सत्यमेव जयते

CWC/2022/75

जल क्षेत्र की एक झलक-2021

WATER SECTOR AT A GLANCE-2021

भारत सरकार

GOVERNMENT OF INDIA

सूचना प्रणाली संगठन

INFORMATION SYSTEM ORGANISATION

केन्द्रीय जल आयोग

CENTRAL WATER COMMISSION

जल संसाधन, नदी विकास एवं गंगा संरक्षण विभाग

DEPARTMENT OF WATER RESOURCES, RD & GR

जल शक्ति मंत्रालय

MINISTRY OF JAL SHAKTI

सत्यमेव जयते

जल क्षेत्र की एक झलक-2021

WATER SECTOR AT A GLANCE-2021

WATER RELATED STATISTICS DIRECTORATE
INFORMATION SYSTEM ORGANISATION
WATER PLANNING & PROJECTS WING
CENTRAL WATER COMMISSION
cwc.gov.in

अक्टूबर, 2022 **OCTOBER, 2022**

FOREWORD

Central Water Commission is the premier Technical Organization of India in the field of water resources and is presently functioning as an attached office of the Ministry of Jal Shakti, Department of Water Resources, River Development and Ganga Rejuvenation, Government of India. The mandate of Central Water Commission is to promote integrated and sustainable development and management of India's water resources by using state-of-the-art technology, competency and by coordinating with all stakeholders.

In order to cater to the ever growing needs of data on water resources and related aspects, CWC brings out various publications at regular intervals. The present publication 'Water Sector at A Glance-2021' is the second edition for providing a gist of water resources at all India level.

Data is an indispensable part of governance and such incorporation of updated water-related information in this publication would certainly contribute to improve the policy-making in the country. The publication improvement Committee under the Chairmanship of Shri Kushvinder Vohra, Member (WP&P), CWC, and the entire team of ISO under the leadership of Shri S. C. Malik, Advisor (ISO), CWC have put tremendous efforts to collect and collate enormous data from various Ministries/ Departments/ Organisations/ Directorates of Central and State Governments for compilation of this publication in time. I also take this opportunity to applaud all the data source agencies, especially the team of ISO for their meticulous work in compiling this publication.

I hope, this publication would be of great interest and use to the users of Statistics of water resource sector and concerned.

New Delhi
October, 2022

(R. K. Gupta)
Chairman, CWC

कुश्विन्दर वोहरा
KUSHVINDER VOHRA
सदस्य (जल आयोजन एवं परियोजना)
तथा पदेन अपर सचिव, भारत सरकार
Member (WP&P)
& *ex-officio* Additional Secretary to the Government of India
Tel : 011-26108590, 20861746
Tel/Fax : 011-26105896
Email : mwp@nic.in

भारत सरकार
जल शक्ति मंत्रालय
केन्द्रीय जल आयोग
जल संसाधन, नदी विकास
और गंगा संरक्षण विभाग
सेवा भवन, राम कृष्ण पुरम, नई दिल्ली-110066
GOVERNMENT OF INDIA
MINISTRY OF JAL SHAKTI
CENTRAL WATER COMMISSION
DEPARTMENT OF WATER RESOURCES,
RIVER DEVELOPMENT AND GANGA REJUVENATION
SEWA BHAWAN, R.K. PURAM, NEW DELHI-110066

MESSAGE

There are a number of water resources projects which have been undertaken since independence in the country with the objective to ensure sustainable development of water resources. The planning, development, execution and management of these projects require a sound and broad database on water resources and related aspects. Central Water Commission being the lead nodal agency in the water resources sector with overall responsibility for its balanced development has been taking care of this aspect by documenting water and related data in the form of various publications.In this endeavor, 'Water Sector at A Glance -2021' is the publication intended to provide a gist of water resources at all India level.

The data/ figures given in this publication are based on the information sourced from various Ministries/Departments/Organizations/Directorates of Central and State Governments. It has been attempted to incorporate latest available data of water resources sector in the publication. Further, efforts have been made to make the publication more concise than earlier version by removing any duplicity/ ambiguity etc. in the publication and arranging data/ material in structured form so as publication is useful for all the stakeholders. Emphasis has been given in presenting data in graphical and tabular form wherever possible, for better understanding and quick analysis by user.

The contribution of all the members of the Committee headed by Member (WP&P), CWC for improvement of this publication is highly appreciated.The work of collection, compilation and finalization of data for the publication was accomplished by the officers/officials of Water Related Statistics Directorate of Information System Organisation (ISO), WP&P Wing of CWC. The officers and staff of the Directorate have done a brilliant job in giving the publication a presentable shape under the guidance of Shri S. C. Malik, Advisor (ISO), CWC.

I appreciate the efforts put in by all the agencies which contributed the data/information and supported our efforts to bring out this publication.

Suggestions/comments, if any, for further improvement of the publication will be highly appreciated.

New Delhi
25th October, 2022

(Kushvinder Vohra)
Member (WP&P), CWC

सुबाष चन्द्र मलिक
सलाहकार

SUBASH CHANDRA MALIK
ADVISOR

केन्द्रीय जल आयोग
जल संसाधन, नदी विकास
और गंगा संरक्षण विभाग
जल शक्ति मंत्रालय, भारत सरकार
नवम तल, सेवा भवन
आर. के. पुरम, नई दिल्ली-110066

Central Water Commission
Department of Water Resources,
River Development and Ganga Rejuvenation
Ministry of Jal Shakti, Government of India
9th Floor, Sewa Bhawan
R. K. Puram, New Delhi-110066

PREFACE

Water resource challenges faced by India are considerable and can only be addressed by adopting an integrated approach considering all uses and sources of water from the river basin/hydrological perspective. This requires sound information and knowledge of the water resource base and its uses, coupled with the availability of appropriate tools for collection, compilation, analysis and decision-making. Hydro-meteorological observations and statistical analysis thereon are the basis for efficient and sustainable water management. Central Water Commission is the nodal agency in the water resources sector. It is mandated to promote integrated and sustainable development and management of India's water resources by using state-of-the-art technology and competency. To cater to the ever-growing need for data on water resources and related aspects, ISO brings out various publications at regular intervals.

The present publication 'Water Sector at A Glance-2021' the second edition of it, provides a general picture of water resources at the national level including National Water Policy, 2012 and its salient features. Attempts have been made to present water statistics both in tabular as well as in map/graphical formats for better and quick understanding by the stakeholders.

I would like to express my deep gratitude to Shri R. K. Gupta, Chairman, CWC and Shri Kushvinder Vohra, Member (WP&P), CWC for their continuous support, guidance and encouragement to bring out this publication on time.

The publication has been prepared through the combined efforts of the officers and officials of the Information System Organisation (ISO). The efforts made by Mr. Jawaid Alam Khan Joint Director; Ms. Suchitra Yadav, Deputy Director; Mr. Ashwani Kumar, Senior Statistical Officer and Mr. Raghuvir Singh, Junior Statistical Officer are praiseworthy.

I hope the publication will prove to be a useful document to policymakers, planners, academicians and researchers. It shall be an endeavour on part of ISO to continuously improve the publication both in content and design with the help of users' feedback.

New Delhi
October, 2022

(Subash Chandra Malik)
Advisor (ISO)

Tel. (O) : +91-11-26192168 • E-mail : isd@nic.in

COMPOSITION OF THE COMMITTEE FOR IMPROVEMENT OF THE PUBLICATION

Sl. No.	Officers	Designation
1	Member (WP&P), CWC	Chairman
2	Chief Engineer (PMO), CWC	Member
3	Chief Engineer (PPO), CWC	Member
4	Chief Engineer (BPMO), CWC	Member
5	Chief Engineer (IMO), CWC	Member
6	Chief Engineer (P&DO), CWC	Member
7	Advisor (ISO), CWC	Member Secretary

****

TEAM OF OFFICERS ASSOCIATED WITH THE PUBLICATION

In supervision of

Mr. Subash Chandra Malik	Advisor

Editorial Board

Mr. Jawaid Alam Khan	Joint Director
Ms. Suchitra Yadav	Deputy Director
Mr. Ashwani Kumar	Senior Statistical Officer
Mr. Raghuvir Singh	Junior Statistical Officer

Other Officers/Officials

Ms. Rachna Singh	Deputy Director
Mr. Sanjeev Sharan Pandey	Deputy Director
Mr. Roshan Lal Meena	Assistant Director
Mr. Keshav Singh	Senior Statistical Officer
Mr. Raj Kumar	Senior Statistical Officer
Ms. Sarita	Junior Statistical Officer
Ms. Jasmeet Kaur	Junior Statistical Officer
Mr. K. Sudhakara Rao	PS to Advisor
Ms. Reena Nagrath	Sr. Computer

****

Acronyms and Abbreviations

AIBP	Accelerated Irrigation Benefits Programme
BCM	Billion Cubic Metre
BCM/yr	Billion Cubic Metre per year
BP	Basin Planning
BPMO	Basin Planning & Management Organization
CA	Central Assistance
CAD	Command Area Development
CAD&WM	Command Area Development & Water Management
CCA	Culturalable Command Area
CCEA	Cabinet Committee on Economic Affairs
CEA	Central Electricity Authority
CGWB	Central Ground Water Board
CIWTC	Central Inland Water Transport Corporation
Ckt.km	Circuit Kilometer
CLA	Central Loan Assistance
cm	Centimetre
Cr	Crore
CUI	Coverage Under Irrigation
cum	Cubic Metre
cumecs	Cubic Metre Per Second
CWC	Central Water Commission
CWPRS	Central Water and Power Research Station
DDP	Desert Development Programme
DHARMA	Dam Health and Rehabilitation Monitoring Application
DPAP	Drought Prone Areas Programme
DRIP	Dam Rehabilitation and Improvement Project
EFC	Expenditure Finance Committee
EMO	Environment Management Organisation
ERM	Extension, Renovation and Modernization
FBP	Farakka Barage Project
FMP	Flood Management Programme
GD	Gauge and Discharge Site

Contd...

Acronyms and Abbreviations

GDP	Gross Domestic Product
GDQ	Gauge, Discharge and Water Quality Site
GDS	Gauge, Discharge and Sediment Site
GDSQ	Gauge, Discharge, Sediment and Water Quality Site
GFCC	Ganga Flood Control Commission
GIA	Gross Irrigated Area
GQ	Gauge and Water Quality Site
GSA	Gross Sown Area
GVA	Gross Value Added
GW	Giga Watt
G.W	Ground Water Scheme
Ha	Hectare
HDD	Hydrological Data Directorate
HEPR	Hydro Electric Potential Reassessment Division
HFL	Highest Flood Level
HKKP	Har Khet Ko Pani
HP	Horse Power
HQ	Head Quarter
IMF	International Monetary Fund
IOC	Indian Oil Corporation
IPC	Irrigation Potential Created
IPU	Irrigation Potential Utilised
ISO	Information System Organisation
IWAI	Inland Waterways Authority of India
IWDP	Integrated Watershed Development Project
IWRM	Integrated Water Resources Management
IWT	Inland Water Transport
km	Kilometer
km^2	Square Kilometer
km^3	Cubic Kilometer
KSINC	Kerala Shipping & Inland Navigation Corporation

Contd...

Acronyms and Abbreviations

KW	Kilo Watt
KW/h	Kilo Watt per hour
LAG	Liquified Amonnia Gas
Lakh Ha	Lakh Hectare
LTIF	Long Term Irrigation Fund
MCM	Million Cubic Metre
MCM/yr	Million Cubic Metre per year
Mha	Million Hectare
mm	Millimetre
MMI	Major and Medium Irrigation
MW	Mega Watt
NABARD	National Bank for Agriculture and Rural Development
NAPCC	National Action Plan on Climate Change
NCIWRD	National Commission on Integrated Water Resources Development
NDP	Net Domestic Product
NIA	Net Irrigated Area
NIH	National Institute of Hydrology
NIT	National Institute of Technology
NP	National Project
NRDWP	National Rural Drinking Water Programme
NRMD	Natural Resource Management Directorate
NRSC	National Remote Sensing Centre
NSA	Net Sown Area
NWP	National Water Policy
NWRC	National Water Resources Council
OECD	Organisation for Economic Co-operation and Development
PDA	Pancheshwar Development Authority
PIM	Participatory Irrigation Management
PL	Price Level
PMKSY	Pradhan Mantri Krishi Sinchayee Yojana
PMO	Project Monitoring Organisation
RDC	River Data Compilation
RGI	Registrar General of India

Contd...

Acronyms and Abbreviations

RRR	Repair, Renovation and Restoration
SG&Met	Snow Gauge & Meteorological Site
Sq.km	Square Kilometer
SW	Surface Water Scheme
TCA	Total Cultivable Area
T&D	Transmission and Distribution Lines
Th.Ha	Thousand Hectare
Ton/Ha	Ton per Hectare
UID	Unique Identifier
UIP	Ultimate Irrigation Potential
UT	Union Territory
WM	Water Management
WP&P	Water Planning and Projects Wing
WQSS	Water Quality Sampling Station
WRIS	Water Resources Information System
WRS	Water Related Statistics
WUA	Water Users' Association

CONTENTS

Sl. No.	Particulars	Page No.
Foreword by Chairman, CWC		
Message by Member (WP&P), CWC		
Preface by Advisor (ISO), CWC		
Composition of Committee for Improvement of the Publication		ix
Team of Officers Associated with the Publication		x
Acronyms and Abbreviations		xi
Section-I	**National Water Policy, 2012**	1
1.1	Status/Progress/Review of Existing State Water Policy on the lines of National Water Policy, 2012	1
Section-II	**Water Resources at a Glance**	4
2.1	World- Land and Water Resources	4
2.2	India- Land and Water Resources	5
2.3	Per Capita Water Availability in India	6
2.4	Total Internal Renewable Water Resources Per Capita of Top 10 and Bottom 10 countries	7
2.5	River Basin Map of India	8
2.6	Water Resources Potential in River Basins of India	9
2.7	Inland Fisheries Resources by States and Union Territories of India during 2019-2020	10
2.8	Watersheds in India	12
2.9	Annual and Monthly Rainfall in India	15
2.10	Status of Monitored Glacial Lakes and Water Bodies	16
2.11	Glacial Lakes with Significant Change in Water Spread **(a)** Lakes with increasing Water Spread **(b)** Lakes with decreasing Water Spread	17
2.12	Details of Hydrological Observations, Snow Gauge & Meteorological Sites & Quality Sampling Stations under CWC	19
2.13	Tolerance and Classification of Water	20
2.14	Water Quality Standards in India	21
2.15	State/UT-wise Categorization of Assessment of GW Units in India, 2020	22
2.16	Categorization Map of Assessment Units of India	24
2.17	Map of Principal Aquifer System of India	25
2.18	State-UT-wise Ground Water Monitoring Wells in India by CGWB	26
2.19	Map of Ground Water Monitoring Stations in India	27
2.20	Water Level Scenario in India- Depth to Water Level Map of Post Post Monsoon (November), 2020	28
2.21	State-wise Ground Water Resources in India, 2020	29
2.22	Dam Safety Act	31
2.23	Dam Rehabilitation and Improvement Project (DRIP)	31
2.24	Abstract of Large Dams (as on 27.06.2019)	34

CONTENTS

Sl. No.	Particulars	Page No.
2.25	State-wise Live Storage Capacity of Reservoirs (as on 2017)	35
2.26	Basin wise Live Storage Capacity of Reservoirs	36
Section-III	**Land Use Statistics**	37
3.1	Year-wise Net Sown Area, Net Irrigated Area and Net Un-Irrigated Area	37
3.2	Year-wise Gross Sown Area, Gross Irrigated Area, Gross Un-Irrigated Area	38
3.3	Total Cultivable Land, Irrigation Use and Cropping Intensity	38
3.4	States/UTs-wise Water Rates for Flow Irrigation	39
3.5	States/UTs-wise Water Rates for Lift Irrigation	40
3.6	Agricultural Land by use in India	41
3.7	Productivity of Food Grain	42
Section-IV	**Major and Medium Irrigation and Other Projects**	43
4.1	Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)	43
4.2	State-wise Details of Major and Medium Irrigation Projects under PMKSY- AIBP	47
4.3	Financial Status of Irrigation Projects under AIBP-PMKSY	48
4.4	Special Package for Marashtra/ Sirhind Feeder (SF)/Rajsthan Feeder (RF)	49
4.5	Details of Special Package Projects of Maharashtra	50
4.6	Capital Expenditure, Working Expenses and Gross Receipts for Major and Medium Irrigation Projects at all India Level (upto 2017-18)	53
4.7	Capital Expenditure , Working Expenses and Gross Receipts for Minor Irrigation Projects at all India Level (upto 2017-18)	55
4.8	Financial Status of CAD&WM Component for 99 Prioritized Projects	56
4.9	Capital Expenditure, Working Expenses and Gross Receipts for CAD Programme (upto 2017-18)	57
4.10	National Projects	58
4.11	List of Water Resources Projects declared as National Projects	59
4.12	External Assistance for Development of Water Resources	61
4.13	Repair, Renovation and Restoration (RRR) of Water Bodies	61
4.14	National Water Mission and Climate Change Issue	62
Section-V	**Flood Management**	63
5.1	State-wise Flood Forecasting Stations as on 2021	63
5.2	Basin-wise Flood Forecasting Stations as on 2021	64
5.3	Flood Forecasting Performance from 2000 to 2020	65

CONTENTS

Sl. No.	Particulars	Page No.
5.4	Flood Damage during 2011 to 2020	67
5.5	Flood Management Programme	68
5.6	State-Wise Status of Works Approved, Works Completed and Funds Released under Flood Management Programme (FMP) since start of XI Plan and up to 30.09.2021	68
5.7	Physical Achievements of Flood Management Works till March, 2017	70
5.8	River Management Activities & Works related to Border Areas (RMBA) Component	71
5.9	Flood Management and Border Areas Programme (FMBAP)	71
5.10	Distribution of Revenue Expenditure by Sub-major Head of Accounts	72
5.11	Distribution of Capital Expenditure by Sub-major Head of Accounts	73
5.12	Morphological Studies	74
Section-VI	**Navigation-Inland Water and Transport**	75
6.1	National Waterways	75
6.2	Development of 106 new National Waterways	78
6.3	List of 111 National Waterways	79
Section-VII	**Hydro-Electric**	85
7.1	Electricity Generation and Consumption	85
7.2	Status of Large Hydro Electric Potential Development (Region/State-wise)	86
7.3	Status of Large Hydro Electric Potential Development (Basin-wise)	89
Section-VIII	**International Treaties and Cooperation**	90
Glossary of Terms		97

Section-I
National Water Policy, 2012

Water, which is a vital sustenance for life and economic development, is becoming an increasingly scarce resource in the country. The planning and execution of water resources development have by and large been carried out by the individual State. As the major rivers in our country are inter-State in nature, it has not been possible for individual State to prepare master plans in respect of these rivers. It was felt that planning at the national level for utilization of water resources should be undertaken so that the greatest goal is achieved and optimum benefits derived from the available water resources.

The National Water Policy was first adopted in the year 1987. It states that the policy may be reviewed and revised periodically as and when need arises. The National Water Policy was subsequently revised in 2002 and 2012. The "National Water Policy – 2012" was adopted by the National Water Resources Council in its 6th meeting held on 28.12.2012.

Further, for revision of the NWP (2012,) Ministry of Jal Shakti constituted a committee on 05.11.2019 under the chairmanship of Dr. Mihir Shah, to draft the National Water Policy. The Committee undertook a process of wide-ranging consultations to ensure that the process of drafting the policy is as inclusive as possible and the best possible policy emerges from this process of co-creation.
Ten meetings and Five consultation meetings of the Drafting Committee for revision of National Water Policy were conducted (November, 2019 - October, 2020), in which the consultations were held with the State Governments/ UTs, Central Ministries, Non-Governmental Organisations, Academia and Water Experts from all over the country.

Based on the consultations and deliberations, the Drafting Committee submitted three drafts of National Water Policy on 17.08.2020, 17.10.2020 and 01.11.2020 respectively. The final draft of National Water Policy dated 07.11.2020 has been submitted by the Drafting Committee to the Ministry of Jal Shakti.

1.1 Status/Progress/Review of Existing State Water Policy on the lines of National Water Policy, 2012

Sl. No.	States/UTs	Status of State Water Policy	Remarks	Existing Policy in consonance with NWP, 2012
1	2	3	4	5
States				
1	Andhra Pradesh	Andhra Pradesh State Water Policy, 2008	Draft submitted on 27.08.2008 for Govt. approval	NO
2	Arunachal Pradesh		Arunachal Pradesh Water Resources Regulatory Authority Act, 2006	

Contd…

Sl. No.	States/UTs	Status of State Water Policy	Remarks	Existing Policy in consonance with NWP, 2012
1	2	3	4	5
3	Assam		Draft Water Policy, 2007 prepared	
4	Bihar		Draft Water Policy, 2010 prepared	
5	Chhattisgarh	Chhattisgarh State Water Policy, 2001	Draft Water Policy, 2012 on website	NO
6	Goa	Goa State Water Policy, 2021		YES
7	Gujarat		Draft Water Policy, 2015 prepared	
8	Haryana			
9	Himachal Pradesh	Himachal Pradesh State Water Policy, 2013	Himachal Pradesh State Water Policy, 2005 modified	YES
10	Jharkhand	Jharkhand State Water Policy, 2011		NO
11	Karnataka	Karnataka State Water Policy, 2002		NO
12	Kerala	Kerala State Water Policy, 2008		NO
13	Madhya Pradesh	Madhya Pradesh State Water Policy, 2003		NO
14	Maharashtra	Maharashtra State Water Policy, 2019	Revised Maharashtra State Water Policy, 2003	YES
15	Manipur			
16	Meghalaya	Integrated Water Policy, 2019		YES
17	Mizoram			
18	Nagaland		Water Policy 2016 (final version) prepared by Indian Environment Law Offices (IELO)	NO
19	Odisha	Odisha State Water Policy, 2007		NO
20	Punjab		Draft Water Policy, 2008 prepared	
21	Rajasthan	Rajasthan State Water Policy, 2010		NO

Contd…

Sl. No.	States/UTs	Status of State Water Policy	Remarks	Existing Policy in consonance with NWP, 2012
1	2	3	4	5
22	Sikkim	Sikkim State Water Policy, 2009		NO
23	Telangana			
24	Tamil Nadu	Tamil Nadu State Water Policy, 1994	Draft Water Policy, 2007 prepared	NO
25	Tripura			
26	Uttar Pradesh	Uttar Pradesh State Water Policy, 1999	Draft Water Policy, 2014 prepared	NO
27	Uttarakhand		Draft Water Policy 2015 prepared	
28	West Bengal		Water Policy 2011 prepared-latest status not known	
UTs				
1	Andaman & Nicobar Islands			
2	Chandigarh			
3	Dadar & Nagar Haveli and Daman & Diu			
4	Lakshadweep			
5	National Capital Territory of Delhi		Draft Water Policy, 2015 prepared	
6	Puducherry	Puducherry Water Policy, 2016		YES
7	Jammu & Kashmir			
8	Ladakh			

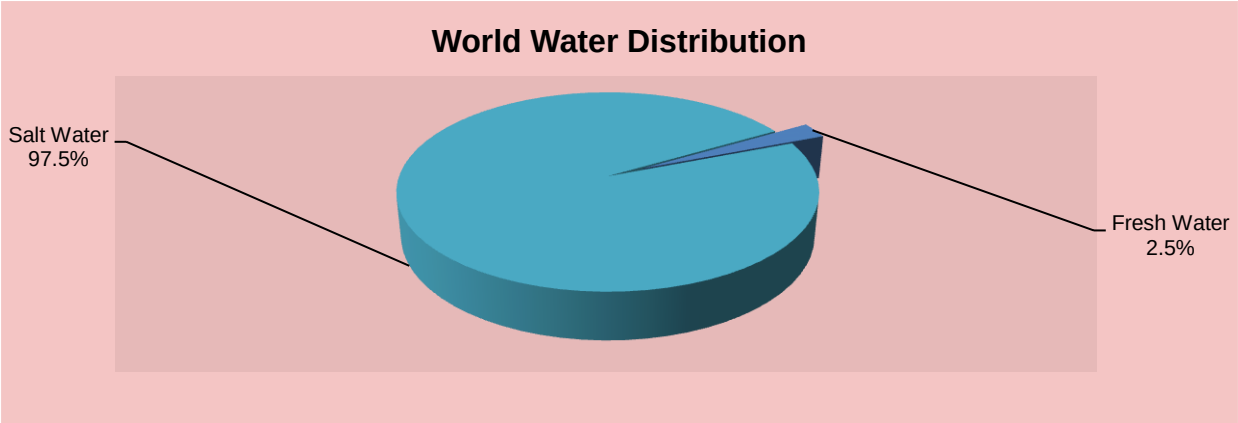
Source: NWP Directorate, CWC, M/o Jal Shakti

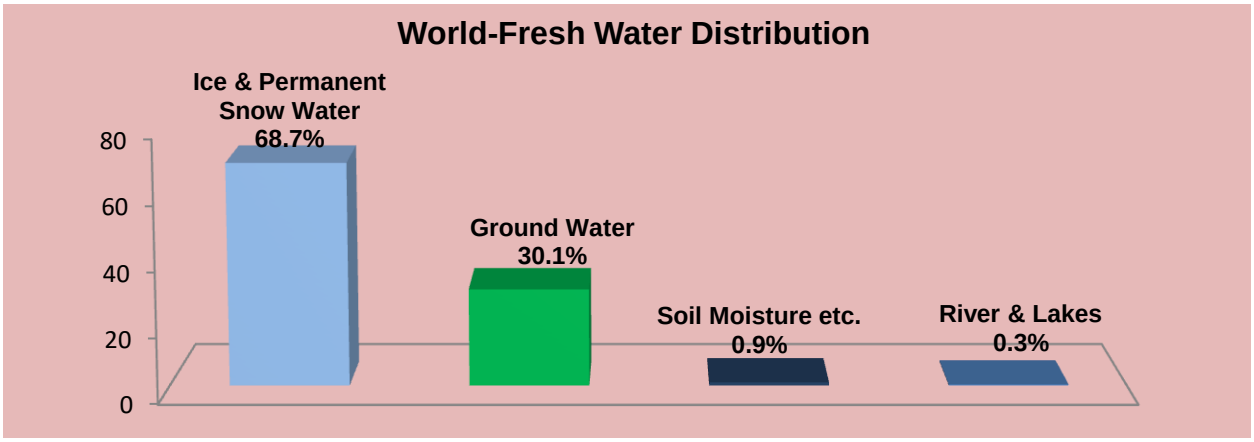
****

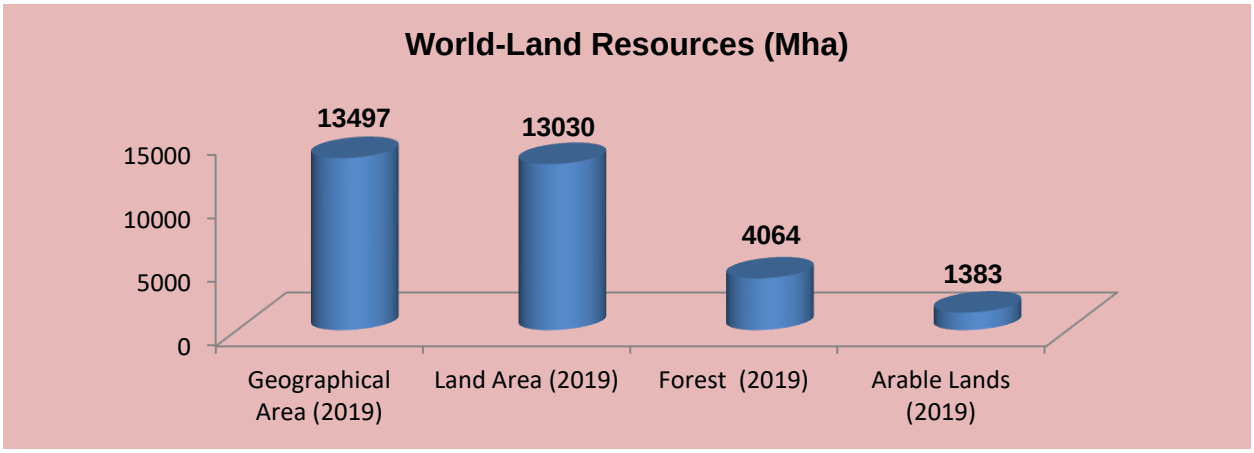
Section-II
Water Resources at a Glance

Water resources are natural resources of water that are potentially useful. Uses of water include agricultural, industrial, household, recreational and environmental activities. All living things require water to grow and reproduce. About 97.5% of the water on the Earth is salt water and only about 2.5% is fresh water; slightly over two thirds of this is frozen in glaciers and polar ice caps. The remaining unfrozen fresh water is found mainly as groundwater, with only a small fraction present above ground or in the air.

2.1 World- Land and Water Resources







Source: website of FAO - www.fao.org, http://www.unep.org

Table 2.2: India- Land and Water Resources

A. General	
Total Geographical Area (TGA)	328.73Mha
Area as % of World Area	2.44%
Location	Latitude 8°4'N to 37°6'N Longitude 68°7'E to 97°25' E
Forest Cover (2019)	21.67% of TGA
Population (As Per Census Of India 2011)	1210.57 Million
Population (Estimated in 2018 as per FAO STAT)	1352.64 Million
Population as % of World Population(as in 2018)	17.73%
Annual Rainfall (2020)	1289.6 mm
B. Water Resources	
Average Annual Precipitation	3880 BCM
Average Annual Water Resources (as per Reassessment of Water Availability in India using Space Inputs-2019)	1999.2 BCM
Estimated Utilizable Surface Water Resources	690 BCM
Total Annual Ground Water Recharge (as per Ground Water Reassessment-2020)	436 BCM
Total Annual Utilizable Water Resources	1126 BCM
Per Capita Water Availability (2011 Census)	1545 m^3/year
Large Dams	5745 Nos.
Completed Dams	5334 Nos.
Under Construction	411 Nos.
Storage Capacity	257.812 BCM
C. Land Resources	
Total Cultivable Land (2018-19)	153.89 Mha
Gross Sown Area (2018-19)	197.32 Mha
Net Sown Area (2018-19)	139.35 Mha
Gross Irrigated Area (2018-19)	102.97 Mha
Net Irrigated Area (2018-19)	71.56 Mha
D. Hydropower (Capacity as on 30.06.2021)	
Identified Hydroelectric Potential (Total)	148701 MW
Identified Hydroelectric Potential (above 25 MW) as per Re-assessment Study	145320 MW
Capacity under Operation (above 25 MW)	41536.6 MW
Capacity Under Construction (above 25 MW)	9057.5 MW

Source: BP-1 Directorate, CWC, RGI, IMD, Central Electricity Authority; 'India State of Forest Report 2019', Forest Survey of India, M/o Environment, Forest & Climate Change; 'Land Use Statistics at A Glance-2021',Directorate of Economics & Statistics, Department of Agriculture, Cooperation & Farmers Welfare (http://eands.dacnet.nic.in)

2.3 Per Capita Water Availability in India

Water availability per person is dependent on population of the country and for India, per capita water availability in the country is reducing due to increase in population. India is now facing a water stressed situation as the per capita water availability in India is below 1700 cubic metres. The country has been facing a water crisis both for agriculture as well as for basic needs. The average annual per capita water availability in the years 2001 and 2011 was assessed as 1816 cubic metres and 1545 cubic metres respectively which may further reduce to 1486 cubic meters and 1367 cubic meters in the years 2021 and 2031 respectively.

Water demand is predicted to increase significantly over the coming decades. In addition to the agricultural sector, which is responsible for 70% of water abstractions nationwide, large increases in water demand are predicted for industry and energy production. Accelerated urbanization and the expansion of municipal water supply and sanitation systems also contribute to the rising localised demand. Climate change scenarios project an exacerbation of the spatial and temporal variations of water cycle dynamics, such that discrepancies between water supply and demand are becoming increasingly aggravated.

Per Capita Water Availability for India during different years

Year	Population (In Millions)	Per capita Average Annual Availability (m3/year)	Note
1	2	3	4
2001	1029 (2001 census)	1816	Based on the study of "Reassessment of Water Resources Potential of India", CWC, 1993 with Average Water Resources Potential as 1869 BCM
2011	1210 (2011census)	1545	
2021	1345	1486	• Based on the study of "Reassessment of Water Availability in India using Space Inputs", CWC, 2019 with Average Annual Water Resources Potential as 1999.2 BCM • Population figures for 2021 to 2051 are taken from projected population by Planning Commission available at http://planningcommission.nic.in/aboutus/committee/strgrp/stgp_fmlywel/sgfw_ch2.pdf
2031	1463	1367	
2041	1560	1282	
2051	1628	1228	

Source: BPMO, CWC, M/o Jal Shakti

Table 2.4: Total Internal Renewable Water Resources (10^9 m^3/yr) of Top 10 and Bottom 10 countries

Rank	Country	Total Internal Renewable Water Resources (10^9 m^3/yr)	Year
1	**2**	**3**	**4**
Top 10 Countries			
1	Brazil	5661.000	2018
2	Russian Federation	4312.000	2018
3	Canada	2850.000	2018
4	United States of America	2818.000	2018
5	China	2812.900	2018
6	Colombia	2145.000	2018
7	Indonesia	2018.700	2018
8	Peru	1641.000	2018
9	**India**	**1446.000**	**2018**
10	Myanmar	1002.800	2018
Bottom 10 Countries			
174	Saint Vincent and the Grenadines	0.100	2018
175	Barbados	0.080	2018
176	Qatar	0.056	2018
177	Antigua and Barbuda	0.052	2018
178	Malta	0.051	2018
179	Maldives	0.030	2018
180	Saint Kitts and Nevis	0.024	2018
181	Nauru	0.010	2018
182	Bahrain	0.004	2018
183	Kuwait	0.000	2018

Source: Food and Agriculture Organization, AQUASTAT data

2.5 River Basin Map of India

Table 2.6: Water Resources Potential in River Basins of India

Sl. No.	River Basin	Catchment Area (Sq.km)	Average Water Resources Potential (BCM)	Utilisable Surface Water Resources (BCM)
1	2	3	4	5
1	Indus (up to Border)	3,17,708	45.53	46
2	a) Ganga	8,38,803	509.52	250
	b) Brahmaputra	1,93,252	527.28	24
	c) Barak & Others	86,335	86.67	-
3	Godavari	3,12,150	117.74	76.3
4	Krishna	2,59,439	89.04	58
5	Cauvery	85,167	27.67	19
6	Subernarekha	26,804	15.05	6.8
7	Brahamani & Baitarni	53,902	35.65	18.3
8	Mahanadi	1,44,905	73	50
9	Pennar	54,905	11.02	6.9
10	Mahi	39,566	14.96	3.1
11	Sabarmati	31,901	12.96	1.9
12	Narmada	96,659.79	58.21	34.5
13	Tapi	65,805.80	26.24	14.5
14	West Flowing Rivers from Tapi to Tadri	58,360	118.35	11.9
15	West Flowing Rivers from Tadri to Kanyakumari	54,231	119.06	24.3
16	East Flowing Rivers between Mahanadi & Pennar	82,073	26.41	13.1
17	East Flowing Rivers between Pennar And Kanyakumari	1,01,657	26.74	16.5
18	West Flowing Rivers of Kutch and Saurashtra including Luni	1,92,112	26.93	15
19	Area of Inland drainage in Rajasthan	1,44,835.90	-----	N.A
20	Minor River draining into Myanmar (Burma) & Bangladesh	31,382	31.17	N.A
TOTAL		**32,71,953**	**1999.2**	**690.1**

Source: BPMO, Central Water Commission, M/o Jal Shakti

Table 2.7: Inland Fisheries Resources by States and Union Territories of India during 2019-20

Sl. No.	States/UTs	Rivers and Canals (Km)	Small Reservoirs		Medium & Large Reservoir		Tanks and Ponds (Ha)	Brackish Water (Ha)	Beels/ Oxbow Lakes/ Derelict Water (Ha)	Any other than Rivers and Canals (Ha)
			Number	Area(Ha)	Number	Area (Ha)				
1	2	3	4	5	6	7	8	9	10	11
1	Andhra Pradesh	11,514	90	34,693.00	26	130,898.00	333,634.00	53,830	0.00	0.00
2	Arunachal Pradesh	3,200	1	136.00	0	0.00	29,087.00	0.00	3,277.00	56,000.00
3	Assam	4,820	0	0.00	2	1,096.00	77,250.00	0.00	154,650.00	462,382.00
4	Bihar	3,200	0	0.00	37	26,304.00	93,218.00	0.00	9,000.00	0.00
5	Chhattisgarh	3,570	1,757	43,681.85	13	39,035.75	109,003.64	0.00	0.00	0.00
6	Goa	250	4	484.00	1	2,964.00	87.70	108.46	0.00	0.00
7	Gujarat	3,865	1,547	92,705.00	88	254,954.00	22,000.00	187,000.00	0.00	0.00
8	Haryana	7,197	0	0.00	0	0.00	17,244.00	0.00	0.00	0.00
9	Himachal Pradesh*	3,000	0	0.00	5	43,785.00	845.34	0.00	0.00	0.00
10	Jharkhand*	1,800	412	28,789.63	23	104,363.00	79,010.00	0.00	0.00	19,936.00
11	Karnataka	5,853	33	7,195.00	49	265,063.00	291,627.00	8000.00	0.00	0.00
12	Kerala	3,220	37	12,039.00	10	21,707.00	27,625.00	65,213.00	0.00	0.00
13	Madhya Pradesh	17,088	3,315	124,486.00	25	228,321.00	76,982.00	0.00	0.00	0.00
14	Maharashtra	33,115	5,273	1,227,089.00	411	302,830.00	289,240.00	2,699.00	41,288.00	450.00
15	Manipur	15,688	5	960.00	1	1,182.00	11,622.80	0.00	24,433.00	0.00
16	Meghalaya*	4,200.87	7	717.53	0	0.00	3,465.37	0.00	284.78	66.94
17	Mizoram	1,750	3	10.00	2	8,000.00	5,492.04	0.00	10.00	0.00
18	Nagaland	1,600	0	0.00	1	2,258.00	3,747.13	0.00	1,110.00	0.00
19	Odisha*	24,878.72	603	34,608.00	8	165,771.00	133,786.00	384,950.00	180,000.00	0.00
20	Punjab	868	12	686.73	1	3,525.00	16,730.00	0.00	0.00	0.00
21	Rajasthan	5,290	346	82,396.00	48	254,475.00	93,909.00	0.00	0.00	0.00

Contd…

Table 2.7: Inland Fisheries Resources by States and Union Territories of India during 2019-20

Sl. No.	States/UTs	Rivers and Canals (Km)	Small Reservoirs		Medium & Large Reservoir		Tanks and Ponds (Ha)	Brackish Water (Ha)	Beels/ Oxbow Lakes/ Derelict Water (Ha)	Any other than Rivers and Canals (Ha)
			Number	Area(Ha)	Number	Area (Ha)				
1	2	3	4	5	6	7	8	9	10	11
22	Sikkim	1,600	3	850.00	0	0.00	1,466.00	0.00	0.00	0.00
23	Tamil Nadu	7,420	69	19,948.00	9	42,067.00	253,975.00	56,000.00	7,000.00	385,218.20
24	Telangana	4,818	56	23,146.00	26	191,763.00	395,828.00	0.00	0.00	0.00
25	Tripura	1,080.00	0	0.00	1	3,049.34	18,530.12	0.00	0.00	12,161.01
26	Uttarakhand*	2,686	0	0.00	7	20,587.00	862.32	0.00	297.00	50.00*
27	Uttar Pradesh	39,542	53	12,899.59	29	132,655.00	172,859.33	0.00	12,034.15	0.00
28	West Bengal	2,526.00	52	28,050.00	0	0.00	263,372.00	210,000.00	42,082.00	26,925.00
29	A & N Islands	0	7	367.00	0	0.00	202.26	0.00	0.00	0.00
30	Chandigarh	0	0	0.00	3	300.00	2.06	0.00	0.00	0.00
31	D & N Haveli and Daman & Diu	0	0	0.00	0	0.00	0.00	0.00	0.00	0.00
32	Delhi	66	0	0.00	0	0.00	12.00	0.00	0.00	0.00
33	Jammu & Kashmir*	26,211	0	530.00		9,700.00	17,010.00	0.00	6,000.00	0.00
34	Ladakh	2,370	1	1.50	1	250.00	10.00	97,700.00	0.00	0.00
35	Lakshadweep	0	0	0.00	0	0.00	1.84	0.00	0.00	0.00
36	Puducherry	7.086	0	303.33	0	1357.12	57.45	0.00	0.00	0.00
All India		**244,293.68**	**13,686.00**	**1,776,772.16**	**827.00**	**2,258,260.21**	**2,839,794.40**	**1,065,500.46**	**481,465.93**	**963,139.15**

Source: Department of Fisheries, States Government/ UTs Administration

Note: Small reservoirs - <1000 ha, Medium reservoirs - 1000 to 5000 ha & Large reservoirs - >5000 ha

*Uttarakhand : 50 waterlogged , Raceways – 1.7 Ha

*Meghalaya : Beels = 220.83, Lakes = 63.95, swamps and low-lying areas = 66.94

*Jharkhand : 19,936 Ha (check dams , Ahar, coalpits and Mines)

*Himachal Pradesh : Raceways – 4.2068 Ha

*Jammu and Kashmir : Raceways – 11.69 Ha

*Odisha : Brakishwater area suitable for culture – 32587 Ha, Backwater – 8100 Ha, Brakishwater Chilika Lake – 79000 Ha, Estuaries – 297850 Ha

Table 2.8: Watersheds in India

Name of Basin & River Length	Sl. No.	Name of Sub-Basin	No. of Watersheds	Area (Sq.km)	Size Range of Watershed (Sq.km)
1	2	3	4	5	6
Indus - 1114 (2280) km	1	Beas	30	19002.47	389.00 – 999.00
	2	Chenab	48	29981.38	323.00 – 1127.00
	3	Ghaghar and others	45	26235.29	207.00 – 1158.00
	4	Gilgit	37	27088.70	340.00 – 1012.00
	5	Jhelum	44	29200.52	320.00 – 1322.00
	6	Lower Indus	31	23894.10	319.00 – 1270.00
	7	Ravi	20	13710.20	390.00 – 1303.00
	8	Shyok	53	38545.05	430.00 – 1374.00
	9	Satluj Lower	58	38442.79	329.00 – 1296.00
	10	Satluj Upper	31	21439.43	384.00 – 952.00
	11	Upper Indus	70	46450.13	383.00 – 974.00
Ganga - 2525 km	12	Above Ramganga Confluence	51	39104.61	430.18 – 1301.20
	13	Banas	64	51651.51	330.66 – 1432.97
Ganga - 2525 km	14	Bhagirathi and others (Ganga Lower)	75	64038.97	308.24 – 1754.95
	15	Chambal Lower	14	10941.26	405.59 – 1135.93
	16	Chambal Upper	30	25546.57	405.14 – 1403.97
	17	Damodar	60	41965.49	326.16 – 1301.09
	18	Gandak and others	76	56260.43	334.87 – 1308.88
	19	Ghaghara Confluence to Gomti Confluence	36	58634.18	372.40 – 1761.77
	20	Ghaghara	76	26254.06	374.93 – 1300.49
	21	Gomti	41	29865.21	333.29 – 1330.50
	22	Kali Sindh and others up to Confluence with Parbati	64	48492.61	429.86 – 1275.01
	23	Kosi	19	18413.58	303.77 – 1694.96
	24	Ramganga	40	30839.69	350.05 – 1442.76
	25	Sone	83	65110.05	380.66 – 1389.01
	26	Tons	23	16905.74	442.40 – 1173.36
Ganga - 2525 km	27	Upstream of Gomti Confluence to Muzaffarnagar	40	29061.37	364.16 – 1281.12
	28	Yamuna Lower	98	124867.19	735.54 – 1781.43
	29	Yamuna Middle	43	34586.39	410.43 – 1232.25
	30	Yamuna Upper	47	35798.19	321.77 – 1241.11
Brahmapurta - 916 (2900) km	31	Brahmaputra Lower	83	87392.22	429.01 – 1490.01
	32	Brahmaputra Upper	97	98972.87	488.58 – 1473.03
Cauvery - 800 km	33	Cauvery Lower	28	17386.45	320.70 – 979.20
	34	Cauvery Middle	86	57280.98	377.45 – 934.52
	35	Cauvery Upper	18	10958.80	362.94 – 991.25

Contd…

Table 2.8: Watersheds in India

Name of Basin & River Length	Sl. No.	Name of Sub-Basin	No. of Watersheds	Area (Sq.km)	Size Range of Watershed (Sq.km)
1	2	3	4	5	6
Godavari - 1465 km	36	Wardha	69	46242.09	361.00 – 946.00
	37	Weinganga	80	49695.40	305.00 – 972.00
	38	Godavari Lower	67	44492.93	304.00 – 990.00
	39	Godavari Middle	56	36290.47	325.00 – 955.00
Godavari - 1465 km	40	Godavari Upper	33	21443.23	331.00 – 988.00
	41	Indravati	60	38306.10	343.00 – 993.00
	42	Manjra	44	29472.88	421.00 – 981.00
	43	Pranhita and others	57	36119.60	326.00 – 982.00
Subernarekha	44	Subernarekha	45	25792.16	387.02 – 962.40
Barak and others	45	Barak	47	27658.98	365.66 – 844.23
	46	Kynchiang and other South Flowing Rivers	17	10267.39	308.78 – 790.32
	47	Naochchara and others	13	7695.81	383.79 – 856.71
Krishna - 1401 km	48	Bhima Lower	36	23652.70	396.00 – 929.00
	49	Bhima Upper	71	44793.32	351.00 – 940.00
	50	Krishna Lower	59	39494.33	277.00 – 971.00
	51	Krishna Middle	36	22229.12	341.00 – 963.00
	52	Krishna Upper	85	54504.77	322.00 – 964.00
Krishna - 1401 km	53	Tungabhadra Lower	59	41556.48	357.00 – 976.00
	54	Tungabhadra Upper	45	28519.41	331.00 – 924.00
Brahmani and Baitarni - 799 km	55	Baitarni	21	14351.23	472.27 – 974.99
	56	Brahmani	58	37545.83	332.75 – 964.48
Pennar - 597 km	57	Pennar Lower	29	17979.85	357.62 – 850.70
	58	Pennar Upper	61	36263.58	310.23 – 926.97
Mahanadi - 851 km	59	Mahanadi Lower	91	57958.88	320.05 – 1457.59
	60	Mahanadi Middle	88	51895.91	301.22 – 902.46
	61	Mahanadi Upper	48	29796.64	314.34 – 907.63
West Flowing Rivers (WFR) from Tapi to Tadri	62	Vasishti and others	47	27473.95	335.12 – 979.25
	63	Bhatsol and others	49	29348.90	310.70 – 932.29
Mahi - 583 km	64	Mahi Lower	22	13377.00	372.00 – 873.00
	65	Mahi Upper	41	24959.80	331.00 – 954.00
Tapi - 724 km	66	Tapi Lower	7	4108.90	427.18 – 781.84
	67	Tapi Middle	47	31766.67	365.64 – 937.44
	68	Tapi Upper	46	28047.34	322.12 – 937.28
East Flowing Rivers (EFR) between Pennar and Kanyakumari	69	Vaippar and others	33	20356.69	318.37 – 887.70
	70	Palar and other	56	35392.34	321.81 – 957.25
	71	Pamba and others	30	18289.41	316.52 – 937.66
	72	Ponnaiyar and other	46	28249.49	356.72 – 900.11

Contd…

Table 2.8: Watersheds in India

Name of Basin & River Length	Sl. No.	Name of Sub-Basin	No. of Watersheds	Area (Sq.km)	Size Range of Watershed (Sq.km)
1	2	3	4	5	6
Narmada - 1312 km	73	Narmada Lower	16	8904.02	307.94 – 750.24
	74	Narmada Middle	63	40575.72	338.11 – 957.42
	75	Narmada Upper	71	43192.68	327.06 – 986.00
West Flowing Rivers (WFR) of Kutch and Saurashtra including Luni	76	Luni Upper	81	70202.58	381.48 – 1447.71
	77	Luni Lower	42	29180.12	315.95 – 1418.64
	78	Drainage of Rann	40	21229.90	310.82 – 968.30
West Flowing Rivers (WFR) of Kutch and Saurashtra including Luni	79	Saraswati	43	27260.84	308.99 – 1017.93
	80	Bhadar and other WFR	30	18489.70	331.14 – 964.84
	81	Shetrunji and other EFR	32	18221.67	300.06 – 855.86
Sabarmati - 371 km	82	Sabarmati Lower	17	8904.02	397.55 – 986.46
	83	Sabarmati Upper	34	40575.72	313.38 – 828.34
East Flowing Rivers (EFR) between Mahanadi and Pennar	84	Vamsadhara & other	34	21870.63	392.23 – 930.46
	85	Nagvati & other	41	24372.24	357.79 – 928.45
	86	East Flowing Rivers (EFR) between Godavari & Krishna	16	10342.29	472.32 – 902.04
	87	East Flowing Rivers (EFR) between Krishna & Pennar	41	23334.63	204.66 – 1404.19
West Flowing Rivers (WFR) from Tadri to Kanyakumari	88	Netravati and others	32	18762.09	317.42 – 928.92
	89	Periyar and others	37	21895.21	340.11 – 933.86
	90	Varrar and others	23	14164.70	363.17 – 978.16
Minor Rivers draining into Myanmar and Bangladesh	91	Imphal and others Sub Basin	29	16754.90	321.00 – 900.00
Minor Rivers draining into Myanmar and Bangladesh	92	Karnaphuli and others Sub Basin	6	3776.84	312.00 – 882.00
	93	Mangpui Lui and others	16	7976.18	359.00 – 656.00
	94	Muhury and others	3	1676.39	532.00 – 608.00

Source: Basin-wise Reports as downloaded from India WRIS, 2014

Table 2.9: Annual and Monthly Rainfall in India (In mm)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1901-10*	19.7	22.4	24.2	37.1	49.5	147.8	273.5	254.9	161.4	60.8	21.5	15.9	1088.7
1911-20*	20.2	25.4	32.6	36.2	64.8	186.7	268.4	247.1	165.6	78.6	36.5	12.5	1174.6
1921-30*	25.6	23.3	23.2	40.6	61.5	167.9	315.9	256.9	180.4	77.1	35.0	18.0	1225.3
1931-40*	17.8	31.8	28.3	40.6	66.4	190.5	308.1	263.4	176.9	79.3	33.1	14.4	1250.5
1941-50*	27.0	24.4	29.8	42.0	71.2	165.3	322.0	264.7	192.0	72.7	29.7	15.0	1255.7
1951-60*	23.6	16.0	28.9	33.6	66.9	162.9	307.9	271.7	183.9	98.9	24.0	11.4	1229.8
1961-70*	15.9	20.4	28.2	36.9	58.8	159.9	292.3	262.7	177.9	69.1	24.1	18.5	1164.4
1971-80*	15.3	21.9	24.1	36.6	59.2	172.3	279.6	263.2	156.5	76.9	36.4	14.2	1156.2
1981-90*	18.2	25.9	36.5	43.2	67.2	164.6	285.5	263.1	172.2	72.9	27.0	20.3	1196.5
1991-2000*	20.0	23.3	28.0	34.7	64.8	171.6	289.9	256.2	167.2	78.9	30.2	15.6	1180.1
2001	7.3	8.8	18.8	46.4	67.2	219.0	279.5	209.2	114.1	107.5	22.5	7.1	1107.3
2002	15.7	20.3	21.5	38.7	61.4	180.1	146.1	259.7	151.1	59.5	18.2	5.7	976.9
2003	7.6	45.6	33.2	35.4	39.1	184.5	316.6	254.9	191.3	100.5	15.5	18.6	1242.8
2004	25.7	8.8	11.3	59.0	88.9	162.9	243.4	248.9	124.5	92.2	15.8	4.6	1085.9
2005	28.1	41.7	42.5	37.7	46.1	143.1	334.2	190.3	206.8	99.2	27.2	11.2	1208.1
2006	17.7	11.9	35.6	32.6	74.9	141.8	287.6	281.3	178.7	51.8	34.6	13.1	1161.5
2007	1.7	36.7	35.2	30.6	46.7	194.2	286.4	257.4	206.6	55.6	14.4	15.3	1180.7
2008	18.4	19.3	41.2	29.5	43.7	201.9	244.8	265.6	165.0	51.6	25.5	11.0	1117.5
2009	12.0	12.0	14.2	25.1	56.0	85.7	280.5	192.4	139.5	71.4	53.7	11.1	953.7
2010	7.0	16.0	14.0	39.0	73.8	138.1	300.5	274.7	197.4	69.0	61.5	22.7	1213.3
2011	6.8	25.8	22.4	41.0	53.1	183.6	246.1	284.9	186.7	38.1	20.1	7.6	1116.0
2012	26.5	12.7	11.3	47.5	31.7	117.6	250.3	262.3	193.4	58.6	30.7	11.7	1054.3
2013	11.3	40.1	15.7	30.3	57.8	219.8	310.1	254.9	152.6	129.3	14.0	6.7	1242.6
2014	19.3	27.4	36.1	22.1	72.9	95.2	261.1	237.4	187.9	60.1	14.4	10.7	1044.7
2015	17.2	20.8	61.4	68.8	53.4	189.0	240.8	204.2	131.8	42.3	39.9	15.4	1085.0
2016	7.8	10.1	30.8	31.4	68.1	147.6	309.2	239.6	168.0	54.5	7.7	8.4	1083.1
2017	26.9	12.4	29.0	44.3	56.1	172.5	290.5	229.6	153.3	81.5	14.7	16.2	1127.1
2018	2.9	12.7	16.5	39.3	64.6	155.7	274.1	240.2	132.7	35.6	21.0	14.7	1020.8
2019	18.5	33.1	18.7	31.5	51.3	113.5	298.8	299.9	259.5	110.1	31.6	19.2	1288.8
2020	28.3	12.1	44.7	42.7	71.8	195.6	257.1	327.8	178.0	78.3	29.2	17.0	1289.6

Source: India Meteorological Department, Ministry of Earth Sciences

* Denotes average for the period.

Table 2.10: Status of Monitored Glacial Lakes and Water Bodies

Month	No. of Glacial Lakes /Water Bodies Monitored (Total Nos.)	Water Spread Area (No.)		
		Increased	Decreased	No Change
1	2	3	4	5
June-Oct, 2016				
June, 2016	372	25	247	100
July, 2016	112	21	55	36
August, 2016	181	21	95	65
September, 2016	195	29	110	56
October 2016	398	105	168	125
June-Oct, 2017				
June, 2017	192	58	90	44
July, 2017	176	47	87	42
August, 2017	165	37	86	42
September, 2017	273	80	116	77
October, 2017	326	97	122	107
June-Oct, 2018				
June, 2018	380	156	29	195
July, 2018	294	129	32	133
August, 2018	208	117	13	78
September, 2018	285	175	15	95
October, 2018	320	192	25	103
June-Oct, 2019				
June, 2019	249	150	15	82
July, 2019	259	161	34	62
August, 2019	254	178	23	51
September, 2019	276	203	14	58
October, 2019	314	228	25	60
June-Oct, 2020				
June, 2020	218	147	26	45
July, 2020	173	104	28	41
August, 2020	267	118	70	79
September, 2020	222	69	79	74
October, 2020	372	136	115	121

Source: Monitoring of Glacier Lakes and Water Bodies in Himalayan Region of Indian River Basin (Report of the respective months), Central Water Commission, M/o Jal Shakti
Note: less No. of Glacial Lakes /Water Bodies Monitored during June due to clouds.

Table 2.11: Glacial Lakes with Significant Change in Water Spread
(a) Lakes with increasing Water Spread

Sl. No.	UID	State Name	Lake_ID	Water Spread Area in Ha	% Diff in Water Spread Area w.r.t. Inventory Area				
				2009 (Inventory)	2020	2019	2018	2017	2016
1	2	3	4	5	6	7	8	9	10
1.	HP_5	Himachal Pradesh	01_52H_004	46	260.87	252.17	243.48	157.89	202.17
2.	HP_12	Himachal Pradesh	01_53E_001	72	140.28	98.61	90.54	81.65	79.54
3.	HP_3	Himachal Pradesh	01_52H_002	62	70.97	72.58	74.58	44.58	29.27
4.	HP_1	Himachal Pradesh	01_52D_001	688	29.94	32.12	32.25	29.05	26.13
5.	JK_85	Jammu & Kashmir	01_43J_007	95	71.58	38.95	1.05	0.35	32.65
6.	JK_159	Jammu & Kashmir	01_43N_032	49	65.31	34.69	34.69	30.08	21.71
7.	JK_187	Jammu & Kashmir	01_52C_003	45	48.89	73.33	73.33	27.36	35.56
8.	JK_115	Jammu & Kashmir	01_43K_014	112	33.93	41.96	41.07	23.57	14.65
9.	JK_23	Jammu & Kashmir	01_43A_002	91	30.77	26.37	26.37	9.56	17.08
10.	JK_67	Jammu & Kashmir	01_43G_001	22154	27.34	20.80	20.8	21.2	-1.34
11.	JK_100	Jammu & Kashmir	01_43J_022	60	26.67	26.67	3.33	6.7	0.89
12.	JK_195	Jammu & Kashmir	01_52I_003	180	26.67	30.00	29.44	24.12	23.42
13.	JK_147	Jammu & Kashmir	01_43N_020	63	25.40	17.46	-1.22	-9.71	10.56
14.	JK_205	Jammu & Kashmir	01_52J_009	57	24.56	42.11	25.32	-6.53	Cloud
15.	JK_5	Jammu & Kashmir	01_42H_005	52	23.08	32.69	23.08	25.11	-11.63
16.	JK_167	Jammu & Kashmir	01_43P_002	52	23.08	23.08	25.67	19.69	7.96
17.	SK_20	Sikkim	03_78A_014	94	59.57	65.96	65.96	5.2	Cloud
18.	SK_26	Sikkim	03_78A_021	56	44.64	37.50	-39.29	-87.99	-81.87
19.	SK_5	Sikkim	03_77D_005	79	40.51	49.37	41.77	-23.83	Cloud
20.	SK_19	Sikkim	03_78A_013	63	38.10	66.67	57.07	28.29	60.98
21.	SK_4	Sikkim	03_77D_004	106	24.53	43.40	31.13	22.23	22.23

Source: Monitoring of Glacier Lakes and Water Bodies in Himalayan Region of Indian River Basin, Central Water Commission, M/o Jal Shakti

UID- Unique identifier of the glacial lake with the letters denote the State (in case of India)

Lake_ID- Each glacial lake has a unique number in the digital database. The numbering is done sequentially within each 1:250,000 reference grid. The first two digits indicate the basin number (01 - Indus, 02 - Ganga and 03 - Brahmaputra). The next three characters depict the reference number of the 1:250,000 SOI topo sheet. The last three digit number indicates lake number within a grid of 1:250,000 SOI topo sheet.

Table 2.11: Glacial Lakes with Significant Change in Water Spread
(b) Lakes with decreasing Water Spread

S. No.	UID	State Name	Lake_ID	Water Spread Area in Ha	% Diff in Water Spread Area w.r.t. Inventory Area				
				2009 (Inventory)	2020	2019	2018	2017	2016
1	2		3	4	5	6	7	8	9
1.	UK_2	Uttrakhand	02_53K_002	1597	-20.66	-3.82	-8.27	-16.62	-54.38
2.	AP_163	Arunachal Pradesh	03_91D_107	67	-23.88	-1.49	Cloud	-11.93	0
3.	AP_85	Arunachal Pradesh	03_91C_038	113	-27.43	Cloud	1.03	-17.89	3.98
4.	UK_8	Uttrakhand	02_53O_005	1510	-36.82	26.09	26.09	21.17	-6.21
5.	UK_10	Uttrakhand	02_53P_002	734	-50.68	-39.10	-38.56	-40.59	-36.48
6.	JK_196	Jammu & Kashmir	01_52I_004	124	-53.23	-29.84	-6.82	-16.63	-25.49
7.	JK_188	Jammu & Kashmir	01_52E_001	51	-74.51	-80.39	Dry	Dry	-11.35

Source: Monitoring of Glacier Lakes and Water Bodies in Himalayan Region of Indian River Basin, Central Water Commission

UID- Unique identifier of the glacial lake with the letters denote the State (in case of India).
Lake_ID- Each glacial lake has a unique number in the digital database. The numbering is done sequentially within each 1:250,000 reference grid. The first two digits indicate the basin number (01 - Indus, 02 - Ganga and 03 - Brahmaputra). The next three characters depict the reference number of the 1:250,000 SOI toposheet. The last three digit number indicates lake number within a grid of 1:250,000 SOI toposheet.

Table 2.12: Details of Hydrological Observations, Snow Gauge & Meteorological Sites and Water Quality Sampling Stations under CWC

(as on 01.01.2021)

Sl. No	Name of States/UTs	Type of Site								
		G	GD	GDQ	GDS	GDSQ	GQ	SG&Met	WQSS	Total
1	2	3	4	5	6	7	8	9	10	11
1	Andhra Pradesh	10	16	4	0	14	1	8	2	55
2	Arunachal Pradesh	7	2	8	0	9	10	18	0	54
3	Assam	7	9	23	1	26	53	5	0	124
4	Bihar	60	28	5	2	22	2	0	0	119
5	Chhattisgarh	11	9	2	1	18	0	14	8	63
6	D.&NH	3	1	0	0	0	0	0	0	4
7	Delhi	0	0	1	0	2	0	0	0	3
8	Goa	0	2	0	0	0	0	0	0	2
9	Gujarat	20	16	4	0	9	0	6	1	56
10	Haryana	3	3	3	0	1	0	0	0	10
11	Himachal Pradesh	6	11	0	4	6	0	23	0	50
12	Jammu & Kashmir	15	7	3	7	6	0	17	0	55
13	Jharkhand	10	19	4	0	6	1	19	6	65
14	Karnataka	7	18	15	0	25	2	4	0	71
15	Kerala	0	14	2	0	24	0	0	0	40
16	Ladakh	4	0	0	0	0	0	0	0	4
17	Madhya Pradesh	57	46	16	0	27	1	10	1	158
18	Maharashtra	34	33	15	1	28	3	14	0	128
19	Manipur	0	1	0	0	0	1	0	0	2
20	Meghalaya	4	5	5	1	3	1	2	0	21
21	Mizoram	1	15	0	6	5	0	0	0	27
22	Nagaland	1	0	0	0	0	0	0	0	1
23	Odisha	49	7	2	0	22	1	5	29	115
24	Pondicherry		0	3	0	0	0	0	0	3
25	Punjab	0	1	0	0	0	0	0	0	1
26	Rajasthan	17	6	8	0	8	0	4	2	45
27	Sikkim	0	0	10	0	1	6	8	13	38
28	Tamil Nadu	0	20	21	0	21	0	1	0	63
29	Telangana	12	12	4	0	8	1	12	0	49
30	Tripura	1	5	0	5	3	2	0	0	16
31	Uttar Pradesh	71	44	13	1	46	4	4	27	210
32	Uttarakhand	23	31	4	6	9	0	7	16	96
33	West Bengal	18	22	8	2	21	10	6	7	94
	Grand Total	**451**	**403**	**183**	**37**	**370**	**99**	**187**	**112**	**1842**

Source: RDC-II Directorate, Central Water Commission, M/o Jal Shakti.

Note: 'G': Gauge; 'GD': Gauge & Discharge; 'GDQ': Gauge, Discharge & Water Quality; 'GDS': Gauge, Discharge & Sediment; 'GDSQ': Gauge, Discharge, Sediment & Water Quality; 'GQ': Gauge & Water Quality; 'SG&Met': Snow Gauge & Meteorological; 'WQSS': Water Quality Sampling Station.

2.13 Tolerance and Classification of Water

As per CPCB, the tolerance limits of parameters are specified as per classified use of water depending on various uses of water. The following classifications have been adopted in India.

Designated Best Uses of Water

Designated best use	Class	Criteria
Drinking water source without conventional treatment but after disinfection	A	1.Total Coliforms Organism MPN/100 ml shall be 50 or less 2. pH between 6.5 and 8.5 3. Dissolved Oxygen 6 mg/l or more 4. Biochemical Oxygen Demand 5 days 20 °C, 2 mg/l or less
Outdoor bathing (organised)	B	1.Total Coliforms Organism MPN/100 ml shall be 500 or less 2. pH between 6.5 and 8.5 3. Dissolved Oxygen 5 mg/l or more 4. Biochemical Oxygen Demand 5 days 20 °C, 3 mg/l or less
Drinking water source after conventional treatment and disinfection	C	1. Total Coliforms Organism MPN/100 ml shall be 5000 or less 2. pH between 6 and 9 3. Dissolved Oxygen 4 mg/l or more 4. Biochemical Oxygen Demand 5 days 20 °C, 3 mg/l or less
Propagation of wild life and fisheries	D	1. pH between 6.5 and 8.5 2. Dissolved Oxygen 4 mg/l or more 3. Free Ammonia (as N) mg/l, 1.2 or less
Irrigation, industrial cooling, controlled waste disposal	E	1. pH between 6.0 and 8.5 2. Electrical Conductivity at 25 °C micro mhos/cm, maximum 2250 3. Sodium absorption Ratio Max. 26 4. Boron Max. 2 mg/l

Source: CPCB/ 'Hydrological Data (Un-Classified) Book-2020', HD Directorate, ISO, CWC, M/o Jal Shakti

Table 2.14: Water Quality Standards in India

Sl. No.	Characteristics	Designated Best Use				
		A	B	C	D	E
1	Dissolved Oxygen (DO) mg/l. min	6	5	4	4	-
2	Biochemical Oxygen demand (BOD) mg/l.max	2	3	3	-	-
3	Total coliform organisms MPN /100 ml.max	50	500	5000	-	-
4	pH value	6.5-8.5	6.5-8.5	6.0-9.0	6.5-8.5	6.0-8.5
5	Colour. Hazen units. max	10	300	300	-	-
6	Odour	Un-objectionable			-	-
7	Taste	Tasteless	-	-	-	-
8	Total dissolved solids. mg/l. max	500	-	1500	-	2100
9	Total hardness (as $CaCO_3$),mg/l.max	200	-	-	-	-
10	Calcium hardness (as $CaCO_3$), mg/l.max	200	-	-	-	-
11	Magnesium hardness (as $CaCO_3$), mg/l.max.	200	-	-	-	-
12	Copper (as Cu).mg/l.max	1.5	-	1.5	-	-
13	Iron (as Fe). Mg/l max	0.3	-	0.5	-	-
14	Manganese (as Mn).mg/l.max	0.5	-	-	-	-
15	Chloride (as Cl). mg/l.max	250	-	600	-	600
16	Sulphates (as SO_4). mg/l. max	400	-	400	-	1
17	Nitrate (as NO_3). mg/l. max	20	-	50	-	-
18	Fluorides (as F). mg/l. max	1.5	1.5	1.5	-	-
19	Phenolic compounds (as C_2H_5OH). mg/l. max	0.002	0.005	0.005	-	-
20	Mercury (as Hg). mg/l.max	0.001	-	-	-	-
21	Cadmium (as Cd).mg/l.max	0.01	-	0.01	-	-
22	Selenium (as Se).mg/l.max	0.01	-	0.05	-	-
23	Arsenic (as As).mg/l.max	0.05	0.2	0.2	-	-
24	Cyanide (as Pb).mg/l.max	0.05	0.05	0.05	-	-
25	Lead (as Pb).mg/l.max	0.1	-	0.1	-	-
26	Zinc (as Zn).mg/l.max	15	-	15	-	-
27	Chromium (as $Cr6^+$).mg/l.max	0.05	-	0.05	-	-
28	Anionic detergents (sa MBAS). mg/l.max	0.2	1	1	-	-
29	Barium (as Ba).mg/l.max	1	-	-	-	-
30	Free Ammonia (as N). Mg/l.max	-	-	-	1.2	-
31	Electrical Conductivity. Micromhos/cm. max.	-	-	-	-	2250
32	Sodium absorption ratio.max	-	-	-	-	26
33	Boron.Mg/l.max	-	-	-	-	2

Source: CPCB, 'Hydrological Data (Un-Classified) Book-2020', HD Directorate, ISO, CWC, M/o Jal Shakti.
Note: Basin-wise details of Water Quality Parameters are given in 'Hydrological Data (Unclassified) Book-2020'

Table 2.15: State/UT-wise Categorization of Assessment of GW Units in India, 2020
Categorization of Blocks/ Mandals/ Talukas in India, 2020

Sl. No.	States/UTs	Total No. of Assessed Units	Safe		Semi-Critical		Critical		Over-Exploited		Saline	
			Nos.	%	Nos.	%	Nos.	%	Nos.	%	Nos.	%
1	2	3	4	5	6	7	8	9	10	11	12	13
	States											
1	Andhra Pradesh	667	551	82.61	40	6.00	15	2.25	23	3.45	38	5.70
2	Arunachal Pradesh	11	11	100.00								
3	Assam	28	28	100.00								
4	Bihar	534	471	88.20	51	9.55	5	0.94	7	1.31		
5	Chhattisgarh	146	110	75.34	27	18.49	9	6.16				
6	Delhi	34	3	8.82	7	20.59	7	20.59	17	50.00		
7	Goa	12	12	100.00								
8	Gujarat	248	182	73.39	24	9.68	4	1.61	25	10.08	13	5.24
9	Haryana	141	30	21.28	14	9.93	12	8.51	85	60.28		
10	Himachal Pradesh	10	10	100.00								
11	Jharkhand	259	244	94.21	10	3.86	2	0.77	3	1.16		
12	Karnataka	227	130	57.27	35	15.42	10	4.41	52	22.91		
13	Kerala	152	120	78.95	29	19.08	3	1.97				
14	Madhya Pradesh	317	233	73.50	50	15.77	8	2.52	26	8.21		
15	Maharashtra	353	271	76.77	63	17.85	8	2.27	10	2.83	1	0.28
16	Manipur	9	9	100.00								
17	Meghalaya	12	12	100.00								
18	Mizoram	26	26	100.00								
19	Nagaland	11	11	100.00								
20	Odisha	314	302	96.18	6	1.91					6	1.91
21	Punjab	150	17	11.33	10	6.67	6	4.00	117	78.00		
22	Rajasthan	295	37	12.54	29	9.83	23	7.80	203	68.81	3	1.02
23	Sikkim	4	4	100.00								
24	Tamil Nadu	1166	409	35.08	225	19.30	63	5.40	435	37.31	34	2.92

Contd….

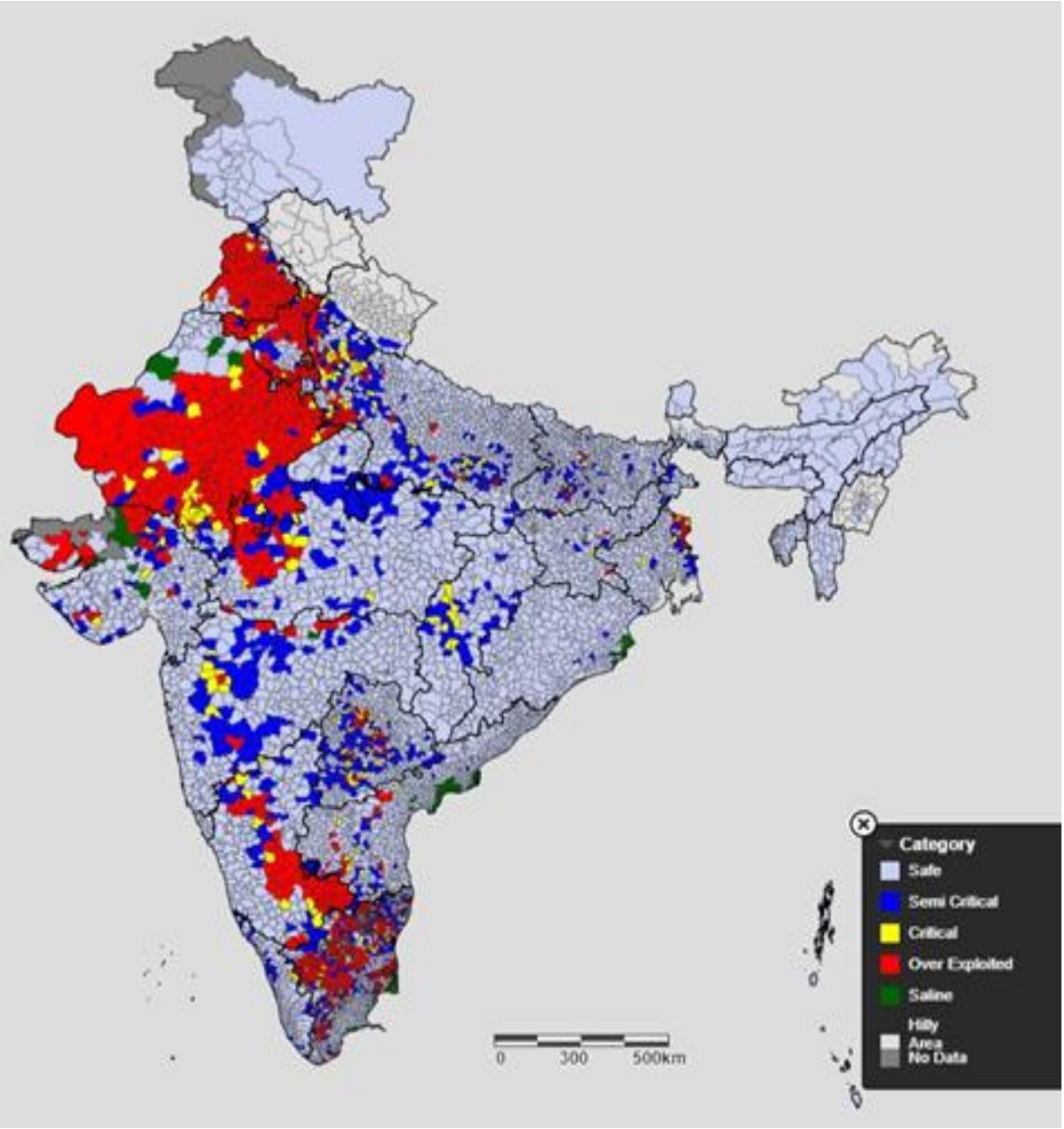
Table 2.15: State/UT-wise Categorization of Assessment of GW Units in India, 2020
Categorization of Blocks/ Mandals/ Talukas in India, 2020

Sl. No.	States/UTs	Total No. of Assessed Units	Safe		Semi-Critical		Critical		Over-Exploited		Saline	
			Nos.	%	Nos.	%	Nos.	%	Nos.	%	Nos.	%
1	2	3	4	5	6	7	8	9	10	11	12	13
25	Telangana	589	321	54.50	180	30.56	44	7.47	44	7.47		
26	Tripura	59	59	100.00								
27	Uttar Pradesh	830	541	65.18	174	20.96	49	5.90	66	7.95		
28	Uttarakhand	18	14	77.78	4	22.22						
29	West Bengal*	268	191	71.27	76	28.36	1	0.37				
30	Andaman and Nicobar	36	35	97.22							1	2.78
31	Chandigarh	1			1	100.00						
32	Dadra & Nagar Haveli	1	1	100.00								
33	Daman & Diu	2	1	50.00					1	50.00		
34	Jammu and Kashmir	20	20	100.00								
35	Ladakh	2	2	100.00								
36	Lakshadweep	9	7	77.78	2	22.22						
37	Puducherry	4	2	50.00			1	25.00			1	25.00
Grand Total		**6965**	**4427**	**63.56**	**1057**	**15.18**	**270**	**3.88**	**1114**	**15.99**	**97**	**1.39**

Source : Central Ground Water Board, M/o Jal Shakti

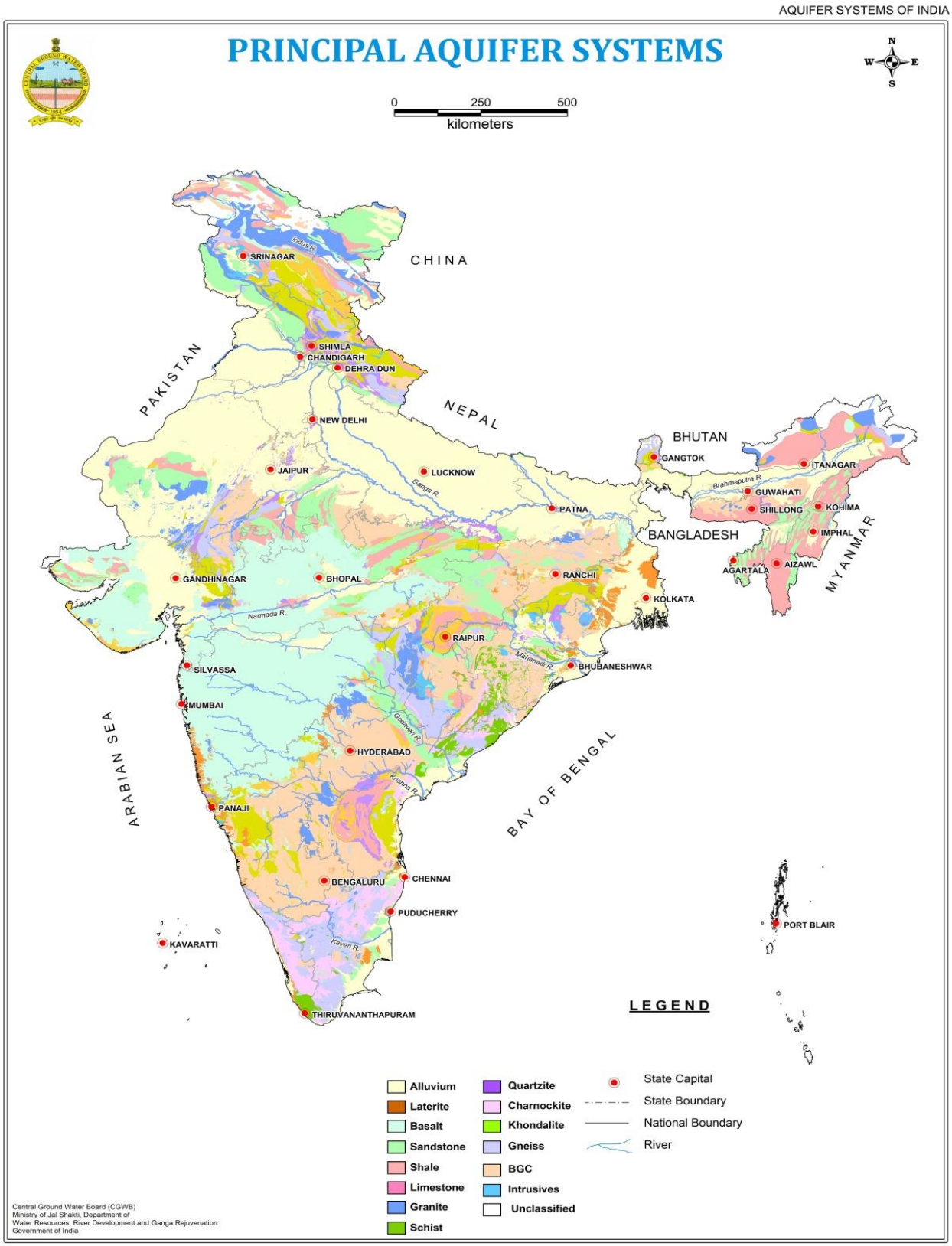
Note: **Blocks**- Bihar, Chhattisgarh, Haryana, Jharkhand, Kerala, Madhya Pradesh, Manipur, Mizoram, Odisha, Punjab, Rajasthan, Tripura, Uttar Pradesh, Uttarakhand, West Bengal; **Taluks**- Goa, Gujarat, Karnataka, Maharashtra; **Mandals**- Andhra Pradesh, Telangana;
District- Arunachal Pradesh, Assam, Meghalaya, Nagaland, Sikkim, Dadra & Nagar Haveli, Daman & Diu, Jammu & Kashmir, Ladakh
Valley- Himachal Pradesh; **Islands**- Andaman & Nicobar and Lakshadweep;
Firka- Tamil Nadu; **Region**- Puducherry;
UT- Chandigarh; **Tehsil**- Delhi.
***West Bengal- The Ground Water Resource Assessment as on 2013 has been considered for the State of West Bengal.**

2.16: Categorization Map of Assessment Units of India, 2020



Source : Central Ground Water Board, M/o Jal Shakti

2.17: Map of Principal Aquifer System of India



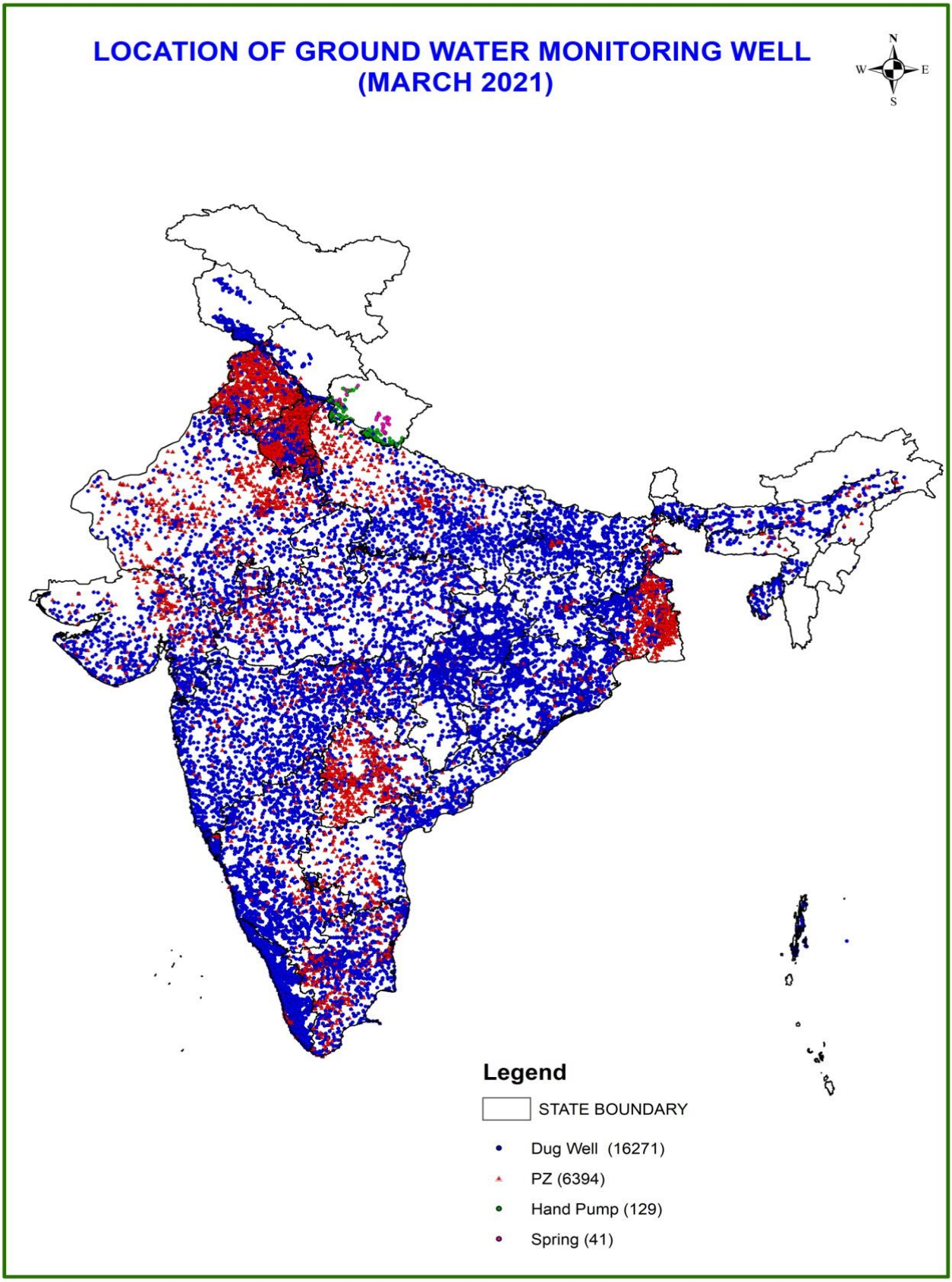
Source: Central Ground Water Board, M/o Jal Shakti

Table 2.18: State/UT-wise Ground Water Monitoring Wells in India by CGWB

Sl. No.	Name of the States/UTs	Number of GW Monitoring Wells (March, 2021)
1	**2**	**3**
States		
1	Andhra Pradesh	867
2	Arunachal Pradesh	30
3	Assam	373
4	Bihar	768
5	Chhattisgarh	1424
6	Delhi	114
7	Goa	132
8	Gujarat	943
9	Haryana	1331
10	Himachal Pradesh	128
11	Jammu & Kashmir	301
12	Jharkhand	462
13	Karnataka	1675
14	Kerala	1591
15	Madhya Pradesh	1511
16	Maharashtra	1901
17	Manipur	0
18	Meghalaya	64
19	Nagaland	30
20	Odisha	1600
21	Punjab	1148
22	Rajasthan	1266
23	Tamil Nadu	1386
24	Telangana	736
25	Tripura	121
26	Uttar Pradesh	987
27	Uttarakhand	215
28	West Bengal	1549
Union Territories		
1	Andaman & Nicobar Islands	113
2	Chandigarh	30
3	Dadra & Nagar Haveli	17
4	Daman & Diu	13
5	Puducherry	9
Total Ground Water Monitoring Wells		**22835**

Source: Central Ground Water Board, M/o Jal Shakti

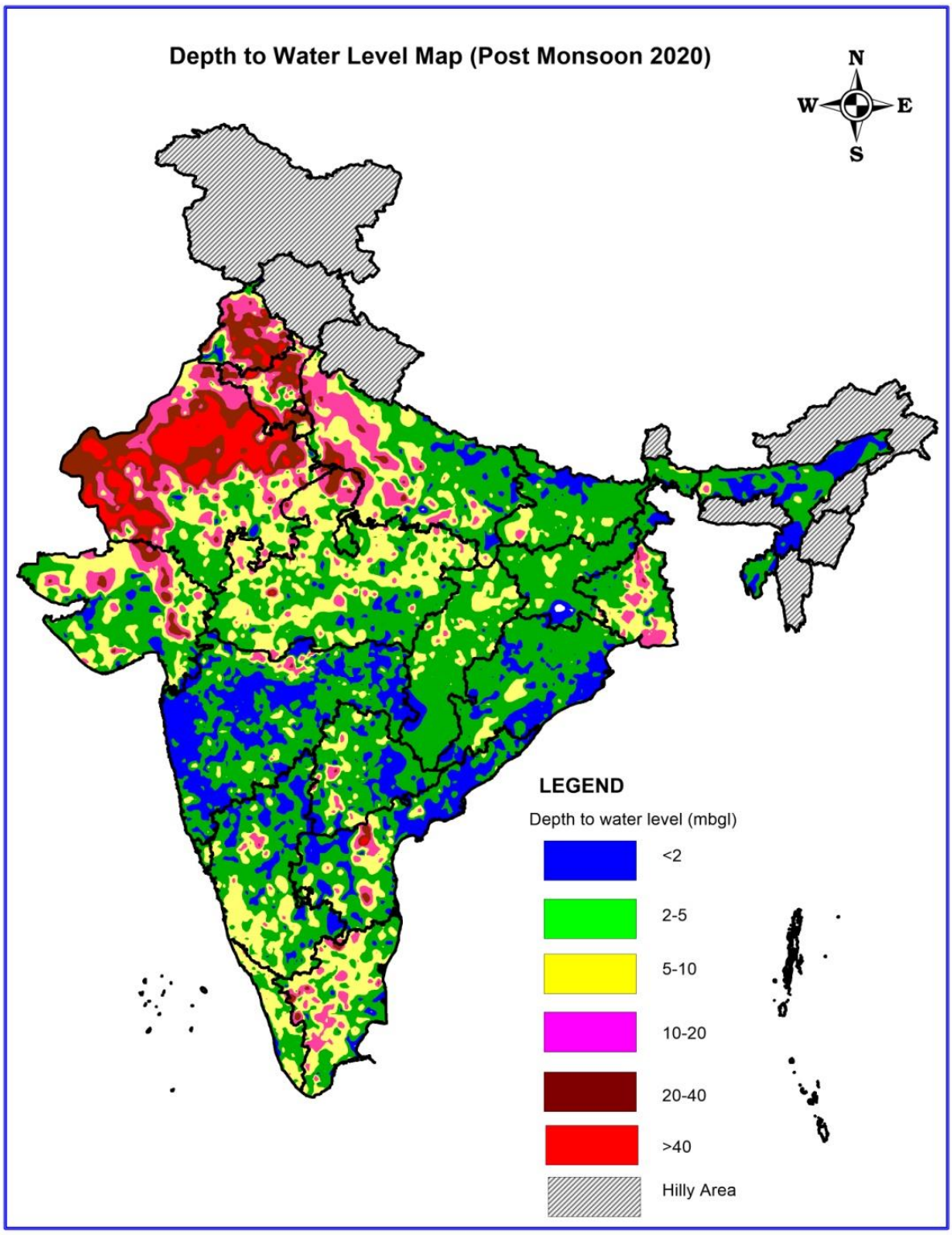
2.19: Map of Ground Water Monitoring Stations in India



Source: Central Ground Water Board, M/o Jal Shakti

2.20: Water Level Scenario in India

Depth to Water Level Map of Post Monsoon (November), 2020



Source: Central Ground Water Board, M/o Jal Shakti

Table 2.21: State-wise Ground Water Resources in India, 2020

(in BCM)

Sl. No.	States / Union Territories	Ground Water Recharge					Total Natural Discharges	Annual Extractable Ground Water Resource	Current Annual Ground Water Extraction			Annual GW Allocation for Domestic use as on 2025	Stage of Ground Water Extraction (%)
		Monsoon Season		Non-monsoon Season		Total Annual Ground Water Recharge			Irrigation	Industrial & Domestic	Total		
		Recharge from Rainfall	Recharge from other Sources	Recharge from Rainfall	Recharge from other Sources								
1	2	3	4	5	6	7	8	9	10	11	12	13	15
1	Andhra Pradesh	8.93	8.54	0.85	5.83	24.15	1.21	22.94	6.60	1.03	7.63	1.31	33.26
2	Arunachal Pradesh	2.01	0.07	1.11	0.002	3.19	0.27	2.92	0.003	0.01	0.01	0.01	0.36
3	Assam	17.92	0.96	7.64	0.53	27.05	5.09	21.97	1.97	0.60	2.58	0.66	11.73
4	Bihar	21.02	3.32	1.29	2.42	28.05	2.60	25.46	10.33	2.69	13.02	2.29	51.14
5	Chhattisgarh	8.33	1.38	1.11	1.84	12.65	1.11	11.55	4.53	0.82	5.35	0.84	46.34
6	Delhi	0.05	0.13	0.004	0.13	0.32	0.03	0.29	0.07	0.22	0.29	0.19	101.40
7	Goa	0.34	0.02	0.003	0.04	0.40	0.08	0.32	0.02	0.05	0.08	0.05	23.48
8	Gujarat	19.59	2.89	0.00	4.32	26.81	1.90	24.91	12.65	0.64	13.30	0.78	53.39
9	Haryana	3.24	2.81	0.58	2.90	9.53	0.90	8.63	10.47	1.15	11.61	0.57	134.56
10	Himachal Pradesh	0.66	0.13	0.13	0.14	1.07	0.10	0.97	0.20	0.16	0.36	0.10	36.83
11	Jharkhand	4.91	0.43	0.47	0.35	6.15	0.51	5.64	0.93	0.72	1.64	0.52	29.13
12	Karnataka	7.47	4.68	2.23	3.77	18.16	1.76	16.40	9.60	1.03	10.63	1.16	64.85
13	Kerala	4.20	0.13	0.46	0.86	5.65	0.53	5.12	1.16	1.48	2.65	2.25	51.68
14	Madhya Pradesh	27.75	1.60	0.12	6.69	36.16	2.78	33.38	17.33	1.64	18.97	1.84	56.82
15	Maharashtra	20.66	2.38	0.53	8.45	32.01	1.76	30.25	15.29	1.34	16.63	1.34	54.99
16	Manipur	0.40	0.001	0.11	0.002	0.51	0.05	0.46	0.003	0.02	0.02	0.02	5.12
17	Meghalaya	1.66	0.01	0.36	0.01	2.04	0.22	1.82	0.03	0.05	0.08	0.06	4.22
18	Mizoram	0.19	0.00	0.03	0.00	0.22	0.02	0.20	0.00	0.01	0.01	0.01	3.81
19	Nagaland	1.08	0.76	0.27	0.06	2.17	0.22	1.95	0.002	0.02	0.02	0.02	1.04
20	Odisha	10.26	2.71	1.51	2.60	17.08	1.37	15.71	5.50	1.36	6.86	1.46	43.65
21	Punjab	5.01	10.42	0.95	6.41	22.80	2.20	20.59	32.80	1.05	33.85	1.08	164.42
22	Rajasthan	8.80	0.58	0.29	2.57	12.24	1.17	11.07	14.37	2.27	16.63	2.17	150.22

Contd…

Table 2.21: State-wise Ground Water Resources in India, 2020

(in BCM)

Sl. No.	States / Union Territories	Ground Water Recharge					Total Natural Discharges	Annual Extractable Ground Water Resource	Current Annual Ground Water Extraction			Annual GW Allocation for Domestic use as on 2025	Stage of Ground Water Extraction (%)
		Monsoon Season		Non-monsoon Season		Total Annual Ground Water Recharge			Irrigation	Industrial & Domestic	Total		
		Recharge from Rainfall	Recharge from other Sources	Recharge from Rainfall	Recharge from other Sources								
1	2	3	4	5	6	7	8	9	10	11	12	13	15
23	Sikkim	0.96	0.00	0.00	0.00	0.96	0.10	0.86	0.00	0.01	0.01	0.01	0.86
24	Tamil Nadu	6.83	9.04	1.26	2.45	19.59	1.90	17.69	13.52	1.15	14.67	1.52	82.93
25	Telangana	7.50	3.29	1.10	4.75	16.63	1.60	15.03	7.13	0.88	8.01	0.74	53.32
26	Tripura	0.85	0.06	0.34	0.22	1.47	0.22	1.24	0.02	0.08	0.10	0.09	7.94
27	Uttar Pradesh	37.75	13.16	1.30	19.99	72.20	5.32	66.88	41.29	4.74	46.03	5.38	68.83
28	Uttarakhand	1.29	0.31	0.10	0.32	2.02	0.17	1.85	0.63	0.24	0.87	0.16	46.80
29	West Bengal*	18.71	1.51	5.26	3.85	29.33	2.77	26.56	10.84	1.00	11.84	1.53	44.60
30	Andaman and Nicobar	0.32	0.0002	0.00	0.0001	0.32	0.03	0.28	0.0001	0.01	0.01	0.01	2.60
31	Chandigarh	0.01	0.02	0.005	0.03	0.06	0.01	0.06	0.01	0.04	0.05	0.03	80.60
32	Dadra & Nagar Haveli	0.04	0.01	0.003	0.02	0.07	0.005	0.07	0.01	0.02	0.03	0.02	45.99
	Daman & Diu	0.03	0.0005	0.00	0.001	0.03	0.001	0.03	0.003	0.03	0.03	0.02	113.38
33	Jammu & Kashmir	0.80	2.04	0.95	0.88	4.68	0.46	4.22	0.20	0.69	0.89	0.57	21.03
34	Ladakh	0.01	0.05	0.02	0.04	0.12	0.01	0.11	0.001	0.02	0.02	0.02	17.90
35	Lakshadweep	0.011	0.00	0.002	0.00	0.01	0.01	0.005	0.00	0.003	0.003	0.005	58.47
36	Puducherry	0.06	0.10	0.01	0.05	0.22	0.02	0.20	0.10	0.05	0.15	0.05	74.27
Grand Total		**249.65**	**73.54**	**30.41**	**82.54**	**436.15**	**38.51**	**397.62**	**217.61**	**27.30**	**244.92**	**28.90**	**61.60**

Source: Central Ground Water Board, M/o Jal Shakti

Note:

1. Data on Ground Water Extraction for Industries is not available for Karnataka, Punjab & Uttar Pradesh and is available only for 2 Districts of Maharashtra.
2. * The Ground Water resources assessment as on 2013 has been considered for the State of West Bengal.

2.22 The Dam Safety Act, 2021

This Act provide for surveillance, inspection, operation and maintenance of the specified dam for prevention of dam failure related disasters and to provide for institutional mechanism to ensure their safe functioning and for matters connected therewith or incidental thereto. The detailed information is available at

http://jalshakti-dowr.gov.in/sites/default/files/Dam%20Safety%20Act%202021.pdf

2.23 Dam Rehabilitation and Improvement Project (DRIP)

In April 2012, Ministry of Jal Shakti initiated World Bank assisted Dam Rehabilitation and Improvement Project (DRIP) with an objective to improve safety and operational performance of selected dams, along with institutional strengthening with system wide management approach. The Scheme has provision to rehabilitate 223 dams, located in 7 States Jharkhand, Karnataka, Kerala, Madhya Pradesh, Odisha, Tamil Nadu and Uttarakhand with budget outlay of Rs.3466 Cr. Phase 1 of the project has been completed on March 31, 2021 with nearly all intended objectives. The completion cost of the Scheme is Rs 2567 Cr. Detailed information in respect of DRIP can be accessed through official Website of DRIP (www.damsafety.in).

Scheme Outcome

- Physical rehabilitation of 198 dam projects to address various safety concerns of dams, safety of downstream people, property, environment and ecology of river
- The Dam Break Analysis of all 198 dam projects prepared. The Emergency Action Plans (EAP) of 197 Dams (172 Projects) are published and 102 DRIP dams (77 Dam Project) have held Stakeholder Consultation Meetings for dissemination of published EAPs
- Operation and Maintenance Manuals of 196 dam projects have been prepared out of which 190 are published.
- 2 nos. of Inspection Manuals for Dam Field Engineers in post-seismic event for dams located in Uttarakhand and Jharkhand published
- 16 nos. of new Guidelines and Manuals published on various aspects of dam safety.
- Capacity building of 8 Academic Institutions and 2 Central Agencies in addition to 10 Project Agencies
- 191 nos. of training programs conducted, wherein about 5500 officials trained
- Dam Health and Rehabilitation Monitoring Application (DHARMA), a web-based asset management tool developed to support the effective collection and management of dam data. The licenses for this tool have been provided to 18 States and 3 Central Agencies. This tool has 1109 nos. of official users with stored data of 1550 nos. of large dams.

Impacts

- The Scheme has been able to develop two most important technical documents (EAP, O&M manual) for all DRIP dams which will ensure safety and operational performance of selected dams; will mitigate the associated risks with dam failure through stakeholders sensitization about consequences, contribute in making more disaster resilience society.
- Capacity building of all partners will ensure availability of trained manpower to ensure safe dam operations.

- DRIP has given platform to all concerned States to take up need based de-siltation activities of reservoirs.
- DRIP will enable India to act as knowledge hub and strength in dam safety management especially for African and South East Asian Countries.
- First time in Country, academic institutions have been taken on board for long term capacity building to meet the future challenges of dam safety management.
- IISc Bangalore and IIT Roorkee have started Post Graduate Degree Programmes in Dam Engineering for Academic Session 2021. IIT Madras is also likely to start similar program from next year onwards.
- DRIP has prepared dam owners of India to achieve the technical activities like safety inspections, investigations, rehabilitations, instrumentation, and risk assessment etc. and institutional set up envisaged under Dam Safety Bill which has been passed by Lok Sabha and currently under consideration in Rajya Sabha.

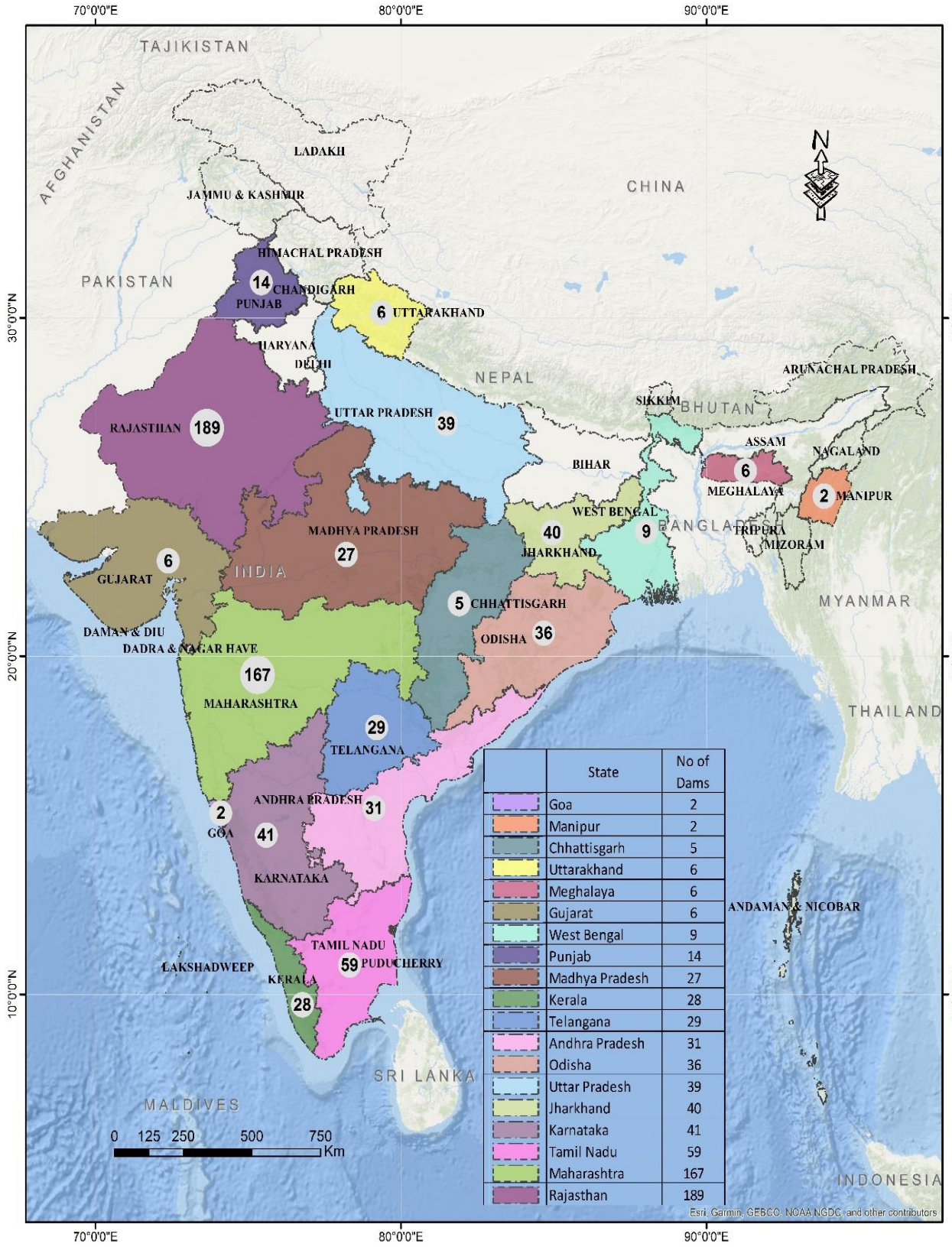
DRIP Phase II & Phase III Coverage across India

Based on the success of ongoing DRIP, the Ministry of Jal Shakti initiated activities for DRIP Phase II and Phase III, by inviting proposals in year 2017 for inclusion of more number of States and dams facing serious health and dam safety challenges. It is a State Sector Scheme with financial outlay of Rs. 10211 Cr (US$ 1.5 Billion), with duration of 10 years, to be implemented in two Phases I.e. Phase-II and Phase-III, each of six years duration with an overlap of two years. Detailed information in respect of DRIP Phase II & Phase III can be accessed through official website of DRIP (www.damsafety.in)

The Scheme has four components; (i) Rehabilitation of dams and associated appurtenances to improve the safety and operational performance of selected existing dams and associated appurtenances in a sustainable manner, and (ii) Dam safety Institutional Strengthening to strengthen the dam safety institutional setup in participating States as well as on a Central level, (iii) Incidental Revenue Generation for sustainable operation and maintenance of dams, and (iv) Project Management.

EFC for DRIP Phase-II and Phase-III was approved on 26th May 2020 and the Union Cabinet approved the Scheme on 29th October 2020. Loan Signing ceremony with World Bank for loan amounting US $ 250 Million was held on August 04, 2021. Loan Agreement was signed by DEA and World Bank and Project Agreement was signed by 10 partner States (Gujarat, Manipur, Meghalaya, Chhattisgarh, Madhya Pradesh, Rajasthan, Odisha, Kerala, Maharashtra and Tamil Nadu) with World Bank. Loan negotiation for the second tranche of USD 250 Million with AIIB is likely to be held in November 2021.

DRIP Phase II & Phase III Coverage across India



	State	No of Dams
	Goa	2
	Manipur	2
	Chhattisgarh	5
	Uttarakhand	6
	Meghalaya	6
	Gujarat	6
	West Bengal	9
	Punjab	14
	Madhya Pradesh	27
	Kerala	28
	Telangana	29
	Andhra Pradesh	31
	Odisha	36
	Uttar Pradesh	39
	Jharkhand	40
	Karnataka	41
	Tamil Nadu	59
	Maharashtra	167
	Rajasthan	189

Source: Dam Safety (REHL) Directorate, Central Water Commission, M/o Jal Shakti

******

Table 2.24: Abstract of Large Dams (As on 27.06.2019)

Sl. No.	States/UTs	Total Completed Dams	Under Construction Dams	Total Dams
1	2	3	4	5
1	Andaman & Nicobar*	2		2
2	Andhra Pradesh	149	17	166
3	Arunachal Pradesh	1	3	4
4	Assam	3	1	4
5	Bihar	24	2	26
6	Chhattisgarh	249	9	258
7	Goa	5	0	5
8	Gujarat	620	12	632
9	Himachal Pradesh	19	1	20
10	Haryana	1	0	1
11	Jammu & Kashmir*	15	2	17
12	Jharkhand	55	24	79
13	Karnataka	230	2	232
14	Kerala	61	0	61
15	Madhya Pradesh	899	7	906
16	Maharashtra	2117	277	2394
17	Manipur	3	1	4
18	Meghalaya	8	2	10
19	Mizoram	1	0	1
20	Nagaland	1	0	1
21	Odisha	200	4	204
22	Punjab	14	2	16
23	Rajasthan	204	8	212
24	Sikkim	2	0	2
25	Tamil Nadu	118	0	118
26	Telangana	168	16	184
27	Tripura	1	0	1
28	Uttar Pradesh	117	13	130
29	Uttarakhand	17	8	25
30	West Bengal	30	0	30
Grand Total		**5334**	**411**	**5745**

Source: Dam Safety Monitoring Directorate, CWC/NRLD-2019 Published on 27.06.2019

'*' Union Territory

International Commission on Large Dams (ICOLD) Specification;

A large dam is classified as one with a maximum height of more than 15 m from its deepest foundation to the crest.

A dam between 10 & 15 m in height from its deepest foundation is also included in the classification of a large dam provided it complies with one of the following conditions:

a) the length of crest of the dam is not less than 500 m or

b) the capacity of the reservoir formed by the dam is not less than one MCM or

c) the maximum flood discharge dealt with by the dam is not less than 2000 cubic metres per second or

d) the dam has specially difficult foundation problems, or

e) the dam is of unusual design

Table 2.25: State-wise Live Storage Capacity of Reservoirs (As on 01.12.2017)

Sl. No	States / UTs	Total Live Storage Capacity (BCM)
1	2	3
1	Andaman & Nicobar Islands	0.019
2	Arunachal Pradesh	0.000
3	Andhra Pradesh (Erstwhile)	28.716
4	Assam	0.012
5	Bihar	2.613
6	Chhattisgarh	6.736
7	Goa	0.290
8	Gujarat	22.553
9	Himachal Pradesh	13.792
10	Jammu & Kashmir	0.029
11	Jharkhand	2.436
12	Karnataka	31.903
13	Kerala	9.768
14	Maharashtra	37.358
15	Madhya Pradesh	33.075
16	Manipur	0.532
17	Meghalaya	0.479
18	Nagaland	1.220
19	Odisha	24.032
20	Punjab	2.402
21	Rajasthan	9.708
22	Sikkim	0.007
23	Tamil Nadu	7.859
24	Tripura	0.312
25	Uttrakhand	5.670
26	Uttar Pradesh	14.263
27	West Bengal	2.027
28	Mizoram	0.000
Total		**257.812**

Source: Water Management Directorate, Central Water Commission, M/o Jal Shakti.
Note: Reconciliation of Live Storage Capacities of Reservoirs is under process.
The above figures are as furnished/ made available to CWC as on 01.12.2017.

Table 2.26: Basin-wise Live Storage Capacity of Reservoirs

Sl. No.	Basin Name	Live Storage (in BCM)		
		Completed Projects	Under Construction Projects	Total
1	2	3	4	5
1	Indus	16.223	0.100	16.3232
2	Ganga	48.677	7.649	56.326
3	Brahmaputra	1.718	0.795	2.5131
4	Barak & others	0.719	9.172	9.891
5	Godavari	35.04	8.412	43.4515
6	Krishna	50.651	4.156	54.807
7	Cauvery	9.083	0.015	9.098
8	Subernrekha	0.309	2.150	2.459
9	Brahmani & Baitarni	5.55369	0.703	6.25669
10	Mahanadi	13.06564	1.461	14.52694
11	Pennar	2.938	2.141	5.079
12	Mahi	5.017	0.150	5.167
13	Sabarmati	1.577	0.109	1.686
14	Narmada	21.816	2.641	24.4567
15	Tapi	9.137	1.558	10.695
16	West Flowing Rivers (WFR) from Tapi to Tadri	14.668	2.430	17.098
17	West Flowing Rivers (WFR) from Tadri to Kanyakumari	11.023	1.416	12.439
18	East Flowing Rivers (EFR) between Mahanadi and Pennar	2.676	1.181	3.857
19	East Flowing Rivers (EFR) between Pennar and Kanyakumari	1.441	0.015	1.456
20	West Flowing Rivers (WFR) of Saurashtra and Kutch including Luni	6.336	0.511	6.847
21	Area of Inland drainage of Rajasthan	0.000	0.000	0.000
22	Minor Rivers draining into Myanmar and Bangladesh	0.14358	0.000	0.14358
23	Area of North Ladakh not draining into Indus	0.000	0.000	0.000
Total		**257.812**	**46.765**	**304.577**

Source: WM Directorate, Central Water Commission, M/o Jal Shakti

Note: Reconciliation of Live Storage Capacities of Reservoirs is under process. The above figures are furnished/ made available to CWC as on 01.12.2017.

Section-III
Land Use Statistics

In India, on the basis of nine-fold land-use classification, the land use statistics is available for roughly 308 Mha of land out of the 329 Mha of the total geographic area which accounts for 93.6% of the total land. Land is an environmental asset that outlines the space in which all the natural processes and human/economic activities are occurring. With growing population and changing industrial profile of economies and consequently, the country's socio-economic priorities drive changes in land use. Land-use change has broad lines of impact with a potential for influencing economic growth, quality of life, management of environmental resources, and national food supply.

Land is required for both agriculture and non-agricultural purposes, including establishment of industries, housing, roads, parks, railway lines etc. Further, due to the rapid industrialization and population growth, land resources are under pressure from physical, human and global causes such as soil erosion, desertification, pollution, food shortage, land conflict, water shortage and climate change. In addition, the urbanization of land has measurable impact on the quantity and quality of water resources.

Table 3.1: Year-wise Net Sown Area, Net Irrigated Area and Net Un-Irrigated Area

(In Th. Ha)

Sl. No.	Year	Net Sown Area	Net Irrigated Area	Net Un-Irrigated Area
1	2	3	4	5
1	2010-11	141563	63665	77898
2	2011-12	140980	65707	75272
3	2012-13	139934	66287	73647
4	2013-14	141426	68117	73309
5	2014-15	140128	68384	71745
6	2015-16	139506	67300	72206
7	2016-17	139415	68649	70766
8	2017-18	139180	69478	69703
9	2018-19	139351	71554	67797

Source: Directorate of Economics & Statistics, Department of Agriculture, Cooperation & Farmers Welfare

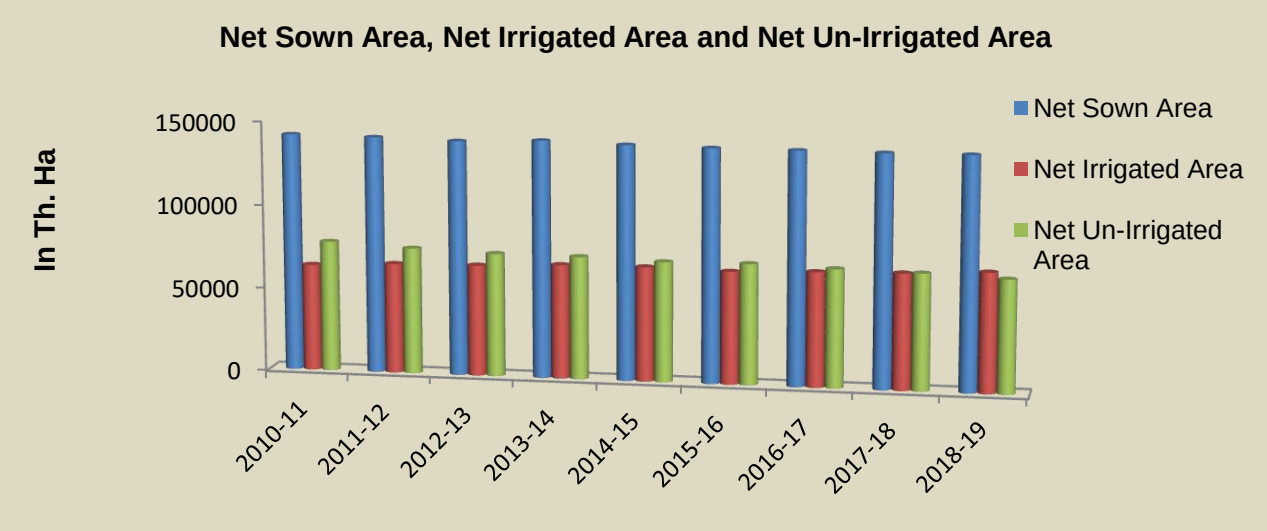


Table 3.2: Year-wise Gross Sown Area, Gross Irrigated Area and Gross Un-Irrigated Area

(In Th. Ha)

Sl. No.	Year	Gross Sown Area	Gross Irrigated Area	Gross Un-Irrigated Area
1	2	3	4	5
1	2010-11	197683	88940	108743
2	2011-12	195796	91786	104010
3	2012-13	194219	92244	101976
4	2013-14	200951	95759	105192
5	2014-15	198378	96754	101624
6	2015-16	197054	96782	100271
7	2016-17	200203	98148	102055
8	2017-18	199988	100085	99904
9	2018-19	197320	102667	94653

Source: Directorate of Economics & Statistics, Department of Agriculture, Cooperation & Farmers Welfare

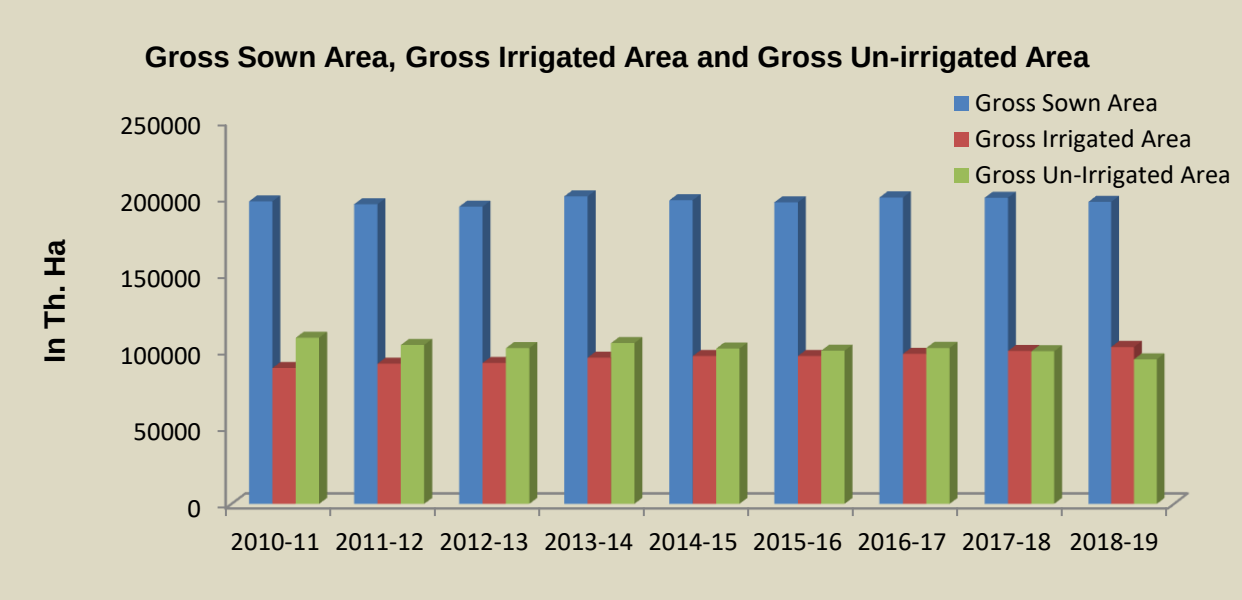


Table 3.3: Total Cultivable Land, Irrigation use & Cropping Intensity

(In Th. Ha)

Sl. No.	Year	Cultivated Land	Net Sown Area	Irrigation Use (%)	Gross Sown Area (Total Cropped Area)	Cropping Intensity (%)
1	2	3	4	5=(4/3)*100	6	7=(6/4)*100
1	2010-11	155840	141563	91	197683	140
2	2011-12	155492	140980	91	195796	139
3	2012-13	155226	139934	90	194219	139
4	2013-14	155582	141426	91	200951	142
5	2014-15	155219	140128	90	198378	142
6	2015-16	154916	139506	90	197054	141
7	2016-17	154502	139415	90	200203	144
8	2017-18	153990	139181	90	199988	144
9	2018-19	153882	139351	91	197320	142

Source: Directorate of Economics & Statistics, Department of Agriculture, Cooperation & Farmers Welfare

Table 3.4: States/UTs- wise Water Rates for Flow Irrigation

Sl. No.	States/UTs	For Irrigation Purposes Flow Irrigation	
		Rate (Rs./Ha)	Date since Applicable
1	2	3	4
1	Andhra Pradesh	148.20 to 864.50	01-07-1996
2	Arunachal Pradesh	No water rates	
3	Assam	150.00 to 751.00	30-03-2000
4	Bihar	74.10 to 370.50	27-11--2011
5	Chhattisgarh	172.97 to 741.29	15-06-1999
6	Delhi	34.03 to 148.20	2009
7	Goa	72.00 to 360.00	06-04-2016
8	Gujarat	314.19 to 590.59	16-06-2021
9	Haryana	37.06 to 296.52	30-11-2018
10	Himachal Pradesh	66.47	31-03-2019
11	Jammu & Kashmir/Ladakh	212.50 to 523.84	01-04-2018
12	Jharkhand	74.10 to 370.50	26-11-2001
13	Karnataka	37.06 to 988.39	18-09-2018
14	Kerala	37.00 to 99.00	18-09-1974
15	Madhya Pradesh	50.00 to 960.00	31-12-2005
16	Maharashtra	3.38 to 13.50	11-01-2018
17	Manipur	184.00 to 602.00	24-08-2013
18	Meghalaya	No water rates	
19	Mizoram	No water rates	
20	Nagaland	No water rates	
21	Odisha	60.00 to 930.00	05-04-2002
22	Punjab	123.50	12-11-2014
23	Rajasthan	49.40 to 286.52	24-05-1999
24	Sikkim	10.00 to 250.00	2002
25	Tamil Nadu	2.77 to 61.78	06-11-1987
26	Tripura	312.50	01-10-2003
27	Uttarakhand	No water rates	
28	Uttar Pradesh	192.92 to 6148.20	03-09-2014
29	West Bengal	37.06 to123.50	01-07-2003
30	A & N Islands	No water rates	
31	Chandigarh*	Not Available	
32	Dadra & Nagar Haveli	110.00 to 830.00	29-01-1996
33	Daman & Diu	286	2007
34	Lakshadweep	No water rates	
35	Puducherry	Not Available	

Source: Dept. of irrigation, Water Resources Dept and State Government Offices

*In rural areas of Chandigarh, the water rates for irrigation purpose is Rs 23/- per hour w.e.f. 01-01-2010.

Table 3.5: States/UTs- wise Water Rates for Lift Irrigation

Sl. No.	States/UTs	For Irrigation Purposes	
		Lift Irrigation	
		Rate (Rs./Ha)	Date since Applicable
1	2	3	4
1	Andhra Pradesh	Not Available	
2	Arunachal Pradesh	No water rates	
3	Assam	150.00 to 751.00	30-03-2000
4	Bihar	Not Available	
5	Chhattisgarh	172.97 to 741.29	15-06-1999
6	Delhi	33.35 to 148.20	2009
7	Goa	144.00 to 720.00	06-04-2016
8	Gujarat	104.73 to 196.86	16-06-2021
9	Haryana	18.53 to 148.26	30-11-2018
10	Himachal Pradesh	132.91	31-03-2019
11	Jammu & Kashmir/Ladakh	1045.22 to 2614.28	01-04-2018
12	Jharkhand	74.10 to 370.50	26-11-2001
13	Karnataka	74.13 to 2965.16	18-09-2018
14	Kerala	93.00 to 148.50	18-09-1974
15	Madhya Pradesh	50.00 to 960.00	31-12-2005
16	Maharashtra	0.47 to 10.97	11-01-2018
17	Manipur	184.00 to 602.00	24-08-2013
18	Meghalaya	No water rates	
19	Mizoram	No water rates	
20	Nagaland	No water rates	
21	Odisha	Not Available	
22	Punjab	123.50	12-11-2014
23	Rajasthan	24.70 to 573.04	24-05-1999
24	Sikkim	Not Available	
25	Tamil Nadu	Not Available	
26	Tripura	312.50	01-10-2003
27	Uttarakhand	No water rates	
28	Uttar Pradesh	97.44 to 3075.08	03-09-2014
29	West Bengal	251.94 to 2015.52	01-07-2003
30	A & N Islands	No water rates	
31	Chandigarh*	Not Available	
32	Dadra & Nagar Haveli	75.00 to 275.00	29-01-1996
33	Daman & Diu	286	2007
34	Lakshadweep	No water rates	
35	Puducherry	Not Available	

Source: Dept. of irrigation, Water Resources Dept and State Government Offices

*In rural areas of Chandigarh, the water rates for irrigation purpose is Rs 23/- per hour w.e.f. 01-01-2010.

Table 3.6: Agriculture Land by use in India

(In Mha)

Sl. No.	Classification	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
1	2	3	4	5	6	7	8	9	10	11
I	**Geographical Area for Land Utilisation Statistics**	**328.73**	**328.73**	**328.73**	**328.73**	**328.73**	**328.73**	**328.73**	**328.73**	**328.73**
II	**Reporting Area for Land Utilisation Statistics (1 to 5)**	**307.48**	**307.39**	**307.49**	**307.80**	**307.78**	**307.75**	**308.32**	**307.77**	**307.78**
1.	Forests	71.59	71.60	71.57	71.83	71.76	71.87	72.02	72.05	72.01
2.	Not available for Cultivation (A+B)	43.58	43.53	43.57	43.86	43.93	44.02	44.82	44.32	44.51
(A)	Area under non-agricultural uses	26.40	26.31	26.50	26.91	26.94	27.08	27.84	27.33	27.34
(B)	Barren & Un-culturable Land	17.18	17.22	17.07	16.94	16.99	16.95	16.99	16.99	17.17
3.	Other Un-cultivated Land excluding Fallow Land (A+B+C)	26.15	26.11	26.09	25.84	25.78	25.64	25.70	25.79	25.75
(A)	Permanent Pastures & other Grazing Lands	10.31	10.31	10.26	10.27	10.26	10.26	10.34	10.34	10.38
(B)	Land under misc. tree crops & groves (not included in net sown area)	3.20	3.16	3.18	3.19	3.10	3.09	3.12	3.17	3.15
(C)	Culturable Waste Land	12.65	12.64	12.64	12.39	12.42	12.29	12.24	12.29	12.22
4.	Fallow Lands (A+B)	24.60	25.18	26.33	24.85	26.18	26.72	26.36	26.43	26.16
(A)	Fallow Lands other than Current Fallows	10.32	10.67	11.04	10.69	11.09	11.31	11.27	11.62	11.63
(B)	Current Fallows	14.28	14.51	15.29	14.16	15.09	15.41	15.09	14.81	14.53
5.	Net Sown Area (6-7)	141.56	140.98	139.93	141.43	140.13	139.51	139.42	139.18	139.35
6.	Gross Sown Area/ (Gross Cropped Area)	197.68	195.80	194.22	200.95	198.38	197.05	200.20	199.99	197.32
7.	Area Sown more than once	56.12	54.82	54.29	59.53	58.25	57.55	60.79	60.81	57.97
8.	Cropping Intensity*	139.64	138.88	138.79	142.09	141.57	141.25	143.60	143.69	141.60
III	**Net Irrigated Area**	**63.67**	**65.71**	**66.29**	**68.12**	**68.38**	**67.30**	**68.65**	**69.48**	**71.55**
IV	**Gross Irrigated Area**	**88.94**	**91.79**	**92.24**	**95.76**	**96.75**	**96.78**	**98.15**	**100.08**	**102.67**

Source: Directorate of Economics & Statistics, Department of Agriculture, Cooperation & Farmers Welfare

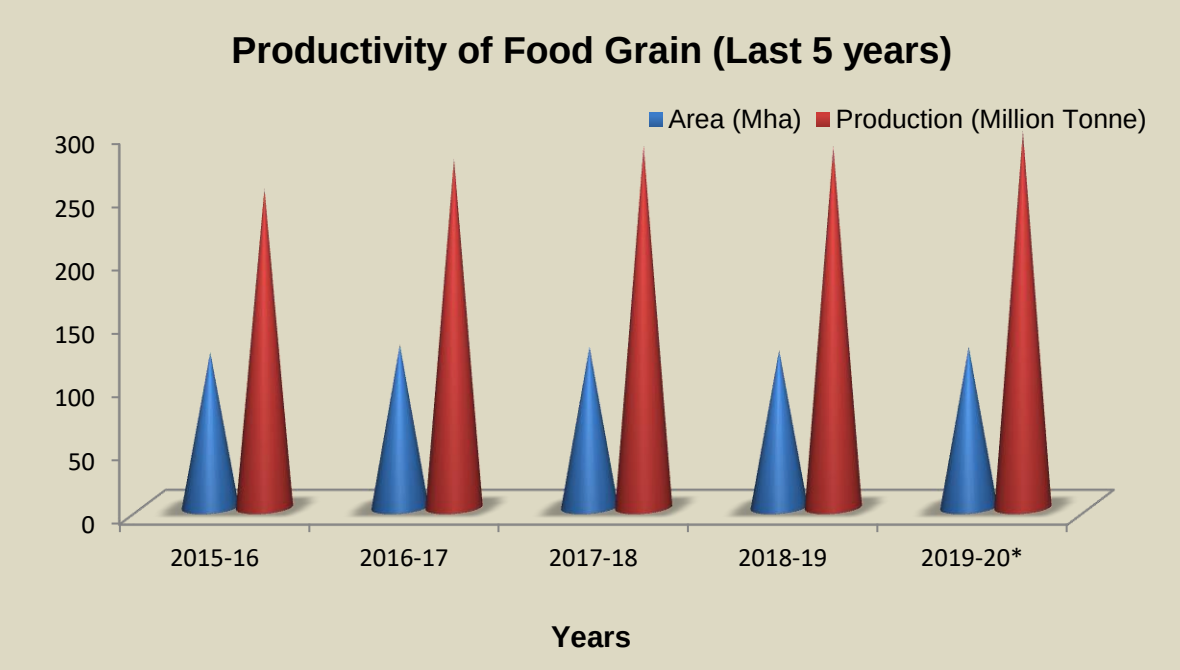
'*': Cropping Intensity is percentage of the gross cropped area to the net area sown.

Table 3.7: Productivity of Food Grain

Sl. No.	Year	Area (Mha)	Production (Million Tonne)	Yield (Million Tonne/ Mha)
1	2	3	4	5
1	1950-51	97.32	50.82	0.52
2	1960-61	115.58	82.02	0.71
3	1970-71	124.32	108.42	0.87
4	1980-81	126.67	129.59	1.02
5	1990-91	127.84	176.39	1.38
6	2000-01	121.05	196.81	1.63
7	2010-11	126.67	244.49	1.93
8	2011-12	124.75	259.29	2.08
9	2012-13	120.78	257.13	2.13
10	2013-14	125.05	265.05	2.12
11	2014-15	124.30	252.03	2.03
12	2015-16	123.22	251.54	2.04
13	2016-17	129.23	275.11	2.13
14	2017-18	127.52	285.01	2.24
15	2018-19	124.83	284.95	2.28
16	2019-20*	127.59	296.65	2.33

Source: Directorate of Economics & Statistics, Department of Agriculture, Cooperation & Farmers Welfare

'*' 4th Advanced Estimates



****

Section-IV
Major and Medium irrigation and Other Projects

Irrigation projects with a Culturable Command Area (CCA) between 2,000 and 10,000 Ha are classified as Medium Irrigation Projects and those with CCA of more than 10,000 Ha as Major Irrigation Projects.

4.1 Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)

4.1.1 PMKSY-AIBP

Government of India has launched the Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) during 2015-16 with the motto of providing 'Har Khet Ko Pani' ensuring access to some means of protective irrigation to all agricultural farms in the country, to produce 'per drop more crop', thus, bringing much desired rural prosperity. The programmes as being implemented by the Government of India, viz. Accelerated Irrigation Benefits Programme, Repair, Renovation and Restoration (RRR) of Water bodies and Command Area Development & Water Management (CAD&WM) have been subsumed in PMKSY. Under PMKSY-AIBP, 99 projects have been prioritized amongst the 149 ongoing projects under AIBP. Out of these priority projects, 44 projects have been reported as completed as on March, 2021.

Total Irrigation Potential targeted under 99 Priority Project is 76.03 Lakh Ha. During 2016-17, 2017-18, 2018-19, 2019-20 and 2020-21; a Central Assistance of Rs. 3307.97 Cr, Rs. 3593.69 Cr, Rs. 2871.57 Cr, Rs. 1745.76 Cr and Rs. 1508.78 Cr respectively has been released under PMKSY-AIBP. An Irrigation Potential of 5.11 Lakh Ha, 7.02 Lakh Ha, 6.15 Lakh Ha, 3.17 Lakh Ha and 1.25 Lakh Ha have been created during 2016-17, 2017-18, 2018-19, 2019-20 and 2020-21 respectively with a cumulative Irrigation Potential of 64.10 Lakh Ha till March, 2021.

4.1.2 Command Area Development (CAD) Works

Initially, 60 major and medium irrigation projects were taken up under the CAD Programme, covering a Culturable Command Area (CCA) of about 15.00 Mha. At the end of FY 2015-16, there were 158 ongoing projects spread across the 29 States of the country with CCA of 16.3 Mha.

Completion of CAD works of 99 prioritised AIBP projects only are being targeted from 2016-17 onwards under Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) – 'Har Khet Ko Pani'. The arrangement of funds for Central Share/ or Central Assistance (CA) has been made by taking loan from NABARD as per year-wise requirements. A dedicated Long Term Irrigation Fund (LTIF) in NABARD has been created. Accordingly, funding of Central Assistance and State share for above mentioned 99 projects along with CAD works is being made through NABARD.

Out of 99 prioritized CAD&WM projects, the State Governments have intimated that, CAD works are not required/deemed completed in 8 projects. Of the balance 91 projects, 1 Project of Rajasthan (Narmada Canal) included for Non- Structural intervention only for Central Assistance

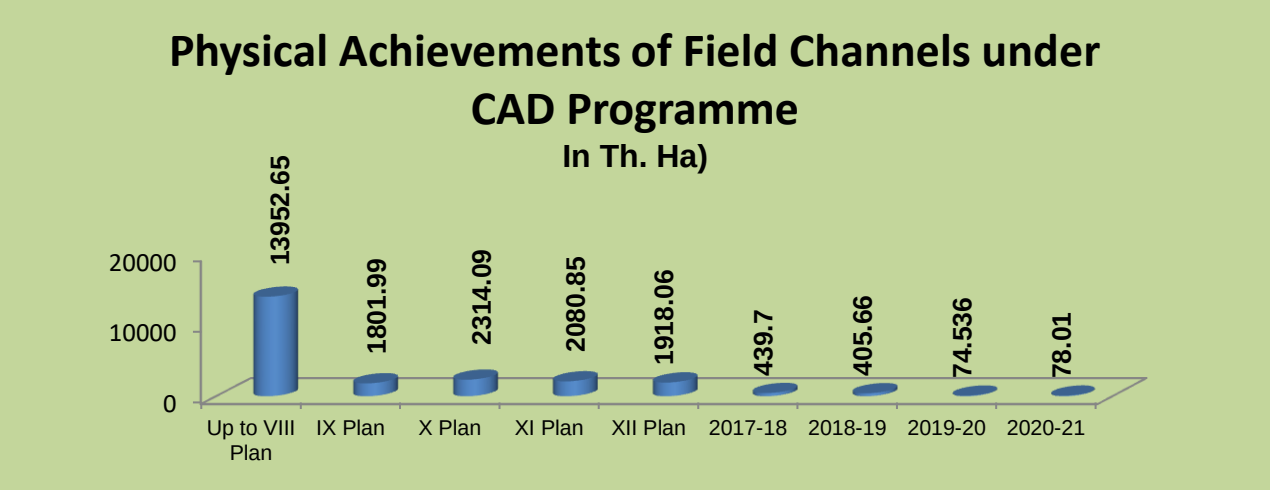
of Rs. 54.06 Cr; 87 projects in balance Culturable Command Area (CCA) of 45.08 Lakh Ha have been included under CAD&WM programme with Central Assistance (CA) of Rs. 8,235.69 Cr and targeted expenditure of Rs.18,736.476 Cr; 3 projects namely Punpun (Bihar), Karipuzha (Kerala) & Madhya Ganga (Uttar Pradesh) are yet to be included.

During 2016-17 to March, 2021 the Central Assistance amounting to Rs. 2747.35 Cr was released to 76 projects with the total reported progress of 14.96 Lakh Ha Culturable Command Area and an expenditure of Rs. 5,328.85 Cr (as reported by States).

4.1.3 Physical Achievements of Field Channels under CAD Programme (In Th. Ha)

Sl. No.	Plan/Year	Achievements
1	2	3
1	Up to VIII Plan	13952.65
2	IX Plan	1801.99
3	X Plan	2314.09
4	XI Plan	2080.85
5	XII Plan	1918.06
6	2017-18	439.70
7	2018-19	405.66
8	2019-20	74.536
9	2020-21	78.01
Cumulative Achievement up to 31.03.2021		**23065.55**

Source: CAD Wing, D/o WR, RD & GR, M/o Jal Shakti



4.1.4 Pradhan Mantri Krishi Sinchayee Yojana- Har Khet Ko Pani - Ground Water

Pradhan Mantri Krishi Sinchayee Yojana- Har Khet Ko Pani-Ground Water scheme, launched by the Department of Water Resources, River Development and Ganga Rejuvenation, Ministry of Jal Shakti, envisages to provide irrigation facility for small and marginal Farmers in areas having sufficient potential for future development of ground water. The scheme is being

implemented with an objective to support goal of Hon'ble Prime Minister of India, for doubling the farmers' incomes. Though the scheme was approved for 2015-20, keeping in view the various requirements to implement the scheme, guidelines were revised and scheme was effectively launched in July, 2019.

Beneficiaries under this scheme are small and marginal farmers only identified by State Governments. Priority is to be given to SC/ST and Women farmers. The scheme expects to give a boost to assured irrigation in tribal and backward areas (with abundant replenishable ground water) of the country, which are deprived of benefits of irrigation projects. The scheme is applicable only in areas having stage of ground water extraction less than 60%, average rainfall more than 750 mm rainfall and having shallow ground water levels (less than 15 m below ground level).

Better irrigation facilities are expected to result in improved socio-economic conditions of small and marginal farmers and may enhance food production by more than two-fold in target areas. Implementation of the scheme is also expected to generate employment for skilled/unskilled personnel including ground water professionals.

For the scheme, provision of Rs. 319 Cr (RE: 219 Cr) was made during FY 2019-20 and Rs. 400 Cr (RE: 80 Cr) earmarked for FY 2020-21 towards Central Assistance for proposals of State Governments under PMKSY-HKKP-GW. As on 31st March, 2021, the Department of Water Resources, RD & GR, Ministry of Jal Shakti, has issued administrative approvals amounting Rs. 1718.49 Cr to States of Assam, Arunachal Pradesh, Nagaland, Tripura, Mizoram, Manipur, Gujarat, Uttar Pradesh, Tamil Nadu, Uttarakhand, Telangana, and West Bengal for providing assured irrigation in 1.49 Lakh Ha land benefitting around 1.96 Lakh small and marginal farmers. Since the release of funds has commenced only from August, 2019, projects are under various stages of execution. State-wise details of administrative approvals issued and funds released as on 31st March, 2021are as below:

State-wise details of Administrative Approvals issued and Funds Released

(As on 31st March'21)

Sl. No.	Projects/State	Cost of Proposal (Rs. Cr)	Central Assistance (Rs. Cr)	Central Assistance Released (Rs. Cr)	Total Project Command (Ha)	Beneficiaries (No.)
1	Assam Phase-I	246.07	221.07	145.87	19116	19643
2	Arunachal Pradesh Phase-I	45.3	40.77	34.46	1785	3350
3	Arunachal Pradesh Phase-II	44.95	40.25	24.15	1957	3633
4	Nagaland	18.15	16.25	9.75	667	264
5	Tripura Phase-I	13.31	11.91	7.15	339	851
6	Gujarat	163.29	98.13	6.00	3768	3655

Contd…

Sl. No.	Projects/State	Cost of Proposal (Rs. Cr)	Central Assistance (Rs. Cr)	Central Assistance Released (Rs. Cr)	Total Project Command (Ha)	Beneficiaries (No.)
7	Uttar Pradesh	46.6	27.82	16.69	34659	14347
8	Tamil Nadu	9.13	5.48	3.67	610	1233
9	Manipur	61.68	55.51	33.31	2057	1445
10	Mizoram	16.04	14.44	8.66	553	411
11	Assam Phase-II	292.01	262.81	10.0	19680	17216
12	Uttarakhand	15.89	14.3	1.36	1030	1085
13	Telangana	379.49	227.69	-	22925	24000
14	West Bengal	318.24	189.99	-	75680	103596
15	Tripura Phase-II	48.34	43.51	-	2670	1639
Total		**1718.49**	**1269.93**	**301.07**	**149659**	**196368**

Ground water development for irrigation is planned in such a way that after implementation of the project, stage of ground water extraction should not exceed 70% at any time. The scheme includes measures to prevent over-exploitation and facilitate recharge to ground water. Suitable recharge measures are to be taken up under NRM (National Resource Management) component of MGNREGS or any other recharge scheme in the target area of the present scheme to provide sustainability to ground water. State/UT Government ensures that micro-irrigation practices are implemented in at least 30% of the proposed irrigated area in convergence with the relevant scheme(s) of Central/State/UT Governments.

Table 4.2: State-wise Details of Major and Medium Irrigation Projects under PMKSY-AIBP

Sl. No.	Name of States	No. of MMI Projects Benefitting under AIBP	No. of MMI Projects Completed under AIBP	No. of ongoing MMI Projects under PMKSY-AIBP	CLA/Grant Released under PMKSY (Rs. in Cr) (2016-2021)	Cumulative CLA/Grant Released as on 31.03.2021 (Rs. in Cr)
1	**2**	**3**	**4**	**5**	**6**	**7**
1	Andhra Pradesh	16	8	8	22.64	2087.76
2	Assam	11	8	3	0.00	512.61
3	Bihar	9	5	2	110.24	872.14
4	Chhattisgarh	11	9	3	41.09	559.57
5	Goa	2	1	1	0.00	273.17
6	Gujarat	15	14	1	4083.05	12964.73
7	Haryana	3	2	0	-	90.54
8	Himachal Pradesh	4	1	0	-	378.89
9	Jammu & Kashmir	19	12	4	39.71	530.01
10	Jharkhand	10	3	1	756.73	2004.32
11	Karnataka	19	8	5	1186.63	7157.47
12	Kerala	5	1	2	0.00	201.11
13	Madhya Pradesh	22 i/c phases of BDP, ISP & OSP total 33 Nos.	13 i/c phases of BDP, ISP & OSP total 19 Nos.	14 i/c phases of BDP, ISP & OSP total 21 Nos.	608.90	6040.52
14	Maharashtra	64	46	26	1892.14	12256.21
15	Manipur	3	1	2	228.36	1595.83
16	Meghalaya	1	0	0	-	4.00
17	Odisha	18	12	8	1208.88	5898.60
18	Punjab	7	5	2	52.42	724.45
19	Rajasthan	10	9	2	458.46	2632.60
20	Tamil Nadu	1	1	0	-	20.00
21	Telengana	17	9	11	937.54	4325.87
22	Tripura	3	0	0	-	126.29
23	U.T. of Ladakh	1		1	10.00	34.63
24	Uttrar Pradesh	18	11	4	391.84	5937.67
25	Uttrakhand	2	1	0	-	609.75
26	West Bengal	7	3	0	-	385.00
Total		**297***	**187****	**99**	**1508.78**	**68223.74**

Source: Monitoring (Central) Directorate, Central Water Commission, M/o Jal Shakti

Note: '*' 5 projects have been deferred; '**'including 44 projects amongst 99 priority projects under PMKSY-AIBP reported completed by State Governments.

Table 4.3: Financial Status of Irrigation Projects under AIBP-PMKSY

Sl. No.	Name of States	Cumulative CLA/Grant Released up to 31.03.2015 under AIBP	CLA/Grant Released under PMKSY (Rs. in Cr)		Cumulative CLA/Grant Released up to 31.03.2021 under AIBP-PMKSY
			2015-16 to 2019-20	2020-21	
1	2	3	4	9	10
1	Andhra Pradesh	2065.12	22.64	0.00	2087.76
2	Assam	404.68	107.92	0.00	512.61
3	Bihar	720.39	137.63	14.12	872.14
4	Chhattisgarh	518.48	34.64	6.45	559.57
5	Goa	273.17	0	0.00	273.17
6	Gujarat	8753.70	4033.09	177.96	12964.73
7	Haryana	90.54	0	0.00	90.54
8	Himachal Pradesh	378.89	0	0.00	378.89
9	Jammu & Kashmir	463.01	57.49	9.50	530.01
10	Jharkhand	965.97	1038.35	0.00	2004.32
11	Karnataka	5762.68	1163.57	231.22	7157.47
12	Kerala	201.11	0	0.00	201.11
13	Madhya Pradesh	5243.41	777.15	19.96	6040.52
14	Maharashtra	10056.28	1899.34	300.59	12256.21
15	Manipur	1225.10	347.22	23.51	1595.83
16	Meghalaya	4.00	0	0.00	4.00
17	Odisha	4515.94	1306.28	76.39	5898.60
18	Punjab	670.98	53.47	0.00	724.45
19	Rajasthan	2128.54	410.46	93.61	2632.60
20	Tamil Nadu	20.00	0	0.00	20.00
21	Telangana	3275.83	887.22	162.82	4325.87
22	Tripura	126.29	0	0.00	126.29
23	U.T.of Ladakh	64.64	9.19	0.81	34.63
24	Uttar Pradesh	4034.74	1561.13	391.84	5937.67
25	Uttrakhand	609.75	0	0.00	609.75
26	West Bengal	385.00	0	0.00	385.00
Total		**52918.22**	**13346.79**	**1508.78**	**67773.78**

Source: Monitoring (Central) Directorate, PMO, Central Water Commission, M/o Jal Shakti

4.4 Special Package for Marashtra/ Sirhind Feeder (SF)/Rajsthan Feeder (RF)

Government of India has sanctioned a special package for completion of Irrigation Projects to address agrarian distress in Vidarbha and Marathwada and other chronically drought prone areas of Rest of **Maharashtra** during July, 2018. The package consists of 8 Major and Medium Irrigation (MMI) Projects approved by TAC of MoWR, RD & GR and 83 Surface Minor Irrigation (SMI) Projects. The balance estimated cost of projects of Maharashtra to be completed under this package is Rs 13651.61 Cr as on 01.04.2018, with Rs 3831.41 Cr being the Central Assistance (CA) by Government of India. On completion of the balance works of these projects, additional Irrigation Potential of 3.77 Lakh Ha would be created. Project-wise details of these 8 Major and Medium Irrigation projects indicating Central Assistance released are given in **Table 4.5.**

In addition, GoI has sanctioned a **Special Package for** Relining of Sirhind Feeder for 96.00Km and Relining of Rajasthan Feeder for 100Km for the States of Punjab and Rajasthan during the year 2016 for Rs.1305.267 Crore and Rs.671.478 Crore respectively at 2015 price level. A Central Assistance of Rs Rs 205.758 Cr and Rs. 620.41 Cr respectively for Sirhind Feeder (SF) and Rajasthan Feeder (RF) were approved. In addition Rs. 50.00 Crore for Sirhind Feeder & Rs. 105.84 Crore for Rajasthan feeder (RF) have already been released. The details of both Feeder canal are as given below:

S. No.	Name of the project	Project cost for works (Rs Crore)	Eligible CA as per Cabinet Note (Rs Crore)	CCA to be Created (in Th. Ha.)	Expenditure incurred till date (in Rs Cr.)	CA released till date (in Rs Crore)	Completion date
1	**Relining of Sirhind Feeder from RD 119700 to 447927**	623.08	255.758	621	80.5047	50.00	June 2022
2	**Relining of Rajasthan Feeder from RD 179000 to 496000**	1210.417	726.25	1963	Nil	105.84	June 2022

Table 4.5: Details of Special Package Projects of Maharashtra

S. No.	Project Name	Districts Benefitted	Cost of the project in Cabinet Note	Latest Cost - Works	Approved Cost - Works	Balance Cost (Works) as on 01.04.2018 based on Latest Cost	Balance Eligible CA based on latest balance cost as on 01.04.2018	Expenditure incurred in 2018-19	Expenditure incurred in 2019-20	Expenditure incurred in 2020-21
1	2	3	4	5	6	7	8	9	10	11
1	Tembhu LIS Dist. Satara	Satara, Sangli, Solapur	3108.54	2993.50	2993.50	1088.62	272.16	260.10	374.34	308.25
2	Urmodi Dist. Satara	Satara	1566.39	895.81	580.79	414.93	103.73	42.50	43.28	0.00
3	Sulwade Jamphal Kanoli L.I. Scheme Dist. Dhule	Dhule	2183.25	2098.60	2098.60	2071.54	517.89	1.70	382.19	195.35
4	Shelgaon Barrage Medium Project, Dist.Jalgaon	Jalgaon	620.58	879.49	879.49	535.45	133.86	55.94	188.59	0.00
5	Ghungshi Barrage LIS Akola	Akola (V)	462.25	479.65	479.65	163.78	40.95	10.21	15.36	0.00
6	Purna Barrage No.2 (Nerdhamana) Dist.Akola	Akola (V)	667.66	848.07	848.07	302.19	75.55	24.80	12.46	2.96
7	Jigaon Dist. Buldhana	Buldhana (V), Akola (V)	7764.39	7222.95	7222.95	4266.74	1066.69	561.39	425.63	688.50
8	Warkhed Londhe Dist. Jalgaon	Jalgaon	465.86	465.86	465.86	363.62	90.91	77.38	104.13	80.26
Total MMI			**16838.92**	**15883.93**	**15568.91**	**9206.87**	**2301.72**	**1034.02**	**1545.98**	**1275.32**
Total SMI (83 Projects)			8364.84	8247.49	7067.41	4057.25	1014.31	633.10	479.14	0.00
Grand Total			**25203.76**	**24131.42**	**22636.32**	**13264.12**	**3316.03**	**1667.12**	**2025.12**	**1275.32**

Table 4.5: Details of Special Package Projects of Maharashtra

S. No.	Project Name	Districts Benefitted	CA released during 2018-19	CA released during 2019-20	CA released during 2020-21	CA released during 2021-22	Total CA released so far
1	**2**	**3**	**12**	**13**	**14**	**15**	**16**
1	Tembhu LIS Dist. Satara	Satara, Sangli, Solapur	25.00	69.79	77.56	80.54	252.89
2	Urmodi Dist. Satara	Satara	13.27	10.63	0.00	10.82	34.72
3	Sulwade Jamphal Kanoli L.I. Scheme Dist. Dhule	Dhule	0.23	0.00	95.97	48.84	145.04
4	Shelgaon Barrage Medium Project, Dist.Jalgaon	Jalgaon	15.22	13.99	47.15	0.00	76.35
5	Ghungshi Barrage LIS Akola	Akola (V)	3.27	2.55	3.84	0.00	9.66
6	Purna Barrage No.2 (Nerdhamana) Dist.Akola	Akola (V)	0.00	0.00	12.43	0.74	13.17
7	Jigaon Dist. Buldhana	Buldhana (V), Akola (V)	262.03	17.01	39.53	239.00	557.57
8	Warkhed Londhe Dist. Jalgaon	Jalgaon	10.41	19.35	26.03	20.07	75.85
Total MMI			**329.43**	**133.31**	**302.52**	**400.00**	**1165.25**
Total SMI			170.58	166.69	97.49		434.75
Grand Total			**500.00**	**300.00**	**400.00**	**400.00**	**1600.00**

Table 4.5: Details of Special Package Projects of Maharashtra

S. No.	Project Name	Districts Benefitted	Ultimate Irrigation Potential	IP created up to March 2017 (Ha)	IP created during 2017-18 (Ha)	Balance IP as on 01.04.2018	IP created during 2018-19 (Ha)	IP target for 2018-19 (Ha) as per CA proposal	IP created during 2019-20 (Ha)	IP created during 2020-21 (Ha)
1	2	3	17	18	19	20	21	22	23	24
1	Tembhu LIS Dist. Satara	Satara, Sangli, Solapur	111856.00	10258.00	5279.00	96319.00	37698.00	0.00	34000.00	11000.00
2	Urmodi Dist. Satara	Satara	32000.00	6497.00	1131.00	24372.00	1323.00	0.00	0.00	0.00
3	Sulwade Jamphal Kanoli L.I. Scheme Dist. Dhule	Dhule	52720.00	0.00	0.00	52720.00	0.00	0.00	0.00	0.00
4	Shelgaon Barrage Medium Project, Dist.Jalgaon	Jalgaon	11318.00	0.00	0.00	11318.00	0.00	0.00	0.00	0.00
5	Ghungshi Barrage LIS Akola	Akola (V)	6660.00	0.00	0.00	6660.00	0.00	0.00	0.00	0.00
6	Purna Barrage No.2 (Nerdhamana) Dist.Akola	Akola (V)	6954.00	0.00	0.00	6954.00	0.00	0.00	0.00	0.00
7	Jigaon Dist. Buldhana	Buldhana (V), Akola (V)	101088.00	0.00	0.00	101088.00	0.00	0.00	0.00	0.00
8	Warkhed Londhe Dist. Jalgaon	Jalgaon	7919.00	0.00	0.00	7919.00	0.00	0.00	0.00	0.00
Total MMI			**330515.00**	**16755.00**	**6410.00**	**307350.00**	**39021.00**	**0.00**	**34000.00**	**11000.00**
Total SMI			75925.00	8766.00	1571.00	65588.00	4712.00	0.00	8427.00	0.00
Grand Total			**406440.00**	**25521.00**	**7981.00**	**372938.00**	**43733.00**	**0.00**	**42427.00**	**11000.00**

Source: Monitoring (Central) Directorate, PMO, Central Water Commission, M/o Jal Shakti

Table 4.6: Capital Expenditure, Working Expenses and Gross Receipts for Major and Medium Irrigation Projects at All India Level (up to 2017-18)

(Rs. In Cr)

Year	Annual Plan	Capital Expenditure		Working Expenses			Gross Receipts
		During the Year	Up to the end of the Year	Direction and Administration	Expenses other than Direction and Administration	Total	
1	2	3	4	5	6	7	8
1992-93	VIII Plan	3416.32	37077.90	256.88	2905.25	3162.13	320.29
1993-94		3975.27	41080.38	295.55	3334.29	3629.85	477.58
1994-95		4806.07	45885.59	341.53	4010.91	4352.44	444.46
1995-96		5458.64	51346.89	424.76	4393.77	4818.53	495.43
1996-97		5494.42	56840.72	472.62	4973.02	5445.64	458.39
Sub Total		23150.72	-	1791.33	19617.25	21408.58	2196.15
1997-98	IX Plan	7137.93	63984.15	853.49	5404.43	6257.92	363.34
1998-99		7093.71	71077.86	929.64	6285.74	7215.38	441.80
1999-00		7874.72	78952.83	1167.66	6812.55	7980.22	456.94
2000-01		6821.63	78197.22	993.48	7768.94	8762.42	753.52
2001-02		7649.38	85846.70	1396.63	6842.56	8239.19	652.25
Sub Total		36577.36	-	5340.90	33114.22	38455.12	2667.85
2002-03	X Plan	10161.31	96007.86	1444.52	7401.38	8845.90	783.39
2003-04		14463.44	110472.71	1431.83	4861.78	6293.60	1047.60
2004-05		17652.23	128444.65	1556.67	5461.65	7018.31	1264.15
2005-06		21964.79	150409.65	2012.43	6203.62	8216.06	1194.70
2006-07		26542.23	168979.77	2442.34	7162.09	9604.43	1504.66
Sub Total		90784.00	-	8887.79	31090.52	39978.30	5794.50
2007-08	XI Plan	30879.23	199861.52	3101.12	8797.76	11898.88	2044.92
2008-09		36230.56	236092.07	3565.20	8631.66	12196.86	1903.97
2009-10		32074.86	268164.22	4654.78	10266.14	14920.92	2351.11
2010-11		32303.61	300464.06	5504.71	11858.86	17363.58	2597.52
2011-12		33895.28	334359.04	6110.55	12609.55	18720.10	3892.87
Sub Total		165383.53	-	22936.36	52163.97	75100.34	12790.40

Contd…

Table 4.6: Capital Expenditure, Working Expenses and Gross Receipts for Major and Medium Irrigation Projects at All India Level (up to 2017-18)

(Rs. In Cr)

Year	Annual Plan	Capital Expenditure		Working Expenses			Gross Receipts
		During the Year	Up to the end of the Year	Direction and Administration	Expenses other than Direction and Administration	Total	
1	2	3	4	5	6	7	8
2012-13	XII Plan	36097.64	370908.34	6497.26	14851.62	21348.87	3128.30
2013-14		36666.20	407574.54	6838.53	15288.23	22126.76	4348.74
2014-15		38535.84	449110.29	6978.80	15419.01	22097.82	4155.10
2015-16		42316.69	496704.51	7265.30	12480.75	19483.24	6218.30
2016-17		62015.20	557910.02	7376.53	11629.13	19005.66	4243.95
Sub Total		**215631.57**	**-**	**34956.41**	**69668.74**	**104062.35**	**22094.39**
2017-18		61782.18	619692.20	7907.85	11357.19	19265.04	7010.89
Sub Total		**61782.18**	**-**	**7907.85**	**11357.19**	**19265.04**	**7010.89**
Grand Total		**593309.36**	**-**	**81820.65**	**217011.88**	**298269.73**	**52554.18**

Source: Consolidated data from the publication 'Finance Accounts' published by States/UTs

Table 4.7: Capital Expenditure, Working Expenses and Gross Receipts for Minor Irrigation Projects at All India Level (up to 2017-18)

(Rs. in Cr)

Year	Annual Plan / 5-Year Plan	Capital Expenditure		Working Expenses			Gross Receipts
		During the Year	Up to the end of the Year	Direction and Administration	Expenses other than Direction and Administration	Total	
1	2	3	4	5	6	7	8
1992-93	VIII Plan	559.84	6502.96	71.26	879.18	950.44	58.47
1993-94		635.33	7138.29	82.27	1377.25	1459.52	68.98
1994-95		732.40	7898.25	107.02	1510.47	1617.49	98.84
1995-96		756.33	8654.58	117.09	1638.68	1755.77	111.52
1996-97		889.95	9533.14	138.30	1775.35	1913.64	103.84
Sub Total		3573.85	-	515.94	7180.92	7696.87	441.67
1997-98	IX Plan	906.22	10439.36	169.65	1737.28	1906.93	115.92
1998-99		1006.68	11346.24	215.83	1912.91	2128.74	101.37
1999-00		1141.59	12604.02	261.62	1475.22	1736.83	95.26
2000-01		965.23	10396.79	271.08	1733.24	2004.33	80.14
2001-02		1038.38	11435.17	276.88	1829.79	2106.66	80.15
Sub Total		5058.10	-	1195.05	8688.44	9883.49	472.85
2002-03	X Plan	1065.81	12502.56	316.67	1741.33	2058.00	101.18
2003-04		1608.77	14111.33	357.75	1659.57	2017.33	127.91
2004-05		2469.54	16580.87	390.58	1960.33	2350.91	144.68
2005-06		2884.00	19464.88	426.00	2096.97	2522.97	169.78
2006-07		3020.37	20261.37	536.27	2396.44	2932.71	177.32
Sub Total		11048.49	-	2027.27	9854.64	11881.90	720.87
2007-08	XI Plan	4045.68	26706.02	657.02	3000.30	3657.32	209.10
2008-09		4622.89	31328.82	695.22	3633.08	4328.30	216.24
2009-10		5669.51	37100.29	854.31	3953.55	4805.09	579.81
2010-11		6952.23	44052.52	977.76	4190.99	5205.58	641.18
2011-12		8456.32	52509.31	1140.12	4738.88	5879.00	453.89
Sub Total		29746.62	-	4324.42	19516.81	23875.29	2100.23
2012-13	XII Plan	9323.12	61832.44	1308.04	5016.87	6324.91	911.89
2013-14		10197.89	72030.32	1390.38	5307.87	6698.25	917.66
2014-15		10095.68	82098.65	1477.96	5345.41	6823.37	733.90
2015-16		12316.53	94424.68	1574.04	5607.83	7481.71	736.20
2016-17		13971.51	108396.19	1616.18	5760.80	7376.98	831.27
Sub Total		**55904.73**	**-**	**7366.61**	**27038.78**	**34705.22**	**4130.92**
2017-18		14759.68	123155.87	1778.96	6475.00	8253.96	740.18
Sub Total		**14759.68**	**-**	**1778.96**	**6475.00**	**8253.96**	**740.18**
Grand Total		**120091.47**	**-**	**17208.25**	**78754.58**	**96296.72**	**8606.71**

Source: Consolidated data from the publication 'Finance Accounts' published by States/UTs

Table 4.8: State-wise Financial Status of CAD&WM Component for 99 Prioritized Projects

Sl. No	Project Name	Targeted CCA (Th. Ha)	Targeted Expenditure (Rs. Cr)	Target CA (Rs. Cr)	2016-17 to 2020-21		
					CCA Covered (Th. Ha)	Expenditure Incurred (Rs. Cr)	CA Released (Rs. Cr)
1	2	3	4	5	6	7	8
1	Andhra Pradesh	178.620	970.980	349.373	0.000	0.920	69.180
2	Assam	49.687	215.458	96.637	23.400	39.600	7.550
3	Bihar	30.510	142.395	50.664	17.250	66.530	35.823
4	Chhattisgarh	42.625	159.760	79.570	0.000	0.000	21.710
5	Goa	11.777	137.920	18.770	1.050	36.240	3.840
6	Gujarat	1363.859	5021.765	2510.883	938.610	3608.290	1719.155
7	Jammu & Kashmir	2.460	11.639	5.241	1.693	6.503	3.570
8	Jharkhand	66.645	747.530	133.320	0.000	0.000	0.000
9	Karnataka	84.018	1016.590	175.600	34.844	154.160	75.280
10	Kerala	18.476	107.300	48.720	0.600	1.540	2.690
11	Madhya Pradesh	595.520	2536.988	1259.018	248.429	620.995	294.762
12	Maharashtra	500.601	2065.789	967.089	108.873	316.181	120.020
13	Manipur	13.062	87.553	44.358	8.670	35.160	0.000
14	Odisha	236.397	1266.055	420.397	71.590	354.688	131.964
15	Punjab	142.658	475.478	228.870	0.000	0.000	18.080
16	Rajasthan	117.975	450.880	230.050	30.730	82.350	51.389
17	Telangana	529.028	1460.730	702.206	10.680	5.220	36.340
18	Uttar Pradesh	524.381	1861.666	914.928	0.000	0.470	156.000
	Grand Total	**4508.299**	**18736.476**	**8235.694**	**1496.314**	**5328.85**	**2747.352**

Source: CAD&WM Wing, D/o Water Resources, RD & GR, M/o Jal Shakti

Table 4.9: Capital Expenditure, Working Expenses and Gross Receipts for CAD Programme (up to 2017-18)

(Rs. In Cr)

Year	Annual Plan	Capital Expenditure		Working Expenses			Gross Receipts
		During the year	up to the end of the year	Direction and Administration	Expenses other than Direction and Administration	Total	
1	2	3	4	5	6	7	8
1992-93	VIII Plan	83.04	606.04	0.60	210.11	210.70	0.00
1993-94		71.11	688.80	0.60	246.65	247.25	0.00
1994-95		83.38	772.19	0.73	267.27	268.00	0.00
1995-96		89.70	861.89	0.85	336.42	337.27	0.00
1996-97		135.02	996.91	0.82	297.34	298.16	0.00
Sub Total		462.25	-	3.60	1357.79	1361.38	0.00
1997-98	IX Plan	109.69	1106.60	1.04	316.67	317.71	0.00
1998-99		119.54	1226.14	1.39	334.26	335.65	0.00
1999-00		109.30	1335.44	1.67	354.71	356.39	0.00
2000-01		157.43	1476.16	1.20	393.20	394.40	0.00
2001-02		152.26	1628.39	1.18	354.16	355.34	0.00
Sub Total		648.22	-	6.47	1753.01	1759.48	0.00
2002-03	X Plan	97.01	1725.40	22.60	442.30	464.89	0.00
2003-04		77.47	1808.21	2.51	427.59	430.10	0.00
2004-05		139.50	1947.71	2.85	360.60	363.45	0.00
2005-06		165.59	2113.30	49.32	374.00	423.31	0.00
2006-07		172.95	2286.25	57.91	403.61	461.52	0.00
Sub Total		652.52	-	135.18	2008.09	2143.28	0.00
2007-08	XI Plan	233.84	2520.08	33.10	493.97	527.07	0.00
2008-09		255.11	2775.19	36.60	444.78	481.38	0.00
2009-10		319.04	3124.66	78.86	502.98	581.83	0.00
2010-11		551.42	3676.08	91.79	605.94	697.73	0.00
2011-12		332.46	4008.54	107.02	786.58	893.61	0.00
Sub Total		1691.86	-	347.37	2834.24	3181.61	0.00
2012-13	XII Plan	483.34	4491.88	69.52	793.52	868.43	0.00
2013-14		616.95	5108.83	112.99	785.87	898.86	0.00
2014-15		507.33	5616.17	133.21	758.14	890.95	0.00
2015-16		661.86	6277.40	112.67	1061.06	1173.72	0.00
2016-17		1086.47	7363.88	144.12	915.40	1059.54	0.00
Sub Total		3355.97	-	572.52	4313.98	4891.51	0.00
2017-18		633.09	7996.97	268.68	796.27	1064.94	0.00
Sub Total		633.09	-	268.68	796.27	1064.94	0.00
Grand Total		7443.91	-	1333.81	13063.39	14402.21	0.00

Source: Consolidated data from the publication 'Finance Accounts' published by States/UTs

4.10 National Projects

The Government of India initially declared 14 projects as National Projects in February, 2008. Later, Cabinet Committee on Infrastructure approved inclusion of Saryu Nahar Pariyojana in the scheme of National Project on 3rd August, 2012. Polavaram Irrigation Project was included under the scheme of National Projects vide Gazette notification dated 01.03.2014. Implementation of these projects is monitored by the High Powered Steering Committee constituted by Union Cabinet with Secretary, M/o JS, D/o WR, RD & GR as Chairman of the Committee. The proportion of Central share from 2016-17 onwards has been reduced to 60% from 75% except in case of projects in eight North Eastern States and three Himalayan States which will continue to get 90% of the cost as Central Grant.

The criteria for selection of National Projects are as under:

1. International projects where usage of water in India is required by a treaty or where planning and early completion of the project is necessary for the interest of the country.

2. Inter-State projects which are dragging on due to non-resolution of Inter-State issues relating to sharing of costs, rehabilitation, aspects of power production etc., including river interlinking projects.

3. Intra State projects with additional potential of more than 2 Lakh Ha and with no dispute regarding sharing of water and where hydrology is established.

4. Extension, Renovation and Modernization (ERM) projects envisaging restoration of lost irrigation potential of 2 Lakh Ha or more would be eligible for inclusion as a National Project subject to:

i. The Command Area Development & Water Management (CAD&WM) works shall be ensured in the entire command area of the ERM project.
ii. The CAD&WM works shall be taken up simultaneously with the ERM works so as to facilitate achievement of the benchmark efficiency for water use.
iii. The management of command area system by Water Users' Association (WUAs) after the ERM works will be necessary. The WUAs may be entrusted with the responsibility for the collection of irrigation service fees and for undertaking annual repairs by retaining a part of the fee collected.
iv. Independent evaluation of the project will be carried out after project implementation and the project should achieve the benchmark water use efficiency in practice as prescribed by Central Water Commission.

The 4th criteria for selection of National Projects were included on 28.09.2012 by the letter of D/o WR, RD & GR, M/o Jal Shakti.

Table 4.11: List of Water Resources Projects declared as National Projects

Sl. No	Name of the Project	Status	State River/Basin)	1) Irrigation Potential (Ha) 2) Power (MW) 3) Storage (MCM)	Central Assistance Released so far under Scheme of National Projects (Rs Cr)	Date of Completion
1	2	3	4	5	6	7
1	Indira Sagar Polavaram Project	Under Execution	Andhra Pradesh (Godavari)	1. 4.36 Lakh 2. 960 MW 3. 5511 MCM (Gross)	**Total= 11600.23**	April, 2022
2	Gosikhurd Irrigation Project	Under Execution	Maharashtra (Wainganga/ Godavari)	1) 2.50 Lakh 2) 26.5 MW 3) 1147.14 MCM (Gross)	**Total= 3535.946**	Dec, 2023
3	Shahpurkandi Dam Project	Under Execution	Punjab (Ravi)	1) 0.37 Lakh 2) 206 MW 3) 120.88 MCM (Gross)	**Total = 233.502**	August, 2024
4	Saryu Nahar Pariyojana	Under Execution	Uttar Pradesh (Diversion Scheme among Rivers Ghaghara, Saryu, Rapti & Bansagar/ Ganga)	1) 14.04 (NP Component:4.73) 2) – 3) Barrage	**Total = 2243.1**	December 2021
5	Teesta Barrage Project	Under Execution	West Bengal (Teesta)	1) 9.23 Lakh (NP component :5.27) 2) 1000 MW 3) Barrage	**Total = 178.20**	Project is at standstill since 2014-15 due to land acquisition issues
6	Ujh Multipurpose Project	Accepted by the Advisory Committee of DoWR	J&K (Ujh / Ravi)	1) 0.77 Lakh 2) 196 MW 3) 925 MCM (Gross)	Nil	---
7	Lakhwar Multipurpose Project	Accepted by the Advisory Committee of DoWR	Uttarakhand (Yamuna)	1) 0.3378 Lakh 2) 300 MW 3) 587.84 MCM (Gross)	Nil	----
8	Renuka Dam Project	Accepted by the Advisory Committee of DoWR	Himachal Pradesh (Giri/Yamuna)	1) Drinking water 2) 40 MW 3) 498.33 MCM (Live)	457.57#	---
9	Noa-Dihing Dam Project	Appraisal Stage	Arunachal Pradesh (Noa-Dihing)	1) 0.036 Lakh (CCA) 2) 72 MW 3) 322.00 MCM (Gross)	Nil	---
10	Kulsi Dam Project	Appraisal Stage	Assam (Kulsi) Tributary of Brahamputra	1) 0.395 Lakh (GIA) 2) 55 MW 3) 525.64 MCM (Gross)	Nil	---
11	Kishau Multipurpose Project	Revised DPR under Preparation	Himachal Pradesh/ Uttarakhand	1) 0.97 Lakh Ha 2) 660 MW 3) 1824 MCM (Gross)	Nil	---

Contd…

Table 4.11: List of Water Resources Projects declared as National Projects

Sl. No	Name of the Project	Status	State River/Basin)	1) Irrigation Potential (Ha) 2) Power (MW) 3) Storage (MCM)	Central Assistance Released so far under Scheme of National Projects (Rs Cr)	Date of Completion
1	2	3	4	5	6	7
12	Bursar HE Project	Appraisal Stage	J&K (Marusudar/ Chenab / Indus)	1) 1.74 Lakh (Indirect) 2) 800 MW 3) 616.74 MCM (Gross)	Nil	---
13	Ken Betwa Link Project	Appraisal Completed (Ph-1) / Comprehen sive DPR including Phase-II under Appraisal	Madhya & Uttar Pradesh (Ken &Betwa/ Yamuna Basin)	1) 9.04 Lakh 2) 130 MW 3) 3495 MCM (Live)	Nil	---
14	2nd Ravi Vyas Link Project	Under DPR / PFR stage	Punjab (Ravi Beas Link)	Harness water flowing across border (about 719.30 MCM in non-monsoon period)	Nil	---
15	Upper Siang Project	under DPR / PFR stage	Arunachal Pradesh (Siang)	1) Indirect 2) 9750 MW 3) 9200 MCM (Live) 4) Flood moderation	Nil	
16	Gyspa HE Project	under DPR / PFR stage	HP (Bhaga / Chenab / Indus)	1) 0.50 Lakh Ha 2) 300 MW 3) 912.78 MCM (Live)	Nil	

Source: National Projects Directorate, Central Water Commission, M/o Jal Shakti
Note:

In view of the SLP (C) No-19409 of 2015 (Arising out of impugned final order dated 20.11.2014 in CWP No-4739/2014 passed by Hon'ble High Court of H.P), Government of India had released as a special case one time assistance of Rs. 446.96 Cr vide its order dated 03.10.2016 for payment of compensation to the outsees whose land has been acquired for the project.

* Further, amount of Rs. 10.61 Crore has been released further to Himachal Pradesh vide letter dated 11.08.2021 of DoWR, RD & GR to transfer it to Himachal Pradesh Power Corporation Limited (HPPCL) for depositing the same with the Hon'ble High Court Shimla towards land acquisition of Renuka Dam as a grant under PMKSY – HKKP in the matter of Regular First Appeal RFA 161/2019 in compliance to Hon'ble High Court Order dated 30.07.2021.

4.12 External Assistance for Development of Water Resources

External assistance flows to the country in various forms; as multilateral or bilateral aid, loan, grants and commodity aid from various foreign countries and other donor agencies such as World Bank, Japan International Cooperation Agency (JICA), Asian Development Bank (ADB), Asian Infrastructure Investment Bank (AIIB) etc. for the implementation of irrigation and multipurpose projects.

External Assistance Directorate of Central Water Commission functions as a nodal Directorate for the techno-economical appraisal of such irrigation and multipurpose project proposals seeking external assistance, received from State Governments.

The important activities of Central Water Commission in Externally Aided Irrigation projects are:

1. Examining Concept Notes of proposed Externally Aided Projects (EAPs) for in- principle Consent for preparation of DPR.
2. Techno-economic Appraisal of DPR of proposed EAPs and preparation of TAC Note for putting the same before the Advisory Committee of the D/o WR, RD & GR on Irrigation, Flood Control and Multipurpose Projects.

4.13 Repair, Renovation and Restoration (RRR) of Water Bodies Scheme

The scheme of RRR of water bodies has multiple objectives such as reclamation of the lost irrigation potential, improvement of catchment area of the tanks, increase in storage capacity of water bodies and development of tourism and cultural activities.

Under this scheme, 3114 water bodies were completed with domestic support and 8054 water bodies were completed with external assistance. To increase the participation of all the States it was felt to frame a new scheme for RRR of Water Bodies during the XII plan as a State Sector Scheme with domestic budgetary support.

Government of India is committed to accord high priority to water conservation and its management. To this effect, Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) was launched in 2015-16. PMKSY- 'Har Khet Ko Pani' (HKKP) is one of the component of PMKSY. The scheme of RRR of water bodies has become a part of PMKSY (HKKP).

Funding pattern under PMKSY:

Sl. No.	Category	Funding Pattern Central: State
1	2	3
1.	Seven North-Eastern States including Sikkim & Hilly States (Himachal Pradesh, Uttarakhand), UTs of Jammu & Kashmir, Ladakh	90 : 10
2.	Project benefitting special areas i.e. undivided Koraput, Bolangir and Kalahandi (KBK) districts of Odisha, Bundelkhand region of UP and MP, Marathwada & Vidarbha region of Maharashtra, Naxal affected areas, DPAP areas, Tribal areas, Flood prone area, Desert Development Programme (DDP) area of General Category States / UTs.	60 : 40
3.	General Category States/UTs excluding the special areas.	25 : 75

There are 2218 water bodies (ongoing at start of XII plan/included thereafter) with an estimated cost of Rs. 1910 Cr. Under the programme, at present as reported by States (till March, 2021), restoration works of 1591 water bodies have been completed. Total Central Assistance released (till March, 2021) is Rs. 469.69 Cr.

4.14 National Water Mission and Climate Change Issue

The 'National Water Mission' was formulated by the erstwhile Ministry of Water Resources, River Development and Ganga Rejuvenation (now Ministry of Jal Shakti) with main objective of 'conservation of water, minimizing wastage and ensuring its more equitable distribution both across and within States through integrated water resources development and management'. The Mission, duly approved by the Government, has set five goals to achieve the above objective, which are:

1. Comprehensive water database in public domain and assessment of the impact of climate change on water resource.
2. Promotion of citizen and State actions for water conservation, augmentation and preservation.
3. Focused attention on vulnerable areas including over-exploited areas
4. Increasing water use efficiency by 20% in all sector
5. Promotion of basin level integrated water resources management.

Climate Change cell was created in CWC in August, 2007 to deal with all the studies, works and reports on the subject regarding impact of climate change on water resources being referred to CWC. CWC provides inputs and assistance to NWM Secretariat in examining the research proposals related to climate change received in NWM Secretariat. D/o WR, RD & GR, M/o Jal Shakti has established six Chairs in Academic institutes-IIT Kanpur, IIT Kharagpur, IIT Guwahati, IIT Roorkee, NIT Patna and NIT Srinagar with the objective of carrying out studies and research on 'Impact of climate change on Water Resources'. Monitoring of Glacial lakes/Water bodies in the Himalayan Region of Indian River Basin is being carried out on monthly basis from June to October. The main objective of the study is to monitor the changes in the spatial extent of the glacial lakes and water bodies greater than 50 Ha area with the area of base year 2009 using satellite data received from NRSC, Hyderabad. Monthly Monitoring Reports are sent to Central/State Government agencies and other stakeholders.

Base line Study of 22 completed important projects was taken up by NWM to know the status of water use activity.

****

Section-V
Flood Management

Floods are recurrent phenomena in India. Due to different climatic and rainfall patterns in different regions, it has been experienced that, while some parts are suffering from devastating floods, another part is suffering drought at the same time. With the increase in population and development activity, there has been a tendency to occupy the flood plains, which has resulted in damage of a more serious nature over the years. Often, because of the varying rainfall distribution, areas which are not traditionally prone to floods also experience severe inundation. Flooding is caused by the inadequate capacity within the banks of the rivers to contain the high flows brought down from the upper catchments due to heavy rainfall. Flood management refers to all the methods used to reduce or prevent the detrimental effects of flood waters.

Table 5.1: State-wise Flood Forecasting Stations as on 2021

Sl. No.	Name of State/UT	Number of Flood Forecasting Stations		
		Level	Inflow	Total
1	2	3	4	5
1	Andhra Pradesh	10	10	**20**
2	Arunachal Pradesh	3	0	**3**
3	Assam	30	0	**30**
4	Bihar	40	3	**43**
5	Chhattisgarh	1	2	**3**
6	Gujarat	6	7	**13**
7	Haryana	1	1	**2**
8	Himachal Pradesh	1	0	**1**
9	Jammu & Kashmir*	3	0	**3**
10	Jharkhand	2	15	**17**
11	Karnataka	1	14	**15**
12	Kerela	3	2	**5**
13	Madhya Pradesh	2	10	**12**
14	Maharashtra	8	15	**23**
15	Odisha	12	7	**19**
16	Rajasthan	4	11	**15**
17	Sikkim	3	5	**8**
18	Tamil Nadu	4	11	**15**
19	Telangana	5	8	**13**
20	Tripura	2	0	**2**
21	Uttar Pradesh	39	5	**44**
22	Uttarakhand	4	2	**6**
23	West Bengal	12	4	**16**

Contd…

Table 5.1: State-wise Flood Forecasting Stations as on 2021

Sl. No.	Name of State/UT	Number of Flood Forecasting Stations		
		Level	Inflow	Total
1	2	3	4	5
24	Daman & Diu*	1	0	**1**
25	NCT of Delhi	2	0	**2**
	Total	**199**	**132**	**331**

Source: FFM Directorate, Central Water Commission, M/o Jal Shakti
Note: * Union Territory

Table 5.2: Basin-wise Flood Forecasting Stations as on 2021

Sl. No	Major Interstate River Systems	FF Stations as on Date		
		Level	Inflow	Total
1	2	3	4	5
1	Indus and its Tributaries	3	0	**3**
2	Ganga & its Tributaries	96	39	**135**
3	Brahmaputra & its Tributaries	39	5	**44**
4	Barak System	6	0	**6**
5	Subarnarekha (i/c Burhabalang)	4	3	**7**
6	Brahmani & Baitarni	3	2	**5**
7	East Flowing Rivers (Mahanadi to Pennar)	4	4	**8**
8	Narmada	4	6	**10**
9	Tapi	1	2	**3**
10	Mahi	1	4	**5**
11	Sabarmati	1	1	**2**
12	Mahanadi	3	3	**6**
13	Godavari	18	24	**42**
14	Krishna	5	19	**24**
15	West Flowing Rivers (Kutch & Saurashtra)	1	1	**2**
16	West Flowing Rivers (Tapi to Tadri))	2	1	**3**
17	Cauvery and its Tributaries	3	9	**12**
18	Pennar	1	1	**2**
19	East Flowing Rivers (Pennar to Kanyakumari)	1	6	**7**
20	West Flowing Rivers (Tadri to Kanyakumari)	3	2	**5**
Total		**199**	**132**	**331**

Source: FFM Directorate, Central Water Commission, M/o Jal Shakti

Table 5.3: Flood Forecasting Performance from 2000 to 2020

Sl. No.	Year	No. of Level Forecasts Issued			No. of Inflow Forecasts Issued			Total No. of Forecasts Issued		
		Total	Within +/-15 cm of Deviation from Actual	Accuracy (%)	Total	Within +/-20% cumecs of Deviation from Actual	Accuracy (%)	Total	Within +/-15 cm or +/-20% cumecs of Deviation from Actual	Accuracy (%)
1	2	3	4	5	6	7	8	9	10	11
1	2000	5622	5504	97.90	821	747	90.99	6443	6251	97.02
2	2001	4606	4533	98.42	857	809	94.40	5463	5342	97.79
3	2002	3618	3549	98.09	623	602	96.63	4241	4151	97.88
4	2003	5989	5789	96.66	611	586	95.91	6600	6375	96.59
5	2004	4184	4042	96.61	705	654	92.77	4889	4696	96.05
6	2005	4323	4162	96.28	1295	1261	97.37	5618	5423	96.53
7	2006	5070	4827	95.21	1593	1550	97.30	6663	6377	95.71
8	2007	6516	6339	97.28	1707	1651	96.72	8223	7990	97.17
9	2008	5670	5551	97.90	1021	1003	98.24	6691	6554	97.95
10	2009	3343	3298	98.65	667	629	94.30	4010	3927	97.93
11	2010	6491	6390	98.44	1028	988	96.11	7519	7378	98.12
12	2011	4848	4795	98.91	1143	1109	97.03	5991	5904	98.55
13	2012	4200	4136	98.47	831	803	96.63	5031	4939	98.17
14	2013	5741	5471	95.30	1319	1289	97.73	7060	6760	95.75
15	2014	3884	3804	97.94	888	863	97.18	4772	4667	97.80
16	2015	3500	3429	97.97	572	562	98.25	4072	3991	98.01
17	2016	4969	4891	98.43	1270	1057	83.23	6239	5948	95.34
18	2017	5085	4975	97.84	1212	926	76.40	6297	5901	93.71
19	2018	4969	4871	98.03	1882	1624	86.29	6851	6495	94.80
20	2019	6004	5773	96.15	3750	2678	71.41	9754	8451	86.64
21	2020	8243	8133	98.67	3478	3065	88.13	11721	11198	95.54
Average		**5089**	**4965**	**97.56**	**1299**	**1165**	**89.68**	**6388**	**6129**	**95.95**

Source: FFM Directorate, Central Water Commission, M/o Jal Shakti

Forecast Performance (from 2000 to 2020)

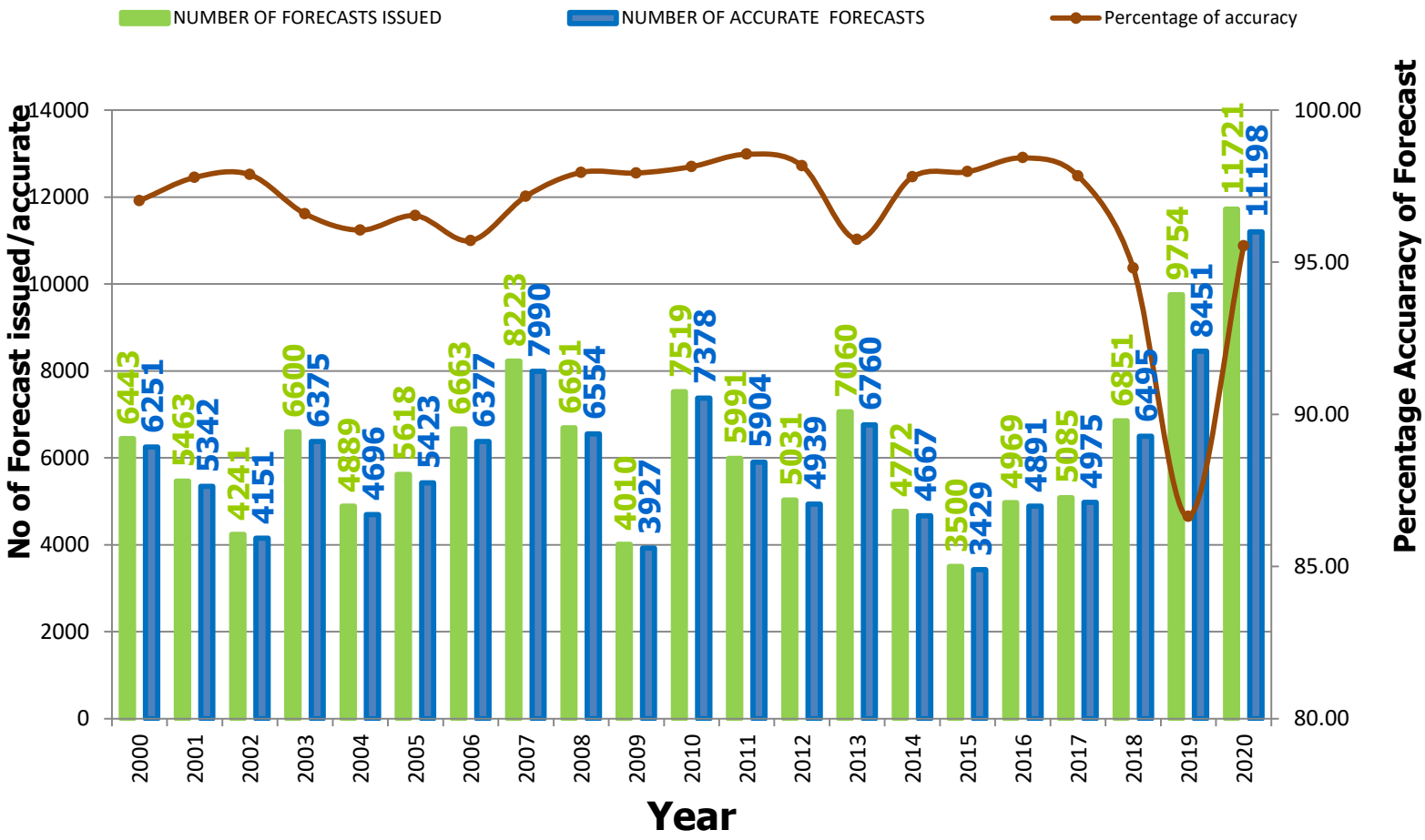


Table 5.4: Flood Damage during 2011 to 2020

Sl. No.	Year	Area Affected in Mha	Population Affected in Million	Damage to Crops		Damage to Houses		Cattle Lost No.	Human Lives Lost No.	Damage to Public Utilities in Rs. Cr.	Total Damages to Crops, Houses & Public Utilities in Rs. Cr (Col.6+8+11)
				Area in Mha	Value in Rs. Cr	Nos.	Value in Rs. Cr				
1	2	3	4	5	6	7	8	9	10	11	12
1	2011	1.90	15.97	2.72	1393.85	1152518	410.48	35982	1761	6053.57	7857.89
2	2012	2.14	14.69	1.95	1534.11	174526	240.57	31558	933	9169.97	10944.65
3	2013	7.55	25.93	7.48	6378.08	699525	2032.83	163958	2180	38937.84	47348.75
4	2014	12.78	26.51	8.01	7255.15	311325	581.98	60196	1968	7710.95	15548.08
5	2015	4.48	33.20	3.37	17043.95	3959191	8046.97	45597	1420	32200.18	57291.10
6	2016	7.06	26.55	6.66	4052.72	278240	114.68	22367	1420	1507.93	5675.33
7	2017	6.08	47.34	4.97	8951.98	1252914	9384.02	26673	2063	12329.85	30665.85
8	2018	7.72	37.40	2.52	3708.19	913414	2508.66	60279	1839	12132.92	21849.97
9	2019	11.604	46.35	10.688	10902.347	656595	462.787	25852	2754	4498.393	15863.526
10	2020	6.90	27.43	6.552	5626.023	237196	272.098	47463	1815	5458.007	21189.166
Total		**68.214**	**301.370**	**54.920**	**66846.400**	**9635444**	**24055.075**	**519925**	**18153**	**129999.610**	**234234.312**
Avg.		6.821	30.137	5.492	6684.640	963544	2405.508	51993	1815	12999.961	23423.431
Max.		12.780	47.340	10.688	17043.950	3959191	9384.020	163958	2754	38937.840	57291.100
(Year)		2014	2017	2019	2015	2015	2017	2013	2019	2013	2015

Source: FFM Directorate, Central Water Commission, M/o Jal Shakti

5.5 Flood Management Programme (FMP)

'Flood Management Programme (FMP)' is a State sector scheme amounting to Rs. 8,000 Cr under Central Plan proposed by M/o Jal Shakti, D/o WR, RD & GR was approved by the Government of India during XI Plan (November, 2007). The continuation of flood management programme has been approved by the Government of India during XII Plan with an outlay of Rs 10,000 Cr and revised guidelines issued during October, 2013.

A total 522 schemes costing Rs.13238.37 Cr were approved during XI (420 projects costing Rs. 7857.08 Cr) Plan and XII (102 projects costing Rs. 5381.29 Cr) Plan. Out of these schemes, 235 schemes have been physically and financially completed; 168 schemes were physically completed with outstanding financial liability; 36 schemes foreclosed & shifted and 83 schemes are ongoing. A Central Assistance of Rs. 4873.07 Cr was released during XI (Rs. 3566.00 Cr) and XII (Rs. 1307.07 Cr) Plan.

Table 5.6: State-Wise Status of Works Approved, Works Completed and Funds Released under Flood Management Programme (FMP) since start of XI Plan and up to 30.09.2021

(Rs in Cr)

Sl. No.	State	XI Plan			XII Plan			Total (XI + XII Plan)						2017-18	2018-19	2019-20	2020-21	2021-22	Total funds released
		Works Approved		Funds Released (XI Plan)	Works Approved		Funds Released (XII Plan)	Works Approved		Works completed	Works shifted/foreclosed	Works ongoing	Funds Released (XI + XII Plan)	Funds released	Funds released	Funds released	Funds released	Funds released	
		Nos.	Estimated Cost		Nos.	Estimated Cost		Nos.	Estimated Cost										
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	Arunachal Pradesh	21	224.69	81.69	0	0.00	87.91	**21**	**224.69**	21	0	0	169.60	21.18					190.78
2	Assam	100	996.14	748.86	41	1386.97	64.89	**141**	**2383.11**	105	30	6	813.75	245.49	142.118	85.03			1286.39
3	Bihar	43	1370.42	723.18	4	447.63	184.64	**47**	**1818.05**	42	1	4	907.82		16.583				924.41
4	Chhattisgarh	3	31.13	15.57	0	0.00	3.75	**3**	**31.13**	3	0	0	19.32						19.32
5	Goa	2	22.73	9.98	0	0.00	2.00	**2**	**22.73**	2	0	0	11.98						11.98
6	Gujarat	2	19.79	2.00	0	0.00	0.00	**2**	**19.79**	2	0	0	2.00						2.00
7	Haryana	1	173.75	46.91	0	0.00	0.00	**1**	**173.75**	1	0	0	46.91						46.91
8	Himachal Pradesh	3	225.32	165.98	4	1139.62	221.87	**7**	**1364.94**	6	1	0	387.85	87.50	162.6	176.41	11.87		826.23
9	Jammu & Kashmir	28	408.22	252.57	15	562.47	169.95	**43**	**970.69**	19	3	21	422.52	110.40	52.1984	92.81	10.14		688.0
10	Jharkhand	3	39.30	18.44	0	0.00	4.27	**3**	**39.30**	3		0	22.71						22.71
11	Karnataka	3	59.46	23.80	0	0.00	0.00	**3**	**59.46**	2	1	0	23.80						23.80

Contd…

Table 5.6: State-Wise Status of Works Approved, Works Completed and Funds Released under Flood Management Programme (FMP) since start of XI Plan and up to 30.09.2021

(Rs in Cr)

Sl. No.	State	XI Plan			XII Plan			Total (XI + XII Plan)						2017-18	2018-19	2019-20	2020-21	2021-22	Total funds released
		Works Approved		Funds Released (XI Plan)	Works Approved		Funds Released (XII Plan)	Works Approved		Works completed	Works shifted/foreclosed	Works ongoing	Funds Released (XI + XII Plan)	Funds released	Funds released	Funds released	Funds released	Funds released	
		Nos.	Estimated Cost		Nos.	Estimated Cost		Nos.	Estimated Cost										
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
12	Kerala	4	279.74	63.68	0	0.00	55.22	**4**	**279.74**	2	2	0	118.90	19.05					137.95
13	Manipur	22	109.34	66.34	0	0.00	24.36	**22**	**109.34**	22		0	90.70						90.70
14	Meghalaya	0	0.00	3.81	0	0.00	0.00	**0**	**0.00**	0		0	3.81						3.81
15	Mizoram	2	9.13	14.48	0	0.00	1.93	**2**	**9.13**	1	1	0	16.41	0.47					16.88
16	Nagaland	11	49.35	28.96	6	74.52	54.17	**17**	**123.87**	14		3	83.12		10.841				93.96
17	Odisha	67	169.00	101.12	1	62.32	0.00	**68**	**231.32**	66	2	0	101.12				15.785		116.905
18	Puducherry*	1	139.67	7.50	0	0.00	0.00	**1**	**139.67**	0	1	0	7.50						7.50
19	Punjab	5	153.40	40.43	0	0.00	0.00	**5**	**153.40**	4	1	0	40.43						40.43
20	Sikkim	28	104.92	83.69	17	261.40	8.15	**45**	**366.32**	28	17	0	91.84						91.84
21	Tamilnadu	5	635.54	59.82	0	0.00	0.00	**5**	**635.54**	5		0	59.82						59.82
22	Tripura	11	26.57	23.62	0	0.00	0.00	**11**	**26.57**	11		0	23.62						23.62
23	Uttar	26	667.57	290.69	3	291.70	111.22	**29**	**959.27**	24	2	3	401.91	13.55	15.575	39.15			470.18
24	Uttarakhand	12	119.82	49.63	10	715.72	153.98	**22**	**835.54**	16	2	4	203.61		4.634	35.58			243.82
25	West Bengal	17	1822.08	643.26	1	438.94	158.75	**18**	**2261.02**	16		2	802.01	65.03	23.652	117.12			1007.81
Total		**420**	**7857.08**	**3566.00**	**102**	**5381.28**	**1307.07**	**522**	**13238.36**	**415**	**64**	**43**	**4873.07**	**562.67**	**428.20**	**546.09**	**37.795**		**6447.83**

Source: FMP Directorate, CWC, M/o Jal Shakti

'*' The scheme has been shifted to be funded under RMBA component.

Table 5.7: Physical Achievements of Flood Management Works till March, 2017*

S.No.	Name of States /UTs	Area Benefited	Length of embankments	Length of drainage channel	Village raised/ protected	Town/ Vill. protection works	Raised Platforms
		Mha	Km	Km	(Nos)	(Nos)	(Nos)
1	2	3	4	5	6	7	8
1	Andhra Pradesh	1.310	2230.000	13569.000	23	72	0
2	Arunachal Pradesh	0.100	65.230	16.920	17	30	0
3	Assam	2.110	4473.820	874.970	1100	911	0
4	Bihar	3.692	3759.910	365.000	0	204	58
5	Chattisgarh	0.000	0.000	0.000	0	0	0
6	Delhi	0.078	83.000	453.000	0	0	0
7	Goa	0.003	23.190	32.770	0	2	0
8	Gujarat	0.483	104.120	271.000	30	805	0
9	Haryana	2.000	1144.000	4385.000	98	448	7
10	Himachal Pradesh	0.018	159.160	11.000	82	0	0
11	Jammu & Kashmir	0.217	560.681	324.000	1301	22	0
12	Jharkhand	0.001	14.000	0.000	5	2	0
13	Karnataka	0.005	73.515	10.000	0	0	0
14	Kerala	0.346	205.744	82.190	6	4	0
15	Madhya Pradesh	0.004	26.000	0.000	0	37	0
16	Maharashtra	0.001	44.500	110.000	0	0	0
17	Manipur	0.132	577.000	166.000	512	38	0
18	Meghalaya	0.015	112.000	0.000	10	8	0
19	Mizoram	0.000	0.000	0.000	0	38	0
20	Nagaland	0.632	10.519	0.000	0	8	0
21	Orissa	0.630	7137.750	650.000	14	29	0
22	Punjab	3.190	1370.000	6622.000	0	3	0
23	Rajasthan	0.082	145.000	197.000	0	25	0
24	Sikkim	0.041	101.810	64.860	0	18	0
25	Tamil Nadu	0.122	87.000	19.000	4	46	0
26	Tripura	0.033	141.740	95.230	0	11	0
27	Uttar Pradesh	1.703	3813.970	3995.000	4511	65	0
28	Uttaranchal	0.002	9.000	0.000	0	6	0
29	West Bengal	3.584	10539.00	7392.760	0	74	0
	Union Territories						
30	A & N Islands	0.000	0.00	0.00	0		0
31	Chandigarh	0.000	0.00	0.00	0		0
32	Dadra & Nagar Haveli	0.000	0.00	0.00	0		0
33	Daman & Diu	0.000	0.00	0.00	0		0
34	Lakshadweep	0.000	0.00	0.00	0		0
35	Pondicherry	0.004	61.00	20.00	0		0
Total		**20.538**	**37072.659**	**39726.700**	**7713**	**2906**	**65**

Source: FMP Directorate, Central Water Commission, M/o Jal Shakti

*Tentative; as the table has been compiled from available information in office and website of various State Govts.

5.8 River Management Activities & Works related to Border Areas (RMBA) Component:

This started as a Central Sector Scheme with an outlay of Rs. 820 Cr in XI plan for taking up non-structural measures such as Hydrological Observation and Flood Forecasting works on common border rivers, payment to neighbouring countries (China) for supplying HO data on common rivers, investigation of WR projects in neighbouring countries, activities of GFCC and Pancheshwar Development Authority (PDA) was funded through this scheme. In addition to above activities, 100% Central Assistance was also provided for taking up structural measures such as Anti Erosion/Flood Management schemes on rivers on international borders and Union Territories. The scheme with an outlay of Rs. 740 Cr was also continued during XII Plan. A Central Assistance (as Grant-in-Aid) of Rs. 563.61 Cr was released during XI & XII Plan (XI plan-Rs. 340.41 Cr and XII Plan-Rs. 223.2 Cr).

5.9 Flood Management and Border Areas Programme (FMBAP)

A comprehensive scheme titled 'Flood Management and Border Areas Programme (FMBAP)' with an outlay of Rs. 3342.00 Cr (FMP-Rs. 2642 Cr & RMBA-Rs. 700 Cr) for period 2017-2020 with merged components from the existing Flood Management Programme (FMP) and River Management Activities & Works related to Border Areas (RMBA) schemes during XII Five Year Plan has been approved by the Union Cabinet on 7th March, 2019 and aims at completion of the on-going projects already approved under FMP. The scheme has been extended till March, 2021.

A total 522 schemes costing Rs.13238.37 Cr were approved during XI (420 projects costing Rs. 7857.08 Cr) Plan and XII (102 projects costing Rs. 5381.29 Cr) Plan. Out of these schemes, 415 schemes have been completed; 64 schemes foreclosed and shifted and 43 schemes are ongoing. These 415 completed schemes have been given protection to an area of around 4.994 Mha and protected a population of about 52.21 Million.

Release under the FMP as well as RMBA is as under:

(Rs. In Cr)

Releases under FMP and RMBA since XI Plan										
Sl. No.	**Component**	**XI Plan**	**XII Plan**	**Total during (XI+XII)**	**FY: 2017-18**	**FY: 2018-19**	**FY: 2019-20**	**FY: 2020-21**	**Total during 2017-21**	**Total Funds Released as on date**
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
1	FMP	3566.00	1307.07	4873.07	562.67	428.20	546.09	37.79	1574.76	6447.83
2	RMBA (Grant-in-Aid)	340.41	223.20	563.61	159.25	256.48	69.61	42.49	527.83	1091.43
Total Outlay: 22902		**3906.41**	**1530.27**	**5436.7**	**721.92**	**684.68**	**615.70**	**64.50**	**2086.8**	**7539.26**

Source: FMP Directorate, Central Water Commission, M/o Jal Shakti

Table 5.10: Distribution of Revenue Expenditure by Sub-major Head of Accounts

(Rs. in Cr)

Sl. No.	Year/Plan Period	Flood Control	Anti-sea-Erosion	Drainage	General	Total
1	2	3	4	5	6	7
1	1998-99	331.15	15.13	176.86	4.62	527.76
2	1999-00	353.02	21.51	189.79	42.09	606.41
3	2000-01	395.08	12.25	186.32	126.75	720.41
4	2001-02	407.91	19.67	156.07	79.88	663.52
5	2002-03	322.94	9.87	166.36	13.71	512.88
6	2003-04	406.59	13.87	156.82	8.12	585.40
7	2004-05	389.53	12.26	157.28	2.01	561.07
8	2005-06	479.51	18.64	193.15	2.11	693.41
9	2006-07	535.66	11.98	196.38	3.05	747.06
10	2007-08	553.47	21.93	144.82	0.52	720.74
11	2008-09	781.67	66.50	215.37	0.41	1063.95
12	2009-10	841.14	28.89	292.06	0.00	1162.09
13	2010-11	790.76	31.46	309.16	0.37	1131.75
14	2011-12	1250.57	45.05	287.94	0.88	1584.44
15	2012-13	1338.74	83.05	368.72	0.60	1791.10
16	2013-14	1473.99	54.39	315.72	1.86	1845.97
17	2014-15	1552.82	54.50	369.57	0.78	1977.67
18	2015-16	1334.69	56.93	198.66	0.00	1590.29

Source: Consolidated data from the publication 'Finance Accounts' published by States/UTs

Table 5.11: Distribution of Capital Expenditure by Sub-major Head of Accounts

(Rs. in Cr)

Sl. No.	Year/Plan Period	Flood Control	Anti-sea-Erosion	Drainage	General	Total
1	2	3	4	5	6	7
1	1998-99	227.76	39.51	168.80	0.00	436.06
2	1999-00	308.93	26.71	150.55	0.00	486.20
3	2000-01	308.40	20.31	173.32	0.00	502.03
4	2001-02	355.50	29.62	177.42	0.00	562.54
5	2002-03	317.84	35.88	107.75	0.00	461.47
6	2003-04	307.91	54.37	102.08	0.00	464.36
7	2004-05	524.50	57.67	110.84	0.00	693.02
8	2005-06	727.52	62.87	288.38	0.00	1078.77
9	2006-07	976.33	71.80	247.62	0.00	1295.75
10	2007-08	1369.46	107.80	264.38	0.00	1741.63
11	2008-09	2007.18	188.99	313.27	0.00	2509.44
12	2009-10	2760.11	220.26	284.52	0.00	3264.89
13	2010-11	3161.57	160.97	234.41	0.00	3556.96
14	2011-12	3995.36	48.24	286.49	0.00	4330.09
15	2012-13	3623.44	114.92	431.91	0.00	4170.27
16	2013-14	3308.94	148.98	368.61	0.00	3826.53
17	2014-15	4800.48	131.35	518.61	0.00	5450.44
18	2015-16	3912.91	129.62	530.76	0.00	4573.29

Source: Consolidated data from the publication 'Finance Accounts' published by States/UTs

5.12 Morphological Studies

The study of river morphology and implementation of suitable river training works as appropriate have become imperative for our nation as large areas of the country are affected by floods every year causing severe damage to life and property in-spite of existing flood control measures taken both by Central and State Governments.

The morphological studies of 15 Rivers (Ganga, Sharda, Rapti, Kosi, Bagmati, Yamuna, Bramhaputra, Subansiri, Pagladiya, Krishna, Tungbhadra, Mahananda, Mahanadi, Hoogli & Tapti) by using Remote Sensing technology have been awarded to IITs /NITs on nomination basis. The details and status of these studies are given below:

Sl. No.	Institute	Name of Rivers	Status
1	2	3	4
1	IIT Roorkee	Ganga, Sharda, Rapti	Completed & accepted by Central Evaluation & Monitoring Committee (CEMC)
2	IIT Delhi	Kosi, Bagmati, Yamuna	Final Report of Yamuna Submitted. Studies of Kosi and Bagmati are under process.
3	IIT Guwahati	Bramhaputra, Subansiri, Pagladiya	Final Report Submitted & yet to be accepted by Central Evaluation and Monitoring Committee (CEMC)
4	IIT Madras	Krishna, Tungbhadra	Final Report Submitted & yet to be accepted by Central Evaluation and Monitoring Committee (CEMC)
5	IIT Kharagpur	Mahananda, Mahanadi, Hoogly	Final Report Submitted & yet to be accepted by Central Evaluation and Monitoring Committee (CEMC)
6	SVNIT Surat	Tapi	Completed & accepted by Central Evaluation & Monitoring Committee (CEMC)

Section-VI

Navigation-Inland Water and Transport

India is endowed with a variety of navigable waterways comprising river systems, canals, back waters, creeks and tidal inlets. However, navigation by mechanized crafts is possible only over a limited length covering about half of the reported navigable waterways. Length of waterways along with its navigable length is an indicator of inland water potential of a State.

6.1 National Waterways

Criteria for declaration of National Waterway

- It should possess capability of navigation by mechanically propelled vessels of minimum 300 Tonnes (DWT) capacity (45 m x 8 m x1.2 m);
- It should have a fairway of minimum 40 m wide channel with 1.4 m depth in case of rivers and minimum 30 m wide channel with 1.8 m depth in case of canals. Exception may be given in case of irrigation-cum-navigation canals based on request of the concerned State Government in order to safeguard the interest of irrigation;
- It should be a continuous stretch of minimum 50 km; the only exception to be made to waterway length is for urban conglomerations and intra-port traffic; and
- It should pass through and serve the interest of more than one States or connect a vast and prosperous hinterland and major port, or either pass through or connect a strategic region where development of navigations is considered necessary to provide logistic support for economic development or national security, or connect place not served by any other mode of transport.

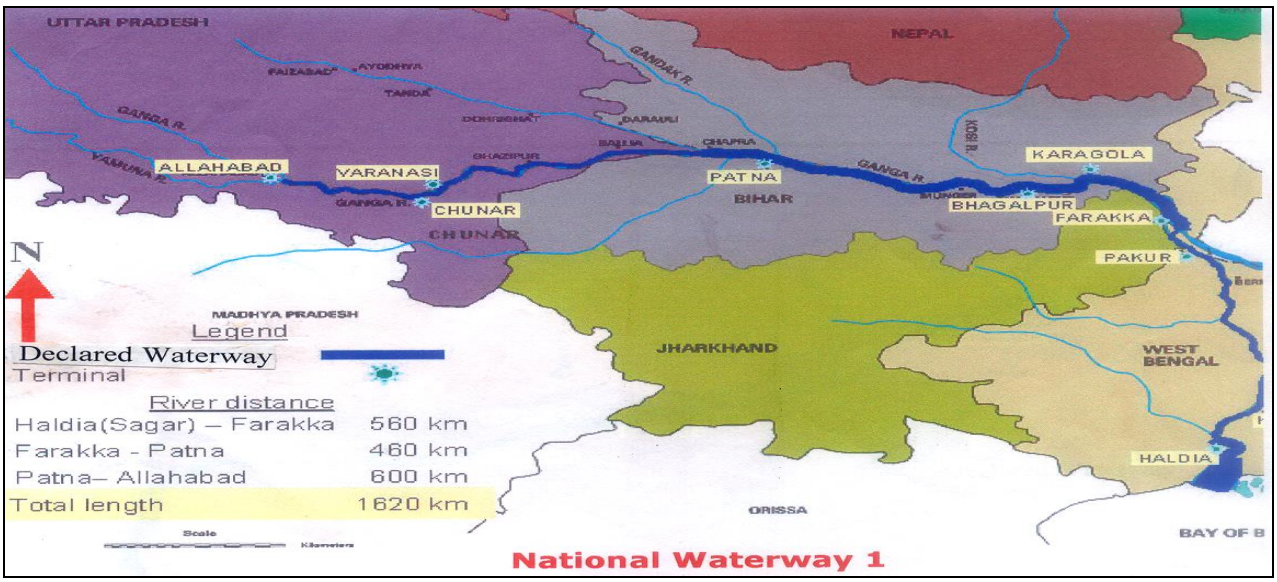
To promote Inland Water Transport (IWT) in the country, the following five waterways had been declared as National Waterways till the enactment of National Waterways Act, 2016 (effective from 12.04.2016):

(a) Allahabad-Haldia stretch (1620 km) of Ganga-Bhagirathi-Hooghly River System was declared National Waterway-1 in 1982 and effective in October, 1986.
(b) Sadiya-Dhubri stretch (891 km) of the Brahmaputra River was declared National Waterways-2 in September, 1988.
(c) Kottapuram-Kollam stretch (168 km) of the West Coast Canal along with Champakara canal (14 km) and Udyogmandal canal (23 km) was declared National Waterways-3 in February, 1993 (Total 205 km).
(d) Kakinada- Puducherry canals along with Godavari and Krishna Rivers (1078 km) as National Waterway-4 in 2008 and
(e) East Coast Canal integrated with Brahmani River and Mahanadi Delta Rivers (588 km) as National Waterway-5 in 2008.

6.1.1 National Waterways-1 (The Ganga-Bhagirathi-Hooghly)

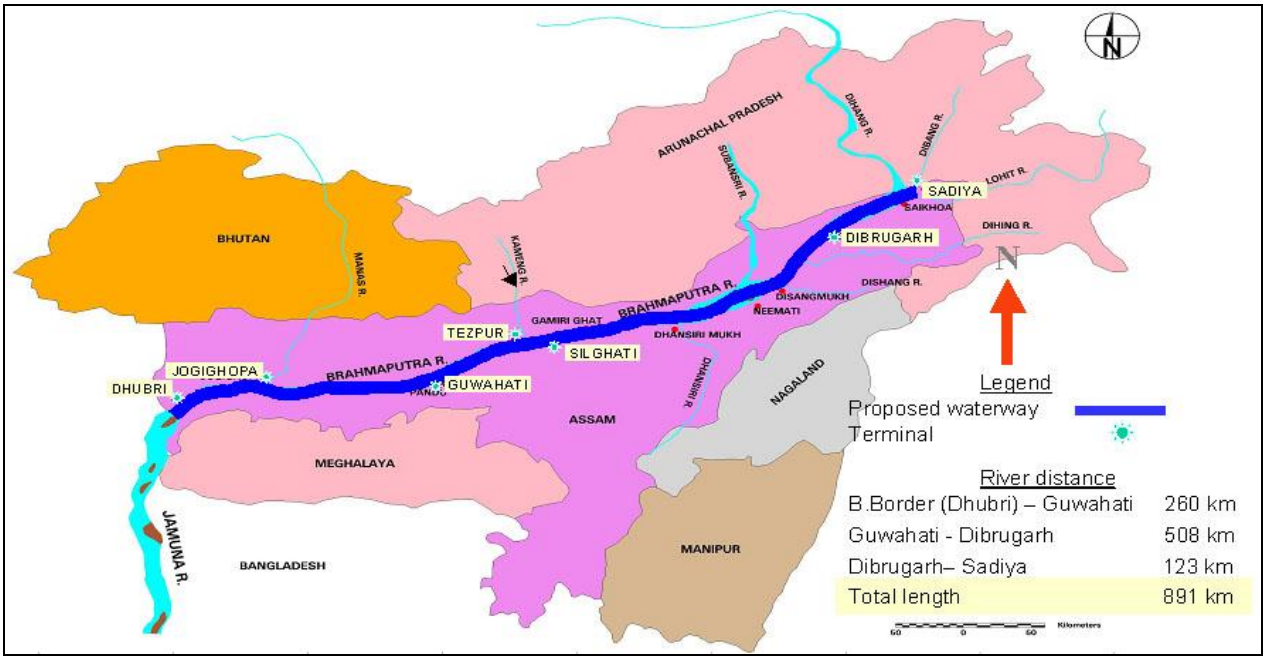
The Ganga - Bhagirathi - Hooghly River System between Haldia (Sagar) and Allahabad (1620 km) was declared as National Waterway-1 in 1986. Since then IWAI is carrying out various developmental works on the waterway for improvement of its navigability and also development

and maintenance of other infrastructure such as navigation aids and terminal facilities as laid down in the IWAI Act, 1985 (82 of 1985). During 2019-20, the important works carried out for development and maintenance of fairway, navigational aids and terminal facilities on NW-1 for maintenance of the following Least Available Depth (LAD):



6.1.2 National Waterways-2 (River Brahmaputra)

National Waterway-2: River Brahmaputra from Dhubri (Bangladesh Border) to Sadiya (891 km) was declared as National Waterway-2 (NW-2) in 1988. The waterway is being developed with fairway of required depth and width, day and night navigation aids and terminals.



The facilities created on NW-2 and planned in the near future are as under:

(i) Fairway development works/River conservancy works:

A navigable fairway of 45 m width and 2.5 m Least Available Depth (LAD) from Dhubri to Neamati (629 km), 2.0 m LAD from Neamati to Dibrugarh (139 km) and 1.5 m LAD from Dibrugarh to Sadiya (123 km)/Oriumghat (92 km) has been provided. Annual river conservancy works like Bandalling and maintenance dredging are carried out regularly to maintain the navigable fairway.

6.1.3 National Waterway-3 (West Coast Canal)

West Coast Canal from Kottapuram to Kollam (168 km) together with Champakara canal (14 km) and Udyogmandal canal (23 km) was declared as NW-3 in 1993. The National Waterways Act, 2016 included stretch of West Coast Canal from Kottapuram to Kozhikode for a length of 160 km, thereby extending the total length of NW-3 to 365 km. IWAI is conducting channel developmental works that includes dredging for providing fairway of 2.20 m LAD, channel width of 38 / 32 m, 24 hours navigational facilities and terminal facilities equipped with mechanical cargo handling equipment. IWAI has constructed nine permanent terminals at Kottapuram, Aluva, Maradu, Vaikkom, Thanneermukkom (Cherthala), Alapuzha, Kayamkulam, Thrikkunnapuzha and Kollam. In addition, two terminals with Ro-Ro facilities have been constructed by IWAI at Bolghatty and Willingdon Island. NW-3 is provided with 24 hours navigational aids in the entire route. An average tonnage of 7.57 Lakh Tonnes of cargo moved on NW-3 per annum in the last five years. IWAI has sanctioned Rs. 38 Cr for reconstruction of lock gate at Trikkunnapzha across NW-3 for utilization of full capacity of NW-3 under execution through State Govt. of Kerala. The NW-3 is fully navigable.

6.1.4 National Waterway-4

National Waterway-4 was declared in 2008 for the length of 1,078 km comprising of the Kakinada-Puducherry stretch of canals and the Kaluvelly Tank, Bhadrachalam-Rajahmundry stretch of River Godavari and Wazirabad-Vijayawada stretch of River Krishna in Andhra Pradesh & Tamil Nadu. With the notification of the National Waterways Act 2016, the total length of NW-4 got extended to 2,890 km.

6.1.5 National Waterway-5

NW-5, notified on 25.11.2008, comprises of Talcher-Dhamra stretch of river Brahmani, Geonkhali-Charbatia stretch of East Coast Canal, Charbatia-Dhamra stretch of Matai river & Mangalgadi- Paradip stretch of Mahanadi delta rivers with a total distance of 588 km (497 km in Odisha and 91 km in West Bengal). MoU is being renewed between IWAI, Govt. of Odisha (GoO), Paradip Port Trust (PPT) and Dhamra Port Company Ltd. (DPCL), for developing the commercially viable stretch of 332 km between Paradip/Dhamra and Talcher, in two phases:

Phase-I: Dhamra/Paradip Port to Pankopal (201 km)
Phase-II: Pankopal to Talcher (131 km)

6.2 Development of 106 new National Waterways

Government declared 111 (including 5 existing and 106 new) National Waterways (NWs) spread over 24 States under the National Waterways Act, 2016, which came into effect from 12th April, 2016 to promote Inland Water Transport (IWT) in the country. A list of all the NWs with their approx. length is given in table 3.3.6. Efforts initiated towards undertaking the developmental activities for providing safe fairway channel and creating infrastructures, in phased manner on the identified new National Waterways from 2016-17.

6.2.1 Status of 106 new National Waterways

I. The Feasibility Reports (FRs) and the Detailed Project Reports (DPRs) of new 106 NWs, have now been completed. After detailed analysis of the outcomes and recommendations of the FRs/DPRs, input from stakeholders, 106 NWs have been categorized into three categories. The detailed parameters which have been analyzed and considered for above categorization has been elaborated in the Annex below mentioned each Category:

1	Category 'A': Feasible NWs with Cargo	18 NWs	NW-9, 10, 16, 27, 68, 111, 25, 28, 37, 40, 44, 73, 85, 86, 97, 100, 57 & 94
2	Category 'B': Feasible NWs with only Tourism potential/Ferry/Cruise	25 NWs	NW-6, 7, 8, 14, 15, 18, 20, 23, 24, 29, 30, 36, 42, 47, 50, 52, 83, 87, 88, 90, 91, 95, 104, 108 & 110
3	Category 'C': NWs not feasible for Cargo/Cruise	63 NWs	Remaining NWs except enlisted in 1 & 2 above

II. In addition to earlier existing 5 NWs as detailed in Para 8 above, new national waterways which are considered the most viable and where development activities have been initiated in Phase I are:

1. River Barak (NW-16),
2. River Gandak (NW-37),
3. Sundarbans (Protocol Route) Waterways (NW -97),
4. Cumberjua River (NW-27),
5. Mandovi River (NW-68),
6. Zuari River (NW-111),
7. Alappuzha – Kottayam –Athirampuzha Canal (NW -9) and
8. Rupnarayan River (West Bengal) (NW -86)

Table 6.3: List of 111 National Waterways
(Government of India has declared 111 Waterways as National Waterways through National Waterways Act, 2016 enacted on 12.04.2016)

Sl. No.	National Waterway No.	Details of Waterways	States	Length (in km)
1	2	3	4	5
1	National Waterway 1	Ganga-Bhagirathi-Hooghly River System (Haldia - Allahabad)	Uttar Pradesh, Bihar, Jharkhand & West Bengal	1620
2	National Waterway 2	Brahmaputra River (Dhubri-Sadiya)	Assam	891
3	National Waterway 3	West Coast Canal (Kottapuram- Kollam), Champakara and Udyogmandal Canals	Kerala	205
		West Coast Canal (Kottapuram-Kozhikode)		170
4	National Waterway 4	Kakinada Canal (Kakinada to Rajahmundry)	Andhra Pradesh, Telangana, Chhattisgarh, Karnataka, Tamil Nadu, Puducherry and Maharashtra	50
		Godavari River (Bhadrachalam to Rajahmundry)		171
		Eluru Canal (Rajahmundry To Vijayawada)		139
		Krishna River (Wazirabad to Vijayawada)		157
		Commamur Canal (Vijayawada to Peddaganjam)		113
		North Buckingham Canal (Peddaganjam to Central StationofChennai)		316
		South Buckingham Canal (Central Station of Chennai to Marakanam)		110
		Marakanamto Puducherry Through KaluvellyTank		22
		River Godavari (Bhadrachalam-Nashik)		1202
		River Krishna (Wazirabad - Galagali)		636
5	National Waterway 5	East Coast Canal and Matai River	Odisha and West Bengal	256

Contd…

Table 6.3: List of 111 National Waterways
(Government of India has declared 111 Waterways as National Waterways through National Waterways Act, 2016 enacted on 12.04.2016)

Sl. No.	National Waterway No.	Details of Waterways	States	Length (in km)
1	2	3	4	5
		Brahmani-Kharsua-Dhamra Rivers		265
		Mahanadi Delta Rivers (Consisting of Hansua River, Nunanala, Gobrinala, Kharnasi River and Mahanadi River)		67
6	National Waterway 6	Aai River	Assam	68
7	National Waterway 7	Ajoy (Ajay) River	West Bengal	90
8	National Waterway 8	Alappuzha- Changanassery Canal	Kerala	29
9	National Waterway 9	Alappuzha- Kottayam-Athirampuzha Canal	Kerala Alternate route:11.5 km	40
10	National Waterway10	AmbaRiver	Maharashtra	45
11	National Waterway 11	Arunawati - Aran River System	Maharashtra	99
12	National Waterway 12	Asi River	Uttar Pradesh	5.5
13	National Waterway 13	Avm Canal	Kerala &Tamil Nadu	11
14	National Waterway 14	Baitarni River	Odisha	48
15	National Waterway 15	Bakreswar- Mayurakshi River System	West Bengal	135
16	National Waterway 16	Barak River	Assam	121
17	National Waterway 17	Beas River	Himachal Pradesh & Punjab	189
18	National Waterway 18	Beki River	Assam	69
19	National Waterway 19	Betwa River	Uttar Pradesh	67
20	National Waterway 20	Bhavani River	Tamil Nadu	95
21	National Waterway 21	Bheema River	Karnataka & Telangana	139
22	National Waterway 22	Birupa-Badi Genguti-Brahmani River System	Odisha	156
23	National Waterway 23	Budha Balanga	Odisha	56
24	National Waterway 24	Chambal River	Uttar Pradesh	61
25	National Waterway 25	Chapora River	Goa	33
26	National Waterway 26	Chenab River	Jammu & Kashmir	51

Contd…

Table 6.3: List of 111 National Waterways
(Government of India has declared 111 Waterways as National Waterways through National Waterways Act, 2016 enacted on 12.04.2016)

Sl. No.	National Waterway No.	Details of Waterways	States	Length (in km)
1	2	3	4	5
27	National Waterway 27	Cumberjua River	Goa	17
28	National Waterway 28	Dabhol Creek -Vashishti River System	Maharashtra	45
29	National Waterway 29	Damodar River	West Bengal	132
30	National Waterway 30	Dehing River	Assam	109
31	National Waterway 31	Dhansiri/Chathe	Assam	114
32	National Waterway 32	Dikhu River	Assam	63
33	National Waterway 33	Doyans River	Assam	61
34	National Waterway 34	Dvc Canal	West Bengal	137
35	National Waterway 35	Dwarekeswar River	West Bengal	108
36	National Waterway 36	Dwarka River	West Bengal	119
37	National Waterway 37	Gandak River	Bihar & Uttar Pradesh	296
38	National Waterway 38	Gangadhar River	Assam & West Bengal	62
39	National Waterway 39	Ganol River	Meghalaya	49
40	National Waterway 40	Ghaghra River	Bihar & Uttar Pradesh	354
41	National Waterway 41	Ghataprabha River	Karnataka	112
42	National Waterway 42	Gomti River	Uttar Pradesh	514
43	National Waterway 43	Gurupur River	Karnataka	10
44	National Waterway 44	Ichamati River	West Bengal	63
45	National Waterway 45	Indira Gandhi Canal	Punjab, Haryana & Rajasthan	650
46	National Waterway 46	Indus River	Jammu & Kashmir	35
47	National Waterway 47	Jalangi River	West Bengal	131
48	National Waterway 48	Jawai-Luni-Rann of Kutch River System	Gujarat & Rajasthan	590
49	National Waterway 49	Jhelum River	Jammu & Kashmir	110
50	National Waterway 50	Jinjiram River	Assam & Meghalaya	43
51	National Waterway 51	Kabini River	Karnataka	23
52	National Waterway 52	Kali River	Karnataka	53

Contd…

Table 6.3: List of 111 National Waterways
(Government of India has declared 111 Waterways as National Waterways through National Waterways Act, 2016 enacted on 12.04.2016)

Sl. No.	National Waterway No.	Details of Waterways	States	Length (in km)
1	2	3	4	5
53	National Waterway 53	Kalyan -Thane-Mumbai Waterway, Vasai Creek & Ulhas River System	Maharashtra	145
54	National Waterway 54	Karamnasa River	Bihar & Uttar Pradesh	86
55	National Waterway 55	Kaveri - Kollidam River System	Tamil Nadu	311
56	National Waterway 56	Kherkai River	Jharkhand	22
57	National Waterway 57	Kopili River	Assam	50
58	National Waterway 58	Kosi River	Bihar	236
59	National Waterway 59	Kottayam-Vaikom Canal	Kerala	19
60	National Waterway 60	Kumari River	West Bengal	80
61	National Waterway 61	Kynshi River	Meghalaya	28
62	National Waterway 62	Lohit River	Assam & Arunachal Pradesh	86
63	National Waterway 63	Luni River	Rajasthan	336
64	National Waterway 64	Mahanadi River	Odisha	426
65	National Waterway 65	Mahananda River	West Bengal	80
66	National Waterway 66	Mahi River	Gujarat	247
67	National Waterway 67	Malaprabha River	Karnataka	94
68	National Waterway 68	Mandovi River	Goa	41
69	National Waterway 69	Manimutharu River	Tamil Nadu	5
70	National Waterway 70	Manjara River	Maharashtra & Telangana	245
71	National Waterway 71	Mapusa/Moide River	Goa	27
72	National Waterway 72	Nag River	Maharashtra	59
73	National Waterway 73	Narmada River	Maharashtra & Gujarat	226
74	National Waterway 74	Netravathi River	Karnataka	79
75	National Waterway 75	Palar River	Tamil Nadu	142
76	National Waterway 76	Panchagangavali (Panchagangoli) River	Karnataka	23
77	National Waterway 77	Pazhyar River	Tamil Nadu	20

Contd…

Table 6.3: List of 111 National Waterways
(Government of India has declared 111 Waterways as National Waterways through National Waterways Act, 2016 enacted on 12.04.2016)

Sl. No.	National Waterway No.	Details of Waterways	States	Length (in km)
1	2	3	4	5
78	National Waterway 78	Penganaga - Wardha River System	Maharashtra & Telangana	262
79	National Waterway 79	Pennar River	Andhra Pradesh	28
80	National Waterway 80	Ponniyar River	Tamil Nadu	126
81	National Waterway 81	Punpun River	Bihar	35
82	National Waterway 82	Puthimari River	Assam	58
83	National Waterway 83	Rajpuri Creek	Maharashtra	31
84	National Waterway 84	Ravi River	Jammu & Kashmir, Himachal Pradesh & Punjab	44
85	National Waterway 85	Revadanda Creek-Kundalika River System	Maharashtra	31
86	National Waterway 86	Rupnarayan River	West Bengal	72
87	National Waterway 87	Sabarmati River	Gujarat	210
88	National Waterway 88	Sal River	Goa	14
89	National Waterway 89	Savitri River (Bankot Creek)	Maharashtra	45
90	National Waterway 90	Sharavati River	Karnataka	29
91	National Waterway 91	Shastri River-Jaigad Creek System	Maharashtra	52
92	National Waterway 92	Silabati River	West Bengal	26
93	National Waterway 93	Simsang River	Meghalaya	63
94	National Waterway 94	Sone River	Bihar	141
95	National Waterway 95	Subansiri River	Assam	106
96	National Waterway 96	Subarnrekha River	Jharkhand, West Bengal & Odisha	311
97	National Waterway 97	Sundarbans Waterway	West Bengal	172
		Bidya River	West Bengal	56
		Chhota Kalagachi (Chhoto Kalergachi) River	West Bengal	15
		Gomar River	West Bengal	7
		Haribhanga River	West Bengal	16
		Hogla (Hogal)-Pathankhali River	West Bengal	37

Contd…

Table 6.3: List of 111 National Waterways
(Government of India has declared 111 Waterways as National Waterways through National Waterways Act, 2016 enacted on 12.04.2016)

Sl. No.	National Waterway No.	Details of Waterways	States	Length (in km)
1	2	3	4	5
		Kalindi (Kalandi) River	West Bengal	9
		Katakhali River	West Bengal	22
		Matla River	West Bengal	99
		Muri Ganga (Baratala)River	West Bengal	28
		Raimangal River	West Bengal	53
		Sahibkhali (Sahebkhali) River	West Bengal	14
		Saptamukhi River	West Bengal	37
		Thakurran River	West Bengal	64
98	National Waterway 98	Sutlej River	Himachal Pradesh & Punjab	377
99	National Waterway 99	Tamaraparani River	Tamil Nadu	62
100	National Waterway 100	Tapi River	Maharashtra & Gujarat	436
101	National Waterway 101	Tizu-Zungki Rivers	Nagaland	42
102	National Waterway 102	Tlwang (Dhaleswari River)	Assam & Mizoram	87
103	National Waterway 103	Tons River	Uttar Pradesh	73
104	National Waterway104	Tungabhadra River	Karnataka, Telangana & Andhra Pradesh	232
105	National Waterway 105	Udayavara River	Karnataka	15
106	National Waterway 106	Umngot (Dawki) River	Meghalaya	20
107	National Waterway 107	Vaigai River	Tamil Nadu	46
108	National Waterway 108	Varuna River	Uttar Pradesh	53
109	National Waterway 109	Wainganga -Pranahita River System	Maharashtra & Telangana	166
110	National Waterway 110	Yamuna River	Delhi, Haryana & Uttar Pradesh	1080
111	National Waterway 111	Zuari River	Goa	50
Total Length				**20162.5**

Source: 'Statistics of Inland Water Transport, 2019-20', M/o Ports, Shipping & Waterways

****

Section-VII
Hydro-Electric

Hydro-Electric forms an integral part of overall development of water resources of the river basin. The hydro schemes also form part of the complex integrated power generation system with diverse power generation resources. In the planning of hydro development and deciding on installed capacity etc, these two inter-connections viz. with the water resources developments of the river basin and with the power system are to be kept in view.

In the overall basin context, the impact of operation of upstream projects, constraints imposed by the downstream projects, irrigation diversions downstream, flood moderation etc. are to be considered. Further, with progressive development of consumptive water use and new water resources based development projects in the river basin; water availability would undergo considerable changes over the life of the plant. These are some of the important aspects which have to be considered while planning hydro electric/multipurpose projects.

India has total identified hydropower potential of about 1,48,701 MW out of which 1,45,320 MW of hydropower potential is in stations with installed capacity over 25 MW. During 2020-21, the expected Hydel generation was 1,50,299.52 GWh which was about 10.95% of total electricity generation.

Table 7.1: Electricity Generation & Consumption

Sl. No.	Year	Hydel Generation (GWh)	% of Hydel to Total Generation	Electricity Consumed in Agriculture (GWh)	% of Agriculture to Total Consumption
1	2	3	4	5	6
1	2012-13	113720.29	11.79	147461.92	20.80
2	2013-14	134847.53	13.13	152744.33	20.31
3	2014-15	129243.69	11.57	168913.46	20.75
4	2015-16	121376.65	10.40	173185.37	20.06
5	2016-17	122377.56	9.91	191150.89	20.91
6	2017-18	126122.70	9.68	199246.85	20.47
7	2018-19	134893.62	9.83	213409.18	20.57
8	2019-20	155769.12	11.26	211294.89	20.08
9	2020-21	150299.52	10.95	Data under compilation	Data under compilation

Source: CEA, M/o Power

Table 7.2: Status of Large Hydro Electric Potential Development (Region/Sate-wise)
(In terms of Installed Capacity - Above 25 MW)

(As on 30.06.2021)

Region/ State	Identified Capacity as per Reassessment Study	Capacity In Operation		Capacity under Active Construction		Capacity on which Construction is Held-up		Capacity yet to be taken up under Construction	
	Above 25 MW	(MW)	%	(MW)	%	(MW)	%	(MW)	%
1	2	3	4	5	6	7	8	9	10
Northern									
Jammu & Kashmir	11567	3360	29.05	1661.5	14.36	898	7.76	5647.5	48.82
Ladakh	2046	89	4.35	0	0	0	0	1957	95.65
Himachal Pradesh	18470	9920	53.71	2246	12.16	44	0.24	6260	33.89
Punjab	971	1096.3	100	206	21.22	0	0	0	0
Haryana#	64	0	0	0	0	0	0	0	0
Rajasthan##	483	411	85.09	0	0	0	0	0	0
Uttarakhand	17998	3855.4	21.42	1144	6.36	247	1.37	12751.7	70.85
Uttar Pradesh*	664	501.6	75.54	0	0	0	0	162.4	24.46
Sub Total (NR)	**52263**	**19233.3**	**36.8**	**5257.5**	**10.06**	**1189**	**2.28**	**26583.3**	**50.86**
Western									
Madhya Pradesh	1970	2235	100	0	0	400	20.3	0	0
Chhattisgarh	2202	120	5.45	0	0	0	0	2082	94.55
Gujarat###	590	550	100	0	0	0	0	0	0
Maharashtra	3314	2647	79.87	0	0	0	0	667	20.13
Goa	55	0	0	0	0	0	0	55	100
Sub Total (WR)	**8131**	**5552**	**68.28**	**0**	**0**	**400**	**4.92**	**2179**	**26.8**

Contd…

Table 7.2: Status of Large Hydro Electric Potential Development (Region/Sate-wise)
(In terms of Installed Capacity - Above 25 MW)

(As on 30.06.2021)

Region/ State	Identified Capacity as per Reassessment Study	Capacity In Operation		Capacity under Active Construction		Capacity on which Construction is Held-up		Capacity yet to be taken up under Construction	
	Above 25 MW	(MW)	%	(MW)	%	(MW)	%	(MW)	%
1	2	3	4	5	6	7	8	9	10
Southern									
Andhra Pradesh	3261	1610	49.37	960	29.44	0	0	691	21.19
Telangana	1099	800	72.79	0	0	0	0	299	27.21
Karnataka	6459	3644.2	56.42	0	0	0	0	2814.8	43.58
Kerala	3378	1856.5	54.96	100	2.96	0	0	1421.5	42.08
Tamil Nadu	1693	1778.2	100	0	0	0	0	0	0
Sub Total (SR)	**15890**	**9688.9**	**60.97**	**1060**	**6.67**	**0**	**0**	**5141.1**	**32.35**
Eastern									
Jharkhand	582	170	29.21	0	0	0	0	412	70.79
Bihar####	40	0	0	0	0	0	0	0	0
Odisha	2981	2142.3	71.86	0	0	0	0	838.8	28.14
West Bengal	2829	441.2	15.6	120	4.24	0	0	2267.8	80.16
Sikkim	4248	2282	53.72	500	11.77	537	12.64	929	21.87
Sub Total (ER)	**10680**	**5035.5**	**47.15**	**620**	**5.81**	**537**	**5.03**	**4487.6**	**42.02**
North Eastern									
Meghalaya	2298	322	14.01	0	0	0	0	1976	85.99
Tripura	0	0	0	0	0	0	0	0	0

Contd…

Table 7.2: Status of Large Hydro Electric Potential Development (Region/Sate-wise)
(In terms of Installed Capacity - Above 25 MW)

(As on 30.06.2021)

Region/ State	Identified Capacity as per Reassessment Study	Capacity In Operation		Capacity under Active Construction		Capacity on which Construction is Held-up		Capacity yet to be taken up under Construction	
	Above 25 MW	(MW)	%	(MW)	%	(MW)	%	(MW)	%
1	2	3	4	5	6	7	8	9	10
Manipur	1761	105	5.96	0	0	0	0	1656	94.04
Assam	650	350	53.85	120	18.46	0	0	180	27.69
Nagaland	1452	75	5.17	0	0	0	0	1377	94.83
Arunachal Pradesh	50064	1115	2.23	2000	3.99	0	0	46949	93.78
Mizoram	2131	60	2.82	0	0	0	0	2071	97.18
Sub Total (NER)	**58356**	**2027**	**3.47**	**2120**	**3.63**	**0**	**0**	**54209**	**92.89**
All India	**145320**	**41536.6**	**28.58**	**9057.5**	**6.23**	**2126**	**1.46**	**92599.9**	**63.72**

Source: Hydro Electric Potential Reassessment Division, Central Electricity Authority, M/o Power
Note: 1. Does not include pumped storage Projects.

2. In some states the total of the capacity developed and balance capacity is different from the potential assessed. This is due to change in capacity of the Projects, addition/ deletion of the Projects and merger of two Projects into one etc.

* Eastern Yamuna Canal Project (35 MW) has been developed in 2 stages each having Installed Capacity below 25 MW

Western Yamuna Canal Project (64 MW) has been developed in 4 stages each having Installed Capacity below 25 MW

Two Projects namely Mahi Bajaj Sagar I & II were identified for I.C. of 97 MW has been developed with I.C of 140 MW. Gandhi Sagar (115 MW) Project was identified in Rajasthan but has been developed in Madhya Pradesh with same capacity.

Two Projects namely Ukai Dam and Sardar Sarovar were identified for an I.C. of 590 MW. However as per actual, the I.C. is 550 MW.

Identified project namely East Gandak Canal has been developed with installed capacity below 25 MW

3. In addition to above 9 PSS (4785.6 MW) are under operation, 2 PSS (1500 MW) are under active construction, 1 PSS (80 MW) on which construction is held up and 1 PSS (1000 MW) is Concurred by CEA, 1 PSS (1200 MW) is under examination in CEA, 8 PSS (7530 MW) are under S&I, 1 PSS of I.C. 660 MW is under Held-up and 9 PSS (7400 MW) are under PFR Preparation list.

Table 7.3: Status of Large Hydro Electric Potential Development Basin-wise (In terms of Installed Capacity - Above 25 MW)

(As on 30.06.2021)

Basin	Identified Capacity as per Reassessment Study	Capacity In Operation		Capacity under Active Construction		Capacity on which Construction is Held-up		Capacity yet to be taken up under Construction	
	Above 25 MW	(MW)	%	(MW)	%	(MW)	%	(MW)	%
1	2	3	4	5	6	7	8	9	10
Indus	33028	14294.3	43.28	4113.5	12.45	898.0	2.72	13722.2	41.55
Ganga	20252	5527.2	27.29	1144.0	5.65	291.0	1.44	13289.9	65.62
Central Indian Rivers	3868	3147.5	81.37	0.0	0.00	400.0	10.34	320.5	8.29
West Flowing Rivers	8997	5631.7	62.60	100.0	1.11	0.0	0.00	3265.3	36.29
East Flowing Rivers	13775	8249.0	59.88	960.0	6.97	0.0	0.00	4566.1	33.15
Brahmaputra	65400	4687.0	7.17	2740.0	4.19	537.0	0.82	57436.0	87.82
All India	**145320**	**41536.6**	**28.58**	**9057.5**	**6.23**	**2126.0**	**1.46**	**92599.9**	**63.72**

Source: Hydro Electric Potential Reassessment Division, Central Electricity Authority, M/o Power

Note:

1. Does not include pumped storage Projects.
2. In some States, the total of the capacity developed and balance capacity is different from the potential assessed. This is due to change in capacity of the Projects, addition/ deletion of the Projects and merger of two Projects into one etc.
3. In addition to above 9 PSS (4785.6 MW) are under operation, 2 PSS (1500 MW) are under active construction, 1 PSS (80 MW) on which construction is held-up and 1 PSS (1000 MW) is Concurred by CEA, 1 PSS (1200 MW) is under examination in CEA, 8 PSS (7530 MW) are under S&I, 1 PSS of I.C. 660 MW is under Held up and 9 PSS (7400 MW) are under PFR Preparation list.

Section – VIII
International Treaties and Cooperation

The International Water Treaty sets out a mechanism for cooperation and information exchange between one or more countries regarding their use of river water under the arbitration of Neutral Expert. It had fixed and delimited the rights and obligations on the use of the river water. The following Agreement and Treaty were signed between India and other countries:

S. No.	MoU Details	Current Progress/ Status of Activities undertaken
1.	MoU between India and Australia on cooperation in the field of Water Resource Management	➢ The MoU between India and Australia on cooperation in the field of water resources management was signed on 10.11.2009, and renewed on 5.9.2014. ➢ India-Australia JWG meetings has been held so far and as per JWG meeting held on 11-13 July, 2018, collaboration on following 2 projects viz. (i) Irrigation efficiency pilot project and (ii) Brahmani-Baitarni Integrated Water Resources Management Phase are being taken up. ➢ 3rd Joint Working Group Meeting between India and Australia under renewed MoU was held on 22 September 2020. (i) Irrigation Efficiency Pilot Project ➢ Subarnarekha irrigation project (Odisha) has been finalized as the pilot project for increasing the ➢ water / crop productivity.
2.	Memorandum of Understanding of Cooperation in the field of Water Management between Hungary and India Signed on 16.10.2016	➢ MoU between India and Hungary on Water Management was signed on 16.10.2016. ➢ Following issues has been agreed under Working program for bilateral hungarian-indian Cooperation for the period of 2021-2023: • Integrated water resourcesmanagement • Floodmanagement • Drought and water scarcity management • Rejuvenation of Rivers and other water bodies • Research andeducation ➢ 1st Pre Meeting of the JWG was held virtually on dated 20.11.2020.
3.	MoU between India and **Morocco** on cooperation in the field of Water Resources	➢ MoU between India and the Morocco was signed on 14.12.2017 for a period of 5 years on cooperation in the field of Water Resources development and management. ➢ Further cooperation in various areas like Sediment management, climate change impacts, Ground water management, Nuclear Science application (Basin wise Isotope studies of ground water and surface water) in water resources and capacity building is expected.

Contd…

S. No.	MoU Details	Current Progress/ Status of Activities undertaken
4.	European Union Signed on 07.10.2016 for a period of 5 years. The phase-I of the IEWP (2017-2020) ended in October 2020 and the phase II (2020-2023) started in November 2020	Indo-European Water partnership(IEWP) with a view to bring together representatives of relevant stakeholders, including interested EU Member States and Indian States, European and Indian institutions, business and civil society. The objective of the MoU is ***to strengthen the technological, scientific and management capabilities of India and the EU in the field of water management on the basis of equality, reciprocity and mutual benefit***. Remark:- Indo-European Water partnership(IEWP) with a view to bring together representatives of relevant stakeholders, including interested EU Member States and Indian States, European and Indian institutions, business and civil society to strengthen, promote and develop cooperation in the field of water management on the basis of equality, reciprocity and mutual benefits.
5.	Israel 11.11.2016 for a period of 5 years	Cooperation at the regional, national and international level in the field of water resources development and management by collaborating and sharing of experience and expertise in the areas mutually agreed upon, including technique in the efficient use of waste water desalination, aquifer recharge and in-situ water conservation techniques and water management
6.	Netherlands 27.6.2017 for a period of five years	River Basin Management Planning/Integrated Water Resources Management, Pollution abatement for Rivers including River Ganga, Decision Support Systems (data gathering, applications of Remote Sensing & GIS in Hydrology and Water Resources), Delta management -water safety including Flood Management along rivers, deltas and coasts, Promoting water management, water quality issues and waste water recycling and re-use through innovative concession arrangements
7.	Thailand For period of 01 year	Memorandum of Agreement (MoA) with Asian Institute of Technology, Bangkok for implementing one of the component of "Mandatory Cadre Training Program - Level 2 Training for Senior Time Scale (STS) Officers of Central Water Commission [(Deputy Director (DD)/Executive Engineer (EE)IDy Commissioner (DC)]".

Contd…

S. No.	MoU Details	Current Progress/ Status of Activities undertaken
8.	MoU between **United States Geological Survey**, **United States of America** and DoWR, RD & GR Signed in December, 2019	➢ The USGS and the DoWR, RD & GRhave agreed to pursue scientific and technical cooperation in the field of water resources through the MoU signed between both countries. ➢ Suggestive list of activities proposed by Principal Representative/Interlocutor: (i) Collaborating in Developing Integrated Hydrological Modeling Tools. (ii) Collaboration in the field of Modern Irrigation Management Using low cost and water efficient technologies. Applications of IoT (Internet of Things) for improving water use/application efficiency at various spatial scales (eg. at farm level, canal head, reservoir, river basin scale etc.) (iii) Stream channel Morphology, Erosion Processes and Geomorphology. Ecological Flows. (iv) Aquifer Mapping in 2D/3D, Aquifer Response Modeling, Aquifer Management, Coastal Aquifer Management. (v) Capacity Building& Technology transfer. Remarks:- The USGS and the DoWR, RD & GRhave agreed to pursue scientific and technical cooperation in the field of water resources through the MoU signed between both countries.
9.	MoM between India and **Tanzania** on bilateral cooperation in the field of Water Resources Management and Development 10/07/2016 for period of 05 years	➢ The MoU between India and Tanzania was signed on 10.07.2016 in the field of water resources. ➢ As per outcome of JWG Meeting, bilateral cooperation may be extended in technical fields like IWRM, preparation of DPRs of water projects, application of GIS and remote sensing in WRM, Aquifer mapping, Bilateral arrangements for capacity building Training to Tanzanian Officials by NWA, Pune or RGI, Raipur depending on the areas of interests in water sector. ➢ NWA, Pune has submitted a Training Programme proposal for conducting Two weeks training programme including financial implication for 15 number of officers of Tanzania. This Training is proposed of officials of Tanzania to be on 'Investigation and preparation of DPRs of water resources projects at a total cost of Rs. 14,57,000/-. The proposal has been sent to MEA seeking their comments regarding funding possibility of this training programme under ITEC.
10.	Cambodia Deprioritized 08.12.2007 Extended to 7.12.2017	Exchange of experts and organization of training programs; study tour in the areas of development and management of water resources, both surface and groundwater. -No bilateral request. This MoU is de-prioritized' The action on this MoU will be taken on bilateral request received through Ministry of External Affairs.

Contd…

S. No.	MoU Details	Current Progress/ Status of Activities undertaken
11.	China 05.06.2008 renewed on 20.05.2013 for a period of 5 years	Cooperation on provision of Hydrological Information of the Brahmaputra/Yaluzangbu River in Flood Season by China to India. Hydrological data is being provided by china regularly to India which enable India to improve advisory forecasts in the downstream reaches of the Brahmaputra River for taking suitable administrative / evacuation safety measures.
12.	China 11.04.2005 Renewed on 16.12.2010 and 06.11.2015 for a period of 5 years	Cooperation on provision of Hydrological Information of the LangqenZangbo/ Sutlej River in Flood Season by China to India. Hydrological data was provided by the Chinese side for the flood season 2019(1st June to 15th October). During the 12th ELM Meeting at Ahmadabad (12-13 June, 2019) both sides agreed to continue to implement the MoU and Implementation Plan of LangqenZangbo/Sutlej River. The MoU enabled India to improve flood forecasting and timely warning for mitigation measures in the downstream reaches of the Sutlej River. **Remarks:-** Cooperation on provision of Hydrological Information of the LangquenZangbo/ Sutlej River in Flood Season by China to India.
13.	China 23.10.2013 for a period of 5 years	Cooperation on trans-border rives, Expert-Level Mechanism on provision of flood-season hydrological data and emergency management and exchange of views on other issues of mutual interest.
14.	Rwanda Deprioritized 22.01.2013 for a period of 5 years	Cooperation in agriculture, water resources management & capacity building including marshland and hillslide irrigation; watershed management & water governance; irrigation projects techniques; procedure of planning irrigation projects; guidelines for water management for irrigation; crop water requirement; pressurized and surface irrigation techniques; water availability and reliability for irrigation projects; water use efficiency technology; on-farm water management, etc. MoU between India and Rwanda was signed on 22.01.2013 and as per the renewal clause of the MoU the MoU may be extended for a further period of 5 year unless either of the parties given a written notice before 6 months of its expiry to terminate the MoU There is no progress in this MoU and hence it has been kept in deprioritized category and action may be initiated on the request from MEA/ Rwanda side

Contd…

S. No.	MoU Details	Current Progress/ Status of Activities undertaken
15.	Iraq Deprioritized 23.08.2013 for a period of 5 years	Mutual cooperation in water resources development and management including hydrology and hydrological modeling, application of remote sensing & GIS in hydrology and water resources, integrated water resources development and management, irrigation and drainage, surface and groundwater management and development minor irrigation, hydrometeorology, watershed, lakes and wetlands development, dam safety & surveillance, reservoir regulation, training and capacity building. A request letter for imparting training to Iraqi Officials was received through MEA and accordingly, a Training programme has been customized for Iraqi officials which has been submitted to MEA for consideration and funding under ITEC programme. The training proposal has been prepared and under finalization
16.	Fiji Deprioritized 12.2.2014 for a period of 5 years.	A suggestion for visit of Indian experts to Fiji to train Fijian officials on issues related to water engineering, hydrology, modelingetc MEA has been requested to take up the matter with Fijian Government for sending a format proposal seeking training in water sector through MEA. The proposal from Fiji is awaited.
17.	Bahrain Deprioritized 22.02.2015 for a period of 5 years.	Cooperation in the field of water resources development and management, both surface and ground water through the sharing of technical expertise and experiences. There is no progress in this MoU and hence it has been kept in deprioritized category and action may be initiated on the request from MEA/Bahrain side. This MoU may be helpful for WAPCOS in establishing contact and initial footprint in the country from where leads are taken to Procure business through global tenders
18.	Iran Deprioritized 4.5.2013 for 5 years	Cooperation on water Resources management and development by collaboration and sharing of experience and expertise on traditional system of water conservation, groundwater recharge, drought and impact of climate change on water resources etc. No major outcomes. MoU between India and Iran was signed 04.05.2013. This MoU was signed originally for a period of 5 years i.e. till 03.05.2018. As per renewal clause of the MoU, this MoU may be extended for a further period of 5 years if both parties mutually agree. Since no request has been received from Iran MEA vide email dated 2019 has been requested to take a suitable stand to discontinue this MoU signed with Iran or renewal of the same in case MEA feels it necessary from political angle. Agreement has been approved for Discontinuation

Contd…

S. No.	MoU Details	Current Progress/ Status of Activities undertaken
19	MoU between India and the United Kingdom on River Ganga Rejuvenation Signing Date : 17.04.2018	On rejuvenation of River Ganga, a MoU has been signed between National Mission for Clean Ganga and Natural Environmental Research Council UK on 18th April, 2018 during the visit of Prime Minister to London, United Kingdom. UK Scotland support in sustainable management of water resources in the Ganga basin. Collaborative programmes of research and innovation and exchange of policy experts with the support of UK water partnership
20	Memorandum of Cooperation between Department of Water Resources, River Development and Ganga Rejuvenation, Ministry of Jal Shakti of the Republic of India and Water and Disaster Management Bureau, Ministry of Land, Infrastructure, Transport and Tourism of Japan in the field of Water Resource Signing Date'. 11.12.2019	MEA, vide O.M. dated 12.02.2021 was requested to take up the matter with Japanese side requesting them to forward the details/ composition of Joint Working croup (Japan) along with a draft ,Joint Working Program so that requisite action(s)/ approval(s) may be taken in this Ministry. Accordingly, a meeting between Deputy Secretary of DoWR, RD&GR and Mr.Kiyose Kazuhiro, Counsellor, Embassy of ,Japan, New Delhi was held on 24 February 2021 Some of the key issues discussed in this meeting as part of future cooperation under MoC included flood control integrated water resource management, water quality management, reclaimed water utitization, etc. MLIT has also informed that Embassy of Japan in New Delhi will set up a preparatory meeting with MEA to identify areas of cooperation'

Contd…

S. No.	MoU Details	Current Progress/ Status of Activities undertaken
21	MOU on Cooperation in the field of Water Management between India and Netherlands Signing Date : 27.06.2017	It was explored that the collaboration with Netherlands may be enhanced in the areas of climate change impact, flood protection, waste to energy, solid waste management, wastewater recycle and reuse, agriculture, food security, water quality.

Source: ISM-2 Dte., Central water Commission

Appendix Glossary

GLOSSARY OF TERMS

Area sown more than once	This represents the area on which crops are cultivated more than once during the agricultural year. This is obtained by deducting Net Area Sown from Total Cropped Area.
Beel	A beel is a billabong or a lake-like wetland with static water (as opposed to moving water in rivers and canals.
Brackish water	Brackish water (less commonly brack water) is salt water and fresh water mixed together. It is saltier than fresh water, but not as salty as seawater. It may result from mixing of seawater with fresh water, as in estuaries, or it may occur in brackish fossil aquifers.
Canal	Canals are waterways channels, or artificial waterways, for water conveyance, or to service water transport vehicles. They may also help with irrigation. A canal is like navigation when it parallels a river and shares part of its waters and drainage basin, and leverages its resources by building dams and locks to increase and lengthen its stretches of slack water levels while staying in its valley. In contrast, a canal cuts across a drainage divide atop a ridge, generally requiring an external water source above the highest elevation.
Cropping Intensity	It is the ratio of gross (total) area sown to the net area sown expressed as a percentage.
Culturable Command Area (CCA)	It is the area which can be physically irrigated from a scheme and is fit for cultivation.
Dam	Any artificial barrier which impounds or diverts water. A dam is generally considered hydrologically significant if it is 1.25 feet (0.4 m) or more in height from the natural bed of the stream and has storage of at least 15 acre-feet or it has an impounding capacity of 50 acre-feet or more and is at least six feet (2 m) above the natural bed of the stream.
Glacier	A glacier is a persistent body of dense ice that is constantly moving under its own weight. A glacier forms where the accumulation of snow exeeds its ablation (melting and sublimation) over many years, often centuries. Glaciers slowly deform and flow under stresses induced by their weight, creating crevasses, seracs, and other distinguishing features. They also abrade rock and debris from their substrate to create landforms such as cirques and moraines. Glaciers form only on land and are distinct from the much thinner sea ice and lake ice that form on the surface of bodies of water.
Gross Sown Area	This is the sum total of the areas under all crops over the various seasons in an agriculture year (i.e. from the 1st July to 30th June next year).

Contd…

Appendix Glossary

GLOSSARY OF TERMS

Gross Irrigated Area	It is the total area irrigated under various crops in a year, counting the area irrigated under more than one crop during the same year as many times as the number of crops grown and irrigated.
Irrigation Potential Created (IPC)	The Irrigation potential created by a project at a given time during or after its construction is the aggregate gross area that can be irrigated annually by the quantity of water that could be made available by all the connected and completed works up to the end of the water courses or the last point in the water delivery system. It is the area that can be irrigated from a project in a design agriculture year that is from the 1st July to 30th June next year for the projected cropping pattern and accepted water allowance on its full development. Before an area is included under potential created, it has to be ensured that the water for the area to be reported upon is available and the conveyance system up to and including the irrigation outlet to serve an area up to 40 Ha in the area to be irrigated is completed.
Irrigation Potential Utilised	The Irrigation potential utilised is the total gross area actually irrigated by a project/scheme during the agricultural year under consideration.
Lake	A lake is an area filled with water, localized in a basin, surrounded by land, apart from any river or other outlet that serves to feed or drain the lake. Lakes lie on land and are not part of the ocean. Therefore, they are distinct from lagoons, and are also larger and deeper than ponds, though there are no official or scientific definitions.
Large Dam	A dam exceeding 15m in height above deepest river bed level and a dam between 10 and 15 m height provided volume of earthwork exceeds 0.75 MCM and storage exceeds 1 MCM or the maximum flood discharge exceeds 2000 cumecs.
Live Capacity	It is the total amount of storage capacity available in a reservoir for all purposes, from the dead storage level to the normal water or normal pool level/surface level. It does not include surcharge, or dead storage, but does include inactive storage, active conservation storage and exclusive flood control storage.
Major Irrigation Scheme	A scheme having Culturable Command Area (CCA) more than 10,000 Ha is classified as major irrigation scheme.
Medium Irrigation Scheme	A scheme having CCA more than 2,000 Ha and up to 10,000 Ha individually is classified as medium irrigation scheme.
Minor Irrigation Scheme	A scheme having CCA up to 2,000 Ha individually is classified as minor irrigation scheme.

Contd…

Appendix Glossary

GLOSSARY OF TERMS

Navigable Inland Waterways	A stretch of water, not part of the sea, over which craft of a carrying capacity not less than 50 Tonnes can navigate when normally loaded. This term covers both navigable rivers and lakes (natural water-courses, whether or not they have been improved for navigation purposes) and canals (waterways constructed primarily for the purpose of navigation). The length of rivers and canals is measured in mid channel and length of lakes, as well as lagoons, is counted as the length between the most distant points between which the transport is performed. An inland waterway forming a common frontier between two countries is reported by both.
Net Sown Area	It is the total area sown with crops and orchards, counting areas sown more than once in the same agricultural year only once.
Net Irrigated Area	It is the total area which is irrigated counting area irrigated more than once on the same land in an agricultural year once only.
Oxbow Lake	An oxbow lake is a U-shaped lake that forms when a wide meander of a river is cut off, creating a free-standing body of water.
Reporting Area for Land Utilisation Statistics	The Reporting area stands for the area for which data on land use classification are available.
Power (KW)	Mechanical force developed by the motive power installation in craft. This power should be measured in effective kilowatts (power transmitted to the propeller).
River	River is a natural flowing water course, usually freshwater, flowing towards an ocean, sea, lake or another river.
River Basin	River Basin is the basic hydrological unit for water resources planning and management.
Run-off	Water which is not absorbed by the soil and flows to lower ground, eventually draining into a stream, river, or other body of water. It is that part of precipitation that flows toward the streams on the surface of the ground or within the ground. Run-off is composed of base flow and surface run-off.
Run-off/ Potential	Run-off/ potential of a river for a specified period at a site is the total volume of water flow/passed from/through the site during the specified period. It is the notional depth of water in mm over the catchment, equivalent to annual run-off (in cum)/Catchment Area (km^2)*1000 and calculated at the discharge measurement station.
Surface Water	Water that flows in streams and rivers and in natural lakes, in wetlands, and in reservoirs constructed by humans.
Total Cultivable Area	This consists of net area sown, current fallows, fallow lands other than current fallows, culturable waste and land under miscellaneous tree crops.

Contd…

Appendix Glossary

GLOSSARY OF TERMS

Ultimate Irrigation Potential	The ultimate irrigation potential is the gross area that can be irrigated from a project in design year for the projected cropping pattern and assumed water allowance on its full development. The gross irrigated area will be the aggregate of the areas irrigated in the different crop seasons, the areas under two seasonal and perennial crops being counted only once in the year. The Ultimate Irrigation Potential of ground water may however, be taken as the total area that can be irrigated by utilizing the Annually Rechargeable Ground Water Resource Available for Irrigation considering the gross irrigation requirement of crops grown in an unit area.
Watershed	Watershed is a natural hydrologic entity governed by the terrain topography from where runoff is drained to a point. The term watershed is a general phenomenon thus its size and area depends on the scale of the base map used for delineation and codification.

****