Consumption Method is:

$$GE_{IRR} = \text{Extraction} * \text{Power Units}$$

Where,

Extraction = Extraction per unit power consumption

Power Units = Number of units of power consumed for agricultural pump

4.4.3 Extraction for Industrial Use

Most industries, especially in the manufacturing field require a significant amount of water to produce goods. Due to the continuous flow of water, ground water provides ongoing functioning of the industries for a sustain able production.

Data Elements Used

Component	Parameter	Unit
Ground Water Extraction	Well Census	Number
	Number of days	Number
	Number of Industrial Units	Number

Data computation methodology

Ground Water Extraction for Industrial Use can be calculated in 2 ways:

Unit Draft Method: Formula for Unit Draft Method is:

$$GE_{IND} = \text{Unit Draft} * \text{Wells}$$

Where,

Unit Draft = Unit Draft per well

Wells = Number of Wells used for industrial purpose

Consumptive Use Method: Formula for Consumptive Use Method is:

$$GE_{IND} = \text{Number of industrial units} * \text{Unit Water Consumption} * Lg$$

Where,

Lg = Fractional Load on Ground Water for Domestic Water Supply

4.5 Stage of Ground Water Extraction (%)

To define a particular area in terms of Ground Water, we use stage of extraction. It defines the amount of water extracted from total extractable ground water resources and is expressed in percentage.

Data computation methodology

The stage of ground water extraction is calculated as follows:

$$\text{Stage of Extraction (\%)} = (GE)/(AEGR)*100$$

Where,

GE = Existing Gross Ground Water Extraction from all uses

AEGR = Annual Extractable Ground Water Resources

4.6 Categorization of the Assessment Unit

Based on Stage of Extraction we categorize the area into 4 categories SAFE, SEMI-CRITICAL,

CRITICAL and OVER-EXPLOITED. The purpose of this categorization is to find out over exploited and non-exploited areas for planning actions regarding ground water resources.

Data computation methodology

Based on Stage of Ground Water Extraction, assessment units into 4 categories:

- SAFE
- SEMI-CRITICAL
- CRITICAL
- OVER-EXPLOITED

The criteria for categorization of Assessment units will be:

Stage of Extraction (%)	Categorization
0 to <= 70	SAFE
>70 to <=90	SEMI-CRITICAL
>90 to <= 100	CRITICAL
>100	OVER-EXPLOITED

4.7 Allocation of Ground Water Resource for Utilization

The Annual Extractable Ground Water Resources are to be apportioned between domestic, industrial and irrigation uses. This requirement has to be based on population as projected for the year 2025, per capita requirement of water for domestic use, and relative load on ground water for urban and rural water supply.

Data computation methodology

The Annual Extractable Ground Water Resources follow the following empirical relation:

$$Alloc = 22 \times N \times Lg \text{ (mm/year)}$$

Where,

Alloc = Allocation for domestic water requirement

N = population density in the unit in thousands per sq.km.

Lg = fractional load on ground water for domestic water supply (<1.0) It is assumed that the requirement of water for domestic use is 60 lpcd per head.

4.8 Net Annual Ground Water Availability

The water available for future use is obtained by deducting the allocation for domestic use and current extraction for Irrigation and Industrial use from the Annual Extractable Ground Water Recharge. The

resulting ground water potential is termed as the Net Annual Ground Water Availability for future use.

Data computation methodology

Net Annual Ground Water Availability is computed as:

Net Annual Ground Water Availability = Total Annual Ground Water Recharge – Unaccounted Natural Discharges

4.9 In-Storage Unconfined Ground Water Resources

Static Ground Water Resources of an area are the resources which remain available below the dynamic zone of water table fluctuation. This is not replenished every year and extracting this water is called ground water mining.

Data Elements Used

Component	Parameter	Unit
In Storage Resources of Unconfined Aquifer	Area	Hectares
	Bottom of Dynamic Zone	Meters
	Bottom of unconfined Aquifer	Meters

Data computation methodology

In-Storage Ground Water Resources can be expressed as follows:

$$SGWR = A * (Z2 - Z1) * SY$$

Where,

SGWR = Static or In-Storage Ground Water Resources A = Area of the Assessment Unit

Z2 = Bottom of Unconfined Aquifer

Z1 = Pre-monsoon water level

SY = Specific Yield in the Zone of static ground water resources

4.10 In-Storage Confined Aquifer Water Resources

Confined aquifers consist of an impermeable dirt/rock layer which prevents water from seeping into the aquifer from the ground surface located above. Instead, water seeps into confined aquifers from place where the impermeable layer does not exist. Assessment of ground water resources for confined aquifers assumes crucial importance since over- exploitation of these aquifers

may lead to far more detrimental consequences than to those of shallow unconfined aquifers.

Data Elements Used

Component	Parameter	Unit
In Storage Resources of Confined Aquifer	Area	Hectares
	Pre monsoon Piezometric head	Meters
	Post monsoon Piezometric head	Meters
	Bottom of Top Confining Layer	Meters

Data computation methodology

Confined Aquifer Water Resources can be expressed as follows:

$$Q_{Confined} = A * S * \Delta h = A * S * (hPRE - h0)$$

Where,

$Q_{Confined}$ = In storage Ground Water Resource of Confined Aquifer A = Areal extent of the confined aquifer

S = Storativity

Δh = Change in Piezometric head

h0 = Bottom level of the top confining layer

hPRE = Piezometric head during pre-monsoon period

If the confined aquifer is not being exploited for any purpose, the dynamic and static resources of the confined aquifer need not be estimated separately. Instead, the in storage of the aquifer can be computed using the following formula.

$$Q_{Confined} = A * S * \Delta h = A * S * (hPOST - h0)$$

Where,

$Q_{Confined}$ = In storage Ground Water Resource of Confined Aquifer A = Areal extent of the confined aquifer

S = Storativity

Δh = Change in Piezometric head

hPOST = Piezometric head during post-monsoon period h0 =

Bottom of the Top Confining Layer

4.11 Dynamic Confined Aquifer Water Resources

Data Elements Used

Component	Parameter	Unit
Dynamic Resources of Confined Aquifer	Area	Hectares
	Pre monsoon Piezometric head	Meters
	Post monsoon Piezometric head	Meters

Data computation methodology

Confined Aquifer Water Resources can be expressed as follows:

$$Q_{Confined} = A * S * \Delta h = A * S * (hPOST - hPRE)$$ Where,

$Q_{Confined}$ = Dynamic Ground Water Resource of Confined Aquifer A =

Areal extent of the confined aquifer

S = Storativity

Δh = Change in Piezometric head

hPOST =Piezometric head during post-monsoon period

hPRE = Piezometric head during pre-monsoon period

4.12 In-Storage Semi-Confined Aquifer Water Resources

An aquifer which is partially confined by soil layers of low permeability through which recharge and discharge can still occur. Unless and until, it is well studied that the recharge to this is not computed either in the over lying unconfined aquifer or underlying/overlying semi confined aquifers, it should not be assessed separately.

Data Elements Used

Component	Parameter	Unit
In Storage Resources of Semi-Confined Aquifer	Area	Hectares
	Pre monsoon Piezometric head	Meters
	Post monsoon Piezometric head	Meters

	Bottom of Top Confining Layer	Meters

Data computation methodology

Semi-Confined Aquifer Water Resources can be expressed using the same formula as in Confined Aquifer Water Resources:

$$Q_{Semi - Confined} = A * S * \Delta h = A * S * (ht – h0)$$

Where,

$Q_{Semi - Confined}$ = In storage Ground Water Resource of Semi – ConfinedAquifer

A = Areal extent of the semi-confined aquifer S

= Storativity

Δh = Change in Piezometric head

h0 = Bottom level of the top confining layer hPRE =

Piezometric head at any particular time

4.13 Dynamic Semi-Confined Aquifer Water Resources

Data Elements Used

Component	Parameter	Unit
Dynamic Resourcesof Semi-ConfinedAquifer	Area	Hectares
	Pre monsoon Piezometric head	Meters
	Post monsoon Piezometric head	Meters

Data computation methodology

Semi-Confined Aquifer Water Resources can be expressed as follows:

$$Q_{Semi - Confined} = A * S * \Delta h = A * S * (hPOST – hPRE)$$

Where,

$Q_{Semi - Confined}$ = Dynamic Ground Water Resource of Semi – Confined

Aquifer

A = Areal extent of the semi-confined aquifer S

= Storativity

Δh = Change in Piezometric head

hPOST = Piezometric head during post-monsoon period

hPRE = Piezometric head during pre-monsoon period

4.14 Quality Tagging

Quality assessment of ground water is equally important as the quantity assessment. The major sources of quality concern are salinity, fluoride, and arsenic. It can vary depending on the area also. If the particular parameter is influencing an area in mappable units then the parameter should be tagged to the assessment subunit. Apart from salinity, fluoride and arsenic, if there is any other parameter, that is also captured in this.

4.15 Additional Potential Resource

4.15.1 Spring Discharge

Spring discharge constitutes an additional source of ground water in hilly areas which emerges at the places where ground water level cuts the surface topography.

Data computation methodology

Potential ground water resource due to springs can be expressed as follows:

Potential Resources (Springs) = Q * No of days Where,

Q = Spring Discharge

No of days = Number of days spring yields

4.15.2 Waterlogged areas and shallow water table

In the area where the ground water level is less than 5m below ground level or in water logged areas, the resources up to 5 m below ground level are potential and are used in addition to the annual recharge in the area.

Data Elements Used

Component	Parameter	Unit
Waterlogged and shallow water table	Depth to water table below ground surface	Meters

	Area of shallow water table zone	Hectares
	Specific Yield	Fraction

Data computation methodology

Potential ground water resource in shallow water table areas can be expressed as follows:

Potential Resources (Waterlogged/Shallow Water Table) = (5-D) * A * SY

Where,

D = Depth to water table below ground surface in pre-monsoon period in shallow aquifers

A = Area of shallow water table zone

SY = Specific Yield

4.15.3 Flood Prone

Ground water recharge from a flood plain is calculated considering area extent of flood plain, Retention period of flood and Type of sub-soil strata and silt charge in the river water which gets deposited and control seepage.

Data Elements Used

Component	Parameter	Unit
Flood Prone	Number of Days	Number
	Flood Prone Area	Hectare

Data computation methodology

Potential ground water resource in flood prone areas can be expressed as follows: Potential Resources (Flood Prone) = 1.4 * N * A/1000

Where,

N = No of Days Water is Retained in the Area A

= Flood Prone Area

4.16 Coastal Areas

Data computation methodology

Coastal Area resources can be expressed as follows:

$$\Delta S = A * (PostWT - PreWT) * SY$$

Where,

ΔS = Change in Ground Water Storage A

= Area of Coastal Zones

PreWT = Water table during Pre-monsoon = RL of GL – water level during pre-monsoon season in mbgl

PostWT = Water table during Post-monsoon = RL of GL – water level during post-monsoon season in mbgl

SY = Specific Yield

In-storage Coastal Area resources can be expressed as follows:

$$\text{In-Storage Resources} = A * (PreWT - \text{Bottom of Aquifer}) * SY$$

Where,

A = Area of Coastal Zones

PreWT = Water table during Pre-monsoon = RL of GL – water level during pre-monsoon season in mbgl

Bottom of the Aquifer is to be limited to 40*(pre monsoon water table above mean sea level)

4.17 Water Depletion Zones

Data computation methodology

Water Depletion zone resources can be expressed as follows:

$$\Delta S = A * (Pre - Post) * SY$$

Where,

ΔS = Change in Ground Water

Storage A = Area of Water

Depletion Zones

Pre = Pre - monsoon Ground water

level Post = Post - monsoon Ground

water level SY = Specific Yield

4.18 Validation using GW

Ground Water assessment is based on the Stage of Extraction which has inherent uncertainties. The estimation of ground water extraction is based on indirect assessment using factors such as electricity consumption, well census and area irrigated from ground water. Thus, it is very important to validate the 'Stage of Ground Water Extraction' with long term trend of ground water levels. Long term water level trends are needed for a minimum period of 10 years for both pre-monsoon and post-monsoon period. This data will help in getting the Trend of Ground Water over the years. Following table is used for validation:

Stage of Extraction	Ground Water Level Trend Observed	Remarks
<= 70%	Significant decline in trend in both pre-monsoon and post-monsoon	Not acceptable and needs reassessment
>100%	No significant decline in both pre-monsoons and post-monsoon long term trend	Not acceptable and needs reassessment

5.0 PROCEDURE AND ASSUMPTIONS OF PRESENT ASSESSMENT

5.1. Data Source for Each of the Data Element and How the Data Was Used in the Computation (Constraint in the Database If Any)

The present assessment was conducted online for the first time via INGRES portal. The rainfall data being one of the primary components of ground water recharge are collected from Indian Meteorological Department Lucknow and IMD website Fifty years data from 1951 to 2000 are considered for normal rainfall and average annual data from 2016-2020 available for all rain gauge stations in the district are taken into account for computation purposes. Density of CGWB monitoring wells (1050 numbers) was not sufficient for water level fluctuation computation and trend analysis; hence data of representative permanent observation wells of Ground Water Department (MW-10,000 numbers) are used for the assessment. Ground Water Draft for domestic water supply has been computed on the basis of block wise/urban population for the base year. The population is collected from National Census for the census year 2011 and decadal growth rate between 2001 and 2011. The irrigation data for bore/tube wells and dug wells are collected from Census of Minor Irrigation Department Govt. of U.P. The data pertaining to surface water irrigation, canal, tanks ponds etc are also collected from Water Resources Department (Irrigation) whereas data of conservation structures like percolation tanks, stop dams and check dams are taken from District Development offices. Changes, If any, applied in the Original Methodology Proposed By GEC 15 is provided along with Justification

All the data provided by the state departments has been computerized and Estimation of ground water resources has been carried out based on the methodology recommended by the Ground Water Estimation Committee (GEC-2015) for estimation of recharge, extraction, natural discharge, stage of extraction etc.

5.2 Various Norms Used in the Computation

5.2.1 Norms Used in Rainfall Recharge:

Ground water recharge from monsoon and non-monsoon rainfall has been computed separately. For computations of recharge from monsoon rainfall both methods i.e., water level fluctuation method and rainfall infiltration factor method (deduction threshold value of 10%) have been used. For comparison of figures obtained from these two methods, percent deviation is calculated and figures of recharge have been accepted as recommended in this methodology. For computation of non-monsoon rainfall recharge rainfall infiltration factor method is adopted when ratio of normal non-monsoon rainfall to normal annual rainfall is more than 10% as suggested in the methodology. For Uttar Pradesh especially in western part, this component of recharge is zero as said ratio is less than 10%. The specific yield and rainfall infiltration factor of the formations for calculating the recharge for rainfall are used recommended by subcommittee in accordance with GEC 2015.

Table: 6 Norms recommended for the Rainfall Infiltration Factor

NORMS RECOMMENDED FOR THE RAINFALL INFILTRATION FACTOR							
Sl. No	Principal Aquifer	Major Aquifers		Age	Recommended(%)	Minimum (%)	Maximum (%)
		Code	Name				
1	Alluvium	AL01	Younger Alluvium (Clay/Silt/Sand/Calcareous	Quaternary	22	20	24
2	Alluvium	AL02	Pebble / Gravel/ Bazada/	Quaternary	22	20	24
3	Alluvium	AL03	Older Alluvium (Silt/Sand/Gravel)	Quaternary	22	20	24
4	Alluvium	AL04	Aeolian Alluvium (Silt/	Quaternary	22	20	24
5	Alluvium	AL05	Coastal Alluvium (Sand/Silt/Clay) -East		16	14	18
5	Alluvium	AL05	Coastal Alluvium (Sand/Silt/Clay) - West	Quaternary	10	8	12
6	Alluvium	AL06	Valley Fills	Quaternary	22	20	24
7	Alluvium	AL07	Glacial Deposits	Quaternary	22	20	24
8	Laterite	LT01	Laterite / Ferruginous concretions	Quaternary	7	6	8
9	Basalt	BS01	Basic Rocks (Basalt) Vesicular or Jointed	Mesozoic to Cenozoic	13	12	14
9	Basalt	BS01	Basic Rocks (Basalt) - Weathered	Mesozoic to Cenozoic	7	6	8

NORMS RECOMMENDED FOR THE RAINFALL INFILTRATION FACTOR							
Sl. No	Principal Aquifer	Major Aquifers		Age	Recommended(%)	Minimum (%)	Maximum (%)
		Code	Name				
10	Basalt	BS01	Basic Rocks (Basalt) - Massive	Mesozoic to Cenozoic	2	1	3
11	Basalt	BS02	Ultra Basic – Vesicular orJointed	Mesozoic to Cenozoic	13	12	14
11	Basalt	BS02	Ultra Basic - Weathered	Mesozoic to Cenozoic	7	6	8
12	Basalt	BS02	Ultra Basic - Massive Poorly	Mesozoic to Cenozoic	2	1	3
13	Sandstone	ST01	Sandstone/Conglomerat	UpperPalaeozoic	12	10	14
14	Sandstone	ST02	Sandstone with Shale	Upper Palaeozoic	12	10	14
15	Sandstone	ST03	Sandstone with shale/coal beds	Upper Palaeozoic	12	10	14
16	Sandstone	ST04	Sandstone with Clay	Upper Palaeozoic	12	10	14
17	Sandstone	ST05	Sandstone/Conglomerat	Proterozoic toCenozoic	6	5	7
18	Sandstone	ST06	Sandstone with Shale	Proterozoic to Cenozoic	6	5	7
19	Shale	SH01	Shale with limestone	Upper Palaeozoic	4	3	5
20	Shale	SH02	Shale with Sandstone	Upper Palaeozoic	4	3	5
21	Shale	SH03	Shale, limestone and sandstone	Upper Palaeozoic	4	3	5
22	Shale	SH04	Shale	Upper Palaeozoic	4	3	5
23	Shale	SH05	Shale/Shale with Sandstone	Proterozoic to Cenozoic	4	3	5
24	Shale	SH06	Shale with Limestone	Proterozoic to Cenozoic	4	3	5
25	Limestone	LS01	Miliolitic Limestone	Quarternary	6	5	7
27	Limestone	LS02	Limestone / Dolomite	Upper Palaeozoic	6	5	7
28	Limestone	LS03	KarstifiedLimestone / Dolomite	Upper Palaeozoic to Cenozoic	10	5	15
29	Limestone	LS03	Limestone/Dolomite	Proterozoic	6	5	7
30	Limestone	LS03	KarstifiedLimestone/Dolomite	Proterozoic	10	5	15
31	Limestone	LS04	Limestone with Shale	Proterozoic	6	5	7
32	Limestone	LS04	KarstifiedLimestone with Shale	Proterozoic	10	5	15
33	Limestone	LS05	Marble	Azoic to Proterozoic	6	5	7
34	Limestone	LS05	KarstifiedMarble	Azoic to Proterozoic	10	5	15
35	Granite	GR01	Acidic Rocks (Granite,Syenite, Rhyolite Weathered,Jointed	Mesozoic to Cenozoic	7	5	9
36	Granite	GR01	Acidic Rocks (Granite,Syenite, Rhyolite etc.)-Massive	Mesozoic to Cenozoic	2	1	3

NORMS RECOMMENDED FOR THE RAINFALL INFILTRATION FACTOR							
Sl. No	Principal Aquifer	Major Aquifers		Age	Recommended(%)	Minimum (%)	Maximum (%)
		Code	Name				
37	Granite	GR02	Acidic Rocks (Pegmatite, Granite,Syenite,Rhyolite Weathered,Jointed	Proterozoic to Cenozoic	11	10	12
38	Granite	GR02	Acidic Rocks (Pegmatite, Granite, Syenite,Rhyolite etc.) - Massive,Poorly Fractured	Proterozoic to Cenozoic	2	1	3
39	Schist	SC01	Schist - Weathered, Jointed	Azoic to Proterozoic	7	5	9
40	Schist	SC01	Schist - Massive, Poorly Fractured	Azoic to Proterozoic	2	1	3
41	Schist	SC02	Phyllite	Azoic to Proterozoic	4	3	5
42	Schist	SC03	Slate	Azoic to Proterozoic	4	3	5
43	Quartzite	QZ01	Quartzite - Weathered, Jointed	Proterozoic toCenozoic	6	5	7
44	Quartzite	QZ01	Quartzite - Massive, Poorly	Proterozoic toCenozoic	2	1	3
45	Quartzite	QZ02	Quartzite - Weathered, Jointed	Azoic to Proterozoic	6	5	7
46	Quartzite	QZ02	Quartzite- Massive,Poorly Fractured	Azoic to Proterozoic	2	1	3
47	Charnockite	CK01	CharnockiteWeathered, Jointed	Azoic	5	4	6
48	Charnockite	CK01	Charnockite - Massive, Poorly	Azoic	2	1	3
49	Khondalite	KH01	Khondalites, Granulites Weathered, Jointed	Azoic	7	5	9
50	Khondalite	KH01	Khondalites,Granulites Mssive, PoorlyFractured	Azoic	2	1	3
51	Banded Gneissic Complex	BG01	Banded Gneissic Complex Weathered, Jointed	Azoic	7	5	9
52	Banded Gneissic Complex	BG01	BandedGneissicComplex Massive,PoorlyFractured	Azoic	2	1	3
53	Gneiss	GN01	Undifferentiated metasedimentaries/ Undifferentiated metamorphic - Weathered,	Azoic to Proterozoic	7	5	9
54	Gneiss	GN01	Undifferentiated metasedimentaries/ Undifferentiated metamorphic - Massive, Poorly Fractured	Azoic to Proterozoic	2	1	3
55	Gneiss	GN02	Gneiss -Weathered, Jointed	Azoic to Proterozoic	11	10	12
56	Gneiss	GN02	Gneiss-Massive, Poorly Fractured	Azoic to Proterozoic	2	1	3
57	Gneiss	GN03	Migmatitic Gneiss-Weathered,Jointed	Azoic	7	5	9
58	Gneiss	GN03	Migmatitic Gneiss - Massive,	Azoic	2	1	3

NORMS RECOMMENDED FOR THE RAINFALL INFILTRATION FACTOR							
Sl. No	Principal Aquifer	Major Aquifers		Age	Recommended(%)	Minimum (%)	Maximum (%)
		Code	Name				
59	Intrusive	IN01	Basic Rocks (Dolerite, Anorthosite etc.) - Weathered, Jointed	Proterozoic to Cenozoic	7	6	8
60	Intrusive	IN01	Basic Rocks (Dolerite, Anorthosite etc.) - Massive, Poorly Fractured	Proterozoic to Cenozoic	2	1	3
61	Intrusive	IN02	Ulrta Basics (Epidiorite, Granophyre etc.) - Weathered, Jointed	Proterozoic to Cenozoic	7	6	8
62	Intrusive	IN02	Ulrta Basics (Epidiorite, Granophyre etc.) - Massive, Poorly Fractured	Proterozoic to Cenozoic	2	1	3

5.2.2 Norms Used in Recharge from Other Sources:

As per recommendations of methodology, recharge from other sources has been calculated separately for monsoon and non-monsoon periods. The factors for calculation of return flow from irrigation, canal seepage, recharge from Tanks and Ponds and water conservation structures have been taken as those recommended by GEC '15. The canals in Uttar Pradesh by and large run during non-monsoon period, as major part of the area is falling under non-paddy crops especially in western part of U.P.

5.2.3 Norms Used in Ground Water Extraction for Domestic and Industrial Water Supply

Ground Water Draft for domestic and industrial water supply has been computed on the basis of block wise population for the base year. The population figures were available for the year 2011 and same was projected for March-2017 and 2025, considering decadal growth rate between 2001-2011. The average per capita consumption has been considered 60 litres per day. Population getting water supply from surface water has been not considered for ground water draft calculation. Extraction during monsoon and non-monsoon periods has been calculated separately taking 4 months as monsoon period and 8 months as non-monsoon period.

Table: 7 Norms recommended for the Specific Field

NORMS RECOMMENDED FOR THE SPECIFIC YIELD							
Sr. No	Principal Aquifer	Major Aquifers		Age	Recommended (%)	Minimum (%)	Maximum (%)
		Code	Name				
1	Alluvium	AL01	Younger Alluvium (Clay/Silt/Sand/ Calcareous concretions)	Quaternary	10	8	12
2	Alluvium	AL02	Pebble / Gravel/Bazada/ Kandi	Quaternary	16	12	20
3	Alluvium	AL03	Older Alluvium (Silt/Sand/Gravel/Lith omargic clay)	Quaternary	6	4	8
4	Alluvium	AL04	Aeolian Alluvium (Silt/Sand)	Quaternary	16	12	20
5	Alluvium	AL05	Coastal Alluvium (Sand/Silt/Clay)	Quaternary	10	8	12
6	Alluvium	AL06	Valley Fills	Quaternary	16	12	20
7	Alluvium	AL07	Glacial Deposits	Quaternary	16	12	20
8	Laterite	LT01	Laterite / Ferruginous concretions	Quaternary	2.5	2	3
9	Basalt	BS01	Basic Rocks (Basalt) - Weathered, Vesicular or Jointed	Mesozoic to Cenozoic	2	1	3
10	Basalt	BS01	Basic Rocks (Basalt) - Massive Poorly Jointed	Mesozoic to Cenozoic	0.35	0.2	0.5
11	Basalt	BS02	Ultra Basic -Weathered, Vesicular or Jointed	Mesozoic to Cenozoic	2	1	3
12	Basalt	BS02	Ultra Basic - Massive Poorly Jointed	Mesozoic to Cenozoic	0.35	0.2	0.5
13	Sandstone	ST01	Sandstone/Conglome rate	Upper Palaeozoic to Cenozoic	3	1	5
14	Sandstone	ST02	Sandstone with Shale	Upper Palaeozoic to Cenozoic	3	1	5
15	Sandstone	ST03	Sandstone with shale/coal beds	Upper Palaeozoic to Cenozoic	3	1	5
16	Sandstone	ST04	Sandstone with Clay	Upper Palaeozoic to Cenozoic	3	1	5
17	Sandstone	ST05	Sandstone/Conglome rate	Proterozoic toCenozoic	3	1	5
18	Sandstone	ST06	Sandstone with Shale	Proterozoic toCenozoic	3	1	5

NORMS RECOMMENDED FOR THE SPECIFIC YIELD							
Sr. No	Principal Aquifer	Major Aquifers		Age	Recommended (%)	Minimum (%)	Maximum (%)
		Code	Name				
19	Shale	SH01	Shale with limestone	Upper Palaeozoic to Cenozoic	1.5	1	2
20	Shale	SH02	Shale with Sandstone	Upper Palaeozoic to Cenozoic	1.5	1	2
21	Shale	SH03	Shale, limestone and sandstone	Upper Palaeozoic to Cenozoic	1.5	1	2
22	Shale	SH04	Shale	Upper Palaeozoic to Cenozoic	1.5	1	2
23	Shale	SH05	Shale/Shale with Sandstone	Upper Palaeozoic to Cenozoic	1.5	1	2
24	Shale	SH06	Shale with Limestone	Upper Palaeozoic to Cenozoic	1.5	1	2
25	Limestone	LS01	Miliolitic Limestone	Quarternary	2	1	3
26	Limestone	LS01	KarstifiedMiliolitic Limestone	Quarternary	10	5	15
27	Limestone	LS02	Limestone / Dolomite	Upper Palaeozoic to Cenozoic	2	1	3
28	Limestone	LS02	KarstifiedLimestone /Dolomite	Upper Palaeozoicto Cenozoic	10	5	15
29	Limestone	LS03	Limestone/Dolomite	Proterozoic	2	1	3
30	Limestone	LS03	Karstified Limestone/Dolomite	Proterozoic	10	5	15
31	Limestone	LS04	Limestone with Shale	Proterozoic	2	1	3
32	Limestone	LS04	Karstified Limestone with Shale	Proterozoic	10	5	15
33	Limestone	LS05	Marble	Azoic to Proterozoic	2	1	3
34	Limestone	LS05	Karstified Marble	Azoic to Proterozoic	10	5	15
35	Granite	GR01	Acidic Rocks (Granite,Syenite, Rhyoliteetc.) Weathered ,Jointed	Mesozoic to Cenozoic	1.5	1	2
36	Granite	GR01	Acidic Rocks (Granite,Syenite, Rhyoliteetc.)-Massive or Poorly Fractured	Mesozoic to Cenozoic	0.35	0.2	0.5
37	Granite	GR02	Acidic Rocks Weathered, Jointed	Proterozoic to Cenozoic	3	2	4

NORMS RECOMMENDED FOR THE SPECIFIC YIELD							
Sr. No	Principal Aquifer	Major Aquifers		Age	Recommended (%)	Minimum (%)	Maximum (%)
		Code	Name				
38	Granite	GR02	Acidic Rocks Massive, Poorly Fractured	Proterozoic to Cenozoic	0.35	0.2	0.5
39	Schist	SC01	Schist - Weathered, Jointed	Azoic to Proterozoic	1.5	1	2
40	Schist	SC01	Schist - Massive, Poorly Fractured	Azoic to Proterozoic	0.35	0.2	0.5
41	Schist	SC02	Phyllite	Azoic to Proterozoic	1.5	1	2
42	Schist	SC03	Slate	Azoic to Proterozoic	1.5	1	2
43	Quartzite	QZ01	Quartzite –Weathered, Jointed	Proterozoic to Cenozoic	1.5	1	2
44	Quartzite	QZ01	Quartzite - Massive, Poorly Fractured	Proterozoic to Cenozoic	0.3	0.2	0.4
45	Quartzite	QZ02	Quartzite - Weathered, Jointed	Azoic to Proterozoic	1.5	1	2
46	Quartzite	QZ02	Quartzite- Massive, Poorly Fractured	Azoic to Proterozoic	0.3	0.2	0.4
47	Charnockite	CK01	Charnockite - Weathered, Jointed	Azoic	3	2	4
48	Charnockite	CK01	Charnockite - Massive, Poorly Fractured	Azoic	0.3	0.2	0.4
49	Khondalite	KH01	Khondalites, Granulites - Weathered, Jointed	Azoic	1.5	1	2
50	Khondalite	KH01	Khondalites, Granulites - Mssive, Poorly Fractured	Azoic	0.3	0.2	0.4
51	Banded Gneissic Complex	BG01	Banded Gneissic Complex - Weathered,Jointed	Azoic	1.5	1	2
52	Banded Gneissic Complex	BG01	BandedGneissic Complex - Massive, PoorlyFractured	Azoic	0.3	0.2	0.4
			Undifferentiated				
53	Gneiss	GN01	Undifferentiated metasedimentaries/ Undifferentiated metamorphic - Weathered, Jointed	Azoic to Proterozoic	1.5	1	2
54	Gneiss	GN01	Undifferentiated metasedimentaries/ Undifferentiated metamorphic - Massive, Poorly Fractured	Azoic to Proterozoic	0.3	0.2	0.4
55	Gneiss	GN02	Gneiss -Weathered, Jointed	Azoic to Proterozoic	3	2	4

NORMS RECOMMENDED FOR THE SPECIFIC YIELD							
Sr. No	Principal Aquifer	Major Aquifers		Age	Recommended (%)	Minimum (%)	Maximum (%)
		Code	Name				
56	Gneiss	GN02	Gneiss-Massive, Poorly Fractured	Azoic to Proterozoic	0.3	0.2	0.4
57	Gneiss	GN03	Migmatitic Gneiss-Weathered,Jointed	Azoic	1.5	1	2
58	Gneiss	GN03	Migmatitic Gneiss - Massive, Poorly Fractured	Azoic	0.3	0.2	0.4
59	Intrusive	IN01	Basic Rocks (Dolerite, Anorthosite etc.) - Weathered, Jointed	Proterozoic to Cenozoic	2	1	3
60	Intrusive	IN01	Basic Rocks (Dolerite, Anorthosite etc.) - Massive, Poorly Fractured	Proterozoic to Cenozoic	0.35	0.2	0.5
61	Intrusive	IN02	Ultrabasics (Epidiorite, Granophyre etc.)-Weathered,Jointed	Proterozoic to Cenozoic	2	1	3
62	Intrusive	IN02	Ultrabasics (Epidiorite, Granophyre etc.) - Massive, Poorly Fractured	Proterozoic to Cenozoic	0.35	0.2	0.5

Table: 8 Norms recommended for the water conservation structure

NORMS RECOMMENDED FOR WATER CONSERVATION STRUCTURE
40% of Gross Storage 20% during Monsoon and 20% During Non-Monsoon

Table: 9 Norms recommended for Tanks and Ponds

NORMS RECOMMENDED FOR THE TANKS AND PONDS
As the data on the field studies for computing recharge from Tanks & Ponds are very limited, it is recommended to follow the same norm as followed in GEC 1997 in future assessments also. Hence the norm recommended by GEC-2015 for Seepage from Tanks & Ponds is 1.4 mm / day.

5.2.4 Norms Used in Ground Water Extraction for Irrigation Uses

Block wise ground water extortion for irrigation has been calculated based on the number of ground water structures and the unit draft of different types of structures. Number of ground water structures data was obtained from census of Minor Irrigation -2014, for the year, 2015,

2016 and 2017. The unit draft of different ground water abstraction structures in each assessment unit for irrigation was determined in the field considering discharge of the well, pumping hours, number of running hours, days during monsoon and non-monsoon seasons.

The unit draft is also validated with the delta factor of crop water requirement and irrigated area. Private Shallow Tube well (P.S.), Private Deep Tubewells (P.T.W.) State Tube wells (S.T.W) are main abstraction structures, which are used for irrigation in the State.

Table: 10 Norms recommended for the Recharge from Irrigation

NORMS RECOMMENDED FOR THE RECHARGE FROM IRRIGATION				
DTW (m bgl)	Ground Water		Surface Water	
	Paddy	Non Paddy	Paddy	Non Paddy
<=10	45	25	50	30
11	43.3	23.7	48.3	28.7
12	41.7	22.3	46.7	27.3
13	40	21	45	26
14	38.3	19.7	43.3	24.7
15	36.7	18.3	41.7	23.3
16	35	17	40	22
17	33.3	15.7	38.3	20.7
18	31.7	14.3	36.7	19.3
19	30	13	35	18
20	28.3	11.7	33.3	16.7
21	26.7	10.3	31.7	15.3
22	25	9	30	14
23	23.3	7.7	28.3	12.7
24	21.7	6.3	26.7	11.3
>=25	20	5	25	10

Table: 11 Norms recommended for the Recharge due to canals

NORMS RECOMMENDED FOR THE RECHARGE DUE TO CANALS			
Formation	Canal Seepage factor ham/day/million Square meters of wetted Area		
	Recommended	Minimum	Maximum
Unlined canals in normal soils with some clay content along with sand	17.5	15	20
Unlined canals in sandy soil with some silt content	27.5	25	30
Lined canals in normal soils with some clay content along with sand	3.5	3	4
Lined canals in sandy soil with some silt content	5.5	5	6
All canals in hard rock area	3.5	3	4

6. COMPUTATION OF GROUND WATER RESOURCES IN UTTAR PRADESH

6.1. Salient features of the dynamic ground water resource assessment and Year of assessment

Estimation of ground water resources has been carried out based on the methodology recommended by the Ground Water Estimation Committee (GEC 2015). The base year for the assessment of ground water resources is 2019-20 and data of rainfall, ground water structures, canal, tanks ponds etc. are collected of five years from 2016 to 2020. The water level data are used from 2010 to 2020.

Assessment Unit

The administrative block has been considered as a unit of assessment. The unit is further considered command area due to lack of non-command area. The ground water resources have been computed for all 836 assessment units (826 blocks and 10 Urban area having more than ten lakhs population) of the State. Categorization of 6 newly created blocks has also been included in this assessment.

6.2. Sub-Unit-Wise Method Adopted for Computing Rainfall

Recharge During The following sub-units are taken into account for the computation of various parameters

(a) Hilly Area

Area having more than 20% slope has been excluded for ground water recharge computation.

(b) Poor Ground Water Quality Area

There is no clear cut demarcated area of poor quality in the State for computation of ground water resources. Apart from this, statistical data of ground water structure is also not available. Hence this unit has not been considered for resource estimation.

(c) Command and Non-Command Area

In the methodology, it is recommended that dynamic ground water resources estimation should be carried out for command and non-command area. As data of non-command area is not available hence the entire assessment unit is considered as Command area. Block-wise/Urban area, total geographical areas, hilly area, command area, non-command area and area worthy for ground recharge are given in Annexure III A- whereas district-wise geographical areas, hilly area, command area, and area worthy for ground recharge are shown in **Table-12**

Table:12 District-wise recharge worthy area of Uttar Pradesh under different categories

S.No	Name of District	Total Recharge Worthy Area of Assessed Units(in sq.km)	Safe		Semi-Critical		Critical		Over-Exploited	
			Recharge Worthy Areaof Assessed Units (in sq.km)	%	Recharge Worthy Areaof Assessed Units (in sq.km)	%	Recharge Worthy Areaof AssessedUnits (in sq.km)	%	Recharge Worthy Areaof Assessed Units (in sq.km)	%
1	**Agra**	3947.17	296.38	7.51	848.76	21.50	561.58	14.23	2240.45	56.76
2	**Aligarh**	3718.96	1762.31	47.39	1641.78	44.15	246.37	6.62	68.50	1.84
3	**Ambedkar Nagar**	2458.98	2158.67	87.79	300.31	12.21				
4	**Amethi**	2329.92	2228.16	95.63	101.76	4.37				
5	**Amroha**	2149.03			734.77	34.19	1064.54	49.54	349.72	16.27
6	**Aurraiya**	2094.27	2094.27	100.00						
7	**Ayodhya**	2522.01	2097.35	83.16	424.66	16.84				
8	**Azamgarh**	4171.19	3020.63	72.42	1150.56	27.58				
9	**Baghpat**	1351.39			482.18	35.68	210.63	15.59	658.57	48.73
10	**Bahraich**	4396.45	4396.45	100.00						
11	**Ballia**	3042.36	3042.36	100.00						
12	**Balrampur**	3348.57	3348.57	100.00						
13	**Banda**	4404.60	2159.49	49.03	2245.11	50.97				
14	**Barabanki**	3891.32	3891.32	100.00						
15	**Bareili**	4093.64	3244.34	79.25	742.83	18.15			106.47	2.60
16	**Basti**	2938.07	2938.07	100.00						
17	**Bijnaur**	4589.03	2809.11	61.21	1398.84	30.48	381.08	8.30		
18	**Budaun**	4237.88	1341.79	31.66	2136.10	50.40			759.99	17.93
19	**Bulandshahar**	3609.47	386.86	10.72	1023.77	28.36	1002.49	27.77	1196.35	33.14
20	**Chandauli**	1849.27	1849.27	100.00						
21	**Chitrakoot**	3006.65	1041.84	34.65	1410.80	46.92	554.01	18.43		
22	**Deoria**	2538.00	2538.00	100.00						
23	**Etah**	2427.57	485.67	20.01	1361.60	56.09	580.30	23.90		
24	**Etawah**	2403.01	2403.01	100.00						
25	**Farrukhabad**	2206.23	1063.82	48.22	1142.41	51.78				
26	**Fatehpur**	4252.55	2270.83	53.40	1287.95	30.29	349.59	8.22	344.18	8.09
27	**Firozabad**	2419.53			891.92	36.86	202.61	8.37	1325.00	54.76
28	**G.B. Nagar**	1442.73			473.82	32.84	636.66	44.13	332.25	23.03
29	**Ghaziabad**	1169.14			228.16	19.52			940.98	80.48
30	**Ghazipur**	3300.52	3082.02	93.38	218.50	6.62				
31	**Gonda**	3996.09	3996.09	100.00						
32	**Gorakhpur**	3226.54	3226.54	100.00						
33	**Hamirpur**	3815.40	1597.48	41.87	2217.92	58.13				
34	**Hapur**	1144.81			238.01	20.79	560.55	48.96	346.25	30.25
35	**Hardoi**	5948.43	5645.63	94.91	302.80	5.09				
36	**Hathras**	1837.99	327.40	17.81	290.96	15.83	537.95	29.27	681.68	37.09
37	**Jalaun**	4565.83	4565.83	100.00						
38	**Jaunpur**	3968.25	2204.19	55.55	1360.87	34.29	403.19	10.16		
39	**Jhansi**	4619.37	2644.95	57.26	1974.42	42.74				

S.No	Name of District	Total Recharge Worthy Area of Assessed Units(in sq.km)	Safe		Semi-Critical		Critical		Over-Exploited	
			Recharge Worthy Areaof Assessed Units (in sq.km)	%	Recharge Worthy Areaof Assessed Units (in sq.km)	%	Recharge Worthy Area of Assessed Units (in sq.km)	%	Recharge Worthy Areaof Assessed Units (in sq.km)	%
40	**Kannauj**	2143.46	996.35	46.48	773.25	36.07			373.86	17.44
41	**Kanpur Dehat**	3237.37	943.68	29.15	2293.69	70.85				
42	**Kanpur Nagar**	3345.79	949.51	28.38	1920.02	57.39	476.26	14.23		
43	**Kasganj**	1993.88	1098.74	55.11	688.08	34.51	207.06	10.38		
44	**Kaushambi**	1780.01	484.65	27.23	1015.97	57.08			279.39	15.70
45	**Kushi Nagar**	2873.78	2873.78	100.00						
46	**Lakhimpur Khiri**	6555.05	6555.05	100.00						
47	**Lalitpur**	3819.42			3819.42	100.00				
48	**Lucknow**	2452.86	2142.76	87.36					310.10	12.64
49	**Maharajganj**	2477.60	2477.60	100.00						
50	**Mahoba**	2293.41			1417.74	61.82			875.67	38.18
51	**Mainpuri**	2760.72	1663.68	60.26	886.69	32.12			210.35	7.62
52	**Mathura**	3360.78	2082.21	61.96	262.94	7.82	316.86	9.43	698.77	20.79
53	**Mau**	1716.24	1716.24	100.00						
54	**Meerut**	2802.20	1184.97	42.29	939.52	33.53	499.93	17.84	177.78	6.34
55	**Mirzapur**	2954.37	2137.01	72.33	487.67	16.51	232.99	7.89	96.70	3.27
56	**Moradabad**	2249.44	317.95	14.13	1585.16	70.47	269.08	11.96	77.25	3.43
57	**Muzaffarnagar**	2756.66	1469.32	53.30	743.91	26.99	304.70	11.05	238.73	8.66
58	**Pilibhit**	3369.59	3369.59	100.00						
59	**Pratapgarh**	3717.43	1166.46	31.38	1591.70	42.82	959.27	25.80		
60	**Prayagraj**	4947.63	3352.78	67.77	1140.30	23.05	384.50	7.77	70.05	1.42
61	**Rae Bareli**	3924.58	3924.58	100.00						
62	**Rampur**	2297.90	933.32	40.62	1149.00	50.00	215.58	9.38		
63	**S.Kabir Nagar**	1646.99	1646.99	100.00						
64	**S.Ravidas Nagar**	983.05			983.05	100.00				
65	**Saharanpur**	3689.41	260.96	7.07	1652.30	44.78	415.60	11.26	1360.55	36.88
66	**Shahjahanpur**	4581.31	4581.31	100.00						
67	**Shambhal**	2415.20	304.73	12.62	566.81	23.47	1543.66	63.91		
68	**Shamli**	1361.26			234.40	17.22			1126.86	82.78
69	**Shrawasti**	1857.82	1857.82	100.00						
70	**Siddharth Nagar**	2895.03	2895.03	100.00						
71	**Sitapur**	5746.95	5746.95	100.00						
72	**Sonbhadra**	2382.06	2080.98	87.36	301.08	12.64				
73	**Sultanpur**	2670.20	2670.20	100.00						
74	**Unnao**	4602.34	4602.34	100.00						
75	**Varanasi**	1563.74	179.37	11.47	923.21	59.04			461.16	29.49
	Total	**229657.75**	**148825.61**	**64.80**	**52007.48**	**22.65**	**13117.04**	**5.71**	**15707.61**	**6.84**

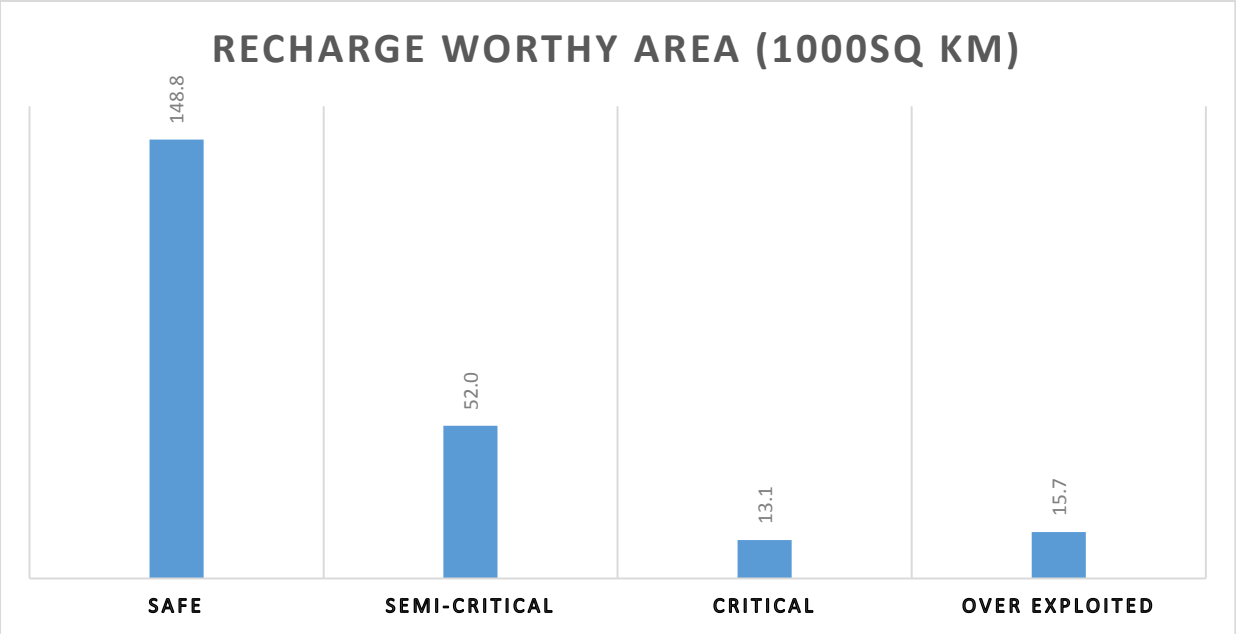


Fig 5: Recharge worthy area of state under different categories

6.3. Dynamic Ground Water Resources of Uttar Pradesh

Dynamic Groundwater resources of Uttar Pradesh have been computed according to Methodology and norms described in Chapter-5. The Assessment unit (Block/Urban) wise details have been provided in Annexure III B to III F. The Salient features of the computations are given below.

6.3.1. Recharge from Rainfall

Recharge from rainfall is mainly a function of geographical area of the district, normal monsoon rainfall and lithology of the area. Recharge from rainfall has been computed separately for monsoon and non-monsoon periods. The recharge from rainfall during monsoon season has been computed using mainly Water Level Fluctuation Method, whereas recharge from rainfall during non-monsoon period has been computed using Rainfall Infiltration Factor Method. Details of the assessment unit wise monsoon rainfall recharge and non-monsoon rainfall recharge have been given in Annexure III D. District-wise recharge from rainfall is given in Table-1by adding up assessment wise figures of the respective districts. Total recharge from Rainfall in the state is of the order of 3905130.69 Ham with Lakhimpur district having the highest recharge of 134549.73 Ham and Mahoba district has minimum recharge of the order of 9639.68 Ham.

6.3.2. Recharge from Other Sources

Total Recharge to ground water has several components, rainfall being the major one. The other component include seepage from canals, return flow from surface water irrigation, return flow from ground water irrigation, seepage from Tanks and Ponds. Recharge of assessment units from other sources has been given in Annexure-III D.

6.3.3. Recharge from All Sources

Total replenishable ground water resources including rainfall recharge and recharge from other sources have been computed on assessment unit wise and by adding up assessment unit figures of the respective districts which is presented in Annexure III D and Table-6 respectively.

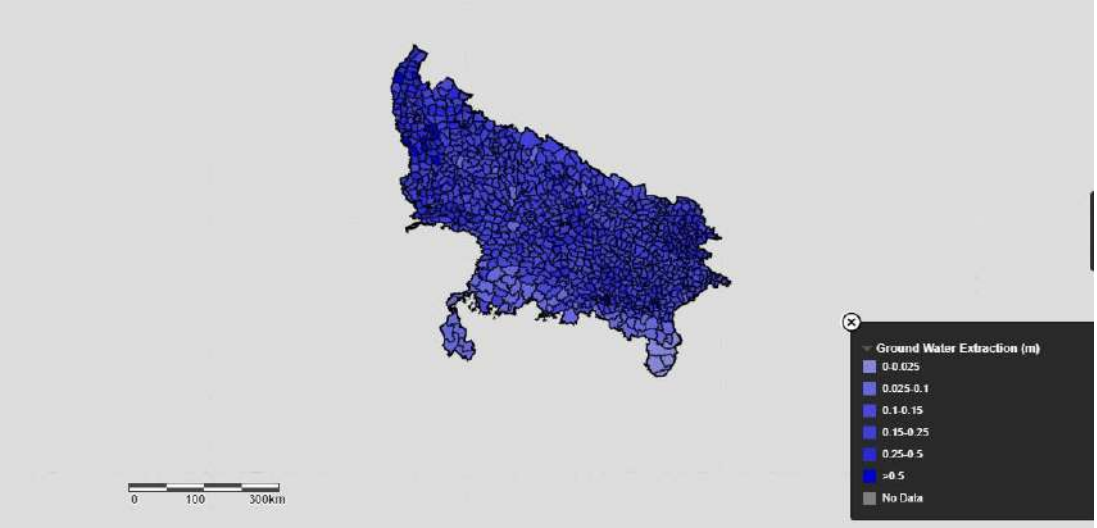
6.3.4. Unaccounted Natural Discharge and Annual Extractable Ground Water Resources

The total annual ground water recharge of the area is the sum of monsoon and non-monsoon recharge. An allowance of 5% to 10% of total annual ground water recharge has been kept for natural discharge in the non-monsoon season respectively. Because WLF and RIF method are employed to compute rainfall recharge during monsoon season. The balance ground water available accounts for existing net ground water availability for various uses and potential for future development. Assessment unit wise unaccounted natural discharge and net ground water availability is given in Annexure-III D whereas district wise unaccounted natural discharge and net ground water availability is given in Table -6.

6.3.5. Ground Water Extraction for Various Uses

Ground water extraction for various uses has been calculated and details of assessment unit wise groundwater are given in Annexure-III D. District-wise ground water extraction figures are also compiled and given in Table-13.

Fig 6: Ground water Extraction (m) (IN-GRES)



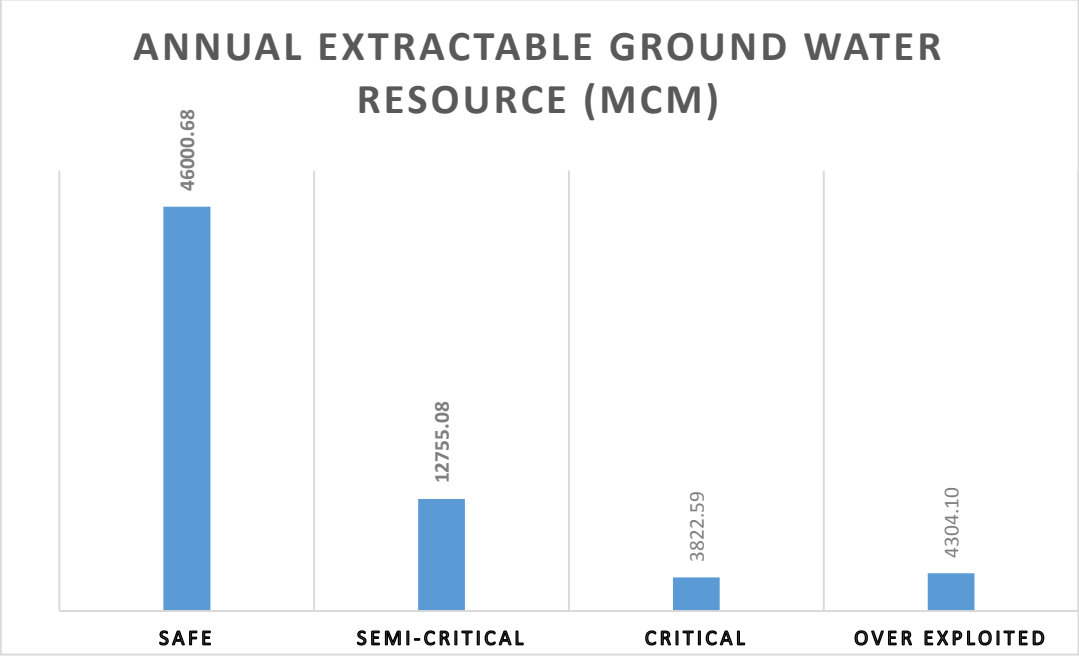


Fig 7: Annual Extractable Groundwater Resources under different categories

Table: 13 District- wise Total Annual Extractable resources of Uttar Pradesh under different categories

UTTAR PRADESH										
S.No	Name of District	Total Annual Extractable Resource of Assessed Units(in Mcm)	Safe		Semi-Critical		Critical		Over-Exploited	
			Annual Extractable Resource (in Mcm)	%	Annual Extractable Resource (in Mcm)	%	Annual Extractable Resource (in Mcm)	%	Annual Extractable Resource (in Mcm)	%
1	**Agra**	791.76	50.54	6.38	150.65	19.03	150.34	18.99	440.23	55.60
2	**Aligarh**	964.35	491.61	50.98	397.69	41.24	64.84	6.72	10.21	1.06
3	**Ambedkar Nagar**	733.40	649.31	88.53	84.09	11.47				
4	**Amethi**	820.27	785.46	95.76	34.81	4.24				
5	**Amroha**	508.22			197.67	38.89	226.55	44.58	84.00	16.53
6	**Aurraiya**	663.45	663.45	100.00						
7	**Ayodhya**	919.78	796.38	86.58	123.39	13.42				
8	**Azamgarh**	1132.52	844.64	74.58	287.88	25.42				
9	**Baghpat**	359.06			139.45	38.84	54.51	15.18	165.10	45.98
10	**Bahraich**	1322.91	1322.91	100.00						
11	**Ballia**	870.63	870.63	100.00						
12	**Balrampur**	872.91	872.91	100.00						
13	**Banda**	630.68	329.82	52.30	300.86	47.70				
14	**Barabanki**	1892.28	1892.28	100.00						
15	**Bareili**	1254.53	1002.85	79.94	233.87	18.64			17.81	1.42
16	**Basti**	724.79	724.79	100.00						
17	**Bijnaur**	1355.89	763.73	56.33	471.51	34.78	120.65	8.90		
18	**Budaun**	791.25	240.54	30.40	399.93	50.54	0.00	0.00	150.79	19.06
19	**Bulandshahar**	1517.60	168.95	11.13	505.81	33.33	360.84	23.78	482.00	31.76
20	**Chandauli**	514.43	514.43	100.00						
21	**Chitrakoot**	376.38	80.67	21.43	198.11	52.64	97.60	25.93		
22	**Deoria**	1290.78	1290.78	100.00						
23	**Etah**	571.90	125.34	21.92	315.99	55.25	130.57	22.83		
24	**Etawah**	743.77	743.77	100.00						
25	**Farrukhabad**	512.32	264.26	51.58	248.06	48.42				
26	**Fatehpur**	1380.89	720.62	52.19	418.89	30.33	88.82	6.43	152.56	11.05
27	**Firozabad**	669.99			317.67	47.41	54.67	8.16	297.65	44.43
28	**G.B. Nagar**	612.35			111.88	18.27	372.76	60.87	127.71	20.86
29	**Ghaziabad**	395.37			120.17	30.40			275.20	69.60
30	**Ghazipur**	950.63	884.64	93.06	65.99	6.94				
31	**Gonda**	950.98	950.98	100.00						
32	**Gorakhpur**	1625.75	1625.75	100.00						
33	**Hamirpur**	492.75	214.60	43.55	278.14	56.45				
34	**Hapur**	492.40			97.68	19.84	228.26	46.36	166.45	33.80
35	**Hardoi**	1750.45	1650.86	94.31	99.59	5.69				
36	**Hathras**	609.00	120.22	19.74	91.21	14.98	210.60	34.58	186.97	30.70
37	**Jalaun**	1076.44	1076.44	100.00						
38	**Jaunpur**	1213.60	734.66	60.54	379.04	31.23	99.90	8.23		
39	**Jhansi**	752.09	491.88	65.40	260.22	34.60				
40	**Kannauj**	681.69	405.11	59.43	189.47	27.79			87.11	12.78
44	**Kaushambi**	514.56	146.26	28.42	293.80	57.10			74.51	14.48
45	**Kushi Nagar**	1588.77	1588.77	100.00						
46	**Lakhimpur Khiri**	2008.58	2008.58	100.00						

UTTAR PRADESH										
S.No	Name of District	Total Annual Extractable Resource of Assessed Units(in Mcm)	Safe		Semi-Critical		Critical		Over-Exploited	
			Annual Extractable Resource (in Mcm)	%	Annual Extractable Resource (in Mcm)	%	Annual Extractable Resource (in Mcm)	%	Annual Extractable Resource (in Mcm)	%
47	**Lalitpur**	411.51			411.51	100.00				
48	**Lucknow**	714.38	662.40	92.72					51.98	7.28
49	**Maharajganj**	996.69	996.69	100.00						
50	**Mahoba**	200.83			101.95	50.77			98.88	49.23
51	**Mainpuri**	873.86	558.89	63.96	268.85	30.77			46.12	5.28
52	**Mathura**	1147.57	712.68	62.10	97.62	8.51	94.74	8.26	242.53	21.13
53	**Mau**	461.21	461.21	100.00						
54	**Meerut**	790.96	345.53	43.68	304.11	38.45	118.61	15.00	22.72	2.87
55	**Mirzapur**	584.42	417.32	71.41	94.42	16.16	60.05	10.27	12.63	2.16
56	**Moradabad**	675.67	126.66	18.75	466.45	69.03	65.35	9.67	17.21	2.55
57	**Muzaffarnagar**	1081.53	663.62	61.36	252.46	23.34	73.23	6.77	92.23	8.53
58	**Pilibhit**	1121.85	1121.85	100.00						
59	**Pratapgarh**	1376.21	506.71	36.82	547.30	39.77	322.19	23.41		
60	**Prayagraj**	1350.52	811.91	60.12	383.91	28.43	129.35	9.58	25.35	1.88
61	**Rae Bareli**	1221.00	1221.00	100.00						
62	**Rampur**	718.91	351.58	48.91	301.28	41.91	66.04	9.19		
63	**S.Kabir Nagar**	442.64	442.64	100.00						
64	**S. Ravidas Nagar**	335.18			335.18	100.00				
65	**Saharanpur**	1247.17	107.27	8.60	527.47	42.29	144.55	11.59	467.87	37.51
66	**Shahjahanpur**	1272.21	1272.21	100.00						
67	**Shambhal**	465.41	68.30	14.67	109.90	23.61	287.21	61.71		
68	**Shamli**	425.50			87.42	20.54			338.08	79.46
69	**Shrawasti**	466.28	466.28	100.00						
70	**Siddharth Nagar**	876.02	876.02	100.00						
71	**Sitapur**	2065.61	2065.61	100.00						
72	**Sonbhadra**	233.74	203.51	87.07	30.23	12.93				
73	**Sultanpur**	836.43	836.43	100.00						
74	**Unnao**	1775.01	1775.01	100.00						
75	**Varanasi**	533.94	66.19	12.40	297.56	55.73			170.19	31.87
	Total	**66882.45**	**46000.68**	**68.78**	**12755.08**	**19.07**	**3822.59**	**5.72**	**4304.10**	**6.44**

Table: 14 District-wise Ground Water Extraction for Various Uses and Stage of Ground water extraction

UTTAR PRADESH															
S. No.	Name of District	Ground Water Recharge					Total Natural Discharges	Annual Extractable Ground Water Resource	Current Annual Ground Water Extraction				Annual GW Allocation for Domestic Use as on 2025	Net Ground Water Availability for future use	Stage of Ground Water Extraction (%)
		Monsoon Season		Non-monsoon Season		Total Annual Ground Water Recharge			Irrigation	Industrial	Domestic	Total			
		Recharge from rainfall	Recharge from other sources	Recharge from rainfall	Recharge from other sources										
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Agra	46874.16	14095.73	652.55	23756.78	85379.22	6203.69	79175.53	82090.24	0.00	10386.66	92476.90	11671.76	4936.82	116.80
2	Aligarh	55114.00	14673.90	3079.62	32242.43	105109.95	8674.49	96435.46	58849.03	0.00	11080.98	69930.01	12635.10	28986.07	72.51
3	Ambedkar Nagar	51627.40	12365.43	387.87	16021.81	80402.51	7062.11	73340.40	39455.32	0.00	6033.74	45489.06	6670.83	27214.24	62.02
4	Amethi	40352.54	20923.02	891.90	28145.88	90313.34	8286.10	82027.24	45357.00	0.00	4729.24	50086.24	5243.71	31426.53	61.06
5	Amroha	35354.74	6202.05	2016.91	9923.03	53496.73	2674.85	50821.88	44426.08	0.00	4564.47	48990.55	5188.02	3481.23	96.40
6	Aurraiya	32998.17	12464.06	1414.93	25970.98	72848.14	6502.76	66345.38	29753.60	0.00	2811.57	32565.17	3041.69	33550.08	49.08
7	Ayodhya	54982.69	15418.54	715.74	28749.66	99866.63	7889.13	91977.50	51372.96	0.00	6691.13	58064.09	7822.51	32782.02	63.13
8	Azamgarh	62092.79	23175.98	0.00	35731.33	121000.10	7748.38	113251.72	64876.48	0.00	12787.70	77664.18	14836.82	33538.44	68.58
9	Baghpat	16608.52	8267.17	1222.67	12927.22	39025.58	3119.27	35906.31	35149.16	0.00	2.45	35151.61	2.60	2419.68	97.90
10	Bahraich	87156.59	18078.22	3863.07	31599.66	140697.54	8406.59	132290.95	62375.08	0.00	9178.60	71553.68	10470.83	59445.07	54.09
11	Ballia	57231.32	13717.04	547.50	22032.83	93528.69	6465.43	87063.26	46915.44	0.00	7698.07	54613.51	8772.29	31375.53	62.73
12	Balrampur	61981.74	9818.66	6270.59	17104.81	95175.80	7884.46	87291.34	43492.24	0.00	5795.61	49287.85	6750.02	37049.06	56.46
13	Banda	49146.14	6735.10	519.80	11056.88	67457.92	4389.58	63068.34	37248.09	0.00	3762.52	41010.61	4256.96	21563.31	65.03
14	Barabanki	73808.32	45072.05	1657.39	84096.03	204633.79	15406.27	189227.52	107211.15	0.00	8511.84	115722.99	9670.51	72345.88	61.16
15	Bareili	82098.23	17554.41	3109.74	29694.68	132457.06	7003.68	125453.38	72084.80	0.00	13150.76	85235.56	14695.65	41749.49	67.94
16	Basti	63481.53	5522.12	829.32	9011.66	78844.63	6365.42	72479.21	39328.12	0.00	6212.45	45540.57	6902.14	26248.92	62.83
17	Bijnaur	90035.80	18274.04	6117.09	32201.59	146628.52	11040.00	135588.52	86484.11	0.00	7567.86	94051.97	8345.53	40758.88	69.37
18	Budaun	68192.08	5836.08	943.26	9595.56	84566.98	5441.57	79125.41	52939.36	0.00	8091.96	61031.32	9105.51	18340.29	77.13
19	Bulandshahar	49271.23	43536.67	2414.01	68823.75	164045.66	12285.66	151760.00	132226.74	0.00	6449.51	138676.25	6972.13	18475.12	91.38
20	Chandauli	32077.50	15410.99	0.00	8485.84	55974.33	4531.65	51442.68	22626.09	0.00	4439.93	27066.02	4896.29	23920.30	52.61
21	Chitrakoot	30697.23	4131.54	305.36	6042.80	41176.93	3539.43	37637.50	28736.33	0.00	2375.04	31111.37	2726.88	6174.29	82.66
22	Deoria	48883.60	45209.84	1534.42	45516.00	141143.86	12066.32	129077.54	69475.14	0.00	6870.06	76345.20	7468.53	52133.91	59.15
23	Etah	34631.75	9164.26	0.00	18546.08	62342.09	5151.70	57190.39	41172.57	0.00	4426.67	45599.24	4840.12	11177.70	79.73
24	Etawah	37198.53	15074.13	985.42	28143.00	81401.08	7023.72	74377.36	28675.37	0.00	3091.88	31767.25	3431.04	42270.94	42.71
25	Farrukhabad	36840.10	4924.99	1221.68	12972.81	55959.58	4727.45	51232.13	33753.52	0.00	3784.93	37538.45	4244.47	13234.14	73.27
26	Fatehpur	84640.60	24327.98	3736.62	36214.51	148919.71	10830.96	138088.75	90085.36	0.00	6945.93	97031.29	7940.09	40520.76	70.27
27	Firozabad	36615.11	11409.37	663.76	23645.80	72334.04	5335.15	66998.89	68630.88	0.00	6405.04	75035.92	7151.21	7236.25	112.00
28	G.B. Nagar	17852.82	18170.90	938.55	30197.13	67159.40	5924.21	61235.19	60634.00	0.00	1530.81	62164.81	1620.99	3882.66	101.52
29	Ghaziabad	13308.85	10988.67	1078.71	17617.85	42994.08	3456.81	39537.27	37002.24	0.00	8060.30	45062.54	12199.42	1678.00	113.97
30	Ghazipur	52829.48	17785.91	959.94	29128.33	100703.66	5641.14	95062.52	51244.48	0.00	6582.80	57827.28	7362.55	36455.44	60.83
31	Gonda	62117.13	14574.16	2546.00	21572.87	100810.16	5711.68	95098.48	48974.41	0.00	9194.93	58169.34	10644.32	35479.78	61.17
32	Gorakhpur	81953.64	64410.14	2056.40	29233.48	177653.66	15079.09	162574.57	88464.86	0.00	8686.27	97151.13	9644.51	64465.23	59.76
33	Hamirpur	40206.10	5725.02	0.00	7498.95	53430.07	4155.43	49274.64	31428.77	0.00	2125.79	33554.56	2255.14	15590.73	68.10
34	Hapur	17655.02	12863.80	1372.91	20510.59	52402.32	3162.81	49239.51	49326.80	0.00	3.27	49330.07	3.56	2391.80	100.18
35	Hardoi	104565.74	29991.19	5035.71	51362.01	190954.65	15909.95	175044.70	93874.65	0.00	8219.51	102094.16	9183.18	71986.87	58.32
36	Hathras	26825.12	13727.91	579.02	24930.66	66062.71	5162.58	60900.13	54238.10	0.00	3966.28	58204.38	4390.96	7743.60	95.57
37	Jalaun	77303.79	11887.53	949.23	26719.68	116860.23	9216.36	107643.87	50166.00	0.00	4162.29	54328.29	4509.25	52968.61	50.47
38	Jaunpur	75996.21	19753.21	0.00	36126.92	131876.34	10516.36	121359.98	74007.00	0.00	12180.13	86187.13	13725.89	33627.11	71.02
39	Jhansi	35884.12	21075.00	22.39	23350.22	80331.73	5122.30	75209.43	40434.77	0.00	3030.01	43464.78	3439.34	31335.34	57.79
40	Kannauj	37361.83	10242.60	1667.92	24076.62	73348.97	5180.20	68168.77	39944.50	0.00	4191.18	44135.68	4685.36	28671.84	64.74
41	Kanpur Dehat	53815.45	14683.33	461.51	27480.12	96440.41	7041.54	89398.87	61299.46	0.00	3925.70	65225.16	4202.93	23896.49	72.96
42	Kanpur Nagar	40715.03	14570.10	2014.96	31183.44	88483.53	5876.82	82606.71	55330.64	0.00	7502.80	62833.44	8000.00	19276.06	76.06
43	Kasganj	25330.22	14008.47	0.00	20681.08	60019.77	4222.71	55797.06	37232.13	0.00	3786.70	41018.83	4325.08	14239.85	73.51

S. No.	Name of District	Ground Water Recharge					Total Natural Discharges	Annual Extractable Ground Water Resource	Current Annual Ground Water Extraction				Annual GW Allocation for Domestic Use as on 2025	Net Ground Water Availability for future use	Stage of Ground Water Extraction (%)
		Monsoon Season		Non-monsoon Season		Total Annual Ground Water Recharge			Irrigation	Industrial	Domestic	Total			
		Recharge from rainfall	Recharge from other sources	Recharge from rainfall	Recharge from other sources										
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
44	Kaushambi	32336.86	7841.99	3333.26	12394.10	55906.21	4449.76	51456.45	35109.06	0.00	4266.45	39375.51	4995.90	12138.36	76.52
45	Kushi Nagar	54020.64	67119.23	2246.95	52404.24	175791.06	16913.59	158877.47	59050.84	0.00	8272.46	67323.30	9485.76	90340.84	42.37
46	Lakhimpur Khiri	127372.32	25179.80	7177.41	55419.80	215149.33	14291.34	200857.99	109722.42	0.00	11307.14	121029.56	13690.09	77445.49	60.26
47	Lalitpur	19387.84	6892.54	0.00	18060.74	44341.12	3189.85	41151.27	29491.40	0.00	3256.65	32748.05	3775.90	7883.96	79.58
48	Lucknow	33891.13	16500.84	1193.78	25626.73	77212.48	5774.79	71437.69	35829.96	0.00	11666.73	47496.69	13872.83	25306.78	66.49
49	Maharajganj	67611.57	16810.53	1967.16	21137.60	107526.86	7857.60	99669.26	53353.07	0.00	6716.82	60069.89	7698.58	38617.58	60.27
50	Mahoba	9639.68	4883.41	0.00	6948.60	21471.69	1388.53	20083.16	17677.50	0.00	1114.08	18791.58	1212.54	1993.42	93.57
51	Mainpuri	39523.87	19822.93	0.00	35612.15	94958.95	7572.53	87386.42	55734.83	0.00	4770.12	60504.95	5240.74	28499.35	69.24
52	Mathura	45496.28	30198.40	0.00	48416.41	124111.09	9353.76	114757.33	77715.34	0.00	6175.51	83890.85	6972.00	33236.75	73.10
53	Mau	32398.04	5798.58	3213.88	8604.81	50015.31	3893.92	46121.39	24303.69	0.00	5989.67	30293.36	7033.82	14783.86	65.68
54	Meerut	42116.25	15539.14	2834.37	24596.20	85085.96	5989.79	79096.17	52687.00	0.00	8766.22	61453.22	9444.78	18415.22	77.69
55	Mirzapur	27003.16	16601.62	57.63	20096.67	63759.08	5317.05	58442.03	28771.40	0.00	6474.91	35246.31	7319.87	22542.11	60.31
56	Moradabad	40862.74	11462.40	1855.13	17827.52	72007.79	4440.87	67566.92	47402.83	0.00	10051.78	57454.61	11804.71	12582.82	85.03
57	Muzaffarnagar	50587.49	23665.46	3128.13	40176.05	117557.13	9403.86	108153.27	71932.20	0.00	6555.94	78488.14	7363.97	30173.69	72.57
58	Pilibhit	73382.69	14857.06	4318.14	27281.73	119839.62	7654.22	112185.40	59010.41	0.00	5158.34	64168.75	5768.94	47406.05	57.20
59	Pratapgarh	69552.90	32203.93	0.00	46208.37	147965.20	10344.54	137620.66	95016.46	0.00	7853.59	102870.05	8699.65	33904.57	74.75
60	Prayagraj	75007.83	29080.57	1663.88	41326.10	147078.38	12026.33	135052.05	83776.69	0.00	16415.99	100192.68	18291.78	35279.67	74.19
61	Rae Bareli	62824.50	25566.80	1502.35	41900.83	131794.48	9694.67	122099.81	61253.82	0.00	6725.43	67979.25	7673.42	53172.60	55.68
62	Rampur	44976.14	11690.95	1837.12	18880.57	77384.78	5494.18	71890.60	46907.99	0.00	4930.74	51838.73	5579.04	19403.58	72.11
63	S.Kabir Nagar	35894.70	4030.38	320.30	7004.99	47250.37	2986.50	44263.87	25180.86	0.00	4110.76	29291.62	4631.67	14451.35	66.18
64	S.Ravidas Nagar	18854.50	7720.63	184.70	9928.07	36687.90	3170.36	33517.54	23564.51	0.00	3336.18	26900.69	3626.50	6326.52	80.26
65	Saharanpur	67123.72	22036.58	5801.71	37584.63	132546.64	7829.98	124716.66	125786.56	0.00	6976.31	132762.87	7702.09	11256.03	106.45
66	Shahjahanpur	88882.69	17119.02	5231.84	25391.20	136624.75	9403.68	127221.07	69330.63	0.00	8071.57	77402.20	9367.31	48523.13	60.84
67	Shambhal	38786.21	3429.23	2040.90	5358.13	49614.47	3073.58	46540.89	34589.16	0.00	5401.36	39990.52	6263.01	5910.42	85.93
68	Shamli	20926.70	9034.87	1544.69	13703.88	45210.14	2660.34	42549.80	41319.36	0.00	3009.89	44329.25	3066.96	2004.04	104.18
69	Shrawasti	33714.02	4479.09	3478.99	7410.28	49082.38	2454.12	46628.26	27471.96	0.00	4.53	27476.49	5.29	19151.01	58.93
70	Siddharth Nagar	64816.89	10830.58	1409.47	15781.93	92838.87	5237.28	87601.59	47152.30	0.00	6930.18	54082.48	8079.37	32369.89	61.74
71	Sitapur	109136.46	39979.52	4825.97	70649.18	224591.13	18029.93	206561.20	107818.20	0.00	10628.90	118447.10	12255.85	86487.23	57.34
72	Sonbhadra	16651.40	4834.56	72.92	3645.20	25204.08	1830.31	23373.77	11043.47	0.00	4071.87	15115.34	4747.94	7582.39	64.67
73	Sultanpur	45564.14	18448.49	499.32	26403.64	90915.59	7272.67	83642.92	44641.36	0.00	5776.60	50417.96	6429.21	32572.33	60.28
74	Unnao	75358.84	45363.14	2650.76	65733.87	189106.61	11605.65	177500.96	99531.27	0.00	8150.97	107682.24	9372.65	68597.04	60.67
75	Varanasi	27605.99	11147.16	342.97	17952.64	57048.76	3654.40	53394.36	38375.40	0.00	10328.05	48703.45	10946.31	8690.25	91.21
	Total (Ham)	**3775021.15**	**1316010.74**	**129518.20**	**1999390.22**	**7219940.31**	**531695.79**	**6688244.52**	**4128945.02**	**0.00**	**474261.11**	**4603205.95**	**538364.20**	**2153092.69**	**68.83**
	Total (Bcm)	**37.75**	**13.16**	**1.30**	**19.99**	**72.20**	**5.32**	**66.88**	**41.29**	**0.00**	**4.74**	**46.03**	**5.38**	**21.53**	**68.83**

7. GROUND WATER EXTRACTION AND CATEGORIZATION OF ASSESSMENT

7.1. Stage of Ground Water Extraction and Categorization of assessment

The distributions of various categorized blocks are shown in the Figure-15, in which 177 blocks are falling in semi-critical category, 49 assessment units (48 blocks and 1 urban area) in critical category and 66 assessment unit (57 blocks and 9 urban area) of the state are categorized as over-exploited. List of semi-critical, critical and over- exploited area is given in Table-15. Almost all over-exploited blocks are falling in western part of Uttar Pradesh, where ground water draft has increased manifold during past decades. The stage of ground water extraction of the State is 68.83%.

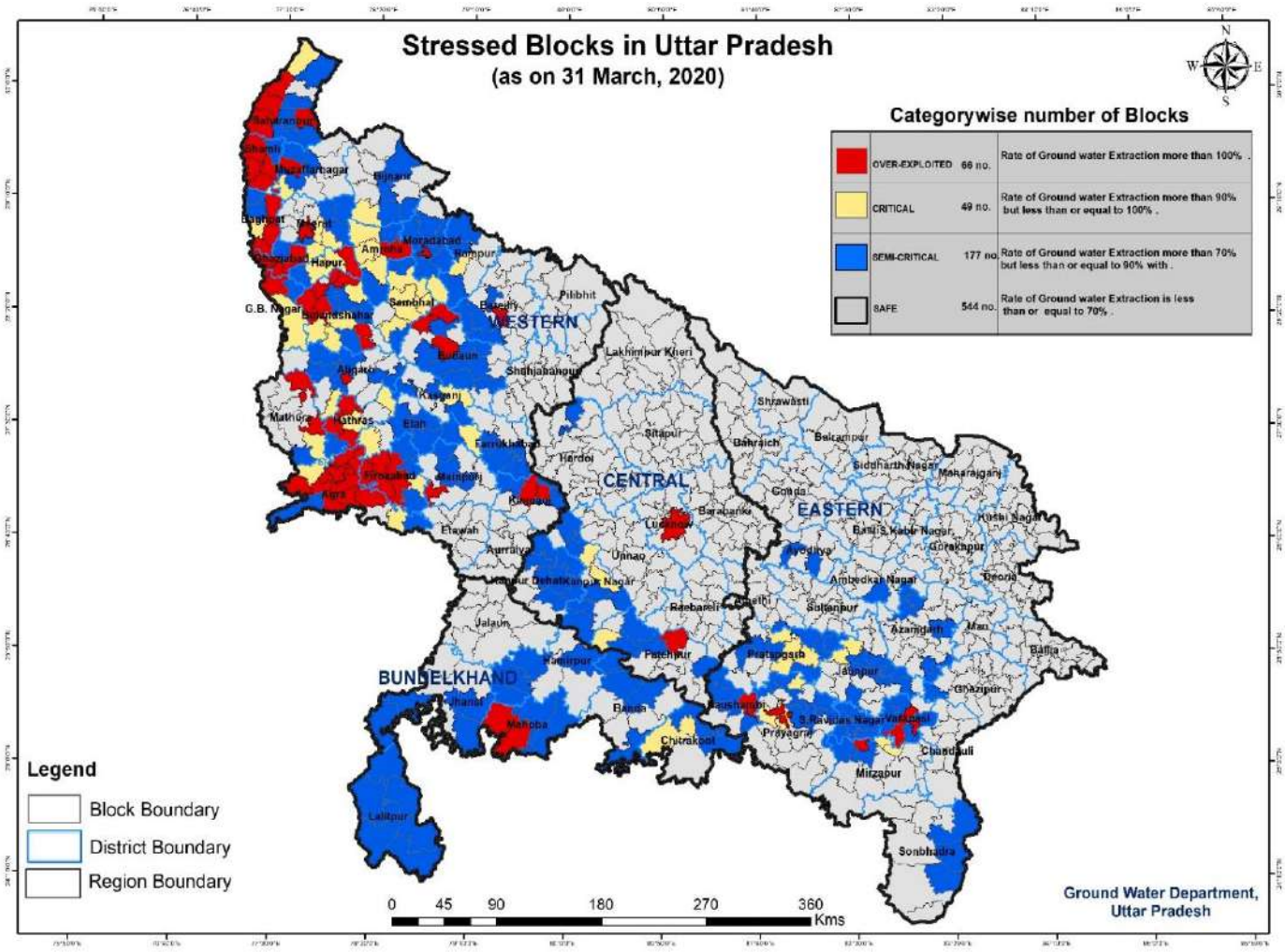


Fig 8: Categorization of Assessment Unit (Block & Urban area) For Ground Water Extraction - As on March 2020

Total recharge from Rainfall in the state is of the order of 3905130.69 Ham with Lakhimpur district having the highest recharge of 134549.73 Ham and Mahoba district has minimum recharge of the order of 9639.68 Ham. Component of recharge from other sources is highest in Barabanki district (129168 ham) where maximum canal irrigation facility is available. Lowest value of recharge from other source is recorded in Sonbhadra (8479.76 ham) and Sambhal (8787.36ham) where use of ground water as well surface water for irrigation purpose is very low. Total recharge from rainfall is 3905130.69 ham) whereas from other sources is 3312561.32 ham.

Total annual recharge from all sources in the State is of the order of 7219940 Ham, with Sitapur district having the highest recharge of 224591 ham and Mahoba district has minimum recharge of the order of 21472 ham.

Total unaccounted natural discharge in the State is of the order of 531696 ham with Sitapur district having the highest discharge of 18030 ham and Mahoba with lowest of 1,388 ham. The Annual Extractable Ground Water Resources in the state is 6688244 ham with Sitapur district having the highest net ground water availability of 206561 ham and Sonbhadra with lowest of 23373 ham.

Total extraction of ground water for all uses in state is calculated as 4603205.95 Ham. The maximum ground water withdrawl for all uses is 138676.25 ham in Bulandshahar district and minimum extraction of ground water for all uses is 15115.34 ham in Sonbhadra district at eastern part of Uttar Pradesh. Comparison of ground water extraction for various uses reveals that extraction for irrigation accounts for almost 90 % of total ground water extraction, whereas extraction for domestic & industrial supply accounts for meager 10% of the total ground water extraction in the state.

After successful upload of data on the online portal of IN-GRES (India Groundwater Resource Estimation System) and computation based on GEC 2015 methodology, 544 blocks are Safe, 177 blocks are falling in semi-critical category, 49 assessment units in critical category and 66 assessment unit of the state are categorized as over-exploited. The ground water resources of the individual block /assessment unit show wide variation in the resource available and stage of ground water extraction. In Uttar Pradesh, the ground water extraction concentrates mainly in the Western Uttar Pradesh, Bundelkhand Region and south eastern part of the of the State. The stage of ground water extraction of the State is 68.83%.

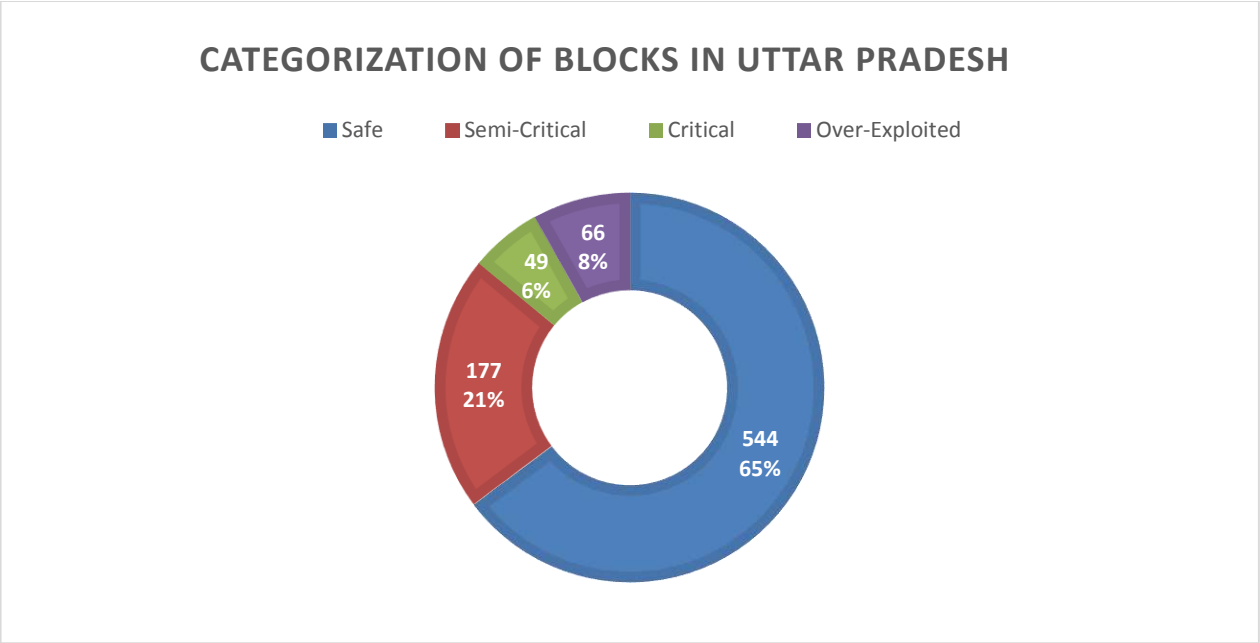


Table 15: Categorization of Assessment units

CATEGORIZATION of ASSESSMENT UNITS, 2020							
UTTAR PRADESH							
S. No	**Name of District**	**S. No**	**Name of Semi-Critical Assessment Units**	**S. No**	**Name of Critical Assessment Units**	**S. No**	**Name of Over-Exploited Assessment Units**
1	**Agra**	1	Jagner	1	Achhnera	1	Agra City
		2	Jaitpur Kalan	2	Bah	2	Akola
		3	Kheragarh			3	Barauli Ahir
						4	Bichpuri
						5	Etmadpur
						6	Fatehabad
						7	Fatehpur Sikri
						8	Khandauli
						9	Saiyana
						10	Shamsabad
2	**Aligarh**	1	Chandaus	1	Iglas	1	Aligarh City
		2	Gangiri				
		3	Jawa Sikandairpur				
		4	Khair				
		5	Lodha				
3	**Ambedkar Nagar**	1	Jalalpur				
4	**Amethi**	1	Sangrampur				
5	**Amroha**	1	Amroha	1	Dhanaura	1	Joya
		2	Gangeshwari	2	Gajraula		
				3	Hasanpur		
6	**Ayodhya**	1	Bikapur				
		2	Milkipur				
7	**Azamgarh**	1	Ahiraula				
		2	Atraulia				
		3	Koilsa				
		4	Palhana				
		5	Palhani				
		6	Sathiyaon				
		7	Tarwa				
8	**Baghpat**	1	Baraut	1	Baghpat	1	Binauli
		2	Chhaprauli			2	Khekra
						3	Pilana
9	**Banda**	1	Baberu				
		2	Jaspura				
		3	Naraini				
		4	Tindwari				
10	**Bareili**	1	Alampur Jafarabad			1	Bareilly City
		2	Fatehganj				
		3	Majhgawa				
		4	Ramnagar				
12	**Bijnaur**	1	Kotwali	1	Jaleelpur		
		2	Nehtaur (Aaku)				
		3	Noorpur				
		4	Seohara (Budhanpur)				
13	**Budaun**	1	Bisauli			1	Ambiapur
		2	Jagat			2	Asafpur
		3	Miaon			3	Islamnagar
		4	Quadar Chowk				
		5	Sahaswan				
		6	Salarpur				
		7	Ujhani				
14	**Bulandshahar**	1	Anup Shahar	1	Arnia Khurd	1	Bhawan Bahadur Nagar
		2	Jahangirabad	2	Khurja	2	Bulandshahar

S. No	Name of District	S. No	Name of Semi-Critical Assessment Units	S. No	Name of Critical Assessment Units	S. No	Name of Over-Exploited Assessment Units
		3	Lakhaothi	3	Shikarpur	3	Danpur
		4	Pahasu	4	Unchagaon	4	Gulaothi
						5	Siana
						6	Sikandrabad
15	**Chitrakoot**	1	Mau	1	Karwi		
		2	Pahari				
		3	Ramnagar				
17	**Etah**	1	Jaithara	1	Aliganj		
		2	Nidhauli Kalan	2	Jalesar		
		3	Sakit				
		4	Shitalpur				
18	**Farrukhabad**	1	Barhpur				
		2	Kamalganj				
		3	Mohamadabad				
		4	Nawabganj				
19	**Fatehpur**	1	Airaya	1	Amauli	1	Bhitaura
		2	Khajuha				
		3	Malawan				
		4	Telyani				
20	**Firozabad**	1	Eka	1	Aron	1	Firozabad
		2	Jasrana			2	Hathwant
		3	Madanpur			3	Narkhi
						4	Shikohabad
						5	Tundla
21	**G.B.Nagar**	1	Dadri	1	Jewar	1	Bisrakh
22	**Ghaziabad**	1	Muradnagar			1	Bhojpur
						2	Loni
						3	Razapur
						4	Ghaziabad City
23	**Ghazipur**	1	Saidpur				
24	**Hamirpur**	1	Gohand				
		2	Rath				
		3	Sarila				
		4	Sumerpur				
25	**Hapur**	1	Dholana	1	Hapur	1	Garh
				2	Simbholi		
26	**Hardoi**	1	Todarpur				
27	**Hathras**	1	Sadabad	1	Hathras	1	Mursan
				2	Sikandra Rao	2	Sahpau
						3	Sasni
28	**Jaunpur**	1	Baksha	1	Badlapur		
		2	Barsathi	2	Maharajganj		
		3	Dharmapur				
		4	Karanja Kalan				
		5	Kerakat				
		6	Muftiganj				
		7	Sikrara				
		8	Sirkoni				
29	**Jhansi**	1	Babina				
		2	Bangra				
		3	Baragaon				
		4	Mauranipur				
30	**Kannauj**	1	Chhibramau			1	Jalalabad
		2	Gograpur			2	Talgram
		3	Kannauj				
31	**Kanpur Dehat**	1	Akbarpur				
		2	Derapur				
		3	Jhinjhak				
		4	Maitha				
		5	Malsa				
		6	Rasulabad				
		7	Sarwan Khera				
32	**Kanpur Nagar**	1	Bidhnu	1	Kanpur City		
		2	Bilhaur	2	Chaubepur		
		3	Ghatampur				
		4	Patara				
		5	Sarsol				
		6	Shivrajapur				
33	**Kasganj**	1	Kasganj	1	Ganjdundwara		
		2	Patiyali				
		3	Sahawar				
34	**Kaushambi**	1	Kara			1	Chail
		2	Manjhanpur			2	Muratganj
		3	Newada				
		4	Sirathu				
35	**Lalitpur**	1	Bar				
		2	Birdha				
		3	Jakhora				
		4	Madaora				
		5	Mahroni				
		6	Talbehat				
36	**Mahoba**	1	Charkhari			1	Jaitpur
		2	Kabrai			2	Panwari
37	**Mainpuri**	1	Jagir			1	Barnahal
		2	Kurawali				
		3	Mainpuri				
38	**Mathura**	1	Farah	1	Baldeo	1	Nohjhil
						2	Raya
39	**Meerut**	1	Hastinapur	1	Kharkhoda	1	Meerut City
		2	Mawana Kalan	2	Machhra		
		3	Meerut	3	Rajpura		
		4	Parichhatgarh				
40	**Mirzapur**	1	Chanbey	1	Majhawan	1	Kon
		2	City	2	Sikhar		

S. No	Name of District	S. No	Name of Semi-Critical Assessment Units	S. No	Name of Critical Assessment Units	S. No	Name of Over-Exploited Assessment Units
41	**Moradabad**	1	Bhagatpur Tanda	1	Bilari	1	Moradabad City
		2	Chhajlet				
		3	Dilari				
		4	Kundarki (Dengapur)				
		5	Moradabad				
		6	Mundapandey				
42	**Muzaffarnagar**	1	Charthawal	1	Budhana	1	Bhaghara
		2	Muzaffarnagar				
		3	Shahpur				
43	**Pratapgarh**	1	Aspur Deosara	1	Mandhata		
		2	Baba Belkhar Nath Dh	2	Sadar		
		3	Gaura	3	Sandwa Chandika		
		4	Lakshamanpur	4	Shivgarh		
		5	Lalganj				
		6	Mangaraura				
		7	Patti				
		8	Rampur- Sangramgarg				
44	**Rampur**	1	Said Nagar	1	Chamrauwa		
		2	Saur				
		3	Shahabad				
45	**S.Ravidas Nagar**	1	Abhauli				
		2	Aurai				
		3	Bhadohi				
		4	Deegh				
		5	Gyanpur				
		6	Suriyawan				
46	**Saharanpur**	1	Ballia Kheri	1	Sadhauli Kadeem	1	Gangoh
		2	Deoband			2	Nagal
		3	Muzaffarabad			3	Nakur
		4	Nanauta			4	Sarsawa
		5	Rampur Maniharan				
47	**Shambhal**	1	Asmoli	1	Bahjoi		
		2	Janawai	2	Baniakhera		
				3	Gunnaur		
				4	Pawansa		
				5	Sambhal		
48	**Shamli**	1	Thana Bhawan			1	Kairana
						2	Kandhala
						3	Shamli
						4	Un
49	**Sonbhadra**	1	Dudhi				
		2	Nagawa				
50	**Varanasi**	1	Baragaon			1	Araziline
		2	Chiraigaon			2	Harahua
		3	Kashi Vidyapith			3	Varanasi City
		4	Pindra				
		5	Sevapuri				
		6	Kone				
51	**Prayagraj**	1	Bahadurpur	1	Baharia	1	Prayagraj City
		2	Dhanupur	2	Chaka		
		3	Holagarh	3	Bhagwatpur		
		4	Mauaima				
		5	Pratappur				
		6	Saidabad				
		7	Shringveerpurdham				
		8	Sahson				
52	**Lucknow**					1	Lucknow City

ABSTRACT

Total No. of Assessed Units	Number of Semicritical Assessment Units	Number of Critical Assessment Units	Number of Over Exploited Assessment Units
836	**177**	**49**	**66**

Note: 10 Urban cities (more than 10 lakh population) are also included in the Assessment Units

Table 16: Total number of Number of Assessment Units under different categories

DYNAMIC GROUND WATER RESOURCES OF UTTAR PRADESH, 2020										
S.No	Name of District	Total No. of Assessed Units	Safe		Semi-Critical		Critical		Over-Exploited	
			No.	%	No.	%	No.	%	No.	%
1	AGRA	16	1	6.25	3	18.75	2	12.50	10	62.50
2	ALIGARH	13	6	46.15	5	38.46	1	7.69	1	7.69
3	AMBEDKAR NAGAR	9	8	88.89	1	11.11	0	0.00	0	0.00
4	AMETHI	13	12	92.31	1	7.69	0	0.00	0	0.00
5	AMROHA	6	0	0.00	2	33.33	3	50.00	1	16.67
6	AURRAIYA	7	7	100.00	0	0.00	0	0.00	0	0.00
7	AYODHYA	11	9	81.82	2	18.18	0	0.00	0	0.00
8	AZAMGARH	22	15	68.18	7	31.82	0	0.00	0	0.00
9	BAGHPAT	6	0	0.00	2	33.33	1	16.67	3	50.00
10	BAHRAICH	14	14	100.00	0	0.00	0	0.00	0	0.00
11	BALLIA	17	17	100.00	0	0.00	0	0.00	0	0.00
12	BALRAMPUR	9	9	100.00	0	0.00	0	0.00	0	0.00
13	BANDA	8	4	50.00	4	50.00	0	0.00	0	0.00
14	BARABANKI	15	15	100.00	0	0.00	0	0.00	0	0.00
15	BAREILI	16	11	68.75	4	25.00	0	0.00	1	6.25
16	BASTI	14	14	100.00	0	0.00	0	0.00	0	0.00
17	BIJNAUR	11	6	54.55	4	36.36	1	9.09	0	0.00
18	BUDAUN	15	5	33.33	7	46.67	0	0.00	3	20.00
19	BULANDSHAHAR	16	2	12.50	4	25.00	4	25.00	6	37.50
20	CHANDAULI	9	9	100.00	0	0.00	0	0.00	0	0.00
21	CHITRAKOOT	5	1	20.00	3	60.00	1	20.00	0	0.00
22	DEORIA	16	16	100.00	0	0.00	0	0.00	0	0.00
23	ETAH	8	2	25.00	4	50.00	2	25.00	0	0.00
24	ETAWAH	8	8	100.00	0	0.00	0	0.00	0	0.00
25	FARRUKHABAD	7	3	42.86	4	57.14	0	0.00	0	0.00
26	FATEHPUR	13	7	53.85	4	30.77	1	7.69	1	7.69
27	FIROZABAD	9	0	0.00	3	33.33	1	11.11	5	55.56
28	G.B. NAGAR	3	0	0.00	1	33.33	1	33.33	1	33.33
29	GHAZIABAD	5	0	0.00	1	20.00	0	0.00	4	80.00
30	GHAZIPUR	16	15	93.75	1	6.25	0	0.00	0	0.00
31	GONDA	16	16	100.00	0	0.00	0	0.00	0	0.00
32	GORAKHPUR	20	20	100.00	0	0.00	0	0.00	0	0.00
33	HAMIRPUR	7	3	42.86	4	57.14	0	0.00	0	0.00
34	HAPUR	4	0	0.00	1	25.00	2	50.00	1	25.00
35	HARDOI	19	18	94.74	1	5.26	0	0.00	0	0.00
36	HATHRAS	7	1	14.29	1	14.29	2	28.57	3	42.86
37	JALAUN	9	9	100	0	0.00	0	0.00	0	0.00
38	JAUNPUR	21	11	52.38	8	38.10	2	9.52	0	0.00
39	JHANSI	8	4	50.00	4	50.00	0	0.00	0	0.00

DYNAMIC GROUND WATER RESOURCES OF UTTAR PRADESH, 2020										
S.No	Name of District	Total No. of Assessed Units	Safe		Semi-Critical		Critical		Over-Exploited	
			No.	%	No.	%	No.	%	No.	%
40	KANNAUJ	8	3	37.50	3	37.50	0	0.00	2	25.00
41	KANPUR DEHAT	10	3	30.00	7	70.00	0	0.00	0	0.00
42	KANPUR NAGAR	11	3	27.27	6	54.55	2	18.18	0	0.00
43	KASGANJ	7	3	42.86	3	42.86	1	14.29	0	0.00
44	KAUSHAMBI	8	2	25.00	4	50.00	0	0.00	2	25.00
45	KUSHI NAGAR	14	14	100.00	0	0.00	0	0.00	0	0.00
46	LAKHIMPUR KHIRI	15	15	100.00	0	0.00	0	0.00	0	0.00
47	LALITPUR	6	0	0.00	6	100.00	0	0.00	0	0.00
48	LUCKNOW	9	8	88.89	0	0.00	0	0.00	1	11.11
49	MAHARAJGANJ	12	12	100.00	0	0.00	0	0.00	0	0.00
50	MAHOBA	4	0	0.00	2	50.00	0	0.00	2	50.00
51	MAINPURI	9	5	55.56	3	33.33	0	0.00	1	11.11
52	MATHURA	10	6	60.00	1	10.00	1	10.00	2	20.00
53	MAU	9	9	100.00	0	0.00	0	0.00	0	0.00
54	MEERUT	13	5	38.46	4	30.77	3	23.08	1	7.69
55	MIRZAPUR	12	7	58.33	2	16.67	2	16.67	1	8.33
56	MORADABAD	9	1	11.11	6	66.67	1	11.11	1	11.11
57	MUZAFFARNAGAR	9	4	44.44	3	33.33	1	11.11	1	11.11
58	PILIBHIT	7	7	100.00	0	0.00	0	0.00	0	0.00
59	PRATAPGARH	17	5	29.41	8	47.06	4	23.53	0	0.00
60	PRAYAGRAJ	24	12	50.00	8	33.33	3	12.50	1	4.17
61	RAE BARELI	18	18	100.00	0	0.00	0	0.00	0	0.00
62	RAMPUR	6	2	33.33	3	50.00	1	16.67	0	0.00
63	S.KABIR NAGAR	9	9	100.00	0	0.00	0	0.00	0	0.00
64	S. RAVIDAS NAGAR	6	0	0.00	6	100.00	0	0.00	0	0.00
65	SAHARANPUR	11	1	9.09	5	45.45	1	9.09	4	36.36
66	SHAHJAHANPUR	15	15	100.00	0	0.00	0	0.00	0	0.00
67	SHAMBHAL	8	1	12.50	2	25.00	5	62.50	0	0.00
68	SHAMLI	5	0	0.00	1	20.00	0	0.00	4	80.00
69	SHRAWASTI	5	5	100.00	0	0.00	0	0.00	0	0.00
70	SIDDHARTH NAGAR	14	14	100.00	0	0.00	0	0.00	0	0.00
71	SITAPUR	19	19	100.00	0	0.00	0	0.00	0	0.00
72	SONBHADRA	10	7	70.00	3	30.00	0	0.00	0	0.00
73	SULTANPUR	14	14	100.00	0	0.00	0	0.00	0	0.00
74	UNNAO	16	16	100.00	0	0.00	0	0.00	0	0.00
75	VARANASI	9	1	11.11	5	55.56	0	0.00	3	33.33
	Total	**836**	**544**	**65.07**	**177**	**21.17**	**49**	**5.86**	**66**	**7.89**

7.2. Reasons for Significant Change in Resources, Extraction, Categorisation of Assessment Units

The ground water resources have been assessed in block-wise and Urban area having more than ten lakhs population. The total annual ground water recharge of the state has been estimated as 72.20 bcm and annual extractable groundwater resources are 66.88 bcm. The annual ground water extraction is 46.03 bcm and stage of groundwater extraction is 68.83 %. Out of the 836 (826 blocks and 10 Urban areas) assessment units, 66 have been categorized as Over Exploited, 49 as Critical, 177 as Semi Critical and 544 as Safe. There are no Saline blocks in the state. As compared to 2017, 113 assessment units in Over exploited category has decreased to 66 in the current assessment year whereas 151 blocks in Semi Critical Category has increased to 177 in 2019/2020. 48 assessment units in the Critical Category has changed to 49 and 541 safe blocks in 2017 has increased to 544 in 2019/2020.

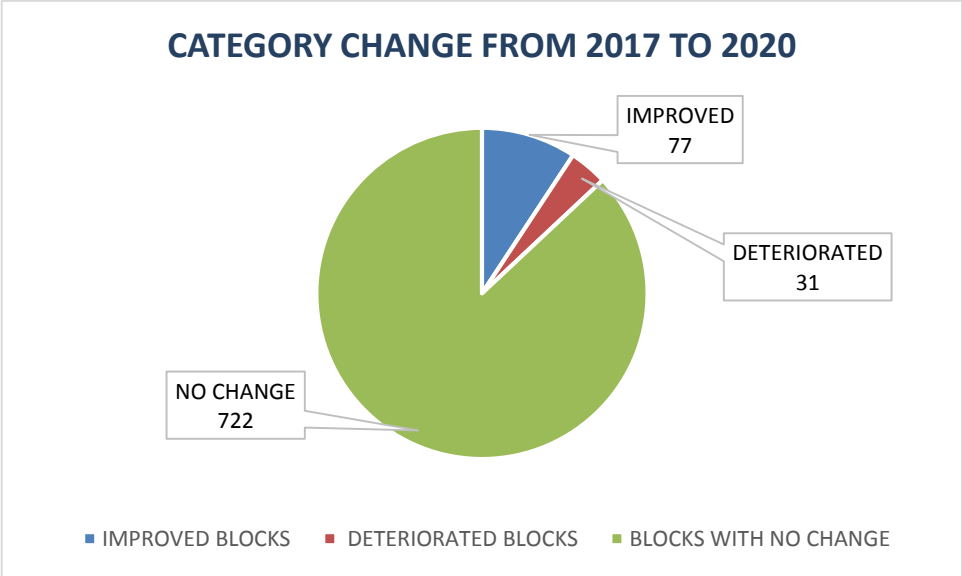


Table 17: Number of Improved and Deteriorated blocks from 2017 to 2020

STATE-WISE SUMMARY OF ASSESSMENT UNITS IMPROVED AND DETERIORATED FROM 2017 TO 2020	
Name of State	**UTTAR PRADESH**
IMPROVED ASSESSMENT UNITS	**77**
DETERIORATED ASSESSMENT UNITS	**31**
ASSESSMENT UNITS WITH NO CHANGE	**722**

Table 18: Assessment units which improved from Semi-critical to Safe category

S. No	Name of District	Name of Assessment Unit	Stage of Ground Water Extraction (%) in 2017	Categorization in 2017	Stage of Ground Water Extraction (%) in 2020	Categorization in 2020	Remark
1	AMBEDKAR NAGAR	BASKHARI	74.00	Semi-Critical	67.83	Safe	Extraction for irrigation reduced as per MI Census, WL raised subsequently
2	AMBEDKAR NAGAR	BHITI	89.09	Semi-Critical	68.48	Safe	Extraction for irrigation reduced as per MI Census, WL raised subsequently
3	AMBEDKAR NAGAR	JAHANGIRGANI	89.81	Semi-Critical	57.61	Safe	Extraction for irrigation reduced as per MI Census, WL raised subsequently
4	AMBEDKAR NAGAR	KATEHARI	74.03	Semi-Critical	61.50	Safe	Extraction for irrigation reduced as per MI Census, WL raised subsequently
5	BARABANKI	BANI KODAR	80.40	Semi-Critical	65.64	Safe	Extraction for irrigation reduced as per MI Census, WL raised subsequently
6	CHITRAKOOT	MANIKPUR	70.66	Semi-Critical	65.54	Safe	Increased Rainfall Recharge as calculated by WTF
7	ETAH	AWAGARH	71.36	Semi-Critical	68.32	Safe	Increased Rainfall Recharge as calculated by WTF
8	FARRUKHABAD	SHAMSABAD	70.98	Semi-Critical	68.15	Safe	Extraction for irrigation reduced as per MI Census, WL raised subsequently
9	FATEHPUR	BAHUA	71.40	Semi-Critical	69.07	Safe	Extraction for irrigation reduced as per MI Census, WL raised subsequently
10	FATEHPUR	DHATA	71.49	Semi-Critical	64.02	Safe	Extraction for irrigation reduced as per MI Census, WL raised subsequently
11	FATEHPUR	HASWA	74.96	Semi-Critical	63.55	Safe	Extraction for irrigation reduced as per MI Census, WL raised subsequently
12	FATEHPUR	HATHGAON	73.37	Semi-Critical	66.28	Safe	Extraction for irrigation reduced as per MI Census, WL raised subsequently
13	GHAZIPUR	MOHAMMADABAD	78.89	Semi-Critical	57.87	Safe	Extraction for irrigation reduced as per MI Census, WL raised subsequently
14	GHAZIPUR	VARACHAKWAR	72.96	Semi-Critical	68.35	Safe	Extraction for irrigation reduced as per MI Census, WL raised subsequently
15	HAMIRPUR	MAUDAHA	80.22	Semi-Critical	54.39	Safe	Extraction for irrigation reduced as per MI Census, WL raised subsequently
16	JAUNPUR	DOBHI	83.39	Semi-Critical	66.57	Safe	Increased Rainfall Recharge as calculated by WTF
17	JAUNPUR	RAMNAGAR	81.35	Semi-Critical	64.30	Safe	Extraction for irrigation reduced as per MI Census, WL raised subsequently
18	JAUNPUR	RAMPUR	71.36	Semi-Critical	67.98	Safe	Extraction for irrigation reduced as per MI Census, WL raised subsequently
19	MEERUT	SARURPUR	72.04	Semi-Critical	68.12	Safe	Extraction for irrigation reduced as per MI Census, WL raised subsequently
20	RAE BARELI	SARAINI	79.99	Semi-Critical	66.30	Safe	Extraction for irrigation reduced as per MI Census, WL raised subsequently
21	VARANASI	CHOLAPUR	71.18	Semi-Critical	68.65	Safe	Extraction for irrigation reduced as per MI Census, WL raised subsequently

Table 19: Assessment units which improved from Over exploited to critical category

S. No	Name of District	Name of Assessment Unit	Stage of Ground Water Extraction (%) in 2017	Categorization in 2017	Stage of Ground Water Extraction (%) in 2020	Categorization in 2020	Remark
1	AMROHA	DHANAURA	104.43	Over Exploited	97.09	Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
2	AMROHA	GAJRAULA	110.42	Over Exploited	98.04	Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
3	AMROHA	HASANPUR	111.60	Over Exploited	92.35	Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
4	BIJNAUR	JALEELPUR	110.20	Over Exploited	92.02	Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
5	G.B. NAGAR	JEWAR	108.81	Over Exploited	98.36	Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
6	HAPUR	HAPUR	112.42	Over Exploited	96.87	Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
7	HAPUR	SIMBHOLI	102.44	Over Exploited	96.87	Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
8	JAUNPUR	BADLAPUR	123.05	Over Exploited	92.64	Critical	Increased Rainfall Recharge as calculated by WTF
9	JAUNPUR	KARANJA KALAN	100.64	Over Exploited	79.34	Semi-Critical	Increased Rainfall Recharge as calculated by WTF
10	JAUNPUR	KERAKAT	104.41	Over Exploited	87.65	Semi-Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
11	JAUNPUR	MAHARAJGANJ	113.25	Over Exploited	93.16	Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
12	JAUNPUR	SIKRARA	103.87	Over Exploited	76.21	Semi-Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
13	JAUNPUR	SIRKONI	104.46	Over Exploited	78.30	Semi-Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
14	KANPUR NAGAR	CHAUBEPUR	109.89	Over Exploited	97.91	Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
15	KANPUR NAGAR	KANPUR CITY	102.35	Over Exploited	94.49	Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
16	MATHURA	BALDEO	102.73	Over Exploited	95.79	Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
17	MEERUT	KHARKHODA	110.86	Over Exploited	97.36	Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
18	MEERUT	MACHHRA	114.91	Over Exploited	95.04	Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
19	MEERUT	RAJPURA	104.29	Over Exploited	95.52	Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
20	MUZAFFARNAGAR	BUDHANA	101.11	Over Exploited	99.21	Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
21	PRATAPGARH	MANDHATA	107.37	Over Exploited	95.65	Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
22	PRATAPGARH	SADAR	120.43	Over Exploited	95.02	Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
23	PRATAPGARH	SANDWA CHANDIKA	138.73	Over Exploited	94.44	Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
24	PRATAPGARH	SHIVGARH	107.93	Over Exploited	90.56	Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
25	PRAYAGRAJ	CHAKA	106.43	Over Exploited	93.29	Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
26	RAMPUR	CHAMRAUWA	133.15	Over Exploited	94.46	Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
27	SAHARANPUR	SADHAULI KADEEM	138.97	Over Exploited	91.76	Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
28	SHAMBHAL	BAHJOI	108.46	Over Exploited	92.08	Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
29	SHAMBHAL	BANIAKHERA	101.08	Over Exploited	92.44	Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
30	SHAMBHAL	PAWANSA	102.61	Over Exploited	92.59	Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently

Table 20: Assessment units which improved from Critical to Semi-critical category

S. No	Name of District	Name of Assessment Unit	Stage of Ground Water Extraction (%) in 2017	Categorization in 2017	Stage of Ground Water Extraction (%) in 2020	Categorization in 2020	Remark
1	BIJNAUR	NOORPUR	96.24	Critical	89.93	Semi-Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
2	JAUNPUR	BAKSHA	96.15	Critical	80.16	Semi-Critical	Increased Rainfall Recharge as calculated by WTF
3	JAUNPUR	MUFTIGANJ	95.83	Critical	86.90	Semi-Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
4	KANPUR NAGAR	GHATAMPUR	93.99	Critical	88.59	Semi-Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
5	KANPUR NAGAR	SARSOL	90.41	Critical	87.59	Semi-Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
6	KASGANJ	KASGANJ	99.19	Critical	87.51	Semi-Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
7	MEERUT	MEERUT	91.70	Critical	86.93	Semi-Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
8	MEERUT	PARICHHATGARH	90.94	Critical	85.68	Semi-Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
9	MIRZAPUR	CHANBEY	93.63	Critical	77.89	Semi-Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
10	MIRZAPUR	CITY	95.94	Critical	88.10	Semi-Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
11	MORADABAD	BHAGATPUR TANDA	94.95	Critical	88.43	Semi-Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
12	MORADABAD	DILARI	97.70	Critical	82.68	Semi-Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
13	MUZAFFARNAGAR	CHARTHAWAL	95.11	Critical	89.54	Semi-Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
14	PRATAPGARH	MANGARAURA	91.28	Critical	82.02	Semi-Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
15	PRATAPGARH	PATTI	95.06	Critical	81.37	Semi-Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
16	PRAYAGRAJ	BAHADURPUR	90.75	Critical	84.10	Semi-Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
17	PRAYAGRAJ	DHANUPUR	94.63	Critical	85.78	Semi-Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
18	PRAYAGRAJ	PRATAPPUR	91.46	Critical	86.99	Semi-Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
19	BHADOI	BHADOHI	91.35	Critical	74.97	Semi-Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
20	BHADOI	GYANPUR	96.88	Critical	85.42	Semi-Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
21	SAHARANPUR	DEOBAND	91.90	Critical	86.12	Semi-Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
22	SAHARANPUR	MUZAFFARABAD	92.74	Critical	86.27	Semi-Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
23	SAHARANPUR	NANAUTA	93.90	Critical	87.50	Semi-Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
24	SAHARANPUR	RAMPUR MANIHARAN	92.85	Critical	89.74	Semi-Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
25	SHAMBHAL	ASMOLI	94.41	Critical	82.67	Semi-Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently
26	VARANASI	PINDRA	114.92	Critical	83.27	Semi-Critical	Extraction for irrigation reduced as per MI Census, WL raised subsequently

Table 21: Assessment units which Deteriorated from Critical to Over-exploited category

S. No	Name of District	Name of Assessment Unit	Stage of Ground Water Extraction (%) 2017	Categorization 2017	Stage of Ground Water Extraction (%) in 2020	Categorization 2020	Remark
1	AGRA	AGRA CITY	93.37	Critical	174.33	Over Exploited	Recharge Reduced as per new Methodology and INGRES
2	AGRA	AKOLA	96.54	Critical	117.64	Over Exploited	Less recharge
3	BUDAUN	ASAFPUR	97.06	Critical	100.41	Over Exploited	Less recharge
4	BULANDSHAHAR	BHAWAN BAHADUR NAGAR	97.84	Critical	101.98	Over Exploited	Less recharge
5	MIRZAPUR	KON	98.14	Critical	113.85	Over Exploited	Extraction for Irrigation increased (1.2 times), WL decreased

Table 22: Assessment units which Deteriorated from Safe to Semi-Critical category

S. No	Name of District	Name of Assessment Unit	Stage of Ground Water Extraction (%) 2017	Categorization 2017	Stage of Ground Water Extraction (%) in 2020	Categorization 2020	Remark
1	AGRA	JAITPUR KALAN	65.13	Safe	80.44	Semi-Critical	Less recharge
2	AZAMGARH	AHIRAULA	69.76	Safe	71.48	Semi-Critical	Marginally less recharge
3	AZAMGARH	ATRAULIA	65.94	Safe	71.22	Semi-Critical	Marginally less recharge
4	AZAMGARH	KOILSA	69.28	Safe	73.56	Semi-Critical	Less recharge
5	AZAMGARH	PALHANA	69.72	Safe	72.84	Semi-Critical	Less recharge
6	AZAMGARH	PALHANI	67.65	Safe	77.95	Semi-Critical	Less recharge
7	AZAMGARH	TARWA	65.03	Safe	86.81	Semi-Critical	Less recharge
8	BAREILI	MAJHGAWA	68.84	Safe	70.08	Semi-Critical	Less recharge
9	BIJNAUR	KOTWALI	68.70	Safe	71.86	Semi-Critical	Less recharge
10	ETAH	SAKIT	69.34	Safe	70.48	Semi-Critical	Extraction increased
11	FATEHPUR	KHAJUHA	50.97	Safe	72.09	Semi-Critical	Less recharge
12	FIROZABAD	EKA	66.84	Safe	72.40	Semi-Critical	Less recharge
13	FIROZABAD	JASRANA	62.84	Safe	78.61	Semi-Critical	Less recharge
14	HARDOI	TODARPUR	66.84	Safe	73.00	Semi-Critical	Less recharge
15	KANPUR DEHAT	DERAPUR	48.86	Safe	74.96	Semi-Critical	Rapid increase in Extraction for Irrigation. WL decreased significantly
16	KANPUR DEHAT	JHINJHAK	68.98	Safe	75.36	Semi-Critical	Less recharge
17	KANPUR DEHAT	MAITHA	67.78	Safe	73.90	Semi-Critical	Extraction for Irrigation increased (1.18 times)
18	KASGANJ	PATIYALI	64.40	Safe	76.56	Semi-Critical	Less recharge
19	MAINPURI	KURAWALI	68.57	Safe	70.30	Semi-Critical	Less recharge
20	SONBHADRA	NAGAWA	66.58	Safe	74.11	Semi-Critical	Marginally less recharge

Table 23: Assessment units which Deteriorated from Semi-Critical to Critical category

S. No	Name of District	Name of Assessment Unit	Stage of Ground Water Extraction (%) 2017	Categorization 2017	Stage of Ground Water Extraction (%) in 2020	Categorization 2020	Remark
1	AGRA	BAH	83.98	Semi-Critical	96.37	Critical	Less recharge
2	BULANDSHAHAR	ARNIA KHURD	88.53	Semi-Critical	94.00	Critical	Less recharge
3	ETAH	ALIGANJ	88.26	Semi-Critical	90.02	Critical	Less recharge
4	HATHRAS	SIKANDRA RAO	88.58	Semi-Critical	91.43	Critical	Less recharge
5	KASGANJ	GANJDUNDWARA	77.10	Semi-Critical	92.04	Critical	Less recharge
6	MIRZAPUR	SIKHAR	85.44	Semi-Critical	91.81	Critical	Extraction for Irrigation increased (1.11 times), WL decreased

References:

Dynamic Groundwater Resources of Uttar Pradesh, 2017

Central Ground Water Board, Northern Region Lucknow, Ground Water Year Book (2016 2017)

Government of India (2012), National Water Policy. Ministry of Water Resources, New Delhi. Ground Water Estimation Committee (1997); Ground Water Estimation Methodology - 1997. Ministry of Water Resources, Govt. of India, New Delhi

Report of the Ground Water Resource Estimation Committee (GEC-2015) Methodology. Ministry of Water Resources, River Development & Ganga Rejuvenation Government of India New Delhi October, 2017

GWD UP & CGWB; Dynamic Ground Water Resources of Uttar Pradesh (As on March, 2004). GWD UP & CGWB; Dynamic Ground Water Resources of Uttar Pradesh (As on March, 2009). GWD UP & CGWB; Dynamic Ground Water Resources of Uttar Pradesh (As on March, 2011). GWD UP & CGWB; Dynamic Ground Water Resources of Uttar Pradesh (As on March, 2013).

Khan Seraj, Central Ground Water Board, Northern Region Lucknow, Hydrogeology of Uttar Pradesh, Oct. 2017

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Annexure 1a

(TO BE PUBLISHED IN THE GAZETTE OF INDIA PART-I, SECTION -I)

Government of India
Ministry of JAL SHAKTI
Department of Water Resources, River Development & Ganga Rejuvenation
****

Shram Shakti Bhavan, Rafi Marg,
New Delhi, Dated: 24/06/2020

RESOLUTION

Sub: Constitution of Central Level Expert Group (CLEG) for overall re-assessment of ground water resources of the country as on 31 Mar 2020.

The last assessment of state-wise annual ground water recharge for the entire country has been made as on 31st March 2017 based on the methodology finalized by Ground Water Resources Estimation Committee (GEC) - 2015. Since then there have been changes in ground water scenario in many places of the country and accordingly, a Central Level Expert Group (CLEG) is hereby constituted for over-all supervision of the re-assessment of ground water resources (as on 31st March 2020) in the entire country. The composition and terms of reference of the Expert Group are as follows:-

1. **Composition:**

S.No.	Names/Designation	Committee
1.	Chairman, CGWB	Chairman
2.	Member(RM),CWC	Member
3.	Member (WP & P), CWC or, representative	Member
4.	Member (CGWA), CGWB	Member
5.	Member(HQ), CGWB	Member
6.	Member (ED & MM), CGWB	Member
7.	Member (RGI), CGWB	Member
8.	Additional Director General (Stat), DoWR,RD & GR	Member
9.	Chief General Manager, NABARD	Member
10.	Director, NIH, Roorkee or representative	Member

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11.	Representative of NITI Aayog	Member
12.	Joint Secretary, Ministry of Agriculture & Farmer Welfare	Member
13.	Joint Secretary, Ministry of Environment, Forests & Climate Change	Member
14. (a)	Joint Secretary, Ministry of Rural Development (Watershed Development Programme)	Member
14 . (b)	Joint Secretary, Ministry of Rural Development (MGNREGS)	Member
15.	Joint Secretary, Department of Drinking Water Supply & Sanitation, Ministry of Jal Shakti	Member
16.	Joint Secretary, Ministry of Housing & Urban Affairs	Member
17.	Representative of IIT, Delhi (Water Resources Section), Civil Engineering Department	Member
18.	Chief Engineer (HQ), NWDA or representative	Member
19.	Technical Expert (WM), NRAA, Ministry of Agriculture & Farmer Welfare	Member
20.	Representative of India Meteorological Department, Ministry of Earth Sciences	Member
21.	Representative of Geological Survey of India, Ministry of Mines	Member
22.	Secretary In-Charge, Water Resources Department, Uttar Pradesh	Member
23.	Secretary In-Charge, Water Resources Department, Punjab	Member
24.	Secretary In-Charge, Water Resources Department, Maharashtra	Member
25.	Secretary In-Charge, Water Resources Department, Andhra Pradesh	Member
26.	Secretary In-Charge, Water Resources Department, Rajasthan	Member
27.	Secretary In- Charge, Water Resources Department, Madhya Pradesh	Member
28.	Secretary In- Charge, Water Resources Department, Gujarat	Member

639400/2020/GW Section

29.	Secretary In- Charge, Water Resources Department, West Bengal	Member
30.	Secretary In- Charge, Water Resources Department, Tamil Nadu	Member
31.	Secretary In- Charge, Water Resources Department, Haryana	Member
32.	Secretary In- Charge, Water Resources Department, Karnataka	Member
33.	Secretary In- Charge, Water Resources Department, Telangana	Member
34.	Representative of Department of Civil Engg., Indian Institute of Science (IISc), Bangalore	Member
35.	Representative of Department of Civil Engg., Indian Institute of Technology-Hyderabad	Member
36.	Member (WQ & TT), CGWB	Member Secretary

The committee may co-opt any other Member(s), if necessary.

2. Terms of Reference: –

i. To ensure the assessment of annual ground water recharge of the States/UTs in coordination with the respective state level committees for the reference year 2020. The Committee will work on ground water assessments in accordance with the methodology and will adopt improved procedures and practices wherever possible for the sake of achieving greater accuracy of assessment(s).

ii. To supervise the estimation of status of utilization of the annual extractable ground water resource as on 31st March 2020 of the States/UTs to be carried by the respective State/UT level committees.

iii. To supervise compilation of a National level report on assessment of ground water resources and status of its utilization as on 31st March, 2020.

iv. To work towards integration of ground water and surface water data with a view to facilitate planning for conjunctive use of water resources.

v. Any other aspect relevant to the terms referred to above.

3. Time frame:-

The Committee will submit its report on or before 31.03.2021.

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4. **Expenditure**

Expenditure on account of TA/DA to official Members of the Expert Group will be met from the source from which they draw their salaries and that of non-official Members (if any), will be borne by the Central Ground Water Board as per Govt. norms.

This issues with the approval of competent authority.

(Mukesh Kumar)
Deputy Secretary (EA&IC)
email: dirgw-mowr@nic.in

मुकेश कुमार/MUKESH KUMAR
उप सचिव/Deputy Secretary
जल शक्ति मंत्रालय/Ministry of Jal Shakti
जल संसाधन, नदी विकास एवं गंगा संरक्षण विभाग
Deptt. of Water Resources, River Development and Ganga Rejuvanation
भारत सरकार/Government of India
नई दिल्ली/New Delhi-110001

ORDER

Ordered that the Resolution be published in the Gazette of India for general information.

Ordered that a copy of the Resolution published be communicated to this Ministry for record.

(Mukesh Kumar)
Deputy Secretary (EA&IC)
email: dirgw-mowr@nic.in

मुकेश कुमार/MUKESH KUMAR
उप सचिव/Deputy Secretary
जल शक्ति मंत्रालय/Ministry of Jal Shakti
जल संसाधन, नदी विकास एवं गंगा संरक्षण विभाग
Deptt. of Water Resources, River Development and Ganga Rejuvanation
भारत सरकार/Government of India
नई दिल्ली/New Delhi-110001

To

The Manager,

Government of India Press,

Faridabad (Haryana).

Copy to:

1. PS to Minister (JAL SHAKTI)
2. PS to MoS (JAL SHAKTI)
3. Sr PPS to Secretary (DoWR, RD & GR)
4. PPS to Joint Secretary (IC & GW)
5. All members concerned.
6. Chairman, CGWB, Faridabad.
7. Member (WQ & TT) and Member Secretary of the CLEG-2020, CGWB, Faridabad for information and necessary action.

Copy also to:

NIC for uploading the Resolution on Ministry's website.

Annexure 1b

उत्तर प्रदेश शासन
नमामि गंगे तथा ग्रामीण जलापूर्ति अनुभाग–3
संख्याः 763/76–3–2020–04आर/2009
लखनऊः दिनांकः 03 सितम्बर, 2020

कार्यालय–ज्ञाप

उत्तर प्रदेश में वार्षिक पुनर्भरणीय भूजल संसाधन (Annual Replenishable Ground Water Resource) का भूगर्भ संसाधन आकलन समिति–2015 (GEC-2015) द्वारा निर्धारित प्रकिया के अनुसार आंकलन 31 मार्च, 2017 के आंकडों के आधार पर किया गया है। इसके दृष्टिगत जल शक्ति मंत्रालय, भारत सरकार के निर्देशानुसार आधार वर्ष 2019–20 के लिए 31 मार्च, 2020 तक के आकड़ों पर आधारित भूजल संसाधनों के पुनर्आकलन के निर्देश दिये गये है।

उक्त के कम में जल शक्ति मंत्रालय, भारत सरकार द्वारा केन्द्र स्तरीय विशेषज्ञ समिति का गठन करते हुए राज्य स्तर पर प्रमुख सचिव, नमामि गंगे तथा ग्रामीण जलापूर्ति विभाग की अध्यक्षता में राज्य स्तरीय समिति के गठन की अपेक्षा की है। उल्लेखनीय है कि पूर्व में शासनादेश संख्या–724/62–1–2017 –4आर/2009, दिनांक 12 जून, 2017 द्वारा "राज्य स्तरीय भूजल आकलन समिति" गठित की गयी थी।

अतः वर्तमान में जल शक्ति मंत्रालय, भारत सरकार के नवीन दिशा–निर्देशों के कम में 31 मार्च, 2020 तक के आकडों के आधार पर प्रदेश में भूजल संसाधन आकलन रिपोर्ट केन्द्रीय भूजल बोर्ड तथा उ0प्र0 भूगर्भ जल विभाग, द्वारा संयुक्त रुप से समयबद्ध ढ़ंग से तैयार किये जाने, सम्बन्धित कार्य/गतिविधि का नियमित अनुश्रवण करने तथा उसके अनुमोदन हेतु "राज्य स्तरीय भूजल आकलन समिति" का गठन निम्नानुसार किया जाता है :–

1.	प्रमुख सचिव, नमामि गंगे तथा ग्रामीण जलापूर्ति विभाग, उ0प्र0 शासन	अध्यक्ष
2.	आयुक्त/अपर आयुक्त मनरेगा, उत्तर प्रदेश	सदस्य
3.	अधिशासी निदेशक, पेयजल एवं स्वच्छता मिशन, लखनऊ	सदस्य
4.	प्रमुख वन संरक्षक, वन विभाग, उ0प्र0	सदस्य
5.	निदेशक, स्थानीय निकाय, निदेशालय, लखनऊ	सदस्य
6.	प्रमुख अभियन्ता, सिंचाई एवं जल संसाधन विभाग, उत्तर प्रदेश	सदस्य
7.	प्रमुख अभियन्ता, सिंचाई विभाग(यांत्रिक), उत्तर प्रदेश	सदस्य
8.	प्रबन्ध निदेशक, उ0प्र0 जल निगम, लखनऊ	सदस्य
9.	निदेशक, कृषि विभाग, उत्तर प्रदेश	सदस्य
10.	मुख्य अभियन्ता, लघु सिंचाई विभाग, उत्तर प्रदेश	सदस्य
11.	महाप्रबंधक, राष्ट्रीय कृषि एवं ग्रामीण विकास बैंक, लखनऊ	सदस्य
12.	मुख्य अभियन्ता, राज्य जल संसाधन अभिकरण, उ0प्र0	सदस्य
13.	सदस्य सचिव, प्रदूषण नियंत्रण बोर्ड, उ0प्र0	सदस्य
14.	निदेशक, पर्यावरण विभाग, उ0प्र0	सदस्य
15.	उप महानिदेशक (उ0क्षे0) भारतीय भू–वैज्ञानिक सर्वेक्षण, उ0प्र0	सदस्य
16.	मुख्य नगर एवं ग्राम नियोजक, उ0प्र0	सदस्य
17.	निदेशक, रिमोट सेंसिंग एप्लीकेशन सेन्टर, उ0प्र0	सदस्य
18.	निदेशक, भारतीय मौसम विभाग, लखनऊ	सदस्य
19.	सचिव, राजस्व परिषद, उ0प्र0	सदस्य
20	निदेशक, भूगर्भ जल विभाग, उ0प्र0	सदस्य
21.	निदेशक आवास बन्धु, उत्तर प्रदेश	सदस्य
22.	निदेशक, उद्यान विभाग, उत्तर प्रदेश	सदस्य

उक्त समिति के सदस्य सचिव क्षेत्रीय निदेशक, केन्द्रीय भूजल परिषद, उत्तरी क्षेत्र, लखनऊ होगें।

उक्त समिति के मुख्य कार्य एवं उत्तरदायित्व निम्नानुसार होगें:–

(1) (GEC-2015) के अनुसार भूजल संसाधनों की गणना/आकलन की मेथडोलाजी (Ground Water Estimation Methodology) के अनुसार प्रदेश में वार्षिक रिप्लेनिशेबिल भूजल संसाधन का आकलन सुनिश्चित कराया जाना।

(2) भूजल आकलन के प्रणाली विज्ञान (Methodology) में चिन्हित आवश्यक आंकडों/सूचनाओं को समयबद्ध ढंग से उपलब्ध कराये जाने की व्यवस्था सम्बन्धित विभागों के स्तर पर सुनिश्चित कराया जाना एवं आवश्यक दिशा–निर्देश निर्गत कराया जाना।

(3) उक्त आकलन हेतु, भूगर्भ जल विभाग, निदेशालय स्तर पर एक "भूजल प्रकोष्ठ" का गठन किया जायेगा, जो इसके लिए उत्तरदायी होगा एवं तकनीकी सहयोग प्रदान करेगा। इस भूजल प्रकोष्ठ में दो अधिकारी भूगर्भ जल विभाग, उ0प्र0 एवं दो अधिकारी क्षेत्रीय निदेशक, केन्द्रीय भूजल परिषद, उ0क्षे0, लखनऊ के द्वारा नामित अधिकारी होगे, जो इस कार्य हेतु समर्पित रहेंगे तथा आकलन का नियमित अनुश्रवण एवं मार्ग–निर्देशन करेंगे।

समिति द्वारा उक्त आंकलन हेतु भारत सरकार द्वारा समय–समय पर परिचालित प्रक्रिया के अनुसार कार्यवाही सुनिश्चित करायी जायेगी।

समिति द्वारा उक्तानुसार 31–03–2020 की स्थिति पर आधारित भू–जल संसाधनों के आंकलन से सम्बन्धित रिपोर्ट समय–सीमा के अन्तर्गत प्रस्तुत करने की कार्यवाही भी सुनिश्चित करायी जायेगी।

शत्रुघ्न सिंह
विशेष सचिव।

संख्याः 763 (1)/76–3–2020, तद्दिनांक।

प्रतिलिपि निम्नलिखित को सूचनार्थ एवम् आवश्यक कार्यवाही हेतु प्रेषित हैः–

1. समिति के समस्त सदस्यगण।
2. अपर मुख्य सचिव/प्रमुख सचिव/सचिव सिंचाई एवं जल संसाधन/कृषि/नगर विकास/विज्ञान एवं प्रौद्योगिकी/पर्यावरण/आवास एवं शहरी नियोजन/औद्योगिक विकास/उद्यान/ग्राम विकास, उ0प्र0 शासन।
3. स्टाफ आफिसर, मुख्य सचिव, उ0प्र0 शासन।
4. स्टाफ आफिसर, कृषि उत्पादन आयुक्त, उ0प्र0 शासन।
5. संयुक्त सचिव, जल शक्ति मंत्रालय, भारत सरकार, श्रमशक्ति भवन, रफी मार्ग, नई दिल्ली।
6. अध्यक्ष, केन्द्रीय भूजल बोर्ड, भूजल भवन, एन0आई0एच0–4, फरीदाबाद।
7. क्षेत्रीय निदेशक, केन्द्रीय भूजल परिषद, उत्तरी क्षेत्र, लखनऊ।
8. गार्ड फाइल ।

आज्ञा से

(शत्रुघ्न सिंह) 3-9-20
विशेष सचिव।

Annexure 2a

भारत सरकार
जल शक्ति मंत्रालय
केंद्रीय भूमि जल बोर्ड, उत्तरी क्षेत्र
भूजल भवन
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सं॰ 4(211)/ के॰भू॰ज॰बो॰/उ॰क्षे॰/एस॰&आइ॰/2020-1593

11 SEP 2020

कार्यालय आदेश

विषय: भूजल संसाधन आकलन (2019-2020) हेतु भूजल प्रकोष्ठ

विषयांतर्गत, उत्तर प्रदेश शासन के 'नमामि गंगे तथा ग्रामीण जलापूर्ति अनुभाग - 3 के पत्र संख्या 763/76-3-2020-04 आर/ 2009 द्वारा जारी कार्यालय ज्ञाप, दिनांक 03 सितंबर 2020 (छायाप्रति संलग्न) में निहित समिति के मुख्य कार्य एवं उत्तरदायित्व सं॰ 3 के क्रम में एतदद्वारा '**भूजल प्रकोष्ठ**' का गठन निम्नानुसार किया जाता है ।

1. श्री रवि कान्त सिंह, सीनियर हाइड्रोजियोलोजिस्ट, भूगर्भ जल विभाग, उ॰प्र॰
2. श्री अवधेश कुमार, अधिशासी अभियंता, भूगर्भ जल विभाग, उ॰प्र॰
3. डॉ॰ विकास रंजन, सीनियर हाइड्रोजियोलोजिस्ट (वैज्ञानिक-सी), केन्द्रीय भूमि जल बोर्ड, उ॰ क्षे॰, लखनऊ
4. डॉ॰ आर के प्रसाद, वैज्ञानिक-बी, केन्द्रीय भूमि जल बोर्ड, उ॰ क्षे॰, लखनऊ

उपरोक्त अधिकारी भूजल आकलन के कार्य हेतु समर्पित रहेंगे तथा आकलन का नियमित अनुश्रवण एवं मार्ग-निर्देशन करेंगे।

11/09/20

(पी.के. त्रिपाठी)
कार्यालय प्रमुख

वितरण:

1. प्रमुख सचिव, नमामि गंगे तथा ग्रामीण जलापूर्ति, उत्तर प्रदेश सरकार, कक्ष संख्या-1, सचिव भवन, सचिवालय, लखनऊ - 226021
2. निदेशक, भूगर्भ जल विभाग, उ॰प्र॰, नवाँ तल, इन्दिरा भवन, अशोक मार्ग, लखनऊ - 226001
3. श्री रवि कान्त सिंह, सीनियर हाइड्रोजियोलोजिस्ट/ श्री अवधेश कुमार, अधिशासी अभियंता, भूगर्भ जल विभाग, उ॰प्र॰, नवाँ तल, इन्दिरा भवन, अशोक मार्ग, लखनऊ - 226001
4. डॉ॰ विकास रंजन, सीनियर हाइड्रोजियोलोजिस्ट (वैज्ञानिक-सी/ डॉ॰ आर के प्रसाद, वैज्ञानिक-बी, केन्द्रीय भूमि जल बोर्ड, उ॰ क्षे॰, लखनऊ

Annexure 2b

भारत सरकार
जल शक्ति मंत्रालय
केंद्रीय भूमि जल बोर्ड, उत्तरी क्षेत्र
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No. 4(211)/ CGWB/ NR/ S&I/ 2020 – 1170
Date: 21 SEP 2020

To
The Principal Secretary
Namami Gange and Rural Drinking Water Supply &
Chairman, State Level Committee (SLC) for Ground Water Estimation
Government of Uttar Pradesh
Room No. 1, Sachiv Bhawan, Sachivalay
Lucknow – 226 001

Sub: Request for suitable date and time to convene meeting of State Level Committee for approval of Ground Water Resource Estimation –reg

Ref: नमामि गंगे तथा ग्रामीण जलापूर्ति अनुभाग - 3 के पत्र संख्या 763/76-3-2020-04 आर/ 2009 द्वारा जारी कार्यालय ज्ञाप, दिनांक 03 सितंबर 2020

Sir

This is in reference to the Government Order, dated 03.09.2020 whereby State Level Committee (**SLC**) for Estimation of Ground Water Resources for the base year 2019-20 has been constituted. In continuation to above, the process has been initiated and Ground Water cell having officers of CGWB and GWD has been constituted (copy enclosed).

In the above context, it is to inform that in order to carry out the exercise in a smooth manner, input data from different member departments is required.

In view of the above, it is proposed to convene **1st meeting** of the **SLC** to take decisions as regard to coordination with different departments for expeditious sharing of required data so that the exercise can be completed in time and final report can be put up before **SLC** for approval. It is, therefore, requested to kindly accord suitable date and time, preferably in the last week of September, 2020/ 1st week of October, 2020, for holding the meeting.

Yours faithfully

(*P K Tripathi*)
Regional Director (I/C) &
Member Secretary, SLC

Copy to: The Director, Ground Water Department, UP & State Level Nodal Officer (NAQUIM), 9th Floor, Indira Bhawan, Lucknow – 226001 for kind information, with the request to kindly coordinate in the matter.

(*P K Tripathi*)
Regional Director (I/C) &
Member Secretary, SLC

Annexure 2c

भारत सरकार
जल शक्ति मंत्रालय
केंद्रीय भूमि जल बोर्ड, उत्तरी क्षेत्र
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No. 4(211)/ CGWB/ NR/ S&I/ 2020 – 1199
Date: 28 SEP 2020

Sub: Gist/ Decisions of the Meeting between CGWB and GWD on 16:09.2020 to discuss plan for Estimation of GW Resources as on 31.03.2020

A meeting of CGWB and GWD, UP officers was held on 16.09.2020 in the chamber of the Director, GWD, UP to discuss plan to complete the exercise of GW Resource Estimation, 2020. Following officers were present in the meeting.

1. Shri V K Upadhyay, Director, GWD, UP
2. Shri P K Tripathi, Regional Director (I/C), CGWB, NR, Lucknow
3. Shri Vikas Ranjan, Scientist-C, CGWB (Northern Region), Lucknow
4. Shri R.K. Prasad, Scientist-B, CGWB (Northern Region), Lucknow
5. Shri Amod Kumar, Executive Engineer, NHP, PIC, GWD, Lucknow
6. Shri Anupam, Executive Engineer, NHP, PIC, GWD, Lucknow
7. Shri P.K. Johari, Technical Advisor, NHP, PIC, GWD, Lucknow

Discussions were held on various aspects, such as availability of data from different sources, resource estimation of 10 blocks on priority as per directions from CGWB, CHQ etc. and plan for timely completion of exercise were discussed. Following is the summary of discussions and decisions taken.

Availability of data pertaining to Irrigation Department in respect of Command and Non-command areas was discussed in detail. It was informed by GWD, UP that request letter has been sent to the Irrigation Department for providing all relevant data. Shri Johri informed that all the maps are available with SWaRA. It was decided to pursue the matter with Irrigation Department again. Also, the Principal Secretary, Namami Gange and Rural Drinking Water Supply will be requested to direct Irrigation Department to provide data.

Regarding MI census data, it was informed by GWD, UP that the updated data for some districts has already been obtained from MI Department. The Director, GWD, UP will again write to the MI Department to provide data for remaining districts.

Regarding rainfall data, it was decided to use district-wise data as also done for Resource Estimation, 2017. This is especially in view of the opinion of Director, IMD during the final SLC meeting for Resource Estimation, 2017 held on 28.03.2019, wherein he had informed that the district-level data uploaded on IMD website is properly validated after collection of data at sub-division level.

Resource estimation process in respect of urban areas was also discussed and it was decided that the same procedure as adopted in 2017 will be used, i.e on the basis of Nagar Nigam areas.

As regard to 1st State Level Committee meeting to initiate the process and involve all the concerned departments for data/ information, it was decided that CGWB will make a formal request to the Principal Secretary, Namami Gange & Rural Drinking Water Supply and Chairman of the Committee for a convenient date to hold the meeting.

It was decided that all efforts should be made to complete the exercise/ approval of the report by 31st December, 2020.

25/9/2020

(Dr Vikas Ranjan)
Scientist C
For Regional Director

PTO.

Distribution:

1. The Director, Ground Water Department, UP, 9th Floor, Indira Bhawan, Lucknow – 226001, along with the request to distribute copy of this to all concerned officers of GWD, UP present in the meeting.
2. Dr Vikas Ranjan, Scientist C, CGWB, NR, Lucknow
3. Dr R K Prasad, Scientist B, CGWB, NR, Lucknow

Annexure 2d

भारत सरकार
जल शक्ति मंत्रालय
केंद्रीय भूमि जल बोर्ड, उत्तरी क्षेत्र
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No. 4 (211)/ CGWB/NR/S&I/2020 - 1229

08 OCT 2020

Meeting Notice

Sub: 1st Meeting of State Level Committee for Estimation of Ground Water Resources of UP as on March 2020 scheduled to be held on 14th September 2020 - reg.

Ref: नमामि गंगे तथा ग्रामीण जलापूर्ति अनुभाग-3 के पत्र संख्या 763/76-3-2020-04 आर/ 2009, दिनांक 03 सितंबर 2020 द्वारा गठित राज्य स्तरीय समिति (State Level Committee)

This is in reference to the GO cited above vide (copy attached) which State Level Committee for Ground Water Resource Estimation for the Base Year 2019-20 has been constituted.

In continuation to above, it is to inform that ***1st*** meeting of the **SLC** is scheduled to be held on **14h October, 2020** *at* **04:30 PM** under the chairmanship of the Principal Secretary, Namami Gange & Drinking Water Supply, Government of UP in the Conference Room of State Drinking Water & Sanitation Mission, UP Jal Nigam premises.

The Agenda Items for the meeting are as follows.

1. Availability of data pertaining to Irrigation Department in respect of Command and Non-command areas.
2. Availability of MI Census Data
3. Priority completion of Resource Estimation in respect of the districts having 10 blocks with continuous OE status.
4. Resource Estimation of urban areas on the basis of Nagar Nigam area and availability of ground water extraction data for cities.
5. Utilization of District-wise Rainfall Data of IMD for Resource Estimation.
6. Any other agenda item with permission of Chairman.

It is requested to kindly participate in the meeting with relevant data/ information.

(P K Tripathi)
Regional Director (I/C) &
Member Secretary

Encl: As above

Distribution:

1. PA to Principal Secretary, Namami Gange & Rural Drinking Water Supply, Government of UP and Chairman, State Level Committee, Sachivalaya, Lucknow.

PTO

2. The Commissioner/ Additional Commissioner, MGNREGA, UP, Lucknow
3. The Executive Director, Drinking Water and Sanitation Mission, Lucknow
4. The Principal Conservator of Forests, Forest Department, UP, Lucknow
5. The Director, Directorate of Local Bodies, Lucknow
6. The Engineer-in-Chief, Irrigation and Water Resources Department, UP, Lucknow
7. The Engineer-in-Chief (Mechanical), Irrigation and Water Resources Department, UP, Lucknow
8. The Managing Director, UP Jal Nigam, Lucknow.
9. The Director, Agriculture, UP, Lucknow.
10. The Chief Engineer, Minor Irrigation Department, UP, Lucknow.
11. The General Manager, NABARD, Lucknow.
12. The Chief Engineer, SWaRA, UP, Lucknow.
13. The Member Secretary, UPPCB, Lucknow.
14. The Director, Environment, Lucknow.
15. The Deputy Director General, GSI, Lucknow.
16. The Chief Town and Village Planning, UP, Lucknow.
17. The Director, UPRSAC, Lucknow.
18. The Director, IMD, Lucknow.
19. The Secretary, Revenue, Lucknow.
20. The Director, GWD, UP, Lucknow.
21. The Director, Awas Bandhu, Lucknow.
22. The Director, Horticulture, UP, Lucknow.

Annexture 2e

भारत सरकार
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भूजल भवन
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No. 4 (211)/ CGWB/NR/S&I/2020 – 1329
Date: 29 OCT 2020

Minutes of 1st SLC Meeting (14.10.2020) – Ground Water Resources

Sub: Minutes of meeting on 1st State Level Committee for Estimation of Ground Water Resources of UP as on March 2020 held on 14th October 2020 - reg.

Ref: नमामि गंगे तथा ग्रामीण जलापूर्ति अनुभाग-3 के पत्र संख्या 763/76-3-2020-04 आर/ 2009, दिनांक 03 सितंबर 2020 द्वारा गठित राज्य स्तरीय समिति (State Level Committee)

1st meeting of State Level Committee for Ground Water Resource Estimation for the Base Year 2019-20 was held on **14h October, 2020** *at* **04:30 PM** under the chairmanship of the Principal Secretary, Namami Gange & Drinking Water Supply, Government of UP in the Conference Room of State Drinking Water & Sanitation Mission, UP Jal Nigam premises. The Attendance Sheet is attached.

The meeting started with the welcome address by Sh. P K Tripathi, Regional Director (I/C), CGWB, NR, Lucknow. He gave brief introduction about the need for Resource Estimation on regular intervals. Shri V K Upadhyay Director, GWD, UP impressed upon the need for properly validated input data for accurate assessment as it forms the basis of various policy decisions.

With the permission of Chairman, a brief presentation was given by Dr. Vikas Ranjan, Scientist, CGWB, outlining the methodology of Resource Estimation exercise and the steps involved in the process. The committee was apprised about the timeline fixed by Central Government.

Agenda-wise discussions were held, mainly focusing on availability of validated data from different departments and following decisions were taken.

- As regard to data pertaining to Irrigation Department, such as Command Area Non-command area, wetted area etc., the Executive Engineer, SWaRA assured that all the available data/ maps will be shared with GWD, UP, both in hard as well as soft copy.
- Regarding MI Census data, the Chief Engineer, MI informed that the data is readily available and will be shared with GWD, UP.
- For Resource Estimation of urban areas, same approach is to be followed as for previous estimation exercise (2017). The Manageing Director, UP Jal Nigam assured that all the water supply data – demand, supply from different sources, number of tube wells, their depth and average discharge will be provided. It was further decided that since extraction by individuals is unknown, the demand can be worked out on the basis of population and computations done accordingly.

PTO

- Regarding rainfall data, the Director, IMD informed that updated data is available with IMD. It was also informed by him that district-level data compiled is properly validated after collection of data at sub-division level. It was decided that District-wise rainfall data will be utilized for the purpose of computations as also done for Resource Estimation, 2017. Updated data will be provided by IMD.

- It was decided that Resource Estimation in respect of the districts having 10 blocks with continuous OE status (2004-2017) will be completed on priority basis as desired by the CHQ, CGWB.

- The exercise for entire State shall be completed by **31.12.2020** for putting up before SLC for consideration and approval.

The meeting ended with thanks to the Chair.

28/10/20

(P K Tripathi)
Regional Director (I/C) &
Member Secretary

Distribution:

1. PA to Principal Secretary, Namami Gange & Rural Drinking Water Supply, Government of UP and Chairman, State Level Committee, Sachivalaya, Lucknow.
2. The Commissioner/ Additional Commissioner, MGNREGA, UP, Lucknow
3. The Executive Director, Drinking Water and Sanitation Mission, Lucknow
4. The Principal Conservator of Forests, Forest Department, UP, Lucknow
5. The Director, Directorate of Local Bodies, Lucknow
6. The Engineer-in-Chief, Irrigation and Water Resources Department, UP, Lucknow
7. The Engineer-in-Chief (Mechanical), Irrigation and Water Resources Department, UP, Lucknow
8. The Managing Director, UP Jal Nigam, Lucknow.
9. The Director, Agriculture, UP, Lucknow.
10. The Chief Engineer, Minor Irrigation Department, UP, Lucknow.
11. The General Manager, NABARD, Lucknow.
12. The Chief Engineer, SWaRA, UP, Lucknow.
13. The Member Secretary, UPPCB, Lucknow.
14. The Director, Environment, Lucknow.
15. The Deputy Director General, GSI, Lucknow.
16. The Chief Town and Village Planning, UP, Lucknow.
17. The Director, UPRSAC, Lucknow.
18. The Director, IMD, Lucknow.
19. The Secretary, Revenue, Lucknow.
20. The Director, GWD, UP, Lucknow.
21. The Director, Awas Bandhu, Lucknow.
22. The Director, Horticulture, UP, Lucknow

Annexure 2f

भारत सरकार
जल शक्ति मंत्रालय
केंद्रीय भूमि जल बोर्ड, उत्तरी क्षेत्र
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No. 4(211)/ CGWB/ NR/ S&I/ 2020 – 131
Date: 02 FEB 2021

Sub: Gist/ Decisions of the Meeting between CGWB and GWD on 25.01.2021 to discuss status of Estimation of GW Resources as on 31.03.2020

A meeting of CGWB and GWD, UP officers was held on 25.01.2021 in the chamber of the Director, GWD, UP to discuss plan to complete the exercise of GW Resource Estimation, 2020. Following officers were present in the meeting.

1. Shri V K Upadhyay, Director, GWD, UP
2. Shri P K Tripathi, Regional Director (I/C), CGWB, NR, Lucknow
3. Dr Vikas Ranjan, Scientist-C, CGWB (Northern Region), Lucknow
4. Shri Sujatro Ray Chowdhuri, Scientist-B, CGWB (Northern Region), Lucknow
5. Shri Ravi Kant Singh, Sr Hydrogeologist, GWD, UP.
6. Shri Awdhesh Kumar, Executive Engineer, GWD, UP
7. Other Officers from GWD, UP

Discussions were held on various aspects, particularly in the light of reconstitution of blocks and automation of estimation exercise through IN-GRES Software developed by IIT, Hyderabad with Technical Partner, M/s Vassar Labs. Following decisions were taken.

1. Availability of required SHAPE file(s) (reconstituted blocks and urban areas) with UPRSAC was confirmed through telephonic conversation. Ground Water department, UP will do the needful for obtaining authentic SHAPE files from UPRSAC.

2. District-wise Normal Annual Value has not been updated at IMD website. It is learnt from IMD that the updated data is under finalization. It was decided that letter will be sent to IMD by GWD, UP requesting for updated data and officer from CGWB will be deputed to make follow-up efforts.

3. Area in respect of Urban Assessment Units provided in Statistical Diary is to be considered for estimation.

4. Efforts will be made to obtain Canal Command area data from Irrigation Department/ SWaRA.

5. Certain discrepancies have been pointed out in the SHAPE file available with the Technical Partner M/s Vassar Labs. The sent SHAPE file is to be checked for correction of same.

6. It has been observed that certain issues still exist with the Automation Software. In-GRES Parallel exercise of estimation through Excel Calculator prepared by GWD, UP will be carried out in order to avoid any last-moment urgency in the event of issues cropping up with automation.

7. Shri Ravikant Singh, Sr Hydrogeologist will prepare timeline for completion of exercise.

2/2/2021
(Dr Vikas Ranjan)
Scientist C
for Regional Director

Distribution:

1. The Director, Ground Water Department, UP, 9th Floor, Indira Bhawan, Lucknow – 226001, along with the request to distribute copy of this to all concerned officers of GWD, UP present in the meeting.
2. Dr R K Prasad, Scientist B, CGWB, NR, Lucknow.
3. Shri Sujatro Ray Chowdhuri, Scientist B, CGWB, NR, Lucknow.

Annexture 2g

भारत सरकार
जल शक्ति मंत्रालय
केंद्रीय भूमि जल बोर्ड, उत्तरी क्षेत्र
भूजल भवन
सैक्टर-बी, सीतापुर रोड योजना, अलीगंज
लखनऊ - 226021
दूरभाष : (0522)-2363812,
ई-मेल: rdnr-cgwb@nic.in

Text

GOVERNMENT OF INDIA
MINISTRY OF JAL SHAKTI
CENTRAL GROUND WATER BOARD, NORTHERN REGION
BHUJAL BHAWAN
SECTOR-B, SITAPUR ROAD YOJANA, ALIGANJ,
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No. 4 (211)/ CGWB/NR/S&I/2021 – 251
Date: 07 APR 2021

Minutes of 2nd SLC Meeting (30.03.2021) – Ground Water Resources

विषय: भूजल संसाधन आकलन रिपोर्ट (31.03.2020 के आंकड़ों पर आधारित) के अनुमोदन हेतु प्रमुख सचिव, नमामि गंगे एवं ग्रामीण जल आपूर्ति, उ.प्र. शासन की अध्यक्षता में राज्य स्तरीय भूजल आकलन समिति की दिनांक 30.03.2021 को आहूत बैठक का कार्यवृत्त।

Ref: नमामि गंगे तथा ग्रामीण जलापूर्ति अनुभाग–3 के पत्र संख्या 763/76-3-2020-04 आर/ 2009, दिनांक 03 सितंबर 2020 द्वारा गठित राज्य स्तरीय समिति (State Level Committee)

महोदय,

बैठक में उपस्थित अधिकारियों का विवरण संलग्न है।

कोविड-19 से सुरक्षा के दृष्टिगत बैठक वर्चुअल मोड में प्रमुख सचिव, नमामि गंगे एवं ग्रामीण जल आपूर्ति, उ.प्र. शासन की अध्यक्षता में उनके कक्ष में आयोजित हुई, जिसमें केन्द्रीय भूमि जल बोर्ड, उत्तरी क्षेत्र तथा भूगर्भ जल विभाग, उ.प्र. के अधिकारियों द्वारा प्रतिभाग किया गया।

बैठक के प्रारम्भ में प्रमुख सचिव, नमामि गंगे एवं ग्रामीण जल आपूर्ति, उ.प्र. शासन का अभिनंदन करते हुए निदेशक, भूगर्भ जल विभाग द्वारा अवगत कराया गया कि प्रदेश में विकासखंडवार भूजल संसाधनों का आकलन प्रत्येक 3 वर्ष में किया जाता है। पूर्व में यह आकलन वर्ष 2017 में किया गया था एवं भारत सरकार के दिशा-निर्देशों के अनुक्रम में 31.03.2020 के आंकड़ों के आधार पर भूगर्भ जल विभाग, एवं केन्द्रीय भूमि जल बोर्ड द्वारा संयुक्त रूप से भूजल संसाधन आकलन रिपोर्ट तैयार की गयी है, जिसे 'राज्य स्तरीय भूजल आकलन समिति' की स्वीकृति हेतु प्रस्तुत की गया है। केन्द्रीय भूमि जल बोर्ड, उत्तरी क्षेत्र, लखनऊ द्वारा इस रिपोर्ट में उल्लेखित आंकड़ों के बारे में संक्षेप में बताया गया। उन्होने यह भी बताया कि विगत आकलन वर्ष-2017 की भाँति वर्तमान में भूजल संसाधनों का आकलन **'GEC-2015'** की संस्तुतियों के आधार पर किया गया है। भूगर्भ जल विभाग एवं केन्द्रीय भूमि जल बोर्ड द्वारा भूजल संसाधन आकलन रिपोर्ट से संबन्धित प्रस्तुतीकरण में विस्तृत जानकारी उपलब्ध करायी गयी, जिसमें वर्ष-2020 के आंकड़ों पर आधारित रिपोर्ट पर विस्तृत चर्चा भी की गयी।

समिति के सदस्यों को कार्य प्रणाली की बुनियादी अवधारणाओं से अवगत कराया गया। प्रस्तुतीकरण में बताया गया कि उत्तर प्रदेश के 820 विकासखंडों तथा 10 शहरी क्षेत्रों का भूजल संसाधन आकलन किया गया। जिसमें **57** विकासखंड एवं 9 शहरी क्षेत्र अतिदोहित, 48 विकासखंड एवं 1 शहरी क्षेत्र क्रिटिकल तथा 174 विकासखंड सेमी-क्रिटिकल एवं शेष 541 विकासखंड सुरक्षित श्रेणी में वर्गीकृत किए गए है। राज्य के लिए वार्षिक भूजल रिचार्ज 66.73 बीसीएम और कुल भूजल दोहन 45.98 बीसीएम के रूप में अनुमानित किया गया है। इस प्रकार, राज्य के लिए भूजल दोहन की दर 68.90 प्रतिशत है।

ड्राफ्ट के संबंध में अवगत कराया गया कि लघु सिंचाई के सेन्सेस के आंकड़ों को इस रिपोर्ट को तैयार करने हेतु आधार बनाया गया। क्षेत्रीय परिस्थितियों के अनुसार, विशेषकर उथले भूजल स्तर क्षेत्रों के लिए यूनिट ड्राफ्ट को **validate** एवं परिभाजित किया गया है। एग्रीकल्चर प्रैक्टिस की वजह से भी ड्राफ्ट में कमी दर्ज की गई है। कुछ ब्लॉक में सतही जल सिंचन में कमी आने की वजह से रिटर्न फ़्लो द्वारा रिचार्ज में कमी आई है।

समिति के सदस्यों को IN-GRES (INdia-Groundwater Resource Estimation System, भारत-भूजल संसाधन आकलन प्रणाली), आईआईटी, हैदराबाद द्वारा विकसित किए गए एक नवीनतम सॉफ्टवेयर समाधान के बारे में

अवगत कराया गया और यह भी अवगत कराया गया कि पहली बार सम्पूर्ण आकलन सॉफ्टवेयर का उपयोग करके किया गया है। सदस्यों को सॉफ्टवेयर द्वारा अनुमोदन की प्रक्रिया की जानकारी दी गयी।

रिपोर्ट के प्रस्तुतीकरण के दौरान यह बात प्रकाश में आयी कि पश्चिमी उत्तर प्रदेश की स्थिति अन्य क्षेत्रों की अपेक्षा ज्यादा खराब है। अतः इस क्षेत्र पर विशेष ध्यान दिया जाना आवश्यक है।

इस आकलन हेतु उत्तर प्रदेश द्वारा अपनाए गए नवीन दृष्टिकोणों के बारे में समिति के सदस्यों को सूचित किया गया यथा-औसत जल-स्तर का अनुमान जीआईएस तकनीकी के माध्यम से किया गया है। Arc-GIS सॉफ्टवेयर का उपयोग करके कंटूर मैप्स बनाए गए एवं विकासखंडों का औसत जल स्तर statistical analysis के माध्यम से किया गया, जिससे समीपस्थ विकासखंडों के भूजल स्तर के प्रभाव का आकलन भी किया जा सकता है।

फील्ड अधिकारियों द्वारा भरे जा रहे डाटा के सत्यापन के लिए मानक एक्सेल कैलकुलेटर बनाया गया। परिणामों को सबसे पहले एक्सेल पर जांचा गया एवं विसंगतियों का निवारण करने के उपरांत ही इनपुट डाटा को अंतिम मंजूरी दी गयी। पूर्व-सत्यापन के कारण सभी अधिकारियों के समय और ऊर्जा की बचत हुई। नतीजतन सबसे बड़े राज्य होने के बावजूद, उत्तर प्रदेश अल्प समय में IN-GRES पोर्टल पर बिना किसी त्रुटि के डेटा अपलोड कर सका।

समिति को नवनिर्मित / विलय किए गए विकासखंडों के बारे में अवगत कराया गया। जिसमें 07 नए विकासखंड बनाए गए है और 2 विकासखंडों का विलय किया गया है। इस प्रकार, राज्य में वर्तमान में कुल 826 विकासखंड है। समिति को अवगत कराया गया कि इन विकासखंडों के डेटा / मानचित्र उपलब्ध नहीं है। अतः इन विकासखंडों का आकलन करना संभव नहीं था। परंतु भूजल विनियमन प्रक्रिया के लिए इन ब्लॉकों की श्रेणी आवश्यक है। इसलिए, ऑनलाइन 830 विकासखंड / शहरी क्षेत्र के आकलन को मंजूरी देने का प्रस्ताव किया गया और उन 7 विकासखंडों की श्रेणी का निर्धारण ऑफलाइन उन विकासखंडों के आधार पर करने का निर्णय लिया गया, जिनसे इनको अलग कर बनाया गया है। इस प्रकार इन नए 7 विकासखंडों की निर्धारित श्रेणियों को समिति के सदस्यों के समक्ष रखा गया (Annexure-I) जिस पर समिति ने अपनी सहमति दी।

समिति को डेटा उपलब्धता की सीमाओं के बारे में भी बताया गया यथा – कमांड क्षेत्र का विवरण / मानचित्र उपलब्ध नहीं हो सका इसलिए, पूर्व आकलन के दौरान उपलब्ध आंकड़ों के आधार पर ही गणना की गयी। इसके अलावा, शहरी निकायों ने नगर निगम क्षेत्र की जीआईएस मानचित्र और शहर में जल आपूर्ति की स्थिति उपलब्ध नहीं कराई गयी अतः IN-GRES के लिए उपलब्ध मानचित्रों को SHAPE FILE में तैयार करने के लिए विभाग द्वारा डिजिटाइज कराया गया।

बैठक में प्रस्तुतीकरण एवं विस्तृत विचार – विमर्श के उपरांत निम्न निर्णय / निर्देश दिये गए :-

1. प्रमुख सचिव, नमामि गंगे एवं ग्रामीण जल आपूर्ति, उ.प्र. शासन द्वारा निर्देश दिये गए कि विभाग के पास जो भी भूजल डाटा है, उसे प्रदेश के समस्त संबन्धित विभागों तथा मंडलायुक्तों, जिलाधिकारियों, जिला विकास अधिकारियों एवं भूजल कार्यों से संबन्धित समस्त जनपदीय कार्यालयों को भी उपलब्ध कराया जाए ताकि भूजल डाटा का उपयोग संबन्धित विभाग अपनी-अपनी योजनाओं में कर सके। यदि डाटा विभाग की वेबसाइट आदि पर उपलब्ध है, तो उस लिंक अथवा वेबसाइट (www.upgwd.gov.in/www.cgwb.gov.in/www.india-wris.nrse.gov.in) से समस्त विभागों को अवगत कराया जाए।

2. भूगर्भ जल विभाग, उ.प्र. तथा केन्द्रीय भूमि जल बोर्ड (उ.क्षे.) द्वारा संयुक्त रूप से तैयार की गयी भूजल संसाधन आकलन रिपोर्ट-2020 को अध्यक्ष महोदय की सहमति से राज्य स्तरीय समिति द्वारा स्वीकृति प्रदान की गयी तथा रिपोर्ट को भारत सरकार को अनुमोदन हेतु प्रेषित किए जाने की स्वीकृति प्रदान की गयी।

3. 07 नए विकासखंडों हेतु ऑफलाइन आकलित की गयी श्रेणियों पर भी भारत सरकार से अनुमोदन प्रपट किए जाने के निर्देश दिये गए।

अंत में बैठक सधन्यवाद समाप्त हुई।

07/04/21

(पी.के. त्रिपाठी)
कार्यालय प्रमुख

वितरण:

1. प्रमुख सचिव, नमामि गंगे तथा ग्रामीण जलापूर्ति विभाग, उत्तर प्रदेश शासन
2. आयुक्त / अपर आयुक्त मनरेगा, उत्तर प्रदेश
3. अधिशासी निदेशक, पेयजल एवं स्वच्छता मिशन, लखनऊ
4. प्रमुख वन संरक्षक, वन विभाग, उत्तर प्रदेश
5. निदेशक, स्थानीय निकाय, निदेशालय, लखनऊ
6. प्रमुख अभियंता, सिंचाई एवं जल संसाधन विभाग, उत्तर प्रदेश
7. प्रमुख अभियंता, सिंचाई विभाग (यांत्रिक), उत्तर प्रदेश
8. प्रबंध निदेशक, उत्तर प्रदेश जल निगम, लखनऊ
9. निदेशक, कृषि विभाग, उत्तर प्रदेश
10. मुख्य अभियंता, लघु सिंचाई विभाग, उत्तर प्रदेश
11. महाप्रबंधक, राष्ट्रीय कृषि एवं ग्रामीण विकास बैंक, लखनऊ
12. मुख्य अभियंता, राज्य जल संसाधन अभिकरण, उत्तर प्रदेश
13. सदस्य सचिव, प्रदूषण नियंत्रण बोर्ड, उत्तर प्रदेश
14. निदेशक, पर्यावरण विभाग, उत्तर प्रदेश
15. उप महानिदेशक (उ.क्षे.), भारतीय भू-वैज्ञानिक सर्वेक्षण, उत्तर प्रदेश
16. मुख्य नगर एवं ग्राम नियोजक, उत्तर प्रदेश
17. निदेशक, रिमोट सेन्सिंग एप्लिकेशन सेन्टर, उत्तर प्रदेश
18. निदेशक, भारतीय मौसम विभाग, लखनऊ
19. सचिव, राजस्व परिषद, उत्तर प्रदेश
20. निदेशक, भूगर्भ जल विभाग, उत्तर प्रदेश
21. निदेशक, आवास बंधु, उत्तर प्रदेश
22. निदेशक, उद्यान विभाग, उत्तर प्रदेश

(पी.के. त्रिपाठी)
कार्यालय प्रमुख

Annexure-I

S. NO.	DISTRICT	EXISTING BLOCKS (NOS)	NEW BLOCK/ MERGED BLOCK	PARENT BLOCK(S)	JUSTIFICATION FOR RECOMMENDED CATEGORY
1	SONBHADRA	8	9.**KONE**	DUDHI & CHOPAN	Maximum area of Kone falls in Dudhi (SC) and some part in Chopan (S), so Kone can be considered **Semi-critical**
			10 **KARMA**	ROBERTSGANJ & GHORAWAL	Both Roberstsganj and Ghorawal are categorized as Safe, So Karma can also be assigned as **Safe**
2	GORAKHPUR	19	**20. BHAROHIYA**	CAMPIERGANJ & JUNGLE KUDIA	Both Campierganj and Jungle Kaudia fall in Safe category, so Bharohiya can be considered **Safe.**
3	PRAYAGRAJ	20	**21.SHRINGVERPUR DHAM**	KAURIHAR & HOLAGARH	Since Kaurihar is Safe and Holagarh is Semi-critical, Shringverpur Dham can be considered **Semi-Critical.**
			22. SAHSON	BAHARIYA & PHULPUR	Since Bahariya falls under Critical and Phulpur is Safe, Sahason can be categorized as **Semi-critical.**
			23. BHAGWATPUR	CHAKA	Since Bhagwatpur is formed entirely from Chaka which falls under Critical category, Bhagwatpur can be categorized as **Critical.**
4	SULTANPUR	13	**14.KARAUNDIKALA**	KADIPUR	Since Karaundikala is formed entirely from Kadipur which falls under Safe category, Karaundikala can be categorized as **Safe.**
5	G B NAGAR	4	**3.JEWAR (Merged)**	DANKAUR & JEWAR	Major area of Dankaur has been merged in Jewar (C) and remaining area in Bisrakh and Dadri. So, Dankaur no longer exists as a separate block. Since both Dankaur and Jewar are Critical, merged block Jewar can be considered as **Critical.**

Annexture 2h

Gmail

Groundwater Dept <upgwd.in@gmail.com>

Approval of National Compilation on Dynamic Ground Water Resources of India, 2020

RD CGWB, NR, Lucknow <rdnr-cgwb@nic.in> Fri, Jun 18, 2021 at 12:20 PM
To: Director <upgwd.in@gmail.com>
Cc: VIKAS RANJAN <vikasranjan-cgwb@gov.in>, Ravi Kant Singh <raviks1978@gmail.com>, SUJATRO RAY CHOWDHURI <sujatro.rc-cgwb@gov.in>, "Dr. Ranjeet Kumar Prasad" <rkprasad13@hotmail.com>, "Dr. Shaista Khan" <shaista.khans03@gmail.com>

Sir,
I am pleased to inform you that the "Dynamic Ground Water Resource Estimation-2020" of Uttar Pradesh has been accepted by Ministry of Jal Shakti, Govt. of India. I would like to congratulate once again the whole team of UPGWD and CGWB, NR on behalf of CGWB.
In this regard, have to publish state report on GWRE-2020 by 15th July.
This is for your kind attention and necessary action.
Thank You.
Regards,
P.K.Tripathi
Head of Office

Central Ground Water Board
Northern Region, Bhujal Bhawan
Sector-B, Sitapur Road Yojana,
Aliganj
Lucknow - 226 021
Ph: +91-522-2363812
E-mail: rdnr-cgwb@nic.in
जल है तो कल है, Save Water
Save this Planet

From: "ratikanta nayak" <tsmsouth-cgwb@gov.in>
To: "Regional Director CR" <rdcr-cgwb@nic.in>, "RDSR" <rdsr-cgwb@nic.in>, "RDSWR" <rdswr-cgwb@nic.in>, "Regional Director, CGWB,Tvm." <rdkr-cgwb@nic.in>, "Subramanian Sudaramorthy" <rdsecr-cgwb@nic.in>, "RD NWR CGWB" <rdnwr-cgwb@nic.in>, "A K Agrawal" <rdmer-cgwb@nic.in>, "Santanu Kumar Samanta" <rder-cgwb@nic.in>, "Regional Director, WCR" <rdwcr-cgwb@nic.in>, "Regional Director" <rdwr-cgwb@nic.in>, "RDNER" <rdner-cgwb@nic.in>, "RD-CGWB-NHR-DSALA" <rdnhr-cgwb@nic.in>, "RD CGWB, NR, Lucknow" <rdnr-cgwb@nic.in>, "regional director, NCCR" <rdnccr-cgwb@nic.in>, "Rdur-cgwb" <rdur-cgwb@nic.in>, "RD, CGWB, Jammu" <rdnwhr-cgwb@nic.in>, "RD SER CGWB" <rdser-cgwb@nic.in>, "North Central Region Bhopal" <rdncr-cgwb@nic.in>, "Officer Incharge SUO Delhi" <oicnd-cgwb@nic.in>
Cc: "Ground Water Resources Assessment Cell CGWB, MoWR" <res-cgwb@nic.in>, "P Nandakumaran" <msouth-cgwb@gov.in>, "Member N and W" <mnorth-cgwb@gov.in>, "Member(E), CGWB" <meast-cgwb@gov.in>, "Member (CGWA)" <mcgwa-cgwb@gov.in>, "Member HQ CGWB" <mhq-cgwb@gov.in>, "Member(RGI),CGWB,Faridabad" <mrgi-cgwb@nic.in>, "T.S.to Chairman Cell" <tschmn-cgwb@nic.in>, "TS to Member HQ" <tsmsam-cgwb@nic.in>, "anurag khanna" <a.khanna-cgwb@gov.in>, "Dr.S.Suresh" <gisndc-cgwb@nic.in>, "Dr Prabir" <prabir.naik-cgwb@gov.in>
Sent: Friday, June 18, 2021 11:51:07 AM
Subject: Approval of National Compilation on Dynamic Ground Water Resources of India, 2020

Sir,
It is to inform that the competent authority, Ministry of Jal Shakti, Government of India has accepted the "National Compilation on Dynamic Ground Water Resources of India, 2020".
The soft copy of the report will be shared soon. All Regions may finalise & publish their respective State/UT Reports on Dynamic Ground Water Resources, 2020 latest by 15th July, 2021.
with regards

Dr Ratikanta Nayak
Scientist-D
& TS to Member (South)

Directorate
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