

DYNAMIC GROUND WATER RESOURCES OF INDIA

(AS ON 31 MARCH 2009)



**Central Ground Water Board
Ministry of Water Resources
Government of India**

**Faridabad
November 2011**

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ध्रुव विजय सिंह
DHRUV VIJAI SINGH



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Foreword

Ground water is an important resource to meet water requirements of our country. The spatial distribution of availability of ground water resources in the country, however, is uneven. The eastern parts of the country have plenty of ground water resources which remained untapped, while in regions like North West India, arid regions of western India and peninsular India, ground water resources are depleting. Realistic assessment is therefore a pre-requisite for sustainable management of this resource.

Ground water resources in our country are being periodically assessed. The replenishable ground water resources (as on 31 March 2009) are estimated by State Ground Water Departments in association with Central Ground Water Board. A National report is compiled under the overall supervision of the Central Level Expert Group on ground water assessment. The combined efforts of State Ground Water Departments, Central Ground Water Board and Central Level Expert Group ushered in refinements in ground water resources assessment. Contributions of these organizations and groups are praise worthy.

I would like to place on record my appreciation of the work done by the Central Ground Water Board, in bringing out this Report which presents a holistic and realistic scenario of the ground water regime of the country. I am sure this report would be of immense use to planners, administrators and managers for efficient utilization of ground water resources.



(Dhruv Vijai Singh)

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PREFACE

Ground water resources Assessment on periodic basis is a part of National Water policy. Central and State governments have taken up various programmes for ground water development, artificial recharge and rainwater harvesting, ground water regulation etc for sustainable management. Presently, the guidelines of Ground Water Resources Estimation Methodology, 1997 are being followed, along with subsequent refinements suggested in Ground Water Estimation Methodology in Hard Rock Terrain, 2004 and by R&D Advisory Committee on Ground Water Estimation.

The process of ground water resources assessment as on March, 2009 has been taken up by Central Ground Water Board. In view of the wide ranging implications of resources assessment, the Ministry of Water Resources constituted a Central Level Expert Group for over-all supervision of reassessment of ground water resources of the country for the reference year 2008-09. Ground Water Resources were estimated at the state level under the guidance of State Level Committees. The annual replenishable ground water resources of the country have been assessed keeping an allocation for the unavoidable natural discharge.

The National Report on "Dynamic Ground Water Resources of India (As on March, 2009) is the team work of the officers of CGWB and State Ground Water Departments. The contribution of members of the Central Expert Group and State Level Committees in bringing out refinements in the National Report is thankfully acknowledged.

I am sure that this document will be of immense use amongst the administrators, planners, managers, professionals and academicians working in the field of water management particularly Ground water resource management.

(Dr. S.C. Dhiman)

DYNAMIC GROUND WATER RESOURCES OF INDIA (As on 31 March 2009)

AT A GLANCE

1.	Annual Replenishable Ground Water Resources	431 bcm
2.	Net Annual Ground Water Availability	396 bcm
3.	Annual Ground Water Draft for Irrigation, Domestic & Industrial uses	243 bcm
4.	Stage of Ground Water Development	61%
5.	Categorization of Blocks / Mandals/ Talukas	
	Total Assessed units	5842
	Safe	4277
	Semi-Critical	523
	Critical	169
	Over-Exploited	802
	Saline	71

DYNAMIC GROUND WATER RESOURCES OF INDIA
 (As on 31 March 2009)

CONTENTS

SI No.	Particulars	Page No
	Executive Summary	i-iii
1	Introduction	1-5
1.1	Previous assessments	1
1.2	Ground water management initiatives	3
1.3	Re-assessment of Ground Water Resources (2008-09)	4
2	Ground Water Resources Estimation Methodology	6-13
2.1	Assessment of Ground Water Draft	7
2.2	Assessment of Ground Water Recharge from Other Sources	7
2.3	Assessment of Ground Water Recharge from Rainfall	8
2.4	Ground Water Recharge during monsoon season	10
2.5	Ground Water Recharge during non-monsoon season	10
2.6	Annual Replenishable Ground Water Resources	11
2.7	Net Annual Ground Water Availability	11
2.8	Future utilization of Ground Water Resources	11
2.9	Stage of Ground Water Development	12
2.10	Categorization of Assessment Units	12
3	Rainfall of India	14-23
3.1	Rainfall pattern	14
3.2	Trends in rainfall	16
3.3	Drought analysis	23
4	Hydrogeological Setup of the Country	24-35
4.1	Porous Formations	24

4.2	Fissured Formations	25
4.3	Ground water level scenario in the Country	26
5	Ground Water Resources of India	36-68
5.1	Dynamic Fresh Ground Water Resources	36
5.2	Ground Water Utilization	41
5.3	Stage of Ground Water Development	43
5.4	Categorization of Assessment Units	43
5.5	State-wise Ground Water Resources Scenario	45
5.6	Reasons for improvement in the status of Categorization of Assessment Units (from 2004 to 2009 assessment)	67
6	Conclusion	69-70
7	Way Forward	71-73
8	PLATES	
I	Annual Normal rainfall and Coefficient of variance	18
II	Normal monsoon rainfall	19
III	Annual Normal Rainy Days	20
IV	Year-wise monsoon rainfall distribution	21
V	Increase/Decrease in annual rainfall in 100 years	22
VI	Major Aquifer System	27
VII	Depth to Water Level – Pre-monsoon & post monsoon 2008	31
VIII	Water level Fluctuation between post monsoon 2000 with post monsoon 2008	33
IX	Water Level Fluctuations of Post monsoon water level with decadal mean	35
X	Ground water Resources Availability and Utilization in India	37
XI	Recharge from Rainfall vis-à-vis Other Sources	38
XII	Annual Replenishable Ground Water Resources	40

XIII	Irrigation Draft vis-à-vis Domestic & Industrial Draft	42
XIV	Categorization of Blocks/ Mandals/ Talukas as on 31 st March 2009	44
9	ANNEXURES	74-148
I	State-wise Ground Water Resources Availability, Utilization and Stage of Development, India	74
II	District-wise Ground Water Resources Availability, Utilization and Stage of Development	75-112
III	Categorization of Blocks/ Mandals/ Taluks in India	113
IV	State-wise categorization of Blocks/ Mandals/ Taluks	114-148
10.	APPENDICES	149-221
A	Government Resolution on Constitution of Central Level Expert Group	149
B	MOWR guidelines for constitution of the State Level Committees	152
C	Approvals of Ground Water Assessment Reports by the State Level Committees	155
D	List of the members and special invitees in the meetings of the Central Level Expert Group	205
E	Sample Estimation Report of an Assessment unit	209
F	Reasons for Improvement in the Status of Categorization of assessment units	219
11	References	222-223
12	Data Elements	224
13	Abbreviations	225

Annexure II District-wise Ground Water Resources Availability, Utilization and Stage of Development

Sl. No.	States / Union Territories	Page No.
States		
1	Andhra Pradesh	75
2	Arunachal Pradesh	76
3	Assam	77
4	Bihar	78
5	Chhattisgarh	80
6	Delhi	81
7	Goa	82
8	Gujarat	83
9	Haryana	84
10	Himachal Pradesh	85
11	Jammu & Kashmir	86
12	Jharkhand	87
13	Karnataka	88
14	Kerala	89
15	Madhya Pradesh	90
16	Maharashtra	92
17	Manipur	93
18	Meghalaya	94
19	Mizoram	95
20	Nagaland	96
21	Orissa	97
22	Punjab	98
23	Rajasthan	99
24	Sikkim	100
25	Tamil Nadu	101
26	Tripura	102
27	Uttar Pradesh	103
28	Uttarakhand	105
29	West Bengal	106
Union Territories		
1	Andaman & Nicobar	107
2	Chandigarh	108
3	Dadara & Nagar Haveli	109
4	Daman & Diu	110
5	Lakshdweep	111
6	Puducherry	112

Annexure IV District-wise Categorization of Blocks/ Mandals/ Taluks in India

Sl. No.	States / Union Territories	Page No.
States		
1	Andhra Pradesh	114
2	Bihar	117
3	Chhattisgarh	118
4	Delhi	119
5	Gujarat	120
6	Haryana	121
7	Himachal Pradesh	123
8	Jharkhand	124
9	Karnataka	125
10	Kerala	127
11	Madhya Pradesh	128
12	Maharashtra	130
13	Punjab	131
14	Rajasthan	134
15	Tamil Nadu	138
16	Uttar Pradesh	141
17	Uttarakhand	144
18	West Bengal	145
Union Territories		
1	Daman & Diu	146
2	Lakshdweep	147
3	Puducherry	148

EXECUTIVE SUMMARY

Ground Water Resources Assessment is carried out at periodical intervals jointly by State Ground Water Departments and Central Ground Water Board under the overall supervision of the State Level Committee on Ground Water Assessment. Previous such joint exercises were carried out in 1980, 1995 and 2004.

The assessment involves estimation of dynamic ground water resources or annual replenishable ground water resources (recharge), annual ground water draft (utilization) and the percentage of utilization with respect to recharge (stage of development). The assessment units (blocks/ watersheds) are categorized based on Stage of Ground Water Development (Utilization) and the long term water level trend. The methodology for assessment is broadly based on Ground Water Resources Assessment Methodology, 1997 with additional inputs from Ground Water Estimation Methodology in Hard Rock Terrain (2004) and R&D Advisory Committee on Ground Water Estimation (2010).

Rainfall is the main source of annual replenishable ground water resource. Most part of India receives rainfall mainly during SW monsoon. Major part of country including Northern, Central and Eastern India receives annual normal rainfall between 75 and 150 cm. Highest rainfall of more than 250 cm is received in the North Eastern States and along West Coast in the Konkan region and western part of the country including Rajasthan and Gujarat receives the lowest rainfall, at places even less than 15 cm in a year. There have been normal rainfalls in the major part of the country between 2004 and 2009. Excess rainfalls during this period have been recorded mainly in parts of Peninsular and Western India.

The aquifer properties of rock formations have significant influence in ground water recharge. Porous formations like alluvial formations in the Indo-Ganga-Brahmaputra basin having high specific yield values are the most important repository of ground water resources. Ground water occurrences in the fissured formations, which occupy almost two-third part of the country including peninsular India, on the other hand are limited to weathered, jointed and fractured portions of the rocks. Ground water level is the basic indicator of the ground water regime of an area. Ground water levels in the period between 2006 and 2008 show improvement in the coastal and western part of the country and decline in the north western and northern part.

The annual replenishable ground water resources have been assessed as 431 bcm. Keeping an allocation for natural discharge, the net annual ground water availability is 396 bcm. The annual ground water draft (as on 31st March, 2009) is 243 bcm. The Stage of ground water development works out to be about 61%. The development of ground water in different areas of the country has not been uniform. Out of 5842 assessment units (Blocks/ Mandals/ Talukas) in the country, 802 units in various States have been categorized as 'Over-exploited' i.e. the annual ground water extraction exceeds the net annual ground water availability and significant decline in long term ground water level trend has been observed either in pre-monsoon or post- monsoon or both. In addition 169 units are 'Critical' i.e. the stage of ground water development is above 90 % and within 100% of net annual ground water availability and significant decline is observed in the long term water level trend in both pre-monsoon and post-monsoon periods. There are 523 semi-critical units, where the stage of ground water development is between 70% and 100% and significant decline in long term water level trend has been recorded in either Pre-monsoon or Post-monsoon. 4277 assessment units are Safe where there is no decline in long term ground water level trend. Apart from this, there are 71 blocks completely underlain by saline ground water.

There is an overall increase in ground water development in 2009 as compared with 2004, particularly in the areas where future scope for ground water development existed. This has led to the increase in the Stage of Ground water development from 58% in 2004 to 61% in 2009. The over-exploited areas are mostly concentrated on three parts of the country. In north western part in Punjab, Haryana, Delhi, Western Uttar Pradesh where through replenishable resources is abundant but there have indiscriminate withdrawals of ground water leading to over-exploitation, in western part of the country particularly in Rajasthan where due to arid climate, ground water recharge itself is less leading to stress on the resource and in peninsular India like Karnataka and Tamil Nadu where due to poor aquifer properties, ground water availability is less. In some areas of the country, good continuous rainfall and management practices like ground water augmentation and conservation measures through government and private initiatives have resulted in improvement in ground water situation which is also reflected in the change in Category from Over-exploited and Critical (2004) to other categories (2009).

Ground water resources assessment like other fields of science requires continuous refinements. The issue becomes more relevant considering the strong linkage between assessment and ground water management. Some of the suggestions to bring in further refinements in the ground water resources assessment approach are – strengthening of database, setting up dedicated Groundwater Resources Assessment Cell, quantity considerations in ground water resources assessment, development of a dedicated software for ground water assessment, pilot studies on yearly assessment and assessments in doab (alluvial area) and micro-level unit (hard rock area), application of alternate methods for recharge estimation and remote sensing technique in ground water resources assessment and further study on linkage between assessment and management.

CHAPTER 1

INTRODUCTION

Ground water resources play a vital role in sustaining the livelihoods of many countries in the world. Its ubiquitous occurrence, reliability and availability in all seasons have made it the primary buffer against drought, playing a pivotal role in ensuring the food security at all levels. Ground water has an important role in meeting the water requirements of agriculture, industrial and domestic sectors in India. About 85 percent of India's rural domestic water requirements, 50 percent of its urban water requirements and more than 50 percent of its irrigation requirements are being met from ground water resources. Ground water is annually replenishable resource but its availability is non-uniform in space and time. Hence, the sustainable development of ground water resources warrants precise quantitative assessment based on reasonably valid scientific principles. National Water Policy, 2002 has also laid emphasis on periodic assessment of ground water resources on scientific basis. The policy also reiterates that the exploitable quantity of ground water should be limited to the amount, which is being recharged annually, more commonly known as *Dynamic Ground Water Resource*. Technically, the dynamic ground water refers to the quantity of ground water available in the zone of water level fluctuation, which is replenished annually.

1.1 Previous Assessments:

The assessment of water resources of the country dates back to 1901 when the First Irrigation Commission assessed the Surface Water Resources as 144 million hectare meters (M.ham) (NABARD, 2006). In 1949 Dr. A. N. Khosla based on empirical formula estimated the total average annual runoff of all the river systems of India including both surface and ground water resources as 167 M.ham (Central Ground Water Board, 1995). Since then attempts have been made from time to time by various Working Groups/ Committees/Task Forces constituted by Govt. of India to estimate the ground water resources

of the country based on available data and in response to developmental needs. In 1976, the National Commission of Agriculture assessed the total ground water resources of the country as 67 M.ham. and the Utilizable ground water was worked out to be 35 M.ham, out of which 26 M.ham was considered available for irrigation (Central Ground Water Board, 1995).

The first systematic methodology to estimate the ground water resources of the country was evolved by Ground Water Over-Exploitation Committee in 1979. The committee was constituted by Agriculture Refinance and Development Corporation (ARDC) and was headed by Chairman, CGWB with Members from – State Ground Water Organizations and Financial Institutions. Based on the norms suggested by the committee, the country's Gross Ground Water Recharge has been assessed as 47 M.ham. and the Net Recharge as 32 M.ham (Central Ground Water Board, 1995).

In 1982, Government of India constituted 'Ground Water Estimation Committee' (GEC) drawing Members from various States / Central organizations engaged in hydrogeological studies and ground water development. The Committee submitted its recommendations in the year 1984 and suggested a methodology (GEC-1984) for assessment of dynamic ground water resources. As per the recommendations of the GEC-1984 the State Governments were advised to constitute Working Groups for assessment of ground water potentials. The Working Groups were headed by Irrigation Secretaries-In charge of Ground Water Developments and included Heads of Ground Water Department, State Agriculture Departments, representatives from Agriculture Universities and NABARD. Director, CGWB was the convener of the group. The base year for the computation of the resource mostly varied between 1991 and 1993 and a National report on Ground Water Resources of India was brought out in 1995 by compiling the data of all the States and Union Territories of the country. As per the report, the total Replenishable Ground Water in India was estimated to be about 432 billion cubic meter. The ground water resource available for irrigation purpose was about 361 billion cubic meter. The Net Ground Water Draft from

Irrigation uses was around 115 billion cubic meters and the level of development was 32%. The volumetric resource was converted in terms of area and the Utilizable Irrigation Potential from ground water of the country was worked out to be 64 million hectare (Central Ground Water Board, 1995).

Increasing thrust on ground water and changed scenario of data acquisition led the Government of India to form another Committee in 1995 to review the existing methodology for ground water resource assessment and to suggest revisions if necessary. The Committee submitted its report in 1997 wherein a revised and elaborate methodology for resource assessment has been suggested, more commonly called as GEC-1997. While estimating the ground water resources in the hard rock terrains some limitations have been observed. To address these limitations another Committee on Ground Water Estimation Methodology in Hard Rock Terrain was formed in 2001 to review the existing methodology for resource estimation in hard rock terrains. The Committee made certain suggestions on the criteria for categorization of blocks to be adopted for the entire country irrespective of the terrain conditions. Based on GEC-1997, the dynamic ground water resources of India were estimated for the entire country with 2004 as base year. The annual replenishable ground water resources is 433 billion cubic meter (bcm). Keeping an allocation for Natural Discharge during non-monsoon season of 34 bcm, the Net Annual Ground Water Availability has been estimated as 399 bcm. The annual ground water draft for all uses is of the order of 231 bcm and the overall Stage of ground water development for the entire country is 58%. Out of total 5723 assessment units in the country, 4078 (71%) assessment units have been categorized as Safe, 550 (10%) as Semi-Critical, 226 (4%) as Critical and 839 (15%) as Over-Exploited. Remaining 30 blocks were totally underlain by Saline ground water (Central Ground Water Board, 2006).

1.2 Ground water management initiatives

The findings of the ground water resources assessment guide the planners and stakeholders to take appropriate management measures for optimal

utilization and sustainability of the resource. Ground water resources in the country are withdrawn by approximately 20 million wells (World Bank, 2010) mostly through private initiatives. It is a common-pool resource, used by millions of farmers across the country. Management of this resource is hence done both through Govt. and private initiatives. The areas where future scope for ground water development exists, Banks and NABARD provide loans for sinking of wells and installation of pump sets. Various Govt. schemes also exist to sponsor well construction in Safe blocks. On the other hand, measures are being taken to control further deterioration of the resources in Over-exploited and Critical blocks. Ground water management practices like water conservation and water harvesting measures, Farmer's Participatory Action Research Programme (FPARP), efficient water use practices with community participation, restrictions on institutional funding for ground water irrigation in Over-exploited and Critical blocks are some such examples. Community management of ground water resources has been quite effective in certain places in the country. Success stories on effective community participation on water conservation measures such as community management and water conservation measures in Aravalli hills of Rajasthan, Ralegaon Sidhi, Hiware Bazar and World Bank sponsored Projects in rural Maharashtra, Andhra Pradesh Farmer-Managed Groundwater Systems Project (APFAMGS), Water Conservation measures and efficient water use practices in Gujarat are well known. There are several such efforts across the length and breadth of the country. All these initiatives have helped in improving the ground water situation in localized areas in certain parts of the country.

1.3 Re-assessment of Ground Water Resources (2008-09)

In order to assess prevailing ground water scenario of the country, a re-assessment of ground water resources was felt necessity. It would also indicate the impact of the on-going ground water management practices on the ground water regime. As a first step, the methodology for assessment of Ground water resources was reviewed by the Ministry of Water Resources,

Govt. of India. A Group was constituted in 2009 to look into New and Alternate methods of ground water resources assessment. The Group reviewed various methods of resources assessment and suggested that the recharge estimation technique adopted in GEC-97 is appropriate and suitable for country-wide groundwater resources estimation, considering the present status of database with the Central and State agencies. The group recommended a protocol to be followed by the State Government for ground water resources assessment. Certain modifications in the allocation for domestic and industrial uses were also brought in by the R&D Advisory Committee on Ground Water Estimation.

In 2010, Ministry of Water Resources constituted a Central Level Expert Group (CLEG) for over-all supervision of the re-assessment of ground water resources in the entire country. The terms of reference of the Group include supervision of assessment of annual replenishable ground water resources and the status of utilization for the reference year 2008-09. The copy of the Government Resolution is given as **Appendix A**. Ministry of Water Resources also requested all the State Governments to constitute State Level Committees for overall supervision of assessment of the groundwater resources at the State level (**Appendix B**). The ground water resources assessment for 2008-09 at the States have been carried out jointly by State Ground Water Departments and Central Ground Water Board under the supervision and final approval of the State level Committees (**Appendix C**). Central Level Expert Group provided the technical guidance in this regard. Based on the assessment figures provided by the State Government, the national report has been compiled under the supervision of the Central Level Expert Group for overall reassessment of the ground water resources of the country. Five meetings of the CLEG were held during 2010-11 to finalize the national report on dynamic ground water resources of India (as on 31 March 2009). List of the members and special invitees who have attended the meetings of the Central Level Expert Group is given in **Appendix D**.

CHAPTER 2

GROUND WATER RESOURCES ESTIMATION METHODOLOGY

The ground water resources assessment for 2008-09 were carried out based on the guidelines of Ministry of Water Resources which broadly follows the methodology recommended by Ground Water Resources Estimation Committee, 1997. However, there have been few modifications in the MOWR guidelines namely in the criteria of Categorization of Assessment units and future Allocation for irrigation and domestic & industrial sector. Further MOWR suggested a protocol for assessment of ground water resources. The salient features of the methodology are enumerated in the following paragraphs.

Ground water resources are estimated assessment unit wise. The assessment unit is watershed in the states occupied predominantly with hard rocks. This is because the ground water balance equations recommended in GEC-1997 can be better applied in the assessment units with hydrologic/hydrogeological boundaries. However, in the states covered predominantly with alluvium and/ or soft rocks, administrative blocks are chosen as assessment unit since in alluvial areas it is difficult to identify watershed considering the possibility of trans-boundary aquifer system. Within the assessment areas, the hilly areas (slope greater than 20%) are to be excluded since these are not likely to contribute to ground water recharge. The assessment units are to be divided into command and non-command areas for the purpose of computation of ground water resources. The ground water resources in the poor quality (saline) areas are to be computed separately (Ministry of Water Resources, 1997).

The ground water recharge is estimated season-wise both for monsoon season and non-monsoon season separately. The following recharge and discharge components are assessed in the resource assessment - recharge from rainfall, recharge from canal, return flow from irrigation, recharge from

tanks & ponds and recharge from water conservations structures and discharge through ground water draft.

2.1 Assessment of ground water draft

Ground water draft is estimated seasonally. The most commonly used method for computation of irrigation draft is – number of abstraction structures multiplied by the unit seasonal draft. Alternative methods like area irrigated by ground water and the associated crop water requirements are also recommended for assessment of ground water draft for irrigation. Ground water draft for Domestic & Industrial needs is computed using unit draft method and based on consumptive use pattern of the population.

2.2 Assessment of ground water recharge from other sources

Ground water recharge due to return flow from irrigation, seepage from canals, recharge from tanks and ponds and recharge from water conservation structures are to be estimated separately for both monsoon and non-monsoon seasons based on the recommended norms as given in **Table 1**. The details of the norms are given in **Annexure I**.

Table -1 Recommended norms for the Assessment of Recharges from Other Sources

Parameters	Sources of Recharge	Range of Parameters
Canal seepage factor	Unlined canals	15 to 30 ham/day/million sq.m. of wetted area
	Lined canals & canals in hard rock terrain	20% of above value suggested for unlined canals
Return flow factor	Surface water Irrigation	0.10 – 0.50
	Ground water Irrigation	0.05 – 0.45
Seepage from tanks and ponds	1.4 mm/day over the average water spread area	
Water conservation structures	50% of the Gross Storage. Out of this, 50% is during monsoon season and the remaining 50% during non-monsoon season	

(Source: Ministry of Water Resources, 1997)

2.3 Assessment of ground water recharge from rainfall

Ground water recharge from rainfall is estimated for monsoon and non-monsoon seasons separately.

Rainfall recharge during monsoon season is estimated using two methods – Water level fluctuation Method and Rainfall Infiltration Factor Method.

2.3.1 Water level Fluctuation (WLF) Method

Under this method the change in storage will be computed by multiplying water level fluctuation between pre and post monsoon seasons with the area of assessment and specific yield.

$$\text{Change in Storage} = \Delta S = h * Sy * A \quad \dots\dots(i)$$

Where,

h = rise in water level due to monsoon (fluctuation between pre-monsoon and post-monsoon water level), A = area for computation of recharge, Sy = specific yield.

The Specific yield of a soil or rock is the ratio of the volume of water that, after saturation, can be drained by gravity to its own volume (Todd & Mays, 2005). The Specific yield data were either arrived through field studies, including long-duration pumping tests and dry season groundwater balance (in hard-rock areas) or adopted from the norms recommended by GEC-1997, which were derived from the various water-balance studies carried out by CGWB, SGWDs and academic/research institutions. The range of specific yield considered for different formations are given in the **Table 2**.

Table - 2 Specific Yields for Different Formations

Formation		Range of Specific Yield
Unconsolidated formations	Alluvium	0.04 to 0.22
Semi-consolidated formations	Sedimentary rocks	0.01 to 0.15
Consolidated formations	Crystalline and other hard rocks	0.002 to 0.04

The change in storage calculated from the above relation is the resultant of the recharge from rainfall and other sources during the monsoon period and the gross ground water draft during monsoon season. In order to segregate the rainfall recharge during monsoon season, the following equation is used –

$$R_{rf} = h \times S_y \times A + DG - R_c - R_{sw} - R_t - R_{gw} - R_{wc} \quad \dots\dots\dots (ii)$$

Where,

DG = Gross ground water draft for all uses during monsoon season

R_c = recharge due to seepage from canals during monsoon season

R_{sw} = recharge from surface water irrigation during monsoon season

R_t = recharge from tanks and ponds during monsoon season

R_{gw} = recharge from ground water irrigation during monsoon season

R_{wc} = recharge from water conservation structures during monsoon season

The rainfall recharge thus calculated is normalized for the normal monsoon season rainfall.

2.3.2 Rainfall Infiltration Factor (RIF) Method

The other method for assessment of rainfall recharge is using Rainfall infiltration factor. The recharge from rainfall is to be estimated as given below

$$R_{rf} = f * A * \text{normal monsoon rainfall} \quad \dots\dots\dots (iii)$$

Where;

f = rainfall infiltration factor

A = area

The same Rainfall Infiltration Factor should be used for computation of recharge due to rainfall during monsoon and non monsoon seasons.

The norms adopted for computation of recharge from rainfall is given in **Table – 3.**

Table – 3 Rainfall Infiltration Factor for different formations

Formation		Range of Rainfall Infiltration Factor
Unconsolidated formations –	Alluvium	0.08 to 0.25
Semi-consolidated formations	Sedimentary rocks	0.03 to 0.14
Consolidated formations	Crystallines and other hard rocks	0.01 to 0.12

(Source: Ministry of Water Resources, 1997)

The rainfall recharge computed by WLF method is to be compared with recharge computed by RIF method. In case the difference between the two sets of data are more than 20%, then rationalized RIF figure is to be considered, otherwise monsoon recharge using WLF method is to be considered. Whenever the percent difference is less than - 20%, 80 % of the recharge computed by RIF method is to be used and wherever, the percent difference is more than + 20 %, 120 % of recharge computed by RIF method is to be taken.

2.4 Ground water Recharge during Monsoon Season

The total recharge in monsoon season is the sum of the normalized rainfall recharge and the recharge from other sources as expressed in the following equation –

$$R(\text{normal}) = R_{rf} \text{ (normal)} + R_c + R_{sw} + R_t + R_{gw} + R_{wc} \quad \dots \dots \dots \text{(iv)}$$

Where,

R (normal) = Total recharge during monsoon season

R_{rf} (normal) = Rainfall recharge during monsoon season for normal monsoon season rainfall

2.5 Ground water Recharge during non-Monsoon Season

Similar expression as given in equation (iv) above is used for recharge during non-monsoon season wherein all the recharge components including rainfall

recharge and recharge from other sources during non-monsoon season are computed. Only difference is that rainfall recharge during non-monsoon is computed using RIF method only. If the rainfall during non-monsoon period is less than 10% of the annual rainfall, the recharge due to rainfall is taken as zero. The total recharge during non monsoon is the sum of recharge from rainfall and recharge from other sources.

2.6 Annual Replenishable Ground Water Resources

The Annual Replenishable Ground Water Resources of the area is the sum of recharge during monsoon and non monsoon seasons. An allowance is kept for natural discharge during non monsoon season by deducting 5% of Annual Replenishable Ground Water Resource, wherever WLF method is employed to compute rainfall recharge during monsoon season and 10% if RIF method is used.

2.7 Net Annual Ground Water Availability

The Net annual ground water availability is the available resource after deducting the natural discharges from the Annual Replenishable Ground Water Resource and is expressed as:-

$$\text{Net Annual Ground Water Availability} = \text{Annual Replenishable Ground Water Resource} - \text{Natural Discharge during non monsoon season} \quad \dots \quad (\text{v})$$

2.8 Future Utilization of Ground Water Resources

The projected demand for domestic and industrial water supply is kept based on projected population for the year 2025 and present dependency on ground water. The ground water available for future irrigation is obtained by deducting the sum of projected demand for Domestic and Industrial use and existing gross irrigation draft from the Net Annual Ground Water Availability. In order to rationalize the projected demand of ground water resources in over-exploited areas, following procedure is adopted:

- Case I, when $GWav \geq Dgi + Alld$

In such cases projected demand for future domestic and industrial uses = Alld

- Case II, when GWav < Dgi + Alld

In such cases, projected demand for future domestic and industrial uses = (GWav – Dgi) or Dgd, whichever is more.

Where,

GWav = Net Annual Ground Water Availability

Dgi = Existing Ground Water draft for Irrigation

Dgd = Existing Ground Water draft for Domestic use

Dg = Existing Ground water draft for all uses

Alld = Computed value of allocation for domestic use

(Based on projected population, fractional load on ground water and per capita requirement)

2.9 Stage of Ground Water Development

The stage of Ground water Development is to be computed as given below,

$$\text{Stage Of Development} = \frac{\text{Existing Gross Draft For All Uses}}{\text{Net Annual Availability}} \times 100 \dots \dots \dots \text{(vi)}$$

2.10 Categorization of Assessment Units

The assessment units are to be categorized for ground water development based on two criteria – a) stage of ground water development, and b) long-term trend of pre and post monsoon water levels. The long term ground water level trend is to be computed generally for a period of 10 years. The significant rate of water level decline has been taken between 10 and 20 cm per year depending upon the local hydrogeological conditions. There are four categories, namely – ‘Safe’, ‘Semi-critical’, ‘Critical’ and ‘Over-exploited’ areas. The criteria for categorization are given below.

Table - 4 Criteria for Categorization of Assessment Units

Stage of Ground Water Development	Significant Long Term Water level Decline trend		Category
	Pre-Monsoon	Post-Monsoon	
<=90%	No	No	Safe
>70% and <=100%	No	Yes	Semi-Critical
>70% and <=100%	Yes	No	Semi-Critical
>90% and <=100%	Yes	Yes	Critical
>100%	No	Yes	Over-Exploited
>100%	Yes	No	Over-Exploited
>100%	Yes	Yes	Over-Exploited

Apart from the four categories mentioned above, blocks where the entire assessment area is having poor quality ground water are demarcated as Saline blocks.

A sample calculation of one assessment unit is presented as **Appendix E** to illustrate the methodology for assessment of replenishable ground water resources.

The State Governments broadly followed the methodology outlined above while carrying out the computation of ground water resources. However, at some places, the detailed steps, norms and criteria for categorization have been modified by the States to match the prevailing ground water conditions in the field.

CHAPTER 3

RAINFALL OF INDIA

Rainfall is the most important source of ground water recharge. India receives about 120 cm of rain in a year. However distribution of rainfall has a wide variation both in space and time. Most of rainfall (about 76%) occurs during the Monsoon months resulting into eight relatively dry months. Similarly the meteorological Subdivisions like Coastal Karnataka, Konkan and Goa, North east India receive more than 250 cm of rainfall annually whereas West Rajasthan gets only about 30cm (IMD, 2011).

3.1 Rainfall Pattern

Rain gauge stations are established and maintained by different departments and Undertakings of Central and State governments and also by private parties to cater their particular data need. India Meteorological Department (IMD) has 559 observatories (both departmental and part time) while amongst non-Departmental Rain gauge Stations, 3540 are reporting and 5039 are non-reporting.

Though the period of seasons varies from place to place, for Climatological purposes especially for rainfall, year at all the places is uniformly divided into 4 parts, called seasons. The seasons are: Winter (January and February), Pre monsoon (March to May), South West Monsoon (June to September) and Post Monsoon season (October to December).

For the purpose of compiling the rainfall data and draw the inferences India is divided into 36 meteorological homogeneous regions.

The long term average rainfall indicates that most part of India receives rainfall mainly during SW Monsoon season. However main Rainfall season in Tamil Nadu is Post Monsoon season. Jammu and Kashmir, Himachal Pradesh and Uttarakhand receive significant rainfall in all 4 seasons.

Normal Annual rainfall (1941 to 1990) for each Meteorological Sub Division with Coefficient of Variation (measure of dispersion of a probability distribution) is shown in **Plate I**. Maximum variation is observed in NW India while minimum variation is observed in coastal regions and Assam-Meghalaya area. The contour map of normal annual rainfall (**Plate II**) shows that highest rainfall of more than 250 cm is received in the North Eastern States and along West Coast in the Konkan region. The major part of country including Northern, Central and Eastern India receives rainfall between 75 and 150 cm. A portion of Peninsular India including parts of Western Maharashtra and Karnataka receives less rainfall up to 75 cm. Western part of the country including Rajasthan and Gujarat receives the lowest rainfall in the country, at places even less than 15 cm in a year.

Rainy day is defined as a day when rainfall recorded is at least 2.5 mm. Number of rainy days in different parts is shown in **Plate III**. For given amount of rainfall, more number of rainy days is favourable for ground water recharge. Annual number of rainy days is less than 10 in parts of West Rajasthan and Kashmir, gradually increasing towards east and more than 100 days in North East portion of the country.

Perusal of Monsoon rainfall maps of 2005 to 2008 (**Plate IV**) indicate that overall rainfall pattern has been normal during intervening period between two successive ground water assessment viz. 2004 and 2009. In 2005, major part of the country received normal rainfall. In the Western part including parts of Gujarat, Maharashtra, Karnataka and Rayalaseema and Telengana regions of Andhra Pradesh received excess rainfall. Only in Bihar, Jharkhand and Assam-Meghalaya-Tripura regions of North Eastern sector, monsoon rainfall was scanty. In 2006, the states of Jammu & Kashmir, western Rajasthan, Gujarat, Madhya Maharashtra and Orissa recorded excess rainfall, while Himachal Pradesh, Haryana, Uttarakhand, Uttar Pradesh and parts of North Eastern States recorded deficient rainfall. In rest part of the country, monsoon rainfall was normal. In 2007, Uttarakhand, Gujarat, Madhya Maharashtra, Karnataka, Andhra Pradesh, Orissa, Bihar and West Bengal

received excess rainfall. The parts of Punjab, Haryana, Western U.P. and Eastern M.P. received deficient rainfall. In 2008, major part of the country received normal monsoon rainfall, except for Punjab and Orissa, where excess monsoon rainfall was recorded and Western Madhya Pradesh, Vidharbha and Kerala which received deficient monsoon rainfall.

An analysis of average monsoon rainfall data for the period of 2004 to 2008 (**table 5**) reveals that in major part of the country, the average monsoon rainfall for the five year period (2004-08) is within the normal range. In parts of Gujarat, Saurashtra & Kachchh and Madhya Maharashtra, the average rainfall is excess (>20%) of the normal monsoon rainfall and only in Assam & Meghalaya and Western U.P., the rainfall is deficient (>-20%) than normal monsoon rainfall.

3.2 Trends in Rainfall

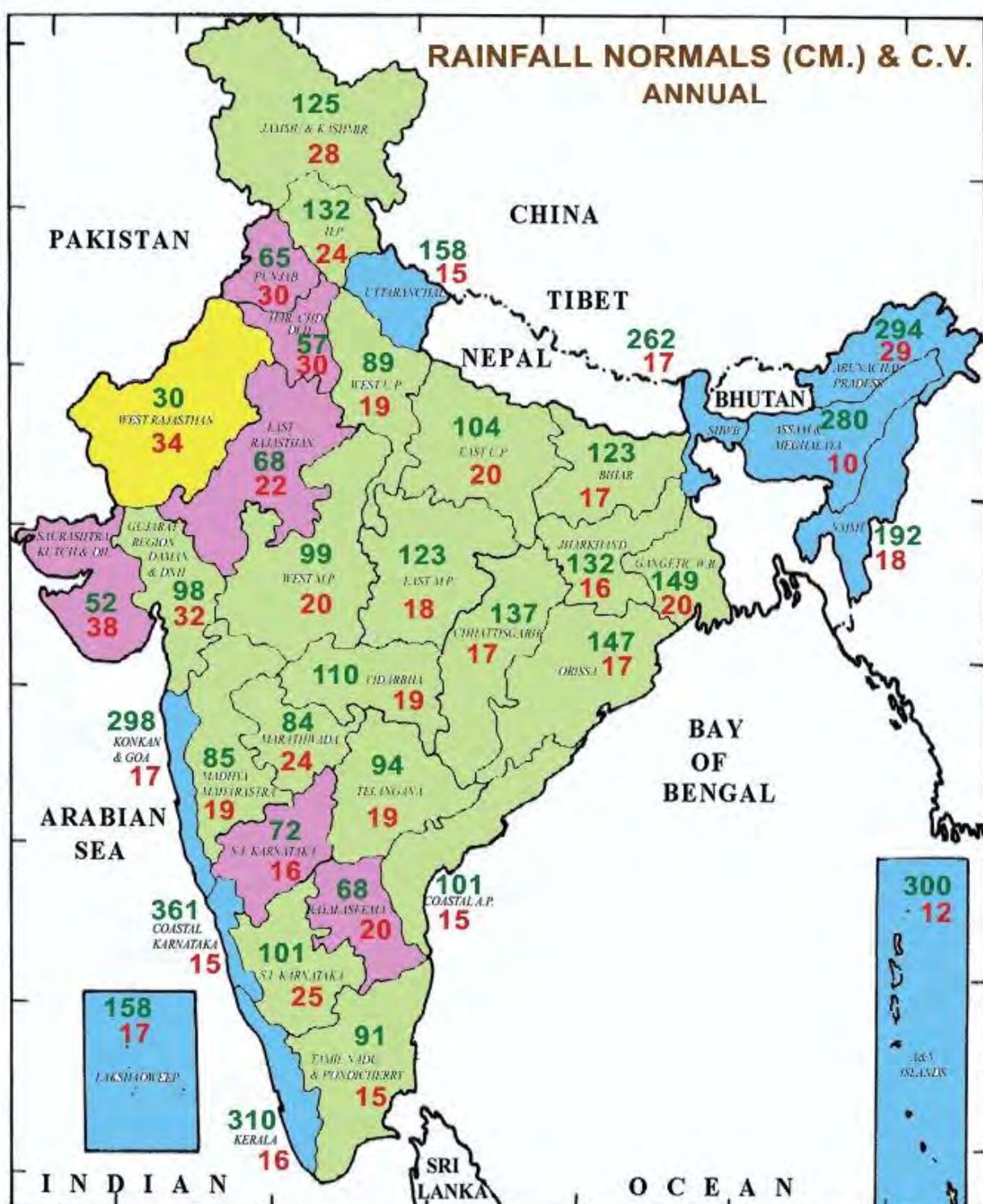
One of the most significant consequences of global warming due to increase in greenhouse gases would be an increase in magnitude and frequency of extreme precipitation events. National Climate Centre of India meteorological Department has studied Trends in the extreme rainfall indices for the period 1901-2000 for 100 stations over India and published same in National Climate Centre Research Report No: 2/2006. Report depicts that Rainfall changes expected for 36 Meteorological sub Divisions for 4 seasons and Annual. **Plate V** shows Increase/Decrease in rainfall in mm in 100 year in each of 36 subdivisions for annual.

From the Figure, it may be seen that Significant increasing trend is observed in the annual scale for the sub-divisions Konkan & Goa, Madhya Maharashtra, North Interior Karnataka, Rayalaseema, coastal Andhra Pradesh, Gangetic West Bengal, Assam & Meghalaya and Jammu & Kashmir. On the other hand significant decrease in rainfall is observed for the sub-divisions Chhattisgarh, Jharkhand and Kerala.

Table - 5 Sub-Division wise Averages (2004-2008) Rainfall (IMD)

METEOROLOGICAL SUBDIVISIONS	2004-2008 (JUNE-SEPT.)		
	AVERAGE	NORMAL	%DEP.
A & N Island	1532.1	1755.2	-13%
Arunachal Pradesh	1622.9	1834.9	-12%
Assam & Meghalaya	1509.6	1885.3	-20%
N M M T	1152.4	1240.9	-7%
ShWB & Sikkim	1915.3	1955.4	-2%
Gangetic West Bengal	1272.5	1136.3	12%
Orissa	1331.2	1164.9	14%
Jharkhand	1035.5	1092.5	-5%
Bihar	1021.6	1039.2	-2%
East U.P.	802.5	913.6	-12%
West U.P.	578.6	772.8	-25%
Uttaranchal	1270.1	1223.1	4%
Har. Chd & Delhi	395.1	470.0	-16%
Punjab	421.3	501.8	-16%
Himachal Pradesh	582.5	773.7	-25%
Jammu & Kashmir	509.3	513.6	-1%
West Rajasthan	244.1	262.8	-7%
East Rajasthan	596.0	623.6	-4%
West Madhya Pradesh	832.7	904.3	-8%
East Madhya Pradesh	962.6	1097.4	-12%
Gujarat Region	1177.5	933.6	26%
Saurashtra & Kutch	648.7	485.7	34%
Konkan & Goa	3126.1	2802.1	12%
Madhya Maharashtra	918.4	700.1	31%
Marathwada	664.5	704.3	-6%
Vidharbha	932.0	976.2	-5%
Chhattisgarh	1068.9	1205.8	-11%
Coastal Andhra Pradesh	618.9	575.2	8%
Telengana	790.1	767.3	3%
Rayalaseema	437.1	380.9	15%
Tamil Nadu & Pondicherry	310.7	315.6	-2%
Coastal Karnataka	2944.6	3173.9	-7%
N. I. Karnataka	517.4	490.9	5%
S. I. Karnataka	741.6	659.3	12%
Kerala	2091.3	2143.0	-2%
Lakshadweep	1048.3	985.2	6%
Country as a whole	874.5	892.2	-2%

Plate I

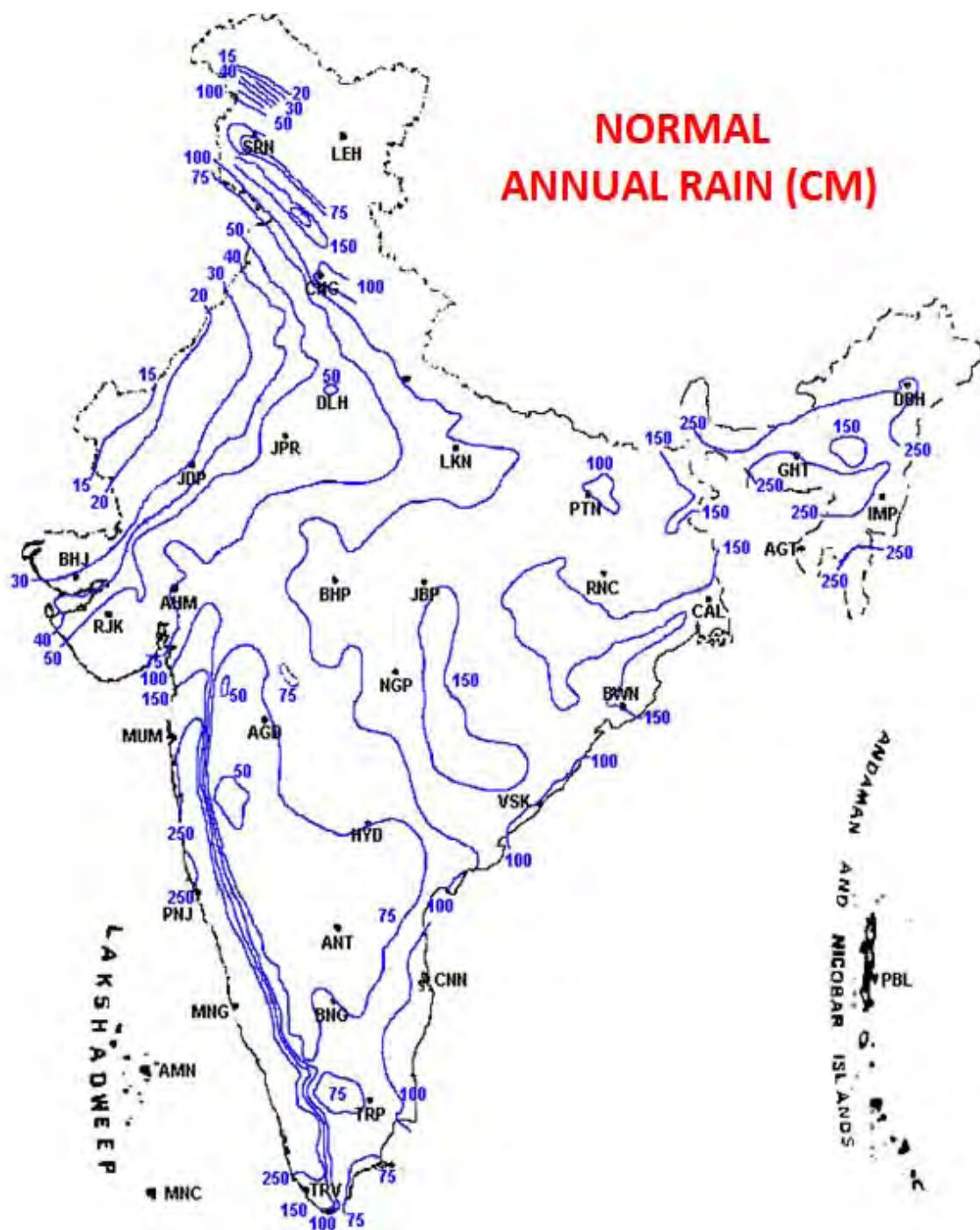


LEGEND :

	NORMAL R/F	Rainfall Normals
■	C.V.	 ≥ 150 Cm.
		 ≥ 40 & < 75 Cm.
		 ≥ 75 & < 150 cm.
		 < 40 Cm.

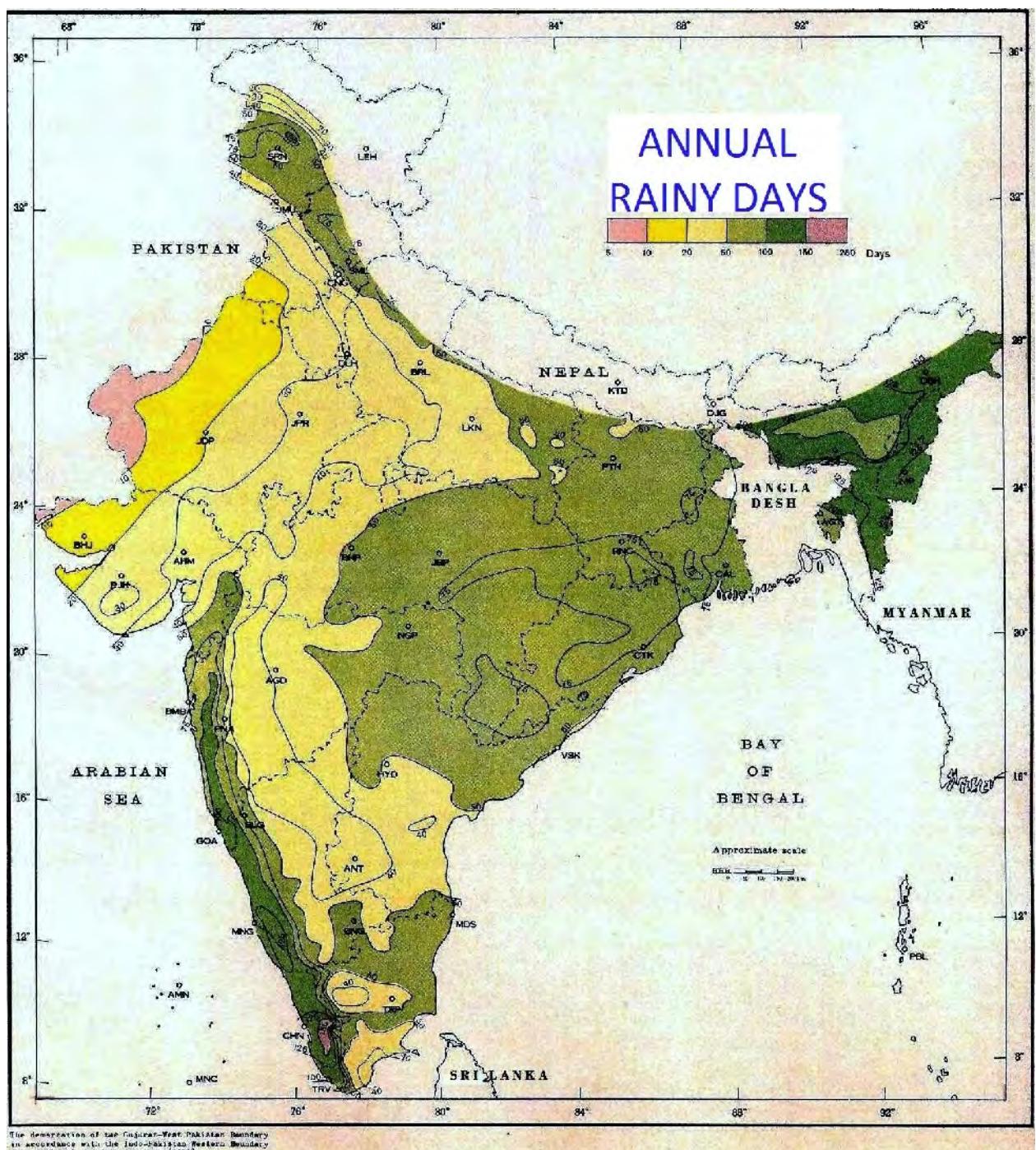
Source: India Meteorological Department

Plate II Normal Annual Rainfall



Source: India Meteorological Department

PLATE III Annual Normal Rainy Days



Source: India Meteorological Department

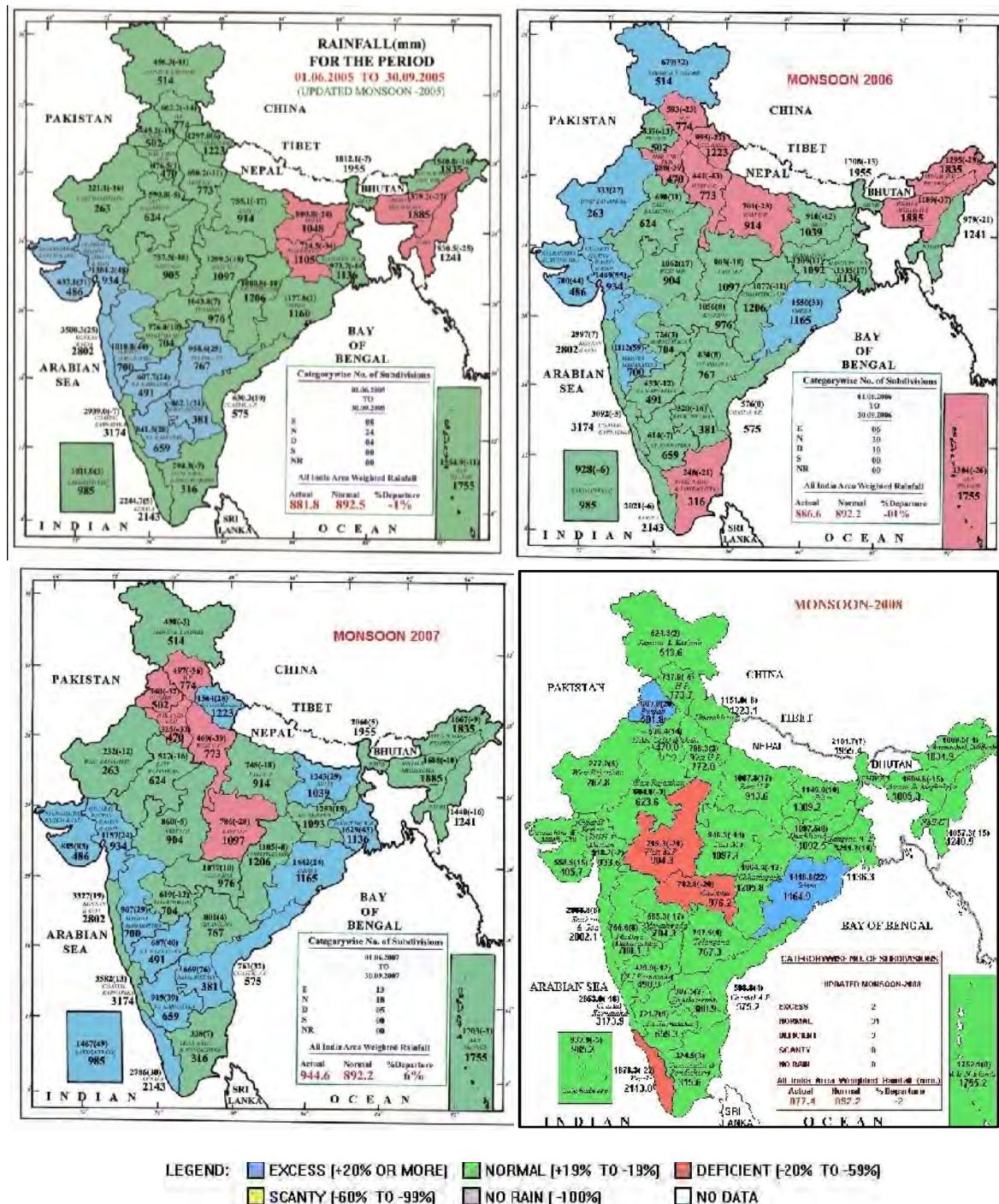


Plate IV. Year-wise monsoon rainfall distribution (2005-2008) [Source: India Meteorological Department]

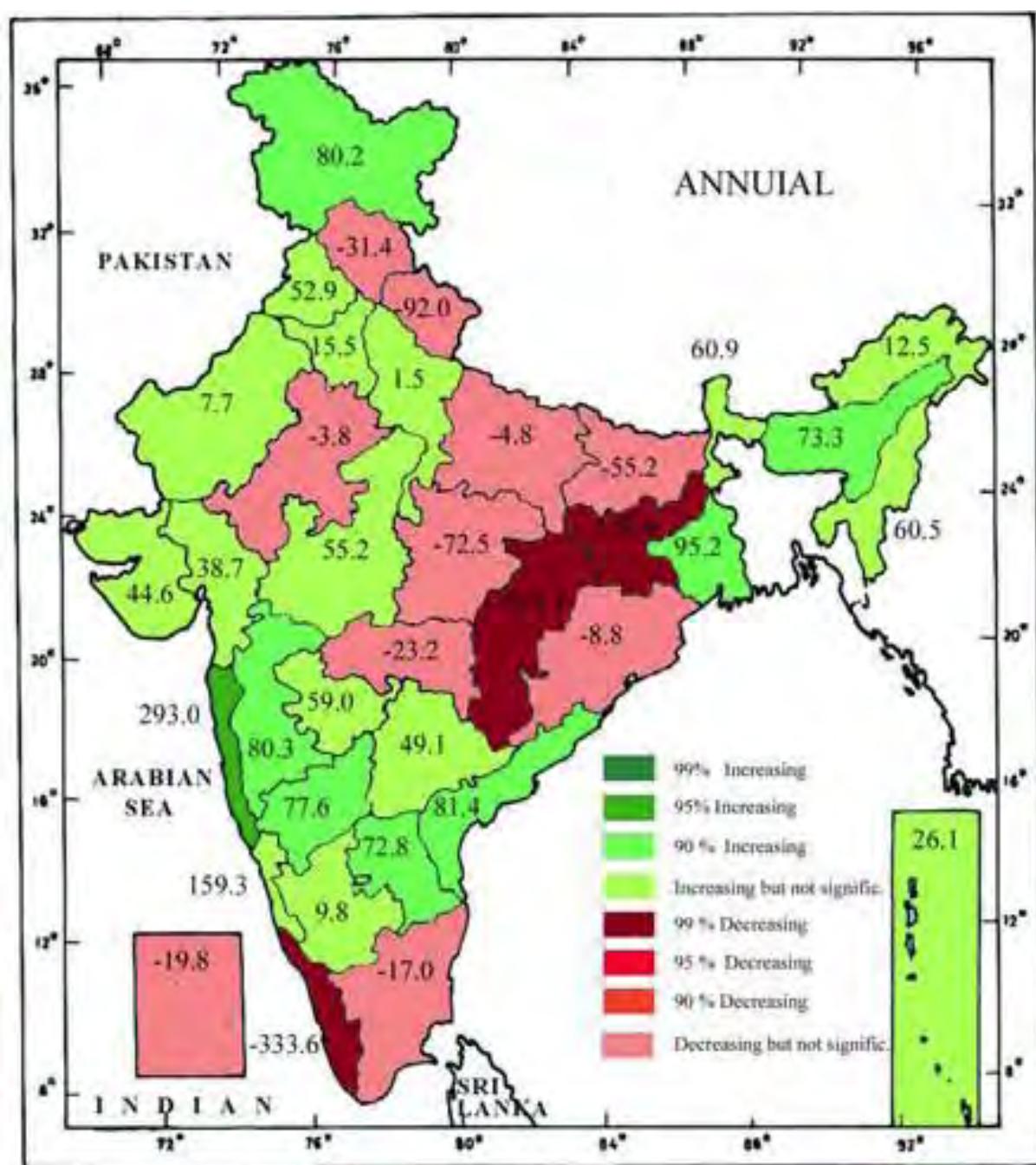


Plate V. Increase/Decrease in annual rainfall (in mm) in 100 years period for each of 36 subdivisions of India [Source: India Meteorological Department]

3.3 Drought analysis

Drought is a short term extreme climatic events. About 68% of the country is prone to drought in varying degrees. Droughts can be of three kinds:- (i) Meteorological drought: This happens when the actual rainfall in an area is significantly less than the climatological mean of that area. The country as a whole may have a normal monsoon, but different meteorological districts and sub-divisions can have below normal rainfall; (ii) Hydrological drought: A marked depletion of surface water causing very low stream flow and drying of lakes, rivers and reservoirs; (iii) Agricultural drought: Inadequate soil moisture resulting in acute crop stress and fall in agricultural productivity.

Drought classification of all India rainfall time series indicates that 10 years viz. 1901, 1904, 1907, 1913, 1920, 1941, 1966, 1968, 1974 & 1986 were under moderate drought category, 6 years (1905, 1911, 1951, 1965, 1982 & 2002) were under severe drought category and 4 years (1918, 1972, 1979 & 1987) were under extreme drought category. Mapping of drought probabilities based on long data series of rainfall reveals that in general in most parts of India, probabilities of moderate drought are in the range 11 to 20%. Major parts of India show probabilities of severe drought in the range 1 to 5%. No severe drought is experienced in some parts viz. West Central, Central Northeast and Northeast regions of India.

CHAPTER 4

HYDROGEOLOGICAL SETUP OF THE COUNTRY

The ground water behavior in the Indian sub-continent is highly complicated due to the occurrence of diversified geological formations with considerable lithological and chronological variations, complex tectonic framework, climatological dissimilarities and various hydrochemical conditions. Studies carried out over the years have revealed that aquifer groups in alluvial / soft rocks even transcend the surface basin boundaries. Broadly two groups of rock formations have been identified depending on characteristically different hydraulic parameters of these formations viz. Porous Formation and Fissured Formation.

4.1 Porous Formations

Porous formations have been further subdivided into Unconsolidated and Semi – consolidated formations.

4.1.1 Unconsolidated Formations

The areas covered by alluvial sediments of river basins, coastal and deltaic tracts constitute the unconsolidated formations. These are by far the most significant ground water reservoirs for large scale and extensive development. The hydrogeological environment and ground water regime conditions in the Indo-Ganga-Brahmaputra basin indicate the existence of potential aquifers having enormous fresh ground water reserves. Bestowed with high incidence of rainfall and covered by a thick pile of porous sediments, these ground water reservoirs get replenished every year and are being used heavily. In these areas, in addition to the Annual Replenishable Ground Water Resources available in the zone of Water Level Fluctuation (Dynamic Ground Water Resource), there exists a huge ground water reserve in the deeper passive recharge zone below the zone of fluctuation as well as in the deeper confined aquifers which is nearly unexplored. Although the

mode of development of ground water is primarily through dug wells and cavity wells, thousands of tube wells have been constructed during last few decades.

4.1.2 Semi-consolidated Formations

The semi-consolidated formations normally occur in narrow valleys or structurally faulted basins. The Gondwanas, Lathis, Tipams, Cuddalore sandstones and their equivalents are the most extensive productive aquifers. Under favorable situations, these formations give rise to free flowing wells. In selected tracts of northeastern India, these water-bearing formations are quite productive. The Upper Gondwanas, which are generally arenaceous, constitute prolific aquifers.

4.2 Fissured Formations (Consolidated Formations)

The consolidated formations occupy almost two-third part of the country. The consolidated formations except vesicular volcanic rocks have negligible primary porosity. From the hydrogeological point of view, fissured rocks are broadly classified into four types viz. Igneous and metamorphic rocks excluding volcanic and carbonate rocks, Volcanic rocks, consolidated sedimentary rocks excluding carbonate rocks and Carbonate rocks.

4.2.1 Igneous and Metamorphic Rocks Excluding Volcanic and Carbonate rocks

The most common rock types are granites, gneisses, charnockites, khondalites, quartzites, schists and associated phyllites, slates, etc. These rocks possess negligible primary porosity but attain porosity and permeability due to fracturing and weathering. Ground water yield also depends on rock type and possibly on the grade of metamorphism like granite, khondalite and biotite gneiss are better sources than charnockites.

4.2.2 Volcanic rocks

The pre-dominant types of the volcanic rocks are the basaltic lava flows of Deccan Plateau. The contrasting water bearing properties of different flow

units controls ground water occurrence in Deccan Traps. The Deccan Traps have usually poor to moderate permeabilities depending on the presence of primary and secondary fractures.

4.2.3 Consolidated Sedimentary Rocks excluding Carbonate rocks

Consolidated sedimentary rocks occur in Cuddapahs, Vindhyan and their equivalents. The formations consist of conglomerates, sandstones, shales, slates and quartzites. The presence of bedding planes, joints, contact zones and fractures controls the ground water occurrence, movement and yield potential.

4.2.4 Carbonate rocks

Limestones in the Cuddapah, Vindhyan and Bijawar group of rocks dominates the carbonate rocks other than the marbles and dolomites. In carbonate rocks, the circulation of water creates solution cavities thereby increasing the permeability of the aquifers. The solution activity leads to widely contrasting permeability within short distances.

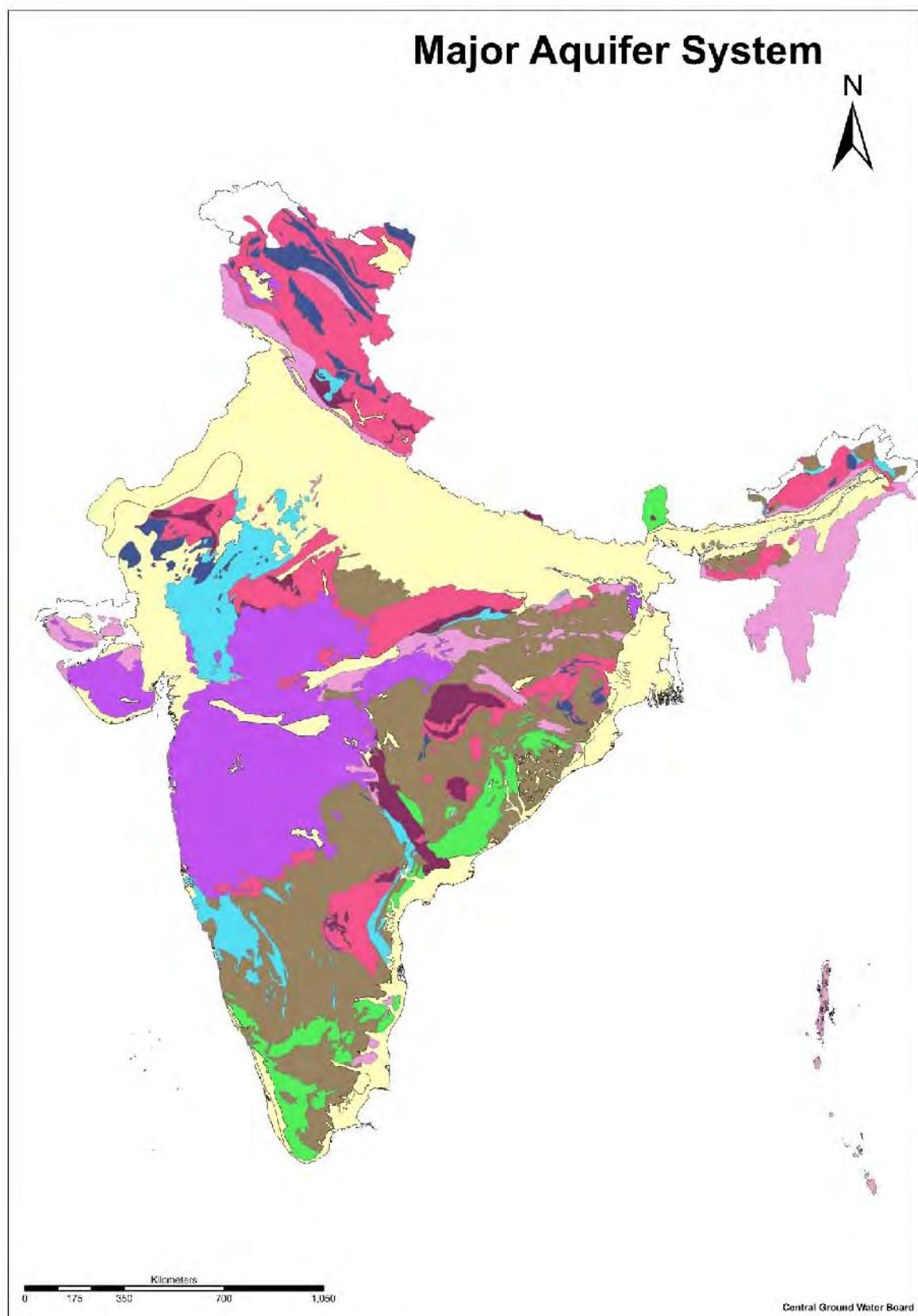
Aquifer map of India is depicted in **Plate VI**.

4.3 Ground Water Level Scenario in the country

Ground water level is one of the basic data-element which reflects the condition of the ground water regime in an area. Ground water levels are being monitored by Central Ground Water Board and State Ground Water Departments. CGWB monitors ground water level four times a year during January, April/ May, August and November. The periodicity of ground water level monitoring by the State Government varies from State to State.

CGWB monitors the ground water level and quality in a network of 15640 ground water monitoring wells located all over the country. This data along with State Government monitoring data is used for assessment of ground water resources. The ground water level scenario based on CGWB information is presented in the following paragraphs.

Plate VI



MAJOR AQUIFER SYSTEMS IN INDIA

Age	Formation	Lithology	Color Code
Quaternary	Unconsolidated	RECENT & OLD AEOIAN ALLUVIUM, CLAY, SILT, SAND, PEBBLE, GRAVEL, CALCAREOUS OLDER ALLUVIUM, LATERITE, FERRUGINOUS CONCRETIONS, LITHOMARGIC CLAY, SILT, SAND, GRAVEL	
Cenozoic , Mesozoic	Consolidated -Effusive	BASALT WITH OR WITHOUT INTERTRAPPEAN	
Cenozoic , Mesozoic, Upper Palaeozoic	Semi-Consolidated	SANDSTONE, SHALE, LIMESTONE INCLUDING CONGLOMORATE	
Cenozoic , Proterozoic	Consolidated -Intrusive	GRANITE, BASALT, DOLERITE	
Cenozoic , Proterozoic	Sedimentaries and Meta Sedimentaries	SHALE, QUARTZITE, SLATE, SANDSTONE, PHYLLITE, SCHIST	
Proterozoic	Sedimentaries and Meta Sedimentaries	LIMESTONE, DOLOMITE	
Proterozoic, Azoic	Meta Sedimentaries	SCHIST, PHYLLITE, SLATE, GNEISS, MARBLE	
Proterozoic, Azoic		CHARNOCKITE, KHONDALITE	
Azoic	Basal Crystalline	GRANITE-GNEISS COMPLEX	

4.3.1 Ground Water Level Scenario, 2008

A perusal of depth to water level map of India for Pre- Monsoon period (May 2008) (**Plate VIIa**) reveals that in sub-Himalayan area, north of river Ganges, generally the depth to water level ranges from 2 to 10 meter below ground level (m bgl). In the eastern part of the country in the Brahmaputra valley water level generally ranges from 2-5 m bgl, except in isolated pockets where depth to water level is less than 2 m bgl. However, in upper Assam, isolated pocket of deeper water level, 5-10 m bgl has been observed. In major parts of Indus basin, depth to water level generally ranges from 5-20 m bgl. In the western part of the country covering states of Gujarat and Rajasthan deeper water level is recorded in the range of 10-20 m.bgl. Relatively deeper water level in the range of 20-40 m bgl and > 40 m bgl have been observed in Alwar, Barmer , Bikaner, Churu, Nagaur, Jhunjhunu, Sikar and Jaipur districts of Rajasthan and also in central and north Gujarat. In Punjab and Haryana deeper water level in the range of 10-20 m bgl and 20-40 m bgl has been observed. In Maharashtra water level recorded is mostly in the range of 5-10 m bgl except western Maharashtra where water level is generally less than 5 m bgl. In the east coast i.e. coastal Andhra Pradesh, Orissa and Tamil Nadu, generally the water level ranges between 2-5 m bgl. However, isolated pockets of water level more than 5 m bgl have also been recorded. Eastern most part of West Bengal recorded water level in the range of 5-10 m bgl. In central India water level generally varies between 5-20 m bgl, except in isolated pockets where water level is more than 20 m bgl. The peninsular part of country generally water level ranges between 5-20 m bgl except in pockets where water level is less than 5 m bgl. Isolated patches of deeper water level in the range of 20-40 m bgl and more than 40 m bgl have also been observed in various parts of the country.

The Post-Monsoon (November 2008) depth to Water level map (**Plate VIIb**) reveals that in Sub-Himalayan area, north of river Ganges and in the eastern part of the country in the Brahmaputra valley, generally the depth to water

level varies from 2-5 meter below ground level m bgl. Isolated pockets of shallow water level less than 2 m bgl have also been observed. In major parts of north-western states (Indus basin), depth to water level generally observed in the range of 10-20 m bgl. In the western parts of the country deeper water level is recorded in the range of 10-20 m bgl. In the west coast water level is generally less than 10 m and in western parts of Maharashtra State isolated pockets of water level less than 2 m has also been observed. In the east coast i.e. coastal Andhra Pradesh and Orissa, shallow water levels of less than 2 m have been recorded. In eastern states, water level in general ranges from 2-5 m bgl. However South-eastern part of West Bengal recorded water level in the range of 5-10 m bgl. In central India water level generally varies between 2-10 m bgl, except in isolated pockets where deeper water level more than 10 m bgl has been observed. Similarly pockets of shallow water level less than 2 m bgl is also observed. The peninsular part of country generally recorded a water level in the range 5-10 m bgl. In some patches water level ranges from 10-20 m bgl. Isolated patches of water level of 10-20 m bgl and 20-40m bgl have been observed as well.

4.3.2 Changes in ground water level regime

In order to analyze the changes in ground water level regime in the decade prior to 2009 assessment, a comparison of depth to water level during Post Monsoon 2000 with Post Monsoon 2008 were carried out (**Plate VIII**). The map reveals that in general, there is marginal change in water levels over the decade.

Decline in the water level is observed mostly in northern, north western and eastern parts of the country in the states of Uttar Pradesh, Rajasthan, Bihar, Jharkhand, West Bengal, Punjab and Haryana. Decline in water level has also been observed in parts of Tamil Nadu and Andhra Pradesh states. Decline in water level of more than 2 m, which is considered to be significant occurred in parts of Rajasthan, Haryana, Punjab, and western Uttar Pradesh, western

Plate VIIa



Plate VIIb



Andhra Pradesh and North West part of Tamil Nadu. Significant rise of more than 2m has been observed in parts of central Maharashtra, Andhra Pradesh, southern and north-west Rajasthan, Karnataka, Orissa and Gujarat states.

Since post-monsoon water level indicates the impact of rainfall on ground water recharge, comparison was made between post-monsoon water level of last three years from the year of assessment and the decadal mean water level. A comparison of depth to water level during Post Monsoon 2006 with decadal mean Post Monsoon (1996-2005) (**Plate IXa**) reveals that in general, there is a decline in the water levels in entire Uttar Pradesh, Punjab, Haryana, eastern Rajasthan, northern Madhya Pradesh, northern Chhattisgarh, West Bengal, southern Andhra Pradesh and in parts in Maharashtra and North Eastern states. Significant decline of more than 2 m is more prominent in south western Uttar Pradesh, Punjab, Haryana and eastern Rajasthan. Rise in water level is more prominent in peninsular states, Gujarat and south Rajasthan states. Rise in water level of more than 2 m has been observed in the states of Gujarat, southern and western Rajasthan, Tamil Nadu and in parts in Maharashtra and Andhra Pradesh states.

Comparison of depth to water level of Post Monsoon 2007 with decadal mean Post Monsoon (1997-2006) (**Plate IXb**) reveals that in general, there is a decline in the water levels in entire Uttar Pradesh, Punjab, Haryana, eastern Rajasthan, northern Madhya Pradesh, parts of West Bengal, south Andhra Pradesh and in patches in Maharashtra and North East states. Significant decline of more than 2 m is more prominent in south western Uttar Pradesh, Punjab, Haryana and eastern Rajasthan states. Rise in water level has been observed in peninsular states, Gujarat, Bihar, Jharkhand and southern Rajasthan. Significant rise of more than 2 m has been observed in parts of Gujarat, southern Rajasthan, Tamil Nadu and in patches in Maharashtra and Andhra Pradesh states.

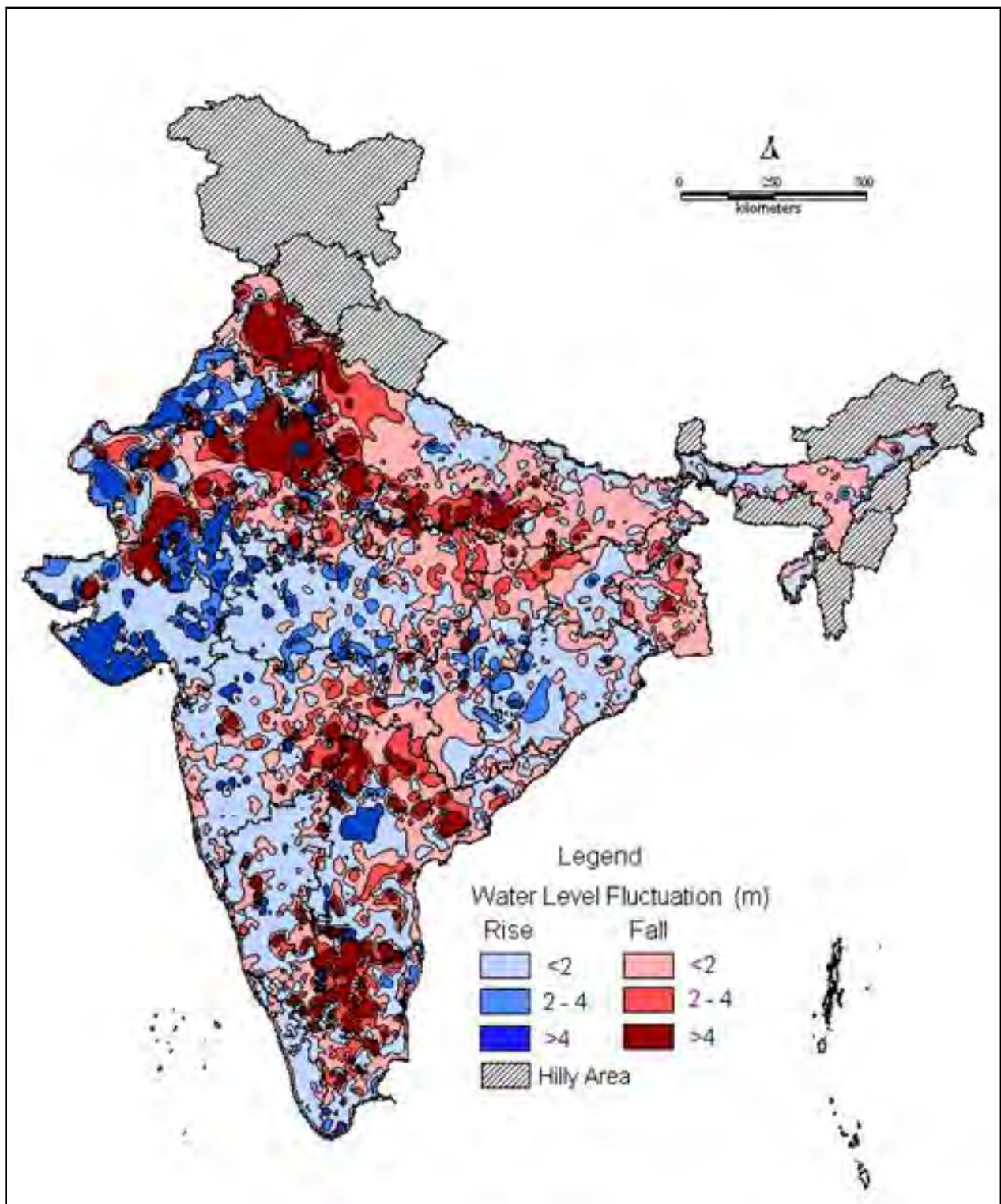
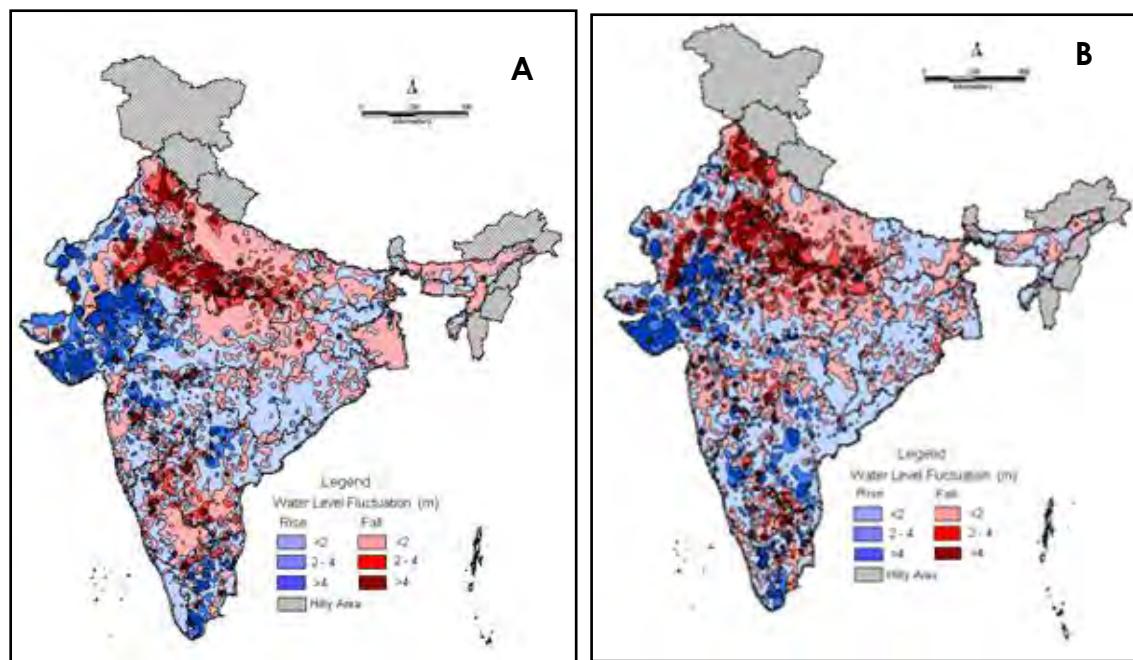


Plate VIII Water level Fluctuation between post monsoon 2000 with post monsoon 2008

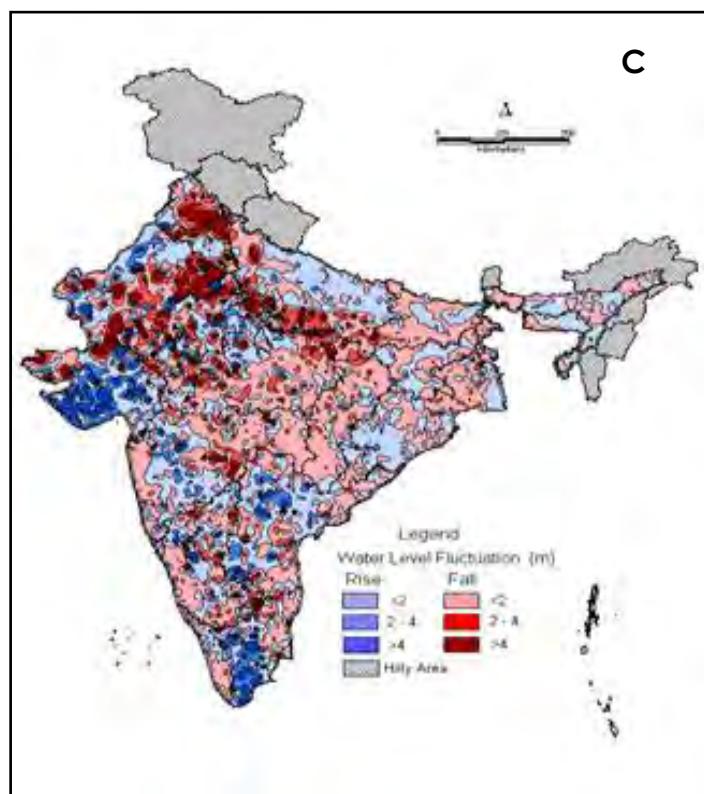
Comparison of depth to water level of Post Monsoon 2008 with decadal mean Post Monsoon (1998-2007) (**Plate IXc**) reveals that in general, there is a decline in the water levels in south western Uttar Pradesh, Punjab, Haryana, central Rajasthan, south eastern Madhya Pradesh, Chhattisgarh, West Bengal, in parts of Andhra Pradesh, Maharashtra and North Eastern states. Decline in water level of more than 2 m have been observed in south western Uttar Pradesh, Punjab, Haryana and eastern Rajasthan states. Rise in water level is observed in parts of peninsular states, Gujarat and south Rajasthan states. Rise in water level of more than 2 m is prominent in the states of Gujarat, southern and western Rajasthan, Tamil Nadu and in parts in Maharashtra and Andhra Pradesh.

4.3.3 Impact of rainfall on ground water regime

Rainfall is the most significant source of ground water recharge and hence changes in the rainfall pattern leaves distinct imprint on the ground water regime of an area. A perusal of the previous chapters indicate that between 2004 and 2009, the periods of ground water resources assessment, the rainfall distribution in the country had shown a definite pattern. In most of these years, the rainfall has been normal in major parts of the country. Above normal rainfall have been recorded in parts of east and west coast and also in some years in the western part of the country, while deficient rainfall has been mostly observed in parts of north, north-west and central India. Ground water level during the period of 2006 to 2008 in major part of the country is around the average water level of the area. Significant rise from the mean water level have been observed in Western India, West coast and parts of peninsular India. Significant fall in water levels as compared to the mean water level has been recorded mostly in North Western and northern part of the country. Thus it can be broadly concluded that the changes in ground water level with respect to the mean water level behaves similarly with the changes in rainfall pattern with normal rainfall.



Post-monsoon 2006 vs. Decadal Mean (1996-2005) Post-monsoon 2007 vs. Decadal Mean (1997-2006)



Post-monsoon 2008 vs. Decadal Mean (1998-2007)

Plate IX Water Level Fluctuations of Post monsoon water level with decadal mean

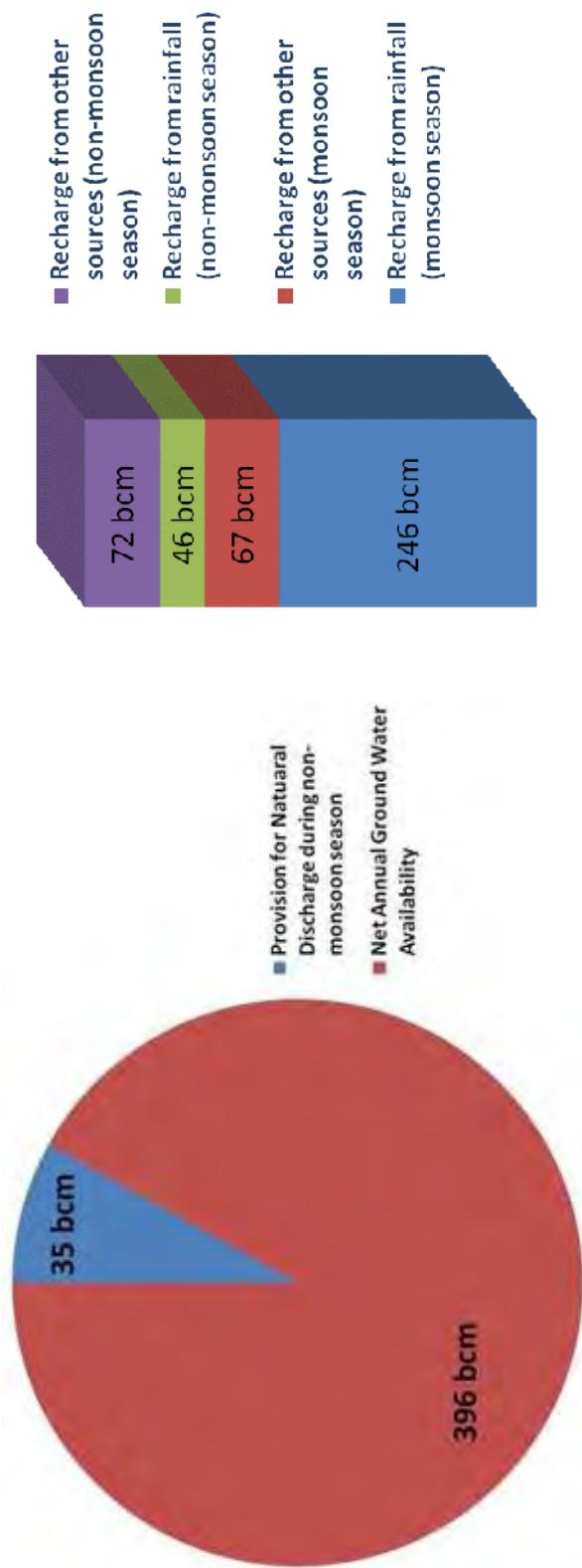
CHAPTER 5

GROUND WATER RESOURCES OF INDIA

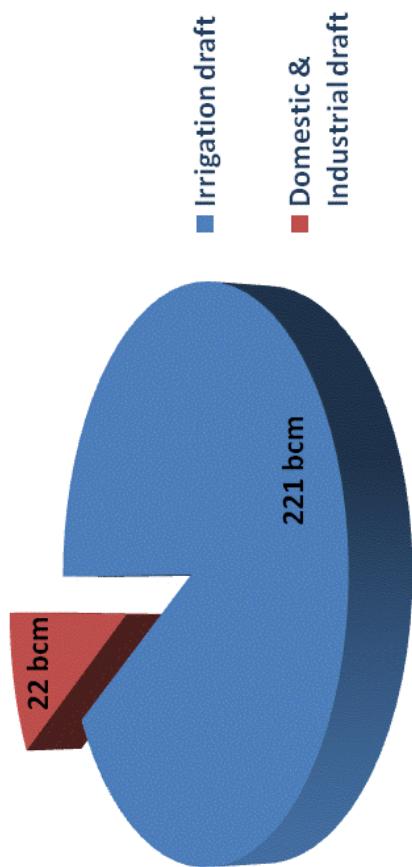
5.1 Dynamic Fresh Ground Water Resources

The dynamic ground water resources of the States and Union Territories have been assessed jointly by the CGWB and State Ground Water Departments under the supervision of the State level Committees. The base year of computation of the resources is 2008-09. The ground water resources in some of the north eastern states viz. Arunachal Pradesh, Manipur, Mizoram, Nagaland and Tripura have been estimated by CGWB in absence of active participation of State Govt. The ground water assessment figures computed at the State Level are presented in the following compilation.

The dynamic ground water resources are also known as Annual Replenishable Ground Water Resources since it replenished/ recharged every year. The Annual Replenishable Ground Water Resource for the entire country has been assessed as 431 billion cubic meter (bcm). The major source of ground water recharge is the monsoon rainfall. About 57% of the annual replenishable resources i.e. 246 bcm are contributed by monsoon rainfall recharge. The overall contribution of rainfall to country's Annual Replenishable Ground Water Resource is 68% and the share of other sources viz. canal seepage, return flow from irrigation, recharge from tanks, ponds, and water conservations structures taken together is 32%. State-wise Ground Water Resources of India as on March, 2009 is given in **Annexure – I** and the district-wise figures are given in **Annexure - II**. **Plate X** presents the over-all scenario of ground water resource utilization and availability of the country. The contribution from other sources such as canal seepage , return flow from irrigation, seepage from water bodies etc in Annual Replenishable Ground Water Resource is more than of 33% in the states of Andhra Pradesh, Delhi, Haryana, Gujarat, Goa, Jammu & Kashmir, Karnataka, Punjab,



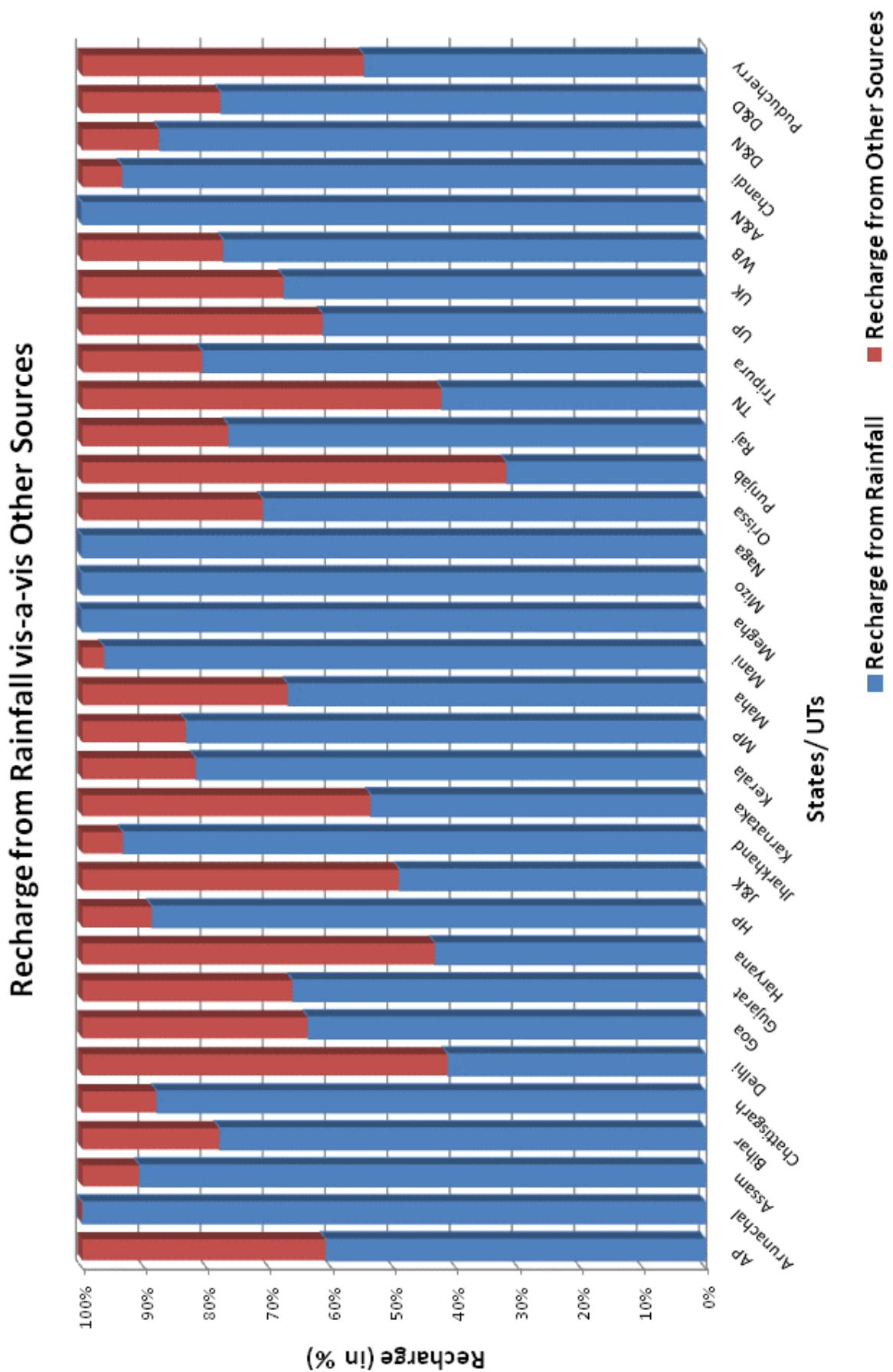
Annual Replenishable Ground Water Resources (431 bcm)



Annual Ground Water Draft (243 bcm)

Plate X Ground water Resources Availability and Utilization in India

Plate XI

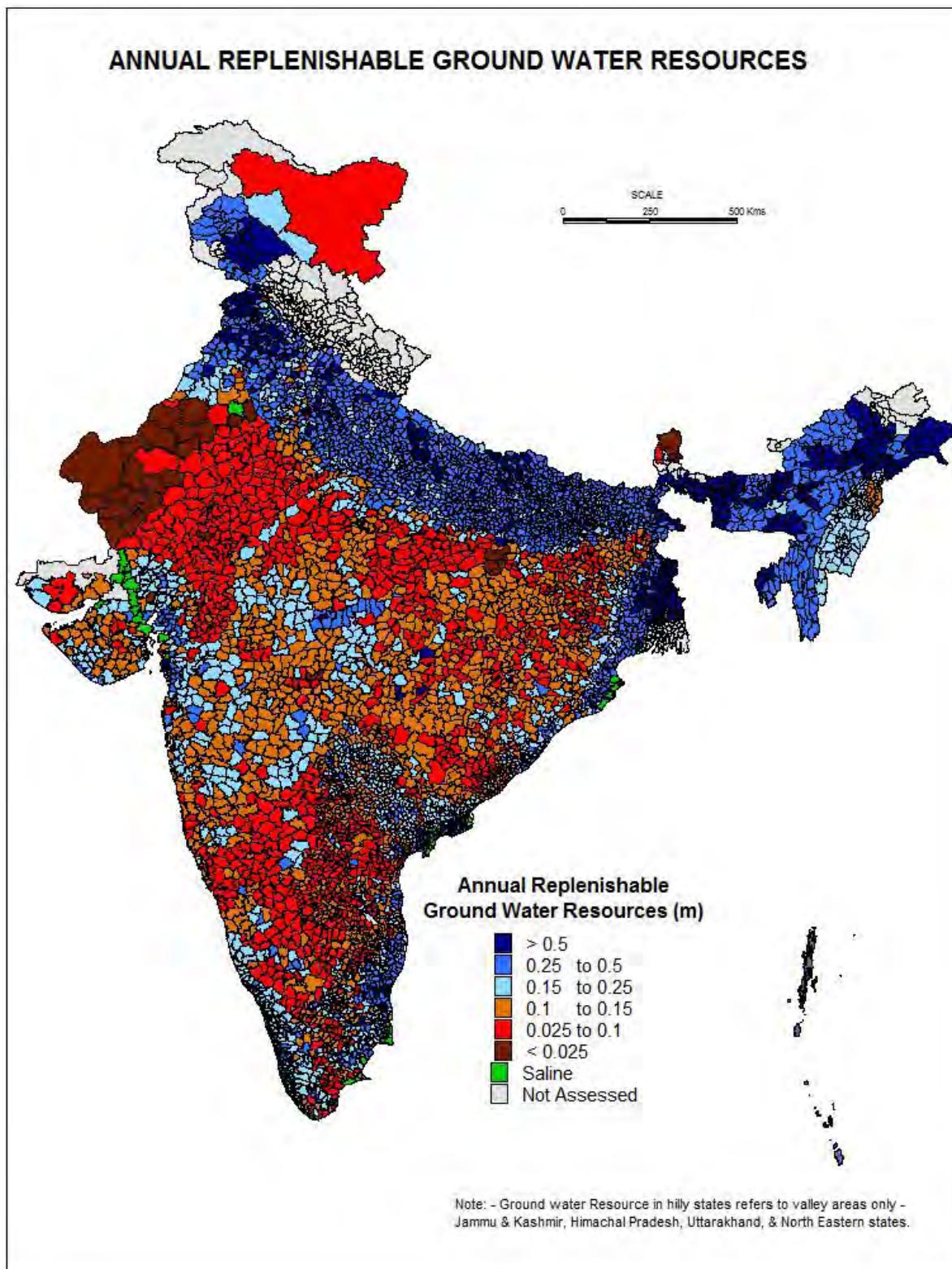


Tamil Nadu, Uttar Pradesh, and UT of Puducherry (**Plate XI**). South-west monsoon being the most prevalent contributor of rainfall in the country, about 73% of country's Annual Ground Water Recharge takes place during the Kharif period of cultivation. Keeping 35 bcm for natural discharge, the Net Annual Ground Water Availability for the entire country is 396 bcm.

The spatial variation in annual replenishable ground water resources is presented in **Plate XII**. Volumetric estimates are dependent on the areal extent of the assessment unit. Thus, relative comparison of ground water resource of different assessment units based on volumetric estimates is not possible. Hence volumetric estimates of annual replenishable ground water resources have been divided by the area of the assessment unit to arrive at estimates per unit area (in meter). Replenishable Groundwater resource is significantly high in the Indus–Ganga–Bramhputra alluvial belt in the North, East and North East India covering the states of Punjab, Haryana, Uttar Pradesh, Bihar, West Bengal and valley areas of North Eastern States, where rainfall is plenty and thick piles of unconsolidated alluvial formations are conducive for recharge. Annual Replenishable Ground Water Resource in these regions varies from 0.25 to more than 0.5 m. The coastal alluvial belt particularly Eastern Coast also has relatively high replenishable ground water resources, in the range 0.25 to more than 0.5 m. In western India, particularly Rajasthan and parts of northern Gujarat which have arid climate, the annual replenishable ground water resources are scanty, mostly up to 0.025 m. Similarly, in major parts of the southern peninsular India covered with hard rock terrains, annual replenishable ground water recharge is less, only up to 0.10 m. This is primarily because of comparatively low infiltration and storage capacity of the rock formations prevailing in the region. The remaining part of Central India is mostly characterized by moderate recharge in the range of 0.10–0.25 m.

The overall estimate of annual replenishable ground water resources of the entire country shows a marginal decrease in the present estimate as

Plate XII



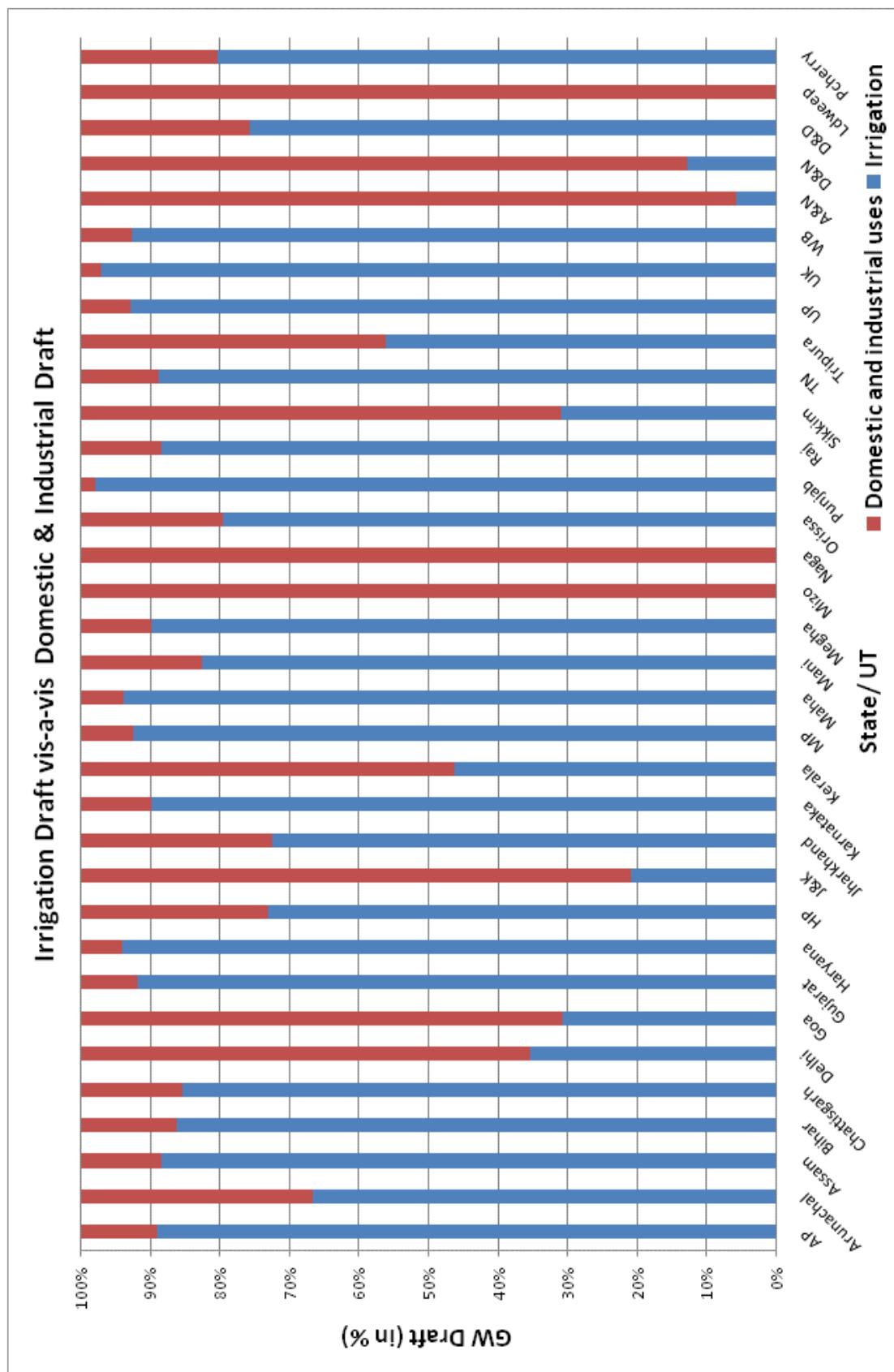
compared to the 2004 by about 2 bcm. However there are significant variations in the recharge estimates of some of the States as indicated in Section 5.5. The main reasons for this can be attributed to – changing ground water regime, widespread implementation of rainwater harvesting and water conservation measures, changes in rainfall pattern, adoption of revised values of parameters like Specific Yield which were estimated based on subsequent field studies and availability of improved database which helped in refinements in assessment and assessment in additional areas which were not estimated in the 2004 exercise.

5.2 Ground Water Utilization

The assessment of ground water draft is carried out based on the Minor Irrigation Census data and sample surveys carried out by the State Ground Water Departments. The Annual Ground Water Draft of the entire country for 2008-09 has been estimated as 243 bcm. Agriculture sector remained the predominant consumer of ground water resources. About 91% of total annual ground water draft i.e. 221 bcm is for irrigation use. Only 22 bcm is for Domestic & Industrial use which is about 9% of the total draft. An analysis of ground water draft figures indicates that in the states of Arunachal Pradesh, Delhi, Goa, Himachal Pradesh, Jammu & Kashmir, Jharkhand, Kerala, North Eastern states of Manipur, Meghalaya, Mizoram, Nagaland and Tripura, Orissa, Sikkim, and Union Territories of Andaman & Nicobar Island, Dadra & Nagar Haveli, Lakshadweep and Puducherry, ground water draft for domestic & industrial purposes are more than 15% (**Plate XIII**).

There has been about 5% increase in the overall estimate of the annual ground water draft of the country in 2009 as compared to 2004. However, in some States, decrease in ground water draft estimates has also been recorded which have been attributed to lower yield of bore wells in Over-exploited blocks in hard rock terrain, good rainfall and provision for alternate source of water resulting in lesser stress on ground water resources etc. State-wise details are given in Section 5.5.

Plate XIII



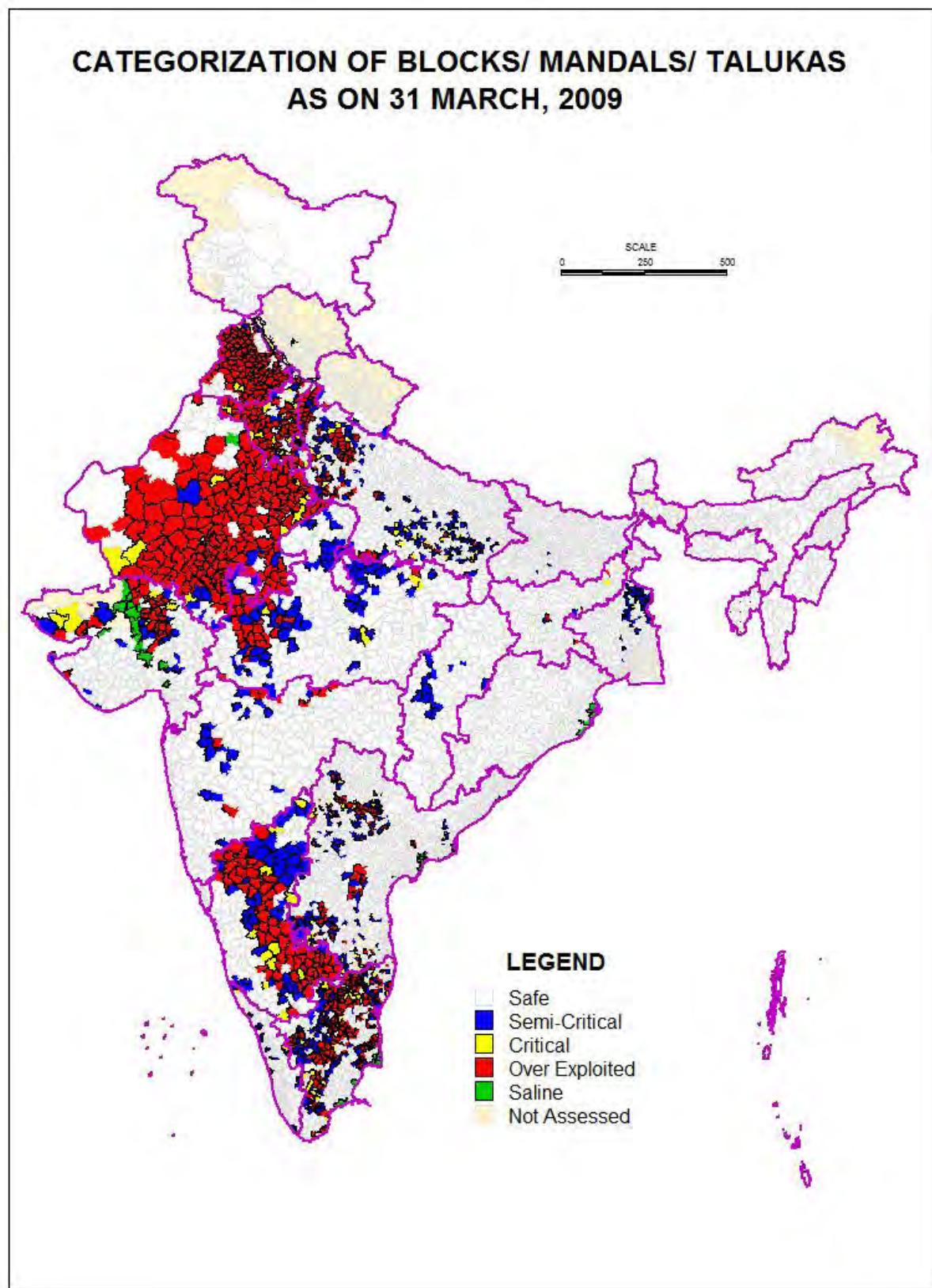
5.3 Stage of Ground Water Development

The stage of ground water development in the country is 61%. The status of ground water development is very high in the states of Delhi, Haryana, Punjab and Rajasthan, where the Stage of Ground Water Development is more than 100%, which implies that in the states the annual ground water consumption is more than annual ground water recharge. In the states of Gujarat, Tamil Nadu and Uttar Pradesh and UTs of and UT of Daman & Diu, Lakshadweep and Puducherry, the stage of ground water development is 70% and above. In rest of the states / UTs the stage of ground water development is below 70%. The ground water development activities have increased generally in the areas where future scope for ground water development existed. This has resulted in increase in stage of ground water development from 58% (2004) to 61% (2009).

5.4 Categorization of Assessment Units

Out of 5842 numbers of assessed administrative units (Blocks/ Taluks/ Mandals/ Districts), 802 units are Over-exploited, 169 units are Critical, 523 units are Semi-critical, and 4277 units are Safe. Apart from these, there are 71 assessment units which are completely Saline (Annexure – III). Number of Over-exploited and Critical administrative units are significantly higher (more than 15% of the total assessed units) in Delhi, Gujarat, Haryana, Himachal Pradesh, Karnataka, Punjab, Rajasthan and Tamil Nadu and also the UTs of Daman & Diu and Puducherry (**Plate XIV**).

Plate XIV



A perusal of the Categorization map indicates that the Over-exploited blocks are concentrated in the North Western, Western and Southern Peninsular part of the country. The reason for over-exploitation in the North Western part i.e. Punjab and Haryana is indiscriminate extraction of ground water mainly for irrigation purpose. In the Western part of the country viz. Rajasthan and Gujarat, over-exploitation is caused by arid climate resulting scanty and irregular rainfall and consequent less recharge. In the southern part of the country i.e. Karnataka, and Tamil Nadu, large number of over-exploited blocks are caused because of hard rock terrain which permits less recharge and thus result in water stressed conditions.

List of categorization of Blocks / Taluks/ Mandals/ Districts is given in **Annexure – IV.**

5.5 State-wise Ground Water Resources Scenario

The ground water conditions, its availability and utilization scenario in various States are described in the following paragraphs.

ANDHRA PRADESH

Nearly 85% of the State is underlain by consolidated formations like Archaeans, Cuddapahs, Dharwars, Kurnools, Deccan Traps etc. Rest of the area is underlain by soft rocks including Gondwanas, Rajamundri Sandstones and alluvium. Ground Water development in the phreatic zone is generally through open wells, filter points and cavity wells. Open wells tapping the weathered zone of Dharwar Group consisting of schists, phyllites etc. yield 2-9 lps, crystalline rocks consisting of granite and gneisses yield 4-16 lps and Cuddapahs yield 2-4 lps. Open wells in Gondwana and Tertiaries yield 1-2 lps. In alluvial formations dug wells and filter points yield 4-15 lps.

Ground water assessment has been carried out watershed-wise which were then apportioned Mandal-wise. The Annual Replenishable Ground Water Resource of the state has been estimated as 33.83 bcm and Net Annual Ground Water Availability is 30.76 bcm. The Annual Ground Water Draft is 14.15 bcm and Stage of Ground Water Development is 46%. Out of

1108 assessment units (Mandals), 84 have been categorized as Over-exploited, 26 as Critical, 93 as Semi-critical and 867 as Safe. 38 Mandals in the State are saline. The ground water development is more wide-spread in the Telengana and Rayalaseema regions of the State as compared to Coastal Andhra Pradesh.

There is no significant variation in the assessment of replenishable ground water resources between 2004 and 2009 estimates. The ground water draft has marginally decreased in 2009 as compared to 2004 estimates. The reason for decrease in ground water draft has been attributed to above normal rainfall in the state during last few years which has reduced the stress on ground water utilization.

ARUNACHAL PRADESH

The entire foot hill belt running along the Himalayan front can be correlated to Bhabar belt with the exception of some area. Unconsolidated Quaternaries and Upper Tertiary form the main hydrogeological unit. Open Wells in Namsai and Miao sub-division tapping saturated sand generally yield in the range of 1000 to 3000 lpd (0.035 to 0.10 lps).

Ground water assessment has been carried out in the valley areas of the districts. The Annual Replenishable Ground Water Resource of the state is estimated as 4.45 bcm and Net Annual Ground Water Availability is 4.01 bcm. The Annual Ground Water Draft is 0.003 bcm and Stage of Ground Water Development is 0.07%. All the districts have been categorized as Safe.

There has been increase in the Replenishable resources which is attributed to the inclusion of more districts in the present assessments as compared to the previous assessment.

ASSAM

Major areas of the state are underlain by unconsolidated formations in Brahmaputra valley other than consolidated and semi-consolidated formations in the hilly areas. Shallow tube wells constructed in alluvial areas yield to the tune of 6-8 lps.

Ground water assessment has been carried out in the valley areas of the districts. The Annual Replenishable Ground Water Resource is 30.35 bcm and Net Annual Ground Water Availability is 27.81 bcm. The Annual Ground Water Draft is 6.03 bcm and Stage of Ground Water Development is 22%. All the districts have been categorized as Safe. A relatively high stage of ground water development has been recorded in the districts of Bongaigaon, Barpeta, Kamrup, Morigaon and Nalbari district.

There has been marginal increase in both recharge and draft components as compared to the previous estimates. Thus the Stage of Development in present estimate remains almost same as compared to the 2004.

BIHAR

The major part of the state is covered with Indo-Gangetic alluvium besides consolidated formations in the southern parts. Ground water development in the phreatic zone is generally through dug wells and shallow tube wells. The yield of these wells generally ranges from 3-10 lps.

The dynamic ground water resources in the state have been estimated block-wise. The Annual Replenishable Ground Water Resources of the state have been estimated as 28.63 bcm and the Net Annual Ground Water Availability is 26.21 bcm. The Annual Ground Water Draft for all uses is 11.36 bcm and Stage of Ground Water Development of the state is 43%. Out of 533 assessment units (blocks), 529 have been categorized as Safe and 4 blocks have been categorized as Semi-critical. Though the ground water development is comparatively low in major part of the State, the higher development areas are mostly located in isolated patches.

There are marginal changes in the recharge and draft estimates in the State as compared to 2004 estimate. The annual replenishable resource has marginally decreased while annual ground water draft has slightly increased in 2009 as compared to 2004.

CHHATTISGARH

The state is underlain by diverse rock types of different geological ages from Pre-Cambrian to Recent. Large part of the State is underlain by hard rocks being tapped mostly by dug wells constructed in the weathered zone. The yield of open (dug) wells varies from 1 to 2 lps. A small part of the State is occupied by Semi-consolidated sedimentary rocks where tube wells have yield of 3 to 5 lps.

The Ground water resources have been assessed block-wise. The Annual Replenishable Ground Water Resource of the State has been estimated as 12.22 bcm and Net Annual Ground Water Availability is 11.58 bcm. The Annual Ground Water Draft is 3.60 bcm and Stage of Ground Water Development is 31%. Out of 146 blocks, 14 have been categorized as Semi-critical and remaining 132 as Safe. In Chhattisgarh, the ground water development concentrates in the central part of the state i.e. within Chhattisgarh basin only. That is why most of the Semi-critical blocks are in the Central part of the State.

As compared with 2004 estimate, there is decrease in Annual Replenishable Ground Water Resources in 2009 by about 18% which is mainly because subsequent field studies have indicated lower Specific Yield values of Granite-Gneiss rocks in the State which led to the refinements of the parameters of assessment. The Ground Water Draft has increased by about 28% during the same period.

DELHI

Delhi region is a part of Indo-Gangetic Plain. Geologically, Delhi is occupied by quartzite of Delhi System and alluvial deposits classified into older and newer alluvium. Bore wells in the Delhi Quartzite generally yield 0.56 to 5 lps for a drawdown of 8 to 30 m. In the older alluvial deposits, yield of the tube wells are generally in the range of 4 to 10 lps with drawdown of 6 to 24 m. In the newer alluvium, tube wells upto the depth of 50 m generally yield 28 to 58 lps with drawdown of 5 to 11 meter.

The Ground water resources have been assessed tehsil-wise. The Annual Replenishable Ground Water Resource of the State has been estimated as 0.31 bcm and Net Annual Ground Water Availability is 0.29 bcm. The Annual Ground Water Draft is 0.40 bcm and Stage of Ground Water Development is 138%. Out of 27 tehsils, 20 have been categorized as Over-exploited, 5 as Semi-critical and remaining 2 as Safe.

Smaller assessment unit (tehsil) was adopted in the present estimate to get a more realistic picture of the ground Water Resources. While there is no change in the estimates of Total Replenishable Ground Water Resources in the State for 2009, the estimates of rainfall recharge in 2009 estimate has varied from 2004 estimate because of inclusion of more meteorological stations for rainfall analysis. There is marginal reduction in the domestic Ground Water Drafts in the current assessment because more area particularly in South and South West District has been covered under surface water supply from Sonia Vihar WTP. Additionally, the regulation on drilling of new bore wells in these two districts may also have contributed to lesser dependency on Ground Water.

GOA

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

Ground Water Resources has been assessed taluk-wise. The Annual Replenishable Ground Water Resource has been estimated as 0.22 bcm and Net Annual Ground Water Availability is 0.13 bcm. The Annual Ground Water Draft is 0.04 bcm and Stage of Ground Water Development is 33% and all the taluks in the state have been categorized as Safe.

There is decrease in the estimates of annual replenishable resources, net annual ground water availability as compared to the previous (2004)

assessment. The main reasons are refinement in the norms of allocation of natural discharge considering the undulating terrain conditions and highly porous lateritic formations and refinements in the unit draft based on sample survey and field studies.

GUJARAT

Major part of the state is underlain by hard rocks consisting of gneisses, schist, phyllites, sandstones and basalts. Remaining area in the north and central Gujarat is occupied by the soft rocks including coastal alluvium. The development of ground water from phreatic zone is mainly through dug wells and shallow tube wells. The yield from dug wells varies from 1 to 5 lps.

Ground water resources have been assessed taluk-wise. The Annual Replenishable Ground Water Resource of the state has been estimated as 18.43 bcm and Net Annual Ground Water Availability is 17.35 bcm. The Annual Ground Water Draft is 12.99 bcm and the Stage of Ground Water Development is 75%. Out of 223 assessment units (Taluks), 27 have been categorized as Over-exploited, 6 as Critical, 20 as Semi- critical, 156 as Safe and 14 as Saline. The ground water development is quite high in the Central Gujarat in parts of Banaskantha, Patan, Mehsana, Gandhinagar, Ahmedabad, in the Western part of State in Katchh district and also in certain coastal pockets of Porbander district.

There has been about 17% increase in the assessment of Annual Replenishable Ground Water Resources of 2009 as compared to 2004. This may be attributed to significant increase in recharge structures such as check dams, percolation tanks and other structures in various parts of the state. There has been about 13% increase in the ground water draft estimates in 2009. While the number of taluks having totally saline water remained the same, the total number of Over-exploited and Critical blocks has decreased.

HARYANA

Major part of the state is occupied by alluvium. The southern part of the state is underlain by consolidated formation of Delhi System and in the northern

part Siwaliks are present. The ground water development of phreatic zone is mainly through shallow tube wells and dug wells in alluvial areas, the yield of wells at places goes 5 to 15 lps.

In Haryana, dynamic ground water resources have been estimated block-wise. Annual Replenishable Ground Water Resource of the state has been estimated as 10.48 bcm and the Net Annual Ground Water Availability is 9.80 bcm. The Annual Ground Water Draft is 12.43 bcm and the Stage of Ground Water Development is 127 %. Out of 116 assessment units (blocks), 68 have been categorized as Over-exploited, 21 as Critical, 9 as Semi-critical and remaining 18 as Safe. Major parts of the State have recorded high stage of ground water development.

There has been about 13% increase in the estimates of annual replenishable ground water resource in the present assessment (2009) as compared to 2004 estimates. The reason being good rainfall in some of the areas in the State and construction of water conservation structures. The ground water draft has increased by about 31% in the present estimate in the State. The ground water draft for irrigation and domestic & industrial use has increased by more than 31% in 2009 when compared with 2004 estimate. The reason being increased dependency on ground water for agriculture use, besides rapid urbanization and industrialization and consequent rise in the use of ground water in these sectors.

HIMACHAL PRADESH

The state essentially is hilly terrain, comprising of fissured formations with a few inter-montane valleys occupied by Quaternary alluvium. The submountainous tract is part of piedmont plain. Kandi belt and adjoining hill slopes are underlain by boulders, gravels and clay. The phreatic zone in the hard rock as well as soft rock areas are developed through dug wells and springs, the yield of open well ranges from 3-8 lps.

The basic assessment unit in Himachal Pradesh is valley areas within districts. The Annual Replenishable Ground Water Resource of the state has been

assessed as 0.59 bcm and Net Annual Ground Water Availability is 0.53 bcm. The Annual Ground Water Draft of the state is only 0.31 bcm. The Stage of Ground Water Development is 58%. Out of 8 assessment units, 6 fall in 'Safe' category, 1 in 'Critical' and 1 in 'Over-exploited' category. Higher exploitation is restricted to western part of the State in the Kala Amb and Una valleys.

There is about 37% increase in the estimate of replenishable resource as compared to the previous (2004) estimate which is attributed to inclusion of additional area feasible for natural recharge of ground water. Similarly, the ground water draft estimate has increased substantially which is due to inclusion of more area in the present estimate and increased dependency on ground water in the State. Apart from ground water available in phreatic zone, spring development is viable alternative.

JAMMU & KASHMIR

The major areas of the state are occupied by high hills. Occurrence of ground water is primarily confined to alluvial regions which have been classified into piedmont deposits of outer plains of Jammu, Dune belt in outer Himalaya, isolated valley fills in lesser Himalaya, Fluvio- Lacustrine deposits in Kashmir valley and moraines and fluvioglacial deposits of Laddakh. Dug wells in Kashmir valley have limited yield. Ground water occurs in perched condition and gives rise to springs in phreatic zone water table.

Dynamic ground water resources are estimated in the valley areas of the districts. The Annual Replenishable Ground Water Resource of the state has been assessed as 3.70 bcm and Net Annual Ground Water Availability is 3.33 bcm. The Annual Ground Water Draft of the state is only 0.73 bcm. The Stage of Ground Water Development is 22 % and all the districts (valley area) in the state fall under Safe category. The ground water development is highest in Srinagar (62 %) followed by Udhampur District (38 %). In rest of the State, the ground water development is below 35%.

The estimates of replenishable ground water resources has increased in the present estimate (2009) as compared to the 2004 estimates because of inclusion of additional districts in the present assessment including Leh and Kargil of Kashmir division and Doda, Poonch, Rajori and Udhampur of Jammu division. These districts were added in the present estimate as basic data elements are presently available for resource computation. Similarly there has been an increase in the draft estimate also.

JHARKHAND

Nearly 85% of the state is covered with hard rocks consisting of granite, granite-gneisses, other formations include Vindhyanas, Gondwanas, Volcanic and unconsolidated sediments. The phreatic zone is mostly developed through hand pumps, dug wells and shallow tube wells. The dug wells tapping the granite suite of rocks yield 4-7 lps, Vindhyanas and Volcanics upto 1 lps and in alluvium upto 3 lps.

Ground water resources are estimated block-wise. The Annual Replenishable Ground Water Resource has been assessed as 5.96 bcm and Net Annual Ground Water Availability is 5.41 bcm. The Annual Ground Water Draft is 1.61 bcm and Stage of Ground Water Development is 30%. Out of 208 assessment units (blocks), 200 blocks have been declared as 'Safe', 2 is 'Semi-critical', 2 is 'Critical' and 4 is 'Over-exploited. The ground water utilization is high in Dhanbad, East Singhbhum, Godda, Ramgarh and Ranchi districts.

The ground water draft in the state has increased by about 48% in comparison to 2004 assessments due to increase in ground water demand because of accelerated urbanization and industrialization.

KARNATAKA

The State has diverse hydrogeological conditions mainly occupied by Peninsular gneisses, granites, schists, basalts along with sedimentaries. The hard rock terrains mainly sustain dug wells and bore wells. The yield of the bore wells ranges from 2 to 3 lps. The recent alluvium is restricted to coastal

area and stream courses. Tube wells in the coastal alluvial deposits in general yield from 10 to 14 lps.

In Karnataka, the assessment unit is Watershed and the sub-assessment unit is command and non-command areas. These estimates are apportioned taluk-wise. The Annual Replenishable Ground Water Resource of the state is 16.81 bcm and the Net Annual Ground Water Availability is 14.81 bcm. The Annual Ground Water Draft is 10.01 bcm and the Stage of Ground Water Development in the state is 68%. The total number of Taluks in Karnataka is 176. The assessment was carried out in command, non-command basis. Thus, out of 270 assessment units, 71 are categorized as Over-exploited, 11 as Critical, 34 as Semi-critical, and 154 are Safe. The Over-exploited assessment units are concentrated in the north western part of the State particularly in Belgaum and Bagalkot, south eastern part of the State in the districts of Bangalore Rural, Bangalore Urban, Kolar, Chikaballapur, Ramanagaram, Tumkur and in the central districts of Koppal, Bellary, Chitradurga and Davangere.

There has been marginal increase in the annual replenishable resource in 2009. However, even though there is a growth in number of irrigation structures by about 5%, the total groundwater draft in 2009 is reduced by about 7% compared to 2004. This is cumulative effect of various contributory factors viz. reduction in yield due to mutual interference of the bore wells in the OE area, reduction in draft due to the restriction in availability of electricity and farmers resorting advanced irrigation practices like micro irrigation as against the traditional flood irrigation especially in OE districts like Kolar.

KERALA

The state is underlain by diverse rock types of different geological ages from Pre-Cambrian to Recent. As much as 88% of the State is underlain by hard rocks and ground water is being tapped mostly through dug wells constructed in the weathered zone. Yields of open (dug) wells vary from 2 to

10 m³/day (about 0.0003 lps) whereas that of bore wells ranges from less than 1 to 5 lps. About 12% of the State is underlain by Semi-consolidated and unconsolidated sedimentary formations where dug wells and filter points generally have yields of 1 to 10 lps. Laterites, which cover most of the geological formations in the major part of the state also forms an important aquifer in the state with dug wells having yields in the range of 0.5 to 6 m³/day (about 0.0002 lps).

The Ground water resources have been assessed block-wise. The Annual Replenishable Ground Water Resource of the State has been estimated as 6.62 bcm and Net Annual Ground Water Availability is 6.03 bcm. The Annual Ground Water Draft is 2.81 bcm and Stage of Ground Water Development is 47%. Out of 152 blocks, 1 has been categorized as 'Over-exploited', 3 as 'Critical', 22 as 'Semi-Critical' and 126 as 'Safe'. Comparatively high development of ground water has been observed in Kasargod, Palakkad and Thiruvananthapuram districts.

As compared to 2004 estimate, the Net Ground Water Availability and Gross Ground Water Draft as in 2009 have decreased by about 3% and 4% respectively, resulting in the Stage of Ground Water Development remaining at about 47% in both the estimates. The changes in the recharge and draft parameters in respect of assessment units are due mainly to the reduction in the irrigation draft and modification of parameter values in the light of information gathered during subsequent field studies.

MADHYA PRADESH

The state is underlain by formations ranging in age from Archaean to Recent, a greater part is occupied by granite, gneisses and metasedimentary rocks. Deccan traps also occupy a larger area. In the area occupied by hard rocks, dug wells and dug cum bore wells are the most common structures. The open wells tapping hard rocks yield varies between 1-5 lps whereas in Vindhyanas and Gondwanas the yield ranges from 2-5 lps. The dug cum bore wells tapping the Deccan traps yield 15-20 lps and shallow tube wells in alluvium yield 10-18 lps.

Dynamic ground water resources have been assessed block-wise in Madhya Pradesh. The Annual Replenishable Ground Water Resource of the state has been assessed as 33.95 bcm and Net Annual Ground Water Availability as 32.25 bcm. The Annual Groundwater Draft in the state is 17.99 bcm and the Stage of Ground Water Development is 56%. Out of 313 assessment blocks 24 have been categorized as Over-exploited, 4 as Critical, 61 as Semi-critical and 224 as Safe. In Madhya Pradesh, the ground water development concentrates mainly in the western (Malwa Region), central (Narsinghpur districts) northern part, Budelkhand Region and part of Baghelkhand Region of the state. The other part of the state has very low development of ground water.

There has been marginal decrease in the assessment of replenishable ground water resources of the State in the present estimate as compared to 2004 estimate. The Ground Water Draft has increased by about 5% during the same period.

MAHARASHTRA

The State is underlain by diverse rock types of different geological ages from Pre-Cambrian to Recent. Large part of the State is underlain by Basaltic hard rocks where dug wells are predominant. They mostly tap the weathered zone. The yield of dug wells varies from 3 to 5 lps. However, in few district bore wells are becoming more popular and they tap both shallow as well as deeper aquifers. A small part of the State is occupied by Semi-consolidated sedimentary rocks where tube wells have average yield of 10 to 30 lps.

The Ground water resources have been assessed watershed wise and subsequently apportioned into block-wise. The Annual Replenishable Ground Water Resource of the State has been estimated as 35.73 bcm and Net Annual Ground Water Availability is 33.81 bcm. The Annual Ground Water Draft is 16.95 bcm and Stage of Ground Water Development is 50%. Out of 353 blocks, 9 have been categorized as over-exploited, 1 critical, 19 semi-critical and remaining 324 as Safe. The ground water development is mainly

concentrated in the central part of the state in the drought prone areas. Over-exploited, critical and semi-critical taluks are mostly located in these areas and also in the areas irrigating water guzzling crops.

As compared with 2004 estimate, there is increase in Annual Replenishable Ground Water Resources in 2009 by about 8% which is mainly attributed to increase in the rainfall recharge. Increased activity on water conservation has also contributed to enhancement in annual replenishable resource. The Ground Water Draft has increased by about 12% during the same period. This has resulted in increasing the number of over-exploited blocks from 7 to 9 compared to 2004.

MANIPUR

The Manipur valley is underlain by thin veneer of alluvial deposit and underlain by semi-consolidated rocks of Tertiary age. Since the upper formation is silty and clayey open wells have poor yield prospects.

Assessment of ground water resources has been done in the valley areas of blocks. The Annual Replenishable Ground Water Resource is 0.44 bcm and Net Annual Ground Water Availability is 0.40 bcm. The Annual Ground Water Draft is 0.004 bcm and Stage of Ground Water Development is 1%. All the blocks have been categorized as Safe.

In Manipur, annual replenishable ground water resources have increased by 16% as compared to previous estimate, because of the inclusion of additional area feasible for natural recharge of ground water. Ground water draft has also increased in the State by many folds because of the same reason.

MEGHALAYA

The northern part of the state is covered by consolidated formations with basic and acid intrusive. The semi-consolidated sandstone with other sedimentary rocks covers the entire south-western and south eastern part of

the state. The unconfined zone in river fill areas is tapped with shallow tube wells, the yield varies from 7 to 12 lps.

Assessment of dynamic ground water resources were carried out in the valley areas of the districts. The Annual Replenishable Ground Water Resource is 1.23 bcm and Net Annual Ground Water Availability is 1.11 bcm. The Annual Ground Water Draft is 0.002 bcm and Stage of Ground Water Development is 0.15%. All the districts (Valleys) in state have been categorized as Safe.

There is no significant change is the present estimates as compared to 2004 assessment.

MIZORAM

Major part of the state is occupied by hills and semi-consolidated rocks of Tertiary age and state of Mizoram are an abode of springs. Studies indicate good scope of tapping ground water in river beds with sumps connected to infiltration galleries. The ground water of the unconfined zone mostly emanates in the form of springs which are being used as source of water supply.

Ground water assessment in Mizoram was carried out in the valley areas of the administrative blocks. The Annual Replenishable Ground Water Resource is 4388 ham (0.04 bcm) and Net Annual Ground Water Availability is almost unchanged. The Annual Ground Water Draft is about 43 ham (0.0004 bcm) and Stage of Ground Water Development is 1%. All the districts (valley area) in state have been categorized as Safe.

There is no significant change is the present estimates as compared to 2004 assessment.

NAGALAND

The state is mostly covered by hilly terrains having slope more than 20%. The consolidated / semi-consolidated formations are confined to south eastern part of the state along the Burma border and the unconsolidated alluvial

plains in the northern part of the state. The open wells are not very common structure. However, in the valley area it can yield up to 15 lps.

Ground water resources assessment was done in the valley areas of the districts. The Annual Replenishable Ground Water Resource is 0.42 bcm and Net Annual Ground Water Availability is 0.38 bcm. The Annual Ground Water Draft is 0.01 bcm and Stage of Ground Water Development is 2%. Entire state has been categorized as Safe.

There is no significant change is the present estimates as compared to 2004 assessment.

ORISSA

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

The Ground water resources in the state have been assessed block-wise. The Annual Replenishable Ground Water Resource of the State has been estimated as 17.78 bcm and Net Annual Ground Water Availability is 16.69 bcm. The Annual Ground Water Draft is 4.36 bcm and Stage of Ground Water

Development is 26%. Out of 314 Blocks spanning across 30 districts of the state, 308 blocks have been assessed as safe and remaining 6 blocks are saline. In Orissa, the ground water development is mostly concentrates in the eastern part of the state where irrigation usage is dominant.

As compared to the last assessment of 2004, there has been an overall decrease in annual replenishable ground water resource of 23%, where as the gross ground water draft has increased by around 13% leading to an overall increase in stage of ground water development by 8% over the last assessment. Decrease in replenishable resources is mainly attributed to the revision in the Specific yield values based on field studies, which led to refinements in recharge parameters used in resources assessment.

PUNJAB

The state is mainly underlain by Quaternary alluvium of considerable thickness which abuts against the semi-consolidated formation of Siwalik System towards northeast. The development of phreatic aquifer is through shallow tube wells, filter points and dug wells. The yield of these wells generally varies from 7 to 15 lps.

Ground water resources in the State have been assessed block-wise. The Annual Replenishable Ground Water Resources of the state have been assessed as 22.56 bcm and the Net Annual Ground Water Availability is 20.35 bcm. The Annual Ground Water Draft is 34.66 bcm and the Stage of Ground Water Development is 170 % leaving little scope for further development of dynamic resource except few pockets. Out of 138 blocks, 110 blocks have been categorized as Over-exploited, 3 as Critical, 2 as Semi-critical and 23 as Safe.

There has been marginal decrease in the overall recharge estimates of the State between the 2004 and 2009 assessments. However in some blocks, due to excess seepage from canal network due to remodeling and addition of new canals have enhanced the ground water recharge. Ground water draft

has been increased by 11% in the 2009 estimates as compared to the 2004 assessment.

RAJASTHAN

Nearly 40% of the state area is occupied by the hard rocks. Unconsolidated and semi consolidated formations occupies major part of the state. Windblown sands form moderately potential aquifer at places in the western Rajasthan. The dug wells tapping consolidated formations yield up to 5 lps whereas in unconsolidated formation maximum yield is up to 10 lps.

Dynamic ground water resources in the State of Rajasthan have been assessment administrative block-wise. The Annual Replenishable Ground Water Resource in the state is 11.86 bcm and the Net Annual Ground Water Availability is 10.79 bcm. Annual Ground Water Draft is 14.52 bcm and Stage of Ground Water Development is 135% leaving little scope for further development of dynamic ground water resources. Out of 239 blocks, 166 (about 69%) have been categorized as Over-exploited, 25 as Critical, 16 as Semi-critical, 31 as Safe and 1 as Saline. Groundwater recharge in Thar desert areas of Western Rajasthan is mostly less owing to arid climatic conditions (low rains & high evaporation) and ground water development is also relatively less due to constraints of deep groundwater levels & inferior quality as well as availability of canal water in parts. The arid climate of Western Rajasthan viz. Barmer, Bikaner and Jaisalmer, has strong influence on the ground water recharge mechanism. In these areas, lateral recharge predominates over vertical recharge. Due to availability of canal water and poor quality of groundwater, the blocks in Ganganagar and the Hanumangarh districts fall in Safe category, Hard rock areas of Aravalli hills are vulnerable to water crisis during spell of drought due to their limited scope for dynamic recharge to groundwater. Groundwater development in alluvial plain areas especially on either side of Aravalli Hill Range is on higher side and most of the blocks fall in Over-exploited category.

There is marginal increase in ground water recharge estimates in 2009 as compared to 2004. The ground water draft in the State has increased by about 12% since the last (2004) assessment.

SIKKIM

Sikkim is a small mountainous state characterized by rugged topography with series of ridges and valleys. The various rock types prevalent in the state are Pelitic and Carbonate rocks. Gondwanas and occasional alluvial terrains along streams and river courses. Ground water occurs largely in disconnected localized pockets and in deeper fractures zones, springs are the main sources of water. The total discharge of the springs is about 0.046 bcm and its annual utilization for domestic purpose is about 0.01 bcm. The stage of development is 21%.

There is marginal decrease net annual ground water availability in the state in 2009 as compared to 2004.

TAMIL NADU

The Tamil Nadu state is underlain by diverse hydrogeological formations, nearly 73% of the state is occupied by hard rocks, the semi consolidated and consolidated formations are mainly confined in the eastern part including the coastal tract. In the hard rock area, ground water is mainly developed through dug wells and dug cum bore wells tapping the weathered zone, the yield of open wells vary from 1 – 3 lps, whereas in dug wells tapping soft rocks including sedimentaries, the yield is up to 5 lps.

Dynamic ground water resources have been assessed block-wise. The Annual Replenishable Ground Water Resource of the state has been estimated as 22.94 bcm and Net Annual Ground Water Availability is 20.65 bcm. The Annual Ground Water Draft is 16.56 bcm and Stage of Ground Water Development is 80% leaving limited scope for further development of the dynamic ground water resources. Out of 386 assessment units (blocks), 139 have been categorized as Over-exploited, 33 as Critical, 67 as Semi-critical, 136 as Safe and 11 as Saline. Greater ground water development is noticed

in the Central part of the State and it is brought out in the category map showing concentration of Over-exploited and Critical block in a linear pattern extending along NE-SW direction in the Central part of the State.

There has been about 6% decrease in the estimates of ground water draft in 2009 as compared to 2004. This is attributed to reduction in irrigation draft due to urbanization in some areas and reduction in usage of dug wells for domestic use. Further, recharge has enhanced in some areas because of increase in normal rainfall and enhanced activity of water conservation and canal irrigation.

TRIPURA

The semi-consolidated formations consisting of friable sandstone, sandy shale etc. of tertiary age forms the main rock type of the area. The unconfined aquifer is mainly tapped through shallow wells with a discharge of 5 to 15 lps in the valley areas whereas in the sandstone, the yield varies from 2 to 4 lps.

Ground water resources in the state have been assessed in the block-wise. The Annual Replenishable Ground Water Resource is 2.97 bcm and Net Annual Ground Water Availability is 2.74 bcm. The Annual Ground Water Draft is 0.16 bcm and Stage of Ground Water Development is 6 %. All the blocks in the state have been categorized as Safe.

There has been 36% increase in the assessment of replenishable resources because of the inclusion of additional area feasible for natural recharge of ground water.

UTTAR PRADESH

The state of Uttar Pradesh is categorized with five distinct hydrogeological units – Bhabar, Terai, Central Ganga Plains, Marginal Alluvial Plain, Southern Peninsular area. Bhabar is mainly the recharge zone having deeper water levels. The ground water development in phreatic aquifer is through hand pumps, dug wells, dug cum bore wells and shallow tube wells. The yield from these wells has been generally found to be in the range of 40 to 60 lps. Terai zone lies between Bhabar in the North and Central Ganga Plain in the South.

It is characterized by fine grained sediments with occasional pebbles and boulders. The average yield of tube wells constructed in this zone varies from 30 to 60 lps at moderate drawdowns. Central Ganga Plain constitutes the most promising ground water repository characterized by multi-layered aquifer systems. The yield of the open wells and hand pumps constructed in the phreatic aquifer vary from 5 to 10 lps. The tube wells in the phreatic aquifer yield between 20 and 28 lps at 6 to 8 m drawdowns. Marginal alluvial plain consists of kankar mixed clay-silt beds intercalated with sand and gravel lenses. The aquifer in this area is capable of yielding 15 to 40 lps at moderate drawdowns. Southern Peninsular Region is characterized by sedimentary formations (sandstone, quartzite, limestone, shale). The wells tapping these formations generally recorded yield between 2 and 8 lps.

The assessment unit for ground water resources assessment in the state of Uttar Pradesh is block. The Annual Replenishable Ground Water Resource of the state has been estimated as 74.72 bcm and Net Annual Ground Water Availability is 68.57 bcm. The Annual Ground Water Draft is 49.48 bcm and Stage of Ground Water Development is 72%. Out of 820 assessment units (blocks), 76 have been categorized as Over-exploited, 32 as Critical, 107 as Semi-critical and 605 as Safe.

The estimates of Replenishable ground water resources have decreased by about 1% as compared to the previous estimate of 2004. On the other hand, there has been a marginal increase of similar magnitude in the ground water draft in the present estimate as compared to 2004.

UTTARAKHAND

The predominantly hilly state of Uttarakhand has a varied hydrogeological set up consisting of Gangetic alluvial plain and Himalayan mountain belt. Ground water in hilly region is mostly tapped through springs and dug wells / hand pumps. The dug wells and hand pumps yield up to 1 lps.

Ground water resources have been assessed in the valley areas of the administrative blocks. The Annual Replenishable Ground Water Resource of

the state has been assessed as 2.17 bcm and Net Annual Ground Water Availability is 2.07 bcm. The Annual Ground Water Draft is 1.05 bcm and Stage of Ground Water Development is 51%. Out of 17 assessment units (blocks), 1 has been categorized as critical, 5 as Semi-critical and 11 as Safe.

There has been around 24% decrease in the ground water draft as compared to 2004 estimate. The reason for the decrease has been attributed to varying source of data used for draft computation. Present estimates are based on latest Minor Irrigation Census data while the 2004 estimates were based on projected figures of ground water structures.

WEST BENGAL

Nearly two third area of the state is occupied by unconsolidated sediments, the western part of the state is partly occupied by the hard rocks. The phreatic aquifer is generally developed through dug well, dug cum bore well and shallow tube well. The yield of these wells varies from 1-5 lps.

Ground water resources have been assessed block-wise. The Annual Replenishable Ground Water Resource of the State has been estimated as 30.50 bcm and Net Annual Ground Water Availability is 27.58 bcm. The Annual Gross Ground Water Draft is 10.91 bcm and Stage of Ground Water Development is 40%. Out of 269 assessed blocks, 38 have been categorized as Semi-critical and remaining 231 as Safe.

There have been marginal changes in the assessment of ground water resources and its utilization in the State during the present assessment as compared to 2004 estimates.

LAKSHADWEEP ISLANDS

The Lakshadweep Islands are underlain by coral sands of recent origin. Ground water occurs under phreatic condition and water levels are strongly influenced by tides. Dug wells are the common ground water abstraction structures in the Islands.

Dynamic ground water resources in the islands have been computed for individual islands by computing various components of recharge and draft. Rainfall is the only source of recharge in the Islands, whereas domestic draft, evapotranspiration losses and water loss due to outflow into the sea are the major components of draft. A part (20%) of the annual water surplus is reserved as buffer zone for reserve during delayed or deficit monsoon years.

As per the computation, the total annual surplus of ground water in the islands amount to 1054 ham (0.011 bcm). The annual ground water draft taking all the island together is 259 ham (0.0026 bcm). The stage of ground water development for the group of islands is of the order of 74 %. Based on the Stage of Development, Agatti, Amini, Androth and Kavaratti Islands have been categorized as 'Semi-Critical', whereas the remaining islands have been categorized as 'Safe'.

A comparison with the earlier estimate of 2004 indicate significant rise in the draft component in all the islands due to the population increase. As a consequence, the domestic draft has increased in all the Islands, which has resulted in significant increase in the Stage of development.

PUDUCHERRY

The U.T. of Puducherry is underlain by the semi-consolidated and unconsolidated sedimentary formations which mainly sustains dug wells and shallow and deep tube wells. The yield of wells generally varies between 3 and 15 lps. High yielding wells in the range of 10 to 40 lps exist in the Tertiary Sandstone.

The Annual Replenishable Ground Water Resource of the State has been estimated as 0.17 bcm and Net Annual Ground Water Availability is 0.15 bcm. The Annual Gross Ground Water Draft is 0.15 bcm and Stage of Ground Water Development is 98%. Out of 4 assessed regions, 1 has been categorized as Over-exploited, 2 have been categorized as Safe and remaining 1 is saline.

The re-assessment of Dynamic resources of UT of Puducherry has shown that

marginal increase in the annual replenishable resource as compared 2004 estimate. However, the ground water draft estimate in Puducherry and Karaikal regions show reduction as compared to the previous estimate (2004), which is also reflected in the reduction in cropped area. In Mahe Region, an increase in draft is seen, because Mahe is an urban agglomeration and the groundwater extraction is mainly for domestic needs, which has increased due to the increase in population density.

5.6 Reasons for improvement in the status of Categorization of Assessment Units (from 2004 to 2009 assessment)

A comparison of ground water resources assessment of 2009 with the earlier assessment of 2004 indicated that in case of some assessment units, the Categorization status has changed from Over-exploited/Critical blocks (2004 assessment) to other categories viz. Critical/ Semi-critical/ Safe blocks (2009 assessment). This issue was discussed in detail in the meeting of the Central Level Expert Group on over-all supervision of the re-assessment of ground water resources in the entire country. The Central Level Group advised the concerned States to carry out a detailed analysis to find out the reasons for such changes. Such changes have mostly occurred in case of few blocks within the State. In some States, there is an overall reduction in the number of Over-exploited/ Critical blocks in 2009 assessment as compared to 2004. The reasons for changes from OE/Critical (2004) to Other Category (2009) are given in **Appendix – F**.

In general, the reasons for changes are attributed to enhancement in recharge because of localized improvement in rainfall pattern, increased activity on rainwater harvesting and water conservation measures etc. In addition, management practices like efficient water use practices with community participation, increased awareness etc. also helped in controlling the utilization of ground water resources in stressed areas. The various parameters used for recharge and draft assessments have also been refined based on latest field studies and sample surveys. This has also resulted in changes in category. In majority of the cases, it is the combination of the

above mentioned reasons which have brought in the changes in category.

CHAPTER 6

CONCLUSION

The annual replenishable ground water resources of the country have been reassessed as 431 bcm as on March, 2009. The main source of ground water resources is recharge through rainfall which contributes to about 68% of the total annual replenishable resources. The annual replenishable ground water resources of the country as a whole do not indicate any appreciable change from previous assessments. However there have been significant variations at the scale of assessment units (blocks / watershed) at several places mainly because of – localized changes in rainfall pattern during last few years, ground water management interventions and improved database resulting in refinements in assessments.

The net annual ground water availability of the country has been assessed as 396 bcm after keeping a provision for natural discharge. There is an overall increase in the ground water withdrawal in the country since 2004. The annual ground water draft of the country as on March, 2009 is 243 bcm. The largest use is in irrigation sector (about 91%). The stage of ground water development for the entire country has been computed as 61%. There utilization pattern is however uneven across the country resulting in ground water stressed conditions in some parts of the country while in other areas, ground water utilization have been sub-optimal. In 2009, assessments were carried out in 5842 assessment units (blocks/mandals/taluks) in the country, out of which around 14% are categorized as Over-exploited. The critical units are 3% of the total assessment units, semi-critical 9% and safe are 73%. The remaining units (less than 1%) are having totally saline ground water. The over-exploitation of ground water resources are caused by various region-specific reasons which are broadly spread over three different parts of the country. The assessment units located in the north-western part of the country in the states of Punjab, Haryana, Delhi and western Uttar Pradesh have plenty

of replenishable ground water resources but because of unregulated extraction beyond the ground water recharge limits, most of these units are Over-exploited. Over-exploited units are also common in western part of the country particularly in Rajasthan because of arid climate resulting in less recharge of ground water and hence stress on the resource. In peninsular India, over-exploited units are widespread in the states of Karnataka and Tamil Nadu which is mainly because of lesser availability due to the poor aquifer properties of the hard rock terrains prevalent in the region.

Some areas show changes in categorization of assessment units from Over-exploited and Critical (2004) to Semi-critical and Safe (2009) reflecting improved ground water condition. These are because of enhanced recharge and controlled withdrawal as a result of normal and excess rainfall in the intervening period since previous assessment (2004) and proactive ground water management measures through Govt. and private initiatives. Future ground water management practices should be upscaled in similar directions viz. augmentation and conservation measures in ground water stressed areas. It is also observed that in eastern and north eastern India, replenishable ground water resources are high (>0.5 m), however ground water development have been low and hence the assessment category is Safe. These areas are suitable for planned ground water development in future.

Effective management of ground water requires accurate assessment of the resources. Therefore continuous refinements in the assessment are necessary to improve the confidence level which will ensure judicious implementation of proactive management practices. Some of the issues concerning improvements in ground water resources assessment have been discussed in the Way Forward.

CHAPTER 7

WAY FORWARD

Assessment of dynamic ground water resources as on 31st March, 2009 was carried out by the States and CGWB following the Ground Water Assessment Methodology-1997. The results of assessment reflect the generalized ground water scenario in an assessment unit. Based on the category of the assessment unit, the ground water management measures are proposed. The Safe blocks are generally recommended for further ground water development and in Critical and Over-exploited blocks, water conservation and regulations measures are adopted. Considering the significance of this exercise in identification of areas for ground water management, continuous endeavor is required to bring in refinements in assessment. Some important issues which require immediate attention and deliberation are enumerated below.

- a. *Strengthening of database:* The most crucial factor determining the accuracy of assessment is the database used for the exercise. The data elements used in resources assessment can broadly be classified into three types - *Spatial data* like areal and morphological details of the assessment units and water bodies, land use pattern etc., *Measured data* like rainfall, canal flow, water level etc., and *Parameters* like specific yield, rainfall recharge factor, canal seepage factor, unit draft (withdrawal) of well etc (NABARD, 2006). Continuous strengthening of all the three types of database is required to bring in further refinements in the assessment. Benchmarking of the data elements used for assessment is essential in this regard. The quality and intensity of spatial and measured data needs to be improved upon by the Central and State Govt. agencies. The refinements of norms of parameters need to be taken up through R&D support in the form of Project based studies. Progressive refinements in data sampling method particularly for determination of parameters like specific yield and draft assessment is required. A procedure for data validation also needs to be established.

- b. *Setting up dedicated Groundwater Resources Assessment Cell in the States:* Groundwater resources assessment is a continuous process and there is an urgent need to setup Groundwater Resources Assessment Cell in each State Ground Water Department with dedicated manpower for continuous updation of database, periodical groundwater resources assessment, field validations of the estimates and refinements of norms for various parameters. Intervention of Planning Commission and necessary support of Ministry of Water Resources, Govt. of India are required to institutionalize the dedicated cells at State level.
- c. *Quantity considerations in ground water resources assessment:* At present, only Salinity component of ground water quality is considered in ground water resources assessment and fresh ground water resources has been assessed excluding the areas having salinity problem. The other components of ground water quality should also be considered similarly.
- d. *Software for ground water assessment:* Ground water resources assessment involves elaborate computation procedure and hence dedicated computer software is required for the purpose. Common software for the country-wide assessment is therefore recommended for centralized storage and processing of the data related to ground water assessment. The existing softwares being used by various agencies may be reviewed and CGWB and states need to work together to develop a common user friendly software.
- e. *Periodicity and scale of assessment:* The assessment of ground water resources involves computation of ground water recharge under normal rainfall scenario at periodical interval of around five years. A study of yearly assessment of ground water resources may taken up on pilot basis to evolve a methodology for assessment and also to find out the utility and feasibility of adopting the procedure for the entire country.

Similarly, as suggested in GEC-1997, ground water assessment in 'Doab' (land area enclosed between two major streams) in alluvial areas and micro-level assessment in hard rock areas may be taken up in few identified areas and

practically of switching over to doab and micro-level unit for the entire alluvial plain and hard rock States respectively can be evaluated.

f. *Application of alternate methods for recharge assessment and remote sensing technique in ground water resources assessment:* Ground water recharge through alternate methods may be taken up in few identified assessment units to cross-check the assessment figures arrived at using GEC. Also applicability of remote sensing technique to provide/refine the inputs (such as runoff and recharge areas, sources of localized recharge, spatial recharge patterns, crop consumptive use patterns, etc.) for recharge assessment to be explored.

g. *Linkage between assessment and management:* Various factors influence the availability and utilization of ground water resources and categorization of assessment units viz. natural factors e.g. rainfall, aquifer properties, water level, quality etc. and man-made factors such as Land use pattern, population density, water requirement for various purposes etc.

Detailed analysis of these factors would help in better understanding of the main driving forces influencing the categorization of a block. Further, this would also help in suggesting area specific ground water management options. The ground water assessment report may therefore be followed by a study to establish the linkage between the assessment and management of ground water resources including various augmentation and conservation measures like artificial recharge and rainwater harvesting and ground water regulation.

ANNEXURE - I

**STATE-WISE GROUND WATER RESOURCES
AVAILABILITY, UTILIZATION AND STAGE OF
DEVELOPMENT, INDIA
(AS ON MARCH, 2009)**

**STATE-WISE GROUND WATER RESOURCES AVAILABILITY, UTILIZATION AND STAGE OF DEVELOPMENT
INDIA**

Sl. No.	States / Union Territories	Annual Replenishable Ground Water Resource					Natural Discharge during non-monsoon season	Net Annual Ground Water Availability	Annual Ground Water Draft			Projected demand for Domestic and Industrial uses upto 2025	Ground Water Availability for future irrigation use	Stage of Ground Water Development (%)					
		Monsoon Season		Non-monsoon Season		Total			Irrigation	Domestic and industrial uses	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					
	States																		
1	Andhra Pradesh	15.12	6.52	5.49	6.70	33.83	3.07	30.76	12.61	1.54	14.15	2.69	15.89	46					
2	Arunachal Pradesh	3.41	0.0003	1.04	0.0004	4.45	0.45	4.01	0.002	0.001	0.003	0.01	4.00	0.07					
3	Assam	18.95	2.20	8.62	0.59	30.35	2.537	27.81	5.333	0.69	6.026	0.977	21.50	22					
4	Bihar	18.92	3.92	3.40	2.38	28.63	2.42	26.21	9.79	1.56	11.36	2.56	13.85	43					
5	Chhattisgarh	9.85	0.56	0.91	0.90	12.22	0.64	11.58	3.08	0.52	3.60	0.64	7.85	31					
6	Delhi	0.11	0.10	0.02	0.08	0.31	0.02	0.29	0.14	0.26	0.40	0.26	0.01	138					
7	Goa	0.135	0.008	0.006	0.072	0.221	0.088	0.133	0.014	0.030	0.044	0.037	0.082	33					
8	Gujarat	12.21	2.76	0.00	3.46	18.43	1.08	17.35	11.93	1.05	12.99	1.47	5.32	75					
9	Haryana	3.53	2.69	1.01	3.25	10.48	0.68	9.80	11.71	0.72	12.43	0.79	-2.70	127					
10	Himachal Pradesh	0.40	0.02	0.12	0.04	0.59	0.06	0.53	0.23	0.08	0.31	0.08	0.22	58					
11	Jammu & Kashmir	1.45	1.69	0.36	0.19	3.70	0.37	3.33	0.15	0.58	0.73	0.82	2.35	22					
12	Jharkhand	4.46	0.14	1.11	0.26	5.96	0.55	5.41	1.17	0.44	1.61	0.62	3.62	30					
13	Karnataka	6.30	4.28	2.73	3.51	16.81	2.00	14.81	9.01	1.00	10.01	1.26	6.18	68					
14	Kerala	4.77	0.06	0.64	1.15	6.62	0.59	6.03	1.30	1.50	2.81	1.71	3.02	47					
15	Madhya Pradesh	27.49	1.10	0.80	4.56	33.95	1.70	32.25	16.66	1.33	17.99	1.83	13.76	56					
16	Maharashtra	22.04	2.67	1.90	9.12	35.73	1.93	33.81	15.91	1.04	16.95	2.00	16.32	50					
17	Manipur	0.24	0.01	0.19	0.01	0.44	0.04	0.40	0.0033	0.0007	0.0040	0.05	0.35	1					
18	Meghalaya	1.0191	0.0000	0.2152	0.0000	1.2343	0.1234	1.1109	0.0015	0.0002	0.0017	0.0964	1.0131	0.15					
19	Mizoram	0.03	Negligible	0.02	Negligible	0.044	0.004	0.039	0.000	0.0004	0.0004	0.0008	0.039	1					
20	Nagaland	0.28	-	0.14	-	0.42	0.04	0.38	-	0.008	0.008	0.01	0.36	2.14					
21	Orissa	11.29	2.53	1.33	2.63	17.78	1.09	16.69	3.47	0.89	4.36	1.27	11.94	26					
22	Punjab	5.86	10.57	1.34	4.78	22.56	2.21	20.35	33.97	0.69	34.66	0.95	-14.57	170					
23	Rajasthan	8.76	0.67	0.32	2.11	11.86	1.07	10.79	12.86	1.65	14.52	1.84	0.75	135					
24	Sikkim	-	-	-	-	-	-	0.046	0.003	0.007	0.010	0.012	0.031	21					
25	Tamil Nadu	7.54	11.05	2.16	2.18	22.94	2.29	20.65	14.71	1.85	16.56	1.97	4.70	80					
26	Tripura	1.66	0	0.73	0.57	2.97	0.23	2.74	0.09	0.07	0.16	0.23	2.42	6					
27	Uttar Pradesh	40.78	11.37	5.41	17.70	75.25	6.68	68.57	46.00	3.49	49.48	5.36	17.22	72					
28	Uttarakhand	1.26	0.24	0.20	0.46	2.17	0.10	2.07	1.01	0.03	1.05	0.08	0.98	51					
29	West Bengal	18.17	2.16	5.43	4.74	30.50	2.92	27.58	10.11	0.79	10.91	1.02	16.75	40					
	Total States	246.05	67.32	45.63	71.45	430.45	34.99	395.52	221.29	21.83	243.14	30.65	153.26	61					
	Union Territories																		
1	Andaman & Nicobar	0.245	-	0.065	-	0.310	0.012	0.298	0.0006	0.010	0.011	0.015	0.283	4					
2	Chandigarh	0.015	0.001	0.005	0.001	0.022	0.002	0.020	0.000	0.000	0.000	0.000	0.020	0.000					
3	Dadara & Nagar Haveli	0.043	0.003	0.009	0.005	0.059	0.003	0.056	0.001	0.007	0.009	0.009	0.047	15					
4	Daman & Diu	0.010	0.001	0.000	0.002	0.012	0.001	0.011	0.008	0.003	0.011	0.004	-0.001	99					
5	Lakshadweep	-	-	-	-	0.0105	0.0070	0.0035	0.0000	0.0026	0.0026	0.0000	0.0000	74					
6	Puducherry	0.086	0.056	0.008	0.022	0.171	0.017	0.154	0.121	0.029	0.150	0.032	0.050	98					
	Total Uts	0.40	0.06	0.09	0.03	0.59	0.04	0.54	0.13	0.05	0.18	0.06	0.40	34					
	Grand Total	246.45	67.38	45.71	71.48	431.03	35.03	396.06	221.42	21.89	243.32	30.71	153.66	61					

ANNEXURE - II

**DISTRICT-WISE GROUND WATER
RESOURCES AVAILABILITY, UTILIZATION
AND STAGE OF DEVELOPMENT
(AS ON MARCH, 2009)**

**GROUND WATER RESOURCES AVAILABILITY, UTILIZATION AND STAGE OF DEVELOPMENT
ANDHRA PRADESH**

Sl. No.	District	Annual Replenishable Ground Water Resource					Natural Discharge During Non Monsoon Period	Net Ground Water Availability	Annual Ground Water Draft			Projected demand for Domestic and Industrial uses upto 2025	Net Ground Water Availability for Future Irrigation use	Stage of Ground Water Development (%)		
		Monsoon Season		Non Monsoon Season		Total			Irrigation	Domestic & Industrial Water Supply	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		
1	Srikakulam	37596	26243	26031	9896	99766	7050	92716	23078	4139	27217	9210	60575	29		
2	Vizianagaram	40428	15860	27151	6751	90190	8337	81853	16360	873	17233	6666	58827	21		
3	Visakhapatnam	54123	5993	11393	6874	78383	6694	71689	21390	1710	23100	12035	38264	32		
4	East Godavari	47721	48712	33079	34022	163534	15552	147982	29193	3936	33129	12700	106111	22		
5	West Godavari	47296	41726	22148	41447	152617	14027	138590	47077	2347	49424	7409	84104	36		
6	Krishna	43331	57967	22656	58588	182542	17507	165035	43038	11760	54798	16623	107202	33		
7	Guntur	39838	103884	30497	17264	191483	19066	172417	23823	8110	31933	16004	132582	19		
8	Prakasam	33058	32278	46728	46155	158219	15734	142485	37179	4320	41499	8610	97530	29		
9	Nellore	110973	49949	1820	74172	236914	21349	215565	73715	5447	79162	10948	130902	37		
10	Chittoor	126260	11552	10869	20105	168786	14929	153857	81677	34420	116097	37478	40973	75		
11	Kadapa	39595	18107	42486	16326	116514	11475	105039	59260	5934	65194	6600	40438	62		
12	Anantapur	62425	17634	43053	29661	152773	9139	143634	103703	8408	112111	12623	36235	78		
13	Kurnool	56561	23110	28347	24416	132434	11578	120856	37504	3681	41185	12485	70873	34		
14	Mehaboobnagar	79746	26429	29150	29135	164460	15628	148832	66232	5680	71912	11283	71653	48		
15	Rangareddy	42051	5651	12249	8313	68264	6065	62199	33572	12564	46136	17921	17195	74		
16	Sangareddy	67576	13329	16248	19095	116248	11210	105038	86387	2313	88700	7793	15780	84		
17	Nizamabad	64612	22479	16046	32094	135231	11553	123678	92449	1776	94225	5678	28233	76		
18	Adilabad	113268	16698	18564	15474	164004	15635	148369	29472	11003	40475	13787	105117	27		
19	Karimnagar	84573	18883	17486	39709	160651	14776	145875	64535	5085	69620	12955	68659	48		
20	Warangal	100682	37896	26162	40512	205252	19834	185418	132596	5049	137645	8422	51139	74		
21	Khammam	137989	14624	37646.96	31766.2022	222026	19199	202827	54188	6100	60288	10635	138953	30		
22	Nalgonda	82160	42958	29537	68269	222924	20815	202109	104477	8941	113418	10814	87357	56		
	State total (ham)	1511862	651962	549347	670044.202	3383215	307152	3076063	1260905	153596	1414501	268679	1588702	46		
	StateTotal (bcm)	15.12	6.52	5.49	6.7	33.83	3.07	30.76	12.61	1.54	14.15	2.69	15.89	46		

**GROUND WATER RESOURCES AVAILABILITY, UTILIZATION AND STAGE OF DEVELOPMENT
ARUNACHAL PRADESH**

Sl. No.	District	Annual Replenishable Ground Water Resource					Natural Discharge During Non Monsoon Period	Net Ground Water Availability	Annual Ground Water Draft			Projected demand for Domestic and Industrial uses upto 2025	Net Ground Water Availability for Future Irrigation use	Stage of Ground Water Development (%)		
		Monsoon Season		Non Monsoon Season		Total			Irrigation	Domestic & Industrial Water Supply	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		
1	Tirap	8718	0	2283	0	11000	1100	9900	3	0	3	108	9789	0.0282		
2	Changlang	21688	18	7113	27	28845	2884	25960	26	0	26	156	25779	0.0982		
3	Lohit	143000	0	51480	0	194480	19448	175032	5	0	5	197	174830	0.003		
4	Anjaw	-	-	-	-	-	0	-	0	0	0	0	0	0		
5	Dibang valley	-	-	-	-	-	0	-	0	0	0	0	0	0		
6	Lower Dibang Valley	71544	0	23496	0	95040	9504	85536	34	0	34	62	85441	0.0391		
7	East Siang	60078	8	13679	12	73777	7378	66400	71	0	71	96	66233	0.1063		
8	West Siang	4947	1	1243	1	6191	619	5572	0	0	0	60	5512	0		
9	Upper Siang	-	-	-	-	-	0	-	0	0	0	0	0	0		
10	East Kameng	16225	0	679	0	16904	1690	15214	15	0	15	45	15154	0.0985		
11	West Kameng	1861	0	530	0	2391	239	2152	0	0	0	63	2089	0		
12	Lower Subansiri	1761	0	803	0	2564	256	2308	5	0	5	58	2245	0.2166		
13	Upper Subansiri	228	0	105	0	333	33	299	0	0	0	27	272	0		
14	Papum Pare	11173	0	2705	0	13877	1388	12490	58	56	114	191	12241	0.9087		
15	Tawang	-	-	-	-	-	0	-	0	0	0	0	0	0		
16	Kurung Kumey	-	-	-	-	-	0	-	0	0	0	0	0	0		
	State Total (ham)	341222	27	104114	40	445403	44540	400863	215	56	271	1062	399585	0.07		
	State Total (bcm)	3.41	0.0003	1.04	0.0004	4.45	0.45	4.01	0.002	0.001	0.003	0.01	3.996	0.07		

Note: 1. Assessment carried out by CGWB in absence of active participation of State Govt

**GROUND WATER RESOURCES AVAILABILITY, UTILIZATION AND STAGE OF DEVELOPMENT
ASSAM**

Sl. No.	District	Annual Replenishable Ground Water Resource					Natural Discharge During Non Monsoon Period	Net Ground Water Availability	Annual Ground Water Draft			Projected demand for Domestic and Industrial uses upto 2025	Net Ground Water Availability for Future Irrigation use	Stage of Ground Water Development (%)		
		Monsoon Season		Non Monsoon Season		Total			Irrigation	Domestic & Industrial Water Supply	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		
1	Barpeta	71753	17701	8567	4554	102575	10258	92318	33954	4213	38167	5959	52405	41		
2	Bongaigaon	90094	17681	30817	4429	143021	7151	135870	55501	2265	57766	2884	77484	43		
3	Cachar	78107	23	35195	11	113335	11334	102002	57	3863	3921	5246	96699	4		
4	Darrang	104148	22693	42329	6263	175432	8772	166661	47425	3736	51161	5159	114078	31		
5	Dibrugarh	121576	8012	57274	2050	188911	9446	179465	23769	2907	26677	3746	151950	15		
6	Dhemaji	113891	4049	69337	1025	188301	18830	169471	12667	1398	14065	2083	154721	8		
7	Dhubri	133095	4387	43145	1107	181734	18173	163561	13742	4370	18112	6535	143285	11		
8	Golaghat	94386	6297	43985	1581	146249	14625	131624	19751	2391	22143	3139	108734	17		
9	Goalpara	68822	7793	27798	1961	106374	5319	101055	24424	2185	26610	3265	73366	26		
10	Hailakandi	23134	225	10860	59	34279	3428	30851	698	1421	2119	2067	28086	7		
11	Jorhat	78769	4641	49493	1171	134075	6704	127371	14537	2572	17109	3465	109368	13		
12	Kamrup	111641	24031	42757	6299	184729	18473	166256	64476	7121	71597	10516	91264	43		
13	Karbi Anglong	23476	2367	11595	760	38199	3820	34379	686	2116	2803	3194	30498	8		
14	Kokrajhar	122443	4070	50664	1679	178856	17886	160970	12734	2319	15054	3143	145093	9		
15	Karimganj	28446	80	18727	34	47287	4729	42558	200	2636	2836	3853	38505	7		
16	Lakhimpur	80114	3385	48773	856	133128	13313	119815	10598	2278	12876	3214	106003	11		
17	Morigaon	47312	8337	19046	2090	76785	7678	69106	26166	2023	28189	2975	39965	41		
18	Nagaon	109601	39926	44122	11309	204957	20496	184462	65771	6161	71932	9056	109634	39		
19	N.C. Hills	6504	54	2979	14	9551	955	8596	167	547	714	745	7684	8		
20	Nalbari	46909	16420	26723	4298	94350	9435	84915	42977	2751	45728	3603	38335	54		
21	Sibsagar	98417	5114	41461	1289	146281	14628	131653	16027	2677	18704	3623	112002	14		
22	Sonitpur	152313	17909	72300	5066	247588	12379	235209	33339	4308	37647	5998	195872	16		
23	Tinsukia	90050	4361	63520	1104	159036	15904	143132	13645	3052	16697	4257	125230	12		
	State Total (ham)	1895002	219554	861468	59009	3035034	253733	2781300	533313	69312	602625	97725	2150262	22		
	State Total (bcm)	18.95	2.20	8.62	0.59	30.35	2.54	27.81	5.33	0.69	6.03	0.98	21.50	22		

**GROUND WATER RESOURCES AVAILABILITY, UTILIZATION AND STAGE OF DEVELOPMENT
BIHAR**

Sl. No.	District	Annual Replenishable Ground Water Resource					Natural Discharge During Non Monsoon Period	Net Ground Water Availability	Annual Ground Water Draft			Projected demand for Domestic and Industrial uses upto 2025	Net Ground Water Availability for Future Irrigation use	Stage of Ground Water Development (%)		
		Monsoon Season		Non Monsoon Season		Total			Irrigation	Domestic & Industrial Water Supply	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		
1	Araria	61908	8338	16078	2720	89043	8646	80397	21120	4496	25615	6104	53174	32		
2	Arwal	12140	6793	1978	2539	23451	1843	21607	9247	1038	10285	1639	10722	48		
3	Aurangabad	72783	13364	9315	4576	100038	8991	91046	17302	3831	21132	6464	67280	23		
4	Banka	28525	9454	6732	1696	46408	3670	42738	12774	3017	15791	4333	25630	37		
5	Begusarai	49136	4279	7198	5966	66579	6496	60083	30735	4415	35150	7611	21737	59		
6	Bhabhua	56239	12846	11757	5275	86117	7169	78947	22951	2344	25294	4005	51992	32		
7	Bhagalpur	58080	3845	11795	2409	76128	6546	69583	17971	4970	22941	7665	43947	33		
8	Bhojpur	45416	18245	7308	11908	82877	7592	75285	27395	4361	31756	6308	41582	42		
9	Buxar	33930	17916	4869	8990	65706	6553	59153	17994	3099	21093	5288	35871	36		
10	Darbhanga	48022	4603	7548	3002	63175	4449	58726	21992	2394	24386	12327	24406	42		
11	E.Champanar	77722	27400	14626	18903	138652	13790	124861	45309	7527	52836	11754	67797	42		
12	Gaya	83653	14471	12210	3765	114099	9466	104634	42961	7703	50664	12390	49284	48		
13	Gopalganj	34337	13608	6885	10521	65351	4995	60356	31889	4102	35992	5993	22474	60		
14	Jamui	26636	7699	6709	2242	43285	3459	39826	12312	2728	15041	5329	22185	38		
15	Jehanabad	20501	6626	2897	1446	31471	2063	29408	17005	1812	18818	2801	9602	64		
16	Katihar	63109	9108	15793	5689	93698	6796	86902	42846	4173	47019	7361	36695	54		
17	Khagaria	46579	1417	6138	4462	58597	5476	53121	20860	2422	23282	3959	28302	44		
18	Kishanganj	60420	2330	14676	2881	80307	8031	72276	16682	2900	19582	4885	50709	27		
19	Lakhisarai	21184	4662	3119	1757	30722	2781	27941	10153	1566	11719	2100	15688	42		
20	Madhepura	34529	9230	8510	5178	57448	5745	51703	25216	3022	28238	4801	21687	55		
21	Madhubani	69157	9004	15264	4891	98316	7472	90844	27345	6483	33828	10006	53494	37		
22	Munger	24811	4170	4019	1074	34074	3168	30907	6922	2046	8968	2888	21097	29		
23	Muzaffarpur	72596	17624	11172	14987	116380	9327	107052	50152	7126	57277	10839	46061	54		
24	Nalanda	50219	11542	7002	3303	72067	5872	66195	38547	4425	42972	5509	22139	65		
25	Nawada	41977	5061	6829	1874	55741	4377	51364	18531	3592	22123	5807	27025	43		
26	Patna	72339	15644	10352	7449	105784	9329	96455	44052	8708	52760	12859	39544	55		
27	Purnea	68281	7244	18860	4538	98923	8856	90066	34240	4966	39207	8528	47298	44		
28	Rohtas	77214	19381	10500	7946	115041	7988	107053	33870	4650	38519	7370	65814	36		
29	Saharsa	37968	7502	8139	5074	58684	4108	54575	17278	2774	20052	4895	32402	37		
30	Samastipur	74205	7463	10749	5496	97913	6577	91336	38389	6499	44888	12191	40756	49		
31	Saran	50251	12024	8105	10351	80731	4285	76446	36798	6661	43459	9582	30066	57		
32	Sheikhpura	12190	2761	2080	672	17703	1770	15933	7340	1071	8411	1390	7204	53		
33	Sheohar	13491	2145	1892	976	18504	1730	16774	8665	1056	9721	1910	6199	58		
34	Sitamarhi	58727	6848	9711	5008	80294	5229	75065	27967	5181	33148	8662	38435	44		
35	Siwan	39980	19346	7263	15296	81885	7890	73995	37786	4873	42658	7402	28807	58		

**GROUND WATER RESOURCES AVAILABILITY, UTILIZATION AND STAGE OF DEVELOPMENT
BIHAR**

Sl. No.	District	Annual Replenishable Ground Water Resource					Natural Discharge During Non Monsoon Period	Net Ground Water Availability	Annual Ground Water Draft			Projected demand for Domestic and Industrial uses upto 2025	Net Ground Water Availability for Future Irrigation use	Stage of Ground Water Development (%)		
		Monsoon Season		Non Monsoon Season		Total			Irrigation	Domestic & Industrial Water Supply	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		
36	Supaul	49742	12616	11809	8198	82365	7846	74519	21804	2922	24726	5391	47324	33		
37	Vaishali	49384	11328	7330	9846	77888	5936	71952	34729	5558	40288	8730	28493	56		
38	W. Champaran	94993	24177	12402	25594	157166	15717	141450	30220	5744	35964	9275	101955	25		
State Total (ham)		1892376	392116	339621	238498	2862611	242034	2620577	979351	156253	1135604	256351	1384877	43		
State Total (bcm)		18.92	3.92	3.40	2.38	28.63	2.42	26.21	9.79	1.56	11.36	2.56	13.85	43		

**GROUND WATER RESOURCES AVAILABILITY, UTILIZATION AND STAGE OF DEVELOPMENT
CHHATTISGARH**

Sl. No.	District	Annual Replenishable Ground Water Resource					Natural Discharge During Non Monsoon Period	Net Ground Water Availability	Annual Ground Water Draft			Projected demand for Domestic and Industrial uses upto 2025	Net Ground Water Availability for Future Irrigation use	Stage of Ground Water Development (%)		
		Monsoon Season		Non Monsoon Season		Total			Irrigation	Domestic & Industrial Water Supply	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		
1	Bastar	98676	774	13745	2444	115639	5782	109857	8626	3041	11667	3383	97848	11		
2	Bijapur	70451	76	10259	119	80903	4045	76858	609	612	1221	851	75398	2		
3	Bilaspur	44346	3576	0	4432	52354	2618	49736	18420	4810	23229	6392	24924	47		
4	Dantewara	52500	238	0	1113	53850	2693	51158	2337	1042	3379	1361	47460	7		
5	Dhamtari	24934	6827	0	7154	38916	1946	36970	22107	2808	24915	3535	11328	67		
6	Durg	55396	9531	8565	18121	91612	4581	87031	55402	4484	59886	5233	26396	69		
7	Janjgir Champa	22266	7656	3516	5957	39396	1970	37427	13250	2935	16186	3995	20182	43		
8	Jashpur	43741	784	5364	3787	53675	2698	50977	15286	1723	17010	2114	33577	33		
9	Kanker	76265	687	8646	2166	87764	4388	83376	15797	1553	17350	2049	65530	21		
10	Kawardha	18112	2163	1865	7348	29488	1474	28014	17532	992	18524	1196	9286	66		
11	Korba	38272	1507	3866	1970	45615	3132	42483	4034	2331	6365	2844	35605	15		
12	Koriya	37089	1667	3397	2430	44583	2229	42354	8412	1357	9770	1543	32399	23		
13	Mahasamund	53584	1775	1096	4350	60806	3040	57765	19051	3634	22685	3660	35054	39		
14	Narayanpur	40156	131	4423	431	45141	4514	40627	1020	371	1391	490	39117	3		
15	Raigarh	38180	2082	4704	5004	49970	2499	47472	17770	2720	20489	3585	26117	43		
16	Raipur	96265	9195	5614	10639	121714	6086	115628	32316	10117	42433	12567	70745	37		
17	Rajnangaon	30617	5232	4371	4910	45130	2257	42874	20585	2520	23105	2600	19688	54		
18	Surguja	144340	2122	11115	7615	165192	8260	156932	35283	4884	40166	7071	114579	26		
	State Total (ham)	985191	56023	90547	89990	1221750	64210	1157540	307836	51936	359772	64471	785233	31		
	State Total (bcm)	9.85	0.56	0.91	0.90	12.22	0.64	11.58	3.08	0.52	3.60	0.64	7.85	31		

**GROUND WATER RESOURCES AVAILABILITY, UTILIZATION AND STAGE OF DEVELOPMENT
NCT DELHI**

Sl. No.	District	Annual Replenishable Ground Water Resource					Natural Discharge During Non Monsoon Period	Net Ground Water Availability	Annual Ground Water Draft			Projected demand for Domestic and Industrial uses upto 2025	Net Ground Water Availability for Future Irrigation use	Stage of Ground Water Development (%)		
		Monsoon Season		Non Monsoon Season		Total			Irrigation	Domestic & Industrial Water Supply	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		
1	Central	251	14	42	78	384	38	346	51	324	376	346	34	109		
2	East	496	275	70	444	1284	97	1188	844	1364	2208	1422	3	186		
3	New Delhi	418	101	70	209	797	80	718	554	160	714	160	24	99		
4	North	741	180	123	511	1555	156	1400	138	895	1034	906	401	74		
5	North East	449	328	63	414	1255	119	1136	329	964	1293	1135	0	114		
6	North West	3158	2406	438	2629	8631	607	8024	3282	5680	8962	5955	872	112		
7	South	2123	1625	305	528	4581	458	4123	1893	6399	8292	6399	0	201		
8	South West	2910	4585	413	1843	9752	625	9127	6460	6109	12569	6109	0	138		
9	West	679	230	87	1816	2811	159	2652	473	3698	4172	3762	0	157		
	State Total (ham)	11224	9743	1612	8472	31050	2339	28714	14025	25594	39619	26193	1333	138		
	State Total (bcm)	0.11	0.10	0.02	0.08	0.31	0.02	0.29	0.14	0.26	0.40	0.26	0.01	138		

**GROUND WATER RESOURCES AVAILABILITY, UTILIZATION AND STAGE OF DEVELOPMENT
GOA**

Sl. No.	District	Annual Replenishable Ground Water Resource					Natural Discharge During Non Monsoon Period	Net Ground Water Availability	Annual Ground Water Draft			Projected demand for Domestic and Industrial uses upto 2025	Net Ground Water Availability for Future Irrigation use	Stage of Ground Water Development (%)		
		Monsoon Season		Non Monsoon Season		Total			Irrigation	Domestic & Industrial Water Supply	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		
1	North Goa	8487	51	0	4464	13003	5201	7802	842	1704	2547	2110	4849	33		
2	South Goa	4980	786	644	2710	9121	3648	5473	513	1323	1837	1639	3320	34		
	State Total (ham)	13467	837	644	7174	22123	8849	13274	1356	3028	4383	3749	8169	33		
	State Total (bcm)	0.13	0.01	0.01	0.07	0.22	0.09	0.13	0.01	0.03	0.04	0.04	0.08	33		

**GROUND WATER RESOURCES AVAILABILITY, UTILIZATION AND STAGE OF DEVELOPMENT
GUJARAT**

Sl. No.	District	Annual Replenishable Ground Water Resource					Natural Discharge During Non Monsoon Period	Net Ground Water Availability	Annual Ground Water Draft			Projected demand for Domestic and Industrial uses upto 2025	Net Ground Water Availability for Future Irrigation use	Stage of Ground Water Development (%)		
		Monsoon Season		Non Monsoon Season		Total			Irrigation	Domestic & Industrial Water Supply	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		
1	Ahmedabad	42855	9201	0	6344	58400	3183	55216	49236	6851	56087	9597	6527	102		
2	Amreli	53311	11937	0	10395	75643	4390	71253	46242	2523	48765	3532	21479	68		
3	Anand	36140	20410	0	22777	79327	5034	74293	36300	4904	41204	6875	31118	55		
4	Banaskantha	75245	10429	0	14779	100452	7702	92749	121408	5451	126859	7638	4068	137		
5	Bharuch	27267	2442	0	5872	35582	1779	33803	17056	1947	19003	2729	14017	56		
6	Bhavnagar	59601	18823	0	11176	89601	4480	85121	49885	5394	55279	7561	27675	65		
7	Dang	7279	769	0	148	8197	410	7787	742	541	1283	758	6287	16		
8	Dohad	23648	4940	0	4832	33419	1671	31748	12517	4205	16722	5547	13685	53		
9	Gandhinagar	36170	4142	0	2761	43073	2154	40920	64534	3038	67572	4257	0	165		
10	Jamnagar	69388	13718	0	15797	98903	4945	93958	57402	4305	61707	6033	30523	66		
11	Junagadh	108495	15514	0	16805	140814	8367	132447	85963	6573	92536	9203	37281	70		
12	Kachchh	57305	14760	0	10957	83023	4426	78597	67518	4058	71576	5694	9788	91		
13	Kheda	45152	18769	0	19792	83713	4532	79181	44546	5610	50156	7862	26773	63		
14	Mahesana	67996	7963	0	10537	86496	5537	80959	114465	5321	119786	7455	78	148		
15	Narmada	15434	1707	0	4733	21874	1324	20549	6465	1488	7953	2085	12000	39		
16	Navsari	19699	9360	0	17835	46893	2345	44549	23496	2224	25720	3117	17936	58		
17	Panchmahals	38192	10648	0	16317	65157	3258	61899	25735	5355	31090	7007	29157	50		
18	Patan	17698	2678	0	4051	24428	1882	22545	32396	1779	34175	2495	0	152		
19	Porbandar	13670	2137	0	1633	17440	1189	16251	13096	1099	14195	1618	2611	87		
20	Rajkot	95766	24925	0	21920	142611	7415	135196	86797	7448	94245	10344	38056	70		
21	Sabarkantha	79300	11717	0	23175	114192	5710	108482	80484	5385	85869	7738	20261	79		
22	Surat	34638	30486	0	46970	112094	8653	103441	35801	5977	41778	8369	59271	40		
23	Surendranagar	50109	4347	0	5720	60175	3296	56879	34027	2574	36601	3605	19247	64		
24	Tapi	27153	6269	0	18074	51496	4636	46861	9412	1337	10749	1824	35625	23		
25	Vadodara	91518	12340	0	22598	126456	6323	120133	64200	7541	71741	10566	45367	60		
26	Valsad	27697	5611	0	9771	43080	2969	40111	13664	2552	16216	3578	22869	40		
State Total (ham)		1220726	276041	0	345768	1842536	107609	1734927	1193381	105480	1298861	147087	531699	75		
State Total (bcm)		12.21	2.76	0.00	3.46	18.43	1.08	17.35	11.93	1.05	12.99	1.47	5.32	75		

**GROUND WATER RESOURCES AVAILABILITY, UTILIZATION AND STAGE OF DEVELOPMENT
HARYANA**

Sl. No.	District	Annual Replenishable Ground Water Resource					Natural Discharge During Non Monsoon Period	Net Ground Water Availability	Annual Ground Water Draft			Projected demand for Domestic and Industrial uses upto 2025	Net Ground Water Availability for Future Irrigation use	Stage of Ground Water Development (%)		
		Monsoon Season		Non Monsoon Season		Total			Irrigation	Domestic & Industrial Water Supply	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		
1	AMBALA	28972	11304	9196	7374	56846	4602	52244	41583	7710	49293	9040	1621	94		
2	PANCHKULA	7729	2464	2569	1844	14606	730	13876	9072	2790	11862	4379	425	85		
3	FATEHABAD	18645	22753	3300	19095	63793	3188	60605	107316	1403	108719	1810	-48521	179		
4	BHIWANI	30186	10199	6122	12500	59007	3869	55138	43068	756	43824	925	11145	79		
5	HISSAR	22829	15951	4390	26564	69734	3485	66249	59836	449	60285	572	5841	91		
6	GURGAON	11761	2990	4440	6655	25846	2585	23261	35777	18150	53927	18150	-30666	232		
7	MEWAT	11257	3387	4280	4825	23749	2126	21623	13280	1173	14453	1830	6513	67		
8	FARIDABAD	8546	3975	3256	5516	21293	1065	20228	14118	2232	16350	2746	3364	81		
9	PALWAL	12277	13619	2497	18734	47127	2356	44771	45892	999	46891	1134	-2255	105		
10	JHAJJAR	12166	13060	2822	16920	44968	2250	42718	40751	192	40943	230	1737	96		
11	JIND	16262	26551	9601	33600	86014	4300	81714	77363	3510	80873	4278	73	99		
12	KAITHAL	16841	20150	5193	14241	56425	5642	50783	101504	6242	107746	6242	-56963	212		
13	KARNAL	26839	26495	5315	32683	91332	5427	85905	118899	1244	120143	1244	-34238	140		
14	KURUKSHETRA	16866	8751	4946	6197	36760	2437	34323	67904	6737	74641	6737	-40318	217		
15	MAHENDRAGARH	12797	1913	3335	5773	23818	2381	21437	22453	388	22841	505	-1521	107		
16	PANIPAT	12814	8359	2597	10068	33838	2973	30865	50961	495	51456	495	-20591	167		
17	REWARI	12328	3581	3075	11799	30783	2784	27999	31255	116	31371	131	-3387	112		
18	ROHTAK	10822	15050	4179	17335	47386	2369	45017	28446	2297	30743	2662	13909	68		
19	SIRSA	13245	25576	4903	35699	79423	3971	75452	115634	776	116410	789	-40971	154		
20	SONEPAT	22272	23582	5955	29691	81500	4074	77426	90622	3913	94535	4168	-17364	122		
21	YAMUNANAGAR	27521	8964	9165	7905	53555	5356	48199	55077	10215	65292	10471	-17349	135		
	STATE TOTAL (ham)	352975	268674	101136	325018	1047803	67970	979833	1170811	71787	1242598	78538	-269516	127		
	STATE TOTAL (bcm)	3.53	2.69	1.01	3.25	10.48	0.68	9.8	11.71	0.72	12.43	0.79	-2.7	127		

**GROUND WATER RESOURCES AVAILABILITY, UTILIZATION AND STAGE OF DEVELOPMENT
HIMACHAL PRADESH**

Sl. No.	District	Annual Replenishable Ground Water Resource					Natural Discharge During Non Monsoon Period	Net Ground Water Availability	Annual Ground Water Draft			Projected demand for Domestic and Industrial uses upto 2025	Net Ground Water Availability for Future Irrigation use	Stage of Ground Water Development (%)		
		Monsoon Season		Non Monsoon Season		Total			Irrigation	Domestic & Industrial Water Supply	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		
1	A. Indora Valley (Kangra District)	7533	295	2509	589	10926	1093	9833	3534	1384	4918	1384	4915	50		
2	B. Nurpur Valley (Kangra District)	6747	197	2247	394	9585	959	8627	2366	777	3143	777	5484	36		
3	A. Balh Valley (Mandi District)	2213	21	951	41	3226	323	2903	248	562	810	562	2100	28		
4	A. Paonta Valley (Sirmour District)	6659	103	1345	207	8314	831	7482	1241	802	2043	802	5439	27		
5	B. Kala Amb Valley (Sirmour District)	107	4	22	8	141	14	126	50	265	315	265	0	249		
6	A. Nalagarh Valley (Solan District)	6284	168	1826	337	8615	861	7753	2021	1921	3942	1921	3811	51		
7	A. Una Valley (Una District)	10464	1460	3046	2673	17643	1764	15879	12915	2587	15502	2587	377	98		
8	B. Hum Valley (Una District)	389	39	113	44	585	59	527	300	51	351	152	74	67		
State Total (ham)		40396	2287	12059	4293	59035	5904	53137	22675	8349	31024	8450	22200	58		
State Total (bcm)		0.40	0.02	0.12	0.04	0.59	0.06	0.53	0.23	0.08	0.31	0.08	0.22	58		

Note: Assessment carried out in the valley areas of 5 districts out of total 12 districts in the State since rest of the areas are predominantly hilly

**GROUND WATER RESOURCES AVAILABILITY, UTILIZATION AND STAGE OF DEVELOPMENT
JAMMU & KASHMIR**

Sl. No.	District	Annual Replenishable Ground Water Resource					Natural Discharge During Non Monsoon Period	Net Ground Water Availability	Annual Ground Water Draft			Projected demand for Domestic and Industrial uses upto 2025	Net Ground Water Availability for Future Irrigation use	Stage of Ground Water Development (%)		
		Monsoon Season		Non Monsoon Season		Total			Irrigation	Domestic & Industrial Water Supply	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		
1	Jammu	39840	32079	10000	11214	93133	9313	83819	10576	8567	19143	11959	61284	23		
2	Kathua	18613	11828	4637	4361	39439	3944	35495	3580	3142	6722	3907	28008	19		
3	Srinagar	5908	8688	1474	481	16550	1655	14895	499	8778	9277	12368	2028	62		
4	Anantnag	13245	34144	3300	28	50718	5072	45646	69	4792	4861	7062	38515	11		
5	Baramulla	23040	21594	5760	848	51242	5124	46118	400	4145	4545	5993	39725	10		
6	Badgam	9131	16501	2278	71	27981	2798	25183	61	7471	7532	10613	14509	30		
7	Pulwama	9349	19402	2337	22	31111	3111	27999	90	7590	7680	10217	17693	27		
8	Kupwara	8340	10612	2086	41	21078	2108	18971	24	4448	4472	7168	11779	24		
9	Udhampur	2384	2713	597	403	6097	610	5487	18	2046	2064	3366	2103	38		
10	Rajauri	6440	3170	1610	586	11806	1181	10625	122	3511	3633	4316	6187	34		
11	Poonch	3920	2442	980	465	7807	781	7026	5	2310	2315	3630	3391	33		
12	Doda	2153	2908	493	377	5931	593	5338	6	1003	1009	1030	4303	19		
13	Kargil	240	1425	60	0	1725	173	1553	0	132	132	211	1342	9		
14	Leh	2640	1593	660	0	4893	489	4403	6	53	59	79	4318	1		
	State Total (ham)	145244	169097	36272	18898	369510	36951	332559	15455	57988	73443	81919	235185	22		
	State Total (bcm)	1.45	1.69	0.36	0.19	3.70	0.37	3.33	0.15	0.58	0.73	0.82	2.35	22		

**GROUND WATER RESOURCES AVAILABILITY, UTILIZATION AND STAGE OF DEVELOPMENT
JHARKHAND**

Sl. No.	District	Annual Replenishable Ground Water Resource					Natural Discharge During Non Monsoon Period	Net Ground Water Availability	Annual Ground Water Draft			Projected demand for Domestic and Industrial uses upto 2025	Net Ground Water Availability for Future Irrigation use	Stage of Ground Water Development (%)		
		Monsoon Season		Non Monsoon Season		Total			Irrigation	Domestic & Industrial Water Supply	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		
1	Bokaro	21605	158	4480	1356	27599	2190	25408	5204	2752	7956	4121	16083	31		
2	Chatra	21664	216	3488	1922	27290	2527	24762	7363	1299	8662	2197	15202	35		
3	Deoghar	16361	53	6348	1198	23960	2396	21564	4550	2605	7155	2605	14408	33		
4	Dhanbad	11189	205	2666	885	14945	1453	13492	3232	3807	7039	5780	4480	52		
5	Dumka	19935	2314	6301	1506	30056	3006	27051	5578	1804	7382	2455	19018	27		
6	E-Singhbhum	22920	146	6114	683	29863	2708	27156	2346	3287	5633	4966	19844	21		
7	Garhwa	25880	1555	4041	2436	33912	2839	31073	9257	1710	10968	2510	19306	35		
8	Giridih	28155	81	6429	2295	36960	3696	33264	8859	3109	11968	5099	19305	36		
9	Godda	9992	1151	3809	1018	15971	1597	14374	3847	1714	5561	2128	8399	39		
10	Gumla	31233	905	8154	286	40578	4058	36520	8170	1370	9541	1670	26680	26		
11	Hazaribagh	24259	703	5999	2479	33438	3250	30188	9480	2264	11744	3392	17316	39		
12	Jamtara	13021	14	3429	94	16559	1656	14903	2936	1055	3991	1293	10674	27		
13	Khunti	10029	744	4281	901	15955	1596	14360	3350	709	4059	963	10047	28		
14	Koderma	6410	3	1371	433	8217	610	7607	1639	839	2478	1342	4627	33		
15	Latehar	22688	222	3362	1508	27779	2523	25256	5762	924	6686	1288	18206	26		
16	Lohardaga	7294	356	1934	834	10418	1042	9376	3143	575	3718	812	5421	40		
17	Pakur	10304	279	3314	197	14094	1409	12685	582	1131	1714	1582	10521	14		
18	Palamu	32841	1542	4772	318	39472	3392	36080	9182	2510	11692	3761	23137	32		
19	Ramgarh	8697	44	1822	760	11323	965	10358	2908	1135	4043	1633	5816	39		
20	Ranchi	26617	996	7734	2625	37973	2900	35072	10036	3919	13954	5080	19957	40		
21	Sahebganj	9375	196	2954	357	12882	1268	11614	1124	1483	2607	1976	8514	22		
22	Saraikela	15537	617	4329	277	20759	1900	18859	912	1298	2210	1731	16217	12		
23	Simdega	22444	276	5407	1655	29783	2825	26958	6358	839	7197	1118	19482	27		
24	W-Singhbhum	27155	887	8387	357	36786	3678	33108	964	1921	2885	2562	29582	9		
State Total (ham)		445603	13662	110922	26381	596569	55482	541087	116782	44059	160841	62062	362243	30		
State Total (bcm)		4.46	0.14	1.11	0.26	5.96	0.55	5.41	1.17	0.44	1.61	0.62	3.62	30		

**GROUND WATER RESOURCES AVAILABILITY, UTILIZATION AND STAGE OF DEVELOPMENT
KARNATAKA**

Sl. No.	District	Annual Replenishable Ground Water Resource					Natural Discharge During Non Monsoon Period	Net Ground Water Availability	Annual Ground Water Draft			Projected demand for Domestic and Industrial uses upto 2025	Net Ground Water Availability for Future Irrigation use	Stage of Ground Water Development (%)		
		Monsoon Season		Non Monsoon Season		Total			Irrigation	Domestic & Industrial Water Supply	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		
1	Bagalkote	15257	15491	5950	10831	47530	3612	43918	39721	4019	43739	4795	8807	100		
2	Bangalore Rural	8506	3466	4999	3562	20532	1138	19394	23201	2451	25653	2464	22	132		
3	Bangalore Urban	5845	1240	3624	1630	12339	615	11724	12910	3793	16703	3793	0	142		
4	Belgaum	36973	49086	9464	29086	124608	10810	113799	113618	8247	121866	9921	19940	107		
5	Bellary	20447	23260	13403	15115	72224	6948	65277	24575	3997	28572	6502	35539	44		
6	Bidar	20587	2431	3874	4440	31332	1978	29354	19337	2796	22133	3307	9882	75		
7	Bijapur	32082	8705	8713	8765	58266	3723	54543	42369	5560	47929	6803	12558	88		
8	Chamrajnagara	9443	11076	9910	6791	37220	3033	34188	22403	2154	24557	2926	12741	72		
9	Chikballapur	10896	8214	7901	4144	31154	2728	28426	37706	2355	40061	2388	1699	141		
10	Chikmagalur	26110	12377	12862	6160	57509	6411	51098	20220	3309	23528	4036	27622	46		
11	Chitradurga	22880	8896	15463	8343	55582	5219	50363	50420	3356	53776	3753	6774	107		
12	Dakshin Kannada	38190	1479	7174	2986	49829	18551	31278	16798	3847	20645	4625	9962	66		
13	Davangere	21990	10532	13697	14932	61151	5446	55705	46706	3244	49950	4071	13193	90		
14	Dharwad	15493	3741	6236	2400	27869	5639	22231	11037	2053	13089	3070	8321	59		
15	Gadag	10329	5771	5959	4620	26679	2115	24564	21159	1821	22980	2352	4723	94		
16	Gulbarga	27108	5627	8551	26854	68140	4351	63789	22251	3131	25382	4245	37590	40		
17	Hassan	14218	35967	13747	26174	90106	7008	83098	37969	5681	43651	6878	45851	53		
18	Haveri	18374	25220	9235	6803	59632	4882	54750	32068	2665	34732	3486	19752	63		
19	Kodagu	16804	1460	9156	988	28408	4379	24029	3588	1603	5191	1947	18495	22		
20	Kolar	11466	5815	7515	6246	31042	1899	29143	49401	3234	52635	3234	0	181		
21	Koppal	12351	20102	6681	20151	59285	5575	53710	24990	2706	27696	3331	30780	52		
22	Mandy	6497	45244	10070	37708	99519	8176	91343	37363	2751	40114	5045	53842	44		
23	Mysore	15180	19038	13957	12269	60444	4475	55968	19540	2092	21632	3425	33535	39		
24	Raichur	17475	30063	9152	33308	89999	7903	82096	23524	2758	26282	4244	55761	32		
25	Ramanagara	6313	4630	7004	3254	21202	1225	19977	17432	4507	21940	4821	1626	110		
26	Shimoga	38971	35964	11424	20158	106518	13901	92618	25632	2904	28536	4111	62945	31		
27	Tumkur	27887	21831	20121	14659	84497	6387	78110	67660	5517	73177	6949	16357	94		
28	Udupi	42720	1291	5995	2462	52469	20582	31887	13760	2659	16419	3285	14842	51		
29	Uttar kannada	67909	3475	5611	2938	79933	28872	51061	15527	2823	18350	3362	32223	36		
30	Yadgir	11666	6545	5265	12986	36461	2902	33559	7786	1941	9727	3210	22707	29		
State Total (ham)		629966	428038	272714	350765	1681483	200480	1481003	900671	99974	1000645	126381	618086	68		
State Total (bcm)		6.30	4.28	2.73	3.51	16.81	2.00	14.81	9.01	1.00	10.01	1.26	6.18	68		

**GROUND WATER RESOURCES AVAILABILITY, UTILIZATION AND STAGE OF DEVELOPMENT
KERALA**

Sl. No.	District	Annual Replenishable Ground Water Resource				Natural Discharge During Non Monsoon Period	Net Ground Water Availability	Annual Ground Water Draft			Projected demand for Domestic and Industrial uses upto 2025	Net Ground Water Availability for Future Irrigation use	Stage of Ground Water Development (%)		
		Monsoon Season		Non Monsoon Season				Irrigation	Domestic & Industrial Water Supply	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	
1	Alappuzha	30137	70	7300	10869	48375	3010	45365	2992	9943	12935	10372	32002	29	
2	Ernakulam	39321	487	7225	14539	61572	5837	55735	10308	13667	23976	15254	30172	43	
3	Idukki	16233	110	3119	2376	21838	2184	19655	2874	5424	8298	5985	10796	42	
4	Kannur	45208	684	0	7225	53117	5206	47911	10943	10795	21739	11932	25035	45	
5	Kasargod	30994	815	0	4552	36360	3636	32724	16705	6629	23333	7798	8221	71	
6	Kollam	30198	160	10394	4171	44923	3997	40927	4015	11696	15711	13102	23810	38	
7	Kottayam	37074	133	8139	6939	52285	4969	47316	3491	9107	12597	10704	33121	27	
8	Kozhikode	36701	229	0	1447	38378	3639	34738	5200	13771	18972	15793	13745	55	
9	Malappuram	39247	369	5442	8080	53139	4708	48431	8166	19785	27951	24392	15872	58	
10	Palakkad	46538	1742	8013	30802	87095	7570	79525	35494	12923	48417	14179	30042	61	
11	Pathanamthitta	20737	154	6709	3461	31061	2650	28411	3463	5962	9424	6304	18644	33	
12	Thiruvananthapuram	22540	275	7421	2981	33217	2743	30474	3985	13116	17101	14699	11790	56	
13	Thrissur	51780	1070	0	17097	69947	5888	64060	22168	13506	35673	15216	26676	56	
14	Waynad	30430	21	0	246	30698	3070	27628	652	4116	4768	4816	22160	17	
State Total (ham)		477138	6319	63762	114786	662005	59106	602899	130456	150440	280896	170547	302087	47	
State Total (bcm)		4.77	0.06	0.64	1.15	6.62	0.59	6.03	1.30	1.50	2.81	1.71	3.02	47	

**GROUND WATER RESOURCES AVAILABILITY, UTILIZATION AND STAGE OF DEVELOPMENT
MADHYA PRADESH**

Sl. No.	District	Annual Replenishable Ground Water Resource					Natural Discharge During Non Monsoon Period	Net Ground Water Availability	Annual Ground Water Draft			Projected demand for Domestic and Industrial uses upto 2025	Net Ground Water Availability for Future Irrigation use	Stage of Ground Water Development (%)		
		Monsoon Season		Non Monsoon Season		Total			Irrigation	Domestic & Industrial Water Supply	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		
1	Alirajpur	19215	776	0	1218	21209	1060	20148	3308	2121	5428	2846	13994	27		
2	Annupur	33772	101	5578	265	39716	1986	37730	1039	1211	2250	1540	35152	6		
3	Ashoknagar	36121	1238	0	5191	42551	2128	40423	15075	1811	16886	2578	22771	42		
4	Balaghat	81465	3887	8091	2607	96050	4803	91248	10133	3228	13361	4031	77083	15		
5	Barwani	35348	1416	0	4913	41677	2084	39593	25250	3132	28382	4761	9582	72		
6	Betul	95977	2792	11934	9266	119969	5998	113970	50105	3516	53622	4638	59227	47		
7	Bhind	50800	704	0	10371	61875	3094	58781	19490	2720	22210	3908	35383	38		
8	Bhopal	27627	1768	0	5051	34446	1722	32724	24326	2289	26614	3146	5253	81		
9	Burhanpur	28260	825	0	4132	33217	1661	31556	20990	1096	22086	1359	9207	70		
10	Chhatarpur	58010	2851	0	11314	72175	3609	68567	42438	2616	45055	3864	22264	66		
11	Chhindwara	116536	3973	11905	13474	145889	7294	138594	66042	5197	71239	6938	65615	51		
12	Damoh	29140	1342	0	7818	38300	1915	36385	20380	1620	22000	2700	13305	60		
13	Datia	29509	776	0	4893	35179	1759	33420	17594	1568	19162	1821	14005	57		
14	Dewas	68602	2568	0	12136	83306	4165	79141	60843	2540	63383	3449	14849	80		
15	Dhar	80372	4221	0	17684	102276	5114	97163	75039	5412	80451	6912	15212	83		
16	Dindori	37665	84	4683	257	42690	2134	40555	1770	1355	3125	1678	37107	8		
17	Guna	61432	2889	0	10437	74757	3738	71020	37605	2855	40459	4078	29337	57		
18	Gwalior	36758	4214	0	12488	53459	2673	50786	19220	2337	21557	3650	27916	42		
19	Harda	39258	2697	0	14963	56918	2846	54072	12063	971	13034	1347	40663	24		
20	Hoshangabad	141136	10395	0	60982	212513	10626	201888	32823	2794	35617	4176	164889	18		
21	Indore	40598	3313	0	11156	55067	2753	52314	62454	3166	65620	3931	-14072	125		
22	Jabalpur	49967	2433	0	6210	58610	2930	55679	25140	3045	28184	4894	25645	51		
23	Jhabua	18939	681	0	1574	21193	1060	20134	7016	2289	9305	3067	10051	46		
24	Katni	30000	1795	0	4529	36324	1816	34508	13000	2457	15457	3440	18067	45		
25	Khandwa	69849	1845	0	9305	80999	4050	76949	44887	2696	47583	4644	27417	62		
26	Khargone	67526	2397	0	11360	81283	4064	77219	52574	3274	55848	4647	19999	72		
27	Mandla	46527	681	6601	2800	56609	2830	53779	6016	2189	8205	3104	44658	15		
28	Mandsaur	47666	2298	0	8587	58551	2928	55624	51057	3093	54150	3093	1474	97		
29	Morena	45294	1020	0	21310	67625	3381	64244	23189	4409	27597	6823	34232	43		
30	Narsinghpur	116084	2252	0	10716	129053	6453	122600	92565	2025	94590	2676	27359	77		
31	Neemuch	31001	3621	0	6572	41193	2060	39133	29993	1678	31672	1894	7246	81		
32	Panna	45696	783	0	3108	49587	2479	47108	11006	1933	12938	2807	33295	27		
33	Raisen	68841	2785	0	7541	79168	3958	75209	35139	3025	38165	4207	35863	51		
34	Rajgarh	76094	3099	0	10003	89196	4460	84736	65771	3296	69067	4079	14887	82		
35	Ratlam	53323	3585	0	13237	70145	3507	66638	81486	2262	83748	2682	-17531	126		
36	Rewa	42652	841	2610	3161	49264	2463	46801	19441	4847	24289	6281	21079	52		
37	Sagar	102238	3102	0	13404	118744	5937	112807	63470	2609	66079	4478	44859	59		

**GROUND WATER RESOURCES AVAILABILITY, UTILIZATION AND STAGE OF DEVELOPMENT
MADHYA PRADESH**

Sl. No.	District	Annual Replenishable Ground Water Resource					Natural Discharge During Non Monsoon Period	Net Ground Water Availability	Annual Ground Water Draft			Projected demand for Domestic and Industrial uses upto 2025	Net Ground Water Availability for Future Irrigation use	Stage of Ground Water Development (%)		
		Monsoon Season		Non Monsoon Season		Total			Irrigation	Domestic & Industrial Water Supply	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		
38	Satna	42882	2017	4309	6529	55737	2787	52950	34520	4933	39453	5723	12707	75		
39	Sehore	64700	3575	0	12959	81233	4062	77172	55271	2124	57394	3237	18664	74		
40	Seoni	67903	1177	10158	4173	83410	4170	79239	17127	3329	20456	4328	57784	26		
41	Shahdol	59087	208	7502	476	67272	3364	63909	2233	1850	4083	2610	59067	6		
42	Shajapur	78544	3629	0	14818	96990	4850	92141	85470	3355	88825	3755	2916	96		
43	Sheopur	29768	484	0	11514	41767	2088	39679	13225	1285	14509	1740	24714	37		
44	Shivpuri	61011	2466	0	10944	74420	3721	70699	45208	3233	48441	4398	21093	69		
45	Sidhi	28542	686	3277	2050	34557	1728	32829	10580	2310	12889	3381	18868	39		
46	Singrauli	36116	626	0	1839	38582	1929	36653	9082	2143	11225	3380	24191	31		
47	Tikamgarh	41058	2736	0	11945	55738	2787	52951	35557	2244	37801	3652	13742	71		
48	Ujjain	65674	3854	0	15955	85483	4274	81209	77074	3006	80079	3764	371	99		
49	Umaria	40845	319	3014	740	44918	2246	42672	3656	1215	4871	1743	37273	11		
50	Vidisha	73820	1726	0	8245	83790	4189	79600	37097	3482	40579	4760	37743	51		
State total (ham)		2749250	109553	79660	456219	3394682	169734	3224948	1665835	133189	1799024	182640	1376473	56		
State total (BCM)		27.49	1.10	0.80	4.56	33.95	1.70	32.25	16.66	1.33	17.99	1.83	13.76	56		

**GROUND WATER RESOURCES AVAILABILITY, UTILIZATION AND STAGE OF DEVELOPMENT
MAHARASHTRA**

Sl. No.	District	Annual Replenishable Ground Water Resource					Natural Discharge During Non Monsoon Period	Net Ground Water Availability	Annual Ground Water Draft			Projected demand for Domestic and Industrial uses upto 2025	Net Ground Water Availability for Future Irrigation use	Stage of Ground Water Development (%)		
		Monsoon Season		Non Monsoon Season		Total			Irrigation	Domestic & Industrial Water Supply	Total					
		Recharge from Rainfall	Recharge From Other Sources	Recharge from Rainfall	Recharge From Other Sources											
1	2	4	5	6	7	8	9	10	11	12	13	14	15	16		
1	Ahmednagar	97668	13458	26970	52704	190801	10020	180781	140938	3385	144323	6054	42643	80		
2	Akola	34006	1030	1795	10572	47403	2583	44820	13236	1228	14465	2457	29127	32		
3	Amravati	59813	3173	7470	27835	98292	5114	93178	76406	2872	79278	4681	22710	85		
4	Aurangabad	64682	12069	2616	46263	125631	6442	119189	70131	3763	73893	7404	42220	62		
5	Beed	81365	13191	15581	31526	141663	7225	134438	63778	4760	68538	9479	61181	51		
6	Bhandara	32257	5902	3904	11711	53774	3167	50607	12150	1967	14117	3935	34522	28		
7	Buldhana	68803	4660	5656	18071	97190	5537	91652	60968	3184	64151	6131	25808	70		
8	Chandrapur	100095	4521	0	3953	108568	5603	102965	8754	6292	15046	12584	81627	15		
9	Dhule	44128	33058	0	49161	126346	7556	118790	56032	1790	57822	3575	59184	49		
10	Gadchiroli	84993	19613	0	32706	137312	9242	128070	16271	2153	18424	4306	107493	14		
11	Gondia	40114	5662	3209	13485	62470	3738	58733	4817	6118	10935	12236	41680	19		
12	Hingoli	50179	1715	7211	49317	108423	5421	103001	36245	1763	38008	3526	63231	37		
13	Jalgaon	84294	6786	4433	46460	141973	7201	134772	89647	4713	94360	8855	40536	70		
14	Jalna	60245	5484	693	34192	100613	5558	95054	44265	894	45159	1787	49002	48		
15	Kolhapur	56577	3317	3771	18679	82344	4117	78227	44540	1326	45867	2653	31034	59		
16	Latur	40268	29453	6000	50542	126264	6744	119520	91637	2065	93702	3801	26868	78		
17	Nagpur	71126	6122	11334	23393	111975	6162	105813	34360	6421	40780	12644	58809	39		
18	Nanded	105394	539	16608	23494	146034	7342	138693	39181	2655	41836	5310	94201	30		
19	Nandurbar	40895	14847	0	21836	77577	4917	72660	24908	2373	27281	4745	43006	38		
20	Nashik	154241	9340	285	56246	220113	11690	208423	99298	3519	102816	6670	105080	49		
21	Osmanabad	62831	15749	7645	30729	116954	5904	111050	71830	1892	73722	3700	35620	66		
22	Parbhani	59112	1059	3863	29006	93040	4773	88267	28044	1346	29390	2673	57550	33		
23	Pune	101518	16112	3692	54304	175626	9342	166284	111842	7067	118909	12763	46621	72		
24	Raigad	56364	609	0	2192	59165	2988	56177	4654	2094	6748	4188	47335	12		
25	Ratnagiri	47634	111	0	1318	49063	2458	46605	4031	1219	5249	2438	40137	11		
26	Sangli	55926	10141	2481	26467	95015	5913	89102	65553	2803	68356	5007	20103	77		
27	Satara	63255	10744	10508	26712	111220	5636	105584	68650	4743	73393	9396	27582	70		
28	Sindhudurg	24818	210	348	2211	27586	1390	26196	5437	1826	7263	3651	17108	28		
29	Solapur	99114	11129	13437	35147	158827	8043	150784	113026	4937	117962	8931	34158	78		
30	Thane	52913	525	0	17891	71329	4015	67315	6341	1255	7596	2510	58464	11		
31	Wardha	60476	380	9366	37345	107567	5711	101856	29810	3574	33383	7147	64899	33		
32	Washim	44786	2470	1604	10377	59238	3364	55874	18169	1854	20023	3709	33996	36		
33	Yeotmal	104550	3405	19403	16466	143824	7659	136165	36363	5739	42102	11478	88324	31		
	State Total (ham)	2204439	266587	189883	912310	3573220	192574	3380646	1591311	103589	1694900	200424	1631859	50		
	State Total (bcm)	22.04	2.67	1.90	9.12	35.73	1.93	33.81	15.91	1.04	16.95	2.00	16.32	50		

**GROUND WATER RESOURCES AVAILABILITY, UTILIZATION AND STAGE OF DEVELOPMENT
MANIPUR**

Sl. No.	District	Annual Replenishable Ground Water Resource					Provision for Natural Discharges	Net Annual Ground Water Availability	Annual Ground Water Draft			Projected demand for Domestic and Industrial uses upto 2025	Net Ground Water Availability for Future Irrigation use	Stage of Ground Water Development (%)		
		Monsoon Season		Non Monsoon Season		Total			Irrigation	Domestic & Industrial Water Supply	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		
1	Imphal West	4458	200	3597	400	8655	865	7789	105	30	135	1275	6409	2		
2	Imphal East	6876	149	5548	298	12870	1287	11583	33	9	42	1164	10386	0.36		
3	Thoubal	5981	157	4826	315	11278	1128	10151	90	11	101	1129	8931	1		
4	Bishnupur	4422.25	2.923	3568.12	5.87	7999.16	799.92	7199.24	30	10	40.08	615	6554.39	0.56		
5	Churachandpur	1939.58	14.429	1564.96	28.93	3547.9	354.79	3193.11	75	10	85.23	488	2630.09	2.76		
	State Total (ham)	23677	524	19103	1047	44350	4435	39915	333	70	403	4671	34911	1.01		
	State Total (bcm)	0.24	0.01	0.19	0.01	0.44	0.04	0.40	0.0033	0.0007	0.004	0.05	0.35	1.01		

Note: 1. Assessment carried out by CGWB in absence of active participation of State Govt

2. Assessment carried out in the valley areas of 5 districts out of total 9 districts in the State since rest of the areas are predominantly hilly

**GROUND WATER RESOURCES AVAILABILITY, UTILIZATION AND STAGE OF DEVELOPMENT
MEGHALAYA**

Sl. No.	District	Annual Replenishable Ground Water Resource					Natural Discharge During Non Monsoon Period	Net Ground Water Availability	Annual Ground Water Draft			Projected demand for Domestic and Industrial uses upto 2025	Net Ground Water Availability for Future Irrigation use	Stage of Ground Water Development (%)		
		Monsoon Season		Non Monsoon Season		Total			Irrigation	Domestic & Industrial Water Supply	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		
1	East Khasi Hills	34098	Nil	6170	Nil	40268	4026	36242	Nil	6	6	2382	33860	0.02		
2	West Garo Hills	23693	Nil	5157	Nil	28850	2885	25965	150	3.55	153.55	2055	23760	0.59		
3	East Garo Hills	6525	Nil	1604	Nil	8129	813	7316	Nil	1.76	1.76	1042	6274	0.02		
4	Jaintia Hills	30750	Nil	7050	Nil	37800	3780	34020	Nil	1.98	1.98	1319	32701	0.006		
5	West Khasi Hills	4312	Nil	914	Nil	5226	522	4704	Nil	2.03	2.03	1293	3411	0.04		
6	Ri-Bhoi	1680	Nil	504	Nil	2184	218	1966	Nil	1.25	1.25	1147	819	0.06		
7	South Garo Hills	855	Nil	121	Nil	976	97	879	Nil	0.67	0.67	399	480	0.08		
State Total (ham)		101913	0	21520	0	123433	12341	111092	150	17.24	167.24	9637	101305	0.15		
State Total (bcm)		1.02	0.00	0.22	0.00	1.23	0.12	1.11	0.0015	0.0002	0.0017	0.096	1.01	0.15		

**GROUND WATER RESOURCES AVAILABILITY, UTILIZATION AND STAGE OF DEVELOPMENT
MIZORAM**

Sl. No.	District	Annual Replenishable Ground Water Resource					Natural Discharge During Non Monsoon Period	Net Ground Water Availability	Annual Ground Water Draft			Projected demand for Domestic and Industrial uses upto 2025	Net Ground Water Availability for Future Irrigation use	Stage of Ground Water Development (%)		
		Monsoon Season		Non Monsoon Season		Total			Irrigation	Domestic & Industrial Water Supply	Total					
		Recharge from Rainfall	Recharge From Other Sources	Recharge from Rainfall	Recharge From Other Sources											
1	2	4	5	6	7	8	9	10	11	12	13	14	15	16		
1	Aizawl	249	Negligible	137	Negligible	386	39	348	0	14	14	27	321	3.94		
2	Champhai	509	Negligible	301	Negligible	810	81	729	0	6	6	9	720	0.76		
3	Kolasib	413	Negligible	259	Negligible	673	67	605	0	5	5	9	597	0.78		
4	Lawngtlang	536	Negligible	277	Negligible	813	81	731	0	6	6	14	717	0.79		
5	Lunglei	381	Negligible	172	Negligible	553	55	497	0	7	7	10	487	1.37		
6	Mamit	271	Negligible	221	Negligible	492	49	443	0	1	1	1	441	0.16		
7	Saiha	205	Negligible	119	Negligible	324	32	291	0	3	3	5	286	1.03		
8	Serchhip	202	Negligible	137	Negligible	339	34	305	0	3	3	4	301	0.95		
	State Total (ham)	2766	Negligible	1623	Negligible	4388	439	3950	0	43	43	79	3871	1.09		
	State Total (bcm)	0.03	Negligible	0.02	Negligible	0.044	0.004	0.0395	0	0.0004	0.0004	0.0008	0.04	1.09		

Note: Assessment carried out by CGWB in absence of active participation of State Govt

**GROUND WATER RESOURCES AVAILABILITY, UTILIZATION AND STAGE OF DEVELOPMENT
NAGALAND**

Sl. No.	District	Annual Replenishable Ground Water Resource				Natural Discharge During Non Monsoon Period	Net Ground Water Availability	Annual Ground Water Draft			Projected demand for Domestic and Industrial uses upto 2025	Net Ground Water Availability for Future Irrigation use	Stage of Ground Water Development (%)		
		Monsoon Season		Non Monsoon Season				Total	Irrigation	Domestic & Industrial Water Supply	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	
1	Kohima	2651	-	1093	-	3743	374	3369	-	72	72	157	3212	2.13	
2	Dimapur	11540	-	5482	-	17022	1702	15320	-	287	287	407	14913	1.87	
3	Phek	1727	-	784	-	2510	251	2259	-	47	47	73	2186	2.07	
4	Mokokchung	2856	-	1568	-	4424	442	3981	-	73	73	111	3870	1.84	
5	Zunheboto	1358	-	582	-	1940	194	1746	-	51	51	79	1667	2.92	
6	Wokha	2833	-	1490	-	4323	432	3891	-	57	57	90	3801	1.46	
7	Tuenchung	3698	-	1826	-	5523	552	4971	-	134	134	222	4749	2.69	
8	Mon	1533	-	720	-	2253	225	2028	-	83	83	137	1890	4.09	
State Total (ham)		28194	0	13545	0	41739	4174	37565	-	803	803	1276	36289	2.14	
State Total (bcm)		0.28	0.00	0.14	0.00	0.42	0.04	0.38	-	0.008	0.008	0.01	0.36	2.14	

Note: Assessment carried out by CGWB in absence of active participation of State Govt

**GROUND WATER RESOURCES AVAILABILITY, UTILIZATION AND STAGE OF DEVELOPMENT
ORISSA**

Sl. No.	District	Annual Replenishable Ground Water Resource					Natural Discharge During Non Monsoon Period	Net Ground Water Availability	Annual Ground Water Draft			Projected demand for Domestic and Industrial uses upto 2025	Net Ground Water Availability for Future Irrigation use	Stage of Ground Water Development (%)		
		Monsoon Season		Non Monsoon Season		Total			Irrigation	Domestic & Industrial Water Supply	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		
1	Angul	37078	4312	1645	5795	48830	2753	46077	11787	3418	15205	4685	29605	33		
2	Balasore	78853	13281	4808	19543	116485	6422	110063	47838	5633	53471	8603	53622	49		
3	Bargarh	38893	4556	1127	4261	48837	2783	46054	6917	3181	10098	3768	35369	22		
4	Bhadrak	26200	8525	1862	11629	48216	2807	45409	22571	2626	25197	3473	19365	55		
5	Bolangir	45972	5958	3265	5599	60794	3138	57656	9098	3023	12121	3437	45121	21		
6	Boudh	14105	7742	1930	6123	29900	2061	27839	4687	865	5552	1265	21887	20		
7	Cuttack	38608	12326	2430	22353	75717	5001	70716	17732	5942	23674	7749	45235	33		
8	Deogarh	13351	4256	0	4566	22173	1544	20629	2144	651	2795	949	17536	14		
9	Dhenkanal	36582	3574	2820	3896	46872	2608	44264	8391	2745	11136	3404	32469	25		
10	Gajapati	10985	3549	5802	3673	24009	1339	22670	4468	1120	5588	1296	16906	25		
11	Ganjam	52792	33115	21513	15650	123070	8529	114541	26437	6971	33408	9203	78901	29		
12	Jagatsinghpur	20734	9595	2328	16026	48683	3654	45029	19397	1935	21332	2463	23169	47		
13	Jajpur	39472	4761	7385	8786	60404	3471	56933	22441	2094	24535	2955	31537	43		
14	Jharsuguda	14605	1572	0	1600	17777	986	16791	3309	1508	4817	1839	11643	29		
15	Kalahandi	49321	15576	0	15088	79985	5074	74911	9618	4234	13852	10644	54649	18		
16	Kandhamal	46661	5696	16364	5610	74331	4065	70266	7003	1745	8748	2524	60739	12		
17	Kendrapara	5926	4318	179	7282	17705	924	16781	8201	660	8861	1200	7380	53		
18	Keonjhar	67852	5920	4720	7605	86097	4774	81323	16645	4130	20775	4849	59829	26		
19	Khurda	27948	7316	8884	6639	50787	3169	47618	9140	5001	14141	8603	29875	30		
20	Koraput	56710	7072	4249	5587	73618	4501	69117	3170	3360	6530	4101	61846	9		
21	Malkangiri	25865	5111	1091	3824	35891	2293	33598	1633	1309	2942	1904	30061	9		
22	Mayurbhanj	87685	31446	10090	29333	158554	10360	148194	33963	6366	40329	8286	105945	27		
23	Nabarangapur	46035	1724	3652	1615	53026	2720	50306	4051	2931	6982	6630	39625	14		
24	Nayagarh	25801	6297	6747	6714	45559	2877	42682	7429	2017	9446	2451	32802	22		
25	Nuapada	25491	5113	0	5314	35918	2232	33686	4947	1494	6441	3262	25477	19		
26	Puri	35384	7829	11480	8202	62895	4089	58806	7246	3202	10448	4102	47458	18		
27	Rayagada	42949	10007	7779	9408	70143	4462	65681	6749	2736	9485	3331	55601	14		
28	Sambalpur	34746	10749	0	10989	56484	3964	52520	5611	2495	8106	3254	43655	15		
29	Subarnapur	17161	2348	607	2531	22647	1218	21429	2694	1249	3943	1606	17129	18		
30	Sundergarh	65419	9060	0	7621	82100	4775	77325	11916	4328	16244	5538	59871	21		
State Total (ham)		1129184	252704	132757	262862	1777507	108593	1668914	347233	88969	436202	127374	1194307	26		
State Total (bcm)		11.29	2.53	1.33	2.63	17.78	1.09	16.69	3.47	0.89	4.36	1.27	11.94	26		

**GROUND WATER RESOURCES AVAILABILITY, UTILIZATION AND STAGE OF DEVELOPMENT
PUNJAB**

Sl. No.	District	Annual Replenishable Ground Water Resource					Natural Discharge During Non Monsoon Period	Net Ground Water Availability	Annual Ground Water Draft			Projected demand for Domestic and Industrial uses upto 2025	Net Ground Water Availability for Future Irrigation use	Stage of Ground Water Development (%)		
		Monsoon Season		Non Monsoon Season		Total			Irrigation	Domestic & Industrial Water Supply	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		
1	Amritsar	32354	71318	8521	24501	136695	13670	123026	215724	4823	220547	7516	-100214	179		
2	Barnala	12984	34508	2239	16492	66223	5583	60641	118371	1224	119594	1795	-59525	197		
3	Bathinda	25194	36640	4502	41104	107439	9801	97638	117778	2924	120702	4378	-24518	124		
4	Faridkot	12707	35997	2189	17136	68029	6803	61226	95253	1943	97195	1943	-35969	159		
5	Fateh Garh Sahib	16344	29819	3774	9513	59450	5945	53505	110450	2033	112483	2640	-59585	210		
6	Ferozepur	41124	120243	8801	48225	218392	21839	196553	273766	3266	277032	4824	-82037	141		
7	Gurdaspur	58691	91286	15398	31171	196545	18617	177929	218298	6455	224753	9041	-49410	126		
8	Hoshiarpur	47953	26091	12355	11043	97441	9284	88158	86475	4822	91297	6121	-4438	104		
9	Jalandhar	36173	61708	8395	24987	131263	13126	118137	265594	4587	270181	6603	-154060	229		
10	Kapurthala	21573	37665	5972	7431	72640	7264	65376	150083	3871	153954	4652	-89359	235		
11	Ludhiana	48497	105027	10323	62206	226053	22605	203448	334616	10888	345504	15890	-147057	170		
12	Mansa	17919	32700	3637	20462	74718	7472	67246	143790	13	143804	13	-76558	214		
13	Moga	21998	75810	4285	30587	132679	13268	119411	240557	1761	242319	2322	-123468	203		
14	Muktsar	21212	26744	3951	33437	85345	8534	76810	51286	2460	53746	2460	23064	70		
15	Nawan Shahr	20988	29430	5063	15489	70969	6955	64014	70277	1487	71765	1853	-8116	112		
16	Patiala	44397	79106	9530	32614	165648	16565	149083	286960	4205	291165	6454	-144330	195		
17	Ropar	18673	13043	4382	9192	45290	3772	41518	43487	2331	45818	3107	-5076	110		
18	Mohali	19520	4591	4357	2103	30571	3057	27514	23438	4567	28005	5455	-1379	102		
19	Sangrur	40362	83653	9164	21623	154802	15480	139322	364296	2948	367244	4324	-229299	264		
20	Tarn Taran	27544	62018	7419	18983	115964	11596	104368	186441	2570	189011	4068	-86141	181		
State Total (ham)		586206	1057396	134257	478299	2256158	221236	2034922	3396941	69177	3466117	95456	-1457475	170		
State Total (bcm)		5.86	10.57	1.34	4.78	22.56	2.21	20.35	33.97	0.69	34.66	0.95	-14.57	170		

**GROUND WATER RESOURCES AVAILABILITY, UTILIZATION AND STAGE OF DEVELOPMENT
RAJASTHAN**

Sl. No.	District	Annual Replenishable Ground Water Resource					Natural Discharge During Non Monsoon Period	Net Ground Water Availability	Annual Ground Water Draft			Projected demand for Domestic and Industrial uses upto 2025	Net Ground Water Availability for Future Irrigation use	Stage of Ground Water Development (%)		
		Monsoon Season		Non Monsoon Season		Total			Irrigation	Domestic & Industrial Water Supply	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		
1	Ajmer	29035	1566	0	5484	36084	3374	32711	38186	4691	42877	4725	0	131		
2	Alwar	59312	4087	11317	12234	86951	7468	79482	123183	9204	132387	9204	0	167		
3	Banwara	10121	1090	0	12161	23373	2055	21318	9212	1595	10808	2458	9648	51		
4	Baran	38726	3155	179	12478	54538	5043	49495	45165	2441	47606	3486	7779	96		
5	Barmer	26258	456	0	1217	27930	2179	25751	23488	5926	29414	6344	2197	114		
6	Bharatpur	37558	2452	1677	7881	49568	4217	45351	44651	6206	50856	6781	1348	112		
7	Bhilwara	32853	2130	0	7835	42818	4159	38659	49609	2792	52400	2897	115	136		
8	Bikaner	23744	235	0	1026	25005	1250	23755	24023	7447	31470	7483	4852	132		
9	Budi	20840	2848	0	10719	34408	3441	30967	29513	2590	32103	3790	217	104		
10	Chittaurgarh	25947	1926	0	8673	36547	3786	32760	44958	1340	46297	1408	0	141		
11	Churu	14216	0	0	0	14216	711	13505	9081	2301	11381	3185	4698	84		
12	Dausa	21151	1684	341	4481	27658	2462	25196	37002	2906	39908	2906	0	158		
13	Dholpur	16960	1127	0	4377	22464	1876	20588	25156	2485	27641	2512	370	134		
14	Dungarpur	7801	1193	0	3674	12668	1185	11483	8087	819	8906	2492	904	78		
15	Ganganagar	2698	13192	669	22156	38715	3871	34843	15477	545	16022	1033	18333	46		
16	Hanumangarh	2969	6919	316	12354	22558	2256	20302	15627	698	16324	1107	3568	80		
17	Jaipur	61415	2741	3336	7553	75045	7331	67714	114641	25317	139958	25318	874	207		
18	Jaisalmer	7161	11	0	39	7212	376	6836	6955	2504	9459	2777	1880	138		
19	Jalore	36950	1734	0	4834	43518	4190	39328	73723	3847	77569	3998	67	197		
20	Jhalawar	35783	2011	0	4825	42619	2828	39791	46273	1565	47837	1923	199	120		
21	Jhunjhunu	20989	580	3518	1866	26953	2548	24405	46389	9238	55627	9290	280	228		
22	Jodhpur	38013	622	1604	1867	42106	3205	38901	69330	12103	81433	12843	4655	209		
23	Karauli	31212	1373	0	4276	36861	3272	33590	39744	5562	45305	6051	427	135		
24	Kota	32861	4108	0	25030	61999	6200	55799	46196	4130	50325	5954	6706	90		
25	Nagaur	52537	723	4932	2219	60411	5931	54480	79375	17558	96933	18814	3161	178		
26	Pali	27285	1133	0	4859	33276	3070	30206	31410	2289	33698	3126	139	112		
27	Pratapgarh	10994	962	0	4160	16116	1499	14617	17405	517	17922	1020	167	123		
28	Rajsamand	8453	423	0	1486	10361	1036	9325	10605	1212	11817	1222	0	127		
29	Sawai Madhopur	32591	1502	0	4113	38207	3583	34624	36637	7725	44361	8183	295	128		
30	Sikar	27235	545	4009	1634	33423	3212	30212	39280	6952	46231	7120	316	153		
31	Sirohi	25953	1022	0	3124	30100	2677	27422	29176	823	29999	1301	1239	109		
32	Tonk	35286	2663	0	7986	45935	4221	41714	34175	7067	41242	8980	436	99		
33	Udaipur	21150	1178	0	4251	26580	2526	24053	22759	3043	25803	4006	231	107		
State Total (ham)		876058	67391	31899	210875	1186224	107039	1079185	1286489	165435	1451924	183738	75103	135		
State Total (bcm)		8.76	0.67	0.32	2.11	11.86	1.07	10.79	12.86	1.65	14.52	1.84	0.75	135		

**GROUND WATER RESOURCES AVAILABILITY, UTILIZATION AND STAGE OF DEVELOPMENT
SIKKIM**

Sl. No.	District	Annual Replenishable Ground Water Resource				Natural Discharge During Non Monsoon Period	Net Ground Water Availability	Annual Ground Water Draft			Projected demand for Domestic and Industrial uses upto 2025	Net Ground Water Availability for Future Irrigation use	Stage of Ground Water Development (%)		
		Monsoon Season		Non Monsoon Season				Irrigation	Domestic & Industrial Water Supply	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	
1	North	-	-	-	-	-	250	9	46	56	84	157	22		
2	South	-	-	-	-	-	1365	109	155	264	280	976	19		
3	East	-	-	-	-	-	805	130	307	437	553	122	54		
4	West	-	-	-	-	-	2205	47	148	195	266	1892	9		
State Total (ham)		-	-	-	-	-	4625	295	657	952	1183	3147	21		
State Total (bcm)		-	-	-	-	-	0.046	0.003	0.007	0.010	0.012	0.031	21		

Note: Assessment carried out by CGWB in absence of active participation of State Govt

**GROUND WATER RESOURCES AVAILABILITY, UTILIZATION AND STAGE OF DEVELOPMENT
TAMIL NADU**

Sl. No.	District	Annual Replenishable Ground Water Resource					Natural Discharge During Non Monsoon Period	Net Ground Water Availability	Annual Ground Water Draft			Projected demand for Domestic and Industrial uses upto 2025	Net Ground Water Availability for Future Irrigation use	Stage of Ground Water Development (%)		
		Monsoon Season		Non Monsoon Season		Total			Irrigation	Domestic & Industrial Water Supply	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		
1	Ariyalur	16433	16722	3167	1289	37611	3761	33850	16684	1252	17936	1348	15818	53		
2	Chennai	721	296	90	27	1134	113	1021	0	4141	4141	4141	(-3120.26)	406		
3	Coimbatore	21040	11481	5902	17263	55687	5569	50118	40003	2108	42111	2299	7816	84		
4	Cuddalore	55302	93864	7780	4884	161831	16183	145648	42775	86259	129034	86586	16288	89		
5	Dharmapuri	26475	23801	5862	6439	62576	6258	56319	62416	2353	64769	2438	(-8535.31)	115		
6	Dindigul	24660	14020	13916	13460	66056	6606	59450	67737	2822	70558	2916	(-11202.39)	119		
7	Erode	16283	48930	5233	15609	86054	8605	77449	47725	2386	50111	2786	26937	65		
8	Kancheepuram	41996	71370	4157	6963	124486	12449	112037	80460	5077	85536	6585	24992	76		
9	Kanyakumari	9261	20709	3650	1551	35171	3517	31654	3270	2456	5727	2888	25495	18		
10	Karur	13235	14340	3356	2735	33666	3367	30299	26262	1033	27295	1097	2941	90		
11	Krishnagiri	24457	23264	6399	5898	60018	5973	54045	53849	3056	56905	3409	Nil (-3242.43)	105		
12	Madurai	17978	48256	4944	2475	73653	7365	66288	47375	5969	53344	6353	12560	80		
13	Nagapattinam	6324	8640	978	7040	22982	2298	20684	28055	643	28698	658	(-8029.13)	139		
14	Namakkal	14220	21833	3943	12938	52934	5293	47641	39087	1838	40925	2054	6500	86		
15	Nilgiris	12065	3243	3754	150	19211	1921	17290	747	1850	2597	1914	14629	15		
16	Perambalur	11227	10913	2073	1651	25865	2587	23279	30180	925	31105	925	(-7826.54)	134		
17	Pudukkottai	36058	57581	7316	2205	103160	10316	92844	36742	1926	38668	2516	53586	42		
18	Ramanathapuram	9339	24630	2320	2406	38694	3869	34825	4616	449	5065	523	29686	15		
19	Salem	26575	21933	6912	32904	88323	8832	79491	75226	2900	78126	3147	1118	98		
20	Sivagangai	38411	7107	47437	5146	98100	9810	88290	24049	1717	25765	1979	62263	29		
21	Thanjavur	27693	38884	4796	4417	75790	7579	68211	86558	3612	90170	3798	(-22145.81)	132		
22	Theni	13754	23568	5059	4374	46755	4676	42079	40898	779	41677	838	344	99		
23	Thoothukudi	20913	21635	6947	1984	51480	5148	46332	25302	3498	28799	3930	17101	62		
24	Tiruchirappalli	29628	41308	6764	3238	80939	8094	72845	58322	5382	63704	5622	8901	87		
25	Tirunelveli	31002	70395	11548	4904	117849	11785	106064	57756	7200	64957	7891	40416	61		
26	Tiruppur	21542	16486	6438	22401	66866	6687	60180	44573	2129	46702	2468	13140	78		
27	Tiruvallur	47420	38904	5941	2529	94794	9479	85314	48001	11013	59013	13009	24305	69		
28	Tiruvannamalai	31496	71584	7005	11317	121401	12140	109261	108582	3564	112146	3795	(-3116.21)	103		
29	Tiruvarur	11019	15306	1790	5024	33140	3314	29826	25315	787	26102	851	3660	88		
30	Vellore	24221	22776	6903	5121	59020	5902	53118	55386	5103	60489	5486	(-7753.80)	114		
31	Villupuram	52431	174181	6898	7169	240679	24068	216611	158602	8927	167529	9957	48052	77		
32	Virudhunagar	21030	27508	6942	2934	58415	5841	52573	34582	2143	36725	2515	15476	70		
State total (ham)		754210	1105468	216218	218446	2294342	229405	2064937	1471134	185296	1656430	196722	397080	80		
State Total (bcm)		7.54	11.05	2.16	2.18	22.94	2.29	20.65	14.71	1.85	16.56	1.97	4.70	80		

**GROUND WATER RESOURCES AVAILABILITY, UTILIZATION AND STAGE OF DEVELOPMENT
TRIPURA**

Sl. No.	District	Annual Replenishable Ground Water Resource					Natural Discharge During Non Monsoon Period	Net Ground Water Availability	Annual Ground Water Draft			Projected demand for Domestic and Industrial uses upto 2025	Net Ground Water Availability for Future Irrigation use	Stage of Ground Water Development (%)		
		Monsoon Season		Non Monsoon Season		Total			Irrigation	Domestic & Industrial Water Supply	Total					
		Recharge from Rainfall	Recharge From Other Sources	Recharge from Rainfall	Recharge From Other Sources											
1	2	4	5	6	7	8	9	10	11	12	13	14	15	16		
1	West Tripura district	69564	0	21015	22516	113095	11310	101785	7134	3281	10415	10526	84125	10		
2	South Tripura district	46135	0	21170	17465	84770	5083	79687	1980	1588	3568	4910	72797	4		
3	North Tripura district	22616	0	15994	9334	47944	2397	45546	174	1435	1609	5334	40038	4		
4	Dhalai district	28010	0	15222	7689	50921	4147	46774	30	730	760	1922	44822	2		
	State total(ham)	166325	0	73401	57004	296730	22937	273792	9318	7034	16352	22693	241782	6		
	State Total (bcm)	1.66	0	0.73	0.57	2.97	0.23	2.74	0.09	0.07	0.16	0.23	2.42	6		

Note: Assessment carried out by CGWB in absence of active participation of State Govt

**GROUND WATER RESOURCES AVAILABILITY, UTILIZATION AND STAGE OF DEVELOPMENT
UTTAR PRADESH**

Sl. No.	District	Annual Replenishable Ground Water Resource					Natural Discharge During Non Monsoon Period	Net Ground Water Availability	Annual Ground Water Draft			Projected demand for Domestic and Industrial uses upto 2025	Net Ground Water Availability for Future Irrigation use	Stage of Ground Water Development (%)		
		Monsoon Season		Non Monsoon Season		Total			Irrigation	Domestic & Industrial Water Supply	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		
1	Agra	47188	20120	7829	35053	110189	11019	99170	88641	6614	95255	8560	1970	96		
2	Aligarh	65013	17110	10878	27249	120249	12025	108224	81504	5094	86598	6105	20615	80		
3	Allahabad	75509	23963	0	25921	125393	10248	115144	77428	9421	86849	22562	15155	75		
4	Ambedkar Nagar	47981	24746	10851	24901	108479	10848	97631	53132	4825	57956	7664	36836	59		
5	Auraiya	27575	11995	0	24839	64410	6441	57969	40712	2605	43316	3312	13945	75		
6	Azamgarh	72046	22941	15695	29334	140017	12834	127183	71666	12563	84230	17057	38460	66		
7	Baghpat	17502	7545	990	14792	40829	2990	37839	41880	2245	44125	2445	-6486	117		
8	Ballia	49060	15736	15379	20098	100273	8075	92198	52035	6473	58508	10737	29426	63		
9	Balrampur	66824	5752	13013	10081	95669	7074	88596	39311	4037	43348	6290	42994	48		
10	Banda	52825	9549	0	8137	70510	7051	63459	30884	2719	33604	4073	28501	53		
11	Barabanki	86140	38678	18101	70064	212983	21298	191685	125096	6891	131987	10203	56386	69		
12	Bareilly	86563	22695	3837	32349	145444	11649	133795	97885	4330	102216	10183	25727	76		
13	Basti	63603	11158	15173	13606	103539	9415	94124	66166	4831	70996	7392	20566	75		
14	Behraich	90799	6801	19718	13280	130598	10845	119753	63726	6556	70282	10732	45295	59		
15	Bijnor	107759	10276	14080	16783	148898	12410	136488	78740	6422	85162	9402	48346	62		
16	Budaun	92134	12008	11847	20049	136038	11751	124287	112394	6618	119012	7509	4385	96		
17	Bulandshahar	57106	34619	7471	60374	159570	14479	145091	106148	5791	111939	8167	30775	77		
18	Chandauli	36100	22355	0	15924	74380	3719	70661	19577	4060	23638	6048	45035	33		
19	Chitrakoot	23796	1150	0	1451	26396	2413	23984	15166	2137	17303	3083	5735	72		
20	Deoria	59898	10742	11739	17144	99522	8844	90678	59180	7308	66489	8538	22960	73		
21	Etah	37178	14598	6614	21841	80231	8023	72208	57117	3413	60529	4620	10471	84		
22	Etawah	34523	13700	2387	26199	76809	7053	69756	36713	2440	39153	2900	30143	56		
23	Faizabad	44547	15436	9829	18500	88312	8299	80013	49533	4027	53560	7718	22762	67		
24	Farrukhabad	41796	5229	4466	9879	61370	5172	56198	36398	3104	39503	4225	15574	70		
25	Fatehpur	61720	18877	0	26891	107488	6584	100904	79378	5274	84652	12061	9465	84		
26	Firozabad	32499	13226	6215	23870	75810	6152	69658	66297	3791	70088	5142	-1781	101		
27	G.B.Nagar	18333	8025	2796	19522	48675	4174	44501	38206	1778	39984	3001	3295	90		
28	Ghaziabad	43119	13814	5249	28337	90519	8045	82474	56040	6899	62940	8455	17979	76		
29	Ghazipur	61401	25712	11594	33306	132012	13201	118811	74173	7586	81759	13419	31219	69		
30	Gonda	79192	9606	19530	16393	124722	9041	115681	75878	6654	82532	11105	28697	71		
31	Gorakhpur	116399	13413	23040	21825	174677	16197	158480	94910	7621	102532	11655	51915	65		
32	Hamirpur	31689	4523	7263	10499	53974	4972	49002	20612	2226	22838	4996	23394	47		
33	Hardoi	99147	32189	7693	42411	181439	18144	163296	114476	7332	121808	10934	37886	75		
34	Hathras	24651	12278	4041	22442	63411	6341	57070	47705	3223	50929	4021	5344	89		
35	J.P. Nagar	44438	5952	5596	8759	64745	4222	60523	61581	2878	64459	3032	-4090	107		
36	Jalaun	71566	19912	9862	33174	134514	13451	121063	42645	4308	46953	6333	72085	39		
37	Jaunpur	84912	27355	0	38806	151074	13082	137992	97823	9427	107251	14512	25657	78		

**GROUND WATER RESOURCES AVAILABILITY, UTILIZATION AND STAGE OF DEVELOPMENT
UTTAR PRADESH**

Sl. No.	District	Annual Replenishable Ground Water Resource					Natural Discharge During Non Monsoon Period	Net Ground Water Availability	Annual Ground Water Draft			Projected demand for Domestic and Industrial uses upto 2025	Net Ground Water Availability for Future Irrigation use	Stage of Ground Water Development (%)		
		Monsoon Season		Non Monsoon Season		Total			Irrigation	Domestic & Industrial Water Supply	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		
38	Jhansi	37218	3865	7252	14159	62493	5890	56603	37730	3317	41046	4167	14707	73		
39	Kannauj	33862	10075	4123	21509	69569	5444	64125	41160	2767	43927	3429	19537	69		
40	Kanpur Dehat	54613	11689	0	22759	89060	8108	80952	51721	3554	55275	4632	24598	68		
41	Kanpur Nagar	46816	12432	0	24024	83272	7591	75681	57709	3331	61040	4259	13713	81		
42	Kashiram Nagar	30156	10702	5027	16261	62147	6215	55932	40497	2363	42860	2890	12545	77		
43	Kaushambhi	31076	6101	1295	6411	44883	3950	40933	29477	3136	32613	5753	5703	80		
44	Kushi Nagar	56246	32363	11599	40069	140277	12787	127490	68869	6371	75240	7306	51314	59		
45	Lakhimpur	137290	35466	39274	75315	287345	26654	260691	153254	8086	161341	14514	92923	62		
46	Lalitpur	38483	3434	6168	10269	58355	4794	53560	25946	2786	28732	3341	24273	54		
47	Lucknow	32923	12924	0	18170	64017	5397	58620	39068	3574	42642	5512	14041	73		
48	Maharajganj	69273	19447	18204	25951	132876	11843	121033	65414	5585	71000	8699	46920	59		
49	Mahoba	11018	904	1932	3290	17146	1715	15431	12706	1443	14150	1890	834	92		
50	Mainpuri	39291	14615	7655	31395	92956	7569	85387	65549	3942	69490	5784	14054	81		
55	Mathura	38606	21767	7310	35173	102856	9074	93781	74491	3662	78153	4428	14863	83		
56	Maunath Bhanjan	27665	6396	5615	7270	46946	3855	43091	27889	3944	31833	6960	8242	74		
57	Meerut	42117	21531	5522	43421	112592	7294	105298	66349	3729	70078	4034	34915	67		
58	Mirzapur	41223	11326	0	11519	64068	5870	58198	29380	4882	34263	9648	19170	59		
59	Moradabad	77047	17084	7550	19468	121148	12115	109034	103476	7403	110879	10500	-4942	102		
60	Muzaffarnagar	50139	30465	11217	54594	146415	12315	134100	140834	7055	147890	7466	-14200	110		
61	Pilibhit	86718	18615	0	25918	131251	7998	123253	75495	2447	77942	5719	42040	63		
62	Pratapgarh	72686	23963	12547	27685	136881	10644	126236	83477	6716	90193	15504	27255	71		
63	Raebareli	56314	22463	10683	34227	123686	10890	112796	76773	6777	83551	9718	26305	74		
64	Rampur	61330	10954	2217	27963	102463	10246	92217	69253	4014	73267	5766	17198	79		
65	Saharanpur	51841	25530	15681	36936	129988	11643	118345	151893	5492	157386	5775	-39323	133		
66	Sant Kabeer Nagar	52873	6048	12923	10246	82090	8209	73881	48692	3377	52069	5668	19522	70		
67	Sant Ravidas Nagar	22409	7018	0	8342	37769	3438	34331	20085	3205	23290	4823	9424	68		
68	Shajahanpur	107989	18607	10904	26634	164134	15499	148635	106815	5068	111883	6672	35147	75		
69	Shrawasti	29611	2271	6988	3955	42825	3438	39387	17382	2153	19535	3579	18426	50		
70	Siddharth Nagar	88149	9955	19944	16306	134353	12588	121765	63509	5099	68608	8933	49323	56		
71	Sitapur	194500	34986	0	68773	298260	28764	269495	124159	8555	132714	12852	132484	49		
72	Sonbhadra	18028	3290	0	1374	22692	2017	20674	9981	1835	11815	4456	6238	57		
73	Sultanpur	81834	44297	0	50523	176654	15586	161068	108346	8113	116459	13344	39378	72		
74	Unnao	68866	35660	6673	56321	167520	15648	151873	108144	6156	114300	9991	33738	75		
75	Varanasi	37096	6966	0	9240	53302	5330	47972	33301	5269	38570	9885	4786	80		
State total (ham)		4077837	1136994	541075	1769552	7525458	668004	6857454	4599580	348728	4948308	536083	1721792	72		
State Total (bcm)		40.78	11.37	5.41	17.70	75.25	6.68	68.57	46.00	3.49	49.48	5.36	17.22	72		

**GROUND WATER RESOURCES AVAILABILITY, UTILIZATION AND STAGE OF DEVELOPMENT
UTTRAKHAND**

Sl. No.	District	Annual Replenishable Ground Water Resource					Natural Discharge During Non Monsoon Period	Net Ground Water Availability	Annual Ground Water Draft			Projected demand for Domestic and Industrial uses upto 2025	Net Ground Water Availability for Future Irrigation use	Stage of Ground Water Development (%)		
		Monsoon Season		Non Monsoon Season		Total			Irrigation	Domestic & Industrial Water Supply	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		
1	Dehradun	34957	1180	4197	1430	41763	130	41633	2435	122	2557	2703	36494	6		
2	Haridwar	31400	15278	7270	31138	85087	3832	81255	41933	2097	44029	2294	37181	54		
3	USNagar	50261	7202	7791	13029	78284	4802	73481	53431	1069	54500	2747	17303	74		
4	Nainital	9493	421	1176	758	11849	1185	10664	3678	74	3752	241	6744	35		
State Total (ham)		126112	24081	20434	46356	216983	9950	207033	101477	3361	104838	7986	97722	51		
State Total (bcm)		1.26	0.24	0.20	0.46	2.17	0.10	2.07	1.01	0.03	1.05	0.08	0.98	51		

Note: Assessment carried out in the valley areas of 4 districts out of total 13 districts in the State since rest of the areas are predominantly hilly

**GROUND WATER RESOURCES AVAILABILITY, UTILIZATION AND STAGE OF DEVELOPMENT
WEST BENGAL**

Sl. No.	District	Annual Replenishable Ground Water Resource					Natural Discharge During Non Monsoon Period	Net Ground Water Availability	Annual Ground Water Draft			Projected demand for Domestic and Industrial uses upto 2025	Net Ground Water Availability for Future Irrigation use	Stage of Ground Water Development (%)		
		Monsoon Season		Non Monsoon Season		Total			Irrigation	Domestic & Industrial Water Supply	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		
1	BANKURA	107226	30500	28017	50014	215757	20434	195324	53814	4970	58784	6135	135375	30		
2	BARDDHAMAN	172440	36960	49654	77880	336933	30605	306328	145288	6850	152138	8343	155063	50		
3	BIRBHUM	70781	25025	19271	47259	162336	14876	147460	30131	4750	34882	6194	111134	24		
4	DAKSHIN DINAJPUR	69462	5487	18962	15476	109387	10939	98449	41504	2091	43595	2877	54068	44		
5	DARJEELING	39332	601	10813	1544	52289	5229	47060	962	911	1872	1275	44824	4		
6	HOOGLY	87800	17749	24855	36218	166621	16578	150042	48864	5705	54569	7230	93948	36		
7	HOWRAH	19382	2802	5576	9009	36768	3677	33092	4665	1488	6153	1857	26570	19		
8	JALPAIGURI	198706	1554	59567	3914	263740	26374	237366	7099	3395	10494	4637	225630	4		
9	KOCHBIHAR	157742	4202	61238	10378	233560	23356	210204	37722	3796	41517	4709	167774	20		
10	MALDA	95966	5129	25363	17560	144017	13224	130793	49066	5485	54551	7795	73933	42		
11	MURSHIDABAD	134047	19045	41382	45773	240247	21894	218353	163042	9171	172214	10974	60833	79		
12	NADIA	111789	17760	42127	49377	221053	22105	198948	167617	6316	173933	7673	34996	87		
13	NORTH 24 PARGANAS	94719	7703	26958	22653	152032	15203	136828	77292	5864	83156	8121	51415	61		
14	PASCHIM MEDINIPUR	231408	21963	69527	52323	375221	35895	339326	92863	7781	100644	9855	236608	30		
15	PURBA MEDINIPUR	54616	2130	15258	8196	80200	8020	72180	19090	2872	21962	3637	49453	30		
16	PURULIA	53173	10726	12742	5926	82568	7935	74633	1444	3837	5281	4747	68441	7		
17	UTTAR DINAJPUR	118151	7115	31624	20343	177234	15260	161973	70947	3954	74901	5884	85142	46		
	State Total (ham)	1816741	216449	542933	473841	3049964	291605	2758359	1011411	79234	1090645	101944	1675206	40		
	State Total (bcm)	18.17	2.16	5.43	4.74	30.50	2.92	27.58	10.11	0.79	10.91	1.02	16.75	40		

Note: Assessment carried out in 17 districts out of total 19 districts in the State since rest of the 2 districts are completely underlain by Confined aquifers

**GROUND WATER RESOURCES AVAILABILITY, UTILIZATION AND STAGE OF DEVELOPMENT
ANDAMAN & NICOBAR**

Sl. No.	District	Annual Replenishable Ground Water Resource				Natural Discharge During Non Monsoon Period	Net Ground Water Availability	Annual Ground Water Draft			Projected demand for Domestic and Industrial uses upto 2025	Net Ground Water Availability for Future Irrigation use	Stage of Ground Water Development (%)		
		Monsoon Season		Non Monsoon Season				Irrigation	Domestic & Industrial Water Supply	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	
1	Andaman& Nicobar Islands	24453	-	6550	-	31002	1191	29811	63	1033	1096	1457	28291	3.70	
	UT Total (ham)	24453	-	6550	-	31002	1191	29811	63	1033	1096	1457	28291	3.70	
	UT Total (bcm)	0.24	-	0.07	-	0.31	0.01	0.30	0.0006	0.01	0.01	0.02	0.28	3.70	

**GROUND WATER RESOURCES AVAILABILITY, UTILIZATION AND STAGE OF DEVELOPMENT
CHANDIGARH**

Sl. No.	District	Annual Replenishable Ground Water Resource					Natural Discharge During Non Monsoon Period	Net Ground Water Availability	Annual Ground Water Draft			Projected demand for Domestic and Industrial uses upto 2025	Net Ground Water Availability for Future Irrigation use	Stage of Ground Water Development (%)		
		Monsoon Season		Non Monsoon Season		Total			Irrigation	Domestic & Industrial Water Supply	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		
1	Chandigarh	1545	53	488	87	2173	217	1956	0	0	0	0	1956	0		
	UT Total (ham)	1545	53	488	87	2173	217	1956	0	0	0	0	1956	0		
	UT Total (bcm)	0.015	0.001	0.005	0.001	0.022	0.002	0.020	0.00	0.00	0.00	0.00	0.020	0		

Note: Ground water draft is through deep tubewells tapping confined aquifer

**GROUND WATER RESOURCES AVAILABILITY, UTILIZATION AND STAGE OF DEVELOPMENT
DADRA & NAGAR HAVELI**

Sl. No.	District	Annual Replenishable Ground Water Resource					Natural Discharge During Non Monsoon Period	Net Ground Water Availability	Annual Ground Water Draft			Projected demand for Domestic and Industrial uses upto 2025	Net Ground Water Availability for Future Irrigation use	Stage of Ground Water Development (%)		
		Monsoon Season		Non Monsoon Season		Total			Irrigation	Domestic & Industrial Water Supply	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		
1	Dadra & Nagar Haveli	4264	263	941	469	5937	297	5641	111	749	861	866	4663	15		
	UT Total (ham)	4264	263	941	469	5937	297	5641	111	749	861	866	4663	15		
	UT Total (bcm)	0.043	0.003	0.009	0.005	0.059	0.003	0.056	0.001	0.007	0.009	0.009	0.047	15		

**GROUND WATER RESOURCES AVAILABILITY, UTILIZATION AND STAGE OF DEVELOPMENT
DAMAN & DIU**

Sl. No.	Union Territory	Annual Replenishable Ground Water Resource					Natural Discharge During Non Monsoon Period	Net Ground Water Availability	Annual Ground Water Draft			Projected demand for Domestic and Industrial uses upto 2025	Net Ground Water Availability for Future Irrigation use	Stage of Ground Water Development (%)		
		Monsoon Season		Non Monsoon Season		Total			Irrigation	Domestic & Industrial Water Supply	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		
1	Diu	199	15	0	30	244	24	220	254	75	329	112	-146	150		
2	Daman	758	67	0	161	986	99	887	580	192	772	289	18	87		
UT Total (ham)		957	82	0	191	1230	123	1107	834	267	1101	401	-128	99		
UT Total (bcm)		0.010	0.001	0.000	0.002	0.012	0.001	0.011	0.008	0.003	0.011	0.004	-0.001	99		

**GROUND WATER RESOURCES AVAILABILITY, UTILIZATION AND STAGE OF DEVELOPMENT
LAKSHADWEEP ISLANDS**

Sl. No.	Islands	Annual Replenishable Ground Water Resource					Natural Discharge During Non Monsoon Period	Net Ground Water Availability	Annual Ground Water Draft			Projected demand for Domestic and Industrial uses upto 2025	Net Ground Water Availability for Future Irrigation use	Stage of Ground Water Development (%)		
		Monsoon Season		Non Monsoon Season		Total			Irrigation	Domestic & Industrial Water Supply	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		
1	Agatti	-	-	-	-	107.779	72.362	35.418	-	31.62	31.62	-	-	89		
2	Amini	-	-	-	-	103.007	68.952	34.054	-	30.55	30.55	-	-	90		
3	Androth	-	-	-	-	192.492	130.246	62.245	-	46.01	46.01	-	-	74		
4	Chetlat	-	-	-	-	41.362	27.794	13.567	-	9.33	9.33	-	-	69		
5	Kadmat	-	-	-	-	124.086	83.384	40.701	-	25.99	25.99	-	-	64		
6	Kalpeni	-	-	-	-	90.678	61.022	29.657	-	16.68	16.68	-	-	56		
7	Kiltan	-	-	-	-	64.827	43.18	21.646	-	16.01	16.01	-	-	74		
8	Kavaratti	-	-	-	-	144.369	95.998	48.371	-	43.05	43.05	-	-	89		
9	Minicoy	-	-	-	-	185.756	121.552	64.203	-	39.55	39.55	-	-	62		
	UT Total (ham)	-	-	-	-	1054.356	704.49	349.862	0	258.79	258.79	0	0	74		
	UT Total (bcm)	-	-	-	-	0.011	0.007	0.0035	0.000	0.003	0.0026	0.000	0.000	74		

GROUND WATER RESOURCES AVAILABILITY, UTILIZATION AND STAGE OF DEVELOPMENT PUDUCHERRY																
Sl. No.	Region	Annual Replenishable Ground Water Resource					Natural Discharge During Non Monsoon Period	Net Ground Water Availability	Annual Ground Water Draft			Projected demand for Domestic and Industrial uses upto 2025	Net Ground Water Availability for Future Irrigation use	Stage of Ground Water Development (%)		
		Monsoon Season		Non Monsoon Season		Total)			Irrigation	Domestic & Industrial Water Supply	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		
1	Puducherry	6291	1965	557	1545	10358	1036	9322	11600	2402	14002	2622	Nil	150		
2	Karaikal	2050	3589	233	642	6514	651	5862	511	388	899	455	4897	15		
3	Mahe	223	0	21	0	244	24	219	0	144	144	162	57	66		
4	Yanam	-	-	-	-	-	-	-	-	-	-	-	-	0		
	UT Total (ham)	8563	5554	811	2187	17116	1712	15404	12111	2934	15044	3239	4954	98		
	UT Total (bcm)	0.086	0.056	0.008	0.022	0.171	0.017	0.154	0.121	0.029	0.150	0.032	0.050	98		

ANNEXURE - III

**CATEGORIZATION OF BLOCKS/ MANDALS/
TALUKAS IN INDIA
(AS ON MARCH, 2009)**

CATEGORIZATION OF BLOCKS/ MANDALS/ TALUKS IN INDIA (As on March 2009)

Sl.N o.	States / Union Territories	Total No. of Assessed Units	Safe		Semi-critical		Critical		Over-exploited		Remarks
			Nos.	%	Nos.	%	Nos.	%	Nos.	%	
States											
1	Andhra Pradesh	1108	867	78	93	8	26	2	84	8	38- Salinity Affected
2	Arunachal Pradesh	16	16	100	0	0	0	0	0	0	
3	Assam	23	23	100	0	0	0	0	0	0	
4	Bihar	533	529	99	4	1	0	0	0	0	
5	Chhattisgarh	146	132	90	14	10	0	0	0	0	
6	Delhi	27	2	7	5	19	0	0	20	74	
7	Goa	11	11	100	0	0	0	0	0	0	
8	Gujarat	223	156	70	20	9	6	3	27	12	14 - Salinity Affected
9	Haryana	116	18	16	9	8	21	18	68	59	
10	Himachal Pradesh	8	6	75	0	0	1	13	1	13	
11	Jammu & Kashmir	14	14	100	0	0	0	0	0	0	
12	Jharkhand	208	200	96	2	1	2	1	4	2	
13	Karnataka	270	154	57	34	13	11	4	71	26	
14	Kerala	152	126	83	22	14	3	2	1	1	
15	Madhya Pradesh	313	224	72	61	19	4	1	24	8	
16	Maharashtra	353	324	92	19	5	1	0	9	3	
17	Manipur	8	8	100	0	0	0	0	0	0	
18	Meghalaya	7	7	100	0	0	0	0	0	0	
19	Mizoram	22	22	100	0	0	0	0	0	0	
20	Nagaland	8	8	100	0	0	0	0	0	0	
21	Orissa	314	308	98	0	0	0	0	0	0	6 - Salinity Affected
22	Punjab	138	23	17	2	1	3	2	110	80	
23	Rajasthan	239	31	13	16	7	25	10	166	69	1 - Salinity Affected
24	Sikkim	4	4	100	0	0	0	0	0	0	
25	Tamil Nadu	386	136	35	67	17	33	9	139	36	11 - Salinity Affected
26	Tripura	39	39	100	0	0	0	0	0	0	
27	Uttar Pradesh	820	605	74	107	13	32	4	76	9	
28	Uttarakhand	17	11	65	5	29	1	6	0	0	
29	West Bengal	269	231	86	38	14	0	0	0	0	
Total States		5792	4235	73	518	9	169	3	800	14	
Union Territories											
1	Andaman & Nicobar	33	33	100	0	0	0	0	0	0	
2	Chandigarh	1	1	100	0	0	0	0	0	0	
3	Dadra & Nagar Haveli	1	1	100	-	-	-	-	-	-	-
4	Daman & Diu	2	0	0	1	50	0	0	1	50	
5	Lakshdweep	9	5	56	4	44	0	0	0	0	
6	Puducherry	4	2	50	0	0	0	0	1	25	1 - Salinity Affected
Total Uts		50	42	84	5	10	0	0	2	4	
Grand Total		5842	4277	73	523	9	169	3	802	14	71 - Salinity Affected

Blocks- Bihar, Chattisgarh, Haryana, Jharkhand, Kerala, M.P., Manipur, Mizoam, Orissa, Punjab, Rajasthan, Tamil Nadu, Tripura, UP, UttaraKhand, WB

Taluks (Command/Non-Command) -Karnataka

Mandal - Andhra Pradesh

Taluks - Goa, Gujarat, Maharashtra, NCT Delhi

Districts (Valley) - Arunachal Pradesh, Assam, Himachal Pradesh, Jammu & Kashmir, Meghalaya, Manipur, Mizoram, Nagaland, Sikkim, Tripura

Islands - Lakshdweep, Andaman & Nicobar Islands

Region - Puducherry

UT - Chandigarh, Dadar & Nagar Haveli, Daman & Diu

ANNEXURE - IV

STATE-WISE CATEGORIZATION OF BLOCKS/ MANDALS/ TALUKAS (AS ON MARCH, 2009)

CATEGORIZATION OF MANDALS IN ANDHRA PRADESH				
SI. No.	DISTRICT	SEMI-CRITICAL	CRITICAL	
1	Anantapur	1 Anantapur	1 Madakasira	
		2 Atmakur	2 Parigi	
		3 B.K.Samudram	3 Penukonda	
		4 Bukkapatnam	4 Raptadu	
		5 Garladinne	5 Roddam	
		6 Gooty		
		7 Gorantla		
		8 Gummagatta		
		9 Kadiri		
		10 Kalyandurg		
		11 Kambadur		
		12 Kanaganapalli		
		13 Kudair		
		14 Narpala		
		15 O.D.Cheruvu		
		16 Ramagiri		
		17 Rayadurg		
		18 Settur		
		19 Somandepalli		
		20 Talupula		
2	Chittoor	1 Chowdepalli	1 Baireddypalli	
		2 Gangavaram	2 G.D.Nellore	
		3 Gudupalli	3 Piler	
		4 Madanapalli	4 Pulicherla	
		5 Nimmanapalli	5 Punganur	
		6 Palamaneru	6 Thavanampalli	
		7 Peddapanjani	7 Yadamarri	
		8 Thottambedu		
		9 Vadamatlapeta		
3	East Godavari	1 Gandepalli	1 Nindra	
		2 Rajanagaram	2 Pakala	
4	Kadapa	1 Atloor	3 Palasamudram	
		2 Kalasapadu	4 Penumuru	
		3 Kamalapuram	5 Puthalapattu	
		4 Lingala	6 R.C.Puram	
		5 Muddanur	7 Ramakuppam	
		6 Obulavaripalli	8 Ramasamudram	
		7 Porumamilla	9 S R Puram	
		8 Rajampeta	10 Santhipuram	
		9 Simhadripuram	11 Tirupathi®	
		10 T.Sundupalli	12 Vijayapuram	
		11 Thondur		
		12 Vallur		
		13 Vempalli	13 Yerpedu	
		1 Chinnamandem		
		2 Pulivendula		
		3 Pullampeta		
		4 Vemula		

CATEGORIZATION OF MANDALS IN ANDHRA PRADESH

SI. NO.	DISTRICT	SEMI-CRITICAL	CRITICAL	OVER EXPLOITED
5	Khammam			1 Tirumalayapalem 1 Musunuru 2 Nuzvid
6	Krishna			
7	Sangareddy	1 Jagdevpur 2 Pulkal 3 Sangareddy 4 Shivampet 5 Thoguta	1 Doulthabad 2 Hathnura 3 Jharasangam 4 Kulcharam 5 Nanganur 6 Nyalkal 7 Papannapet 8 Regode 9 Zaheerabad	1 Dubbak 2 Kalher 3 Koheer 4 Kondapak 5 Kowdipally 6 Mirdoddi 7 Mulugu 8 Narsapur 9 Ramayampet
8	Mehbubnagar	1 Addakal 2 Amangal 3 Bhoothpur 4 Kalwakurthy 5 Keshampeta 6 Koilkonda 7 Kondurg 8 Kosgi 9 Midjil 10 Shadnagar 11 Talakondapalle 12 Uppununthala		
9	Nalgonda	1 Alair 2 Thungathurthi 3 Valigonda 4 Bhongir 5 Kethepalle 6 Mothey 7 Nalgonda 8 Munugode 9 Narayanapur 10 Chandur		1 Thirumalgiri 2 Jajireddi Gudem 3 Nakrekal 4 Suryapet 5 Kanagal
10	Nizamabad	1 Balkonda 2 Jakranpally 3 Kammarpally 4 Nandipet 5 Sirikonda	1 Bheemgal	1 Armoor 2 Biknoor 3 Domakonda 4 Kamareddy 5 Morthad 6 Velpoor
11	Prakasam	1 Ardhaveedu 2 Komarolu 3 Tarlupadu		1 B.Peta 2 Dornala 3 Giddaluru 4 Markapuram 5 Peddaraveedu 6 Racherla 7 Y.Palem
12	Ranga Reddy & Hyderabad	1 Kandukur	1 Shamshabad	1 Medchal

CATEGORIZATION OF MANDALS IN ANDHRA PRADESH			
SI. No.	DISTRICT	SEMI-CRITICAL	CRITICAL
12	Ranga Reddy & Hyderabad	2 Pargi 3 Shabad 4 Shankarpally	
13	Srikakulam	1 Laveru	1 Ranasthalam
14	Warangal	1 Devaruppula 2 Dharmasagar 3 Dornakal 4 Mahabubabad 5 Nekkonda 6 Nellikudur 7 Parvtagiri 8 Sangem 9 Shayampet	1 Bachannapet 2 Chennaraopet 3 Duggondi 4 Geesugonda 5 Jangaon 6 Lingala ghanpur 7 Maddur 8 Mogullapally 9 Narmetta 10 Narsampet 11 Raghunathpally 12 Rayaparthy 13 Stn Ghanpur 14 Thorur 15 Wardhannapet 16 Zaffergadh

ABSTRACT

Assessed Mandal	Semi Critical	Critical	Over-exploited
1108	93	26	84

CATEGORISATION OF BLOCKS IN BIHAR

Sl.no.	District	Semi-critical	Critical	Over-exploited
1	Gaya	1 Gaya Sadar	-	-
2	Nalanda	1 Nagarnausa	-	-
3	Nawada	2 Rajgir 1 Meskaur	-	-

ABSTRACT

Assessed Blocks	Semi critical	Critical	Over- exploited
533	4	0	0

CATEGORIZATION OF BLOCKS IN CHHATTISGARH

Sl. No.	District	Semi-critical	Critical	Over-exploited
1	Bilaspur	1 Belha	-	-
2	Dhamtari	1 Dhamtari	-	-
		2 Kurud	-	-
		3 Nagari	-	-
3	Durg	1 Balod	-	-
		2 Bemetara	-	-
		3 Dhamdha	-	-
		4 Durg	-	-
		5 Gurur	-	-
		6 Patan	-	-
		7 Saja	-	-
4	Kawardha	1 Pandariya	-	-
5	Raigarh	1 Baramkela	-	-
6	Rajnandgaon	1 Rajnandgaon	-	-

ABSTRACT			
No. of Assessed Blocks	Semi Critical	Critical	Over- exploited
146	14	0	0

CATEGORIZATION OF TEHSILS IN DELHI

Sl. No.	District	Semi-critical	Critical	Over-exploited
1	Central	—	—	1 Karol Bagh 2 Pahar Ganj
2	East	1 Gandhi Nagar —	—	1 Preet Vihar 1 Vivek Vihar
3	New Delhi	—	—	1 Chanakya Puri 2 Parliament Street
4	North	—	—	1 Kotwali 2 Sadar Bazar
5	North East	1 Seelam Pur —	—	1 Seema Puri 2 Shahdara
6	North West	1 Narela —	—	1 Model Town 2 Saraswati Vihar
7	South	—	—	1 Defence Colony 2 Hauz Khas 3 Kalkaji
8	South West	—	—	1 Delhi Cantonment 2 Najafgarh 3 Vasant Vihar
9	West	—	—	1 Patel Nagar 2 Rajouri Garden
		1 Punjabi Bagh		

ABSTRACT

No. of Assessed Tehsils	Semi Critical	Critical	Over-exploited
27	5	0	20

CATEGORISATION OF TALUKS IN GUJARAT

SI. NO.	District	Semi Critical	Critical	Over-Exploited
1	Ahmedabad	1 Detroj Rampura	-	1 City - Dascroi
		2 Mandal	-	2 Dholka
		3 Sanand	-	-
		4 Viramgam	-	-
2	Banaskantha	1 Danta	-	1 Deodar
			1 Palanpur	2 Deesa
			-	3 Dhanera
			-	4 Tharad
			-	5 Vadgam
			-	6 Kankrej
3	Bharuch	1 Amod	-	-
4	Gandhinagar	-	-	1 Dehgam
			-	2 Gandhinagar
			-	3 Kalol
			-	4 Mansa
5	Jamnagar	1 Okhamandal	-	-
6	Junagadh	1 Keshod	-	-
		2 Sutrapada	-	-
7	Kachchh	1 Abdasa	1 Bhuj	1 Anjar
		2 Rapar	2 Nakhatrana	2 Bhachau
		-	-	3 Mandavi
		-	-	-
8	Kheda	1 Kapadvanj	-	-
		2 Kathlal	-	-
		3 Kheda	-	-
		4 Mahemdabad	-	-
9	Mahesana	-	1 Vadnagar	1 Bechraji
		-	-	2 Kadi
		-	-	3 Kheralu
		-	-	4 Mahesana
		-	-	5 Satlasna
		-	-	6 Unjha
		-	-	7 Vijapur
		-	-	8 Visnagar
		-	-	1 Chanasma
10	Patan	-	-	2 Patan
		-	-	3 Sidhpur
		-	-	-
11	Porbandar	-	-	1 Porbandar
12	Sabarkantha	1 Prantij	1 Vadali	-
13	Surendranagar	1 Muli	2 Idar	-
14	Vadodara	1 Karjan	-	-
		2 Sinor	-	-
		3 Vadodara	-	-

ABSTRACT

No. of Assessed Taluks	Semi Critical	Critical	Over-Exploited
223	20	6	27

CATEGORISATION OF BLOCKS IN HARYANA

Sl. No.	District	Semi critical	Critical	Over exploited
1	Ambala	1 Ambala I	1 Shazadpur 2 Ambala II	1 Barara 2 Naraingarh 3 Saha
2	Panchkula		1 Raipur Rani 2 Pinjore	1 Barwala
3	Fatehabad		1 Bhattu Kalan 2 Bhuna	1 Fatehabad 2 Ratia 3 Tohana 4 Jakhal
4	Bhiwani		1 Dadri-II 2 Siwani	1 Badra 2 Dadri-I 3 Kairu 4 Loharu
5	Hissar	1 Agroha 2 Uklana 3 Hansi-II	1 Adampur	1 Narnaund
6	Gurgaon			1 Farukhnagar 2 Gurgaon 3 Pataudi 4 Sohna
7	Mewat		1 Punhana	1 Tauru 2 Ferozepur Zhirka
8	Faridabad		1 Ballabgharh	1 Faridabad
9	Palwal		1 Hathin	1 Hodel 2 Palwal 3 Hassanpur
10	Jhajjar	1 Bhadurgarh 2 Salhawas	1 Jhajjar	
11	Jind		1 Jind 2 Pilukhera 3 Uchana	1 Alewa 2 Narwana 3 Safidon 4 Gulha 5 Kaithal 6 Kalayat 7 Pundri 8 Rajaund
12	Kaithal			1 Assandh 2 Gharaunda 3 Indri 4 Karnal 5 Nilokheri 6 Nissang
13	Karnal			1 Babain 2 Ladwa 3 Pehowa 4 Shahbad
14	Kurukshetra			

CATEGORISATION OF BLOCKS IN HARYANA

Sl. No.	District	Semi critical	Critical	Over exploited
15	Mahendragarh			5 Thaneswar 1 Ateli 2 Kanina 3 Mahendragarh 4 Nangal Chaudary 5 Narnaul
16	Panipat			1 Bapoli 2 Israna 3 Madlauda 4 Panipat 5 Samalkha
17	Rewari		1 Jatusana	1 Nahar 2 Rewari 3 Bawal 4 Khol
	Rohtak	1 Rohtak		
18		2 Lakhman Majra		
19	Sirsa	1 Odhan	1 Baraguda	1 Ellenabad 2 Rania 3 Sirsa 4 Ns Chopta
20	Sonepat		1 Gohana 2 Kharkhoda	1 Ganaur 2 Rai 3 Sonepat
21	Yamunanagar		1 Bilaspur	1 Jagadhri 2 Mustafabad 3 Radour 4 Sadhuara 5 Chachrauli

ABSTRACT

No. of Assessed Blocks	Semi critical	Critical	Over-exploited
116	9	21	68

CATEGORIZATION OF VALLEY IN HIMACHAL PRADESH

Sl. No.	District	Semi-critical	Critical	Over-exploited
1	Sirmour			1 Kala Amb Valley
2	Una		1 Una valley	

ABSTRACT

No. of Assessed Valley	Semi Critical	Critical	Over-exploited
8	0	1	1

CATEGORIZATION OF BLOCKS IN JHARKHAND

Sl. No.	District	Semi-critical	Critical	Over-Exploited
1	Bokaro	1 Chas	-	-
2	Dhanbad	-	1 Dhanbad	-
3	Godda	-	-	1 Jharia
4	East Singhbhum	-	-	1 Godda
5	Ramgarh	-	1 Ramgarh	1 Jamshedpur
6	Ranchi	1 Ratu	-	-
		-	-	-
		-	-	1 Kanke

ABSTRACT

No. of Assessed Blocks	Semi Critical	Critical	Over-Exploited
208	2	2	4

CATEGORIZATION OF TALUKAS IN KARNATAKA

SI No	Districts	Semi-critical	Critical	Over-Exploited
1	Bagalkot	1 Mudhol (C) - - - - -	1 Jamkhandi (NC) - - - - -	1 Badami (C+NC) 2 Bagalkote (C+NC) 3 Bilgi (NC) 4 Hungund (NC) 5 Mudhol(NC) 1 Devenhalli 2 Dodaballapur 3 Hoskote 4 Nelamangala 1 Anekal 2 Bangalore East 3 Bangalore North 4 Bangalore South 1 Athani (C+NC) 2 Bailahongal (C+NC) 3 Chikodi (NC) 4 Gokak (NC) 5 Hukkeri (NC) 6 Ramdurg (C+NC) 7 Raibagh(NC) 8 Saundatti (C+NC)
2	Bangalore Rural	- - - - -	- - - - -	
2	Bangalore Urban	- - - - -	- - - - -	
4	Belgaum	1 Belgaum (NC) 2 Chikodi (C) 3 Gokak (C) 4 Raibagh(C) - - - - -	- - - - - - - - -	
5	Bellary	1 Kudligi -	1 Bellary (NC)	1 H.B. Halli 2 Hadagalli
6	Bidar	1 Bidar	1 Basavana Bagevadi 1 NC)	1 Bhalki (NC) 1 Indi (NC)
7	Bijapur	1 Bijapur (NC) 2 Muddebihal (NC) 3 Sindgi (NC)	- - -	- -
8	Chamrajnagara	1 Chamrajnagara (NC)	-	1 Gundlupet (NC)
9	Chikballapur	1 Bagepalli - - - -	- - - -	1 Chikballapur 2 Chintamani 3 Gauribidalur 4 Gudibanda 5 Sidlaghata
10	Chikmagalur	1 Tarikere (NC)	1 Kadur	
11	Chitradurga	- - - -	1 Challakere (NC) 2 Hosadurga - -	1 Chitradurga 2 Hiriyur (NC) 3 Holalkere
12	Dakshin Kannada	1 Bantval 2 Puttur	- -	- -
13	Davangere	- - - -	1 Harihar NC)	1 Channagiri (NC) 2 Davangere (NC) 3 Harpanahalli (NC) 4 Jagalur
14	Dharwad	1 Dharwad 2 Navalgund (NC)	- -	- -
15	Gadag	1 Mundargi 2 Nargund	- -	1 Gadag (NC) 2 Ron (NC)
16	Gulbarga	1 Afzalpur	-	
17	Hassan	1 Belur (NC) - -	- - -	1 Arsikere (NC) 2 C R Patna (NC) 3 Hassan (NC)

CATEGORIZATION OF TALUKAS IN KARNATAKA

SI No	Districts	Semi-critical	Critical	Over-Exploited
18	Haveri	1 Haveri (NC) 2 Hirekerur (NC)	1 Byadgi (NC) 2 Ranibennur (NC)	4 Holenarsipur (NC)
19	Kolar	- - - - -	- - - - -	1 Bangarpet 2 Kolar 3 Malur 4 Mulbagal 5 Srinivaspur
20	Koppal	1 Kushtagi (NC) - -	- - -	1 Gangawati (NC) 2 Koppal (NC) 3 Yelbarga
21	Mandya	1 Maddur (NC) 2 Malavalli (NC) 3 Nagamangala (NC)	- - -	1 Krishnarajpet (NC) 2 Mandya (NC) 3 Pandavapura (NC)
22	Mysore	1 Mysore (NC) 2 Nanjangud (NC)	Tirumakudal Narsipur 1 (NC)	- -
23	Raichur	1 Lingsugur (NC)	-	-
24	Ramanagaram	1 Channapatana (NC)	1 Magadi	1 Kanakapura (NC) 2 Ranmanagaram 3 Chicknayakanhalli
25	Tumkur	1 Kunigal (NC) 2 Pavagada - - - - -	- - - - - -	1 Gubbi (NC) 2 Koratagere 3 Madhugiri 4 Sira (NC) 5 Tiptur (NC) 6 Tumkur (NC) 7 Turuvekere (NC)
26	Yadgir	1 Yadgir	-	-

ABSTRACT

No. of Assessed Taluks	Semi Critical	Critical	Over-exploited
270	34	11	71

Out of 270 assessment units, there are six taluks where Command and Non-command both are falling in over-exploited category. Hence the whole taluk is categorised as OE without separate mention of command and non-command. Thus though in the states 71 assessment units have fallen in OE category but total of

CATEGORIZATION OF BLOCKS IN KERALA

Sl. No.	District	Semi-critical	Critical	Over-exploited
1	Ernakulam	1 Parakkadavu 2 Paravoor 3 Vytila	-	-
2	Idukki	1 Kattappana 2 Nedumkandam	-	-
3	Kannur	1 Kuthuparamba 2 Thalassery	-	-
4	Kasargod	1 Manjeswar	1 Kasargod	-
5	Kollam	1 Anchalumoodu	-	-
6	Kozhikode	1 Balussery 2 Kunnamangalam	-	-
7	Malappuram	1 Kondotty 2 Tirurangadi 3 Vengara		
8	Palakkad	1 Pattambi 2 Thrithala	1 Malampuzha	1 Chittoor
9	Thiruvananthapuram	1 Athiyannur 2 Nedumangad 3 Nemom 4 Parassala 5 Thriuvanantha-puram (Rural)		
10	Thrissur	1 Ollukkara	1 Kodungallur	

ABSTRACT

No. of Assessed Blocks	Semi Critical	Critical	Over-exploited
152	22	3	1

CATEGORIZATION OF BLOCKS IN MADHYA PRADESH

Sl. No.	District	Semi-critical	Critical	Over-exploited
1	Barwani	1 Rajpur 2 Thikri	-	1 Pansemal
2	Bhopal	1 Phanda	-	-
3	Buhanpur	1 Burhanpur	-	-
4	Chhatarpur	1 Badamalhara 2 Buxwaha 3 Chhatarpur 4 Nowgaon 5 Rajnagar	-	-
5	Chhindwara	1 1.Chhindwara	-	-
6	Damoh	1 Hatta 2 Pathariya	-	-
7	Datia	1 Datia	-	-
8	Dewas	1 Khategaon	-	1 Dewas 2 Sonkutch
9	Dhar	1 Manawar 2 Tirla	-	1 Badnawar 2 Dhar 3 Dharampuri 4 Nalcha
10	Gwalior	1 Morar	-	-
11	Indore	1 Mhow	-	1 Depalpur 2 Indore 3 Sanwer
12	Khargone	1 Barwaha 2 Khargone 3 Mahashwar	-	-
13	Khandwa	1 Chhegaon Makhan	-	-
14	Mandsaur	1 Bhanpura 2 Malahargarh	-	1 Mandsaur 2 Sitamau
15	Morena	1 Kailaras 2 Morena 3 Sabalgarh	-	-
16	Neemuch	1 Jawad 2 Neemuch	-	-
17	Narsinghpur	1 ChanwarPatha 2 Gotegaon 3 Kareli	1 Narsinghpur	-
18	Panna	1 Ajaygarh	-	-
19	Rajgarh	1 Biora 2 Khilchipur 3 Narsinghgarh 4 Sarangpur	-	-
20	Ratlam	1 Sailana	-	1 Alote 2 Jaora 3 Piploda 4 Ratlam
21	Rewa	1 Gangeo	-	-
22	Satna	1 Maihar 2 Nagod	1 Amarpatan 2 Sohawal	1 Rampur Baghalan
23	Sagar	1 Banda	-	-

CATEGORIZATION OF BLOCKS IN MADHYA PRADESH

Sl. No.	District	Semi-critical	Critical	Over-exploited
23	Sagar	2 Rehli 3 Sagar	-	-
24	Sehore	1 Astha 2 Sehore	-	-
25	Shajapur	1 Barod 2 Kalapipal 3 Shajapur	1 Agar	1 Mohan Barodia 2 Nalkhera 3 Shujalpur 4 Susner
26	Shivpuri	- 1 Pichor 2 Narwar 3 Khanniyadhana 4 Karera 5 Badarwas	-	-
27	Tikamgarh	1 Baldeogarh 2 Jatara 3 Niwari 4 Palera 5 Tikamgarh	-	-
28	Ujjain	1 Khachrod 2 Mahidpur	-	1 Badnagar 2 Ghatia 3 Ujjain

ABSTRACT

No. of Assessed Blocks	Semi Critical	Critical	Over-exploited
313	61	4	24

CATEGORIZTION OF TALUKS IN MAHARASHTRA

Sr.No.	District	Semi-Critical	Critical	Over-exploited
1	Ahmednagar	1 Kopargaon	-	1 Rahata
		2 Ahmednagar	-	-
		3 Newasa	-	-
		4 Sangamner	-	-
		5 Shrirampur	-	-
2	Amravati	1 Achalpur	-	1 Daryapur
			-	2 Morshi
			-	3 Warud
3	Buldhana	1 Motala	-	4 Chandur Bazar
			-	1 Jalgaon
4	Jalgaon	1 Bodwad	-	1 Raver
		2 Chopda	-	2 Yawal
		3 Pachora	-	-
		4 Parola	-	-
5	Latur	1 Latur	-	-
			-	-
7	Nashik	1 Chandwad	-	-
		2 Deola	-	-
		3 Sinnar	-	-
		4 Niphad	-	-
9	Pune	1 Baramati	-	-
		2 Purandhar	-	-
10	Sangli	1 Miraj	1 Kavathe Mahankal	-
			-	-
12	Solapur		-	1 Malshiras

ABSTRACT

No. of Assessed Taluks	Semi-Critical	Critical	Over-Exploited
353	19	1	9

CATEGORIZATION OF BLOCKS IN PUNJAB

Sl.No.	District:	Semi-Critical	Critical	Over-Exploited
1	Amritsar	-	-	1 Ajnala 2 Chogawan 3 Harsha China 4 Jandiala 5 Majitha 6 Rayya 7 Tarsika 8 Verka
2	Barnala	-	-	1 Barnala 2 Mahal Kalan 3 Sehna
3	Bathinda	-	1 Nathana 2 Rampura	1 Phul 2 Maur 3 Bathinda
4	Faridkot	-	-	1 Faridkot 2 Kot Kapura
5	Fatehgarh Sahib	-	-	1 Khera 2 Sirhind 3 Amloh 4 Bassi Pathana 5 Khamanon
6	Ferozepur	-	-	1 Ferozpur 2 Fazilka 3 Ghall Khurd 4 Guru Har Sahai 5 Jalalabad 6 Makhu 7 Mamdot 8 Zira
7	Gurdaspur	1 Gurdaspur	1 Kalanaur	1 Batala 2 Dina Nagar 3 Fatehgarh Churian 4 Kahnuwan 5 Qadian 6 Sri Hargobindpur 7 Dera Baba Nanak 8 Dhariwal
8	Hoshiarpur	1 Talwara	-	1 Dasuya 2 Garhsahnkar 3 Hazipur 4 Tanda
9	Jalandhar	-	-	1 Adampur 2 Bhogpur 3 Rurka Kalan 4 Jalandhar-East 5 Jalandhar-West 6 Lohian

CATEGORIZATION OF BLOCKS IN PUNJAB

Sl.No.	District:	Semi-Critical	Critical	Over-Exploited
9	Jalandhar	-	-	7 Nakodar
		-	-	8 Nur Mahal
		-	-	9 Phillaur
		-	-	10 Shahkot
10	Kapurthala	-	-	1 Nadala
		-	-	2 Dhilwan
		-	-	3 Kapurthala
		-	-	4 Phagwara
		-	-	5 Sultanpur Lodhi
11	Ludhiana	-	-	1 Dehlon
		-	-	2 Doraha
		-	-	3 Jagraon
		-	-	4 Khanna
		-	-	5 Ludhiana
		-	-	6 Mangat
		-	-	7 Pakhowal
		-	-	8 Raikot
		-	-	9 Samrala
		-	-	10 Sidhwan Bet
12	Mansa	-	-	11 Sudhar
		-	-	1 Bhikhi
		-	-	2 Budhlada
		-	-	3 Jhunir
		-	-	4 Mansa
13	Moga	-	-	5 Sardulgarh
		-	-	1 Bagha Purana
		-	-	2 Dharamkot (Kot Isa Khan)
		-	-	3 Moga I
		-	-	4 Moga II
14	Nawan Shahr	-	-	5 Nihal Singh Wala
		-	-	1 Aur
		-	-	2 Banga
15	Patiala	-	-	3 Nawan Shahr
		-	-	1 Bhuner Heri
		-	-	2 Ghanaur
		-	-	3 Nabha
		-	-	4 Patiala
		-	-	5 Rajpura
		-	-	6 Samana
		-	-	7 Sanaur
16	Ropar	-	-	8 Patran
		-	-	1 Chamkaur Sahib
		-	-	2 Morinda
17	Mohali	-	-	3 Nurpur Bedi
		-	-	1 Dera Bassi
		-	-	2 Kharar
18	Sangrur	-	-	1 Ahmedgarh

CATEGORIZATION OF BLOCKS IN PUNJAB

Sl.No.	District:	Semi-Critical	Critical	Over-Exploited
18	Sangrur	-	-	2 Andana
		-	-	3 Bhiwanigarh
		-	-	4 Dhuri
		-	-	5 Lehraghaga
		-	-	6 Maler Kotla
		-	-	7 Sangrur
		-	-	8 Sherpur
		-	-	9 Sunam
19	Tarn Taran	-	-	1 Bhikhiwind
		-	-	2 Chola Sahib
		-	-	3 Gandiwind
		-	-	4 Khadur Sahib
		-	-	5 Naushehra Panuan
		-	-	6 Patti
		-	-	7 Tarn Taran
		-	-	8 Valtoba

ABSTRACT

No of Assessed Blocks	Semi-critical	Critical	Over-exploited
138	2	3	110

CATEGORISATION OF BLOCKS IN RAJASTHAN				
SL.No.	District	Semi-Critical	Critical	Over-Exploited
1	Ajmer	-	-	1 Arain
		-	-	2 Bhinai
		-	-	3 Jawaja
		-	-	4 Kekri
		-	-	5 Masuda
		-	-	6 Pisangan
		-	-	7 Silora
		-	-	8 Srinagar
		-	-	1 Behror
2	Alwar	-	-	2 Bansur
		-	-	3 Kathumar
		-	-	4 Kishangarh
		-	-	5 Kotkasim
		-	-	6 Laxmangarh
		-	-	7 Mandawar
		-	-	8 Neemrana
		-	-	9 Rajgarh
		-	-	10 Ramgarh
		-	-	11 Reni
		-	-	12 Thanagazi
		-	-	13 Tijara
		-	-	14 Umrain
3	Banswara	1 Kushalgarh	-	-
		1 Anta	1 Chippabarod	1 Atru
4	Baran	-	-	2 Baran
		-	1 Chohtan	1 Baetu
		-	2 Sindhri	2 Balotra
		-	-	3 Dhorimanna
		-	-	4 Siwana
5	Barmer	-	-	5 Sheo
		-	1 Bayana	1 Kumher
		-	2 Deeg	2 Nadbai
6	Bharatpur	1 Kama	1 Nagar	1 Sewar
		-	2 Roopwas	2 Weir
		-	-	3 Asind
		-	-	4 Banera
		-	-	5 Hurda
		-	-	6 Jahajpur
		-	-	7 Kotri
		-	-	8 Mandal
		-	-	9 Mandalgarh
		-	-	10 Raipur
		-	-	11 Sahada
		-	-	12 Shahpura
		-	-	13 Suwana
7	Bhilwara	-	-	1 Bikaner
		-	-	2 Dungargarh
		-	-	3 Nokha
8	Bikaner	-	-	-

CATEGORISATION OF BLOCKS IN RAJASTHAN

SL.No.	District	Semi-Critical	Critical	Over-Exploited
9	Bundi	-	1 Kesorai Patan	1 Hindoli 2 Nainwa 3 Talera
		-	-	1 Badi-sadri 2 Begun 3 Bhadesar
10	Chittorgarh	-	-	4 Bhainsrargarh 5 Bhopalsagar 6 Chittorgarh 7 Dungla 8 Gangrar 9 Kapasan 10 Nimbahera
		-	-	11 Rashmi 1 Raigarh 2 Sujangarh
11	Churu	-	-	3 Bandikui 4 Dausa 5 Lalsot 6 Mahua 7 Sikrai
12	Dausa	-	-	1 Bari 2 Baseri 3 Dholpur 4 Rajakhera
13	Dholpur	-	-	
		-	-	
14	Dungarpur	1 Bichhiwara 2 Dungarpur 3 Sagwara 4 Simalwara	-	-
		-	-	
15	Ganganagar	-	-	-
16	Hanumangarh	-	-	-
		-	-	-
17	Jaipur	-	1 Phagi	1 Amer 2 Bairath 3 Bassi 4 Chaksu 5 Dudu 6 Govindgarh 7 Jamwa Ramgarh 8 Jhotwara 9 Kotputli 10 Sambher 11 Sanganer 12 Shahpura
		-	-	1 Jaisalmer 2 Sankra 1 Ahore
18	Jaisalmer	-	-	
19	Jalore	-	-	

CATEGORISATION OF BLOCKS IN RAJASTHAN

SL.No.	District	Semi-Critical	Critical	Over-Exploited
20	Jhalawar	-	-	2 Bhinmal 3 Jalore 4 Jaswantpura 5 Raniwara 6 Sanchore 7 Sayla 1 Bakani 2 Dag 3 Jhalra Patan 4 Manohar Thana 5 Pirawa
21	Jhunjhunu	-	-	6 Alsisar 7 Buhana 8 Chirawa 9 Jhunjhunu 10 Khetri 11 Nawalgarh 12 Surajgarh 13 Udaipurwati
22	Jodhpur	-	1 Luni	1 Balesar 2 Bhopalgarh 3 Bilara 4 Mandore 5 Osian 6 Shergarh 7 Phalodi
23	Karauli	-	1 Nadauti	1 Hindaun 2 Karauli 3 Sapotra 4 Todabhim
24	Kota	1 Itawa 2 Ladpura 3 Sultanpur	-	1 Khairabad 2 Sangod
25	Nagaur	1 Nagaur	1 Ladnu	1 Degana 2 Didwana 3 Jayal 4 Kuchaman 5 Makrana 6 Merta 7 Mundwa 8 Parbatsar 9 Riyani
26	Pali	-	1 Desuri 2 Pali 3 Rohat	1 Bali 2 Jaitaran 3 Marwar Jn 4 Raipur 5 Rani 6 Sojat

CATEGORISATION OF BLOCKS IN RAJASTHAN

SL.No.	District	Semi-Critical	Critical	Over-Exploited
26	Pali	-	-	7 Sumerpur
27	Pratapgarh	-	1 Dhariawad	1 Arnod
		-	-	2 Chhoti Sadri
		-	-	3 Pratapgarh
28	Rajsamand	-	-	4 Amet
		-	-	5 Bhim
		-	-	6 Deogarh
		-	-	7 Khamnor
		-	-	8 Kumbhalgarh
		-	-	9 Railmagra
		-	-	10 Rajsamand
29	Sawai madhopur	-	1 Khandar	1 Bamanwas
		-	-	2 Bonli
		-	-	3 Gangapur
		-	-	4 Sawai Madhopur
30	Sikar	-	-	5 Danta Ramgarh
		-	-	6 Dhod
		-	-	7 Khandella
		-	-	8 Lachhmangarh
		-	-	9 Neem Ka Thana
		-	-	10 Piprali
		-	-	11 Sri Madhopur
31	Sirohi	1 Abu Road 2 Pindwara 3 Sirohi	-	1 Reodar 2 Sheoganj
32	Tonk	-	1 Deoli 2 Toda Rai Singh 3 Tonk	1 Malpura 2 Newai 3 Uniara
33	Udaipur	1 Kotra 2 Salumber	1 Kherwara 2 Lasadiya 3 Jhadol 4 Sarada	4 Badgaon 5 Bhinder 6 Girwa 7 Gogunda 8 Mavli

ABSTRACT

No of Assessed Blocks	Semi-critical	Critical	Over-exploited
239	16	25	166

CATEGORISATION OF BLOCKS IN TAMIL NADU

CATEGORISATION OF BLOCKS IN TAMIL NADU

Sl.No	District	Semi Critical	Critical	Over Exploited
13	Nagapattinam	-	-	3 Myladuthurai 4 Sembanarkoil
14	Namakkal	1 Kabilarmalai 2 Mohanur 3 Pallipalayam 4 Paramathi 5 Thiruchengode	1 Malasamutharam 2 Namakkal	1 Erumapatti 2 Namagiripettai 3 Puthuchatram 4 Rasipuram 5 Sendamangalam 6 Vennandur
15	Niligiris	-	-	-
16	Perambalur	-	-	1 Alathur 2 Perambalur 3 Veppanthattai 4 Veppur
17	Pudukkottai	1 Karambakudi 2 Thiruvarangulam 3 Viralimalai	-	-
18	Ramanathapuram	-	-	-
19	Salem	1 Edapadi 2 Kadayampatti 3 Salem 4 Sankagiri 5 Tharamangalam	1 Magudanchavadi 2 Mecheri 3 Peddanaicken Palayam	1 Attur-S 2 Ayothiapattinam 3 Gangavalli 4 Konganapuram 5 Nangavalli 6 Omalur 7 Panamarathupatti 8 Thalaivasal 9 Valapadi 10 Veerapandi
20	Sivagangai	-	-	-
21	Thanjavur	1 Pattukottai 2 Thanjavur	-	1 Ammapet 2 Kumbakonam 3 Orathanadu 4 Papanasam 5 Peravoorani 6 Sethubhavachattiram
		-	-	7 Thiruppanandal 8 Thiruvaiyaru 9 Thiruvidaimaruthur 10 Thiruvonam
22	Theni	-	1 Bodinaikkanur 2 Chinnamanur 3 Cumbum 4 Myladumparai 5 Periyakulam 6 Theni	1 Andipatti 2 Uthamapalayam
23	Thiruvarur	1 Thiruvarur	-	1 Kodavasal 2 Nannilam 3 Valangaiman
24	Thoothukudi	1 Kayathar 2 Kovilpatti	1 Tuticorin	1 Ottapidaram 2 Satankulam 3 Udangudi
25	Tiruchirappalli	1 Lalgudi 2 Marungapuri	-	1 Manachanallur 2 Manappari 3 Manikandam

CATEGORISATION OF BLOCKS IN TAMIL NADU

CATEGORIZATION OF DEERS IN TAMIL NADU					
Sl.No	District	Semi Critical	Critical	Over Exploited	
25	Tiruchirappalli	-	-	4	Musiri
		-	-	5	Thathaiyangar pettai
		-	-	6	Thottiyam
		-	-	7	Thuraiyur
		-	-	8	Uppliyapuram
26	Tirunelveli	1 Alankulam	1 Keelapavoor	1	Kuruvikulam
		2 Kadayanallur	2 Radhapuram	2	Melneelithanallur
		3 Vasudevanallur	-	3	Sankarankoil
		-	-	4	Valliyur
		-	-	1	Avinashi
27	Tiruppur	1 Gudimangalam	1 Palladam	2	Pongalur
		2 Tiruppur	-	-	-
		3 Udumalpet	-	-	-
		4 Kangeyam	-	-	-
		5 Kundadam	-	-	-
		6 Mulanur	-	-	-
		7 Vellakovil	-	-	-
		1 Poonamallee	-	1	Ellapuram
28	Tiruvalluvar	-	-	2	Kadambathur
		-	-	3	Minjur
		-	-	4	Pallipattu
		-	-	5	R.K.Pet
		-	-	6	Tiruthani
		-	-	1	Chengam
		-	-	2	Chetpet
		-	-	3	Javadhu Hills
29	Tiruvannamalai	1 Annakkavur	1 Kalasapakkam	4	Polur
		2 Cheyyar	2 Kilpennathur	5	Thandarampattu
		3 East Arani	3 Pudupalayam	6	Tiruvannamalai
		4 Pernamallur	4 Thurinjapuram	7	Vandavasi
		5 Thellar	-	8	Vembakkam
		6 West Arani	-	1	Anaicut
		-	-	2	Arcot
		-	-	3	Gudiyatham
30	Vellore	1 Wallajah	1 Alangayam	4	Jolarpet
		-	2 Nemili	5	K.V.Kuppam
		-	3 Timiri	6	Kandili
		-	-	7	Kanniyambadi
		-	-	8	Katpadi
		-	-	9	Madanur
		-	-	10	Nattrampalli
		-	-	11	Pernampet
		-	-	12	Sholinghur
		-	-	13	Tiruppathur
		-	-	14	Vellore
		-	-	1	Gingee
		-	-	2	Kanai
31	Villupuram	1 Mailam	1 Kandamangalam	3	Kolianur
		2 Sankarapuram	-	4	Marakanam
		3 Vanur	-	5	Melmalaiyanur
		-	-	6	Olakkur
		-	-	7	Thiyagadurgam
		-	-	8	Ulundurpet
		-	-	9	Vallam
		-	-	1	Rajapalayam
32	Virudhunagar	1 Virudhunagar	1 Sivakasi	-	-
		-	2 Srivilliputhur	-	-
		-	3 Vembakkottai	-	-
		-	4 Watrap	-	-

ABSTRACT

ABSTRACT			
No of Assessed Blocks	Semi-critical	Critical	Over-exploited
386	67	33	139

CATEGORIZTION OF BLOCKS IN UTTAR PRADESH

S. No.	DISTRICT NAME	SEMI-CRITICAL	CRITICAL	OVER-EXPLOITED
1	Agra	1 1-Achhnera 2 2-Jagner 3 3-Kheragarh - - -	1 Saiyan - - - -	1 Akola 2 Barauli Ahir 3 Bichpuri 4 Fatehpur Sikri 5 Khandauli 6 Shamsabad
2	Aligarh	1 Chandaus 2 Iglas 3 Khair	1 Atrauli	- - -
3	Allahabad	1 Bahadurpur 2 Dhanupur 3 Kaurihar 4 Pratappur 5 Saidabad 6 Urwa	1 Karchhana	- - - - - -
4	Ambedkar Nagar	1 Bhiti	-	-
5	Baghpat	1 Baraut - - - - -	-	1 Baghpat 2 Binauli 3 Chaprauli 4 Khekra 5 Pilana
6	Banda	-	1 Tindwari	-
7	Bareilly	1 Majhgawa 2 Meerganj	-	- -
8	Bijnor	1 Budhanpur (Seohar) 2 Jaleelpur	1 Noorpur	- -
9	Budaun	1 Jagat 2 Salarpur - - - - -	-	1 Ambiapur 2 Asafpur 3 Bisauli 4 Gunnaur 5 Islamnagar 6 Junawai 7 Sahaswan
10	Bulandshahar	1 Agauta 2 B.B.Nagar 3 Pahasu 4 4Sikandrabad	1 Gulauthi 2 Khurja	- - - -
11	Chitrakoot Dham	1 Ram Nagar	1 Karvi	-
12	Etah	1 Aliganj 2 Nidholi Kalan 3 Sakeet	-	1 Marhara
13	Faizabad	1 Tarun 2 Bikapur	-	- -
14	Fatehpur	1 Airayan 2 Bahua 3 Deomai 4 Khajuha 5 Teliyani 6 Vijayeepur	1 Amauli 2 Haswa 3 Hathgaon 4 Malawan	- - - - - -
15	Firozabad	1 Madanapur - - - -	-	1 Aron 2 Eka 3 Firozabad 4 Narkhi 5 Tundla
16	G B Nagar	1 Bisrakh 2 Dankaur	-	1 Jewar -
17	Ghaziabad	1 Hapur	1 Bhojpur	1 Loni

CATEGORIZTION OF BLOCKS IN UTTAR PRADESH

S. No.	DISTRICT NAME	SEMI-CRITICAL	CRITICAL	OVER-EXPLOITED
18	Ghazipur	2 Simbholi 1 Ghazipur 2 Jakhaniya 3 Karanda 4 Saidpur	- - - - -	- - -
19	Hathras (Mahamaya Nagar)	1 Sahpau	1 Sadabad	1 Hathras 2 Mursan 3 Sasni
20	J P Nagar	- - - - -	1 1. Dhanaura	1 Amroha 2 Gajraula 3 Hasanpur 4 4Joya
21	Jaunpur	1 Barsathi 2 Dobhi 3 Khutahan 4 Muftiganj 5 Sikrara 6 Sujanganj	1 Badlapur 2 Dharmpur 3 Maharajganj	1 Buxa 2 Karanja Kalan 3 Kerakat 4 4.Sirkoni
22	Jhansi	1 Babina 2 Baragaon 3 Chirgaon	1 Bangra	1 Mauranipur
23	Kannauj	1 Kannauj	- -	1 Jalalabad 2 Talgram
24	Kanpur Nagar	1 Ghatampur 2 Sarsaul 3 Shivrajpur	1 1.Bhitar Gaon	- - -
25	Kashiram Nagar	-	-	1 Kasganj
26	Kaushambi	1 Newada	1 1.Kara 2 Manjhanpur	1 Chail 2 Sirathu
		- -	3 Moorat Ganj	-
27	Lucknow	1 Mal 2 Malihabad 3 Mohanlalganj	- - -	- - -
28	Mahoba	1 Kabrai	-	1 Jaitpur
29	Mainpuri	- -	- -	2 Panwari 1 Barnahal 2 Mainpuri
30	Mathura	1 Farah 2 Mat	- - -	1 Baldeo 2 Nohjhil 3 Raya
31	Meerut	1 Daurala 2 Hastinapur 3 Mawana	- - -	1 Kharkhoda 2 Rajpura
32	Mirzapur	1 Chanbey 2 City 3 Kon	1 Majhawan 2 Sikhar	- - -
33	Moradabad	1 Dilari 2 Moradabad	1 Bilari 2 Deengarpur	1 Asmoli 2 Bahjoi 3 Baniakhera 4 Pawansa 5 Sambhal
34	Muzaffarnagar	1 Charthawal 2 Jansath	- - -	1 Bhaghara 2 Budhana 3 Kairana

CATEGORIZTION OF BLOCKS IN UTTAR PRADESH

S. No.	DISTRICT NAME	SEMI-CRITICAL	CRITICAL	OVER-EXPLOITED
		-	-	4 Kandhala 5 Shahpur 6 Shamli 7 Thana Bhawan 8 Un
35	Pratapgarh	1 Baba Bekhernath 2 Patti	1 Sandwa -Chandrika 2 Shivgarh	1 Pratapgarh Sadar
36	Raibareli	1 Bahadurpur 2 Harichandpur 3 Kheron 4 Lalganj 5 Maharajganj 6 Rahi 7 Satawan	1 Sareni	-
37	Rampur	1 Shahbad	-	1 Chamraua 2 Saidnagar
38	Saharanpur	1 Deoband 2 Rampur	-	1 Baliakheri 2 Gangoh 3 Muzafarabad 4 Nagal 5 Nakur 6 Nanauta 7 Puwarka 8 Sarsawa
39	St. Ravidas Nagar	1 Abholi 2 Gyanpur 3 Suriyawan	-	-
40	Sonbhadra	1 Ghorawal	-	-
41	Sultanpur	1 Akhand Nagar 2 Bhadaiyan 3 Bhadar 4 Dubeypur 5 Jagdishpur 6 Jaisinghpur 7 P.P.Kannaicha 8 Sangrampur 9 Shahgarh 10 Shukul Bazar	-	-
42	Varanasi	1 Baragaon 2 Chiraigaon 3 Cholapur 4 Kashividyaapeeth 5 Pindra	1 Arajiline 2 Harhuwa	-

ABSTRACT

No. of Assessed Blocks	Semi-Critical	Critical	Over-Exploited
820	107	32	76

CATEGORIZTION OF BLOCKS IN UTTARAKHAND

S. No.	District	Semi-critical	Critical	Over-Exploited
1	Haridwar	1 Bhagwanpur	1 Laksar	--
		2 Khanpur	--	--
2	Udham Singh Nagar	1 Jaspur	--	--
		2 Kashipur	--	--
		3 Khatima	--	--

ABSTRACT

Assessed Blocks	Semi-Critical	Critical	Over-Exploited
17	5	1	0

CATEGORIZATION OF BLOCKS IN WEST BENGAL

Sl. No.	District	Semi-critical	Critical	Over-exploited
1	Malda	1 Kaliachak I 2 Harishchandrapur II	--	--
2	Nadia	3 Chapra 4 Hanskhali 5 Karimpur I 6 Karimpur II 7 Tehatta I 8 Tehatta II	--	--
3	Barddhaman	9 Bhatar 10 Ketugram I 11 Memari II 12 Magalkote 13 Manteswar 14 Purbasthali II	--	--
4	Mursidabad	15 Barwan 16 Berhampur 17 Bhagabangola I 18 Bhagabangola II 19 Bharatpur I 20 Bharatpur II 21 Domkal 22 Hariharpara 23 Jalangi 24 Lalgola 25 Murjiaganj 26 Nabagram 27 Nowda 28 Raninagar I 29 Raninagar II 30 Sagardighi 31 Suti II	--	--
5	Birbhum	32 Murarai II 33 Nalhati II 34 Rampurhat II 35 Nanoor	--	--
6	Hooghly	36 Pandua 37 Goghat I	--	--
7	Purba Medinipur	38 Mayna	--	--

ABSTRACT

No. of Assessed Blocks	Semi Critical	Critical	Over-exploited
269	38	0	0

CATEGORIZATION OF BLOCKS IN DAMAN&DIU

Sl. No.	Union Territory	Semi-critical	Critical	Over-exploited
1	Diu	-	-	1 Diu
2	Daman	1 Daman	-	

ABSTRACT

No. of Assessed Blocks	Semi Critical	Critical	Over-exploited
2	1	0	1

CATEGORIZTION OF ISLANDS IN LAKSHDWEEP

S. No.	ISLANDS NAME	SEMI-CRITICAL	CRITICAL	OVER-EXPLOITED
1	Agatti	1.Agatti	-	-
2	Amini	2.Amini	-	-
3	Androth	3.Androth	-	-
4	Kavaratti	4.Kavaratti	-	-

ABSTRACT

Assessed Islands	Semi-Critical	Critical	Over-Exploited
9	4	0	0

CATEGORISATION OF Regions IN UT of PUDUCHERRY

Sl.No	District	Semi Critical	Critical	Over Exploited
1	UT of Puducherry	-	-	1 Puducherry

ABSTRACT

No of Assessed Regions	Semi-critical	Critical	Over-exploited
4	0	0	1

APPENDICES

Appendix A

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

GOVERNMENT OF INDIA
MINISTRY OF WATER RESOURCES
Shram Shakti Bhavan, Rafi Marg, New Delhi

No. 3/16/2008-GW

Dated: 5th January, 2010.

RESOLUTION

Subject: Constitution of Central Level Expert Group for overall re-assessment of ground water resources of the country.

The last assessment of state-wise annual replenishable ground water resources for the entire country was made in the year 2004 based on the Methodology, Ground Water Resources Estimation Committee (GEC) -97. Since then there have been changes in ground water scenario in many places of the country. Accordingly, a Central Level Expert Group is hereby constituted for over-all supervision of the re-assessment of ground water resources in the entire country. The composition and terms of reference of the Expert Group are as follows:-

1. Composition:

(i)	Chairman, CGWB	-	Chairman
(ii)	Member(RM), CWC	-	Member
(iii)	Member (WP&P), CWC or representative	-	Member
(iv)	Member (SM&L), CGWB	-	Member
(v)	Member (ED&MM), CGWB	-	Member
(vi)	Member (T&TT), CGWB	-	Member
(vii)	Commissioner(MI), MOWR	-	Member
(viii)	Chief General Manager, NABARD	-	Member
(ix)	Director, NIH, or representative	-	Member
(x)	Representative of Planning Commission	-	Member
(xi)	Joint Secretary, Ministry of Agriculture	-	Member
(xii)	Joint Secretary, Ministry of Environment & Forests -		Member
(xiii)	Joint Secretary, Ministry of Rural Development - Member (Watershed Development Programme)		
(xiv)	Joint Secretary, Department of Drinking Water Supply-		Member
(xv)	Joint Secretary, Ministry of Urban Development-		Member
(xvi)	Representative of IIT, Delhi (Water Resources Section)- Civil Engineering Department		Member
(xvii)	Chief Engineer (HQ), NWDA or representative -		Member
(xviii)	Technical Expert (WM), NRAA, M/o Ag.& Coo. -		Member
(xix)	Representative of India Meteorology Department -		Member

(xx)	Representative of Geological Survey of India -	Member
(xxi)	Secretary In-Charge, Water Resources, Uttar Pradesh-	Member
(xxii)	Secretary In-Charge, Water Resources, Punjab-	Member
(xxiii)	Secretary In-Charge, Water Resources, Maharashtra -	Member
(xxiv)	Secretary In-Charge, Water Resources, Andhra Pradesh-	Member
(xxv)	Secretary In- Charge, Water Resources, Rajasthan-	Member
(xxvi)	Representative of Department of Civil Engg., - Indian Institute of Science(IISc), Bangalore	Member
(xxvii)	Member (SAM), CGWB -	Member Secretary

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

2. Terms of Reference: -

- (i) To ensure assessment of ground water available in deep/unconfined aquifers.
- (ii) To ensure the assessment of annual replenishable ground water resources of the States in coordination with the respective state level committees for the reference year 2008-2009. 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).
- (iii) To supervise the estimation of status of utilization of the annual replenishable ground water resource as on 2008-09 of the States to be carried by the respective State level committees.
- (iv) To prepare a National level report on assessment of ground water resources and status of its utilization as on 31st March, 2009.
- (v) To work towards integration of ground water and surface water data with a view to facilitating planning for constructive/integrated use of water resources.
- (vi) Any other aspect relevant to the terms referred to above.

3. Time frame:-

The Committee will submit its report within - *one year*.

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.

Sd/-

(Rajeev Kumar)
Director(GW)

Tel. Fax No. 23716683
email: dirgw-mowr@nic.in

ORDER

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

/-

(Rajeev Kumar)
Director(GW)

Appendix B

**Ram Mohan Mishra
Joint Secretary
Tele Fax No. 23710343**

D.O. No. 3/16/2008-GW

Date : 5th January, 2010.

Dear Chief Secretaries/Administrators/Advisors to Governors,

As you may be aware that the last State-wise assessment of annual replenishable ground water resources for the entire country was done in the year 2004. Since then substantial changes have been observed in ground water scenario in many parts of the country. It is, therefore, necessary to initiate the process of re-estimation of ground water resources. A brief note on the methodology to be adopted is enclosed.

As you may be aware, the 4th Minor Irrigation Census undertaken by this Ministry for the entire country, with reference year 2006-07, is already in progress. The census data could be suitably used for estimation of ground water draft, which is a vital input for accurate ground water resources estimation.

Draft Order for constituting the State Level Committee to steer the process of re-estimation is enclosed. The concerned Department of the State/UT Government may be advised to take necessary follow up action in this regard on priority.

With regards,

Yours sincerely,

Sd/-
(Ram Mohan Mishra)

To

(As per list enclosed to all Chief Secretaries/Administrators/Advisors to Governors)

DRAFT ORDER

No.

State/UT Government of
Department of

Dated the 2010.

ORDER

Subject: Estimation of annual replenishable ground water resources – constitution of State Level Committee for re-estimation of ground water resources - reg.

The last assessment of state-wise annual replenishable ground water resources for the entire country was made in the year 2004 based on the Methodology adopted by the Ground Water Resources Estimation Committee - 97. Since then changes in ground water scenario in many parts of the country has been observed. The National Water Policy, 2002 has also recommended that the ground water resources of the country should be re-assessed periodically. With a view to re-estimate ground water resources as in 2008-09, the State Level Committee is constituted with the following composition:-

1. Composition

(i)	Secretary in Charge of Water Resources	- Chairman
(ii)	Head, Water Resources Department	- Member
(iii)	Director, Ground Water Department	- Member
(iv)	Chief Engineer, Water Supply & Sanitation Department	- Member
(v)	Head, Dept. of Agriculture	- Member
(vi)	Chief Engineer, Public Health & Engineering Department	- Member
(vii)	Chief Engineer, Rural Water Supply department	- Member
(viii)	Chief Engineer, Minor Irrigation department	- Member
(ix)	Director, Department of Industries	- Member
(x)	General Manager, NABARD	-Member
(xi)	Regional Director, CGWB	- Member Secretary

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

2. Terms of Reference: The broad terms of reference of the Committee would be as follows :-

- (i) To estimate annual replenishable ground water resources of the state in accordance with the Ground Water Resources Estimation Methodology.
- (ii) To estimate the status of utilization of the annual replenishable ground water resource.

3. **Time frame:** The Committee will submit its report within Months/ Year from the date of its constitution.

4. Expenditure: Expenditure on account of TA/DA to official Members of the Committee will be met from the source from which they draw their salaries and that of non-official Members, will be borne by the Department of

(A.B.C.)
X.Y.Z.

Tele. No.
Fax No.
e-mail:.....

To

All members of the State Level Committee.

Appendix C

Approvals of Ground water Resources Assessment Reports by the State Level Committees

ANDHRA PRADESH

Minutes of 3rd Meeting of State Level Committee on Ground Water Resource Estimation held on 26.05.2011, Hyderabad

The Third meeting of state level committee on ground water resource estimation was held on 26.05.2011 in Godavari Conference Hall, Errum Manzil, Hyderabad. **Dr. A.K. Jain, I.F.S & Special Secretary, I&CAD, Govt. of Andhra Pradesh** chaired the meeting on behalf of Principal Secretary, I & CAD, Govt.of A.P.

The following members attended the meeting:

1)	Dr. N. Varadaraj, Regional Director, CGWB, Hyderabad	Member-Secretary
2)	Sri B.M. Murali Krishna Rao, Director, GWD, Govt. of AP	Member
3)	Sri K. Suresh Kumar, Chief Engineer, Public Health and Municipal Engineering Dept.	Member
4)	Sri T.S. Brahmanandachary, Joint. Director, Rural Water Supply & Sanitation Dept. Government of Andhra Pradesh	Representative of CE (RWS)
5)	Sri B. Tata Rao, Joint Director (Agriculture NRM) O/o Director, Agriculture, Hyderabad	Representative of Director (Agri.)
6)	Dr.V.V.S. Gurnadha Rao, Scientist-G NGRI, Hyderabad	Representative of Director
7)	Dr. V. Raghu, Sr. Scientist APSRAC, Hyderabad	Representative of Director
8)	Sri B.R.K. Raju, Supltd. Engineer APTRANSCO, Hyderabad	Representative of Director
9)	Prof . B. Venkateswara Rao, JNTU, Hyderabad	Member
10)	Sri D. Rajesham, Office of Commissioner Rural Development, Govt. of AP	Representative of Commissioner
11)	Sri N. Ravindranath, Asst. Director, Department of Economics & Statistics Govt. of AP	...	Representative of Director
12)	Sri G.V. Subrahmanyam, DEE O/o CE, Inter State Water Resources, Hyderabad	...	Representative of Chief Engineer
13)	Sri S. Mallikarjun, Dy. Ex. Engineer, O/o CE, Minor Irrigation Govt. of AP	...	Representative of Chief Engineer

14)	Sri Krishna Rao, AEE, O/o of the Commissioner, CADA, Hyderabad	Representative of Commissioner, CADA
15)	Sri R. Shanti Kumar, O/o Commissioner, Industries Dept. Hyderabad	Representative of commissioner
16)	Sri R. Ekambaranath, D.E.E Panchayat Raj Department, O/o CE, Panchayat Raj Dept. Govt. of AP	Representative of Chief Engineer
17).	Dr. L.S.N.Reddy Hydrogeologist APSIDC, Govt.of A.P	Reprensentative of Managing Director

In addition to the above, Sri S.Md. Sabjan, DCE (MI), Hyderabad , Dr. M.V.S.S. Giridhar, Asst. Professor, JNTU, Dr. P. Prasad, Sri N.Srinivasulu, Sri B. Gopalu, Sri T. Hans Raj, Sri V. Vijaya Babu, Sri M. Rajendra Kumar, Sri M. Rama Rao of APGWD and S/Sri D. Subba Rao, Suptdg. Hydrogeologist, Dr. P.N. Rao, Scientist-D and Sri P. Sudhakar, Scientist-C, CGWB, SR, Hyderabad also attended the Meeting.

At the outset, Dr. A.K. Jain, I.F.S., & Spl. Secretary, I&CAD, Govt. of AP welcomed all the Members to the Meeting and informed the gathering that Dr. N. Varadaraj, Regional Director, CGWB, will brief the salient features of the Report.

Agenda I : Approval of Dynamic ground water resource estimates

Dr. N. Varadaraj, Regional Director elaborated the salient features of the Report and modifications made since the draft preparation and discussions in second meeting. He informed that the draft report was sent to CGWB Central Ground water estimation cell and the same was received back with suggestions/modifications for getting the same approved by the August Committee. The inputs/suggestions received from CGWB Central Ground water estimation cell were attended and put up for approval of the Committee.

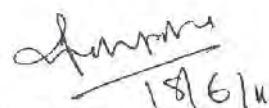
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With the above discussions, the Committee approved the report on Dynamic Ground Water Resource Estimation with a few suggestions and modifications in the text.

While summing up the discussions, Director, GWD, Govt. of AP informed that based on the decisions taken in earlier meetings and the suggestions received from CGWB, MoWR, GOI, the estimates were modified and a final shape is given to the Report, which will be submitted to Ministry of Water Resources, Government of India, for their approval. He felt that there is a need to reassess the existing methodology and refine the same for future assessment. He felt that static resource estimation was done on first approximation as rightly said by Regional Director, CGWB and needs separate methodology and further improvement. He further added that data of 26000 villages, collected from 18 Departments was incorporated and tremendous efforts were put in by Officers of GWD and CGWB in completing this gigantic task in a short span of 6 months time for compilation of the Report. He asserted that the suggestions/decisions of the Committee Members taken in earlier meeting were well attended to in this Report, which was meticulously scrutinized by CGWB.

He also informed that once the Report is approved by MoWR, hard copies of report will be circulated to all line Departments and District Collectors for their use and the soft copy of the district wise resource estimates of the State will be placed in the Website. Mandal wise resources along with the list of over-exploited villages and village level categorization are to be compiled from this stage and to be incorporated in final state level report.

The Meeting ended with the Vote of Thanks by the Chair.



18/6/14

(Dr PRASANTA MAHAPATRA)

Principal Secretary (I&CAD) &

Chairman , State Level Committee

ASSAM

MINUTES OF THE MEETING OF STATE LEVEL COMMITTEE FOR RECONCILIATION OF DYNAMIC GROUND WATER RESOURCES OF ASSAM STATE HELD ON 25.10.11 IN THE CHAMBER OF THE REGIONAL DIRECTOR, CENTRAL GROUND WATER BOARD, NER, GUWAHATI

A meeting of State Level Committee for reconciliation of Dynamic Ground Water Resources of Assam State, 2009, was convened on 25.10.11 in the chamber of the Regional Director, Central Ground Water Board, North Eastern Region, Tarun Nagar, Bye Lane-1, Guwahati. The meeting was chaired by Shri. M.K.Pathak, Secretary, Irrigation, Govt. of Assam, and the following members were present (Attendance sheet attached):

- i) Shri. M.Rahman, Chief Engineer, Minor Irrigation Department, Govt. of Assam
- ii) Shri. T.K. Chakraborty, General Manager, NABARD, Guwahati
- iii) Shri. Shib Sharma, Superintendent Engineer, Water Resources Department, Govt. of Assam
- iv) Shri. G.C.Saha, Regional Director, CGWB, NER, Guwahati & Member Secretary.
- v) Shri. T.K.Baruah, Chief Engineer, Department of Agriculture, Govt. of Assam

The computation of Dynamic Ground Water Resources, as on 2009, for Assam State has been done by CGWB based on GEC Methodology, 1997, and the data provided by Irrigation Department, Govt. of Assam, Directorate of Economics and Statistics, Govt. of Assam, Irrigation and Flood Control Department, Govt. of Assam and Census of India, 2001. The following parameters have been considered for computation:

- i) The resource computations has been done for the ground water year 2008-09.
- ii) District has been taken as the smallest administrative unit for resources computation. The area suitable for ground water recharge has been worked out by deleting the areas with more than 20% slope for the districts of Kamrup, Karbi Anglong, Nagaon and Dima Hasao (N.C. Hills).
- iii) Since there is no major irrigation project in the state therefore area of the state has been taken as non-command area.
- iv) **Ground Water Draft:**
 - Irrigation draft: The number of irrigation tube wells for 2009 has been taken by

Contd.....

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xii) **Categorisation** has been made on the basis of the stage of Ground water development & the significant trend of long term water level decline. Since the Groundwater development for all the Districts is about 22%, all the districts have been categorised as safe.

xiii) Allocation for domestic and industrial water supply has been estimated up to the year 2025 based on the projected population for the year 2025 using 2001 population data and the decadal growth rate and dependency on ground water sources. The dependency on ground water resource for domestic and industrial water supply in rural areas is considered as 90% and for urban areas 50%.

The Dynamic Ground Water Resources, 2009, for the State, as estimated, is as under:

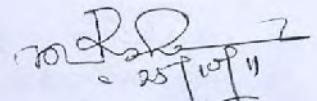
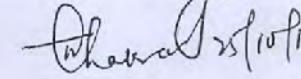
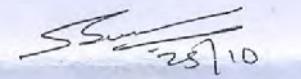
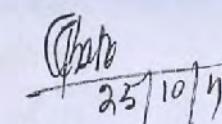
- a) Total Annual Ground Water Recharge: 30.35 BCM
- b) Net Annual Ground Water Availability: 27.81 BCM
- c) Gross Ground Water Draft for all uses: 6.03 BCM
 - i) Irrigation Draft: 5.333 BCM
 - ii) Annual Domestic Draft: 0.69 BCM
- d) Annual allocation for Domestic and Industrial uses: 0.977 BCM
- e) Stage of ground water development: 0.22%

The comparison of the figures with the last reconciled data of 2004 shows that there is a increase in total annual ground water recharge by 3.12 BCM in the 2008-09 estimation.

The Chairman has suggested that in future block should be taken as the smallest administrative unit for resources computation.

In the present estimation, water level during April has been considered as pre-monsoon water level and it reflects rise in long term water level trend. In Assam, it is found that monsoon generally starts during April. Hence, the Chairman has suggested that water level during March should be considered as pre-monsoon water level.

In the meeting the figures have been reconciled with the State Govt. data and all the valuable members including the General Manager, NABARD, accepted the figures computed.

Sl.No.	Name	Designation	Department	Signature
1.	Shri. M.K.Pathak,	Secretary	Irrigation Department, Govt. of Assam	 25/10/11
2.	Shri. M.Rahman	Chief Engineer	Minor Irrigation Department, Govt. of Assam	 25/10/11
3.	Shri. T.K. Chakraborty	General Manager	NABARD, Guwahati	 25/10/11
4.	Shri. Siva Shri. Shub-Sharma	Superintendent Engineer	Water Resources Department, Govt. of Assam	 25/10/10
5.	Shri. G.C.Saha	Regional Director	CGWB, NER, Guwahati	 25/10/11
6.	Shri T.K. Baruah	Chief Engineer	Dept. of Agriculture, Govt. of Assam	 25/10/10

BIHAR

Minutes of the 3rd meeting on State Level Committee for finalisation of Replenishable Ground Water Resources held on 28 January, 2011

The Third meeting of State Level Committee was held on 28.01.11 under the Chairmanship of Sri Sudhir Kumar, AS, Secretary, Minor Water Resources Department, Govt. of Bihar to finalise the Replenishable Groundwater Resources of the Bihar State (2008-09). The meeting was attended by the following members of State Level Committee and officers of CGWB, MER Patna.

1. Sh. B. P. Ojha, Director, Water Quality, Govt. of Bihar
2. Sh. D. N. Choudhary, Director, Groundwater, Govt. of Bihar
3. Sh. S. K. Tiwari, Director, Ground Water, Govt. of Bihar
4. Sh. C. M. Prasad, Dy. Director, Industries Department, Govt. of Bihar
5. Sh. S. K. Mishra, Supdt. Engineer, Minor Water Resource Department, Govt. of Bihar
6. Sh. Jagdish Prasad Srivastava, Joint Secretary, Dept. Of Environment and Forest, Govt. of Bihar
7. Sh. Chanera Nath Jhg, Special Secretary, UPA & HD, Govt. of Bihar
8. Sh. Irai Nain, Chief Engineer, (Planning and Monitoring, WRD), Govt. of Bihar
9. Dr. Ashutosh Upadhyay, Head, Land & Water Management, ICAR, Patna
10. Sh. Sipra Kumar, A.E., WRD, Govt. of Bihar
11. Sh. Anil Kumar, A.E., MWB, Govt. of Bihar
12. Sh. R. Kumar, Hydrogeologist, Groundwater Directorate, Govt. of Bihar
13. Sh. Ramayan Prasad Singh, SSA, Groundwater Department, Govt. of Bihar
14. Sh. Suresh Prasad, Geophysicist, Minor Irrigation Department, Govt. of Bihar
15. Sh. Amarendra Singh, A.E., State Ground Water Department, Govt. of Bihar
16. Sh. S. N. Sinha, Head of Office, CGWB, MER, Patna and Member Secretary
17. Sh. M. L. Doja, Sc D, CGWB, MER, Patna
18. Sh. D.G. Bastidar, Sc C, CGWB, MER, Patna
19. Sh. R. R. Shukla, Sc C, CGWB, MER, Patna
20. Sh. S. N. Dwivedi, Sc B, CGWB, MER, Patna
21. Sh. S. Sahu, Sc B, CGWB, MER, Patna
22. Sh. S. S. Purty, Sc B, CGWB, MER, Patna
23. Dr. R. K. Singh, Asstt. Hydrogeologist, CGWB, MER, Patna
24. Sh. S. Upadhyay, Asstt. Hydrogeologist, CGWB, MER, Patna
25. Sh. S.K. Singh, Geophysicist, CGWB, MER, Patna

The meeting began with the welcome of Chairman and the members of the committee by Sh. S. N. Sinha, Head of Office and Member Secretary of the committee. At the outset, the minutes of the second meeting held on 13 Oct. 2010 were confirmed.

The Chairman briefed the committee members about the meeting which was held in his chamber on 07.01.2011 with officers of CGWB and State Ground Water Board in which a detailed presentation on the calculation in respect of an assessment unit was presented. Upon the advice of the Chairman the draft report annexed with sample working sheet was circulated amongst all the members on 14.01.11. The presentation on calculation with respect to a particular assessment unit was again made before the committee members in this meeting. A presentation on the salient aspects of the present estimation was made by Sh. R. R. Shukla, Scientist 'C' CGWB, MER.

The findings of the field checks made jointly by CGWB and State Ground Water Department as per the suggestions of the second meeting were also discussed before the committee.

The committee members were asked to give their opinions and suggestions on the draft report. The members agreed upon the resource estimation exercise carried out jointly by Groundwater Department, Govt. of Bihar and Central Ground Water Board, MER, Patna. However, Dr Ashutosh Upadhyay, Head, Land and water management, ICAR, Patna suggested that ad-hoc norms as per GEC 1997 should be refined with more field values in future resource estimation.

The Draft Report was finally approved by the Chairman, State Level Committee.

H.S.C.
28/01/2011

CHHATTISGARH

MINUTES OF THE THIRD MEETING OF THE STATE LEVEL GROUND WATER RESOURCE ESTIMATION COMMITTEE.

Held on 14.12.2010

The third meeting of the State Level Ground Water Resource Estimation Committee was held in the State Data Centre, Sihawa Bhawan, Civil line Raipur on 14th Dec' 2010 at 05:30 P.M. The meeting was chaired by Shri N K Aswal, Principal Secretary Water Resources, Govt. of Chhattisgarh. The meeting was attended by representatives from the following organizations.

1. Department of Water Resources, Govt. of Chhattisgarh.
2. Central Ground Water Board, Ministry of Water Resources, Govt. of India.
3. Public Health Engineering Department, Govt. of Chhattisgarh
4. Department of Industries
5. NABARD.

The list of participants is given in Appendix-I.

At the outset of the meeting Shri N K Aswal, Principal Secretary, Department of Water Resources and the Chairman of the State Level Ground Water Resource Estimation Committee welcomed all the members.

Shri Ashis Chakraborty, Regional Director, CGWB, NCCR, Raipur as the Member Secretary gave a brief introduction about the ground water resource estimation in the state carried out for the base year 2008-09. He informed that the block wise Ground Water Resource Estimation of entire Chhattisgarh state has been completed as per GEC'97 norms. It has been done jointly by State Ground Water Department, Govt. of Chhattisgarh & Central Ground Water Board, Govt. of India and placed the report on "Dynamic Ground Water Resources of Chhattisgarh State (2008-09)" in the meeting for approval of State Level Ground Water Resource Estimation Committee.

Shri S.K. Verma, Scientist'C' CGWB, NCCR, Raipur presented the Methodology of Ground Water Resource Estimation, various norms taken into consideration, gist of the different components calculated & comparison with the earlier ground water resource estimate report (base year 2004).

After the presentation, the Chairman of State Level Ground Water Resource Estimation Committee expressed the urgent need for the augmentation of ground water through artificial recharge in all the identified 14 semi-critical blocks. He also emphasised to take proper preventive measure in all the blocks where the stage of ground water development is more than 70%.

At the end of the deliberations, all the members of the State Level Ground Water Resource Estimation Committee appreciated the work carried out by State Ground Water Department, Govt. of Chhattisgarh & Central Ground Water Board, Govt. of India for bringing out the report on "Dynamic Ground Water Resources of Chhattisgarh (2008-09)" which will be helpful for proper development and management of ground water resources in the state of Chhattisgarh and finally the committee approved the report for issuance.

The meeting ended with a vote of thanks to the chair.

Approved by :-

Principal Secretary to Govt. of Chhattisgarh
& Chairman State Level Ground Water Resource
Estimation Committee


16/12/2010
Officer on Special Duty,
Water Resources Department,
Mantralaya, Raipur

List of participants in the third meeting of the State Level Ground Water Resource Estimation Committee, Chhattisgarh held on 14/12/10

Sl. No.	Name	Designation and department
1.	Shri N. K. Aswal	Principal Secretary, Water Resources, Govt. of Chhattisgarh and Chairman of the Committee.
2.	Shri A Chakraborty	Regional Director, Central Ground Water Board, Govt. of India and Member Secretary, ENC, Water Resources Department, Govt. of Chhattisgarh
3.	Shri B. L. Rai	Chief Engineer, Mahanadi Godavari Basin, WRD, Govt. of Chhattisgarh
4.	Shri R. B. Shukla	Suptd. Engineer, Public Health Engineering Department, Govt. of Chhattisgarh
5.	Shri H. R. Marskole	SED, ENC office Water Resources Department, Raipur
6.	Shri P. K. Khanna	Supt. Engineer, Ground Water Survey, Govt. of Chhattisgarh
7.	Shri B D Vaishnov	OSD, Water Resources Department, Raipur
8.	Shri S. R. Gupta	Scientist C, Central Ground Water Board, NCCR, Govt. of India, Raipur
9.	Shri S.K. Verma	Scientist C, Central Ground Water Board, NCCR, Govt. of India, Raipur
10.	Shri A.K. Patre	Additional Director, department of industries, Raipur
11.	Shri A. Bhatnagar	Asstt. General Manager, NABARD
12.	Shri J. Sanel	SGH, Water Resources Department, Ground Water Survey, Raipur
13.	Shri P. N. Singh	SGH, Water Resources Department, Ground Water Survey, Bilaspur
14.	Shri D. P. Nagpure	Asstt. Engineer Water Resources Department, Raipur
15.	Shri K. C. Reddy	

DELHI

GOVERNMENT OF NCT OF DELHI
URBAN DEVELOPMENT DEPARTMENT
10TH LEVEL, C-WING, DELHI SECTT.
IP ESTATE, NEW DELHI.

F.No. 16(215)/UD/W/2009/Vol I/ 92-108

Dated: 24/02/2011

Minutes of the Meeting

Please find enclosed herewith a copy of the Minutes of the Meeting of State Level Technical Advisory Committee (STAC) held under the Chairmanship of Addl. Secretary (Water), Urban Development Deptt., Govt. of NCT of Delhi on 01/02/2011, for information and necessary follow up action.

(Mohan Kumar Aggarwal)
Dy. Secretary (Water)

Copy to:

1. Member (Water), DJB, Varunalaya Phase II, Jhandewalan, Karol Bagh, New Delhi.
2. Chief Engineer (South), DJB, Varunalaya Phase II, Jhandewalan, Karol Bagh, New Delhi.
3. Chief Engineer (Planning), DDA, Vikas Minar, New Delhi.
4. Superintending Engineer (Planning Water), DJB, Room No. 207, Varunalaya Phase II, Karol Bagh, New Delhi.
5. Superintending Engineer (PH), NDMC, Civil Engineering Department, Palika Kendra, Sansad Marg, New Delhi.
6. Superintending Engineer (Design II), DDA, Central Design Office, 14th Floor, Vikas Minar, New Delhi -110002.
7. Superintending Engineer (Planning), Municipal Corporation of Delhi, Delhi.
8. Superintending Engineer, Irrigation & Flood Control opposite ESI Hospital, Basaidarapur, New Delhi.
9. Superintending Engineer (TAS), CPWD, Nirman Bhawan, New Delhi.
10. Commissioner, Department of Industries, GNCT, Plot No. 419, F.I.E., Patparganj, Delhi-92.
11. Director, Department of Environment, GNCT Delhi, C wing, 6th level, Delhi Secretariat, New Delhi-110002.
12. Director (Monitoring), PWD, GNCT Delhi, 12th floor, MSO Building (Delhi Police HQ Building), ITO, New Delhi.
13. Joint Director (Agriculture), Development Department, 5/9 under Hill Road, Delhi-110054.
14. Garrison Engineer (MES), Delhi Cantonment.
15. General Manager, NABARD, 24 Rajendra Place, New Delhi-8.

Copy for information to:

1. PS to Secretary, Urban Development Deptt., Govt. of NCT of Delhi, C wing, 9th floor, Delhi Secretariat, New Delhi-110002.
2. PA to Addl. Secretary (Water), Urban Development Deptt., 10th level, Delhi Secretariat.

(Mohan Kumar Aggarwal)
Dy. Secretary (Water)

**Minutes of meeting of State Level Technical Advisory Committee held on 1.2.2011
at the Committee Room of Department of Urban Development, Delhi Secretariat**

A meeting of the State Level Technical Advisory Committee was held under the chairmanship of Additional Secretary (Water), Department of Urban Development on behalf of Secretary (UD) on 01.02.2011 at the Conference Room, 9th Level, 'C' Wing, Department of Urban Development, Govt. of NCT of Delhi, Delhi Secretariat.

The agenda of the meeting was as follows:

- (i) Approval of the report on Dynamic Ground Water Resources of NCT Delhi.
- (ii) Approval of a project proposal for "Rain Water Harvesting and Artificial Recharge to Ground water at the Office, Mess and the Adjacent Area in and around Chief Engineer Office, WAC, Palam, New Delhi" submitted by Garrison Engineer (North), Air Force, Palam.
- (iii) Any other item with the permission of the Chair.

At the outset, the Additional Secretary (Water) welcomed all the members of the State Level Technical Advisory Committee. Sh. A.D.Rao, Superintending Hydrogeologist, CGWB and Member Secretary of the Committee apprised the committee about the background of the Ground Water Resources Estimation. The methodology adopted in the computation of the resources along with the salient features of the report on Dynamic Ground Water Resources of Delhi were explained to the Committee by Sh A.D.Rao.

Dr. Anil Kumar, Director, Department of Environment, GNCTD, enquired whether any recommendations have been incorporated in the report. It was explained by Additional Secretary (Water) that the Term of Reference of the Committee does not warrant the inclusion of any recommendations. However, the Committee members opined that some recommendations on curbing the menace of over-exploitation of

ground water should have been a part of the report. Member Secretary informed the Committee that this report will be a part of the National Level Compilation and any specific suggestion by the Members are welcome and the same will be incorporated and sent to State Government of Delhi along with the report.

After discussions, the report on the Dynamic Ground Water Resources of NCT Delhi was approved by the Committee.

The second agenda of the meeting was the approval of a project proposal for "Rain Water Harvesting and Artificial Recharge to Ground water at the Office, Mess and the Adjacent Area in and around Chief Engineer Office, WAC, Palam, New Delhi" submitted by Garrison Engineer (North), Air Force, Palam. The salient features of the scheme were explained by Sh. Pratul Saxena, Sr. Hydrogeologist, CGWB. The proposal envisages the construction of ten (10) recharge trenches with twin recharge bores to harness the runoff amounting to 16,101 m/annum at a cost of Rs. 43,44,300.00 (Rs. Forty three lakhs forty four thousand & three hundred only).

The Committee approved the project proposal with the observation that a maintenance clause be inserted in the terms and conditions wherein the contractor concerned shall maintain the recharge trenches and recharge bores for a period of five years from the date of commissioning. It was informed by the Member Secretary that funds are available with CGWB for implementation of Artificial Recharge Schemes. The Members were of the opinion that a letter from Secretary, Urban Development should be sent to all the Heads of Government Departments to avail the opportunity and submit artificial recharge proposals to CGWB.

The meeting ended with a vote of thanks to the Chair.

GUJARAT

Speed Post

No. TS/4(9)/WCR/CGWB/2010-3

Central Ground Water Board

West Central Region

Swaminarayan college Building

Shah Alam Tolka-380022

Date: 06/01/2011

Sub: Minutes of the State Level Committee Meeting on Groundwater Resources Assessment of Gujarat State (as on March, 2009) held on 23-12-2010.

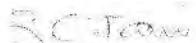
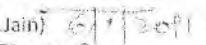
A meeting of the committee was held under the Chairmanship of Secretary (WR), Narmada, Water Resources, Water Supply & Kalpsar Department (N, WR, WS & K Dept.,) Government of Gujarat on 23-12-2010 in the Committee Room of N, WR, WS & K Dept. at 11:00hrs. The list of members present during the meeting is given in Annexure-I.

As per the agenda, a draft report of the dynamic groundwater resources of Gujarat State (as on March 2009), circulated by the Member Secretary of the committee was discussed and approved.

Based on the recommendations contained in the report and related deliberations, following decisions were taken:

1. A joint working group may be constituted for estimating the total number of piezometers required for intensifying the monitoring network in different talukas keeping in view the stage of development, groundwater quality and aquifer distribution.
2. A desk study may be undertaken to find out the trend of groundwater development vis-à-vis quality changes during the last 2 decades based on the data of the Resource Estimation Report for the period 1984-2009.

The meeting ended with a vote of thanks to the Chair.


(Dr. R.C.Jain) 
Regional Director &
Member Secretary
State Level Committee on
Groundwater Resources Estimation

Distribution:

1. The Chief Engineer (P) & additional Secretary, Narmada, Water Resources, Water Supply and Kalpsar Department, Block No 9, 2nd floor, Sachivalaya, Gandhinagar.
2. The Director (Agriculture), Krishi Bhawan, Sector 10A, CH Circle, Gandhinagar.
3. The Managing Director, Gujarat Water Resources and Development Corporation, Sector-10A, Near Bij Nigam, Gandhinagar-382043.
4. The Chief General Manager, NABARD, NABARD Tower, Usmanpura, Ahmedabad.
5. The Member Secretary, Gujarat Water Supply and Sewerage Board, Opposite Air Force Station, Sector-10, Gandhinagar.
6. The Principal Secretary, Industries and Mines Department, Block No-5, 3rd Floor, New Sachivalaya, Gandhinagar.
7. PS to Secretary (WR), Narmada, Water Resources, Water Supply & Kalpsar Department, Block No-9, 2nd Floor, Sachivalaya, Gandhinagar.
8. TS to Chairman, central Ground Water Board, Bhujal Bhawan, NH-IV, Faridabad-121001 for information.
9. TS to Member (SAM), Central Ground Water Board, Bhujai Bhawan, NH-IV, Faridabad-121001 for information.

Annexure-I

List of Members/Officers present during the State Level Committee Meeting on Groundwater Resources Assessment of Gujarat State (as on March, 2009) held on 23-12-2010 at 11.00 Hrs in the Committee Room of Narmada, Water Resources, Water Supply & Kalpsar Department, Gandhinagar.

Sl. No	Name, Designation & Address
1	Shri S. J. Desai, Secretary (WR), Narmada, Water Resources, Water Supply & Kalpsar Department, Block No 9, 1 st Floor, Sachivalaya, Gandhinagar.
2	Shri O.T. Gulati, Chief Engineer (P) & Additional Secretary, Narmada, Water Resources, Water Supply & Kalpsar Department, Block No 9, 2 nd Floors, Gandhinagar.
3	Shri A.P. Bhavsar, Managing Director, Gujarat Water Resources and Development Corporation, Sector 10-A, Near Bij Nigam, Gandhinagar.
4	Shri M. C. Rathod, Superintending Hydrogeologist, Gujarat Water Supply and Sewerage Board, Opp. Air Force Station, Sector 10-A, Gandhinagar.
5	Dr. R. C. Jain, Regional Director, Central Ground Water Board, West Central Region, S.N. College Building, Shah Alam Tolnaka, Ahmedabad.

HARYANA

Minutes of the meeting of State Level Committee for Estimation of Ground Water Resources Potential held on 31-05-2011 under the chairmanship of Sh. Roshan Lal, IAS, Financial Commissioner & Principal Secretary to Govt., Haryana, Agriculture Department.

The list of participants is enclosed.

2. At the very outset, the Chairman welcomed all the participants and asked the Director General Agriculture to initiate the discussions on the subject. Director General explained about the objective of the meeting in detail.
3. Regional Director, Central Ground Water Board dwelt upon the methodology adopted in estimation of current Ground Water Resource Potential in Haryana as on 31st March, 2009. The Ground Water Resources had been worked out on the basis of the Guidelines of the Groundwater Estimation Committee-1997 jointly by the CGWB, NWR, Chandigarh and Ground Water Cell of Agriculture Department, Haryana.
4. Shri Y. B. Kaushik, Scientist 'D' made a brief presentation on the resource assessment methodology, norms used for various parameters and results of the assessment. It included comparison with last assessment as on 31st March, 2004. It was informed that in the current Ground Water Resource Potential for Haryana as on 31st March, 2009, 68 Blocks fell under over-exploited, 21 critical, 09 semi-critical and 18 safe categories.
5. The members of the committee discussed various issues related to the management of ground water and its importance for the State and suggested steps to be initiated for the judicious use of ground water.
6. The following decisions were taken to be included in Guidelines for water conservation, its management and implementation in the State:-
 - a) Massive awareness programmes to educate the farmers about judicious use of surface and ground water shall be launched.
 - b) Incentives shall be provided to the farmers, Panchayats and Industries who have taken excellent measures for conservation of water and saving in consumption of water.

- c) Water saving techniques, such as drip & sprinkler irrigation, under ground pipe line, laser land leveler, zero tillage etc shall be propagated for enhancing water use efficiency.
- d) Cropping pattern in problematic areas, where quality water availability was a matter of concern, shall be modified and salt-tolerant crops shall be encouraged.
- e) Farmers shall be educated about the use of Sodic waters by applying gypsum as per recommendation and supplementing the tube-well irrigation with canal water.
- f) Massive campaign shall be launched to educate farmers about use of bio-fertilizers and excessive use of fertilizers and pesticides to avoid groundwater contamination.
- g) Recycling of waste water by installation of Effluent Treatment Plants shall be made mandatory for industries for zero discharge.
- h) Consolidation and expansion programme for renovation, repair and rejuvenation of water bodies shall be taken up.

7. After detailed deliberations, the House approved the Draft Report on Dynamic Ground Water Resources as on 31st March, 2009 for Haryana.

The meeting ended with a vote of thanks to the Chair.

LIST OF PARTICIPANTS

S No.	Name S/Shri	Designation & Department
1.	A. S. Chahal	Chairman, Haryana Pollution Control Board
2.	Ashok Khetrapal	Engineer-in-chief, Public Health Engineering Department
3.	A. K. Bhatia	Regional Director, Central Ground Water Board
4.	S. S. Bishnoi	Chief Hydrologist, Ground Water Cell
5.	P. K. Garg	AGM (IA), Haryana State Industrial & Infrastructure Development Corporation
6.	Dr. R. P. Narwal	Director, Research, HAU, Hisar
7.	Jitender S. Balhara	Director, Water Resources & Irrigation Department
8.	Vir Singh	Sr. Geologist, Mines & Geology Department
9.	Neeraj kumar	Mining Officer, Mines & Geology Department
10.	Rajiv Bansal	Executive Engineer, Irrigation Department
11.	Rajesh Yadav	Joint Director, Command Area Development Authority,
12.	Sada Ram	General Manager, Haryana State Cooperative Agricultural & Rural Development Bank Ltd.
13.	S. C. Maan	Sr. Scientist, Haryana Pollution Control Board
14.	Suresh Verma	Project Officer, Directorate Rural Development
15.	Y. B. Kaushik	Scientist 'D', Central Ground Water Board
16.	Sanjiv Chadha	Hydrologist, Ground Water Cell
17.	Dr. Shailendra Singh	STA(Hg), Central Ground Water Board

HIMACHAL PRADESH

MINUTES OF THE SECOND MEETING OF STATE LEVEL COMMITTEE ON GROUND WATER RESOURCE ESTIMATION (2008-2009) OF HIMACHAL PRADESH HELD ON 1ST DECEMBER 2010 UNDER THE CHAIRMANSHIP OF PRINCIPAL SECRETARY (I&PH) TO THE GOVERNMENT OF HIMACHAL PRADESH

Second meeting of State Level Committee on Ground Water Resource Estimation of Himachal Pradesh, was held on 1st December, 2010 under the chairmanship of Principal Secretary (I&PH) to the Government of Himachal Pradesh. The following decisions were taken during the meeting.

1. The presentation on “Ground Water Resource Estimation as on March, 2009 (2008-09)” was given by Sh. J.S. Sharma, Sc ‘D’ & H.O.O. It was pointed out by members of the committee that rainfall map of Himachal Pradesh may be rechecked.
2. The Engineer -in -Chief, Department of Irrigation and Public Health and S.E., Soil & Water Conservation department suggested that water level trend may be checked for Nalagarh valley with the water level data of piezometers constructed by Ground Water Organization, IPH deptt. and pointed out that water level. As there is rise in pre-monsoon water level trend. It was informed by Senior Hydrogeologist, GWO, that they are monitoring the water level of piezometers since January, 2010, therefore decadal trend can not be worked out.
3. S.E., Soil & Water Conservation department suggested that, for the next Ground Water Resource Estimation, Marwadi and Joh area of Una valley may be assessed separately from Una valley.
4. The Engineer -in -Chief, Department of Irrigation and Public Health and other members suggested that remedial measures be suggested for over exploited and critical areas in the report. Member secretary said that respective report can be prepared for remedial measures for over exploited and critical areas.
5. Resource estimation as on March, 2009 was approved by the committee members.

Meeting ended with the pleasing note.

Following officers attended the meeting:

1. Er. R.K.Sharma, Engineer –in –Chief (IPH)
2. Er. M.S. Kanwar (D/Z)(IPH)
3. Er. S.K. Vats, Chief Engineer, I&PH Deptt. Mandi Zone.
4. Er. V.K. Goel, Chief Engineer(D&M), I&PH Deptt.
5. Smt. Poornima Chauhan, Director, Urban Development and Town & Country Planning, Shimla.
6. Sh. Shamsher Singh, Dy. Director, Rural Development
7. Er. Suman Vikrant, S.E., P & I-I (IPH)
8. Er. Y.P. Thakur, S.E., Soil & Water Conservation
9. Sh. Vinod Arya, AGM, NABARD, SHIMLA-9
10. Er. O.P. Chauhan, SE, Hydrology, I&PH Deptt. Shimla.
11. Er. A.K. Vaidya, S.E., P & I-I (IPH), Shimla.
12. Rajneesh Sharma, Geologist, Deptt. of Industries, Shimla.
13. Sh. Kuldeep Singh Mandhortra, Sr. Hydrogeologist (IPH).
14. Sh. Shyam Rattan Dixit, STA, GWO, I&PH Deptt.H.P.
15. Sh. J.S.Sharma, Regional Director (Incharge), CGWB, NHR, Dharamshala.
16. Sh. S.K. Saigal, Scientist ‘C’, CGWB, NHR, Dharamshala.
17. Sh. Vidya Nand Negi, Scientist ‘C’, CGWB, NHR, Dharamshala.

JAMMU & KASHMIR

Government of India

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Email: rdnwhr-cgwb@nic.in

14/14
TC-22/NWHR/GEC/2010-11-
Ministry of Water Resources
Central Ground Water Board
North Western Himalayan Region
298-299, Shastri Nagar
Jammu- 180 004

Dated: 19-09-2011

2-D

Minutes of Meeting on Ground Water Resource Estimation of the J & K State

A meeting was organized with the constituted State level coordination Committee on Ground Water Resource Estimation of the J & K State at the Institute of Engineers, Gandhi Nagar, Jammu on 16.09.2011 at 10.00 hrs, under the Chairmanship of the Commissioner Secretary, PHE and I & FC Dept. of J&K Govt. The following officers of different organization have attended the meeting.

S.No.	Name of the Officer	Designation	Member
1	Sh.S.Mehboob Iqbal	Commissioner Secretary, PHE, I & FC Deptt.	Chairman
2	Sh.M.R.Sholla	Chief Engineer, I & FC Deptt. Srinagar	Member
3	Sh.Ashwani Sharma	Chief Engineer & I & FC Deptt. Jammu	Member
4	Sh. M.R. Mattoo	In-charge Director Planning PHE, I & FC Deptt. J & K Govt.	Member
5	Sh. V.K.Abrol	Chief Engineer (Rtd.) & Consultant, PHE, I & FC Deptt. J & K.	Special invitee
6	Sh. Rohit Mishra	DGM, NABARD, Jammu	Member
7	Sh. B.R.Dogra	Chief Engineer,PHE,Dept. Jammu	Member
8	Sh.Imtiyaz.A.Khan	Representative, Director, Geology & Mining, Jammu	Member
9	Sh.G.R. Zasqar Saheb	Chief Engineer, PHE, Srinagar	Member
10	Sh.Naresh Khajuria	Executive Engineer, PHE Ground Water Division , Jammu	Member
11	Sh. N.R.Bhagat	Scientist D,& HOO CGWB, NWHR, Jammu	Member Secretary

In the meeting Sh. N.R.Bhagat, Sc-D & Head of Office, Central Ground Water Board, North Western Himalayan Region has discussed and appraised about the 'Dynamic Ground Water Resource Estimation' of 2004 which was carried out in respect of only eight district of J&K State. As per instructions of CHQ the 'Dynamic Ground Water Resource Estimation for the year 2008-09 was worked out by the Central Ground

Water Board,NWHR in respect of 14 district of J&K State. The over all quality of Ground Water is good through out the J&K State. There is enough Ground Water resource available in the valley. But with increasing rate of population and urbanization, proper management is also required. Therefore PHE and other related department should also work on groundwater management and development program. Sh.Bhagat has presented the report before the members of the Committee on the titled "Dynamic Ground Water Resource Estimation" of J&K for the year 2008-2009. There was very good discussion about the procedures of resources estimation and calculation of recharge in the State. All the members participated have given good response and appreciated this activity of the Central Ground Water Board. After the discussion, the report on 'Dynamic Ground Water Resource Estimation for the year 2008-2009' was finally accepted by all the members participated in meeting above. The Commissioner Secretary has finally approved the report on 'Dynamic Ground Water Resource Estimation of J&K for the year 2008-2009' and advised to circulate the copy of the said report to all the departments associated with the Ground Water management and development.

The meeting was concluded with the Vote of thanks endorsed by Sh. B.R.Dogra, Chief Engineer, PHE, Deptt. Jammu.



(N.R.Bhagat)
Scientist-D&HOO

Copy for Information:

- ✓ 1. The Member (SAM), CGWB Bhujal Bhawan, NH-IV, Faridabad.
2. The Commissioner Secretary, PHE, I & FC Dept., Civil Secretariat J&K Govt.Srinagar.
3. The In-charge, Director Planning, PHE, I & FC Dept.), Civil Secretariat J&K Govt.Srinagar.
4. Sh. V.K.Abrol Chief Engineer (Rtd.) & Consultant, PHE, I & FC Deptt., Jammu.
5. The Chief Engineer, PHE, I & FC Dept. Jammu/Srinagar,
6. The DGM, NABARD, Jammu.
7. The Director, Geology & Mining Jammu/Srinagar.
8. The Executive Engineer PHE Ground Water Division Jammu.



(N.R.Bhagat) 1/1
Scientist-D&HOO

JHARKHAND

MINUTES OF THE FINAL MEETING OF STATE LEVEL COMMITTEE OF RE-ASSESSMENT OF DYNAMIC GROUND WATER RESOURCES OF JHARKHAND STATE FOR THE YEAR (2008- 2009) HELD ON 15TH FEBRUARY 2011

Final meeting of the State Level Committee of re-assessment of dynamic groundwater resource of Jharkhand state for the year 2008-2009 was held on 15th February 2011 in the chamber of the Principal Secretary, Water Resources Department, Government of Jharkhand, in Nepal House, Ranchi. The Principal Secretary, Water Resources Department, Government of Jharkhand, being the Chairman of the Committee, welcomed the members and started the deliberations on the agenda of the meeting regarding the finalization of the dynamic ground water resources of Jharkhand state.

Briefing about the dynamic resources of Jharkhand (2008-09) was made by T.B.N.Singh (Sc-C), CGWB, SUO, Ranchi. The committee members were asked to give their opinions and suggestions on the draft report. Discussion was held on the different calculation procedures like irrigational draft, per capita drinking water draft taken for rural and urban populations of Jharkhand. Member from NABARD wanted to know feasibility of the different abstraction structures like dug wells in over-exploited blocks as mentioned in the report. The members agreed and approved the resource estimation exercise carried out jointly by Central Ground Water Board and Ground Water Directorate, Govt. of Jharkhand. At the end of the long discussions, deliberations and clarifications, Chairman of State level committee, Principal Secretary agreed on the assessment of dynamic resources of Jharkhand and finally approved the report.

List of participants of Final Meeting-

Sl.No.	Name	Designation
1.	Shri R.S Poddar (IAS)	Principal Secretary, WRD
2.	Shri R.M. Rabidas	Engineer-in-Chief, WRD
3.	Shri S.L.S.Jagehswar	Director, GW Directorate
4.	Shri Shri Subodh Kumar	Chief Engineer (H.Q.) DWSD
5.	Shri K.K.Sinha	AGM, NABARD, Ranchi
6.	Shri Surender Kumar	Technical Secretary, Minor Irrigation
7.	Shri S.N. Sinha	Regional Director (I/c), CGWB, Patna
8.	Shri G.K. Roy	Scientist-D, CGWB, SUO Ranchi
9.	Shri TBN Singh	Scientist-C, CGWB, SUO Ranchi
10.	Smt. Rose Anita Kujur	Scientist-C, CGWB, SUO, Ranchi

15/02/2011
(S.N.SINHA),
R.D. (I/C) & Member Secretary

KARNATAKA

Minutes of the meeting of State Level Committee for Re-estimation of Groundwater Resources of Karnataka State as on March 2009, held at Hall No. 222, Vikasa Soudha, Bangalore on 01.09.2010

The meeting was held under the Chairmanship of Sri P.N. Sreenivasachary, IAS, Secretary to the Government, Water Resources Department (MI). The following Members and Invitees were present in the meeting:

S/Shri:

1. B. Guruprasad, CE, Minor Irrigation (S), Bengaluru
2. H.M. Khyum Ali, Addl Director(GW), Department of Mines and Geology, Govt of Karnataka, Bengaluru
3. Prabhakar, H. Chini, CE, PRED, CE, Govt of Karnataka, Bengaluru
4. Dr K.R. Sooryanarayana, Scientist-D, Central Ground water Board, Bengaluru
5. D. Srikanth Murthy, Dy Director, Department of Mines & Geology, Govt of Karnataka, Bengaluru
6. Dr. G.V. Hedge, Senior Geologist, Department of Mines & Geology, Govt of Karnataka, Bengaluru
7. Dr. B.K. Dharmavajan, Addl. Director, Agriculture, Govt of Karnataka, Bengaluru
8. Rama Krishna, H.R. WRDO, Govt of Karnataka, Bengaluru
9. Afaque Manzar, Scientist-B, Central Ground water Board, Bengaluru
10. Sri C.I. Ashok, Dy Director, R&D, Department of Mines & Geology, Govt of Karnataka, Bengaluru
11. Prasad, B.V. Executive Engineer, PRED, Govt of Karnataka, Bengaluru
12. M.S. Mokasai, CEO & CA, TECSOK
13. Vishnu R. Gangul. Adviser, TECSOK
14. Sri Veershekhar Swamy, Senior Geophysicist, Department of Mines & Geology, Govt of Karnataka, Bengaluru
15. K.G. Siddappa, Senior Geologist, Department of Mines & Geology, Govt of Karnataka
16. A. Ramashe, KUM

After the brief introduction by the Chairman, the minutes of the previous meeting held on 8.7.2009 was confirmed by the Committee.

Dr K.R. Sooryanarayana, CGWB presented a brief view of groundwater resources of Karnataka re-estimated jointly by CGWB and DMG as per the guidelines (GEM-1997). The details of taluk-wise categorisation with stage of development along with district-wise maps were also presented. The highlights of the present estimation as on March 2009 are as follows:

Contd.....

.....Contd.

Department of Mines & Geology. Further he mentioned that the marginal improvements noticed in Kolar and Chikkaballapur districts are mainly due to the changed cropping pattern, improved irrigation practices and the overall measures taken by the State and the Central Departments in the area towards groundwater development through the construction of artificial groundwater recharge under various schemes. The Chairman suggested that the Groundwater Department may take up studies on "the impact of the Artificial Recharge Structures" constructed by different Departments in the over-exploited blocks.

Sri Guruprasad, CE, MI(South), has expressed that the recommendations may be made in the final report for remedial measures for groundwater development especially in the over-exploited and the critical talukas.

The committee approved the resources estimated and the categorization made. Chairman enquired about the printing and issuance of the final report. Sri Khyum Ali, Additional Director, informed that Department of Mines & Geology will print and issue the report by the end of September 2010 after due consultation between CGWB & DMG.

At the end, Chairman expressed his views on the urgency of completing the whole process of ground water re-estimation and the outcome of this exercise is important to take further policy decisions on ground water management in the State by the Govt. of Karnataka.

The meeting ended with thanks to the Chair.


(Chairman)

KERALA

**MINUTES OF THE 4th MEETING OF
THE STATE LEVEL GROUND WATER RE-ESTIMATION COMMITTEE ON 30.12.2010**

Venue : Chamber of Secretary, Water Resource Department, Secretariat,
Thiruvananthapuram.
Date and Time : 30th December, 2010 at 15.00 hrs.

The meeting was chaired by Shri Pradeep Kumar, IAS, Secretary, Water Resource Department, Government of Kerala. The following members/invitees attended the meeting:

1.	Dr. Nandakumaran, R, Head of Office, CGWB	Member Secretary
2.	Shri V.P. Radhakrishna Pillai, Director, Ground Water Department, Government of Kerala.	Member
3.	Smt. Leena R, EC, Kerala Water Authority , Government of Kerala (representing MD, KWA)	Member
4.	Shri Suresh Kumar S, Deputy Director, Industries (representing Director, Industries)	Member
5.	Shri Pushparagam V.V, Additional Director, Agricultural Department, Government of Kerala (representing Director, Agriculture Department)	Member
6.	Shri K. Muthusundaran, Deputy CE, Department of Irrigation, Government of Kerala (representing Chief Engineer, Irrigation)	Member
7.	Shri George Chackancherry, Scientist, CWRDM, Kozhikode (representing Executive Director, CWRDM)	Member
8.	Shri M. Sarath Chandran, Assistant Manager, NABARD, Trivandrum	Member
9.	Shri John Kurikin, Former CGM, NABARD	Special Invitee
10.	Shri Balu Joseph, Superintending Hydrogeologist, Ground Water Department, Government of Kerala.	
11.	Smt. T.S. Anitha Shyam, Scientist C, CGWB, Kerala Region	
12.	Smt. S. Santha, AHO, CGWB, Kerala Region.	

After formal welcome by the Chairman and introduction of the members and special invitees, agenda items were taken up for discussion.

Agenda Item 4.1 Confirmation of the Minutes of the 3rd Meeting

As no comments have been received on the minutes of the 3rd meeting which was circulated in advance to all the members, the same was confirmed.

Agenda Item No. 4.2 Finalization of the Assessment of the Dynamic Ground Water Resources of Kerala

- The Member Secretary informed the committee that the draft report of the resource assessment, circulated to the members earlier have been modified and validated on the basis of the feed-back received from the district level officers of the Ground Water Department and field officers of Central Ground Water Board.
- The methodology adopted for the estimation of resources and the final results of the computations were explained. Various aspects of the computation were deliberated in detail by the Committee.
- The Committee was informed that as per the computations, the Net Ground Water Availability of the State as in March 2009 is of the order of 60 BCM and the existing gross ground water draft is of the order of about 28 BCM. Resources to the tune of about 17 BCM will be required for meeting the domestic and industrial water requirements of the state by the year 2025. Hence, about 30 BCM of dynamic ground water resources are available for future irrigation development in the State as a whole. The stage of ground water development in the State as a whole is of the order of about 49 percent, with 128 blocks in 'Safe' category and 24 blocks in 'Over-exploited', 'Critical' and 'Semi-critical' categories combined.
- A comparison of the results of the assessment in 2009 and 2004 shows that the net ground water availability, gross ground water draft and net ground water availability for future irrigation have marginally declined in 2009 when compared to 2004. On the other hand, the overall state of ground water development in the state has registered a marginal increase. It was mentioned that factors such as variation in rainfall, increase in population, decrease in irrigation draft consequent upon the reduction in the area under irrigated crops in the State and modifications in the assessment methodology and parameters are responsible for the variation in the major components of the assessment.
- Shri John Kurien, special invitee, appreciated the efforts of CGWB and State Ground Water Department for ensuring that the ground water resources of the State are assessed as realistically as possible. He observed that for the majority of the blocks, ad-hoc norms (RIF method) have been adopted for computation of monsoon rainfall recharge. He emphasized the need for optimizing and refining the observation well networks of CGWB and GWD in Kerala to ensure that the resources could be computed using Water Level Fluctuation Method for the majority of assessment units. He also opined that the Ground Water Department should commence the collection of relevant data on watershed basis so that assessments could be done for hydrologic units as a whole. Dr. George Chakancheri, representing CWRDM, Calicut, mentioned that the watershed data may be compiled in GIS format to make the computations easier. It was also mentioned that Panchayat-wise data may also be collected from the Department of Local Self-Government for the purpose. The Chairman also suggested that the collection of watershed wise data for Bharathapuzha basin may be initiated as part of the activities under National Hydrology Project in the State.

(Action: Central Ground Water Board, State Ground Water Department)

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- It was also mentioned by Shri. John Kurien that in spite of the existence of well-established canal irrigation projects in districts like Palakkad and Thrissur, the estimation of ground water resources is still being done by considering the entire area as 'non-command'. It was mentioned that non-availability of data regarding the areal extent of block-wise command area, particulars of canals, cropping pattern etc. are the major constraints in computing the resources for command and non-command areas separately. The Chairman then directed the representative of Irrigation Department to provide available data to the Ground Water Department. It was also decided that a pro-forma showing details of information required will be prepared by Ground Water Department and sent to Department of Irrigation for the purpose.

(Action: State Ground Water Department; State Irrigation Department)

After detailed deliberations, the Committee unanimously approved the estimates of dynamic ground water resources of the State as in March 2009, taken up jointly by the Central Ground Water Board and State Ground Water Department. The Chairman opined that the computations be meticulously rechecked ~~and~~ and modifications, if any, be incorporated. He also suggested that the modifications/ changes in the estimation methodology and the reasons for variations in the major components of recharge and draft be clearly brought out in the report. The Member Secretary informed the Committee that the final details of computation shall be circulated to all the members after checking and the report of the estimation shall be finalized within a week.

(Action: Central Ground Water Board, State Ground Water Department)

Agenda Item No. 4.3 - Any other Item

- The Chairman suggested that the State Ground Water Department prepare a Perspective Plan for Ground Water Management in Kerala, aimed at interventions or ensuring the optimal and sustainable development of ground water resources in the State, based on the recently concluded assessment of dynamic ground water resources.
- The Chairman further desired that a meeting of the State Ground Water Authority be convened shortly to discuss issues related to the regulation of over-exploitation of ground water resources in the State.

(Action: State Ground Water Department)

The meeting ended with thanks to the Chair.

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MADHYA PRADESH

Minutes of second meeting of State Level Committee for re-estimation of Ground Water Resources for approval of Dynamic Ground Water Resources of Madhya Pradesh (Base Year-2008-09) held on 13th April 2011

The second meeting of State Level Committee for re-estimation of ground water resources was held under the Chairmanship of the Principal Secretary, Water Resources Department, Govt. of Madhya Pradesh on 13-04-2011 (4:30 PM) for the approval of report on dynamic ground water resources of Madhya Pradesh (base year-2008-09). The following members and invitees attended the meeting.

1. Shri K.C. Prajapati, Secretary, Water Resources Department, Govt. of M.P.
2. Shri M.G. Choubey, Engineer-in-Chief, Water Resources Department, Govt. of M.P.
3. Shri H.P.Tiwari, Chief Engineer, BODHI, Water Resources Department, Govt. of M.P.
4. Shri R.N. Singh, Regional Director, CGWB, NCR, Bhopal.
5. Shri A.K. Kesarwani, Superintending Geohydrologist, Ground Water Survey Circle, Bhopal.
6. Shri M.P.Mishra, Superintending Hydrogeologist, Public Health Engineering Department.
7. Shri S.K.Jatav, Superintending Engineer, Public Health Engineering Department.
8. Shri Parvinder Singh, Scientist 'D', CGWB, NCR, Bhopal.
9. Shri S.S.P.Mishra, Scientist 'D', CGWB, NCR, Bhopal.
10. Shri Kuldeep Singh, Asstt. General Manager, NABARD, Bhopal.
11. Shri Venu Gopal, Dy. Director, Rajeev Gandhi Watershed Mission, Govt. of M.P.
12. Dr.Jitendra Jain, Resource Scientist, State Ground Water Data Centre, Bhopal.
13. M.K.Verma, Scientific Officer, State Ground Water Data Center, Bhopal.
14. Dr. Seraj Khan, Scientist 'B', CGWB, NCR, Bhopal.
15. Dr. L.K.Mathur, Asstt. Hydrogeologist, CGWB, NCR, Bhopal.

Shri R.N.Singh, Regional Director, CGWB, NCR, Bhopal and Member Secretary of the committee welcomed all the committee members and invitees.

Dr.Jitendra Jain, Resource Scientist, State Ground Water Data Centre, Bhopal and Dr. Seraj Khan Sc.'B' CGWB, NCR, Bhopal briefed about the report on dynamic ground water resource assessment of Madhya Pradesh, jointly prepared by Ground Water Survey, Water Resource Department and Central Ground Water Board for the base year 2008-09. Dr.Jitendra Jain Resource Scientist, further informed that as discussed in the meeting held on 18.01.2011, the draft report has been re-examined and modified using the parameters as adopted in assessment year 2004 under the guidance of review committee, consisting of eight members

from Ground Water Survey, Water Resource Department, Govt. of M.P. and Central Ground Water Board, North Central Region Bhopal. The salient features of the report are as under.

Net Annual Ground water Availability in the State	32,24,947 (ham)
Existing Gross Ground water Draft for Irrigation	16,65,835 (ham)
Existing Gross Ground water Draft for Domestic & Industrial water Supply	1,33,189(ham)
Existing Gross Ground water Draft for all uses Provision for domestic, and industrial requirement supply to next 25 year (up to 2033)	17,99,024 (ham)
Net Ground water Availability for future irrigation development	13,76,472 (ham)
Stage of Ground water Development	55.7 (%)
Number of Safe Blocks	224
Number of Semi-Critical Blocks (Non Command)	61
Number of Critical Blocks (Non Command)	04
Number of Over Exploited Blocks (Non Command)	24

After detailed discussions and deliberations, the State Level Committee approved this report.

The meeting ended with vote of thanks to the Chair.


 Principal Secretary,
 Water Resources Department,
 Govt. of Madhya Pradesh
 and

Chairman
 State Level Committee
 For Re-Estimation of Ground Water Resources

MAHARASHTRA

Annexure II

MINUTES OF THE MEETING OF STATE LEVEL TECHNICAL COMMITTEE FOR REVIEW OF GROUND WATER RESOURCES OF MAHARASHTRA FOR 2008-09 AS PER GEC 97 METHODOLOGY

Dated 27th September 2010

(Issued vide Regional Director, CGWB, Nagpur Letter No 54/TS/2104 dated 25th Nov 2010)

The Meeting of the State Level Committee for finalization of the Ground Water Resource Estimation for 2008-09 for the State of Maharashtra was held under the Chairmanship of Smt. Malini Shankar, Principal Secretary to Govt. of Maharashtra, Water Supply and Sanitation Department, Mantralaya, Mumbai on 27th September 2010 at 12.30 p.m. The meeting was held at the Committee Room, Home Department, Room No. 543 (Main Bldg.), 5th Floor, Mantralaya, Mumbai to review and finalize the Ground Water Resource estimation of Maharashtra for the year 2008-09 jointly carried out by Ground Water Surveys & Development Agency (GSDA), Pune and Central Groundwater Board (CGWB), Nagpur. The list of members attended the meeting is enclosed.

At the outset, Shri. B. Jaya Kumar, Regional Director, Central Groundwater Board, Central Region, Nagpur and Member Convenor welcomed the Members and gave opening remarks about the Dynamic Ground Water Resource Estimation of Maharashtra for the year 2008-09 and informed about the deadline given by CGWB, CHQ in completing the state level exercise on or before 30th September 2010. He also indicated the commitment given by CGWB in submitting the National Level Assessment report on or before 31st March 2011 to PMO. The Member Convenor appreciated the role of GSDA & CGWB in completing the present exercise in stipulated time and also the enthusiasm shown by GSDA in completing the assessment for the base year 2007-08. He also explained the Members about the Central Government Policy of carrying out the ground water assessment on yearly basis. At this juncture, Smt. Malini Shankar, the Principal Secretary, Water Supply and Sanitation Department & Chairman of the Committee, indicated that it is good to carryout assessment on yearly basis subject to the availability of data and various inputs from other Departments needed for the above exercise.

Shri. K.M. Nagargoje, Director, GSDA, Pune informed that GSDA has been carrying out ground water assessment since 1973 ever since the Department has formed. He informed the Members that lack of updated data from various Departments like Minor Irrigation, Industries, Water Conservation and Agriculture is required for this purpose.

Contd.....

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(Representative of Chief Engineer, Minor Irrigation, Local Sector, Pune) informed that the IVth Minor Irrigation Census is almost over and the data on irrigation dug wells/bore wells would be published shortly. The Chairman of the committee desired that the data be given village-wise.

The Member Convenor also impressed upon the Chairman of the Committee about the need and compilation of agriculture data district-wise/village-wise.

The Asstt. General Manager, NABARD, Pune Shri. Sandeep Sharma stressed the need of updated database.

Dr. S.D. Dahiwalkar, the Research Engineer, MPKV, Rahuri informed about the studies carried out by MPKV on the effectiveness of percolation tanks on ground water recharge and informed that the percolation tanks are the best among the recharge structures.

The Additional Director, GSDA, Pune Shri. Khandale impressed the committee the need for carrying out ground water assessment for urban areas for scarcity measures. In response to this, the Chairman of the committee advised GSDA to take up pilot studies in some urban areas especially in Jalna district to arrive at the picture.

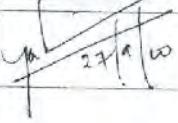
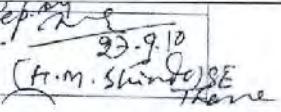
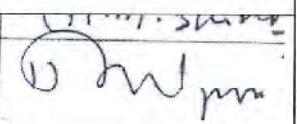
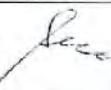
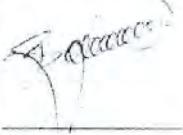
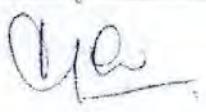
The Director, GSDA, Pune informed the Members that field validation would be carried out in at least 10 % of the assessment units and would inform CGWB and Chairman of the Committee upon completion of the same. These would be incorporated in the report after approval of the Committee.

The Committee has accepted the draft report on the Dynamic Groundwater Resources of Maharashtra 2008-09. The Member convenor requested that the Annexure III D be made as per the format circulated by CHQ i.e. assessment sub unit wise and the GSDA has agreed to compute up to stage of development only.

However, the committee has decided to compute the category only for the watershed and not for the sub-units. Accordingly the draft report will be re-submitted to the Chairman of the Committee after incorporating the necessary modifications as mentioned above.

It has been decided to submit the accepted report to GoI by 15th October 2010 through Central Ground Water Board, Ministry of Water Resources.

The meeting ended with the vote of thanks from the Member Convenor.

List of Members Attended the Meeting on 27 th Sept 2010			
Sr No	Name	Designation	Signature
1	Malini Shankar	Principal Secretary, Water Supply and Sanitation Department, Mantralaya, Mumbai	
2	Shinde H.M.	Superintending Engineer, Minor Irrigation (LS), Pune	
3	Nagargoje K.M.	Director, Groundwater Surveys and Development Agency, Pune	
4	Rendalkar P.D.	Deputy Director, Dept of Industries, Mumbai	
5	Sharma Sandeep	Assistant General Manager, NABARD, Pune	
6	Dahiwalkar S.D.	Research Engineer, Mahatma Phule Agricultural University, Rahuri	
7	Murty C.S.N.	Deputy Director (R&D), Groundwater Surveys and Development Agency, Pune	
8	Jaya Kumar B.	Regional Director, Central Groundwater Board, Central Region, Nagpur	

MEGHALAYA

MINUTES OF THE MEETING OF STATE LEVEL COMMITTEE FOR RECONCILIATION OF DYNAMIC GROUND WATER RESOURCES OF MEGHALAYA STATE HELD ON 14.10.11 IN THE CHAMBER OF THE COMMISSIONER & SECRETARY, WATER RESOURCES DEPARTMENT, GOVT. OF MEGHALAYA, SHILLONG

A meeting of State Level Committee for reconciliation of Dynamic Ground Water Resources of Meghalaya State, 2009, was convened on 14.10.11 at Main Secretariat Building, Shillong. The meeting was chaired by Shri. R.M.Mishra, Commissioner & Secretary, Water Resources Department, Govt. of Meghalaya, and the following members were present (Attendance sheet attached):

- i) Shri. P.S.Lyngdoh, Chief Engineer (WR), Govt. of Meghalaya, Shillong.
- ii) Shri. H.S.Lyngdoh, Director of Agriculture, Govt. of Meghalaya, Shillong.
- iii) Shri. H. Prasad, Chief Engineer, PHE, Govt. of Meghalaya, Lower Lachumier, Shillong.
- iv) Director of Industries, Govt. of Meghalaya, Shillong.
- v) Shri. R.B.Jodha, General Manager, NABARD, Dhankheti, Shillong.
- vi) Shri. G.C.Saha, Regional Director, CGWB, NER, Guwahati & Member Secretary.

The computation of Dynamic Ground Water Resources, as on 2009, for Meghalaya State has been done by CGWB, based on GEC Methodology, 1997 and the following parameters have been considered:

- i) The resource computations are done for the **ground water year 2008-09**.
- ii) District has been taken as the smallest administrative unit for resources computation. The area suitable from the ground water recharge point of view has been calculated taking into consideration the Hydrogeomorphological map of the state prepared by NRSA. There is no poor water quality area reported from the state of Meghalaya, hence it has not been considered.
- iii) Since there is no major irrigation project in the state therefore area of the state has been taken as non-command area.
- iv) **Ground Water Draft:**
 - a) **Domestic draft:** Draft per person for rural area has been taken as 60 lpd and for urban area 135 lpd.
 - b) **Irrigation draft:** This has been calculated only for West Garo Hills District as other districts do not have ground water irrigation

- c) **Industrial Draft:** This has not been considered, as the information is not available.
- v) The recharge from rainfall has been computed using the **Rainfall infiltration factor method**. As most of the area of the state is covered by consolidated and semi-consolidated formations the Rainfall infiltration factor considered is 0.12 and for part of West Garo Hills district 0.20 (Alluvial Plain).
- vi) Recharge from ground water irrigation in West Garo Hills has been considered the only source other than rainfall.
- vii) **Total annual recharge** has been obtained as the arithmetic sum of Recharge from rainfall and the recharge from sources other than rainfall.
- viii) **Net annual availability** has been obtained after deducting the unaccounted natural discharge from the total annual recharge. Since recharge has been computed by the Rainfall infiltration factor method, unaccounted natural discharge has been taken as 10% of annual recharge as recommended by GEC97.
- ix) **Stage of development** has been calculated using the following equation

$$\text{Stage} = (100 * \text{Gross Groundwater draft for all uses}) / \text{Annual available resource}$$
- x) **Categorisation** has been made on the basis of the stage of Ground water development. Since the Groundwater development for all the Districts is far below 70 % the entire district have been categorised as safe.
- xi) **Allocation for domestic and industrial water supply** has been estimated up to the year 2025 based on the projected population for the year 2025 using 2001 population data and the decadal growth rate. The fractional load on ground water has been taken as 1.

The Dynamic Ground Water Resources, for the State, as estimated, is as under:

- a) Total Annual Ground Water Recharge: 1.234 BCM
- b) Net Annual Ground Water Availability: 1.11 BCM
- c) Gross Ground Water Draft for all uses: 0.002 BCM
 - i) Irrigation Draft: 0.0015 BCM
 - ii) Annual Domestic Draft: 0.0002 BCM
- d) Annual allocation for Domestic and Industrial uses: 0.094 BCM

e) Stage of ground water development: 0.12%

The comparison of the figures with the last reconciled data of 2004 shows that there is a decrease in total annual ground water recharge by 0.08 BCM in the 2008-09 estimate. This difference in resource may be attributed to the fact that during 2008-09 estimation average annual rainfall for each district has been calculated and applied whereas for 2004 estimation average annual rainfall for the state as a whole was taken.

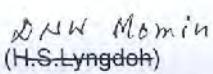
In the meeting the figures have been reconciled with the State Govt. data.



(R M Mishra)
Commissioner & Secretary,
Water Resources Department, Govt. of Meghalaya,
& Chairman, Meghalaya State Level Committee
for Dynamic Ground Resources Assessment



(P S Lyngdoh)
Chief Engineer (WR),
Govt. of Meghalaya,
& Member



(H.S.Lyngdoh)
Director of Agriculture,
Govt. of Meghalaya, Shillong.
& Member



(H. Prasad)
Chief Engineer, PHE,
Govt. of Meghalaya & Member



(R.S.Jodha)
General Manager
NABARD, Dhankheti, Shillong
& Member

()
Director of Industries,
Govt. of Meghalaya,
& Member



(G.C.Saha)
Regional Director
CGWB, NER, Guwahati & Member Secretary.

ORISSA

**MINUTES OF 3RD MEETING OF STATE LEVEL COMMITTEE (SLC)
FOR RE-ESTIMATION OF DYNAMIC GROUND WATER RESOURCES OF ORISSA (2008-09) HELD ON
13-12-2010 UNDER THE CHAIRMANSHIP OF THE COMMISSIONER-CUM- SECRETARY TO GOVT.,
DOWR, GOVT. OF ORISSA**

List of Members and Participants presented in Annexure-I

The 3rd meeting of State level Committee for Re-estimation of Dynamic Ground Water Resources of Orissa (2008-09) was held on 13th December 2010, 4.30 AN, at the Mini Conference Hall of Department of Water Resources, Rajiv Bhawan, Bhubaneswar, under the Chairmanship of the Commissioner-cum-Secretary to Govt., Department of Water Resources, Govt. of Orissa with the following agenda:

1. Presentation of the Draft Dynamic Ground Water Resource Assessment of Orissa (2008-09).
2. Finalization and Approval of the Draft Dynamic Ground Water Resource Assessment of Orissa (2008-09).
3. Any other relevant issues with the kind permission of the Chair.

Initiating the discussion, Shri D.Y Sirsikar, Regional Director, Central Ground Water Board (CGWB) South Eastern Region (SER), Bhubaneswar and Member Convenor, SLC, welcomed the Chairman, all the Members, Officers from the different Departments and Additional Secretary DOWR present in the meeting. Shri P.K Mohapatra, Scientist-D, CGWB briefly appraised the Committee about the entire exercise of re-estimation of Dynamic Ground Water Resources of Orissa (2008-09). Apart from discussing the agenda for the meeting, he also highlighted the enormous quantum of efforts that were invested at each stage to complete the exercise in spite of several constraints.

As per the agenda, initiating the proceedings, Shri A. Choudhury, Assistant Hydrogeologist, CGWB, made a presentation on the background of re-estimation mission, summary of major decisions taken in the past two SLC meetings and overview of associated activities like data collection, validations, compilation, computation for generation of draft result.

Shri S.K Mishra, Chief Engineer & Director, GWSI, appraised the gathering about the various aspects of the re-estimation of Dynamic Ground Water Resources of Orissa (2008-09) including salinity affected areas and poor ground water quality areas which were compiled and demarcated with great care keeping their fragile and sensitive nature in mind.

Shri S.K Mohapatra, Asst. Executive Engineer, GWSI, presented the draft figures of the re-estimation of Dynamic Ground Water Resources of Orissa (2008-09) which included the district wise Total Annual Ground Water Recharge, Annual Net Ground Water Availability, Sectoral Ground Water Drafts, Stage of Ground Water Development, Categorization of Assessment Units, Allocation of Ground Water for future use for next 25 years, Balance Ground Water available for future development, assessment unit wise annual replenishable ground water resource vis-à-vis utilization as well as analysis of long term ground water level trend for categorization, comparison of figures between the current exercise with that of the previous estimation figures, reasons and justification for deviations which was mostly attributed to a refinement of methodology along with growing robustness of reliable database and hence contributed towards a more realistic figures. The summary of findings for the State is as follows:

Fresh Ground Water Quality Area

Annual Ground Water Recharge	:	17,77,507 HM
Annual Natural Discharge	:	1,08,593 HM
Net Annual Ground Water Availability	:	16,68,914 HM
Annual Ground Water Draft for Irrigation	:	3,47,233 HM
Annual Ground Water Draft for Domestic use	:	74,112 HM
Annual Ground Water Draft by Industries	:	14,857 HM
Annual Gross Ground Water Draft for all uses	:	4,36,202 HM
Stage of Ground Water Development	:	26.14 %
Ground Water Resources Reserved for Domestic & Industrial Use for next 25 Years	:	1,20,289 HM
Balance Ground Water Resources Available	:	15,48,625 HM

Poor Ground Water Quality Area

Annual Ground Water Recharge	:	1,58,452 HM
Annual Natural Discharge	:	15,846 HM
Net Annual Ground Water Availability	:	1,42,606 HM
Annual Gross Ground Water Draft for all uses	:	13,757 HM
Stage of Ground Water Development	:	9.65 %

During the interactive session that followed, the Chairman desired that since resource estimation this exercise is a continuous process, the associated database need to be updated regularly. He suggested that the information generated from this assessment exercise should be disseminated through appropriate means to the public domain. If needed a State level workshop may be organized for all stakeholders including policy makers and administrators to spread awareness. This kind of sensitisation will further strengthen the measures being initiated in the State to augment the ground water recharge and prevention of salinity ingressions in to

coastal aquifers through construction of in-stream storage, cross-bund in creeks / nallas, rainwater harvesting structures etc. He also said that since there is no dearth of surface water in the State, the use of ground water by industries particularly during their production phases should be completely prohibited by moving CGWA. Adding further to this approach, Additional Secretary, DoWR expressed the need to expedite the adoption of ground water legislation in the State. She was of the opinion that since a massive Deep Bore Well lift irrigation programme has been recently launched in the State, there should not be any shortage of ground water resources to support the Scheme.

The Chairman also advised that the drilling data as well as water level data generated out of this scheme might be utilized for value addition of the existing ground water database of the State. Scientists of CGWB suggested that the Director GWS&I may be requested to depute his Geologists to collect the hydrogeological and locational data of these bore wells. It was suggested that the wells, which fails to meet the required standard in terms of yield etc., might be used as piezometers for ground water level monitoring. Suggestions were appreciated and accepted.

Shri S.K Mishra, Chief Engineer & Director GWS&I requested that the State Report for Ground Water Resources Assessment (2008-09) may be released in a formal function as it was done for the publication of previous assessment report of the State. The suggestion was consented by the Chairman and all members.

The draft findings of the re-estimation of Dynamic Ground Water Resources of Orissa (2008-09) were agreed upon unanimously and duly approved by the Chairman and Members of the SLC

The meeting ended with a vote of thanks to the Chair.


(Shri Suresh Chandra Mahapatra, IAS)
Commissioner-cum-Secretary to Govt.
Department of Water Resources
Govt. of Orissa
&
Chairman
State Level Committee (SLC)
Re-estimation of Dynamic Ground
Water Resources of Orissa 2008-09)

**List of Members present in the 3rd meeting of the State Level Committee for
Re-estimation of Dynamic Ground Water Resources of Orissa (2008-09) held on
13th December 2010, at Rajiv Bhawan, Bhubaneswar**

Sl. No	Name	Designation	Organization
1	Smt. Usha Padhee, IAS	Additional Secretary	Department of Water Resources Govt. of Orissa
2	Shri Harish Chandra Behera	Engineer-in-Chief	Water Resources Govt. of Orissa
3	Shri D.Y Sirsikar	Regional Director	CGWB, SER Govt. of India
4	Shri S.K Mishra	Chief Engineer & Director	GWS&I Govt. of Orissa
5	Shri B. Hansdah	Joint Director Agriculture	Agriculture & Food Production, Govt. of Orissa
6	Shri D.P Pati	Scientist-D	CGWB, SER Govt. of India
7	Shri P.K Mohapatra	Scientist-D	CGWB, SER Govt. of India
8	Shri P. Parida	Assistant Director	Directorate of Industries Govt. of Orissa
9	Shri B.K Sahoo	Geologist	GWS&I Govt. of Orissa
10	Shri T.B.K Shroff	Executive Engineer for C.E Public Health (Urban)	Public Health Govt. of Orissa
11	Shri S.K Mahapatra	Asst. Executive Engineer	GWS&I Govt. of Orissa
12	Shri A. Choudhury	Asst. Hydrogeologist	CGWB, SER Govt. of India
13	Smt. S. Sarkar	Asst. Hydrogeologist	CGWB, SER Govt. of India
14	Shri N.M Mallick	A.E (Mech.)	GWS&I Govt. of Orissa

PUNJAB

No. 866 /19-W

Dated 28/3/11

To

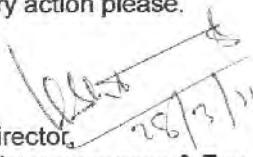
The Regional Director,
Central Ground Water Board,
North Western Region,
Bhujal Bhawan, Plot No.3-B,
Madhya Marg, Sector 27-A,
Chandigarh.

Sub: **Report on Dynamic Ground Water Resources of Punjab State (2008-09) as per GEC-1997 Methodology.**

On the subject matter, as desired, it is to inform that the subject referred Report already stands approved for submission to Govt. of India by the Chairman of "State Level Committee on Ground Water Resources Estimation" i.e. Principal Secretary, Irrigation vide PSI office Diary No. 217 dated 28.1.11 on the Single File moved vide this office U.O. No.95/19-W dated 27.1.11. The photocopy of the noting page is attached for perusal. The 4 copies of the Report are attached herewith.

This is for information and further necessary action please.

DA/As above.


Director,
Water resources & Env., Dte.,
Punjab, Chandigarh.

Subject: Report on Dynamic Ground Water Resources of Punjab State (2008-09) as per GEC-1997 Methodology.

G.O.I. new methodology GEC-1997 for Estimation of Dynamic Ground Water Resources in various States was implemented for the first time for preparing the Estimates as on March 2004 so that uniformity is maintained in the whole country. The GEC-1997 involved new factors and additional data. In order to implement GEC-1997 in agrarian states, like Punjab, GEC-1997 needed some modifications for which decisions were taken in the various meetings held previously. The same decisions have been implemented for preparing the Report on Dynamic Ground Water Resources of Punjab State (2008-09).

The calculations for Ground Water Resources Estimation for Punjab State have been done by Water Resources & Environment Directorate, Punjab. These calculations were done as per the available data collected from the different agencies involved with the Ground Water Resources and in consultation with the Regional Office of C.G.W.B., Punjab Agriculture Department, Department of Remote Sensing and PSWRM&DC Ltd, etc. The meeting of Central Level Expert Group for over all re-assessment of Ground Water Resources of the Country was held on 21.12.2010 and it has been desired in the meeting that the Final Report of Punjab State should be submitted by 7.1.2011. However, due to certain difficulties and short fall in data and delay in preparing the Digital Maps, the finalization of the Report has been delayed.

The Ground Water Estimation as per GEC-1997 has been finalized in consultation with Regional Office, C.G.W.B., Chandigarh and Final Report entitled "Dynamic Ground Water Resources of Punjab State (2008-09)" has been prepared. This report needs to be got approved from the Government or from the "State Level Committee on Ground Water Resources Estimation" constituted vide Government of Punjab notification No.1/5/2003/IPJ(3) 24378-89 dated 11.12.2004, with worthy Principal Secretary Irrigation as Chairman & Regional Director, C.G.W.B., Chandigarh as Member Secretary.

In view of the above and urgency shown by C.G.W.B., it is requested that approval be given so that Final Report is got approved from the Government in order to sent it to GOI and then, if required, it may be put in the meeting of "State Level Committee on Ground Water Resources Estimation", at a later date.

Submitted for approval of the SIP please.

✓
Director/WR
✓

U.O. No. 95 / J.W.
Dated 27/11

for appd [initials]

Approved

C.E./WR
P.S./

✓
H.S. 27/11

Approved

TAMIL NADU

Minutes of the Meeting of the " State Level Committee for Re estimation of Ground Water Assessment "

Venue: PWD Conference Hall, Secretariat Date: 10.02.11 Time: 1600 Hrs

The First State Level Committee meeting for approval of the Report of Dynamic Groundwater Resources of Tamil Nadu (**March 2009**) prepared by SG&SWRDC & CGWB using GEC-97 methodology was convened by the Secretary to Government, PWD & the Chairman of the State Level committee. The meeting was attended by the members or their representatives and the list of the members who had attended the meeting is provided as Annexure -I.

The Chairman cum Secretary to Government, Public Works Department, Government of Tamil Nadu welcomed the gathering and at the outset he expressed his appreciation for the officers of SG&SWRDC & CGWB for their efforts in bringing out the report in final shape. He advised the Chief Engineer, SG&SWRDC & Member Secretary to initiate the meeting.

The Chief Engineer, SG&SWRDC and the Member Secretary welcomed the gathering and informed that dynamic groundwater resources for the State of Tamil Nadu has been computed jointly by SG&SWRDC, Govt. of Tamil Nadu & CGWB, SECR, MoWR and the same has been placed in State Level Working Group for approval. The report has been approved by the State Level Working Group and the suggestions have been incorporated and the report is placed in the State Level Committee for approval. The report needs to have the approval of the State Level Committee for consideration in the National report being compiled by CGWB, New Delhi and after approval of the National Level Committee the government orders to be issued for the implementation of various schemes by adopting the present report.

Contd....

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SG&SWRDC & CGWB, it was decided that if the water level trend does not correspond to Stage of Development, Stage of Development may be taken as a guiding factor to categorize the blocks. Accordingly, if the stage of development is between 70% & 90%, the block is categorized as Semi critical.

The members of the State Level Committee expressed their appreciation for the work carried out by SG&SWRDC & CGWB in estimating the dynamic groundwater resources and approved the report of "Dynamic Groundwater Resources of Tamil Nadu (2008-09) and requested Regional Director to forward the report to CGWB, New Delhi for inclusion in the national report.

The Regional Director, CGWB expressed his gratitude to all the members for their valuable contribution during the deliberations. The meeting ended with thanks to the Chair & Members by Regional Director, CGWB.

All the members of the State Level Committee Unanimously Approved the draft report as on March 2009.

AGENDA 2:

To find out the favorable pockets in over developed blocks etc and also the water quality aspects it was proposed to take up the Groundwater Assessment on Micro watershed Basis for April 2009 to December 2013.

The Data collected and results of field test done upto March 2009 on the basis of Mini water shed study was used and incorporated in the assessment report for year ending March 2009. The Data collected and results of field test done from April 2009 is to be used for the purpose of future assessment. Assessment of Ground Water Potential on Micro Watershed basis(50 - 100 sq.km) may be taken up from April 2009 to December 2013.

Totally about 1600 micro watersheds in the State of Tamil Nadu, Period of Study is April 2009 to December 2013, for completing the study in time additional posts for this purpose, by creation/redeployment will be sent to GoTN separately. Drilling of representative piezometers or selection of more observation wells for each micro

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4

Annexure-I

	Secretary to Government	Public Works Department	Chairman
2	Principal Secretary to Government	Municipal Administration & Water Supply Department	Member
3	Principal Secretary to Government	Agriculture Department	Member
4	Principal Secretary to Government	Industries Department	Member
5	Principal Secretary to Government	Finance Department	Member
6	Chairman	Cauvery Technical Cell	Member
7	Chairman and Managing Director	SIPCOT	Member
8	Chairman	Tamil Nadu Pollution Control Board	Member
9	Engineering-in Chief	Public Works Department	Member
10	Regional Director	Central Ground Water Board	Member
11	Head of Department of Civial Engineering	I.I.T.,Chennai	Member
12	Head of Department-Geology	Anna University Chennai	Member
13	Director	Department of Economics & Statics	Member
14	General Manager	NABARD	Member
15	Chief Engineer	Institute of Water Studies	Member
16	Engineering Director	TWAD Board	Member
17	Director	Agriculture Department	Member
18	Chief Engineer	Agriculture Engineering	Member
19	Chief Engineer	State Ground & Surface Water Resources Data Centre	Member Secretary
20	Special Invitees (if necessary)		

UTTAR PRADESH

Minutes of the 4th Meeting of State Level Committee for Estimation of Ground Water Resources of UP held on 02nd Feb 2011

The 4th meeting of the State Level Committee for Estimation of Ground Water Resources of UP was held on 02nd Feb 2011 under the chairmanship of the Principal Secretary, MI & GW in his chamber, with the following agenda.

- Discussions and approval of Draft report on “Estimation of Ground Water Resources of UP for the Ground Water Assessment year 2008-09”.

Following members/ representatives were present during the meeting.

1. Sri K.B. Biswas, Regional Director, CGWB, NR & Member Secretary, SLC.
2. Dr. D.S. Pandey, Scientist D, CGWB, NR.
3. Dr. K.K. Singh, Scientist D, CGWB, NR.
4. Dr. Vikas Ranjan, Scientist B, CGWB, NR.
5. Dr. S. K. Pandey, Special Secretary, MI & GW, Government of UP.
6. Dr. A.K. Khare, PA (T), Ground Water Department, UP.
7. Sri P.K. Johri, Assistant Engineer, Ground Water Department, UP.
8. Sri Suresh C. Singh, Assistant Engineer, Ground Water Department, UP.
9. Sri Ravi Kant Singh, Hydrologist, Ground Water Department, UP.
10. Sri P. Ram, Chief Engineer, Minor Irrigation Department.
11. Sri Kailash Ram, Deputy Director, Land Development & Water Resources.
12. Sri G.S Gupta, Superintending Engineer, Irrigation Department.
13. Sri U.S. Pandey, Executive Engineer, PA GE (Inspection), UP Jal Nigam.
14. Dr. R.A. Yadav, Magaer (GW), UP Jal Nigam.
15. Sri A.K. Singh, Additional Director, Agriculture (Soil Conservation).
16. Sri Rajesh Kumar, Manager, Directorate of Industries, Kanpur.
17. Sri S.K. Soni, Manager, NABARD.

Sri K.B. Biswas, Regional Director & Member Secretary of the committee presented a brief about the agenda item and requested the Ground Water Department to make the power point presentation on the “*Estimation of Ground Water Resources of UP for the Ground Water Assessment year 2008-09*”. Sri Ravi Kant Singh, Assistant Engineer, Ground Water Department, UP made the presentation.

Various aspects of the report were discussed among the committee members and the estimation for the assessment year 2008-09 was agreed to in principle by the members. However, the Chairman pointed out the reduction in overall Net Ground Water Availability in the state as compared to the earlier estimation as on 31.3.2004 and sought the reason behind the same. The explanations provided were accepted by the Chairman and members. The Chairman desired that these explanations are to be added in the form of a note in the report. It was agreed that the report is approved in principle after incorporating the above note.

The meeting ended with vote of thanks from Dr. S.K. Pandey, Special Secretary, MI & GW, Government of UP.

As per the decision, the following note is being incorporated in the report.

“There is a marginal reduction in the overall Net Ground Water Availability of the state. This is due to the modification in certain parameters of the norms, such as omission of hilly areas, salinity infested areas etc.”

UTTARAKHAND



No. 4(17)/CGWB/UR/Tech. - 08 - 630

Government of India
Ministry of Water Resources
Central Ground Water Board
Uttaranchal Region

419 - A, Kanwali Road, Balliwala
Dehradun - 248 001
Date: 15th September, 2011

Minutes of the Second Meeting of the State Level Technical Co-ordination Committee (SLTCC) for Approval of Dynamic Ground Water Resources of Uttarakhand State, 2008 - 09

The meeting was held in the Chamber of Secretary (Minor Irrigation) and Chairman of the State Level Committee on 14th September, 2011 at 10:00 hrs for approval of Dynamic Ground Water Resources, 2008 - 09 of Uttarakhand State. List of participants is given at *Annexure - I*

At the outset Sh. Om Prakash, Secretary (Minor Irrigation) welcomed all the members of committee. The Member Secretary appraised the committee members that as per the decision taken in the first meeting in the SLTCC, revision of the Dynamic Ground Water Resources Assessment has been carried out in respect of 4 blocks namely Laksar and Khanpur of Haridwar district and Jaspur and Bazpur blocks of district Udhampur.

1. The revised assessment was put up before the Committee Members and the same was approved (*Annexure - II*).
2. The Revised Statement of Dynamic Ground Water Resources in Uttarakhand State put up before the Committee was also approved (*Annexure - III*).
3. The revised status of categorization of the blocks in the Uttarakhand State put up before the committee was also approved (*Annexure - IV*).
4. The Chairman of the Committee opined that suitable scheme for augmentation of Ground Water Resources may be implemented in respect of the blocks where the stage of the categorization is Critical / approaching Critical.
5. The Regional Director, CGWB, Uttarakhand Region informed that a Centrally Sponsored Scheme based on 100% funding from the Government of India is being operated by the CGWB and funds are available for implementation of demonstrative schemes on artificial recharge to ground water by the state agencies. As adequate funds are available, it was requested that the State Government may like to submit scheme proposals for Uttarakhand State for funding by the Government of India.
6. The Secretary advised the Chief Engineer (Minor Irrigation) to formulate scheme proposals on artificial recharge to ground water for the areas where the stage of the development is Critical/ approaching Critical. While formulating the proposal technical assistance may be sought from CGWB, Regional Office. The proposal may be formulated within a months' time.

The meeting ended with the vote of thanks to the Chair.

This issues with the approval of Secretary (Minor Irrigation) & Chairman, SLTCC.

(Dr. R. C. Jain)
Regional Director &
Member Secretary

List of Participants:

1. Secretary (Minor Irrigation), Secretariat, Government of Uttarakhand, Dehradun
2. Er. Mohammad Umar, Chief Engineer, Minor Irrigation, Dehradun
3. Er. P.C.Kimothi, Appraisal Secretary, Jal Sansthan, Dehradun
4. Shri V. C. Garg, GM, (GW/S), Pey Jal Nigam, Dehradun
5. Shri R. K. Rajwar, Project Management Unit, Swajal Project, Dehradun.
6. Shri Rajeev Kumar, Staff Officer, CE, Minor Irrigation, Dehradun.
7. Dr. R. C. Jain, Regional Director, CGWB Dehradun
8. Dr. R. P. Singh, Scientist – ‘D’, CGWB Dehradun
9. Shri. Ravikalyan Bussa, Junior Hydrogeologist, CGWB, Dehradun
10. Shri. D. Bagchi, Assistant Hydrogeologist, CGWB, Dehradun

WEST BENGAL

Minutes of the 4th meeting of the State Level Ground Water Resource Estimation Committee (SLGWREC) on "Dynamic Ground Water Resources of Unconfined Aquifer in West Bengal" held on 08.09.2011 at 12:30 hrs in the Chamber of Secretary, WRIDD, Writers' Building, Kolkata-700 001.

The meeting was chaired by Sri Subrata Biswas, IAS, Secretary, WRIDD, Govt. of West Bengal and the following members were present:

- i) Sh. B. Majumdar, DWRID, Govt. of West Bengal
- ii) Sh. Himangshu Dey, Jt. Sec (MI), Govt. of West Bengal
- iii) Sh. B.K. Datta, PHED, Govt. of West Bengal
- iv) Sh. P.K. Sarkar, Director, SWID, Govt. of West Bengal
- v) Sh. Niladri Naha, Addl. Director (EW), SWID, Govt. of West Bengal
- vi) Sh. Vikas Mittal, NABARD
- vii) Sh. S. Halder, EE, SWID, Govt. of West Bengal
- viii) Sh. S.K. Samanta, Sc-'D' and TS to Regional Director, CGWB, ER, Kolkata

The Chairman welcomed the members of the committee and appraised with the work undertaken by the committee in estimation of Dynamic Ground Water Resources of West Bengal.

Chairman and the other members enquired about the modification of the earlier estimate of the Dynamic Ground Water Resources of West Bengal and it was explained that the resource has been re-estimated using recently published 4th M.I Census data.

After a detailed discussion among the members the Report on "Dynamic Ground Water Resources of West Bengal as on 31st March, 2009" was approved by the committee.

The meeting ended with vote of thanks to the chair.

Officers present in 4th Meeting of the State Level Ground Water Resource Estimation Committee for Assessment of Dynamic Ground Water Resources of West Bengal (2008-09) was held on 08.09.2011 at 12:30 hrs in the Chamber of Principal Secretary, WRIDD, Writers' Building, Kolkata-700 001

Sl. No.	Name of Officer/Designation	Department	Signature
1.	Shri Subrata Biswas, IAS, Secretary & Chairman, SLC	WRIDD, West Bengal	
2.	B. Majumdar	DWRID, GOWB	
3.	P. K. Sarker, Director SWID	WRIDD, G.B	
4.	B. K. Sarker, PWD SEPA-L	PWD, WB	
5.	S. Haldar EE(A-I) SWID	SWID	
6.	Niladri Naskar Addl. Div.	SWID	
7.	Vikas Mittar	NABARD	8/9/11
8.	Himangshu Chakraborty	Jt Secy(M)	8/9/11
9.	S. K. Samanta GOWB	GOWB, ER, 8/9/11	8/9/11
10.			
11.			
12.			
13.			
14.			
15.			
16.			

Appendix D

List of the Members of the Central Level Expert Group for overall re-assessment of ground water resources of the country and Special Invitees in the meetings of the CLEG held between 21.05.10 and 13.10.11

Sl. No.	Name	Designation & Address
1.	B.M. Jha	Ex-Chairman, CGWB, Bhujal Bhawan, Faridabad
2.	Dr. S.C. Dhiman	Chairman, CGWB, Bhujal Bhawan, Faridabad
3.	R.C. Jha	Chairman, Central Water Commission, R.K.Puram, Sewa Bhawan, New Delhi
4.	S. Kunar	Member, CGWB, Bhujal Bhawan, Faridabad
5.	Sushil Gupta	Member, CGWB, Bhujal Bhawan, Faridabad
6.	Mamta Saxena	Additional Director General, MoWR, Lok Nayak Bhawan
7.	Vijay Kumar	Deputy Director General, MoWR, Lok Nayak Bhawan
8.	Madan Lal	Ministry of Water Resources, B-Wing,2nd Floor,Lok Nayak Bhawan, , New Delhi-110003
9.	Rishi Srivastav,	Director (Reservoir Operation), Central Water Commission, West Block – II, Wing 7, R.K. Puram, New Delhi
10.	S.S. Rajsekhar	General Manager (TDS), NABARD, 3rd Floor, 'C', Wing C-24, 'G' Block, Bandra-Kurla Complex, Bandra (East), Mumbai 400 051
11.	C.P. Appanna	General Manager (TDS), NABARD, 3rd Floor, 'C', Wing C-24, 'G' Block, Bandra-Kurla Complex, Bandra (East), Mumbai 400 051
12.	N.V. Baskaran	Asstt. General Manager,(TSD) , NABARD, 3rd Floor, 'C', Wing C-24, 'G' Block, Bandra-Kurla Complex, Bandra (East), Mumbai 400 051
13.	R.K. Jain	Chief Engineer (HQ), NWDA 18-20, Community Centre, Saket, New Delhi - 110017
14.	H.N. Dixit	Director (Tech), NWDA,18-20, Community Centre, Saket, New Delhi
15.	Ashis Banerjee	Dy. Director (CWC), R.K.Puram, Sewa Bhawan, New Delhi
16.	Avinash Mishra	Dy. Adviser (WR), Planning Commission, Room No.321, Yojna Bhawan, New Delhi.

Sl. No.	Name	Designation & Address
17.	N.Y. Apte	DDGM (Hydrology), India Metereological Department, Mausam Bhawan, New Delhi
18.	S.B. Tyagi	Scientist 'E', India Metereological Department, Mausam Bhawan, New Delhi
19.	R.M. Deshpande	Additional Adviser (PHE), Department of Drinking Water Supply, Ministry of Rural Development, CGO Complex, Lodhi Road, New Delhi – 110003
20.	Sudhindra Sharma	Consultant – NRC, Ministry of Drinking Water Supply, Govt. of India, Paryavaran Bhawan, CGO Complex, New Delhi
21.	M. Dhindhayalam	Deputy Adviser (PHE), Central Public Health & Environmental Engineering Organization, Ministry of Urban Development, Room No. 654, 'A' Wing, Nirman Bhawan, New Delhi
22.	V.M. Arora	Director, DoLR, CGO Complex, New Delhi
23.	Prof. A.K. Keshri	Professor, IIT Delhi, Hauz Khas, New Delhi - 110016
24.	Prof. M. Shekhar	Professor, Indian Institute of Science, Bangalore
25.	Dr. N.C. Ghosh	Scientist 'F', NIH, Roorkee
26.	Dr. C.P. Kumar	Scientist 'F', NIH, Roorkee
27.	Dr. Sachdeva Singh	Deputy Commissioner, National Rainfed Area Authority, Dev Prakash Shastri Marg, Pusa, New Delhi – 110012
28.	Muzaffar Ahmed	Superintending Engineer, NWDA 18-20, Community Centre, Saket, New Delhi - 110017
29.	Gautam Dasgupta	Director, CGPB Secretariat, Geological Survey of India, Pushpa Bhawan, A-Block, 2 nd Floor, Madangir Road, New Delhi – 110062.
22.	Malini V. Shanker	Principal Secretary, Water supply & Government of Maharashtra
30.	Dr. A.K. Jain	Special Secretary (Irrigation), Andhra Pradesh, 6 th Floor, J. Block, Secretariat, Hyderabad
31.	Amit Kumar Saha	Asstt. Advisor, CPHEED, Ministry of Urban Development, 564-A Wing, Nirman Bhawan
32.	Rajesh Kumar	Chief Engineer, Central Water Commission, R.K.Puram, Sewa Bhawan, New Delhi
33.	K.M. Nagargoje	Director, Ground Water Survey & Development Agency, Govt. of Maharashtra, Bhujal Bhawan, Shivaji Nagar,

Sl. No.	Name	Designation & Address
		Pune
34.	Updesh Mathur	Chief Engineer, Ground Water Department, Rajasthan, Jodhpur
35.	B. Rath	Deputy Comm., DAC, Ministry of Agriculture, Krishi Bhawan, New Delhi
36.	G.R. Meena	Director (Statistics), Ministry of Water Resources, 'B' Wing, 2nd Floor, Lok Nayak Bhawan, New Delhi
37.	Bhajan Singh	Member in Charge (ED&MM), CGWB, Bhujal Bhawan, Faridabad
38.	Anita Gupta	Regional Director, CGWB, Bhujal Bhawan, Faridabad
39.	Arun Kumar	Regional Director, CGWA, New Delhi
40.	D.S.S. Thambi	Regional Director, CGWB, South East Coastal Region, Chennai
41.	Dr. K. Md. Najeeb	Regional Director, CGWB, South Western Region, Bangalore
42.	Manoj Srivastav	Regional Director, CGWB, Western Region, Jaipur
43.	K.B. Biswas	Regional Director, CGWB, Northern Region, Lucknow
44.	Suresh Khandale	Additional Director, Ground Water Survey & Development Agency, Govt. of Maharashtra, Bhujal Bhawan, Shivaji Nagar, Pune
45.	Shashank Despande	Deputy Director, GSDA, Pune
46.	Chetan Gajabhiyl	Dy Director, Ground Water Survey Department, Nagpur, Maharashtra
47.	Bimaljeet Bhandari	Executive Engineer, Water Resources & Environment Directorate, Govt. Of Punjab, SCO – 32-34, Sector 17-C, Chandigarh
48.	Jitender Pal Singh	Executive Engineer, Irrigation Department, Punjab
49.	Dr. S.K. Pandey	Director, Ground Water Department, Uttar Pradesh
50.	C.S. Shekhawat	Chief Engineer, Ground Water Department, Jodhpur
51.	Sheo Kumar Tiwari	Director, Ground Water Directorate, Bihar
52.	Jai Paul Bains	Junior Hydrologist, Water Resources & Environment Directorate, Govt. Of Punjab, SCO – 32-34, Sector 17-C, Chandigarh
53.	Dr. D. Saha	Suptd. Hydrogeologist, CGWB, Bhujal Bhawan, Faridabad
54.	G.C. Pati,	Suptd. Hydrogeologist, CGWB, Bhujal Bhawan, NH-IV, Faridabad, Haryana

Sl. No.	Name	Designation & Address
55.	Sunil Kumar	Suptd. Hydrogeologist, CGWB, Bhujal Bhawan, Faridabad
56.	Dr. S.K. Jain	Scientist 'D', CGWB, Bhujal Bhawan, Faridabad
57.	A.D. Rao	Suptd. Hydrogeologist, CGWB, Delhi
58.	G. Sudarshan	Scientist 'D', CGWB, New Delhi
59.	Y. B. Kaushik	Scientist 'D', CGWB, NWR, Chandigarh
60.	Washim Ahmed	Scientist 'D', CGWB, WR, Jaipur
61.	Rana Chatterjee	Scientist 'D', CGWB, New Delhi
62.	S.K. Sinha	Scientist 'D', CGWB, Bhujal Bhawan, Faridabad
63.	R.K. Ojha	Under Secretary (GW), Ministry of Water Resources, Room No. 635, Shram Shakti Bhawan, New Delhi
64.	Dr. L.N. Mathur	Scientist 'C', Shram Shakti Bhawan, New Delhi
65.	A.V.S.S Anand	Scientist 'C', CGWB, Vishakhapatnam
66.	Pratul Saxena	Scientist 'C', CGWB, New Delhi
67.	R.R. Sukla	Scientist 'C', CGWB, MER, Patna
68.	T.B.N. Singh	Scientist 'C', CGWB, SUO, Ranchi
69.	Upendra Srivastava	Scientist 'C', CGWB, NR, Lucknow
70.	Sudarshan Sahu	Scientist 'B', CGWB, MER, Patna
71.	Prahlad Ram	Asstt. Hydrogeologist, CGWB, Faridabad

Appendix E

SAMPLE ESTIMATION REPORT

Assessment of Dynamic Ground Water Resources in respect of ATP_D_46_Kanekal Watershed, Ananatapur District, Andhra Pradesh

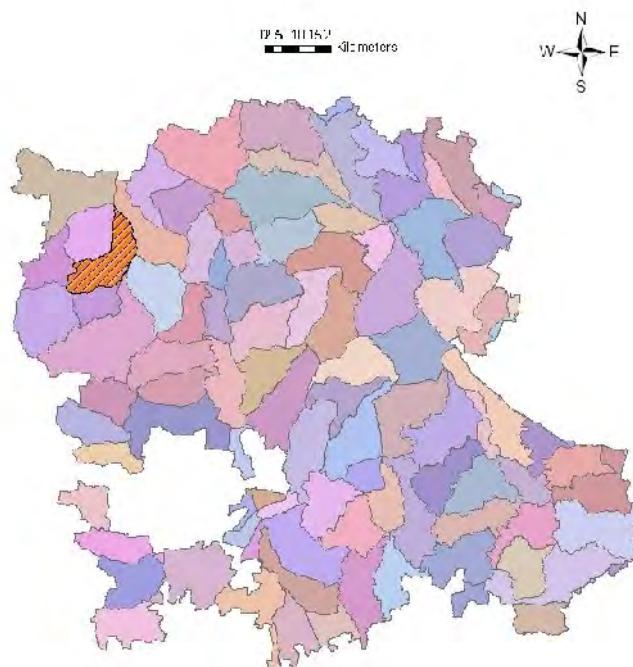
Name of the Assessment unit: ATP_D_46_KANEKAL Watershed

Type (Watershed/Mandal): Watershed

Salient Features:

Total Geographical Area(ha) :	24163
Hilly Area (>20% slope) (ha) :	0
Command Area (ha) :	13814
Non-command Area (ha) :	10349
Saline Area (ha) :	0

Location of Watershed:



Parameter	Normal	Assessment year
Annual Rainfall (mm)	: 458	670
Monsoon Rainfall(mm)	: 278	520

Parameter	Command	Non Command
Net Irrigated area (ha)	: 3903	688

Soil Type	:	Black Cotton Soil
Crops (season-wise)	:	Khariff – Paddy; Rabi– Ground nut, sun flower, paddy
Aquifer	:	Granites

Assessment of Dynamic Ground Water Resources in respect of Command sub unit of Atp_D_46_Kanekal Watershed, Ananatapur District, Andhra Pradesh.

Ground water draft:

Irrigation

Type of Structure	Monsoon Season			Non-Monsoon Season			Data Source
	Number of Structure s	Unit draf t	Total Draft (2*3)	Number of Structure s	Unit draft	Total Draft (5*6)	
1	2	3	4	5	6	7	8
DW+PS	77	0.20	15.40	77	0.45	34.65	MI Census
BWs	711	0.40	284.40	711	0.90	639.9	
Command Area Total	788		299.80 =300.00	788		674.55 =675.00	

Annual Irrigation Draft (monsoon + non-monsoon) **300+675=975 ham**

Domestic & Industrial Draft

Type of Structure	Monsoon Season			Non-Monsoon Season			Data Source
	Number of Structures	Unit draft	Total Draft (2*3)	Number of Structures	Unit draft	Total Draft (5*6)	
1	2	3	4	5	6	7	8
DW & HP	39	0.072	2.81	39	0.144	5.62	MDO Office
PWS	9	0.432	3.89	9	0.864	7.78	
Command Area Total	48		6.70 =7.00	48		13.40 =13.00	

Annual Domestic & Industrial Draft (monsoon + non-monsoon) =**7.00+13.00 = 20.00 ham**

Annual Ground Water Draft = Annual Irrigation Draft + Annual Domestic & Industrial Draft

$$=975.00+20.00 = \mathbf{995.00}$$

Recharge from Other Sources:

Recharge from Canals:

Name of Canal Segment	Length of the Canal (m)	Wetted Perimeter (m)	Wetted Area (million sq.m)	Canal Seepage Factor (ham per million sq.m)	Number of (canal) operational Days		Recharge from Canal segment (ham)		Data Source
					Mon	Non	Mon	Non	
Canal I	2780	10.091	0.02805	15.0	30	90	12.62	37.87	Irrigation Department
Canal II	2210	10.091	0.02230	15.0	30	90	10.04	30.11	
Canal III	1732	10.091	0.01748	15.0	30	90	7.87	23.60	
Canal IV	1200	10.091	0.01211	15.0	30	90	5.45	16.35	
Total Recharge from Canal Seepage						35.98	107.93		

Annual Recharge from Canal Seepage = Monsoon Recharge + Non-monsoon Recharge
 $= 35.98 + 107.93 = 143.91 \text{ ham}$

Recharge from Surface water Irrigation: Monsoon

Name of (canal) Outlet	Irrigation Water Applied (ham)	Return Flow Factor (Command area)						Recharge from Surface Water Irrigation (ham)
		Average Depth to Water Level (m bgl)	Irrigated Area (Paddy) (ha)	Return flow factor	Irrigated Area (non-Paddy) (ha)	Return flow factor	Weighted Return flow factor $(4*5+6*7)/(4+6)$	
1	2	3	4	5	6	7	8	9
Total Command Area	1931.40	4.52	3219	0.50	0	0.30	0.50	965.70
Total Recharge from Surface Water Irrigation (Monsoon season)								965.70

Non-Monsoon

Name of (canal) Outlet	Irrigation Water Applied (ham)	Return Flow Factor (Command area)						Recharge from Surface Water Irrigation (ham)
		Average Depth to Water Level (m bgl)	Irrigated Area (Paddy) (ha)	Return flow factor	Irrigated Area (non-Paddy) (ha)	Return flow factor	Weighted Return flow factor $(4*5+6*7)/(4+6)$	
1	2	3	4	5	6	7	8	9
Total Command Area	21.00	4.62	35	0.50	0	0.30	0.50	10.50
Total Recharge from Surface Water Irrigation (Non-monsoon season)								10.50

Recharge from Groundwater Irrigation:
Monsoon

Irrigation Water Applied (GW Draft) (ham)	Return Flow Factor (Command area)						Recharge from Ground Water Irrigation (ham)
	Average Depth to Water Level (m bgl)	Irrigated Area (Paddy) (ha)	Return flow factor	Irrigate d Area (non- Paddy) (ha)	Return flow factor	Weighted Return flow factor (3*4+5*6) (3+5)	
1	2	3	4	5	6	7	8
300	4.52	30	0.45	221	0.25	0.27	81
Total Recharge from Ground Water Irrigation (Monsoon season)							81

Non-Monsoon

Irrigation Water Applied (GW Draft) (ham)	Return Flow Factor (Command area)						Recharge from Ground Water Irrigation (ham)
	Average Depth to Water Level (m bgl)	Irrigated Area (Paddy) (ha)	Return flow factor	Irrigate d Area (non- Paddy) (ha)	Return flow factor	Weighted Return flow factor (3*4+5*6) (3+5)	
1	2	3	4	5	6	7	8
675	4.62	358	0.45	40	0.25	0.43	290
Total Recharge from Ground Water Irrigation (Non-Monsoon season)							290

Recharge from Tanks and Ponds:
Monsoon

Name of Tanks/ Ponds	Average Water Spread Area	No. of days water is available	Recharge from Tanks and Ponds (0.00144 *2*3)	Data Source
1	2	3	4	5
Nil				Irrigation Department & Zilla Parishad
Total Recharge from Tanks & Ponds (Monsoon season)			0	

Non-Monsoon

Name of Tanks/ Ponds	Average Water Spread Area	No. of days water is available	Recharge from Tanks and Ponds (0.00144 *2*3)	Data Source
1	2	3	4	5
Nil				Irrigation Department & Zilla Parishad
Total Recharge from Tanks & Ponds (Non-Monsoon season)			0	

Recharge from Water Conservation Structures:

S.No	Name of the Structure	No. of structures	Gross Storage [ha.m]	Recharge (ham)		
				Monsoon	Non -Monsoon	Total
1	2	3	4	5	6	7
1	Percolation Tanks	2	0.300	0.08	0.08	0.16
2	Mini-Percolation Tanks	2	0.150	0.04	0.04	0.08
3	Check Dams	11	0.600	0.15	0.15	0.30
4	Dugout Ponds/ Farm Ponds	12	0.220	0.06	0.06	0.12
5	Other Structures	29	0.100	0.03	0.03	0.06
	Total	56	1.380	0.36	0.36	0.72

Recharge from Other Sources (Monsoon) =

$$[\text{Recharge (Canal Seepage)} + \text{Return flow (SW)} + \text{Return flow (GW)} + \text{Recharge (Tanks/Ponds)} + \text{Recharge (Water Conservation Structure)}] = 35.98 + 965.70 + 81.0 + 0.0 + 0.72 \\ = 1083.40 \text{ham}$$

Recharge from Other Sources (Non-Monsoon)

$$[\text{Recharge (Canal Seepage)} + \text{Return flow (SW)} + \text{Return flow (GW)} + \text{Recharge (Tanks/Ponds)} + \text{Recharge (Water Conservation Structure)}] = 107.93 + 10.50 + 290.0 + 0.0 + 0.72 \\ = 409.15$$

Annual Recharge from Other Sources =

$$[\text{Monsoon Other Sources Recharge} + \text{Non-monsoon Other Sources Recharge}] = 1083.40 + 409.15 = 1492.55$$

Rainfall Recharge

Method I: Rainfall Recharge (using Rainfall Infiltration Factor method):

Monsoon

Normal Rainfall (m)	Rainfall Infiltration Factor	Assessment Area (ha)	Rainfall Recharge (ham) (1*2*3)	Data Source
1	2	3	4	5
0.278	0.11	13814	422	IMD & District Authorities
Recharge from Rainfall (Monsoon season)			422	

Non-Monsoon

Normal Rainfall (m)	Rainfall Infiltration Factor	Assessment Area (ha)	Rainfall Recharge (ham) (1*2*3)	Data Source
1	2	3	4	5
0.180	0.11	13814	274	IMD & District Authorities
Recharge from Rainfall (Non-Monsoon season)			274	

Method II: Rainfall Recharge during Monsoon (using Water Level Fluctuation method):

Water Level Fluctuation

Average pre- monsoon Depth to Water level (m bgl)	Average post- monsoon Depth to Water level (m bgl)	Water Level Fluctuation (m) (1-2)	Data Source
1	2	3	4
6.45	2.58	3.87	GWD & CGWB

Rainfall Recharge during Monsoon Season

Assessment Area (ha)	Rock Type	Specific Yield	Average Water Level Fluctua- tion n (m)	Change in Storage (ham)	Ground Water Draft (ham)	Ground Water Recharge (ham) (1+2)	Recharge from Other Sources (ham)	Rainfall Recharg e (ham) (4-3)
1	2	3	4	5	2	3	4	5
13814	Granite	0.03	3.87	1604	300	1904	1083	821
Total Rainfall Recharge(Monsoon season)								821

Normalization of Rainfall Recharge during monsoon season (WLF Method)

Assessment Year	Rainfall Recharge	Rainfall for the corresponding Year	Recharge corresponding to Normal Rainfall (Normal Monsoon Rainfall *[2]/[3])
1	2	3	4
2008	821	520	439
Normal Rainfall Recharge during Monsoon Season (Average of Col. 4)			439

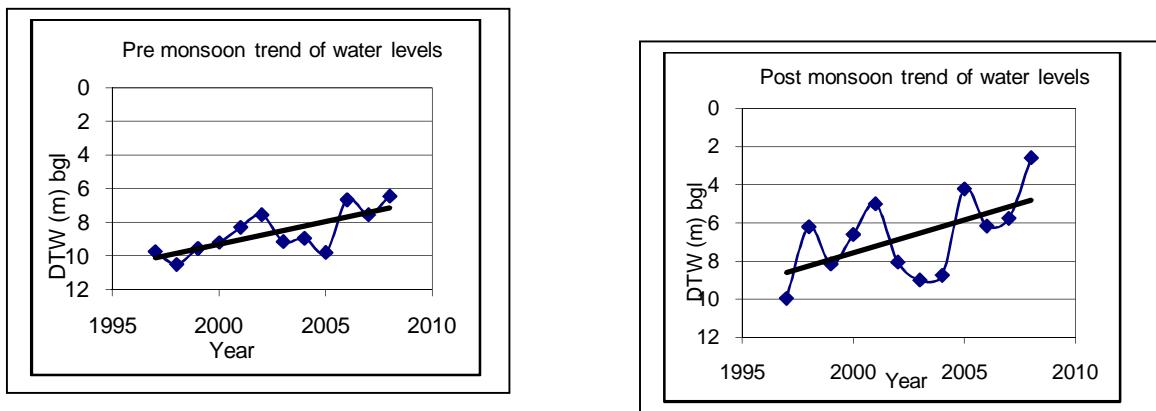
Normal Rainfall Recharge

Normal Rainfall Recharge (RIF method)	Normal Rainfall Recharge (WLF method)	Percentage Difference $[(2)-(1)]/(1)*100$	Normal Rainfall Recharge
1	2	3	4
422	439	$100*17/422 = 4.03$	439

SUMMARY OF RECHARGE ESTIMATION

Monsoon Recharge		Non-monsoon Recharge		Annual Replenishable Ground Water Resources ([1]+[2]+[3]+[4])	Natural discharges (provision)	Net Annual Ground Water Availabilit y [[1]-[2]]	Gross Annual Groun d Water Draft For All Uses	Stage of Ground Water Developme nt [[8]/[7]]*10 0
1	2	3	4	5	6	7	8	9
439	1083	274	489	2285	114	2171	995	46

Long Term Water Level Trend



Stage of ground Water Development = 46%

Average long Term Water level Trend (Pre-monsoon): 27cm/year Rising

Average long Term Water level Trend (Post-monsoon): 35cm/year Rising

Category: Safe

Allocation of ground water resources for utilization

Projected population density at year 2025	Domestic & Industrial Water Supply Requirement (lpcd)	Extend of Dependence on Ground Water	Annual Allocation of ground water resources for domestic and Industrial water requirement upto 2025 (mm) [(22/60000)*(1)*(2)*(3)]	Area	Annual Allocation of ground water resources for domestic and Industrial water requirement upto 2025 (ham) [(5)*(4)/1000]
1	2	3	4	5	6
216	80	0.95	6.02	13814	83

Net Ground Water Availability For future Irrigation :

Net Annual Ground Water Availability (ham)	Annual Ground Water Draft for Irrigation use (ham)	Annual Allocation of ground water resources for domestic and Industrial water requirement upto 2025 (ham)	Net Ground Water Availability for future Irrigation (ham) [(1)-(2)-(3)]
1	2	3	4
2171	975	83	1113

**SUMMARY REPORT OF DYNAMIC GROUND WATER RESOURCES ESTIMATION (2008-09) IN RESPECT OF ATP_D_46_KANEKAL Watershed,
Ananatapur District, Andhra Pradesh.**

(in ham)

Annual Replenishable Ground Water Resources				Total	Natural Discharge during monsoon season	Net Annual Ground Water Availability	Annual Ground Water Draft		
Monsoon Recharge		Non-monsoon Recharge					Irrigation Use	Domestic & Industrial water Use	Total
Rainfall Recharge	Recharge from Other sources	Rainfall Recharge	Recharge from Other sources	6	7	8	9	10	
1	2	3	4	5	114	2171	975	20	995
439	1083	274	489	2285					

Annual Allocation of ground water resources for domestic and Industrial water requirement upto 2025 (ham)	Net Ground Water Availability for future Irrigation (ham)	Stage of Ground Water Development (%)
11	12	13
83	1113	46

Apportioning of Ground Water Assessment from Watershed to Administrative Development Unit (Mandal)

To compute the ground water resources of Kanekal Mandal, it is required to compute the resources of two watersheds viz ATP_D_46_KANEKAL and ATP_D_46_KADLUR and apportion this resource for the respective areas covered by the mandal in those watersheds and total of which is the ground water resources of the Mandal Kanekal for the respective sub unit.

(in m)

Name of the Assessment Unit	Assessment Area (ha)	Annual Replenishable Ground Water Resources				Total [ham/Area]	
		Monsoon Recharge		Non-monsoon Recharge			
		Rainfall Recharge [ham/Area]	Recharge from Other sources [ham/Area]	Rainfall Recharge [ham/Area]	Recharge from Other sources [ham/Area]		
1	2	3	4	5	6	7	
ATP_D_46_KANEKAL	13814	0.03178	0.07840	0.01983	0.03540	0.16541	
ATP_D_46_KADLU R	15235	0.02678	0.03794	0.02048	0.02573	0.11093	

Natural Discharge during monsoon season [ham/Area]	Net Annual Ground Water Availability [ham/Area]	Annual Ground Water Draft			Annual Allocation of ground water resources for domestic and Industrial water requirement upto 2025 [ham/Area]	Net Ground Water Availability for future Irrigation [ham/Area]
		Irrigation Use [ham/Area]	Domestic & Industrial water Use [ham/Area]	Total [ham/Area]		
8	9	10	11	12	13	14
0.00825	0.15716	0.07058	0.00145	0.07203	0.00601	0.08057
0.00558	0.10535	0.05541	0.00038	0.05579	0.00587	0.04407

DYNAMIC GROUND WATER RESOURCES ASSESSMENT (2008-09)
FOR KANEKAL MANDAL

(in ham)

(APPORTIONED ASSESSMENT)						
Name of Watershed	Area of the portion of watershed	Total Replenishable Ground Water Resources [7]*[16]	Net Annual Ground Water Availability [9]*[16]	Annual Ground Water Draft		
				Irrigation Draft [10]*[16]	Domestic & Industrial Draft [11]*[16]	Total [12]*[16]
A	B	C	D	E	F	G
ATP_D_46_KANEKAL	13814	2285	2171	975	20	995
ATP_D_46_KADLUR	7833	869	825	434	3	437
Total	21647	3154	2996	1409	23	1432

Name of Watershed	Annual Allocation of ground water resources for domestic and Industrial water requirement upto 2025 [12]*[16]	Net Ground Water Availability for future Irrigation [13]*[16]	Stage of Ground Water Development (%) [G]/[D]
A	H	I	J
ATP_D_46_KANEKAL	83	1113	-
ATP_D_46_KADLUR	46	345	-
Total	129	1458	48

Weighted Average Ground Water Level Trend

Watershed	Area	Pre-Monsoon Trend	Post-Monsoon Trend
ATP_D_46_KANEKAL	13814	-27	-35
ATP_D_46_KADLUR	7833	-11	-15
Weighted Average Trend		-21	-28

Stage of ground Water Development = 48%

Average long Term Water level Trend (Pre-monsoon): 21cm/year Rising

Average long Term Water level Trend (Post-monsoon): 28cm/year Rising

Category of the Command Sub Unit of Kanekal Mandal = Safe

Appendix F

REASONS FOR IMPROVEMENT IN THE STATUS OF CATEGORIZATION OF ASSESSMENT UNITS (from 2004 to 2009 ASSESSMENT)

Sl. No.	STATE/ UTs	Number of Assessment Unit (blocks/ taluks/ mandals) showing improvement from OE/C (2004) to other Categories (2009)	Reasons for Change
1	Andhra Pradesh	108	<ul style="list-style-type: none"> 1. Enhancement in Recharge due to increase in Rainfall and refinements in database with respect to recharge from other sources including water Conservation structures. 2. Decrease in Ground Water Draft because of the better rainfall in the intervening period reducing the stress on ground water consumption and refinements in Unit draft computed based on sample surveys carried out by State GW Department. 3. Efficient water use practices with community participation.
2	Gujarat	13	<ul style="list-style-type: none"> 1. Good rainfall during 2004-2008 compared to earlier period of estimation 2. Increase in ground water recharge due to enhancement in rainwater harvesting and artificial recharge in the State. 3. Narmada project based Canal augmented seepage and return irrigation flow to the ground water has also resulted in increased ground water recharge. 4. Efficient water use practices with community participation.
3	Haryana	6	<ul style="list-style-type: none"> 1. Enhancement in ground water recharge because of increase in number of running days of the canals 2. Reduction in ground water draft because of refinements in Unit well draft estimations based on studies conducted by State department.
4	Kerala	19	<ul style="list-style-type: none"> 1. Long-term ground water levels trend for the period 1999 – 2008 -

Sl. No.	STATE/ UTs	Number of Assessment Unit (blocks/ taluks/ mandals) showing improvement from OE/C (2004) to other Categories (2009)	Reasons for Change
			<p>a. Showed a predominantly rising trend in a major part of the State.</p> <p>b. Refined the criteria for significant decline of water level (used in categorization) to 15 cm/yr from earlier 10 cm/yr. (2004).</p> <p>2. Reduction in ground water draft because of reduction in the area under major irrigated crops such as paddy.</p> <p>3. Refinements in parameters such as Rainfall Infiltration Factor, Specific Yield and Unit Draft based on field studies.</p>
5	Madhya Pradesh	7	<p>1. Increase in rainfall in some cases</p> <p>2. Enhancement in ground water recharge due to increase in Water conservation and rain water harvesting measures.</p> <p>3. Reduction in ground water draft because of refinements in Unit draft based on field studies.</p>
6	Maharashtra	1	Enhancement in Recharge due to increase in number of water conservation structures from 183 (2004) to 900 (2008-09)
7	Punjab	5	Increase in ground water recharge because of enhancement in Seepage from Canal Network due to remodeling and addition of new canals.
8	Rajasthan	13	<p>1. Increase in recharge from other sources (return flow from irrigation)</p> <p>2. Decrease in ground water draft</p> <p>3. Change in Category because of improvement in long term water level trend.</p>
9	Tamil Nadu	55	<p>1. Reduction in ground water draft</p> <p>2. Increase in recharge due to increase in rainfall, canal seepage, Surface water irrigation return flow, water conservation structures and water spread area in tanks</p>

Sl. No.	STATE/ UTs	Number of Assessment Unit (blocks/ taluks/ mandals) showing improvement from OE/C (2004) to other Categories (2009)	Reasons for Change
			and ponds 3. Changes in block area due to reorganizations. 4. Efficient water use practices with community participation.
10	Uttar Pradesh	19	1. Increase in Normal Rainfall 2. Decrease in ground water draft because of lowering of unit draft based on Sample Survey
11	Uttarakhand	2	Decrease in ground water draft because of refinements in database used for estimation.
12	West Bengal	1	Reduction in ground water draft because of overall reduction in ground water structures by about 20% (MI Census).

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**Data Elements used in Assessment of
Dynamic Ground Water Resources (As on 31st March, 2009)**

Sl. No.	Data Type	Agency
i	Rainfall data	IMD, State Revenue Departments, AP Chief Planning Officer (DES), Statistical Abstract of Punjab (2009)
ii	Water level data	CGWB and SGWDs
iii	Canal Data	State Irrigation Departments, Irrigation & Flood Control Departments
iv	Cropping Pattern Data	Agriculture Departments, Chief Planning Officer, IV M.I. Census 2006-07
v	Abstraction structures Data	IIIrd MI Census, 2000-01 and IVth M.I. Census, 2006-07, AP MRO Offices, RWS Department, AP Chief Planning Officer (DES), Gujarat Electricity Board, Revenue/Agriculture Departments, State Statistical Booklets, Revenue Departments
vi	Tanks and Ponds data	State Minor Irrigation Departments, TAPAS (Delhi based NGO)
vii	Water Conservation Structures Data	Rural Development Department, Irrigation Department, RWS Department, Directorate of Soil Conservation and Watershed Development Department (Kerala), various other State Agencies involved in watershed management
viii	Population data	Population Census, 2001, AP Chief Planning Officer (DES)
ix	Spatial Data of assessment units	Geological Survey of India, National Soil Survey and Land Use Planning Department, State Irrigation Department, State Ground Water Departments and CGWB

ABBREVIATIONS

bcm	Billion cubic metre
C	Command
CGWB	Central Ground Water Board
CLEG	Central Level Expert Group for overall reassessment of ground water resource of the country
cm	Centimetre
DES	Department of Economics & Statistics
GEC-1984	Ground Water Estimation Committee, 1984
GEC-1997	Ground Water Resources Estimation Committee, 1997
GSDA	Ground Water Survey and Development Agency, Maharashtra
ham	Hectare metre
IMD	India Meteorological Department
lps	Litres per second
m	Meter
m bgl	Meter below ground level
m ham	Million hectare metre
M.I.	Minor Irrigation
mm	Millimeter
MOWR	Ministry of Water Resources, Govt. of India
MRO	Mandal Revenue Officer
NABARD	National Bank for Agricultural and Rural Development
NC	Non-command
SGWD	State Ground Water Departments
sq.m.	Square meter
UT	Union Territory