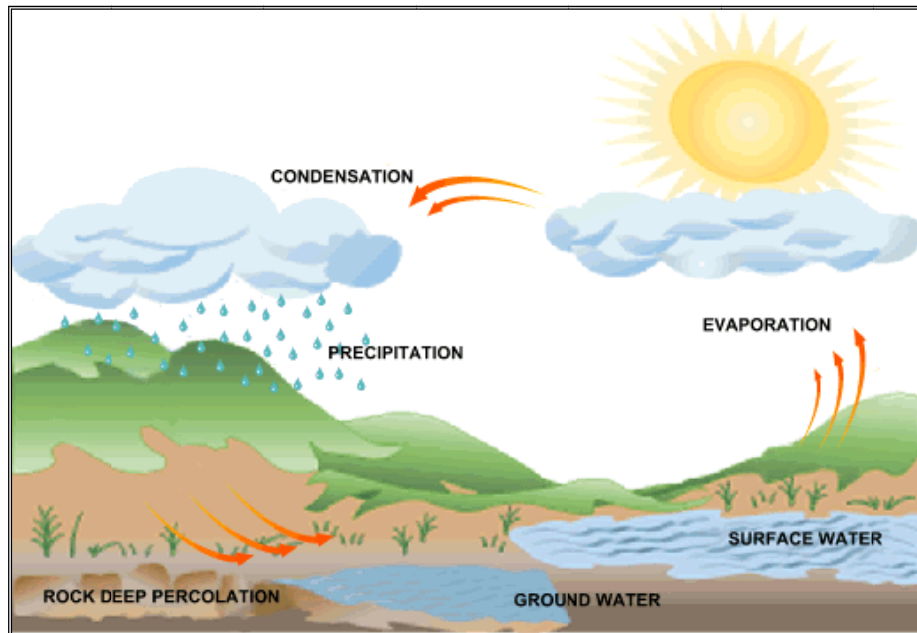


NATIONAL WATER MISSION under National Action Plan on Climate Change



COMPREHENSIVE MISSION DOCUMENT

Volume - I

New Delhi
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Comprehensive Mission Document of National Water Mission

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Comprehensive Mission Document of National Water Mission

EXECUTIVE SUMMARY

The main objective of the National Water Mission is “conservation of water, minimizing wastage and ensuring its more equitable distribution both across and within States through integrated water resources development and management”. The five identified goals of the Mission are: (a) comprehensive water data base in public domain and assessment of impact of climate change on water resource; (b) promotion of citizen and state action for water conservation, augmentation and preservation; (c) focused attention to vulnerable areas including over-exploited areas; (d) increasing water use efficiency by 20%, and (e) promotion of basin level integrated water resources management.

Various strategies for achieving the goals have been identified which lead to integrated planning for sustainable development and efficient management with active participation of the stakeholders after identifying and evaluating the development scenario and management practices towards better acceptability on the basis of assessment of the impacts of climate change on water resources based on reliable data and information.

Relatively very large temporal and spatial variation in rainfall and consequently in the river flow and ground water aquifers is an important feature of the water resources in India. Although the impact of climate change on water resources has not been accurately quantified, various studies indicate that the likely impact of climate change on water resources could contribute to further intensification of the extreme events. Further, the features of water resources - both the availability and the quality may also be considerably affected by the changes in the land use in the form of urbanization, industrialization and changes in the forest cover. Realizing that the various processes which influence the hydrologic cycle are of dynamic nature, precise quantification of the impact specifically due to climate change may not be a simple task and it would be necessary to make suitable assumption at the initial stages and undertake detailed simulation studies with more and more data as they become available with time. However, the likely impact of climate change on water resources could be in the form of:

- Decline in the glaciers and the snowfields in the Himalayas;
- Increased drought like situations due to overall decrease in the number of rainy days in many parts of the country;

- Increased flood events due to overall increase in the rainy day intensity;
- Effect on groundwater quality in alluvial aquifers due to increased flood and drought events;
- Influence on groundwater recharge due to changes in precipitation and evapo-transpiration; and
- Increased saline intrusion of coastal and island aquifers due to rising sea levels.

From the above, it is apparent that in the context of likely impact of climate change on water resources, the most vulnerable areas in India would include (a) drought prone areas, (b) flood prone areas, (c) the coastal regions, (d) the region with deficient rainfall, (e) areas with over-exploited, critical and semi-critical stage of ground water development, (f) water quality affected areas, and (g) snow-fed river basins.

For achieving the objectives of the National Water Mission, long-term sustained efforts both in terms of time bound completion of identified activities and ensuring the implementation of identified policies and enactment of necessary legislation through persuasion at different levels with the State Governments have been envisaged. Some of the important activities which are planned to be completed in a time bound manner on priority are as under.

- **Comprehensive water data base in public domain and assessment of the impact of climate change on water resources**
 - All data and entire information (except data of sensitive and classified nature) would be placed in public domain by 2012
 - Review and establishment of network for collection of additional necessary data by March 2012
 - Reassessment of basin wise water situation by March 2012
 - The initial projections of the impact of climate change on water resources including the likely changes in the water availability in time and space are targeted by the year 2012
- **Promotion of citizen and state actions for water conservation, augmentation and preservation**
 - Empowerment and involvement of Panchayati Raj Institutions, urban local bodies, Water Users' Associations and primary stake holders in management of water resources with focus on water conservation, augmentation and preservation
 - Promote participatory irrigation management

- Encourage participation of NGOs in various activities related to water resources management, particularly in planning, capacity building and mass awareness
 - Involve and encourage corporate sector / industries to take up support and promote water conservation, augmentation and preservation within the industry and as part of corporate social responsibility
 - Sensitization of all Panchayat members and their functionaries in dark and grey blocks will be completed by 2011-12.
- **Focused attention to vulnerable areas including over-exploited areas**
 - Comprehensive assessment of ground water in the country will be made by March 2011
 - The revised master plan for artificial recharge to ground water would be in public domain by September 2011 for the entire country
 - All over-exploited areas will be covered by recharge of ground water by the end of XII Five Year Plan.
 - Expedient implementation of water resources projects particularly the multipurpose projects with carry over storages benefitting drought prone and rain deficit areas
 - Promotion of traditional system of water conservation
 - Physical sustainability of groundwater resources
 - Conservation and preservation of wetland
 - Systematic approach for coping with floods - mapping of areas likely to experience floods, establishing hydraulic and hydrological models and developing comprehensive schemes for flood management and reservoir sedimentation.
- **Increasing water use efficiency by 20%**
 - The timeline for action would be to increase water use efficiency by 20% by the year 2017
 - The gap of about 15% between the irrigation potential created and the irrigation potential utilized would also be reduced by half by the year 2017
 - Development of guidelines for incentivizing recycling of water including wastewater by March 2011.
 - Promotion of water efficient techniques and technologies including (a) promotion of micro irrigation techniques such as sprinkler and drip irrigation and (b) expansion of "Farmers' Participatory Action Research Programme"
 - Undertake Pilot projects for improvement in water use efficiency in collaboration with States by March 2012.
 - Promote Water Regulatory Authorities for ensuring equitable water distribution and rational charges for water facilities

- Promote mandatory water audit including those for drinking water purposes
 - Adequate provision for operation & maintenance of water resources projects
 - Incentive through award for water conservation & efficient use of water
 - Incentivize use of efficient irrigation practices and fully utilize the created facilities
- **Promotion of basin level integrated water resources management**
 - Ministry of Water Resources will review the National Water Policy by 2011 to move towards basin development
 - Guidelines for different uses of water e.g., irrigation, drinking, industrial etc. particularly in context of basin wise situations by March 2012

The document also presents an outline for the operationalization of the “National Water Mission.

A dedicated Mission Secretariat has also been proposed through creation of three posts i.e., one Mission Director and two Advisors and with provision for either outsourcing or redeploying services of professional as per requirement.

Chapter - 1

Introduction

India is faced with the challenge of sustaining its rapid economic growth while dealing with the global threat of climate change. This threat emanates from accumulated greenhouse gas emissions in the atmosphere, anthropogenically generated through long term and intensive industrial growth and high consumption lifestyles in developed countries. While engaged with the international community to collectively and cooperatively deal with this threat, India needs a national strategy to firstly, adapt to climate change and secondly, to further enhance the ecological sustainability of India's development path.

Climate change may alter the distribution and quality of India's natural resources and adversely affect the livelihood of its people. With an economy closely tied to its natural resource base and climate-sensitive sectors such as agriculture, water and forestry, India may face a major threat because of the projected changes in climate.

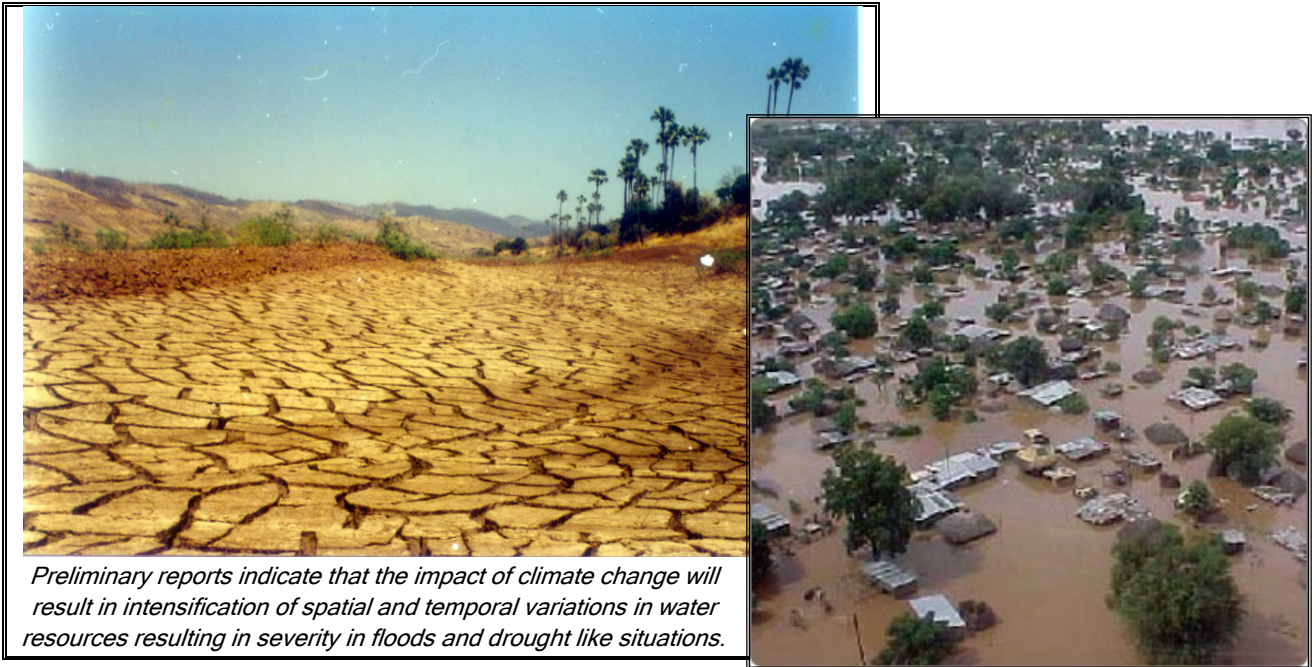
The global warming may affect the hydrological cycle which could result in further intensification of temporal and spatial variations in precipitation, snow melt and water availability. The report on "India's Initial National Communication to the United Nations Framework Convention on Climate Change" published by Ministry of Environment and Forests, Government of India in the year 2004 identifies the following projected impacts of climate change on water resources.

"It is obvious that the projected climate change resulting in warming, sea level rise and melting of glaciers will adversely affect the water balance in different parts of India and quality of ground water along the coastal plains. Climate change is likely to affect ground water due to changes in precipitation and evapo-transpiration. Rising sea levels may lead to increased saline intrusion into coastal and island aquifers, while increased frequency and severity of floods may affect groundwater quality in alluvial aquifers. Increased rainfall intensity may lead to higher runoff and possibly reduced recharge."

Some of the possible identified implications of climate change on water resources are listed below:

- Decline in the glaciers and the snowfields in the Himalayas;
- Increased drought like situations due to overall decrease in the number of rainy days over a major part of the country;
- Increased flood events due to overall increase in the rainy day intensity;
- Effect on groundwater quality in alluvial aquifers due to increased flood and drought events;

- Influence on groundwater recharge due to changes in precipitation and evapo-transpiration; and
- Increased saline intrusion of coastal and island aquifers due to rising sea levels;



With a view to address the related issues, the National Action Plan on Climate Change (NAPCC) has been prepared by the Government of India, which has been released by the Hon'ble Prime Minister on 30th June 2008. The NAPCC has laid down the principles and has identified the approach to be adopted to meet the challenges of impact of climate change through eight National Missions namely, (a) National Solar Mission, (b) National Mission for Enhanced Energy Efficiency, (c) National Mission on Sustainable Habitat, (d) National Water Mission, (e) National Mission for Sustaining the Himalayan Eco-system, (f) National Mission for a Green India, (g) National Mission for Sustainable Agriculture, and (h) National Mission on Strategic Knowledge for Climate Change.

This Comprehensive Mission Document of "National Water Mission" identifies the strategies for achieving the goals of (a) Comprehensive water data base in public domain and assessment of the impact of climate change on water resource, (b) Promotion of citizen and state actions for water conservation, augmentation and preservation, (c) Focused attention to vulnerable areas including over-exploited areas, (d) Increasing water use efficiency by 20%, and (e) Promotion of basin level integrated water resources management.

Chapter - 2

Objectives of National Water Mission

The National Action Plan on Climate Change (NAPCC) describes the features of National Water Mission as under:

“A National Water Mission will be mounted to ensure integrated water resource management helping to conserve water, minimize wastage and ensure more equitable distribution both across and within states. The Mission will take into account the provisions of the National Water Policy and develop a framework to optimize water use by increasing water use efficiency by 20% through regulatory mechanisms with differential entitlements and pricing. It will seek to ensure that a considerable share of the water needs of urban areas are met through recycling of waste water, and ensuring that the water requirements of coastal cities with inadequate alternative sources of water are met through adoption of new and appropriate technologies such as low temperature desalination technologies that allow for the use of ocean water.

The National Water Policy would be revisited in consultation with States to ensure basin level management strategies to deal with variability in rainfall and river flows due to climate change. This will include enhanced storage both above and below ground, rainwater harvesting, coupled with equitable and efficient management structures.

The Mission will seek to develop new regulatory structures, combined with appropriate entitlements and pricing. It will seek to optimize the efficiency of existing irrigation systems, including rehabilitation of systems that have been run down and also expand irrigation, where feasible, with a special effort to increase storage capacity. Incentive structures will be designed to promote water-neutral or water-positive technologies, recharging of underground water sources and adoption of large scale irrigation programmes which rely on sprinklers, drip irrigation and ridge and furrow irrigation.”

The NAPCC also describes the procedure for implementation of the Mission as under:

“These National Missions will be institutionalized by respective ministries and will be organized through inter-sectoral groups which include in addition to related Ministries, Ministry of Finance and the Planning Commission, experts from industry, academia and civil society. The institutional structure would vary depending on the task to be addressed by the Mission and will include providing the opportunity to compete on the best management model.

Each Mission will be tasked to evolve specific objectives spanning the remaining years of the 11th Plan and the 12th Plan period 2012-2013 to 2016-2017. Where the resource requirements of the Mission call for an enhancement of the allocation in the 11th Plan, this will be suitably considered, keeping in mind the overall resources position and the scope for re-prioritization.

Comprehensive Mission documents detailing objectives, strategies, plan of action, timelines and monitoring and evaluation criteria would be developed and submitted to the Prime Minister's Council on Climate Change by December 2008. The Council will also periodically review the progress of these Missions. Each Mission will report publicly on its annual performance.

Building public awareness will be vital in supporting implementation of the NAPCC. This will be achieved through national portals, media engagement, civil society involvement, curricula reform and recognition / awards, details of which will be worked out by an empowered group. The Group will also consider methods of capacity building to support the goals of the National Missions.

We will develop appropriate technologies to measure progress in actions being taken in terms of avoided emissions, wherever applicable, with reference to business as usual scenarios. Appropriate indicators will be evolved for assessing adaptation benefits of the actions.

These Eight National Missions taken together, with enhancements in current and ongoing programmes included in the Technical Document, would not only assist the country to adapt to climate change, but also, importantly, launch the economy on a path that would progressively and substantially result in mitigation through avoided emissions."

The 'Technical Document' annexed with the NAPCC has identified key areas related to (a) studies on management of surface water resources, (b) management and regulation of ground water resources, (c) upgrading storage structures for fresh and drainage system for wastewater, (d) conservation of wetland, and (e) development of desalination technologies etc. required to be considered while preparing the comprehensive document for the National Water Mission. The details are at Annexure-I.

Chapter - 3

Goals and Strategies

Water resources schemes and projects are multidisciplinary in nature and are implemented by several departments and agencies of State Governments and various ministries/departments of Central Government. Therefore, it has been considered necessary to examine all related issue through a consultative process. Accordingly, Ministry of Water Resources (MoWR) constituted six Sub-Committees to examine all related aspects in the field of:

- a. Policy and Institutional Framework;
- b. Surface Water Management;
- c. Ground Water Management;
- d. Domestic and Industrial Water Management;
- e. Efficient Use of Water for Various Purposes; and
- f. Basin Level Planning and Management.

The reports of the Sub-Committees are given in Volume-II of the Comprehensive Mission Document as Appendix-I to Appendix -VI. Based on the (a) objectives of the National Water Mission, (b) identified key areas to be addressed, and (c) recommendations of the Sub-Committees, the following goals have been identified.

- a. Comprehensive water data base in public domain and assessment of the impact of climate change on water resource
- b. Promotion of citizen and state actions for water conservation, augmentation and preservation
- c. Focused attention on vulnerable areas including over-exploited areas
- d. Increasing water use efficiency by 20%
- e. Promotion of basin level integrated water resources management

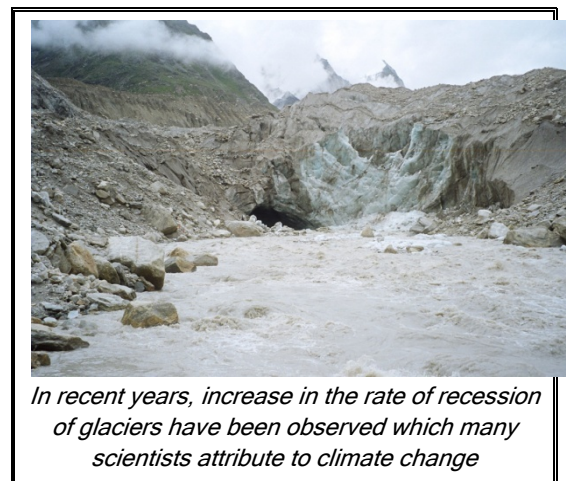
Strategies for each of the identified goals are discussed hereunder.

3.1 Goal - 1: Comprehensive water data base in public domain and assessment of the impact of climate change on water resource

Water related data is being collected by various Central and State agencies for different purposes and kept in as many formats. The networks for data collection for various hydrological and other related parameters require a review for their adequacy to meet the requirement for reliable assessment of the impact of climate change on water resources. The collected data is required to be put in public domain so that policy makers and academicians can access that with ease for their respective uses and people at large can form their well informed views/opinions on various related matters.

The first and the foremost action required is to have a comprehensive data base in public domain (except for the data of sensitive nature) and to have an assessment of the impact of climate change on water resources in terms of availability as well as the quality of the water from surface and ground water sources, which inter-alia includes (i) collection of necessary data; (ii) research and studies to project impact of climate change on water resources; (iii) development of suitable models; and (iv) development of suitable techniques for efficient utilization of water and conversion of poor quality water into fresh water. The strategies identified for achieving the goal include (a) Review and establishment of network for collection of additional necessary data; (b) Development / implementation of modern technology for measurement of various data; (c) Developing inventory of wetland; (d) Research and studies on all aspects related to impact of climate change on water resources including quality aspects of water resources with active collaboration of all research organizations working in the area of climate change; (e) Reassessment of basin wise water situation; and (f) Projection of the impact of climate change on water resources.

Chairman, Central Water Commission would head the group. The Committee would also include Secretary, Earth Sciences besides various representatives of other ministries / departments.



All data and entire information (except data of sensitive and classified nature) would be placed in the public domain by 2012. First set of data

has since been put in public domain with launching of first phase of “Water Resources Information System” on 7th December 2010.

The initial projections of the impact of climate change on water resources including the likely changes in the water availability in time and space are targeted by the year 2012.



The key areas identified in the NAPCC in respect of data base & assessment of impact of climate change on water resources and the identified strategies to achieve the objectives are summarized as under:

Table - 1: Recommended strategies for Goal 1- Comprehensive water data base in public domain and assessment of the impact of climate change on water resource

Key areas highlighted in NAPCC	Recommended strategies and identified action points	
<p>(a) Estimating river flow in mountainous areas, (b) Extending isotopic tracer based techniques of monitoring river water discharge to all major river monitoring stations, (c) Strengthening the monitoring of glacial and seasonal snow covers to assess the contribution of snowmelt to water flow of Indian rivers that originate in the Himalayas, (d) Establishment of a wider network of automatic weather stations and automated rain-gauge</p>	<p>Strategy I.1</p>	<p>Review and establishment of network for collection of additional necessary data</p> <ul style="list-style-type: none"> a. Review of network of hydrological observation stations b. Review of the network of automatic weather stations and automated rain gauge stations and establishment of additional stations especially in respect of: (i) Better network for evaporation data, and (ii) Rain fall data collection network through automated sensors c. Collection of necessary additional hydro-meteorological and hydrological data for proper assessment of impact of climate change particularly in Himalayan region, coastal region etc including other improvements required in hydrometric networks to appropriately address the issues related to the climate change. The data should inter-alia include (i) Coastal and estuarine water, salinity and tidal water levels and the changing discharges in both directions

Key areas highlighted in NAPCC	Recommended strategies and identified action points
<p>stations, (e) Developing an inventory of wetlands, especially those with unique features, and (f) Mapping of catchments and surveying and assessing land use patterns with emphasis on drainage, vegetation cover, silting, encroachment, conservation of mangrove areas, human settlements and human activities and its impact on catchments and water bodies.</p>	<p>in estuarine areas,(ii) Hydrological and hydro-meteorological data in low rainfall areas, (iii) Hydrological and hydro-meteorological data above permanent snowline, glaciated areas, seasonal snow areas in Himalayan region, (iv) Better network for collection of evaporation and rain gauge data using automated sensors, (v) Establishment/strengthening of ground water monitoring network through construction of purpose built observation wells, sanctuary wells for coastal aquifer management and water quality monitoring, (vi) Repeated collection of data about river geometry and morphology for monitoring erosion and carrying capacity, (vii) Massive tidal hydraulics data collection, and (viii) Surface and ground water quality data collection.</p>
<p>Strategy I.2</p>	<p>Development of water resources information system</p> <ul style="list-style-type: none"> a Development of Water Resources Information System which, in addition to hydrological, hydro-meteorological and other relevant information would also include (i) inventory of glaciated lakes and water bodies, (ii) wetland especially, those with unique features; and (ii) mapping of catchments and surveying and assessing land use patterns with emphasis on drainage, vegetation cover, silting, encroachment, conservation of mangrove areas, human settlements. All information except the data of sensitive and classified nature would be in public domain to facilitate and promote citizen action in water conservation, augmentation and preservation. b Development and operationalization of Web-enabled Ground Water Information System and placing it in public domain
<p>Strategy I.3</p>	<p>Development / implementation of modern technology for measurement of various data</p> <p>Development and implementation of modern techniques including isotopic tracer based techniques for measurement especially for the areas like storm surge,</p>

Key areas highlighted in NAPCC	Recommended strategies and identified action points	
(a) Customizing climate change models for regional water basins, and (b) Developing models of urban storm water flows and estimating drainage capacities for storm water and for sewer based on the simulations.	Strategy I.4	tidal hydraulics, salinity and unsteady flow. Developing inventory of wetland
	Strategy I.5	Research and studies on all aspects related to impact of climate change on water resources including quality aspects of water resources with active collaboration of all research organizations working in the area of climate change
		Research and studies specifically for projection of impact of climate change on surface and ground water including its water quality in areas of (i) Basin efficiency, (ii) Possibilities of increasing dam heights, (iii) Identification of minor tanks where FRL can be raised without raising dam heights by installing gates and evaluation of the same, (iv) Identification of tanks and water bodies which can be effectively de-silted, where silt has commercial value and evaluation of the same, (v) Improving intra-national equity in usable water for drought management like conducting economics considering land, water and livelihood to plan how much water is necessary to yield reasonable income, (vi) Water harvesting, provided this is socially desirable and provided that corresponding water saving is possible elsewhere in the region, (vii) Impact on Intensity-Duration-Frequency relationships in urban areas, (viii) Impact on Magnitude-Duration-Frequency of drought (agricultural, meteorological and hydrological), (ix) Study of Water-energy-Climate Change relationships, (x) Planning tidal embankments to protect against tides and increased flood frequency and increased sea level, (xi) Effect of sea level rise on ground water salinity and prospective measures like groundwater recharge, (xii) Possible tidal channels for fresh water storage, (xiii) Preparation of sediment budgets and accounts for each basin, (xiv) Review the interpretation of regime maintenance on Ganga, after climate change, (xv) Isotope applications in GW dating and contaminant transport, (xvi) GW basin models for conjunctive use of SW & GW and application of RS/GIS in GW management, (xvii) Assessment and strategies for development potential of deeper aquifers, (xviii) Coastal aquifer

Key areas highlighted in NAPCC	Recommended strategies and identified action points
	<p>management including use of hydraulic barriers for control of sea water ingress, (xix) Assessment of feasibility and viability of rainwater harvesting in existing domestic and commercial buildings, (xx) Supporting researchable issues specifically of (xxi) Atmospheric Science Groups towards downscaling of GCM or RCM to basin/project level and also understanding the effect of climate change on monsoons, (xxii) Supporting water and climate related researches towards studying the sensitivity of different hydrologic types of water projects to different climate change scenarios and improvements required in hydrometric networks to incorporate climate change, (xxiii) Building a Universal Soil Loss model depicting erosion and sediment transport etc. Proving the model based on sediment flow and reservoir sedimentation data, Actuating the above model for changed rainfall regime and changed management practices, (xxiv) Developing, through R&D effort, a combined unsteady flow hydraulics-cum-sediment transport model capable of depicting river erosion in each flood event. Using the model to test river management works, (xxv) Water quality modeling for each major river and aquifer, (xxvi) Hydro chemical and solute transport modeling in areas vulnerable for seawater ingress and water quality, (xxvii) Developing urban storm water drainage models with due consideration to the topographical features and the urban layouts, and (xxviii) Developing criteria and guidelines to ensure urban storm water drainage improvements.</p>
<p>Strategy I.6</p>	<p>Reassessment of basin wise water situation</p> <p>a. Reassessment of basin wise water situation in present scenario including water quality by using latest techniques, with focus on vulnerable areas which inter-alia may include (i) development or adoption of comprehensive water balance based model (ii) fitting models to basin using current data, and (iii) assessment of likely future situation, with changes in demands, land use, precipitation and evaporation</p>

Key areas highlighted in NAPCC	Recommended strategies and identified action points
	<p data-bbox="792 289 1451 384">b. Comprehensive Reassessment of the ground water resources up to Block / Mandal / Taluka level for the entire country.</p> <p data-bbox="638 415 1451 489">Strategy I.7 Projection of the impact of climate change on water resources</p> <p data-bbox="865 520 1468 709">Projection of water resources availability as a result of impact of climate change which would inter-alia include the likely changes in the characteristics of water availability in time and space with focus on areas vulnerable to climate change.</p>

Details of the strategies are discussed in the recommendations of the Sub-Committees and the same are included in the volume - II of the Mission Document.

3.2 Goal - 2: Promotion of citizen and state action for water conservation, augmentation and preservation

The studies in respect of impact of climate on water resources indicate that various components of the hydrological cycle would be affected resulting in further intensification of temporal and spatial variations of the water availability. This situation calls for urgent steps for conservation of the available water resources. It is also necessary to take immediate steps for augmentation of the utilizable water resources. Water, the most precious gift of nature can be of beneficial use to the mankind only if all the stakeholders are fully involved in its development and management. It has been established that the participatory approach in water management has yielded excellent results. There are many success stories including of Hiware Bazar Panchayat, District Ahmednagar, Maharashtra, Vruksha Prem Seva Trust, Upleta, District Rajkot, Gujarat etc. Mass awareness and capacity building of the stakeholders are also considered very important strategies.

The “Promotion of citizen and state action for water conservation, augmentation and preservation” becomes an important goal of the Mission. The strategy identified include (a) Development of water resources information system; (b) Empowerment and involvement of Panchayati Raj Institutions, urban local bodies, Water Users’ Associations and primary stake holders in management of water resources with focus on water conservation, augmentation and preservation; (c) Promote participatory irrigation management; (d) Sensitization of elected representatives of over-exploited areas on dimensions of the problems and to orient investment under MNREGP towards

water conservation; (e) Provide incentives for water neutral and water positive technologies in industry; (f) Encourage participation of NGOs in various activities related to water resources management, particularly in planning, capacity building and mass awareness; and (g) Involve and encourage corporate sector / industries to take up, support and promote water conservation, augmentation and preservation within the industry and as part of corporate social responsibility. The participation of stakeholders in water management has been very effective in efficient management of water resources.

Hiware Bazar : A Success Story of Citizen Action for Water Management

Hiware Bazar a village in Ahmednagar district of Maharashtra faced acute water shortage with the average annual rainfall of about 400 mm. In 1989-90, hardly 12 per cent of the cultivable land could be farmed. The village's wells used to have water only during the monsoon. The change started in 90s when with labour donations, the panchayat built 40,000 contour trenches around the hills to conserve rainwater and recharge groundwater. Villagers took up plantation and forest regeneration activities. Immediately after the monsoon, many wells in the village collected enough water to increase the irrigation area from 20 ha to 70 ha in 1993.

An integrated model of development with water conservation as its core was adopted. The village invested all its funds on water conservation, recharging groundwater and creating surface storage systems to collect rainwater. The 70-ha regenerated forest helped in treating the catchments for most wells; 414 ha of contour bunding stopped runoff; and around 660 water-harvesting structures caught rainwater. The state government too helped by spending Rs.42 lakh to treat 1,000 ha of land. These activities caused rise in levels of ground water in adjoining wells paving the way for improved irrigation.

Hiware Bazar is now reaping the benefits of its investments. The number of wells has increased from 97 to 217. Irrigated land has gone up from 120 ha in 1999 to 260 ha in 2006. Grass production went up from 100 tonnes in 2000 to 6,000 tonnes in 2004. Milk production rose from 150 lpd in the mid-1990s to 4,000 litres now. In 2005-06, income from agriculture was nearly Rs 2.48 crore.

Hiware Bazar's strong, participatory institutional set-up has facilitated success. The *gram sabha* has the power to decide on a range of issues, including identifying sites for water harvesting structures, sharing water and types of crops to be cultivated. The village voluntary body as its implementing arm.

Nodal responsibility would be with Ministry of Water Resources. At the State level, the nodal responsibility would vest with the Development Commissioners of the State as the basic action would be through MGNREGA. The State level body would be convened by the Secretary, Water Resources of the State. An action plan for each State would also be developed and put into implementation. Do-it-yourself methods would be promoted for citizen action with NGO involvement.

Sensitization of all Panchayat members and their functionaries in dark and grey blocks will be completed by 2011-12.

The key areas identified in the NAPCC and the identified strategies to achieve the objectives are summarized in the following table.

Table - 3.2: Recommended Strategies in respect of Goal 2 - Promotion of citizen and state action for water conservation, augmentation and preservation

Key areas highlighted in NAPCC	Recommended strategies and identified action points	
<p>Building public awareness will be vital in supporting implementation of NAPCC, This will be achieved through national portals, media engagement, civil society involvement, curricula reform and recognition / awards, details of which will be worked out by an empowered Group. The Group will also consider methods of capacity building to support the goals of the National Mission.</p>	Strategy II.1	<p>Empowerment and involvement of Panchayati Raj Institutions, urban local bodies, Water Users' Associations and primary stake holders in management of water resources with focus on water conservation, augmentation and preservation</p> <ul style="list-style-type: none"> a. Interactive session with policy makers for sensitization. b. Capacity Building for organizations associated with water resources development and management. c. Promotion of do-it-yourself action by citizens through intensive social communication.
	Strategy II.2	<p>Promote participatory irrigation management</p> <ul style="list-style-type: none"> a Encourage participatory irrigation management through "Command Area Development and Water Management Programme". b Encourage States to enact appropriate Participatory Irrigation Management (PIM) Act.
	Strategy II.3	<p>Sensitization of elected representatives of over-exploited areas on dimensions of the problems and to orient investment under MNREGP towards water conservation</p>
	Strategy II.4	<p>Provide incentives for water neutral and water positive technologies in industry</p> <ul style="list-style-type: none"> a Provide incentives for water neutral and water positive technologies including attractive fiscal package.

Key areas highlighted in NAPCC	Recommended strategies and identified action points
	<ul style="list-style-type: none"> b Provide incentives for water neutral and water positive technologies in industry c Encourage reuse of treated effluent
Strategy II.5	Encourage participation of NGOs in various activities related to water resources management, particularly in planning, capacity building and mass awareness
Strategy II.6	Involve and encourage corporate sector / industries to take up, support and promote water conservation, augmentation and preservation within the industry and as part of corporate social responsibility

Details of the strategies are discussed in the recommendations of the Sub-Committees and the same are included in the volume - II of the Mission Document.

3.3 Goal - 3: Focused attention to vulnerable areas including over-exploited areas

There is urgent need for appropriate measures in the vulnerable areas which are likely to be adversely affected due to impact of climate change and the areas where the water resources, particularly the groundwater resources are declining due to overuse. In about 15% of the assessment blocks, groundwater has been over-exploited and about 14% of the blocks are in critical or semi-critical state.

The strategies identified for the goal “Focused attention to vulnerable areas including over-exploited areas” include (a) Expeditious implementation of water resources projects particularly the multipurpose projects with carry over storages benefitting drought prone and rain deficit areas; (b) Promotion of traditional system of water conservation; (c) Physical sustainability of groundwater resources; (d) Intensive programme for ground water recharge in over-exploited, critical and semi-critical areas; (e) Conservation and preservation of wetland; (f) Intensive programme for addressing the quality aspects of drinking water particularly in rural area; (g) Promotion of water purification and desalination; and (h) Systematic approach for coping with floods. It is observed that the active participation of the stakeholders has yielded very encouraging results in water management. The “Andhra Pradesh Farmer-Managed Ground Water systems” is one among such success stories.

The nodal responsibility at the national level would be of Chairman, Central Ground Water Board and the Committee would consist of representatives of Ministry of Rural Development, Panchayati Raj, Agriculture and others. There will be focused attention under MGNREGA

for water augmentation in over-exploited areas identified by CGWB. Ministry of Panchayati Raj would undertake a sensitization campaign of Panchayat leadership in all 'dark' and 'grey' blocks. NGO and Civil society action would be promoted by National/State coordinating bodies. At State level, this committee would be headed by Development Commissioners of States and convened by Secretary, Department of Water Resources.

Comprehensive assessment of ground water in the country will be made by March 2011. The revised master plan for artificial recharge to ground water would be in public domain by September 2011 for the entire country and all over-exploited areas will be covered by recharge of ground water by the end of XII Five Year Plan.

Andhra Pradesh Farmer-Managed Ground Water systems (APFAMGS)

The project commonly known as Andhra Model for water resources management was implemented with an objective to equip groundwater farmer users with the necessary data, skills and knowledge to manage groundwater resources available to them in a sustainable manner, mainly through managing and monitoring their own demand and adopt suitable agricultural practices. The project's key premise is behavioural change leading to voluntary self regulation.

Thousands of farmers residing in 638 habitations in seven drought prone districts have voluntarily, under the guidance of local partner NGOs, taken number of steps to tide over the problem of groundwater depletion. Launched in July 2003, the APFAMGS project is a partnership with farmers for implementing Demand Side Groundwater Management concept. The measures taken include participatory hydrological monitoring, by engaging farmers in data collection and analysis, and building their understanding of the dynamics and status of groundwater in local aquifers. This complemented with crop water budgeting, whereby the quantity of water required for dry crops is assessed at the aquifer level and compared with the amount of groundwater actually available. Crop water budgeting is conducted in aquifer-wide meetings at which the budget is produced with thousands of farmers in attendance. This project demonstrates an alternative model to the Supply Side approach which is hugely capital intensive.

The project experience revealed that sustainable management of groundwater is feasible only if users understand its occurrence, cycle and limited availability. It was also observed that access to scientific data and knowledge will enable farmers to make appropriate choices and regarding the use of groundwater resources, obviating the need for any incentives in the form of cash or subsidies to them for making these choices.

The key areas identified in the NAPCC and the identified strategies to address the issues related to such areas are summarized in the following table.

Table - 3.3: Recommended Strategies in respect of Goal 3 - Focused attention to vulnerable areas including over-exploited areas

Key areas highlighted in NAPCC	Recommended strategies and identified action points	
<p>(a) Enhancing storage capacities in multipurpose hydro-projects and integration of drainage with irrigation infrastructures, (b) Restoration of old water tanks, (c) Formulating and implementing a regulatory regime to ensure wise use of wetland at the national, the State, and District levels, (d) Environmental appraisal and impact assessment of developmental projects on wetland, (e) Strengthen links with afforestation programmes and wetland conservation, and (f) Planning of watershed management in mountain ecosystems.</p>	<p>Strategy III.1</p>	<p>Expeditious implementation of water resources projects particularly the multipurpose projects with carry over storages benefitting drought prone and rain deficit areas</p> <p>a Expeditious implementation of projects by States in areas / situations vulnerable to climate change particularly drought prone and rain deficit areas</p> <p>b Expeditious implementation of ERM of irrigation projects by States in areas / situations vulnerable to climate change particularly drought prone and rain deficit areas</p> <p>c Expeditious implementation of minor irrigation schemes including schemes for ground water development by States in areas / situations vulnerable to climate change particularly drought prone and rain deficit areas</p> <p>d Adequate allocations to be made for undertaking projects and their time bound completion</p> <p>e Review of policies related to financing of water resources projects in vulnerable areas</p>
	<p>Strategy III.2</p>	<p>Promotion of traditional system of water conservation</p> <p>Expeditious implementation of programme for repair, renovation and restoration of water bodies in areas / situations vulnerable to climate change by (i) Increasing capacity of minor tanks, and (ii) Rehabilitating water bodies, with changed focus</p>
<p>(a) Enhancing recharge of the sources and recharge zones of deeper ground aquifers, and (b) Mandating water harvesting and</p>	<p>Strategy III.3</p>	<p>Physical sustainability of groundwater resources</p> <p>a. Pursuing the enactment of bill for ground water regulation and management and its enforcement in over-exploited areas.</p>

Key areas highlighted in NAPCC	Recommended strategies and identified action points
artificial recharge in relevant urban areas.	<ul style="list-style-type: none"> b. Expeditious implementation of programme for conservation of water through recharge of ground water including rainwater harvesting in over-exploited, critical and semi-critical areas including (i) Preparation of state-wise implementation plan for rain water harvesting and artificial recharge based on Master Plan of CGWB both for rural and urban areas and monitoring mechanism, (ii) Implementation of rain water harvesting and artificial recharge in over exploited assessment units, critical and semi-critical areas and their impact assessment, and (iii) Identify and evaluate incentives for adopting and sustaining roof top rain water harvesting systems. c. Active community participation in ground water monitoring, regulation & management. d. Promotion of a Panchayat / district level model for ground water regulation. e. Exploration of ground water including ground water exploration to decipher deeper fresh water aquifers up to 1000/1500m.
	<p>Strategy III.4 Intensive programme for ground water recharge in over-exploited, critical and semi-critical areas</p> <ul style="list-style-type: none"> a Rainwater harvesting and artificial recharge to ground water. b Expansion of programme for recharge of ground water through dug well.
	<p>Strategy III.5 Conservation and preservation of wetland</p>
(a) Exploring options to augment water supply in critical areas (b) The	<p>Strategy III.6 Intensive programme for addressing the quality aspects of drinking water particularly in rural area</p>
Mission to seek to ensure that a considerable share of the water needs of urban areas are met through recycling of wastewater; and ensuring that the water requirements of coastal	<p>Strategy III.7 Promotion of water purification and desalination</p> <ul style="list-style-type: none"> a Research for development of cost effective water purification and desalination technologies. b Encourage PPP model for desalination - preparation of necessary guidelines

Key areas highlighted in NAPCC	Recommended strategies and identified action points	
<p>cities with inadequate alternative sources of water are met through adoption of new and appropriate technologies such as low temperature desalination technologies that allow for use of ocean water, (c) Seawater desalination using Reverse Osmosis and multistage flash distillation to take advantage of low grade heat energy e.g. from power plants located in the coastal region or by using renewable energy such as solar, (d) Brackish water desalination, and (e) Water purification technologies. Developing digital elevation models for flood prone areas of forecasting flood, and Mapping areas likely to experience floods and developing schemes to manage floods.</p>	<p>Strategy III.8</p>	<p>c Provide incentive for desalination - preparation of necessary guidelines and initiation of necessary actions by the respective States and concerned central ministries.</p> <p>Systematic approach for coping with floods</p> <p>a Mapping of areas likely to experience floods, establishing hydraulic and hydrological models and developing comprehensive approach to flood management & reservoir sedimentation</p> <p>b Encourage and enforce flood plain zoning in flood prone rivers</p>

Details of the strategies are discussed in the recommendations of the Sub-Committees and the same are included in the volume - II of the Mission Document.

3.4 Goal - 4: Increasing water use efficiency by 20%

One of the most important goals of the National Water Mission is to improve the efficiency of water use at least by 20%. The objective can be achieved by ensuring improved efficiency both on the demand side as well as the supply side. Research in the area of increasing the water use efficiency in agriculture, industry and domestic water is very important strategy. Similarly, full utilization of the created facilities and better design and proper operation and maintenance would considerably help in improving the efficiency on supply side. Use of micro irrigation, promotion of water neutral and water positive technologies, recycling of water etc. are also very important measures for

increasing the efficiency. At the same time adoption of better management practices are also very important.

Farmers Participatory Action Research Programme (FPARP)

Ministry of Water Resources commissioned 5000 FPARP - a programme under "More Crop and Income per Drop of Water", in late 2007, throughout the country with the help of Agricultural Universities/ ICAR institutes/ Engineering colleges/ WALMIs etc. for demonstrating the technologies available - on shelf - to the farmers for increasing the productivity and profitability of agriculture through generating synergy among water, crop, agronomic practices, soil nutrients, crop variety and implements etc.

These 5000 programmes were demonstrated in the field during 2-3 crop seasons by 60 illustrious Institutions across the country in more than 2000 villages and involving thousands of farmers. The programme has been completed by March 2010 except a few experiments for which extension has already been given. The final reports have already been received from some of the Institutions which show substantial increase in the yields of the crops at one hand and water saving at the other hand, in general. The impact assessment of the demonstrations has already been taken up which would help in deciding up scaling of the technology. Locally suited techniques and technologies applied and demonstrated under FPARP included: (a) Micro Irrigation i.e., drip and sprinkler, (b) Rain water harvesting structures (water storage tanks), (c) Soil moisture conservation (Mulching, dead furrow, opening of furrow, tied ridging etc.), (d) System of Rice Intensification (SRI), (e) Broadbed & Furrow irrigation, (f) Deficit irrigation, (g) Refinement of existing ITK of recycling Tank silt to modern technical knowledge, (h) Micro nutrient management, (i) Low Cost Poly-house/net house, (j) Land leveling/configuration, (k) Precision farming irrigated crops/Dry crops, (l) Zero tillage/zero till drill, (m) Deep tillage/Conservation tillage, (n) Improved varieties of seeds, (o) Dry farming technology in soil and water conservation, (p) Pit method/paired row planting of sugarcane, (q) Sub surface method of sugarcane cultivation, (r) Sowing of paddy seeds with drum seeder, and (s) Multiple use of water.

Encouraged by the results received, so far, the Government has decided to extend the programme for two more years during which another 5000 demonstrations would be taken up.

An analysis shows that modernization and renovation of existing old projects, command area development including selective lining of water courses etc. may increase the overall irrigation efficiency by about 20-21%. About 5000 field demonstrations, all over the country, of the technological interventions suited to the local conditions by academicians and research organisations have shown increase in yields as well as water savings. The strategies included under the goal "Increasing water use efficiency by 20%" are (a) Research in area of increasing water use efficiency and maintaining its quality in agriculture, industry and domestic sector; (b) Incentivize recycling of water including wastewater; (c) Development of Eco-friendly sanitation system; (d) Improve efficiency of urban water supply system; (e) Efficiency labeling of water appliances and fixtures; (f) Promotion of water efficient techniques and technologies; (g) Undertake Pilot projects for improvement in water use efficiency in collaboration with States; (h) Promote Water Regulatory Authorities for ensuring equitable water distribution and rational charges for water facilities; (i) Promote mandatory water audit including those for drinking water purposes; (j) Adequate

provision for operation & maintenance of water resources projects; (k) Incentive through award for water conservation & efficient use of water; and (l) Incentivize use of efficient irrigation practices and fully utilize the created facilities.

The Farmers Participatory Action Research programme (FPARP) of the Ministry of Water Resources has demonstrated that with adoption on better techniques and technologies, the efficiency of water use can be considerably improved.

At present, there is a gap of about 15% in the irrigation potential created and utilized. Full utilization of the created facilities has been identified as an important strategy. This has been duly highlighted in the report of the Mid-Term Appraisal of the XI Plan as under.

- It should not happen that the dam is constructed but the distribution system is not making headway making the investment idle and at times infructuous. Command area development should occur pari passu with the creation of infrastructure. Command area development must carefully integrate traditional water harvesting systems already existing in the command. 10% of the AIBP command must mandatorily be provided with water saving micro-irrigation techniques.
- An agricultural improvement programme focused on improving water use efficiency and agricultural productivity must be dovetailed in to the AIBP. Revision of water charges is an important instrument for promoting water use efficiency.
- For command area development to be effective, the participation of farmers as stakeholders in the process must occur right from the planning and implementation to monitoring and maintenance. For this, WUAs need to be set up within the framework of PRIs and provided with autonomy, incentives and powers.

The success of Participatory Irrigation Management is evident from the achievements in respect of Waghad Irrigation Project.

Nodal responsibility would be of Secretary of Ministry of Water Resources and would have Ministry of Agriculture, Urban Development, Power and Rural Development (Department of Drinking Water & Sanitation) as members. At State level the Committee would be chaired by the Secretary, Water Resources of the State with similar composition.

The timeline for action would be to increase water use efficiency by 20% by the year 2017. The gap about 15% between the irrigation potential created and the irrigation potential utilized would also be reduced by half by the year 2017.

**Full Utilization of Created Facilities and Enhancing Water Productivity through Participatory Irrigation Management :
A Success Story of Waghad Irrigation Project**

Waghad Irrigation Scheme located in Nashik district of Maharashtra State was commissioned in 1981. The scheme's cultivatable command area 9642 hectare (ha) but only one-third if it was irrigated as farmers in tail reaches were deprived of the irrigation water. In 1990, a local civil society called Samaj Parivartan Kendra (centre for social transformation) in collaboration with the State Irrigation Department motivated farmers to come forward in taking over the operation and management of the scheme. At the outset only 3 Water Users' Associations (WUAs) were formed at the tail area of the canal command, where barely some 100 ha out of 1150 ha were irrigated. Initially these WUAs had to struggle to get their share of irrigation but with transfer of management to WUAs, farmers in tail area received their quota of irrigation water and thus could irrigate more area. Enthused with the success of the 3 WUAs, farmers from the entire command gradually formed 24 WUAs. As a step forward, in the year 2003, all the WUAs joined their forces to take over the operation and management of the entire irrigation scheme by forming an apex organization called Waghad Project Level Water Users Association (PLWUA).

PLWUA undertakes the water management with technical guidance and support from Water Resources Department. Water is supplied volumetrically at the head of the canal and subsequently the PLWUA distributes the water among 24 WUAs as per their demand and entitlements. WUAs further distribute water among their members. As average land holding of farmers is very small (0.5 to 1.0 ha), volumetric supply to each farm holding is difficult, so farmers have devised innovative way to share water on time basis. The PLWUA collect water charges from its member associations. Management transfer to PLWUA has resulted in to 100% utilization of irrigation potential, saving in water, crop diversification, and 100% collection of water charges. Status of area irrigated, recovery of water charges etc. is as under.

Sl. No.	Description	Before formation of PLWUA(1980-90)	After formation of PLWUA (2006-09)
1	Average area irrigated	3,212 ha	10,750 ha
2	Mode of water supply	Area basis	Volumetric basis
3	Average water charges recovery	Rs 3 lakhs	Rs 22 lakhs
4	Recovery of water charges	60%	100%
5	Crop pattern	Restricted	Cropping freedom
6	Water entitlement	No entitlement	Transparent & enforceable

The major outcome has been in the form of considerable increase in the farmers' income from about Rs 60,000 per hectare in 2003-04 to about Rs 1,20,000 in 2008-09.

The key areas identified in the NAPCC and the identified strategies to address the issues related to such areas are summarized in the following table.

Table - 3.4: Recommended Strategies in respect of Goal 4 -Increasing water use efficiency by 20%

Key areas highlighted in NAPCC	Recommended strategies and identified action points	
<p>(a) The Mission to take into account the provisions of the National Water Policy and develop a framework to optimize water use by increasing water use efficiency by 20%, (b) Increase in the efficiency of water use in domestic and industrial sector, (c) Need for incentives to adopt water-neutral or water-positive technologies, (d) Water recycle and reuse, (e) Ensuring more effective management of water resources, (f) The Mission to seek to ensure that a considerable share of the water needs of urban areas are met through recycling of wastewater; and ensuring that the water requirements of coastal cities with inadequate alternative sources of water are met through adoption of new and appropriate technologies such as low temperature desalination technologies that allow for use of ocean water, (g) Regulation of power tariffs for irrigation, and (h) Incentive structures will be designed to promote recharging of underground water resources.</p>	<p>Strategy IV.1</p>	<p>Research in area of increasing water use efficiency and maintaining its quality in agriculture, industry and domestic sector</p>
	<p>Strategy IV.2</p>	<p>Improvement in efficiency of water use and that of water utilization facilities for increasing food and water security through increasing usable water by (i) Minimising inadvertent evaporation from water logged areas, barren land, agricultural fields between crops, wet soil between crop rows in irrigated fields, (ii) Increasing storages in water use systems by use of ground water space as storage, through enhanced fluctuations like pumping water from Terai to deplete ground water before floods, conjunctive use in time, with larger ground water use in bad years, more efficient use of vadose zone moisture storage, repeated use of surface storage during wet season, increasing storages and carry over storages through implementing a programme for raising dam heights, (iii) Increasing water use efficiency by encouraging re-use of return water, modernization of canals and distribution systems, (iv) Participatory management by water users for increased efficiency, and (v) Identification and evaluation of crop varieties using extreme conditions of water, design for appropriate cropping patterns and adoption of integrated farming system etc. including incentives for efficient use of water.</p> <p>Incentivize recycling of water including wastewater</p> <p>a Incentivize recycling of water including wastewater.</p> <p>b Preparation of necessary guideline for encouraging PPP model for recycling and wastewater treatment.</p> <p>c Provide technical and financial support for common wastewater treatment and recycling plants.</p>

Key areas highlighted in NAPCC	Recommended strategies and identified action points	
<p>(a) Mandatory water assessments and audits; ensuring proper industrial waste disposal, (b) The Mission to seek development of new regulatory structures, combined with appropriate entitlements and pricing</p>		<p>d Strict enforcement of provisions in respect of wastewater treatment.</p>
	<p>Strategy IV.3</p>	<p>Development of Eco-friendly sanitation system</p>
	<p>Strategy IV.4</p>	<p>Improve efficiency of urban water supply system</p>
	<p>Strategy IV.5</p>	<p>a Initiate benchmark studies for urban water use and introduce concept of water efficiency index for urban areas.</p>
		<p>b Develop knowledge bank for urban water supply and use.</p>
<p>c Adopt volumetric metering for urban water supply.</p>		
<p>d Water supply system to be made sustainable through appropriate pricing.</p>		
<p>(a) Ensuring more effective management of water resources, (b) National Water Mission to seek to optimize the efficiency of existing irrigation systems, including rehabilitation of systems that have been rundown and also expand irrigation, where feasible, with a special effort to increase storage capacity, and (c) incentive structures to be designed to promote adoption of large scale programmes which rely on sprinklers, drip irrigation and ridge and furrow irrigation.</p>	<p>Strategy IV.5</p>	<p>Efficiency labeling of water appliances and fixtures</p>
	<p>Strategy IV.6</p>	<p>Promotion of water efficient techniques and technologies</p>
	<p>Strategy IV.7</p>	<p>a Promotion of micro irrigation techniques such as sprinkler and drip irrigation.</p>
		<p>b Expand “Farmers’ Participatory Action Research Programme”.</p>
	<p>Strategy IV.8</p>	<p>Undertake Pilot projects for improvement in water use efficiency in collaboration with States</p>
<p>Strategy IV.9</p>	<p>a. Pilot project for improving water use efficiency.</p>	
	<p>b. Pilot project for improving efficiency of water system.</p>	
<p>Strategy IV.8</p>	<p>Promote Water Regulatory Authorities for ensuring equitable water distribution and rational charges for water facilities</p>	
<p>Strategy IV.9</p>	<p>Promote mandatory water audit including those for drinking water purposes</p>	
<p>a</p>	<p>Preparation of guidelines and manuals.</p>	
<p>b</p>	<p>Pursue the implementation with State governments and other agencies.</p>	

Key areas highlighted in NAPCC	Recommended strategies and identified action points	
Where the resource requirements of the Mission call for an enhancement of allocation in the XI Plan, this will be suitably considered, keeping in view the overall resource position and the scope for re-prioritization.	Strategy IV.10	Adequate provision for operation & maintenance of water resources projects
		Provisions for operation and maintenance of the projects to be appropriately enhanced.
	Strategy IV.11	Incentive through award for water conservation & efficient use of water.
	Strategy IV.12	Incentivize use of efficient irrigation practices and fully utilize the created facilities
		a Preparation of appropriate guidelines.
		b Initiation of actions by the States and other agencies.

Details of the strategies are discussed in the recommendations of the Sub-Committees and the same are included in the volume - II of the Mission Document.

3.5 Goal - 5: Promotion of basin level integrated water resources management

Promotion of basin level integrated water resources management is a very important goal identified for national water Mission. Various strategies identified under the goal are (a) Review of National Water Policy; (b) Review of State Water Policy; (c) Guidelines for different uses of water e.g., irrigation, drinking, industrial etc particularly in context of basin wise situations; (d) Planning on the principle of integrated water resources development and management; (e) Inter-basin integration particularly for augmenting water by converting surplus flood water into utilizable water; and (f) Ensuring convergence among various water resources programmes.

Nodal responsibility will be of the Ministry of Water Resources.

Ministry of Water Resources will review the National Water Policy by 2011 to move towards basin development and have guidelines for different uses of water completed by 2012.

The key areas identified in the NAPCC and the identified strategies to address the issues related to such areas are summarized in the following table.

Table - 3.5: Recommended Strategies in respect of Goal 5 - Promotion of basin level integrated water resources management

Key areas highlighted in NAPCC	Recommended strategies and identified action points	
<p>(a) National Water Policy to be re-visited in consultation with States to ensure basin level management strategies to deal with variability in rainfall and river flows due to climate change, (b) National Water Mission to ensure more equitable distribution both across and within States, and (c) Prioritizing watersheds vulnerable to flow changes and developing decision support systems to facilitate quick and appropriate responses.</p>	<p>Strategy V.1</p>	<p>Review of National Water Policy</p> <p>a Review of National Water Policy by MoWR particularly with a view to ensure (i) integrated water resources management for helping to conserve water, minimize wastage and ensure more equitable distribution, (ii) consideration of precipitation as basic water resource, (iii) evaporation management as an important strategy, (iv) basin level management strategies, (v) appropriate entitlement and pricing, and (vi) appropriate regulatory mechanism.</p> <p>b Consultation with States and the Stakeholders.</p> <p>c Adoption of revised policy by the Government.</p>
	<p>Strategy V.2</p>	<p>Review of State Water Policy</p>
	<p>Strategy V.3</p>	<p>Guidelines for different uses of water e.g., irrigation, drinking, industrial etc particularly in context of basin wise situations</p> <p>(a) Encourage water harvesting, (b) Encourage non-agricultural type developments of the type where not much water is required, (c) Piped surface water for clusters of villages with ground water quality problems, (d) Careful use of dual pipe supply systems to conserve water with due consideration to simultaneous planning for sewerage lines in urban areas to ensure prevention of pollution of water sources (e) Encouraging leakage control programmes (f) Consideration of desalination as an option, for supply to urban coastal communities, (g) Regulation for in-house water withdrawals of industries, through royalties and licenses, (h) Extending subsidies and incentives for recycling and recovery, (i) Revise water tariff based on cost recovery principle, (j) Option of programme based Clean Development Mechanism (CDM) in industrial and domestic wastewater as against project approach,</p>

Key areas highlighted in NAPCC	Recommended strategies and identified action points	
<p>(a) National Water Mission to ensure integrated water resource management helping to conserve water, minimize wastage and ensure more equitable distribution both across and within States, and (b) Integrated water policies to cope with variability in rainfall and river flow at the basin level.</p>	<p>Strategy V.4</p>	<p>potential of efficient water use systems, exploring bilateral joint ventures for funding CDM projects, (k) Promotion of water efficient fixtures, (l) Incentivisation for recycling waste water.</p> <p>Planning on the principle of integrated water resources development and management</p> <ul style="list-style-type: none"> a Preparation of appropriate guidelines b Interaction with States c Adoption and application of guidelines by project authorities and appraising agencies d Amendment to River Board Act under entry 56 of Union list to make it more effective e Setting up of river basin organizations.
	<p>Strategy V.5</p>	<p>Inter-basin integration particularly for augmenting water by converting surplus flood water into utilizable water</p> <p>Expeditious formulation of the projects for utilization of surplus flood water for beneficial use of the society and implementation of projects after evaluating costs and land acquisition problems.</p>
	<p>Strategy V.6</p>	<p>Ensuring convergence among various water resources programmes</p> <p>Convergence among various programmes related to water resources development and management particularly (i) CAD&WM, RRR of Water Bodies, Ground water recharge through dug wells programmes of Ministry of water resources, (ii) NREGA of Ministry of Rural Development, (iii) Drinking water supply of Department of Drinking Water & Sanitation (Ministry of Rural Development), (iv) Integrated watershed development programme of Ministry of Agriculture, (v) various water conservation programmes of Ministry of Environment and Forests.</p>

Details of the strategies are discussed in the recommendations of the Sub-Committees and the same are included in the volume - II of the Mission Document.

As mentioned above, the strategies are described in details in the report of the Sub-committees and the same are included in the volume - II of the Mission Document. More than one Sub-committees have discussed some of the strategies. This is due to the fact that various issues related to the impact of climate change on water resources are closely inter-related and there is considerable inter-dependence. However, efforts have been made to minimize the scope of duplication while identifying the strategies and finalizing the overall target and the timeliness for planning and monitoring by the High Level Steering Committee [as discussed in chapter 4].

Chapter - 4

Monitoring & Evaluation Mechanism, Institutional Setup and Plan of Action

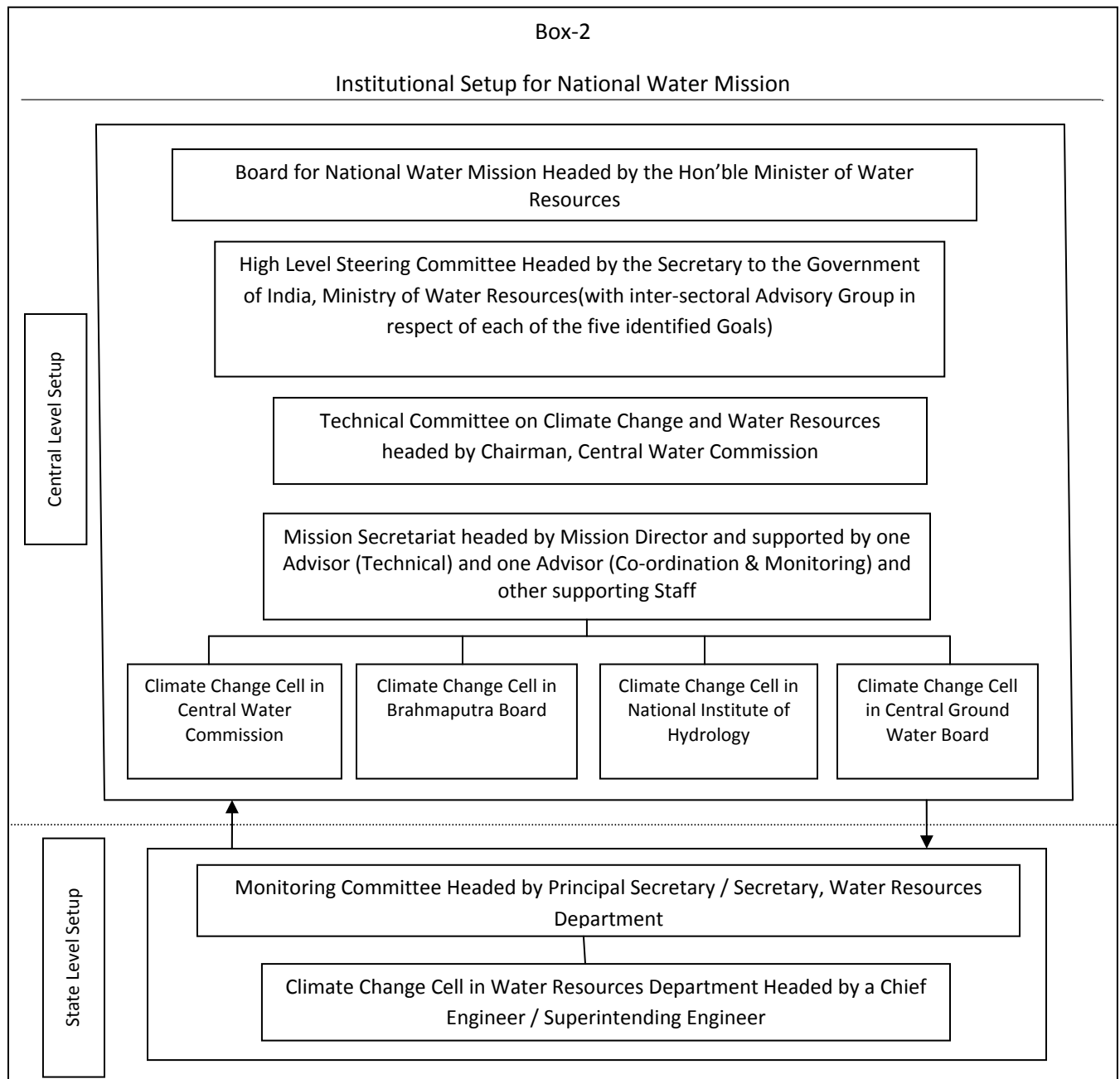
As discussed earlier, the impact of climate change could primarily be in the form of further intensification of variability in river flow and increase in the intensity of extreme events, which requires to be established in quantitative terms. Therefore, the first and the foremost task is to carry out research and studies for realistic assessment of the impact of climate change followed by expeditious actions on implementation of projects in respect of conservation of water resources and adoption of better management practices with emphasis of optimal utilization and increase in efficiency. Obviously, this calls for immediate review of the policies and continuous monitoring of the implementation of programme, their critical review from time to time and identification of corrective measures.

Most of the programmes related to water resources comes under the purview of the State Governments and are being implemented by them. Further several Central Ministries and Organisations are responsible for implementation of activities related water resources [Refer Box-1].

Box-1 Central Ministries / Organisations responsible for various Activities related to Water Resources Development and Management		
Sl. No.	Activities	Ministry / Organisations
1.	Overall Policy Issues, Assessment of Water Resources, Major and Medium Irrigation, Minor Irrigation, Ground Water and Flood Management	Ministry of Water Resources
2.	Rural Drinking Water	Department of Drinking Water & Sanitation, Ministry of Rural Development
3.	Urban Drinking Water	Ministry of Urban Development
4.	Industrial Water	Ministry of Urban Development / Ministry of Commerce and Industry
5.	Hydropower Development	Ministry of Power
6.	Inland Navigation	Ministry of Transport
7.	Environmental Issues	Ministry of Environment and Forests
8.	Overall Planning for Water Resources Development and Fund Allocation	Planning Commission
9.	Watershed Development	Ministry of Agriculture / Ministry of Environment and Forests / Ministry of Rural Development
10.	(a) Water planning for Agriculture, (b) Micro Irrigation & (c) Management of Water related Disaster (Drought)	Ministry of Agriculture
11.	Management of Water related Disaster (Flood)	Ministry of Home Affairs

4.1 Proposed monitoring and evaluation mechanism

In view of above cited position, appropriate measures for mitigation of the impact of climate change on water resources, as also the adaptive measures are required to be undertaken by respective ministries and the State Governments. However, for identification of the most appropriate measures from the national perspectives and for ensuring effective implementation of the identified activities, it is necessary to have proper co-ordination among all the stakeholders on one hand and the various implementing agencies on the other hand.



In view of above, a two-tier setup has been proposed one at Central level and the other at State level. The setup is illustrated in Box-2. A Board under the chairmanship of Hon'ble Union Minister of Water Resources is proposed to be apex body for framing the policies and guidelines for implementation of the National Water Mission. The proposed Board will have representative from States and Central Ministries / Organizations, experts, representatives from professional organizations etc. The composition of the Board is at Annexure-II. A High Level Steering Committee headed by the Secretary to the Government of India, Ministry of Water Resources and comprising of members representing concerned Ministries, Experts, Non-Governmental Organisations (NGOs) etc. has since been constituted. It is proposed to further expand the Steering Committee to include representatives from State Governments and representatives from professional organizations and private agencies dealing with water resources. The proposed composition of the High Level Steering Committee is at Annexure - III. There would be inter-sectrol Advisory Group for each of the five identified goals of the Mission. The composition of the Advisory Groups are at Annexure IV (a) to IV (e)

Similarly, MoWR has also constituted a Technical Committee on Climate Change and Water Resources under the Chairmanship of Chairman, CWC. The Technical Committees also includes representatives from NGOs. It is proposed to further strengthen the Committee by including representatives from Water Resources Departments of State Governments / State Government Organizations dealing with research and management of water resources. The revised Composition of the Technical Committee is at Annexure - V. Specific cells for carrying out research and studies on the impact of climate change on water resources have been created at National Institute of Hydrology, Central Water Commission, Central Ground Water Board and Brahmaputra Board.

4.2 Institutional set-up

As indicated above, the objective of the "National Water Mission" can be achieved only through proper co-ordination, closed monitoring and in-depth evaluation at regular interval. Therefore, a dedicated Secretariat is considered necessary. It is proposed to have a very compact Mission Secretariat headed by a Mission Director (who could be a professional or an expert) in the rank of Additional Secretary to the Government of India. The Mission Director would be equipped with necessary financial & administrative powers and would be accountable for implementation of the identified programme. The Mission Director would be supported by two Advisors - one Advisor to be fully devoted to technical evaluations and the other for co-ordination and monitoring. The advisors could be in the rank of Joint Secretary (or equivalent) or Director (or equivalent), the choice being mainly on the basis of the expertise and capability of the persons. MoWR would be required to make an appropriate choice depending upon the work requirements and

suitability of the persons with a view to ensure that the objectives of the National Water Mission are implemented in a time bound manners. The posts of Mission Director for National Water Mission and the two Advisors are proposed to be created. Necessary secretarial assistance could be either provided by the MoWR or outsourced. The proposed composition of the Mission Secretariat is at Annexure - VI. The three cells created in NIH, CWC and BB and the one proposed at CGWB for research and studies on impact of climate change on water resources would provide necessary input and assistance to the Mission Secretariat. The Mission Secretariat may also engage the services of consultant or outsource the services of professionals on specific matters as and when required.

State Governments would be requested to set up Monitoring Committee under the Chairmanship of the Principal Secretary / Secretary in charge of Water Resources. The State Government would also be requested to create Climate Change Cell at appropriate level. In case of States with considerable potential for water resources development, the cell should be headed by an officer in the grade of Chief Engineer whereas in smaller States, it could be headed by a Superintending Engineer.

4.3 Action Plan and timelines

The identified strategies for addressing the issues related to impact of climate change on water resources are described in Chapter - 3. Specific targets, the timeline for implementation of the identified strategies and action points and the nodal agencies / organizations are at Annexure -VII.

Research and Development, Training and Capacity Building

One of the most important area for research and development is the “Climate changes and water resources”, particularly in the field of (a) impact of climate change on water resources, (b) efficacy for various measures for mitigating the impact of the projected changes in the water resources, (c) changes needed in policy & planning and management practices to optimally utilize the resources; and (d) adaptation measures, their impacts and efficacy. MoWR has duly identified the need for research in the area of impact of climate change on water resources and this area constitutes an important component of the scheme for “Research and Development” for XI Plan. IIT, a premier research institute in the field of hydrology has already initiated research in the area. CWC and BB have also taken up studies in the field and have initiated actions for establishment of additional hydrological observation sites particularly those required for assessment of impact of climate change and glaciers and snowmelt. With a view to actively associate the reputed academic institutions, MoWR has also decided to establish “Professorial Chairs”. These institutions have been associated for specific studies related to impact of climate change on water resources. Indian Institute of Technology, Roorkee and National Institute of Technology, Srinagar are associated with studies in respect of Indus basin. Indian Institute of Technology, Kanpur and National Institute of Technology, Patna has been assigned with the responsibility of research and studies related to Ganga basin. Indian Institute of Technology, Guwahati and Indian Institute of Technology, Kharagpur will contribute in assessment of impact of climate change in respect of Brahmaputra basin. MoWR has also assigned studies to Indian Institute of Science, Bangalore in respect of impact of climate change in rainfall and water resources of peninsular river basins. Depending upon the specific requirements, more institutions could be associated.

Capacity building and training of various stakeholders particularly that of Panchayati Raj Institutions, Urban Local Bodies and Water Users Association has been identified as an important activity. The capacity building for Research Institutes, Water and Land Management Institutes and Academic Institutions in various states has also been identified as an important activity under the scheme for “Research and Development” of the MoWR. Ministry has already invited proposals from various institutes in this regard.

Mass awareness programme, focused awareness programmes for policy makers and training of professionals is very important and is considered necessary for better understanding of the complex issues and identification of strategies in right perspective. This is more so in view of the fact that the present techniques for

projection of impact of climate change on water resources etc. are based on numerous assumptions and need considerable improvement. Further, in view of considerable variation in factor affecting such changes, the techniques developed in a specific country or in a region may not be replicated. It is considered necessary to have trained professional in the area. Although there are schemes for training in the area of water resources, it is proposed to provide additional resources for the purpose and ensure that the policy makers are fully conversant with various aspects and the professional are adequately trained to address the issues. The training programme may include study tours and specialized training abroad also. It is also proposed to associate various academic institutions, Water & Land Management Institutes and reputed Non-governmental Organizations in organizing the training and capacity building programmes.

Prioritization of Strategies

Relatively very large temporal and spatial variation in rainfall and consequently in the river flow and ground water aquifers is an important feature of the water resources in India. Although the impact of climate change on water resources has not been fully and accurately quantified, various studies indicate that the likely impact of climate change on water resources could contribute to further intensification of the extreme events. Further, the features of water resources - both the availability and the quality may also considerably be affected by the changes in the land use through urbanization, industrialization and changes in the forest cover. Realizing that the various processes which influence the hydrologic cycle are of dynamic nature, precise quantification of the impact specifically due to climate change may not be a simple task and it would be necessary to make suitable assumption at the initial stages and undertake detailed simulation studies with more and more data as they become available with time. However, the likely implications of climate change on water resources could be in the form of:

- Decline in the glaciers and the snowfields in the Himalayas;
- Increased drought like situations due to overall decrease in the number of rainy days in many parts of the country;
- Increased flood events due to overall increase in the rainy day intensity;
- Effect on groundwater quality in alluvial aquifers due to increased flood and drought events;
- Influence on groundwater recharge due to changes in precipitation and evapo-transpiration; and
- Increased saline intrusion of coastal and island aquifers due to rising sea levels.

From the above, it is apparent that in the context of likely impact of climate change on water resources the most vulnerable areas in India would include (a) drought prone areas, (b) flood prone areas, (c) the coastal regions, (d) the region with deficient rainfall, (e) areas with over-exploited, critical and semi-critical stage of ground water development, (f) water quality affected areas, and (g) snow-fed river basins.

The degree of impact would vary considerably from one region to the other depending upon numerous factors including the topographic, hydro meteorological and socio-economic profile of the region and accordingly the choice of the adaptation measures would also have to be made after taking into consideration all aspects. The

key conclusions drawn in the report titled “Climate Change Impact in Drought and Flood Affected Areas: Case Studies in India” are:

- Good development is also good adaptation policy;
- High risks call for greater income diversification - need for finding new instruments for promoting income diversification;
- Climate change cuts across sectoral boundaries; and
- There is need to build greater linkages between sectors and integrate many excellent programmes already in existence.

The report has recommended the following strategies that would help in reducing the exposure to climate risks and in building adaptive resilience.

- Strengthening climate information system and mechanism
- Fostering climate-resilient reforms in agriculture and water resources management
- Supporting the management of climate risks with economic mechanism and instruments
- Improving institutional capabilities and linkages in sectoral programmes.

Various issues related to the impact of climate change on water resources are duly addressed under different strategies identified to achieve the five goals of the National Water Mission. However, it is necessary to prioritise the various strategies particularly with a view to address the specific areas which are likely to be affected adversely by the likely impacts of the climate change.

Needless to say, the first and the foremost priority is to put in place a suitable mechanism for operationalising the National Water Mission for coordinated actions for addressing the impact of climate change on water resources. As indicated in the report, it is proposed to create a dedicated Mission Secretariat in the Ministry of Water Resources which will coordinate the various actions. It is proposed to establish the Mission Secretariat on priority. Further, the following specific action points have been identified to be taken up on priority.

A. Research, Studies & Capacity Building

- Development of water resources information system
- Research and studies on all aspects related to impact of climate change on water resources including quality aspects of water resources with active collaboration of all research organizations working in the area of climate change
- Reassessment of basin-wise water situation

- Projection of the impact of climate change on water resources particularly in areas vulnerable to climate change.
- Research in area of increasing water use efficiency in agriculture, industry and domestic sector
- Undertake Pilot projects for improvement in water use efficiency in collaboration with States with focus on areas vulnerable to climate change
- Capacity building and awareness programme including those for Panchayati Raj Institutions, Water Users' Associations, urban local bodies dealing with water and primary users with active involvement of NGOs.

B. Improvement in Management Practices

- Promote participatory irrigation management
- Encourage participation of NGOs in various activities related to water resources management, particularly in planning, capacity building and mass awareness
- Involve and encourage corporate sector / industries to take up support and promote water conservation, augmentation and preservation within the industry and part of corporate social responsibility
- Adequate provision for operation and maintenance of water resources projects
- Incentivize use of efficient irrigation practices and fully utilize the created facilities

C. Expeditious Implementation of Specific Strategies

- Expeditious implementation of water resources projects particularly the multipurpose projects with carry over storages benefitting drought prone and rain deficit areas
- Promotion of traditional system of water conservation
- Intensive programme for ground water recharge in over-exploited areas with active involvement of PRIs, ULBs and NGOs
- Conservation and preservation of wetland
- Systematic approach for coping with floods - preparation of master plan for flood management with due emphasis on non-structural measures for flood management namely flood forecasting, flood plain zoning etc.

D. Policy & Planning

- Review of National Water Policy
- Preparation of guidelines for different uses of water e.g. irrigation, drinking, industrial etc. particularly in context of basin-wise situations
- Planning on the principle of integrated water resources development and management - planning of water resources from national perspective for meeting the requirements for various purposes particularly the drinking water and food production with due consideration to the environmental issues.

It is proposed that the establishment of the Mission Secretariat and implementation of key prioritized strategies would be undertaken and encouraged by Ministry of Water Resources by appropriately modifying the existing schemes - both in terms of their scope and outlays.

Chapter - 7

Outline of the Plan for Operationalization of National Water Mission

The following action points are proposed for operationalisation of the identified strategies under National Water Mission - both long term as well as short term basis.

Strategies	Proposed approach for implementation of the strategies
<u>Stage-I - Taking Up The Prioritized Strategies</u>	
1 Establishment of Mission Secretariat	To be covered under the existing scheme for “Research & Development” by suitably modifying the same.
2 Research, studies & capacity building	
Development of water resources information system	A “Water Resources Information System” and a Web-enabled Ground Water Resources Information System is being developed under the existing schemes of Ministry of Water Resources. It is proposed to suitably modify the schemes to fully achieve the objectives. Focused attention will be given to areas vulnerable to climate change.
Research and studies on all aspects related to impact of climate change on water resources including quality aspects of water resources with active collaboration of all research organizations working in the area of climate change	To be covered under the existing scheme for “Research & Development” by suitably modifying the same. Research and academic institutions such as IITs, NITs, Agriculture Universities, ICAR and NIH will be fully associated in the exercise.

Strategies	Proposed approach for implementation of the strategies
Reassessment of basin-wise water situation	To be covered under the existing schemes by suitably modifying the same. This exercise will be carried out by CWC, CGWB and NIH in collaboration / consultation with the concerned State Governments.
Projection of the impact of climate change on water resources	To be covered under the existing scheme for “Research & Development” by suitably modifying the same. Academic / Research Institutions such as IITs, Roorkee, Kanpur, Kharagpur and Guwahati, NITs, Patna & Srinagar, IISc, Bangalore, CWC, CGWB, Brahmaputra Board and NIH are already involved in the exercise.
Research in area of increasing water use efficiency in agriculture, industry and domestic sector	To be covered under the existing scheme for “Research & Development” by suitably modifying the same
Undertake Pilot projects for improvement in water use efficiency in collaboration with States	To be covered under the existing schemes by suitably modifying the same and in collaboration with concerned Ministries and other organizations, particularly with the Ministry of Agriculture with reference to the activities related to micro-irrigation to be undertaken as part of the “National Mission on Sustainable Agriculture”.
Capacity building and awareness	To be covered under the existing

Strategies	Proposed approach for implementation of the strategies
<p>programme including those for Panchayati Raj Institutions, Water Users' Associations urban local bodies dealing with water and primary users</p>	<p>schemes namely (a) National Water Academy, (b) Rajiv Gandhi National Ground Water Training and Research Institute, and (c) Information, Education and Communication by suitably modifying the scope and outlay for the respective schemes. It is also proposed to actively involve other agencies particularly Agricultural Research Institutes, Agricultural Universities and Water and Land Management Institutes (WALMIs) in capacity building and awareness creation programmes. It is proposed to identify reputed NGOs with expertise and experience in water sector and involve them also in this exercise. The access of water related information through "Water Resources Information System" and "Web-enabled Ground Water Resources Information System" would also be effectively used for awareness creation and capacity building.</p>
<p>3 Improvement in Management Practices</p>	
<p>Promote participatory irrigation management</p>	<p>To be covered under the existing scheme "Command Area Development and Water Management" by suitably modifying the same. It is also planned to ensure command area development works and participatory irrigation management an integral part of all new schemes for irrigation.</p>

Strategies	Proposed approach for implementation of the strategies
<p>Encourage participation of NGOs in various activities related to water resources management, particularly in planning, capacity building and mass awareness</p>	<p>Reputed NGOs are proposed to be identified and involved in capacity building and hand holding in initial stages of formation of Water Users' Associations.</p> <p>To be covered under the existing schemes by suitably modifying the same. Reputed NGOs with expertise and experience in water management will be identified and actively involved.</p>
<p>Involve and encourage corporate sector / industries to take up support and promote water conservation, augmentation and preservation within the industry and part of corporate social responsibility (CSR)</p>	<p>To be covered under the existing schemes by suitably modifying the same. Regular interaction with corporate sector through their associations such as CII, ASSOCHAM, FICCI etc. will be organized for encouraging them to adopt water conservation practices and water efficient technologies. They will also be encouraged to take up waste water treatment, recycling and reuse to minimize water consumption in industries and also take up rainwater harvesting and recharge of ground water in-house as well as a part of CSR.</p>
<p>Adequate provision for operation and maintenance of water resources projects</p>	<p>Through promotion of Water Regulatory Authorities for ensuring equitable water distribution and rational charges for water facilities, persuasion with States and effective implementation of the recommendations of the 13th Finance Commission in this</p>

Strategies	Proposed approach for implementation of the strategies
	regard, particularly the conditions related to setting up of statutory and independent regulatory authority.
Incentivize use of efficient irrigation practices and fully utilize the created facilities	Outline for programme for incentivizing efficient irrigation practices to be prepared by MoWR in consultation with Planning Commission, Ministry of Agriculture and State Governments. Services of NGOs will also be utilized in this important exercise which requires active participation of farmers.
4 Expeditious Implementation of Specific Strategies	
Expeditious implementation of water resources projects particularly the multipurpose projects with carry over storages benefitting drought prone and rain deficit areas	To be promoted under existing programmes and schemes by suitably modifying the same
Promotion of traditional system of water conservation	To be covered under the existing scheme “Repair, Renovation and Restoration of Water Bodies” by suitably modifying the same. Other traditional systems of rainwater harvesting and in-situ storage will also be identified and promoted.
Intensive programme for ground water recharge in over-exploited areas	Activities to be promoted under the existing scheme “Ground Water Management and Regulation” by suitably modifying the same. The programme will be

Strategies	Proposed approach for implementation of the strategies
	<p>taken up on a large scale by converging and pooling resources from other programmes such as MNREGP, Watershed Development Programme and Rural Drinking Water Programme. States, PRIs, ULBs and NGOs will be extensively involved.</p>
<p>Conservation and preservation of wetland</p>	<p>Ministry of Environment and Forests to suitably address the issues in their existing schemes</p>
<p>Systematic approach for coping with floods - preparation of master plan for flood management with due emphasis on non-structural measures for flood management namely flood forecasting, flood plain zoning etc.</p>	<p>Activities to be undertaken by Central Water Commission, Ganga Flood Control Commission and Brahmaputra Board in consultation with Ministry of Environment and Forests, National Disaster Management Authority (NDMA) and State Governments.</p>
<p>5 Policy & Planning</p>	
<p>Review of National Water Policy</p>	<p>Action has already been initiated by MoWR in consultation with all stake holders, particularly, State Governments and civil society.</p>
<p>Preparation of guidelines for different uses of water e.g. irrigation, drinking, industrial etc. particularly in context of basin-wise situations</p> <p>Planning on the principle of integrated water resources development and management - planning of water resources from national perspective for meeting the requirements for various</p>	<p>To be prepared by Central Water Commission / CGWB in consultation with State Governments.</p> <p>Existing guidelines to be reviewed and re-drafted by Central Water Commission / CGWB in consultation with States and other concerned Ministries of</p>

Strategies	Proposed approach for implementation of the strategies
purposes particularly the drinking water and food production with due consideration to the environmental issues	Government of India. Civil society groups will be consulted.

Stage-II - Comprehensive Planning for Water Resources Management

Planning of water resources from national perspective for meeting the requirements for various purposes particularly the drinking water and food production with due consideration to the environmental issues	Based on the activities carried out by Central Water Commission, CGWB, Department of Drinking Water & Sanitation, Ministry of Rural Development in respect of Planning of water resources from national perspective for meeting the requirements for various purposes particularly the drinking water and food production with due consideration to the environmental issues, an outline of the activities to be undertaken during XII & XIII Plan would be prepared.
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Master Plan for Flood Management with due emphasis on non-structural measures for flood management namely flood forecasting, flood plain zoning	Based on the activities carried out by Central Water Commission, Ganga Flood Control Commission and Brahmaputra Board, an outline of the activities to be undertaken during XII & XIII Plan would be prepared
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Stage-III - Implementation of Various Activities Emerging Out of Comprehensive Plan

Activities to be identified in consultation with States for inclusion in XII Plan.

Additional Fund Requirement

The important issue of climate change and its impact on water resources were duly considered by the “Working Group for XI Plan on Water Resources” constituted by the Planning Commission. The related issues are broadly reflected in the recommendations of the Working Group. The XI Plan scheme of the MoWR for “Research and Development” has also laid due emphasis on the research in the area of impact of climate change as also on the need for improving the efficiency of water use and that of the facilities created for water utilization. The allocations for XI Plan have, therefore, some specific provisions in respect of research and development in the area of impact of climate change on water resources.

The various Sub-Committees have identified additional funds requirements for implementation of activities for addressing the specific issues related to impact of climate change on water resources. As per the projections of the various sub-committees, the total estimated additional fund of about Rs. 89,101 crores would be required during the XI Plan and XII Plan period for both State and Central Plan.

In this regard, it is observed that most of the activities are to be implemented by the respective State Governments. Further, the activities are closely inter-linked with the several ongoing schemes for water resources development and management. It is also observed that while a number of activities have to continue on long term basis, some of the activities are required to be taken up on priority, particularly the activities related to vulnerable areas. Various activities proposed to be taken up on priority have been identified in Chapter 6.

In view of above, it is proposed to take up the prioritized strategies through the continuing schemes of the Ministry of Water Resources by suitably modifying scope and outlay of the respective schemes. Proposed approaches for implementation of the identified activities to be taken up on priority are indicated in Chapter 7. The overall additional requirements for such activities are duly taken into consideration while working out the revised outlays of the various schemes of the Ministry of Water Resources at the Mid Term Appraisal stage. The overall outlay for the Central Sector schemes of the Ministry of Water Resources has been proposed for upward revision from approved outlay of Rs. 3,246 crores to Rs. 3,576 crores. Similarly, the revised outlay of Rs. 65,818 crores against the approved outlay of Rs. 47,015 crores has been proposed for the State Sector schemes of the Ministry of Water Resources.

It is also proposed to prepare an action plan for water resources from national perspective for meeting the requirements for various purposes particularly the drinking water and food production with due consideration to the environmental issues, and prepare master plan for flood management with due emphasis on non-structural measures for flood management namely flood forecasting, flood plain zoning. Based on the progress and outcome of the actions taken in respect of prioritized activities by Central Water Commission, Central Ground Water Board, Brahmaputra Board, Ganga Flood Control Commission, National Institute of Hydrology and in consultation with the States, various activities would be identified for inclusion in XII Plan with appropriate outlays.



Reliable data collection on scientific basis is the most important tool to understand the impacts of climate change on water resources.

Specific Strategies / Strategies related to Water Resources as identified in the Technical Document annexed with the “National Action Plan on Climate Change”

General

- Increasing the efficiency of water use
- Exploring options to augment water supply in critical areas
- Ensuring more effective management of water resources
- Need for new regulatory structures with appropriate entitlements and pricing and incentives to adopt water-neutral or water positive technologies
- Integrated water policies to cope with variability in rainfall and river flows at the basin level

Studies on Management of Surface Water Resources

- Estimating river flows in mountainous areas
- Customizing climate change models for regional water basins
- Extending isotopic-tracer-based techniques of monitoring river water discharge to all major river monitoring stations
- Developing digital elevation models of flood prone areas for forecasting floods
- Mapping areas likely to experience floods and developing schemes to manage floods
- Strengthening the monitoring of glacial and seasonal snow covers to assess the contribution of snowmelt to water flows of Indian rivers that originate in the Himalayas
- Establishment of a wider network of automatic weather stations and automated rain gauge stations
- Planning of watershed management in mountain ecosystems

Management and Regulation of Ground Water Resources

- Mandating water harvesting and artificial recharge in relevant urban areas
- Enhancing recharge of the sources and recharge zones of deeper groundwater aquifers

- Mandatory water assessments and audits; ensuring proper industrial waste disposal
- Regulation of power tariffs for irrigation

Upgrading Storage Structures for Freshwater and Drainage Systems for Wastewater

- Prioritizing watersheds vulnerable to flow changes and developing decision support systems to facilitate quick and appropriate responses
- Restoration of old water tanks
- Developing models of urban storm water flows and estimating drainage capacities for storm water and for sewers based on the simulations
- Strengthen links with afforestation programmes and wetland conservation
- Enhancing storage capacities in multipurpose hydro projects, and integration of drainage with irrigation infrastructures

Conservation of Wetlands

- Environmental appraisal and impact assessment of developmental projects on wetlands
- Developing an inventory of wetlands, especially those with unique features
- Mapping of catchments and surveying and assessing land use patterns with emphasis on drainage, vegetation cover, silting, encroachment, conservation of mangrove areas, human settlements and human activities and its impact on catchments and water bodies
- Creating awareness among people on importance of wetland ecosystems
- Formulating and implementing a regulatory regime to ensure wise use of wetlands at the national, the state, and district levels

Development of Desalination Technologies

- Sea water desalination using Reverse Osmosis and multistage flash distillation to take advantage of low grade heat energy e.g. from power plants located in the coastal region or by using renewable energy such as solar
- Brackish water desalination
- Water recycle and reuse
- Water purification technologies

**Composition of Advisory Board under the chairmanship of
Union Minister of Water Resources**

1.	Minister of Water Resources	Chairman
2.	Minister In charge of Water Resources from 5 to States/UTs [by rotation for 2 years]	Member
6.		
7.	Finance Secretary (or nominee)	Member
8.	Principal Advisor, Planning Commission	Member
9.	Secretary, Ministry of Science & Technology (or nominee)	Member
10.	Secretary, Department of Agriculture and Cooperation (or nominee)	Member
11.	Secretary, Ministry of Environment and Forests (or nominee)	Member
12.	Secretary, Department of Drinking Water & Sanitation (or nominee)	Member
13.	Secretary, Ministry of Urban Development (or nominee)	Member
14.	Secretary, Ministry of Earth Sciences (or nominee)	Member
15.	Secretary, Ministry of Water Resources	Member
16.	Secretary, Ministry of Rural Development	Member
17.	Secretary, Department of Industrial Policy & Promotion	Member
18.	Secretary, Ministry of Panchayati Raj	Member
19.	3 Experts on water resources [preferably one each on to surface water, ground water & planning] by rotation for 2	Member
21.	years	
22.		
to	Representatives of 3 NGOs actively associated with	Member
24.	water resources [by rotation for 2 years]	
25.	Representatives of 3 organizations representing	Member
to	industries, professional organization etc. [CII, FICCI,	
27.	Chamber of Commerce, Association of Pump Manufacturers, IWRS, IAH etc.] by rotation for 2 years	
28.	Additional Secretary, Ministry of Water Resources	Member
29.	Chairman, Central Water Commission	Member
30.	Chairman, Central Ground Water Board	Member
31.	JS&FA, Ministry of Water Resources	Member
32.	Mission Director	Member- Secretary

Composition of High Level Steering Committee for National Water Mission

1.	Secretary, Ministry of Water Resources	Chairman
2.	Finance Secretary (or nominee)	Member
3.	Principal Advisor, Planning Commission	Member
4.	Secretary, Ministry of Science & Technology (or nominee)	Member
5.	Secretary, Department of Agriculture and Cooperation (or nominee)	Member
6.	Secretary, Ministry of Environment and Forests (or nominee)	Member
7.	Secretary, Department of Drinking Water & Sanitation (or nominee)	Member
8.	Secretary, Ministry of Urban Development (or nominee)	Member
9.	Secretary, Ministry of Rural Development (or nominee)	Member
10.	Secretary, Ministry of Earth Sciences (or nominee)	Member
11.	Secretary, Department of Industrial Policy & Promotion	Member
12.	Secretary, Ministry of Panchayati Raj	Member
13.	Secretary, Department of Space	Member
14.	Director, National Centre for Medium Range Weather Forecasting	Member
15.	Director, India Meteorological Department	Member
16.	Representatives of two Non Governmental Organizations (by rotation for a period of 2 years)	Member
17.		
18.	Representatives of two professional Organizations (by rotation for a period of 2 years)	Member
19.		
20.	2 Experts / representatives of academic institutions (by rotation for a period of 2 years)	Member
21.		
22.	Principal Secretary / Secretary of Water Resources of five States Government / Union Territories (by rotations for 2 years)	Member
26.		
27.	Chairman, Central Water Commission	Member
28.	Additional Secretary, Ministry of Water Resources	Member
29.	Chairman, Central Ground Water Board	Member
30.	Chairman, Brahmaputra Board	Member
31.	Director, National Institute of Hydrology	Member
32.	Director, Central Water & Power Research Station	Member
33.	Director, Indian Institute of Tropical Meteorology	Member
34.	Joint Secretary & Financial Advisor, MoWR	Member
35.	Commissioner (Project), MoWR	Member
36.	Commissioner (CAD), MoWR	Member
37.	Mission Director	Member-Secretary

Composition of the Inter-sectoral Advisory Group for Goal-I: Comprehensive Water Data Base in Public Domain and Assessment of Impact of Climate Change on Water Resources

1.	Chairman, Central Water Commission	Chairman
2.	Secretary, Ministry of Earth Sciences	Member
3.	Additional Secretary, Ministry of Water Resources	Member
4.	Chairman, Central Ground Water Board	Member
5.	Representative from Ministry of Rural Development	Member
6.	Representative from Ministry of Agriculture	Member
7.	Representative from Ministry of Environment and Forests	Member
8.	Representative from Ministry of Science and Technology	Member
9.	Representative of Department of Drinking Water & Sanitation	Member
10.	Representative of Department of Space	Member
11.		
to	Representatives of 5 States (by rotation for 3 years each)	Members
15.		
16.	A representative of Indian Institute of Technology, Delhi	Member
17.	Director, National Institute of Hydrology	Member
18.	Commissioner (PP), Ministry of Water Resources	Member-Secretary

Composition of the Inter-sectoral Advisory Group for Goal-II: Promotion of Citizen and State Action for Water Conservation, Augmentation and Preservation

1.	Secretary, Ministry of Water Resources	Chairman
2.	Additional Secretary, Ministry of Water Resources	Member
3.	Chairman, Central Water Commission	Member
4.	Representative from Ministry of Rural Development	Member
5.	Representative from Ministry of Agriculture	Member
6.	Representative from NRAA	Member
7.	Representative from Ministry of Environment and Forests	Member
8.	Representative from Ministry of Urban Development	Member
9.	Representative from Department of Drinking Water and Sanitation, Ministry of Rural Development	Member
10.	Representative from Ministry of Panchayati Raj	Member
11.	Representative from Department of Industrial Policy and Promotion	Member
12.		
12.	Representatives of two reputed NGOs (to be nominated by	Member
13.	the Chairman)	
14.	Representative of Planning Commission	Member
15.		
15.	Development Commissioners of 5 States (by rotation for 3	Members
19.	years each)	
20.	Joint Secretary (A), Ministry of Water Resources	Member
21.	Commissioner (PP), Ministry of Water Resources	Member-Secretary

Composition of the Inter-sectoral Advisory Group for Goal-III: Focused Attention to Vulnerable Areas including Over-exploited Areas

1.	Chairman, Central Ground Water Board	Chairman
2.	Member (WP&P), Central Water Commission	Member
3.	Joint Secretary (A), Ministry of Water Resources	Member
4.	Representative from Ministry of Rural Development	Member
5.	Representative from Ministry of Panchayati Raj	Member
6.	Representative from Ministry of Agriculture	Member
7.	Representative from Department of Drinking Water and Sanitation, Ministry of Rural Development	Member
8.	Representative from Ministry of Environment and Forests	Member
9.		
to	Representatives of 5 States (by rotation for 3 years each)	Members
13.		
14.	Member (SML), Central Ground Water Board	Member-Secretary

Composition of the Inter-sectoral Advisory Group for Goal-IV: Increasing Water use Efficiency by 20%

1.	Secretary, Ministry of Water Resources	Chairman
2.	Additional Secretary, Ministry of Water Resources	Member
3.	Chairman, Central Water Commission	Member
4.	Chairman, Central Ground Water Board	Member
5.	Representative from Ministry of Agriculture	Member
6.	Representative from Ministry of Urban Development	Member
7.	Representative from Ministry of Power	Member
8.	Representative from Department of Drinking Water and Sanitation, Ministry of Rural Development	Member
9.	Representative from Department of Industrial Policy and Promotion	Member
10.	Representative of Industries	Member
11.		
to	Representatives of 5 States (by rotation for 3 years each)	Members
15.		
16.	Commissioner (PP), Ministry of Water Resources	Member Secretary

Composition of the Inter-sectoral Advisory Group for Goal-V: Promotion of Basin Level and Integrated Water Resources Management

1.	Secretary, Ministry of Water Resources	Chairman
2.	Additional Secretary, Ministry of Water Resources	Member
3.	Chairman, Central Water Commission	Member
4.	Representative from Ministry of Environment and Forests	Member
5.	Director General, National Water Development Agency	Member
6.		
to	Representatives of 5 States (by rotation for 3 years each)	Members
10.		
11.	Representative of Planning Commission	Member
12.	Commissioner (PR), Ministry of Water Resources	Member-Secretary

Composition of Technical Committee on Climate Change and Water Resources

1.	Chairman, Central Water Commission	Chairman
2.	Member (River Management), Central Water Commission	Member
3.	Chairman, Brahmaputra Board	Member
4.	Chairman, Central Ground Water Board	Member
5.	Representative of Department of Science & Technology	Member
6.	Representative of Indian Meteorological Department	Member
7.	Director, Central Water & Power Research Station	Member
8.	Director, Indian Institute of Tropical Meteorology	Member
9.	Director, National Institute of Hydrology	Member
10.	Director, National Centre for Medium Range Weather Forecasting	Member
11.	Representative of State Government/State Government to Organization dealing with research and management in water resources- [5 by rotation for 2 years]	Member
15.		
16.	A representative of Ministry of Agriculture	Member
17.	A representative of National Remote Sensing Centre, Hyderabad	Member
18.	A representative of Director General, India Meteorological Department	Member
19.	A representative of Govind Ballabh Pant Institute of Himalayan Environment and Development, Koshi Katarmal, Almora	Member
20.	A representative of Director General, Survey of India	Member
21.	A representative of Director General, Geological Survey of India	Member
22.	A representative of Wadia Institute of Himalayan Geology, Dehradun	Member
23.	A representative of Space Application Centre, Ahmedabad	Member
24.	A representative of Director, Snow and Avalanche Study Establishment, Ministry of Defence	Member
25.	Chief Engineer, HSO, Central Water Commission	Member
26.	A representative of M S Swaminathan Research Foundation, Chennai	Member
27.	Chief Engineer (P&D), Central Water Commission	Member-Secretary

Composition of Secretariat for National Water Mission

1.	Mission Director	1
2.	Advisor (Technical)	1
3.	Advisor (Co-ordination and Monitoring)	1
4.	Personal Secretary	1
5.	Personal Assistant	2
6.	Section Officer	1
7.	Upper Division Clerk / Lower Division Clerk	1
8.	Peon	2

Description / Recommended Strategies	XI Plan			XII Plan					Organisation / Agencies to initiate the process	Remarks
	3 rd year	4 th year	5 th year	1 st year	2 nd year	3 rd year	4 th year	5 th year		
GENERAL										
0. Institutional Mechanism										
0.1 Setting up of Mission Secretariat at MoWR for National Water Mission									MoWR	
0.2 Setting up of Climate Change Cells in States									State Governments	To be setup by States
0.3 Setting up of Climate Change Cells in various organizations in MoWR									NIH, CWC, BB and Central Ground Water Board (CGWB)	Climate Change Cells have been setup in NIH, CWC, and BB from their own resources
Goal 1.- Comprehensive water data base in public domain and assessment of the impact of climate change on water resource										
I.1 Review and establishment of network for collection of additional necessary data.										
a. Review of network of hydrological observation stations									CWC, BB, CGWB	
b. Review of the network of									IMD	

Description / Recommended Strategies	XI Plan			XII Plan					Organisation / Agencies to initiate the process	Remarks
	3 rd year	4 th year	5 th year	1 st year	2 nd year	3 rd year	4 th year	5 th year		
automatic weather stations and automatic rain gauge stations and establishment of additional stations										
c. Collection of necessary additional hydro-meteorological and hydrological data for proper assessment of impact of climate change particularly in Himalayan region, coastal region etc including other improvements required in hydrometric networks to appropriately address the issues related to the climate change.									CWC, BB, CGWB and India Meteorological Department (IMD), State Governments	
I.2 Development of Water Resources Information System and development of Web-enabled Ground Water Information System and placing them in public domain									CWC, CGWB, State Governments	
I.3 Development / implementation of modern technology for measurement of various data									CWC, NIH	
I.4 Developing inventory of									CWC, MoEF	

Description / Recommended Strategies	XI Plan			XII Plan					Organisation / Agencies to initiate the process	Remarks
	3 rd year	4 th year	5 th year	1 st year	2 nd year	3 rd year	4 th year	5 th year		
wetland.										
I.5 Research and studies on all aspects related to impact of climate change on water resources including quality aspects of water resources with active collaboration of all research organizations working in the area of climate change									NIH, CWC, CGWB, BB and Research Stations (including those under ICAR), IIT, NIT, Agricultural Universities	
I.6 Reassessment of basin wise water situation										
(a). Reassessment of basin wise water situation in present scenario including water quality by using latest techniques									CWC and CGWB	
(b) Comprehensive Reassessment of the ground water resources up to Block / Mandal / Taluka level for the entire country.									CGWB, State Governments	
I.7 Projection of the impact of									CWC and NIH	

Description / Recommended Strategies	XI Plan			XII Plan					Organisation / Agencies to initiate the process	Remarks
	3 rd year	4 th year	5 th year	1 st year	2 nd year	3 rd year	4 th year	5 th year		
climate change on water resources - Projection of water resources availability as a result of impact of climate change which would inter-alia include the likely changes in the characteristics of water availability in time and space.										
Goal 2.- Promotion of citizen and state actions for water conservation, augmentation and preservation										
II.1 Empowerment and involvement of Panchayati Raj Institutions, urban water bodies, Water Users' Associations and primary stake holders in management of water resources with focus on water conservation, augmentation and preservation									MoWR, MoPR	
a. Interactive session with policy makers for sensitization.									MoWR CWC, CGWB and State Governments	
b. Capacity building for									MoWR, CWC,	

Description / Recommended Strategies	XI Plan			XII Plan					Organisation / Agencies to initiate the process	Remarks
	3 rd year	4 th year	5 th year	1 st year	2 nd year	3 rd year	4 th year	5 th year		
professionals from various departments / organizations associated with water resources development and management									CGWB and State Governments	
c. Promotion of do-it-yourself action by citizens through intensive social communication.									MoWR	
II.2 Promote participatory irrigation management										
a. Encourage participatory irrigation management through "Command Area Development and Water Management Programme"									MoWR	

Description / Recommended Strategies	XI Plan			XII Plan					Organisation / Agencies to initiate the process	Remarks
	3 rd year	4 th year	5 th year	1 st year	2 nd year	3 rd year	4 th year	5 th year		
b. States to enact appropriate Participatory Irrigation Management (PIM) Act.									MoWR and State Government	
II.3 Sensitization of elected representatives of over-exploited areas on dimensions of the problems and to orient investment under MNREGP towards water conservation									MoWR	
II.4 Provide incentives for water-neutral and water-positive										
a. Provide incentives for water neutral and water positive technologies									MoUD, MoCI	
b. Review the policies on effluent treatment in water scarce areas									MoUD, MoCI, MoEF	
c. Encourage reuse of treated									MoUD, MoCI	

Description / Recommended Strategies	XI Plan			XII Plan					Organisation / Agencies to initiate the process	Remarks
	3 rd year	4 th year	5 th year	1 st year	2 nd year	3 rd year	4 th year	5 th year		
effluent										
II.5 Encourage participation of NGOs in various activities related to water resources management, particularly in planning, capacity building and mass awareness									MoUD, MoCI	
II.6 Involve and encourage corporate sector / industries to take up, support and promote water conservation, augmentation and preservation within the industry and as part of corporate social responsibility									MoUD, MoCI	
Goal 3.- Focused attention to vulnerable areas including over-exploited areas										
III.1 Expedient implementation of water resources projects particularly the multipurpose projects with carry over storages benefiting drought prone areas and rain deficient areas										
a. Expedient implementation of									State	

Description / Recommended Strategies	XI Plan			XII Plan					Organisation / Agencies to initiate the process	Remarks
	3 rd year	4 th year	5 th year	1 st year	2 nd year	3 rd year	4 th year	5 th year		
major and medium irrigation projects by States in areas / situations sensitive to climate change. [Creation of storage of 64 BCM is targeted through completion of on-going 205 major & medium irrigation projects during XI Plan. Creation of 9 Mha of irrigation potential is targeted through major & medium irrigation projects (including ERM projects)]									Governments	
b. Expeditious implementation of ERM of irrigation projects by States in areas / situations sensitive to climate change									State Governments	
c. Expeditious implementation of minor irrigation schemes including schemes for ground water development by States in areas / situations sensitive to climate change.									State Governments	
d. Adequate allocations to be									Planning	

Description / Recommended Strategies	XI Plan			XII Plan					Organisation / Agencies to initiate the process	Remarks
	3 rd year	4 th year	5 th year	1 st year	2 nd year	3 rd year	4 th year	5 th year		
made for undertaking projects and their time bound completion									Commission	
e. Review of policies related to financing of water resources projects									Planning Commission	
III.2 Promotion of traditional system of water conservation - expeditious implementation of programme for repair, renovation and restoration of water bodies in areas / situations sensitive to climate change by (i) Increasing capacity of minor tanks, and (ii) Rehabilitating water bodies, with changed focus.									State Governments	
III.3 Physical sustainability of ground water resources										
a. Pursuing the enactment of bill for ground water regulation and management									MoWR	
b. Expeditious implementation of									State	

Description / Recommended Strategies	XI Plan			XII Plan					Organisation / Agencies to initiate the process	Remarks
	3 rd year	4 th year	5 th year	1 st year	2 nd year	3 rd year	4 th year	5 th year		
programme for conservation of water through recharge of ground water including rainwater harvesting in areas / situations sensitive to climate change									Governments and CGWB	
c. Active community participation in ground water regulation & management									MoA, MoRD, MoWR, CGWB	
d. Promotion of a Panchayat /district level model for ground water regulation.									MoPR, State Government, MoWR, CGWB	
e. Exploration of ground water including ground water exploration to decipher deeper fresh water aquifers up to 1000/1500m									State Governments and CGWB	
III.4 Intensive program for ground water recharge in over-exploited, critical and semi-critical areas										
a. Rainwater harvesting and									State	

Description / Recommended Strategies	XI Plan			XII Plan					Organisation / Agencies to initiate the process	Remarks
	3 rd year	4 th year	5 th year	1 st year	2 nd year	3 rd year	4 th year	5 th year		
artificial recharge to ground water									Governments and CGWB	
b. Expansion of program for recharge of ground water through dug wells									State Governments and CGWB	
III.5 Conservation and preservation of wetlands									MoEF, State Governments	
III.6 Intensive programme for addressing the quality aspects of drinking water particularly in rural area									DoDWS	
III.7 Promotion of water purification and desalination										
a. Research for development of cost effective water purification and desalination technologies									M/o Earth Sciences, DST	
b. Encourage PPP model for desalination- preparation of necessary guidelines etc.									M/o UD	

Description / Recommended Strategies	XI Plan			XII Plan					Organisation / Agencies to initiate the process	Remarks
	3 rd year	4 th year	5 th year	1 st year	2 nd year	3 rd year	4 th year	5 th year		
c. Provide incentives for desalination – preparation of necessary guidelines and initiation of necessary actions by the respective States and concerned central Ministries									M/o UD	
III.8 Systematic approach for coping with floods										
a. Mapping of areas likely to experience floods, establishing hydraulic and hydrological models and developing comprehensive schemes for flood management & reservoir sedimentation									MoWR CWC, CGWB, BB and State Governments	
b. Encourage and enforce flood plain zoning in flood prone rivers									MoWR CWC and State Governments	

Description / Recommended Strategies	XI Plan			XII Plan					Organisation / Agencies to initiate the process	Remarks
	3 rd year	4 th year	5 th year	1 st year	2 nd year	3 rd year	4 th year	5 th year		
Goal 4.- Increasing water use efficiency by 20%										
IV.1 Research in area of increasing water use efficiency and maintaining its quality in agriculture, industry and domestic sector									CWC, CGWB, MoA, MoUD, MoCI, MoP, DoDWS, State Governments	
IV.2 Incentivize recycling of water including waste water										
a. Incentivize recycling of water including waste water									MoUD, MoCI	
b. Preparation of necessary guidelines for encouraging PPP model for recycling and wastewater treatment									MoUD, MoCI	
c. Provide technical and financial support for common waste water treatment and recycling plants									MoUD, MoCI, MoEF, Department of Industrial Policy & Promotion	
d. Strict enforcement of provisions in respect of waste water treatment									MoEF, State Governments	

Description / Recommended Strategies	XI Plan			XII Plan					Organisation / Agencies to initiate the process	Remarks
	3 rd year	4 th year	5 th year	1 st year	2 nd year	3 rd year	4 th year	5 th year		
IV.3 Development of Eco-friendly sanitation system									MoUD, MoRD	
IV.4 Improve efficiency of urban water supply system										
a Initiate benchmark studies for urban water use and introduce concept of water efficiency index for urban areas									MoUD	
b Develop knowledge bank for urban water supply and use									MoUD	
c. Adopt volumetric metering for urban water supply.									MoUD	
d Water supply system to be made sustainable through appropriate pricing									MoUD	
IV.5 Efficiency labeling of water appliances and fixtures									MoUD & MoRD	

Description / Recommended Strategies	XI Plan			XII Plan					Organisation / Agencies to initiate the process	Remarks
	3 rd year	4 th year	5 th year	1 st year	2 nd year	3 rd year	4 th year	5 th year		
IV.6 Promotion of water efficient techniques and technologies										
a. Promotion of micro irrigation techniques such as sprinkler and drip irrigation	■	■							MoA	
b. Expand "Farmers' Participatory Action Research Programme"		■							CWC, CGWB, MoA	
IV.7 Undertake Pilot projects for improvement in water use efficiency in collaboration with States.										
a. Pilot project for improving water use efficiency	■	■							MoA, State Governments	
b. Pilot project for improving efficiency of water system	■	■								
IV.8 Promote Water Regulatory Authorities for ensuring equitable water distribution and rational charges for water facilities	■	■							MoWR, State Governments	

Description / Recommended Strategies	XI Plan			XII Plan					Organisation / Agencies to initiate the process	Remarks
	3 rd year	4 th year	5 th year	1 st year	2 nd year	3 rd year	4 th year	5 th year		
IV.9 Promote mandatory water audit including those for drinking water purposes										
a. Preparation of guidelines and manuals									MoWR, MoRD & MoUD	
b. Pursue the implementation with State governments and other agencies									MoWR, MoRD & MoUD	
IV.10 Adequate provision for operation & maintenance of water resources projects. Provision for operation and maintenance of the projects to be appropriately enhanced									13 th Finance Commission	
IV.11 Incentive through award for water conservation & efficient use of water									MoWR, MoUD	
IV.12 Incentivize use of efficient irrigation practices and fully utilize the created facilities										
a. Preparation of appropriate guidelines.									MOA, MoWR & CWC	
b. Initiation of actions by the States and other agencies.									State Governments	

Description / Recommended Strategies	XI Plan			XII Plan					Organisation / Agencies to initiate the process	Remarks
	3 rd year	4 th year	5 th year	1 st year	2 nd year	3 rd year	4 th year	5 th year		
Goal 5.- Promotion of basin level integrated water resources management										
V.1 Review of National Water Policy										
a. Review of National Water Policy by MoWR									MoWR	
b. Consultation with States and the Stakeholders									MoWR	
c. Adoption of revised policy by the Government									MoWR	
V.2 Review of State Water Policy									State Governments	
V.3 Guidelines for different uses of water e.g., irrigation, drinking, industrial etc particularly in context of basin wise situations									MoRD, MoUD, MoEF, MoCI,	
V.4 Planning on principle of integrated water resources development and management										
a. Preparation of appropriate guidelines									CWC	

Description / Recommended Strategies	XI Plan			XII Plan					Organisation / Agencies to initiate the process	Remarks
	3 rd year	4 th year	5 th year	1 st year	2 nd year	3 rd year	4 th year	5 th year		
b. Interaction with States									CWC	
c. Adoptions and application of guidelines by project authorities and appraising agencies									CWC, CGWB, State Governments	
d. Amendment to River Board Act under entry 56 of union list to make it more effective									MoWR	
e. Setting up of river basin organizations									MoWR	
V.5 Inter-basin integration particularly for augmenting water by converting surplus flood water into utilizable water - Expeditious formulation of the projects for utilization of surplus flood water for beneficial use of the society and implementation of projects after evaluating costs and land acquisition problems.									MoWR, MoRD, MoUD, MoA, MoEF, NRAA, DST, MoES	

Description / Recommended Strategies	XI Plan			XII Plan					Organisation / Agencies to initiate the process	Remarks
	3 rd year	4 th year	5 th year	1 st year	2 nd year	3 rd year	4 th year	5 th year		
V.6 Ensuring convergence among various water resources programmes									MoWR	
Convergence among various programmes related to water resources development and management particularly (i) CAD&WM, RRR of Water Bodies, Ground water recharge through dug wells programmes of Ministry of water resources, (ii) NREGA of Ministry of Rural Development, (iii) Drinking water supply of Department of Drinking Water & Sanitation (Ministry of Rural Development), (iv) Integrated watershed development programme of Ministry of Agriculture, (v) various water conservation programmes of Ministry of Environment and Forests.										