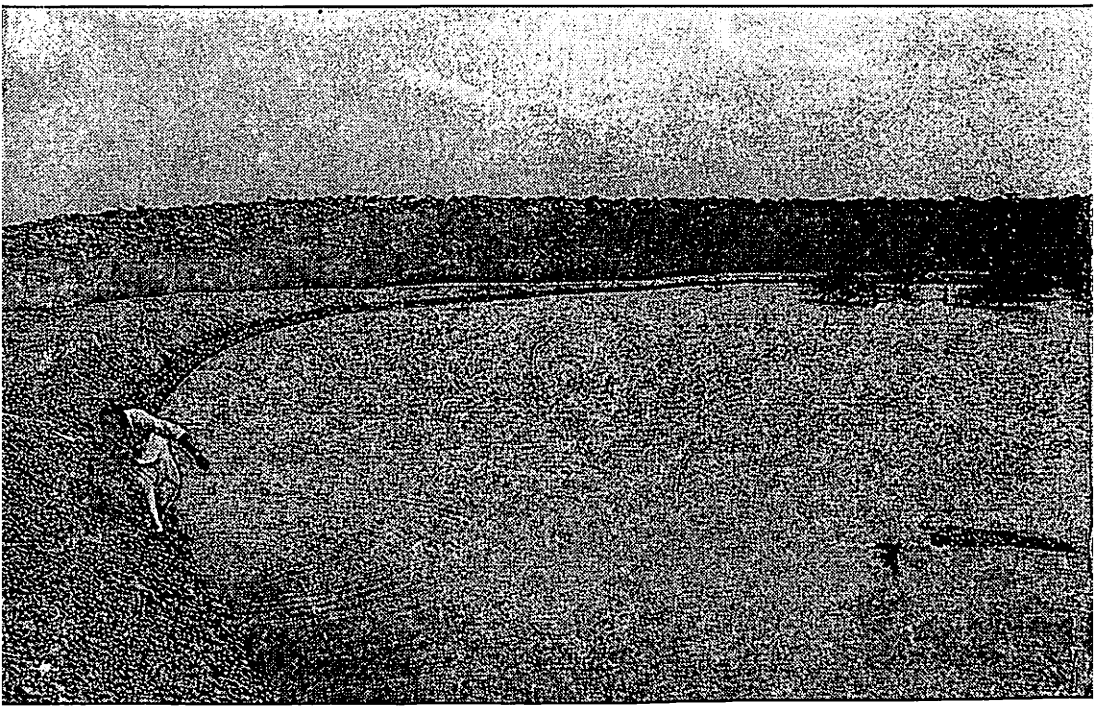
Sustainable, Safe Drinking Water Security in Rural India : An Alternative Approach



Jal Biradari

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Ist Edition
16 December, 2007

Publisher
Tarun Bharat Sangh,
Bhikampura Kishori via Thanagaji,
Distt. Alwar-301022, Rajasthan,
Ph. : 01465-225043
E-mail : watermantbs@yahoo.com

Distributor
Jal Biradari,
34/46, Kiran Path,
Mansarovar, Jaipur-302020
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Designed and printed at :
Kumar & Company, Jaipur

Price : Rs. 25/-

Sustainable, Safe Drinking Water Security in Rural India: An Alternative Approach

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FOREWORD

The Ministry of Rural Development Drinking Water Supply initiated a program to bring sustainability to drinking water systems in rural India. For the purpose a committee of NGO's was setup to provide policy input. Jal Biradari undertook the responsibility of documenting the thoughts of that committee. Dr. M.S. Rathore, Professor at the Institute of Development Studies and Executive Trustee of the Jal Biradari was given this responsibility. This report is the outcome of that assignment. Besides the inputs from the brain storming of committee members, Dr. Rathore took help from Jal Biradari members in different states and Prof. Kanta Ahuja in putting all the ideas in the form of a report.

The report provides excellent guideline for the state departments, NGO's and technocrats working on the subject to solve the rural drinking water problem in the country. I think this report will help Jal Biradari members, in different states, to draw their future line of action to attain the goal of providing drinking water security to rural population.

Rajendra Singh
President
Jal Biradari

CONTENTS

I Introduction

1.1 The population of the country has already crossed the 1 billion mark and is expected to reach 1.64 billion by 2050. The settlement patterns are changing. On the one hand urban concentrations are increasing and on the other, population in existing hamlets and habitations is increasing. As a result providing safe and adequate drinking water to people is a challenge. Its complexity is increasing as the sources of water are depleting rapidly.

Over the last one and half century there have been two major paradigm shifts in water resource management. One is that individual and communities have steadily lost their role, almost completely, to the state in the management of water resources. The second is that the reliance and use of the simple technologies of using rainwater has been replaced by complex engineering technologies of ground water extraction or river water storage and use for multiple purposes. However, river water and ground water aquifers are only a small portion of the total rainwater precipitation. This has resulted in growing and, in many cases, unbearable stress on these sources. Dependence on the state has meant that costs have increased and financial sustainability is endangered, as cost recovery is poor. Repair and maintenance is poor and people have lost interest in using water carefully or in conserving it.

As a result despite all government efforts, including large allocation of resources and launching of a number of new drinking water schemes, the number of 'problem villages' that do not have access to adequate and/or potable water remains unchanged. See Annex Table 1.

II **Jal Darshan** : What we can learn from traditional wisdom

2.1 A strategy of water management must be based on a

philosophy of how water is to be viewed. What is the nature and value of water? Is it an economic commodity to be managed by the market principles of supply and demand? Or, is it a fundamental human right defined on the criteria established in the UN Declaration of Human Rights that includes protection of the right to livelihood and well being? Water is not just a basic need but it is a gift of nature that needs to be treated with respect. It is an essential component of human ecology and environment. Also, water has deep cultural, symbolic and spiritual significance in many cultures. Indian cultural traditions and ancient religious texts like the Rig Veda provide many examples of the way in which water was to be understood and managed. According to ancient Hindu beliefs, water is one of the five elements of the cosmic world. It is worshipped and the sources of rivers are given importance as holy places of worship.

The concept of dharma is another concept that was central to the tradition. This is important as dharma entails responsibilities – individual as well as collective – towards all aspects of the universal community of living beings. It also provides a code of conduct for the use natural resources, as well as a vision. In short, there is much to learn from the rich ancient wisdom. For sustainable use of water, the message that has to be learnt is human behaviour (greed and exploitation) needs to be self regulated and to accept the responsibility of giving back to nature, at least, same amount of water that we extract from the ground (mother earth). Cleanliness and non-pollution directions are also found in some of the Vedic texts.

2.2 Traditional Water Harnessing Systems

Traditional water harnessing systems can be observed even today in different parts of the country. Most are based either on harnessing surface rainwater run-off or groundwater

extraction. The tankas and *khadeens* of Rajasthan, *baoris*/ step wells of western India, *talabs*, *kunds* etc. are functioning at least in some parts of the country. People fall back to some of these sources of water when the new state run systems breakdown for one reason or another (power failure, source failure). The main features of these water supply systems that are also their strengths in comparison to the modern modes of management were:

- **Location** specific and suitable to local conditions.
- **Structure**: Well planned, technically correct, low cost, well designed, sustainable, sound engineering (long lasting), low O&M cost, made with local material, people friendly technology, no outside expert required to build or maintain.
- **Community management**: Decentralised community/ individual management, practices sustained by codes of established customary practices that were also linked to social, religious and spiritual activities around water bodies that ensured cleanliness, maintenance and community involvement.

These systems have lost their significance due to state-sponsored policies and interventions. Introduction of laws based on the British system emphasized private ownership rights of individuals. In 1863, the Public Works Department (PWD) was created. As a result, local control over *johars* and *talaabs* was withdrawn and placed under the PWD. Similarly in 1865, the right to collect revenue from forests and arable and non-cultivated land was taken over by the Government. These changes mark the end of the commons and as a result of the water bodies as well. The commons were the catchment areas for the water bodies and areas of groundwater recharge. High population growth and systematic encroachments have aggravated the situation to an extent that it often appears beyond repair.

Providing water from alternative sources ostensibly for public health reasons may have provided water to some but it has failed to provide water to all. Further it has led to deterioration of most traditional structures that came to be seen as inferior sources. It is necessary now to take a fresh look at not only what we can learn from the traditional sources but also the role that they can play in the system of providing sustainable water security to all.

2.3 Strategy of a sustainable system for water security to all

The long term objective of the strategy for sustainable drinking water security to all in rural areas (SDWP) is to establish a decentralised framework of self-reliant independent communities capable of managing their own affairs so as to promote a healthy and hygienic environment throughout India. Such a strategy needs to be developed on the basis of the following principles:

- The objective should be to provide **safe drinking water security to all**
- Role of state to be transformed from that of providers to that of facilitator.
- Panchayats/communities to be given full responsibility to plan, operate, manage and maintain all rural drinking water schemes as provided by the 73rd & 74th Amendment.
- Ensuring quality and source sustainability through appropriate technological innovations and interventions based on the existing and traditional knowledge and practices including ground water and rainwater harnessing systems.
- Addressing social and gender equity in availability and access.

2.4 Technical alternatives

Detailing such a strategy has the following two components viz (i.) determine technological alternatives and (ii) steps for en-

abling and empowering the village communities to deliver the desired outcomes.

Technical alternatives are not merely engineering solutions but they also have to consider specific geo-cultural contexts. These local specificities define and describe the different ways in which local communities have found solutions to the water issues. Solutions include the settlement pattern of the habitation, identification of a suitable source and the management responsibilities of the community. On the basis of extensive study of local water supply systems, Tarun Bharat Sangh (an NGO working mainly in Rajasthan) has worked out a detailed geo-cultural atlas that demarcates about 95 zones in India demarcated on the basis of agro-climatic and geographical conditions and cultural practices of natural resource management. This can be useful starting point for identifying local solutions. (See Annex). Basically, the local systems are rainwater harnessing systems and groundwater recharge systems. These systems include the management of catchment areas and commons for providing adequate flow and recharge. Restoring the hydrological systems is crucial for local level source sustainability. These are described separately in Section.

2.5 Community Participation

Community participation is considered as panacea for all rural problems. Despite it being prescribed in all the programme guidelines, the processes for realizing the objectives are neither clearly defined nor understood. As a result it is rare to find effective community involvement in programmes. The situation needs serious analysis.

As the community is the user of improved facility, manager of water source and supply and also to take measures for its sustainability. The community participation will be ensured when

- state gives them enough indication that the resources belong to them (i.e., ownership of water) and state will act as facilitator not the provider.

- whatever water source and water supply facilities are created also belong to community and government will not maintain the asset rather people have to generate their own resources for O&M of systems. State will support only in crisis or if some major investment is needed to build a larger system. PRIS/local communities/village water committees be empowered to generate resources for O&M and other use.
- community have to be provided technical input for engineering schemes by organising capacity building trainings such as hand-pump repair, O&M of tube-well, construction of structures, etc. The trainings should empower/equip them to plan, implement, use, maintain and initiate new water supply schemes.

Community Participation

Community participation refers to involvement of the village households, both men and women population in water resource management by working for rejuvenation of traditional water bodies/structures, building new structures, feeling sense of owning the structures and water resource, work for its conservation and protection, pay some contribution (according to capacity) for use of water, identify problems if any and help finding solutions, take care of sanitation in the village, help reducing dupery of village women and facilitate equitable distribution of resources to all.

Community should feel responsibility, authority and have control over resources. Take initiative to build sustainable drinking water source, share some cost in construction and accept responsibility for operation and maintenance of the system(s).

State has to make special efforts by involving right kind of local NGOs to mobilise community participation.

A nation wide campaign is necessary to make free these commons and restore the hydrological system to help attaining sustainable drinking water in rural villages. It is also in line with the Supreme Court judgement to remove all kinds of encroachment from these lands. The second step is empowerment of beneficiaries. This must include a participatory approach as far as decision making is concerned a sense of ownership by the end user fully vested with the rights and duties regarding the restoration and the development of resources and transparency as far as management and benefits are concerned. It has been increasingly realised that an outside NGO cannot play this role and that often the only way it can effectively intervene is in opposing the introduction of new and modern water systems.

Deterioration of commons is linked to the deterioration of the society. In fact these systems even today are generous enough to cover up for the mistakes of new, expensive and unsustainable systems.

It is for these factors that these traditional water structures are answer to the drinking water supply to disperse settlement of village habitation in the rural India. Particularly for those habitations where centralised system of water supply is uneconomic or technically not feasible. Improvisation of these resources by modern science can further strengthen their utility even in the modern era. The only major limitation of these structures is the match their capacity to meet the ever-increasing water demand. The specialty of these structures is that there is range of option ranging from individual household, rooftop harvesting to community structures. But they cannot meet all demands, however, can definitely meet the drinking water demand of a household or village community. It is possible only if we consciously learn from the structures and make understand people at large.

The new generation of engineers has started modifying the time tested designs and material use in these structures without

understanding the social, economic and cultural milieu. Such experiments have further eroded these structures.

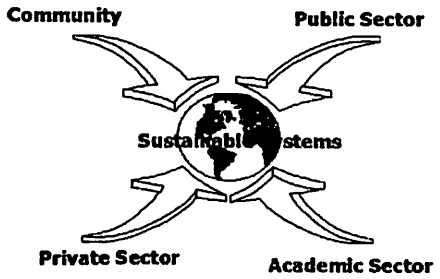
Community involvement in the present context involves four steps or four Ss. These

1. Understanding *or Samajhna*
2. Making others understand *or Samjhaana*
3. Conservation *or Sahejna*
4. Accepting and internalizing the truth or *Satyagrah*

The first step of understanding the nature of water as a natural resource and its importance for all forms of life is important. As described earlier, our ancient cultural traditions do provide this understanding although over time the understanding was reduced to ritualistic acceptance and performance of practices that were not internalized by the community as the 'truth' for use of water. Therefore the understanding has to be followed by the second step viz. making others understand or *samjhaana.* This step in the current context involves Information, Education & Communication (IEC) component to replace the use of symbols and rituals that was done in ancient times to achieve the same result. Effective IEC requires the following steps :

1. *Capacity Development*

Sustainable, responsible use of water begins in the hearts and minds of individuals, who make up neighborhoods, communities, cities, states and nations. The cumulative impact of their attitudes and actions ultimately determines whether or not sustainability is achieved. Hence the four groups that need to be involved are:



The four areas where the capacities are needed to be developed for the sustainability and further can be used as a matrix to identify gaps in the existing capacities and organized for integrated development plan are:

1. **Capacity to educate and train,** including community awareness building, adult training and formal education, so as to provide sufficient numbers of competent human resources to develop and apply enabling systems.

2. **Capacity to measure and understand water resources systems,** through applied research, monitoring, and technology development, so that reliable data is used for analysis and decision-making.

3. **Capacity to legislate, regulate and achieve compliance** through effective governmental, non-governmental and private sector institutions and through efficient enforcement and community acceptance.

4. **Capacity to provide appropriate, affordable water infrastructure, services and products** through sustained investment and management by both private enterprises and public agencies.

2. *Awareness generation*

Converting data produced by many sources into useful information to generate understanding and awareness is the first step. Converting data into information for different stakeholders and for problem solving is the job of an experienced analyst of the subject. Information has to be local at best or region specific at least. The information that is generated must also address issues of social and gender equity and empowerment. At the same time, it must be able to provide a sense of ownership, community involvement and responsibility to ensure that people contribute towards the realization of the goals through resources and time and labour. New modes of spreading awareness now exist. For

instance, the following is a list of suggestive techniques/tools that can be used

- Bus paintings
- Traditional methods of entertainment, puppet shows, etc.
- Village and panchayat level meetings and distribution of printed material
- Street plays and local artist groups that promote IEC
- Mobile van for mass awareness
- Vibrant messages on village walls
- Village resource center to act as information center in many villages
- IEC activities in the local religious and animal fairs
- Use of print and electronic media

3. *Community Involvement*

Community involvement is required at each stage viz. planning, design and O&M activities. Community involvement in technical activities can be ensured through:

- Conducting water budgeting exercise in each village
- Finalizing source with community participation and indigenous knowledge
- Strengthening existing sources and utilizing the existing infrastructure
- Conducting yield test for each new source before developing the same
- Involving community to prepare village action plan for water supply

- Promoting community to keep vigilant eye on quality of works
- Involving women SHG groups in O & M of the facilities
- Installation of rain gauge in each village and school teacher to record daily rainfall.
- Giving community the hands on training for maintaining water quality
- Ensuring community participation also through labor contribution

4. *Community Contribution*

- Some percentage of community contribution towards water supply should be promoted and ensured by:
- Practicing innovative ideas for collecting community contribution
- Mobilizing community for collecting contribution
- Promoting villagers who can afford to contribute for those who cannot afford and later retrieve it in kind
- Maintaining receipt books for the community contributions

5. *Mobilization*

The basic goal of water supply scheme is to increase the access of the villagers to water supply and to decentralize the planning, implementation and maintenance of water supply to local government institutions.

This could be achieved by:

- Promoting villages to conduct regular informal session for project planning and decision making
- Activating the gram sabha as a decision-making forum in the village and for ensuring active participation of women.

Conducting regular meeting of committee for monitoring project implementation

- Promoting a cadre of village motivators for community mobilization
- Ensuring that district teams provide necessary guidance and facilitation
- Focusing specially on capacity building of the service providers
- Ensuring representation of the women and the weaker sections in the committees
- Regularly capturing the feedback and learning and taking corrective actions for the same
- Building process of external audits for regular feedback
- Conducting cross learning review sessions regularly for interaction
- Ensuring decision makers to make field visits
- Activating block teams and regional hubs to provide necessary support
- Ensuring visit of district staff to village on regular intervals
- Involving youth as messengers for mobilization

6. *Women Empowerment*

Drinking water affects women more than any other member of the household. Responsibility for fetching water from sources located outside the home, storage and adequate provision is the concern of women. It is, therefore, imperative that women become active participants in the process. Community participation activities must, therefore include initiatives for

- Involving women in decision making and thus developing leadership qualities

- Allowing women in the gram sabha to play major role in decision making
- Helping women to come forward and start putting up their views by listening to them

III. Conservation or *Sahejna*

Conservation of water is an essential component of drinking water security. The practice of harvesting rainwater dates back to Vedic times when the need to create water sources that would remain both clean and provide plentiful supply was recognized. Over the years rising populations, growing industrialization, and expanding agriculture have pushed up the demand for water. Efforts have been made to collect water by building dams and reservoirs and digging wells; some countries have also tried to recycle and desalinate (remove salts) water. Water conservation has become the need of the day. The idea of ground water recharging by harvesting rainwater is gaining importance in many cities. In the forests, water seeps gently into the ground as vegetation breaks the fall. This groundwater, in turn, feeds wells, lakes, and rivers. Protecting forests means protecting water 'catchments'. In ancient India, people believed that forests were the 'mothers' of rivers and worshipped the sources of these water bodies.

3.1 Ancient Indian Methods of Water Conservation and Rainwater Harvesting

Rainwater harvesting structures are a part of a strategy for water conservation. People in all parts of country have a long standing tradition of rainwater harvesting by designing different types of structures and management systems.

The Indus Valley Civilization, that flourished along the banks of the river Indus and other parts of western and northern India about 5,000 years ago, had one of the most sophisticated urban water supply and sewage systems in the world.

The fact that the people were well acquainted with hygiene can be seen from the covered drains running beneath the streets of the ruins at both Mohenjodaro and Harappa. Another very good example is the well-planned city of Dholavira, on Khadir Bet, a low plateau in the Rann in Gujarat.

One of the oldest water harvesting systems is found about 130 km from Pune along Naneghat in the Western Ghats. In ancient times, houses in parts of western Rajasthan were built so that each had a rooftop water harvesting system. Rainwater from these rooftops was directed into underground tanks. This system can be seen even today in all the forts, palaces and houses of the region. Underground baked earthen pipes and tunnels to maintain the flow of water and to transport it to distant places, are still functional at Burhanpur in Madhya Pradesh, Golkunda and Bijapur in Karnataka, and Aurangabad in Maharashtra.

The principle behind rain water harvesting is simple: to hold the drops of rainwater in a very clean space and stock it. Be it in *kund*, *kundi*, tanka (pond, small pond, reservoir), talab, the names and form may change, but the function is the same: to preserve for tomorrow the drops that have fallen today. Ponds are to be found everywhere. Inside the forts constructed atop mountains, in temples, at the foothills of mountains, in the courtyard of houses, on rooftops, in villages, outside the villages, in uninhabited places, in fields; everywhere, at any time, these can be made. There are *kundis*, which are two to three hundred years old and others that have just been made.

In Rajasthan, wherever any space is available, people made a sloping courtyard there. The slope can be from one side to the others but if the courtyard is big enough, it can run from the four sides and converge towards the middle portion. In this portion, a *kund* is made according to the shape and size of the courtyard and according to the amount of rain, which falls. The inside of the *kund* is lined in such a way that not a single drop from the water collected within is lost through seepage, and thought the

year the water remains clean and protected. People in different parts of country innovated such structures, with improvisation based on local condition and needs and gave them different names. Such structures are time tested and were the sustainable source of drinking water to all.

It is important to realise that presently there is no technological alternative to cost effective, simple, user friendly rainwater harvesting for villages. Government is giving priority to water harvesting in a number of rural development programmes. However, what is missing is community participation. Rainwater harvesting needs to be linked with watershed development, land uses planning and wasteland development for promoting sustainable rural drinking water. The issue of rainwater harvesting has to be taken up as a people's movement for it to be successfully adopted.

3.2 Region specific means and technology of rainwater harvesting/ water conservation

Rainwater, runoff and the floodwaters from rivers were all harvested. Water harvesting systems were located:

- in the open to capture rainwater where it fell
- in the path of a stream or its runoff
- beside rivers to catch the flood waters

The design and structure of each system was decided by the terrain and rainfall pattern of the region. Hence each eco-zone of India had unique techniques for harvesting water.

- **In the hills and mountainous regions** where there are plenty of streams, simple engineering structures were used to divert the water into channels that fed the fields. The structures became more sophisticated and much bigger when the streams turned to rivers.

- **In the arid and semi-arid regions,** where the streams are more seasonal, the diversion channels first led the water to a storage structure like a tank for later use. Storage systems to collect just runoff from the watershed were also built.
- **In the flood plains,** several unique systems to control and harness the floodwaters were devised.
- **In the coastal areas** where there is danger of river water turning saline, several ingenious ways came up to regulate the intrusion of saline water.
- **In regions with good groundwater aquifers,** dugwells with innovative methods to lift the water were in use. Deep wells were dug in the beds of tanks and rivers, both to serve as a source of good water when the water recedes and also to recharge the groundwater when they are fully submerged.
- **In areas where rainfall is the only option,** people devised methods to literally "catch rainwater where it fell".

Throughout India, several ingenious ways have been devised to catch and store rainwater for future use. They are known as traditional water harvesting systems. It is the traditional water harvesting systems that have made life possible even in the Thar Desert.

The technology and engineering of the traditional water harvesting systems differed, depending on whether they were to provide drinking water or to be used for irrigation. Those meant for drinking water were generally smaller, sometimes covered and with steps leading down to the water. This ensured that people could only collect water manually in small quantities to meet their individual or family's needs. Irrigation systems on the other hand spread over large open areas and had a complicated network of pipes and channels for collecting and distributing water.

3.3 Region wise Traditional Water Harvesting System

- *Trans Himalayan Region*

Water from melting snow and ice is the only source of water here. Nearly 68% of Ladakh lies above sea level. The people made

intelligent use of their limited resources and made agriculture possible in this dry and barren land. The snow and ice melt slowly through the day and water is available in the streams only in the evening, when it is too late for irrigation. The water in the streams was hence led by channels to storage tanks called ***zing*** and used the next day.

In the Spiti area of Himachal Pradesh, diversion channels called ***kul*** were used to bring the melting snows from glaciers to circular tanks, from where the water was distributed.

- *Western Himalayas*

The farmers of this region built canals along the contours to collect water from hill streams, springs and melted snow.

Since the first millennium A.D., there has been extensive rice cultivation in Kashmir, aided by an elaborate irrigation system consisting of irrigation canals bringing water from the melting

snows. Water wheels (araghatta) were used to lift water from the Jhelum.

Ponds were the main source of drinking water in Jammu. Ponds in the Kandi region were dug beside rivers. During floods the river waters were diverted into them. In Himachal Pradesh a temporary headwall of boulders called ***kuhl*** was constructed across a ravine to divert the waters of natural flowing streams (khud) through a canal to the fields. About 20 ha could be irrigated by a community kuhl. The water would flow from field to field and surplus water would drain back to the khud. The kohli or water tender distributed and managed the water.

In Uttar Pradesh contour channels called ***guhls*** were used extensively. Streams were dammed by temporary barriers to divert water into these channels.

- *Eastern Himalayas*

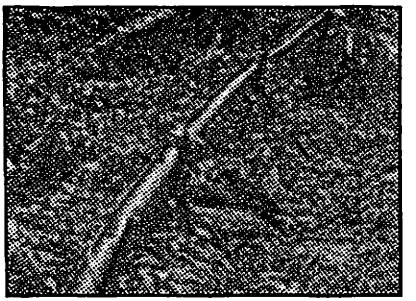
Streams are the only dependable source of water here. Bamboo pipes are used to divert the water for irrigation.

The apatani system of Arunachal Pradesh was practiced by the Apatani tribes. They harvested both ground and surface water for irrigation. The stream water was blocked by constructing a wall 2 to 4 m high and 1 m thick near forested hill slopes. This water was taken to the agricultural fields through channels. The valleys were terraced into plots separated by 0.6 m high earthen dams with inlet and outlet channels (to the next plot) that help to flood or drain the plots as and when required.

- *North Eastern Hill Ranges*

Rainfall and groundwater are the main sources of water in this region. But the terrain makes it difficult to capture the surface water. Natural springs are used for drinking water purposes.

Zabo, meaning 'impounding run-off', is practiced in Nagaland. When rain falls on terraced hill slopes, the runoff collects in ponds in the middle terrace. The runoff then passes through slopes where there are cattle yards, and finally reaches the paddy fields at the foot of the hills.



Rapidly flowing water from streams and springs was captured by bamboo pipes and transported over hundreds of metres to drip irrigate black pepper cultivation in Meghalaya. Many bamboo pipes of varying diameters and lengths were laid to manipulate and control the flow of water.

- *Brahmputra Valley*

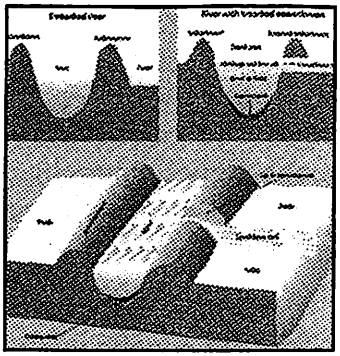
This region has many natural depressions along the banks of the Brahmaputra and Barek rivers. Floodwaters accumulate in these depressions, which are used for cultivation when the waters recede.

Dongs or ponds were constructed by the Bodo tribes of Assam to harvest water for irrigation. In the Jalpaiguri district of West Bengal, small irrigation channels called dungs or jampois were used to bring water from streams to rice fields.

- *Indo Gangetic Plains*

The rivers and their floodwaters are the main source of water here. Ahar-pyne is a traditional floodwater harvesting system indigenous to south Bihar. Here the terrain has a marked slope,

the soil is sandy, groundwater levels are low and rivers flood their banks only during the monsoon. The ahar is the catchment basin embanked on three sides, while the fourth side is the natural slope. Pynes or artificial channels start out from the river, and meander through fields to end up in an ahar.



Inundation canals were an efficient irrigation system in Bengal. Floodwaters rich in silt entered the inundation canals, and were carried to the fields. The canals were broad and shallow and long and continuous. Channels cut into their sides distributed water to the fields. They were closed once the floods ceased.

- *Thar Desert*

The Thar Desert receives very little rainfall. Hence rainwater was captured and stored in ponds and underground tanks.

Tarais (reservoirs) were built in the valley between sand dunes by constructing bunds at the two ends. When it rained the rainwater was collected in the reservoir. The tarais dried up in a few months owing to the highly porous soil. But the region around it remained wet and moist. Wells were usually dug close to the tarai.

Individual homes and farms in Bikaner built tankas. They were round or rectangular underground rooms that functioned as water tanks. Rainwater from the roof or terrace was directed towards an opening in the floor which led to the tanka.

Stepwells are India's most unique contribution to architecture. They are called vav or vavadi in Gujarat, and baolis or bavadis in Rajasthan and northern India. The stepwells of Gujarat consist of a vertical shaft in the middle from which water is drawn. This shaft is surrounded by corridors, chambers and steps, which

provide access to the well. They were profusely carved and served as a cool resting place in summer.

Mata Bhavani's vav at Ahmedabad, built in the eleventh century, is one of the earliest stepwells, while the Rani Vav (Queen's well) at Patan, built during the late eleventh century, is the grandest. The Dada Harir's vav at Ahmedabad, and the octagonal vav at Adalaj, are some of the finest examples of stepwells.

Kunds or kundis in Western Rajasthan and Gujarat harvest rainwater for drinking in the sandy tracts of the Thar Desert. The saucer-shaped catchment area gently slopes towards the pit in the centre, which has a dome-shaped cover, to protect the water. The water inlets are covered with mesh. The depth and diameter of kunds depend on their use (drinking or domestic water requirements).

Kuis or beris were deep pits dug near tanks to collect the seepage. They were also used to harvest rainwater in areas with scanty rainfall. From a narrow mouth a kui gets wider to prevent evaporation of collected water but at the same time facilitates more water collecting.

IV. Interventions

4.1 National Level Action for Drinking Water Security

For drinking water security it is essential to understand the nature of water and use different sources according to the conditions that prevail. In general understanding today, water is regarded as an undifferentiated resource to be used for any and all uses that require water. If irrigation is the priority, surface and

groundwater are all used. Deep wells, bore wells, tubewells and mining of water for irrigation is being used. This is the primary cause of depletion and therefore of drinking water insecurity. It is necessary to distinguish three types of water and use it in a discriminatory manner. Water is of three types viz. rainwater (*indrajal),* surface water (*varun jal*) and sub-surface or groundwater at different depths (*bhoojal)* These three types of water have to be managed differently under varying rainfall conditions.

a) Good rainfall: Rainwater and surface water can be used for drinking, irrigation and industrial use.

b) Lower than good rainfall (normal rainfall): Surface and rainwater should be used for irrigation and GW only for drinking.

c) Drought or failure of rainfall: Groundwater should be reserved and used only for drinking purpose.

d) Deep groundwater should be used only in emergencies. It should be kept as water sanctuary and be left for future generations.

At the central government level following action is required:

- Direction to the states for early announcement of state water policies.
- Enactment of groundwater act to check further depletion of groundwater to be given top priority and facilitated.
- Initiate a movement for removing encroachments in water bodies and protection of catchment areas.
- Strengthen the implementation of anti-pollution control measures for both surface water and groundwater.
- Issue specific guidelines for decentralized community management of water resources.

4.2 State Level Actions

Water is a state subject. Therefore, all States should announce their Water Policy. The policy should be well deliberated by involving not only the concerned government departments but also all other stakeholders. The draft water policy should be put in the public domain and widely circulated before it is finalized.

To check the fast depleting groundwater across the country all states must prepare Groundwater Act keeping community as the manager of resource and the act be strictly implemented. Gram panchayats should act as monitoring authority.

State Groundwater department assesses the status of groundwater and reports data on groundwater withdrawal. The department must be given the responsibility to monitor whether provision has been made in each block by the concerned institutions (government, panchayat and community) to ensure the recharge of at least the quantity of water that is withdrawn. Making block level provisions should be made mandatory.

Forestlands can be used for groundwater augmentation programmes. As there is tremendous scope for rainwater harnessing and recharging, efforts are needed in a mission mode to enhance ground water by undertaking special programmes using appropriate technical and scientific inputs. Further it is essential to ensure that the recharged groundwater, in the periphery of forest areas, should not be abstracted for agriculture or commercial use. It should be strictly used for drinking. No private exploitation should be allowed.

All traditional water bodies in the villages should be identified, demarcated and freed from encroachments. Their catchment and inundated area must be recorded and notified on a public signboard displayed at a prominent place. These water bodies need to be rejuvenated with the help of community

participation. Many of these water bodies are presently being used as waste disposal grounds. It should be ensured that after cleaning they are not being polluted again. A state level rule, regulation or law be promulgated to check pollution in water bodies and panchayats be made responsible for monitoring and reporting the status half yearly.

Models for community management of surface and groundwater at sub-river basin or river basin should be prepared based on traditional experiences. One such model created in Rajasthan, namely Arwari River Parliament can be helpful.

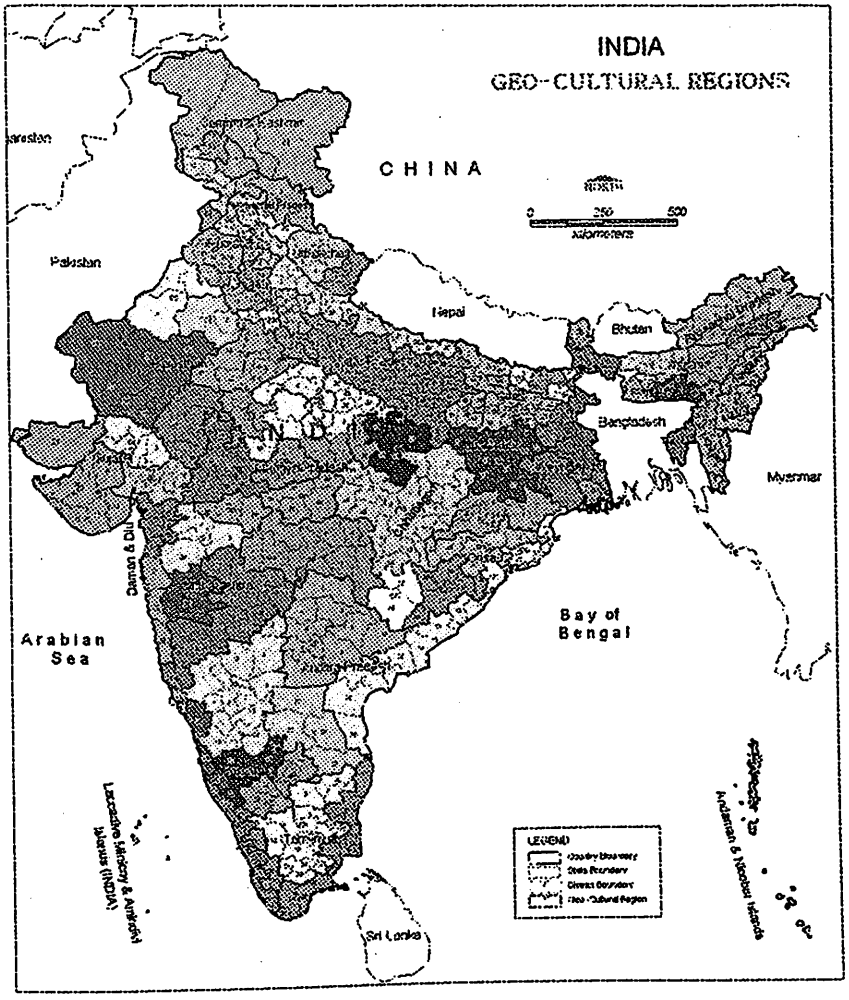
The present system of centralized, supply side management model of drinking water supply has not ensured drinking water security in villages. Therefore, there is a need to adopt new approach, viz. decentralize community driven water management system. This entails transfer of ownership, control and management of village water resources to the village community after building their capacity and providing all kinds of technical support by the line departments. As the quality of surface and groundwater is the major problem, it should be addressed first by measuring the level of pollution, followed by checking pollution by public participation. This may require a water sanitation campaign in each village. Financial and technical support should be made available by the respective departments.

Rooftop harvesting of rainwater should be made mandatory for all the schools, government office buildings and community buildings even in high rainfall areas in order to recharge the acquifers.

Sanitation in school buildings can be made the responsibility of the headmaster and regular monitoring by panchayat representative and village community members.

4.3 Geo-Cultural Level Actions

An alternative model to provide drinking water security in all villages in the country entails understanding the specificities diversity of each geo-cultural zone and plan water resource management for each zone. Tarun Bharat Sangh has prepared a map of geo-cultural zones in India along with other details. This map can be used for such planning.



Document the traditional practices of water harvesting, management and use practices and the institutional arrangements. The 73rd and 74th amendments in the Constitution have empowered village panchayats to manage their natural resources. Therefore, it is perforce to take cognizance while developing any new institutional arrangement for water resource management in a village. A team of geo-scientists, social scientists and engineers be appointed for each geo-cultural zone to provide technical and scientific input to improve their traditional source and institutional system to make them sustainable. Sufficient financial support with some contribution from the user community be ensured to undertake these activities.

In order to make these traditional systems sustainable save them from encroachments by people, state and other agencies. Although there are laws, but yet to be strictly implemented to clear the encroachments.

4.4 Village Level Interventions

The first step in ensuring village drinking water security is to formulate a village water management committee represented by all sections of the village community. The village committee must be made accountable and transparent in all its activities and ensure use of water resources in an equitable manner. This committee should be made responsible for planning, development, management and water security in a village. This is possible only if there are statutory provisions made with administrative and political commitment to support such a model of water resource management.

Each village/habitation should identify at least one surface and groundwater source, based on their traditional wisdom and scientific input. It might be possible that the identified source was sustainable in the past but presently has dried up due to neglect or because of over-exploitation but can be revived with some community effort, may also be considered.

In most States the proposed or enacted Groundwater Act will remain ineffective unless the management and monitoring of groundwater are vested in the village water committees. Groundwater has to be planned on aquifer or block level and recharge measures are to be suggested based on location specific geo-hydrological conditions.

Till now the PHED had a supply-side management system. Consequently people had developed a tendency/ attitude of exploitation and inefficient use of water resource use. People considered water as a free resource and it is the responsibility of democratic state to provide water free for all kinds of uses. The government is seen as provider rather than facilitator. Therefore the traditional wisdom and practices of water conservation and management got eroded. Hence, there is a need to change rolls, i.e. the state should change from provider to facilitator and people should feel their responsibilities to manage the resource sustainably. This is possible only if they learn from their traditional customary practices of water conservation, augmentation and protection. The state and village community should jointly work to ensure recharge of ground water to the extent that matches the exploitation from ground. The natural balance between what one takes from the nature and what gives back to nature should be maintained. It will require special IEC efforts based on specificity of each geo-cultural region.

Presently there is shift in water policy in favour of privatisation of ownership, management, investment and transfer of water resources. This policy will be counter-productive in achieving the goal of sustainable drinking water security. Therefore it be changed to communitisation of the ownership and management. The village community to be accountable and responsible should own the resource.

4.5 State Wise Interventions

1. Jammu and Kashmir

The entire state of Jammu and Kashmir falls under two ecological regions namely, Trans Himalayan Range and Western Himalaya. The Trans Himalayan range consists of Ladakh and Kargil, whereas, Western Himalaya consists of Kashmir Valley and Jammu.

Zings are the water harvesting structures found in Ladakh. They are small tanks that collect glacier water. To ensure sustainable water supply in this state it is essential:

- To maintain network of guiding channels that brings the water from the glacier to the tank. So that when glaciers melt in the day they gather in the channels in the afternoon and the water gets collected in the evening to be used the next day.

- To elect the water official called *Churpun* to ensure that the water is equitably distributed.
- Snow check dams for snow retention
- Traditional roof top harvesting to be encouraged
- Diversion of perennial springs and streams

On the other hand, Kashmir Valley has fertile soil and abundant water that was diverted through canals for irrigation of rice, which forms the major crop of the region. However, the efficiency of these canals needs to be revived through:

- Repairing the ancient canal system

- Constructing loose stone check dams on rivulets.

The Jammu region, which lies largely in the sub Himalayan hills and the adjoining plains had *Kuhls* (diversion canals) as the most ancient irrigation system in the region. In order to regain the ancient wisdom following interventions need to be followed:

- Renovation of old *Kuhls*
- Construction of new *Kuhls*
- Construction of small tanks
- Development of springs
- Construction of recharge structures on the hilly slopes of Jammu
- Revival of village ponds

2. Himachal Pradesh

The state of Himachal Pradesh falls under two ecological regions namely Trans Himalayan Range and Western Himalaya. Lahaul and Spiti of Himachal fall under Trans Himalayan Range whereas rest of Himachal falls under Western Himalaya region.

The Lahaul and Spiti area of Himachal Pradesh is a cold desert, but surprisingly agriculture has been its main stay due to Kul irrigation that utilizes kul (diversion channels) to carry water from glacier to village. The rest of Himachal Pradesh also uses Kul irrigation. To rejuvenate this system following steps needs to be taken:

- Protecting Kuls and repairing and renovating them
- Construction of new kuls wherever necessary

- Access to kul water to be based on availability and need as was practiced in ancient times
- Providing geo-hydrological input
- Construction of loose stone check dams on rivulets.
- Construction of recharge structures on the hilly slopes.
- Construction of small drinking water sources attached to recharge structures.

3. Punjab

The entire state of Punjab falls under two ecological regions namely, Indo-Gangetic Plains and Thar Desert. The area of Punjab falling under the Indo Gangetic Plains comprise of alluvial soil with variations of bangar and khaddar.

The wells and canals formed a major source of irrigation in the region of Punjab falling under Indo Gangetic Plains. The geo cultural regions falling under this zone are Shivalik region, Doab region and Kandi region. The irrigation in the Shivalik region was mainly done through Shah Nahar an inundated canal cutting from Beas river and in Doab region, the irrigation was mainly dependent on wells and Jhalars (shallow wells). The interventions required in this region are:

Shivalik Geo cultural area

- Rejuvenating all the traditional recharge structures
- Removal of encroachment
- Construction of check dams on nallas, choh etc.

Doab Geo cultural area

- Construction of talab and a hand pump near to it
- Rejuvenating ponds by removing encroachment and pollution and ensuring no further pollution.

- Shift from chemical based agriculture to organic based agriculture.

4. Uttaranchal

Majority of Uttaranchal region lies in the ecological region of Western Himalaya. The state comprises of three geo cultural regions namely, Garhwal, Kumayon and Tarai regions.

Since antiquity the people of Uttaranchal have drawn water from small wells or ponds, locally known as Naula or hauzi. Naula is a method of ground water harvesting by making a stone wall across the ground water stream. These Naulas and Hauzis were always full of water however, deforestation and road construction have caused 95 percent of them to dry up and have pushed the rest of them to extinction. In order to rejuvenate the ancient system and aim for sustainable water supply in the region following interventions need to be made;

- Rejuvenate the Naulas
- Construction of temporary bunds, porous and permanent check dams.
- Construction of cement bunds 5-15 m high after stopping the flow of water to create micro streams
- Naulas to be regenerated with the help of these micro streams
- Preserving banjh (oak) and burans (rhododendron) forests that would absorb rain water and further protect Naulas.

5. Uttar Pradesh

Most of the Uttar Pradesh lies in the ecological region of Indo Gangetic Plains, and it comprises of five geo cultural regions namely, Doab, Tarai, Biruj, Bundelkhand and Purvanchal & Vindhayancha.

The Doab region was mainly irrigated by canals. The Gangetic plains of the state were well irrigated by the wells. Most of the

state was served by tanks or johads as a major source of irrigation. Eastern Uttar Pradesh had natural jheels and watercourses, nullahs and lats (long, straight covered embankement) as major source of irrigation. Following interventions are required for sustainable water supply in the region:

- Rejuvenation of old tanks/ village ponds or Johads
- Protecting ponds from further encroachment and deposition of solid and other wastes.
- Construction of hand pumps near tanks
- Rejuvenation of the lat system wherein the long, straight or covered embankment was thrown across a plain on which rice was cultivated.

6. Haryana

Most of the Haryana State falls in the ecological region of Indo Gangetic Plains and it comprises of four geo cultural regions namely, Shivalik, Yamuna Vihar, Jatwal and Aahirwal.

The Rohtak area falling under Jatwal was mainly irrigated by wells. Irrigation from tanks called abi was practiced to some extent in Nardak area and near Ghaggar river and its tributaries. In Sirsal tehsil, the embanked areas locally known as Kunds were built surrounding the nadi (stream) to keep the flood waters at bay. However, the constructions of dams have diverted the nadi flow and people have started depending on ground water through tube wells and are losing their sustainable water supply. Following interventions are needed to rejuvenate sustainability of water supply in the region:

- Rejuvenating nadi, kunds and nallas
- Recharge ponds and hand pumps
- Removal of pollution from ponds
- Measures to check agricultural pollution

- Promoting afforestation program along Yamuna and protecting it from urban pollution.

7. Rajasthan

The state of Rajasthan falls under the ecological regions of Thar Desert and Central Highlands. The state comprises of six geo cultural regions namely Thar, Dhundad, Mewar, Marwar, Hadoti and Shekhawati.

In the regions of Rajasthan, pond water was the source of water earlier, but gradually with time and government intervention, the source got shifted to dug wells and eventually to tube wells. However, the major traditional sources were nadis, tankas and khadins, Johads, Bawari, etc. Following interventions are required to rejuvenate the traditional sources and opt for sustainability of water supply sources in the **Thar region** of Rajasthan:

- Rejuvenating nadis, kunds and khadins
- Promote individual kunds for people who can afford.
- Promote public kunds for poor people.
- Construction of well inside the nadi or hand pump near it for availability of potable drinking water for three months.
- Promoting rooftop rain water harvesting in all private, public and community structures.
- Promoting ground water recharge.
- Modernization of old tanks and construction of new tanks.
- Construction of kuis near to tanks in order to collect their seepage.
- Protecting traditional systems from encroachment of their catchment's areas.

Central Highlands(Aravali Range):

- Finding alternative source to bavdis or step wells for ground water recharge.
- Promote ground water recharge on hill slopes and flat lands.
- Rejuvenate tankas by desilting them and protecting their catchment areas.
- Removal of pollution from the ponds.
- Construction of groundwater recharge structures and link it with drinking water system.

8. Gujarat

The state of Gujarat falls under the ecological regions of Thar Desert and Western Coastal Plains. The state comprises of five geo cultural regions namely, Rann of Kachchh, Saurasthra, North Gujarat, Central Gujarat and South Gujarat.

The state observes extremities in terms of rainfall with Kachchh observing droughts most of the time and South Gujarat observing floods most of the time. North, Central and South Gujarat mostly have alluvial plains, whereas rocky terrain forms the geology of Saurashtra. Kachchh and Saurashtra receive very minimal rains compared to rest of Gujarat. Traditionally, wells, tanks and step wells were the means of water harvesting in Gujarat. Following interventions are required for sustainable water supply in this region:

- Finding alternative source to bavdis or step wells for ground water recharge.
- Rejuvenation of dug wells.
- Construction of hand pump near the tanks.
- Construction of check dams (anicuts) to trap whatever water falls on earth.

- Rejuvenation of virdas
- Artificial recharge of ground water in parts of Kachchh and Saurashtra to deal with salt water intrusion.
- Modernization of old tanks.
- Construction of new tanks.
- Promoting roof top rain water harvesting in all private, public and community structures.
- De silting and deepening of ponds
- Filtration wells on ponds

9. Maharashtra

Major part of Maharashtra falls under the ecological region of Deccan Plateau followed by Western Coastal Plains and Western Ghats. The state comprises of four geo cultural regions namely, Khan Desh, Vidarbha region, Marathwada and Coastal Region.

Traditionally, the well irrigation was the principal form of irrigation in the central Deccan region. Numerous dams (bandharas) were built across rivers and streams in the western Deccan. The community managed Phad system was prevalent in north western Maharashtra as irrigation system that operated through bandharas on the rivers and canals. In Wainganga plain of Maharashtra tank were used for irrigation. The coastal districts of Maharashtra were irrigated largely by wells, lakes and reservoirs in the past.

Following interventions are required for sustainable water supply in all the regions of Maharashtra:

- Renovation of old tanks, desiltation of tanks, construction of new tanks.
- Construction of check dams and percolation tanks

Deccan Plateau

- Nalla treatment, water shed activities, construction of percolation tanks.
- Revival of talaiyas
- Rejuvenation of Phad system

Coastal areas

- Revival of bundhini (embankment) system
- Cleaning of wells and lakes
- Desilting reservoirs

10. Madhya Pradesh

The major part of Madhya Pradesh falls under the ecological region of Central Highlands and comprises of seven geo cultural regions namely, Chambal, Bundelkhand, Madhya Bharat, Malva, Nimad, Satpuda – Narmada and Mahakaushal.

Traditionally, Haveli system was followed as the water harvesting system in this state. In this system, rainwater is held in embanked fields, enclosed on four sides until sowing time and then the water is let out as soon as the land is dry and fields are sown. This system is excellent for wheat production and does not support Kharif production. Haveli system forms the largest sprinkler irrigation tracks in the State.

Following interventions are required to preserve the water supply system:

- Rejuvenate haveli system in which water is allowed to stand in the fields and thus helps in recharging ground water.
- Construction of well or hand pump near the recharge structure to ensure sustainable drinking water supply.
- Rejuvenation of bhandaras and jail karanj, the traditional ways of storing water and a good source of drinking water.

- Removal of pollution from the Tapti river and avoidance of disposal of effluents into the river.
- Avoid degradation of lat system.
- Modernization of old tanks, construction of new tanks.
- Reconstruction of old water conservation structures and removing encroachments and pollution from them.
- Constructing rain water harvesting structures and putting hand pump near them
- Construction of small recharge structures on small rivers and nallas

11. Chattisgarh

The entire state of Chattisgarh falls under the ecological region of Eastern Highlands. The state comprises of two geo cultural regions namely, Mahakaushal and Dandakranya.

Following interventions are required for sustainable water supply system:

- Construction of check dams and percolation tanks.
- Construction of ponds and bandharas
- Construction of gully plugging, sub surface dams, contour bunding.
- Rejuvenating the existing structures and systems.
- Construction of flat battered tanks.

12. Karnataka

The state of Karnataka falls under the ecological region of Deccan Plateau, Western Coastal plains and Western Ghats. The state comprises of four geo cultural regions namely, North East Karnataka, Coastal Karnataka, Pahadi Pathari and Central Karnataka.

The main sources of irrigation in the state were; water channels, tanks, wells and spring locally called *talpariges, etc.* The other sources include channel irrigation, Tungbhadra anicuts (bunds or dykes), channels or pats. The traditional source of irrigation used in South Karnataka is the Palar series of tanks.

The water harvesting structures used in the State are arakere, volakere, devikere, katte, kunte and kola. Following interventions should be taken to preserve these structures and aim for sustainable water supply system:

- Revival of *Gokattes* that are important source of water for cattle that further benefit social forestry, agriculture and dairy activities.
- Rejuvenation and development of tanks, i.e. modernization of tanks.
- Fencing the tanks for security purpose
- De-silting the tanks and using the silt to form islands planted with ornamental shrubs and trees
- Cleaning storm water drains that in turn clog the tanks
- Renovation of percolation tank and recharge of ground water acquifer.
- Construction of new percolation tanks
- Improving designs of tank for minimizing evaporation and seepage losses.
- Control of sediment load and water pollution.
- Construction of small barriers across small streams, lateral drains/ trenches, subsurface dykes etc.
- Promoting roof top rain water harvesting structures in residential, public and commercial structures.
- Built farm ponds and install hand pumps.

13. Kerala

The state of Kerala falls under the ecological zone of Western Coastal Plains and Western Ghats. The state comprises of two geo cultural regions namely Coastal Kerala and Hilly & Plateau Kerala.

The major source of irrigation in Kerala had been river channels, channel fed tanks and river fed tanks. Earlier, wet cultivation commonly known as "palliyals" was practiced on hill sides. Other sources of water harvesting that were used earlier are anicuts and channels commonly known as *Kals*. Following interventions are required to ensure sustainable water supply in the state:

- Construction of tanks, ponds, and other groundwater recharge structures.
- Declare lake and surrounding as free zone with afforestation plan on its periphery.
- Construction of wells near recharge structures.
- Construction of seasonal bunds and temporary sub surface structures on rivers for preventing salinity.
- Construction of roof top harvesting structures on all private, public and community structures.

14. Tamil Nadu

The state of Tamil Nadu falls under the ecological zones of Western Ghats, Eastern Ghats and Eastern Coastal Plains. The state comprises of two geo cultural regions namely, Coastal region and South Hilly & Plateau region.

Channel, tank, rivers, reservoirs and well irrigation is widely spread in this region. Moreover, the tanks were fed by the anicut system known as the Palar anicut system. The ancient tanks that irrigate about one third of Tamil Nadu are commonly known as

eris and the traditional community based repair and maintenance system of these tanks is known as *kudimaramath.*

Following interventions are required to be made for sustainable water supply in the state:

- Rejuvenation of channels, rivers, reservoirs and wells.
- Construction of kundi with a hand pump inside it for ground water recharge.
- Renovation of tanks and construction of new tanks
- Making Eris the property of village community in order to aim their proper management.
- Promote the ancient system of traditional community based repair and maintenance system known as *Kudimaramath.*
- Promote roof top rain water harvesting in all private, public and community structures.
- Restoration of traditional rain water harvesting structures.

15. Andhra Pradesh

The state of Andhra Pradesh falls under the ecological region of Deccan Plateau, Eastern Ghats and Eastern Coastal Plains. The state comprises of three geo cultural regions namely Telangana, Kaling Coastal & Delta Krishna-Godawari and Rayalseema.

Tanks were the major source of irrigation in Andhra Pradesh and streams were used to feed these tanks. The other sources of irrigation were river channels, wells and small tanks known as *Kuntas.* Construction of tanks in earlier days was done through the grant of either rent free land or an assignment of a portion of the land venue for maintenance and repairs. These were known as *Dasabandham Irrigation Sources.*

Following interventions are required for a sustainable water supply system in the state.

- Rejuvenation of old tanks and construction of new tanks.
- Rejuvenation of river channels, wells and *Kuntas*
- Construction of recharge structure and hand pump adjoining it.
- Removal of encroachments and pollution from tanks and traditional water bodies.
- Promoting roof top rain water harvesting in all private, public and community structures.
- Construction of percolation tanks and different structures suitable to different regions.
- De-silting of irrigation tanks
- Construction of infiltration wells in river beds for ground water recharge.
- Reviving the old *Dasabandham Irrigation System*

16. Orissa

The state of Orissa falls in the Ecological region of Eastern Highlands, Eastern Ghats and Eastern Coastal Plates. The state comprises of four geo-cultural region, namely North Region, Coastal Dandiya, Parimi Dadiya Region and South Region.

The *katas, mundas and bandhas* were the main irrigation sources in Orissa. A shallow channel called *chahal* was used to utilize water during dry periods. Community management was a distinctive feature of irrigation system in the state. Other sources of irrigation were tanks, river channels, spring channels and wells.

Following interventions are required for a sustainable water supply system in the state.

- Revival of ponds, Paal, khet talai, and all traditional water bodies and structures.

- Construction of Nalla bunding for ground water recharge
- Renovation of existing tanks by de-siltation of tanks, and revival of village institutions.
- Construction of hand pumps near ground water recharging tanks.
- Removal of pollution from the tanks.
- Promoting roof top rain water harvesting in all private, public and community structures.

17. Bihar

The state of Bihar falls under the ecological region of Indo Gangetic Plains and Eastern Highlands. The State comprises of ten geo cultural regions namely Gandak, Kosi, Mahanadi, Kosi, Kosi-Mithila, Gandak/Bazzika, Ang Region, Maghad, Maghad-Patliputra and Son.

The *ahar-pyne* system of irrigation is the ancient system used in Bihar. The *parabandi* system was used to distribute water among villagers from a common source usually pyne. The other major sources of irrigation were large reservoirs and extensive canal system. In *Kautilyas Arthasastra* written in 300 BC, there is reference to *aharyodaka-setu* as a method used for irrigation. Supply of safe drinking water during floods is the major problem in the state.

Following interventions are required for a sustainable water supply system in the state.

- Installation of Hand Pumps with raised platform not to be affected by floods.
- Revival of all traditional village drinking water systems including *ahar-pyne* system.
- De-siltation of reservoirs and ahars and free them from encroachments.

- Revival of *parabandi* system
- Taking measures to check pollution in traditional drinking water sources.

18. Jharkhand

The entire state of Jharkhand falls under the ecological zone of Eastern Highlands. The State comprises of two geo cultural regions namely Santhala Pargana and Koylanchal.

Systems such as construction of temporary dams on streams, digging of wells to retain rain water on fields and construction of ponds or *ahars* to retain rain water on fields having steep slopes were used for irrigation in the state. The other source of irrigation was traditionally made dam by using *mojars (spheres of wet soil bound with paddy straw)* and sand bags. There were traditionally constructed by institution called **Goam** (voluntary labour).

Following interventions are required for a sustainable water supply system in the state.

- Revival of *ahar-pyne* system
- De-siltation of ponds and tanks and construction of new drinking water sources.
- Revival of dams made of *mojars* and sand bags to facilitate recharging of groundwater.
- Revival of Goam institution to protect the traditional systems.
- Construction of groundwater recharge structures to support drinking water sources.
- Construction of recharge structures on the hill slopes.

19. West Bengal

The entire state of West Bengal falls under ecological region of Indo Gagentic plains. The State comprises of ten geo cultural regions namely Koch Hilly Region, Tarai & Flat Region, Tista River Basin Flat Agricultural Land, Kunch Bihar Flat Region, Flat Region Ganga, Kunch Bihar Flat Region, Flat Region Ganga, Flat Region Lower Ganga, Flat Region Lower Damodar-Agricultural, Pateau Region and Sea Delta Region.

Canals were the main source of irrigation in West Bengal. Every dead river in Bengal was used as a canal and a number of canals were called *kana nadi* meaning blind rivers. Quality of drinking water is the major problem. The source of Drinking water has to be shifted from groundwater to surface water or dug wells.

Following interventions are required for a sustainable water supply system in the state.

- Constructing long canals capable of carrying enough river water to mingle with the rain water down the natural transverse slope.
- Ensure that the canals be spaced at right distance in order to secure healthy overflow irrigation of the state and also to achieve filling of all tanks with river water, killing weeds, destroying mosquitoes and providing healthy drinking water and feeding of the sub soil water supplies of the country.
- Ensure that the overflow canals or *kanas* are broad and shallow to carry the muddy surface water of the rivers and leave out sandy bottom water.
- Promoting rooftop rainwater harvesting in all private, public and community structures.
- Construction of groundwater recharge structures all over the state.

20. Sikkim

The state of Sikkim falls under the ecological region of Eastern Himalayas. The State comprises of one geo cultural region namely Sikkim.

Construction of water channels, regulation of water flow and drawing of drinking water were traditionally organized as community enterprises in Sikkim. Irrigation was mostly confined to rice fields and cardamom plantation based on artificial irrigation. In case of Rice fields the irrigation was done on bench terraces that required irrigation cum drainage channels to serve as filed boundaries. The common sources of drinking weter were streams *kholas (tanks)* and *khup (ponds)*.

Following interventions are required for a sustainable drinking water supply system in the state.

- Construction of soil erosion control measures.
- Construction of recharge structures on the hilly slopes.
- Construction of contour bunding, bench terracing, series of check walls.
- Plantation along the hill slopes.
- Construction of rooftop rainwater harvesting structures in all the private, public and community buildings
- Introduction of water diversion schemes and rain water retention

21. Assam

The major part of Assam falls under ecological region of Brahmaputra Valley. State comprises of five geo cultural regions namely Bogain Gaoń (Bodo), Kamrup, Aahom, Mishing and Karvi.

Assam valley had a long tradition of artificial irrigation used for rice crop. The channels were dug several kilometers long to

bring the water to the fields which were built collectively by the villagers. In certain parts of the state there was also a tradition to dig ponds (known as *dongs*) that were mostly used for drinking water.

Following interventions are required for a sustainable water supply system in the state.

- Introduction of water diversion schemes and rain water retention structures.
- Construction of contour bunding, bench terracing, series of check walls for soil conservation and increase in base flow and water availability.
- Plantation along the hill slopes.
- Construction of rooftop rainwater harvesting structures in all the private, public and community buildings.

22. Manipur

The state of Manipur lies in the ecological region of North Eastern Hill Ranges. State comprises of one geo cultural region namely Madu Tai Region.

Natural springs and streams are the major source of water supply in the region. The hills were cut into terraces and water was brought to them from hill streams through irrigation channels. Natural springs were harnessed by building storage tanks along them

Following interventions are required for a sustainable water supply system in the state

- Introduction of water diversion schemes and rain water retention structures.
- Construction of contour bunding, bench terracing, series of check walls to check soil erosion and increase flow in the traditional systems.

- Plantation along the hill slopes
- Cleaning of the storage tanks to avoid choking of the springs.
- Construction of roof top rain water harvesting structures in all public private and community buildings.

23. Meghalaya

The state of Meghalaya lies in the ecological region of North Eastern Hill Ranges. State comprises of three geo-cultural regions namely Goro Land, Khasi Land and Mizoram Regions.

The source of water for irrigation in this region is natural springs, streams and rainfall. In the state an ingenious system of tapping stream and spring water by using bamboo pipes to irrigate plantation is widely prevalent.

Following interventions are required for a sustainable water supply system in the state

- Construction of roof top rain water harvesting structures in public private and community buildings.
- Take measures to augment the supply of traditional drinking water sources, and protect them from pollution.
- Construction of contour bunding, bench terracing, series of check walls to augment supply of water.
- Activities to check soil erosion to improve life of water bodies.
- Cleaning of the springs.

24. Mizoram

The state of Mizoram lies in the ecological region of North Eastern Hill Ranges. State comprises of two geo-cultural regions namely Khasi Land and Mizoram Regions.

The traditional sources of water were the numerous springs in the hills commonly known as *tuikher*. Jhum cultivation is the predominant mode of cultivation in Mizoram.

Following interventions are required for a sustainable water supply system in the state

- Introduction of water diversion schemes and rain water retention
- Construction of roof top rain water harvesting structures in public private and community buildings.
- Construction of contour bunding, bench terracing, series of check walls as a soil erosion control measure.
- Cleaning of the springs.
- Promoting afforestation program along hills and protecting water bodies from pollution.

25. Tripura

The state of Mizoram lies in the ecological region of North Eastern Hill Ranges. State comprises of one geo cultural region namely Tripura Region.

Following interventions are required for a sustainable water supply system in the state

- Introduction of water diversion schemes and rain water retention
- Construction of recharge structures on the hilly slopes
- Construction of contour bunding, bench terracing, series of check walls
- Construction of soil erosion control measures
- Cleaning of the springs.

- Construction of roof top rain water harvesting structures in public private and community buildings.
- Promoting afforestation program along hills and protecting it from pollution.

26. Nagaland

The state of Mizoram lies in the ecological region of North Eastern Hill Ranges. State comprises of one geo cultural region namely Nagaland Region.

Jhum cultivation and wet terrace cultivation are the predominant modes of cultivation in the state. Where terrace cultivation is practiced, water is channeled from streams or water falls to nearby terraced plot. Another indigenous cultivation practice in Nagaland is the *Zado* system also known as *Ruza* System. It is a combination of Forestry, agriculture and animal care with a well founded conservation base, called erosion control, water resources development and protection of environment. Apart from springs small natural tanks that collect rain water also used occasionally to from vegetable on the banks

Following interventions are required for a sustainable water supply system in the state

- Rejuvenation of the *Zado* and *Jhum* system.
- Revival of small old tanks and construction of new tanks
- Introduction of water diversion schemes and rain water retention
- Construction of recharge structures on the hilly slopes
- Construction of contour bunding, bench terracing, series of check walls
- Construction of soil erosion control measures
- Cleaning of the springs.

- Construction of roof top rain water harvesting structures in public private and community buildings.
- Promoting afforestation program along hills and protecting it from pollution.

27. Arunachal Pradesh

The state of Arunachal Pradesh lies in the ecological region of Eastern Himalayas Ranges. State comprises of one geo cultural region namely Tri Vitiran, Missi and Changlang Region.

There are two important traditional irrigation systems in Arunachal Pradesh namely, the irrigation of rice terraces with the help of bamboo pipes and the Apatani system of wet rice irrigation. The main form of cultivation is the shifting cultivation.

Following interventions are required for a sustainable water supply system in the state

- Rejuvenation of the *Apatani* system of irrigation.
- Introduction of water diversion schemes and rain water retention
- Construction of recharge structures on the hilly slopes
- Construction of contour dams dividing the plots.
- Creating barriers to channelize the water to the terraced land.
- Construction of soil erosion control measures
- Cleaning of the springs.
- Construction of roof top rain water harvesting structures in public private and community buildings.
- Promoting afforestation program along hills and protecting it from pollution.

Union Territory Wise Interventions

28. Delhi

The Union Territory of Delhi falls under the ecological zone of Indo Gangetic Plains and it comprises of two geo cultural regions namely, Indraprastha and Khandavprastha.

The major source of water supply in Delhi was tanks, *baolis (step wells),* deep wells, Sahajahani canals and *dighis (a square or circular reservoir),* bunds and wells.

Following interventions are required for a sustainable water supply system in the region.

- Rejuvenation and cleaning of tanks and reservoirs for better ground water recharge
- Construction of tube wells within the tank beds or hand pumps near to it for ground water recharging
- Rejuvenation and cleaning of deep wells and *dighis.*
- Construction of roof top rainwater harvesting in all public, private and community structures
- Cleaning of Yanuma and saving it from further pollution
- Promoting afforestation program along the Yamuna river

29. Goa

The Union Territory of Goa falls under the ecological zone of Western Coastal Plains and it comprises of one geo cultural region namely Coastal, Hilly and Plateau.

Drainage canals, natural and man-made, from the two rivers of Goa and sluice gates on these rivers are the sources of irrigation in Goa. They are known as the *Khazana lands* and they play a crucial role in state's coastal ecology. The sluice gates are also important because they regulate the inundation on the field to salt water that can impair its fertility.

Following interventions are required for a sustainable water supply system in the region.

- Avoiding environmental degradation
- Controlling deforestation in the upper river catchment area and mining activities that has added to the silt load in the rivers
- Controlling heavy pollution near the town and waste material to flow into the *Khazana Land.*

32. Lakshadweep Islands

The Union Territory of Lakshadweep Islands falls under the ecological zone of The Islands and it comprises of one geo cultural regions namely Lakshadweep Region.

Although these islands receive a good average rainfall there is acute drinking water shortage due to absence of forest and vegetation. To meet the drinking water requirements, dug wells and step wells were used. Whereas for other purposes water from step wells, ponds or tanks were used.

Following interventions are required for a sustainable water supply system in the region.

- Revival, protection and development of ground water and rain water harvesting system.
- Construction of roof top rainwater harvesting in public, private and community structures
- Development of surface water system either through diversion or storage
- Construction of infiltration wells in river beds for ground water recharge
- Clearance of excess surface runoff
- Conducting hydrogeological study

33. Andaman and Nicobar Islands

The Union Territory of Andaman and Nicobar Islands falls under the ecological zone of The Islands and it comprises of one geo cultural region namely Andaman and Nicobar Region

Various ways of water harvesting are prevalent in Andaman and Nicobar Islands due to its rugged physiographic and major loss of rainfall as surface runoff. Rainwater harvesting was done through streams, small tanks, unmetalled pits, wells and *bunds*. For irrigating some wild fruits and vegetables channels were dug from higher elevation to the fields directing the flow of rain to the fields situated at lower elevation.

Following interventions are required for a sustainable water supply system in the region.

- Development of surface water system either through diversion or storage
- Construction of recharge structures in hard rock area
- Construction of infiltration wells in river beds for ground water recharge
- Clearance of excess surface runoff
- Conducting hydrogeological study
- Construction of seasonal bunds and temperory sub surface structures on rivers for preventing salinity.

34. Chandigarh

The Union Territory of Chandigarh falls under the ecological zone of Indo-Gangetic Plains and it comprises of one geo cultural region namely Doaba Region

35. Dadra and Nagar Haveli

The Union Territory of Dadra and Nagar Haveli falls under

the ecological zone of Western Coastal Plains and it comprises of one geo cultural region namely South Gujarat.

30. Pondicherry

The Union Territory of Pondicherry falls under the ecological zone of Eastern Coastal Plains and it comprises of three geo cultural regions namely Kaling Coastal & Delta Krishna-Godawari, Coastal Region and Coastal Kerala.

31. Daman and Diu

The Union Territory of Daman and Diu falls under the ecological zone of Western Coastal Plains and Daman comprises of South Gujarat geo cultural region whereas Diu comprises of Saurashtra geo cultural region.

APPENDIX

ID_ST	STATE	ID_DIST	DIST	ID_REG	REGION
10	Andhra Pradesh	55	Karimnagar	1	Telangana
44	Andhra Pradesh	136	Visakhapatnam	2	Kaling Coastal & Delta Krishna-Godawari
4	Andhra Pradesh	86	Anantapur	3	Rayalseema
26	Arunachal Pradesh	91	East Kameng	4	63 Tri Vitiran, Missi and Changlang
6	Assam	5	Dhubri	5	Kamrup
18	Assam	31	Barpeta	6	Bogain Gaon (Bodo)
24	Assam	100	Sonitpur	7	Aahom
12	Assam	86	Karimganj	8	Karvi
12	Assam	54	Tinsukia	9	Mishing
33	Lakshadweep	1	Lakshadweep	10	Lakshadweep Region
20	Bihar	159	Gaya	11	Maghad
20	Bihar	156	Kalmur(Bhabua)	12	Son
36	Bihar	95	Sheohar	13	Gandak
8	Bihar	18	Darbhanga	14	Mithila
12	Bihar	24	Madhepura	15	Kosi
32	Bihar	198	Bhagalpur	16	Ang Region
10	Chhattisgarh	31	Bastar	17	Dhandakranya
140	Chhattisgarh	316	Jashpur	18	Mahakaushal
78	Uttar Pradesh	42	Agra	19	Biruj
68	Andaman and Nicoba	3	Andamans	20	Andaman and Nicobar Region
12	Goa	3	North Goa	21	Coastal, Hilly and Plateau
105	Gujarat	138	Surat	22	South Gujarat
7	Gujarat	1	Kachchh	23	Kachha ka Ran
35	Gujarat	20	Mahesana	24	North Gujarat
80	Gujarat	78	Jamnagar	25	Saurashtra
42	Gujarat	92	Kheda	26	Central Gujarat
40	Haryana	35	Panjpat	27	Yamuna Vihar
48	Haryana	75	Hisar	28	Jatwal
32	Haryana	70	Gurgaon	29	Aahirwal
54	Himachal Pradesh	42	Una	30	Kangada
57	Himachal Pradesh	31	Kinnaur	31	Cold Desert
9	Himachal Pradesh	5	Mandi	32	Himalaya Range (Dholadhar)
40	Jammu and Kashmir	18	Pulwama	33	Kashmir Ghati
103	Haryana	71	Ambala	34	Shivalik
55	Jharkhand	45	Sahibganj	35	Santhala Pargana

143	Jharkhand	126	Chatra	36	Koylanchal
72	Karnataka	135	Bangalore Rural	37	Central Karnataka
12	Karnataka	24	Dakshina Kannada	38	Coastal Karnataka
168	Karnataka	110	Bijapur	39	North East Karnataka
48	Karnataka	83	Hassan	40	Pahadi Pathari
182	Uttar Pradesh	63	Baghpat	41	Doab Region
178	Kerala	81	Wayanad	42	Coastal Kerala
39	Kerala	27	Pathanamthitta	43	Hilly & Plateau Kerala
70	Madhya Pradesh	75	Umaria	44	Baghelkhand
42	Madhya Pradesh	84	East Nimar	45	Nimad Region
280	Madhya Pradesh	349	Tikamgarh	46	Bundelkhand
84	Madhya Pradesh	178	Vidisha	47	Madhya Bharat Region
70	Madhya Pradesh	191	Hoshangabad	48	Satpuda - Narmada Region
126	Madhya Pradesh	198	Ratlam	49	Malva Region
165	Maharashtra	99	Washim	50	Vidharbha Region
30	Maharashtra	51	Pune	51	Central Region
195	Maharashtra	332	Parbhani	52	Marathwada
60	Maharashtra	26	Jalgaon	53	Khan Desh
75	Maharashtra	122	Mumbai	54	Coastal Region
144	Manipur	45	Charachandpur	55	Madu Tai Region
18	Meghalaya	7	Lawngtlai	56	Mizoram
51	Meghalaya	6	South Garo Hills	57	Goro Land
126	Mizoram	29	Aizawl	58	Mizoram
152	Nagaland	36	Mokokochung	59	Nagaland
120	Delhi	12	North East	60	Indraprastha
150	Delhi	33	West	61	Khandavprastha
180	Orissa	173	Anugui	62	Parimi Dadiya Region
120	Orissa	160	Rayagada	63	south Region
140	Orissa	28	Sambalpur	64	North Region
160	Orissa	104	Kendrapara	65	Coastal Dandiya
113	Punjab	19	Hoshiarpur	66	Doaba Region
168	Punjab	100	Moga	67	Malva Region
63	Punjab	32	Patiala	68	Puad Region
66	Rajasthan	6	Bikaner	69	Thar Region
22	Rajasthan	159	Udaipur	70	Mewar Region
198	Rajasthan	106	Bharatpur	71	Dundhad Region
88	Rajasthan	116	Baran	72	Hadoti Region

66	Rajasthan	22	Sikar	73	Shekhawati Region
154	Rajasthan	119	Jaisalmer	74	Marwar Region
92	Sikkim	10	South Sikkim	75	Sikkim
382	Tamil Nadu	233	Cheenai	76	Coastal Region
408	Tamil Nadu	238	Tiruvanamalai	77	South Hilly & Plateau Region
100	Tripura	10	Dhalai	78	Tripura
1040	Uttar Pradesh	1771	Mainpuri	79	Purvanchal & Vindhayancha
162	Uttaranchal	21	Rudraprayag	80	Gadwal Region
392	Uttar Pradesh	368	Bijnor	81	Tarai Region
135	Uttaranchal	45	Almora	82	Kumayon
84	West Bengal	42	Medinipur	83	Plateau Region
84	West Bengal	51	SouthTwenty Four Pargana	84	Sea Delta Region
336	West Bengal	78	Nadla	85	Flat Region Ganga
21	Punjab	2	Amritsar	86	Majha Region
70	Madhya Pradesh	15	Morena	87	Bundelkhand - Chambal
4	Bihar	14	Muzaffarpur	88	Gandak / Bazzika
12	Bihar	27	Katihar	89	Mahanadi
4	Bihar	12	Saharsa	90	Kosi - Mithila
20	Jammu and Kashmir	15	Kargil	91	Cold Desert (Leh - Laddakh)
9	Himachal Pradesh	1	Chamba	92	Cold Desert (Trans Himalayan Range)
9	Himachal Pradesh	11	Sidnla	93	Himalaya Range (Mahasu)
24	Karnataka	26	Udupi	94	Coastal Karnataka/ Malayanad
69	Mizoram	22	Jaintia Hills	95	Khasi Land

ID-ST	STATE	ID-DIST		DIST ID-REG	REGION
1	Andhra Pradesh	1	Adilabad	1	Telangana
1	Andhra Pradesh	2	Nizamabad	1	Telangana
1	Andhra Pradesh	3	Karimnagar	1	Telangana
1	Andhra Pradesh	4	Medak	1	Telangana
1	Andhra Pradesh	5	Hyderabad	1	Telangana
1	Andhra Pradesh	6	Rangareddy	1	Telangana
1	Andhra Pradesh	7	Mehboob Nagar	1	Telangana
1	Andhra Pradesh	8	Nalgonda	1	Telangana
1	Andhra Pradesh	9	Warangal	1	Telangana
1	Andhra Pradesh	10	Khammam	1	Telangana
1	Andhra Pradesh	11	Srikakulam	2	Kaling Coastal & Delta Krishna-Godawari
1	Andhra Pradesh	12	Vizianagaram	2	Kaling Coastal & Delta Krishna-Godawari
1	Andhra Pradesh	13	Visakhapatnam	2	Kaling Coastal & Delta Krishna-Godawari
1	Andhra Pradesh	14	East Godavari	2	Kaling Coastal & Delta Krishna-Godawari

1	Andhra Pradesh	15	West Godavari	2	Kaling Coastal & Delta Krishna-Godawari
1	Andhra Pradesh	16	Krishna	2	Kaling Coastal & Delta Krishna-Godawari
1	Andhra Pradesh	17	Guntur	2	Kaling Coastal & Delta Krishna-Godawari
1	Andhra Pradesh	18	Prakasam	2	Kaling Coastal & Delta Krishna-Godawari
1	Andhra Pradesh	19	Nellore	2	Kaling Coastal & Delta Krishna-Godawari
1	Andhra Pradesh	20	Cuddapah	3	Rayalseema
1	Andhra Pradesh	21	Kurnool	3	Rayalseema
1	Andhra Pradesh	22	Anantapur	3	Rayalseema
1	Andhra Pradesh	23	Chittoor	3	Rayalseema
2	Arunachal Pradesh	1	Tawanga	4	63 Tri Vitiran, Missi and Changlang
2	Arunachal Pradesh	2	West Kameng	4	63 Tri Vitiran, Missi and Changlang
2	Arunachal Pradesh	3	East Kameng	4	63 Tri Vitiran, Missi and Changlang
2	Arunachal Pradesh	4	Papum Pare	4	63 Tri Vitiran, Missi and Changlang
2	Arunachal Pradesh	5	Lower Subansiri	4	63 Tri Vitiran, Missi and Changlang
2	Arunachal Pradesh	6	Upper Subansiri	4	63 Tri Vitiran, Missi and Changlang
2	Arunachal Pradesh	7	West Siang	4	63 Tri Vitiran, Missi and Changlang
2	Arunachal Pradesh	8	East Siang	4	63 Tri Vitiran, Missi and Changlang
2	Arunachal Pradesh	9	Upper Siang	4	63 Tri Vitiran, Missi and Changlang
2	Arunachal Pradesh	10	Dibang Valley	4	63 Tri Vitiran, Missi and Changlang
2	Arunachal Pradesh	11	Lohit	4	63 Tri Vitiran, Missi and Changlang
2	Arunachal Pradesh	12	Changlang	4	63 Tri Vitiran, Missi and Changlang
2	Arunachal Pradesh	13	Tirap	4	63 Tri Vitiran, Missi and Changlang
3	Assam	1	Kokrajhar	6	Bogain Gaon (Bodo)
3	Assam	2	Dhubri	5	Kamrup
3	Assam	3	Goalpara	5	Kamrup
3	Assam	4	Bongaigaon	6	Bogain Gaon (Bodo)
3	Assam	5	Barpeta	6	Bogain Gaon (Bodo)
3	Assam	6	Kamrup	6	Bogain Gaon (Bodo)
3	Assam	7	Nalbari	6	Bogain Gaon (Bodo)
3	Assam	8	Darrang	6	Bogain Gaon (Bodo)
3	Assam	9	Marigaon	7	Aahom
3	Assam	10	Nagaon	7	Aahom
3	Assam	11	Sonitpur	7	Aahom
3	Assam	12	Lakhimpur	9	Mishing
3	Assam	13	Dhematil	9	Mishing
3	Assam	14	Tinsukia	9	Mishing
3	Assam	15	Dibrugarh	9	Mishing
3	Assam	16	Sirsagar	7	Aahom
3	Assam	17	Jorhat	7	Aahom
3	Assam	18	Golaghat	7	Aahom
3	Assam	20	North Cachar Hills	8	Karvi

3	Assam	21	Cachar	8	Karvi
3	Assam	22	Karimganj	8	Karvi
3	Assam	23	Hailakandi	8	Karvi
4	Bihar	1	Pashchim	13	Gandak
4	Bihar	2	Purba Champaran	13	Gandak
4	Bihar	3	Sheohar	13	Gandak
4	Bihar	4	Sitamarhi	13	Gandak
4	Bihar	5	Madhubani	14	Mithila
4	Bihar	6	Supaul	15	Kosi
4	Bihar	7	Araria	15	Kosi
4	Bihar	8	Kishanganj	14	Mahanadi
4	Bihar	9	Purnia	14	Mahanadi
4	Bihar	10	Katihar	14	Mahanadi
4	Bihar	11	Madhepura	15	Kosi
4	Bihar	12	Saharsa	15	Kosi - Mithila
4	Bihar	13	Darbhanga	14	Mithila
4	Bihar	14	Muzaffarpur	13	Gandak / Bazzika
4	Bihar	15	Genalani	13	Gandak
4	Bihar	16	Siwan	13	Gandak
4	Bihar	17	Saran	13	Gandak
4	Bihar	18	Vaishali	13	Gandak
4	Bihar	19	Samastipur	13	Gandak
4	Bihar	20	Begusarai	16	Ang Region
4	Bihar	21	Khagaria	16	Ang Region
4	Bihar	22	Bhagalpur	16	Ang Region
4	Bihar	23	Banjka	16	Ang Region
4	Bihar	24	Munger	16	Ang Region
4	Bihar	25	Lakhisarai	16	Ang Region
4	Bihar	26	Sheikhpura	16	Ang Region
4	Bihar	27	Nalanda	11	Maghad
4	Bihar	28	Patna	11	Maghad - Patliputra
4	Bihar	29	Bhojpur	12	Son
4	Bihar	30	Buxar	12	Son
4	Bihar	31	Kaimur(Bhabua)	12	Son
4	Bihar	32	Rohtas	12	Son
4	Bihar	33	Jehanabad	11	Maghad
4	Bihar	34	Aurangabad	12	Son

4	Bihar	35	Gaya	11	Maghad
4	Bihar	36	Nawada	11	Maghad
4	Bihar	37	Jamui Sikkim	16	Ang Region
5	Chhattisgarh	1	Koriya	18	Mahakaushal
5	Chhattisgarh	2	Surguja	18	Mahakaushal
5	Chhattisgarh	3	Jashpur	18	Mahakaushal
5	Chhattisgarh	4	Raigarh	18	Mahakaushal
5	Chhattisgarh	5	Korba	18	Mahakaushal
5	Chhattisgarh	6	Janjgir-Champa	18	Mahakaushal
5	Chhattisgarh	7	Bilaspur	18	Mahakaushal
5	Chhattisgarh	8	Kawardha	18	Mahakaushal
5	Chhattisgarh	9	Bajnandgaon	18	Mahakaushal
5	Chhattisgarh	10	Durg	18	Mahakaushal
5	Chhattisgarh	11	Raipur	18	Mahakaushal
5	Chhattisgarh	12	Mahasamund	18	Mahakaushal
5	Chhattisgarh	13	Dhamtari	18	Mahakaushal
5	Chhattisgarh	14	Kanker	18	Mahakaushal
5	Chhattisgarh	15	Bastar	17	Dhandakranya
5	Chhattisgarh	16	Dantewada	17	Dhandakranya
6	Goa	1	North Goa	21	Coastal, Hilly and Plateau
6	Goa	2	South Goa	21	Coastal, Hilly and Plateau
6	Assam	19	Karbi Anglong	7	Aahom
7	Gujarat	1	Kachchh	23	Kachha ka Ran
7	Gujarat	2	Banas Kantha	24	North Gujarat
7	Gujarat	3	Patan	24	North Gujarat
7	Gujarat	4	Mahesana	24	North Gujarat
7	Gujarat	5	Sabar Kantha	24	North Gujarat
7	Gujarat	6	Gandhinagar	24	North Gujarat
7	Gujarat	7	Ahmadabad	26	Central Gujarat
7	Gujarat	8	Surendranagar	25	Saurashtra
7	Gujarat	9	Rajkot	25	Saurashtra
7	Gujarat	10	Jamnagar	25	Saurashtra
7	Gujarat	11	Porbandar	25	Saurashtra
7	Gujarat	12	Junagadh	25	Saurashtra
7	Gujarat	13	Amreli	25	Saurashtra
7	Gujarat	14	Bhavnagar	25	Saurashtra
7	Gujarat	15	Anand	26	Central Gujarat

7	Gujarat	16	Kheda	26	Central Gujarat
7	Gujarat	17	Panch Mahals	26	Central Gujarat
7	Gujarat	18	Dohad	26	Central Gujarat
7	Gujarat	19	Vadodara	26	Central Gujarat
7	Gujarat	20	Narmada	22	South Gujarat
7	Gujarat	21	Bharuch	22	South Gujarat
7	Gujarat	22	Surat	22	South Gujarat
7	Gujarat	23	The Dangs	22	South Gujarat
7	Gujarat	24	Navsari	22	South Gujarat
7	Gujarat	25	Valsad	22	South Gujarat
8	Haryana	1	Panchkula	30	Shivalik
8	Haryana	2	Ambala	30	Shivalik
8	Haryana	3	Yamunanagar	30	Shivalik
8	Haryana	4	Kurukshetra	30	Shivalik
8	Haryana	5	Kaithal	27	Yamuna Vihar
8	Haryana	6	Karnal	27	Yamuna Vihar
8	Haryana	7	Panjpat	27	Yamuna Vihar
8	Haryana	8	Soripat	27	Yamuna Vihar
8	Haryana	9	Und	27	Yamuna Vihar
8	Haryana	10	Fatehabad	28	Jatwal
8	Haryana	11	Sisa	28	Jatwal
8	Haryana	12	Hisar	28	Jatwal
8	Haryana	13	Bhiwani	28	Jatwal
8	Haryana	14	Rohtak	28	Jatwal
8	Haryana	15	Jhajjar	28	Jatwal
8	Haryana	16	Mahendragarh	29	Aahirwal
8	Haryana	17	Rewari	29	Aahirwal
8	Haryana	18	Gurgaon	29	Aahirwal
8	Haryana	19	Faridabad	29	Aahirwal
9	Himachal Pradesh	1	Chamba	31	Cold Desert (Trans Himalayan Range)
9	Himachal Pradesh	2	Kangra	30	Kangada
9	Himachal Pradesh	3	Lahul and Spiti	31	Cold Desert
9	Himachal Pradesh	4	Kullu	31	Cold Desert
9	Himachal Pradesh	5	Mandi	32	Himalaya Range (Dholadhar)
9	Himachal Pradesh	6	Hamirpur	30	Kangada
9	Himachal Pradesh	7	Una	30	Kangada

9	Himachal Pradesh	8	Bitaspur	30	Kangada
9	Himachal Pradesh	9	Sohn	30	Kangada
9	Himachal Pradesh	10	Sirmaur	30	Kangada
9	Himachal Pradesh	11	Sidnla	32	Himalaya Range (Mahasu)
9	Himachal Pradesh	12	Kinnaur	31	Cold Desert
10	Jammu and Kashmir	1	Kupwara	31	Cold Desert
10	Jammu and Kashmir	2	Baramula	31	Cold Desert
10	Jammu and Kashmir	3	Srinagar	33	Kashmir Ghati
10	Jammu and Kashmir	4	Badgam	33	Kashmir Ghati
10	Jammu and Kashmir	5	Pulwama	33	Kashmir Ghati
10	Jammu and Kashmir	6	Anantnag	33	Kashmir Ghati
10	Jammu and Kashmir	7	Leh(Ladakh)	31	Cold Desert (Leh - Laddakh)
10	Jammu and Kashmir	8	Kargil	31	Cold Desert (Leh - Laddakh)
10	Jammu and Kashmir	9	Doda	31	Cold Desert
10	Jammu and Kashmir	10	Udhampur	34	Shivalik
10	Jammu and Kashmir	11	Punch	34	Shivalik
10	Jammu and Kashmir	12	Rajauri	34	Shivalik
10	Jammu and Kashmir	13	Jammu	34	Shivalik
10	Jammu and Kashmir	14	Kathua	34	Shivalik
11	Jharkhand	1	Garhwa	36	Koylanchal
11	Jharkhand	2	Palamu	36	Koylanchal
11	Jharkhand	3	Chatra	36	Koylanchal
11	Jharkhand	4	Hazaribag	36	Koylanchal
11	Jharkhand	5	Kodarma	36	Koylanchal
11	Jharkhand	6	Giridih	36	Koylanchal
11	Jharkhand	7	Deoghar	35	Santhala Pargana
11	Jharkhand	8	Godda	35	Santhala Pargana
11	Jharkhand	9	Sahibganj	35	Santhala Pargana
11	Jharkhand	10	Pakaur	35	Santhala Pargana
11	Jharkhand	11	Dumka	35	Santhala Pargana
11	Jharkhand	12	Dhanbad	36	Koylanchal
11	Jharkhand	13	Bokaro	36	Koylanchal
11	Jharkhand	14	Ranchi	36	Koylanchal
11	Jharkhand	15	Lohardaga	36	Koylanchal
11	Jharkhand	16	Gumla	36	Koylanchal
11	Jharkhand	17	Pashchimi Singhbhum	36	Koylanchal
11	Jharkhand	18	Purbi Singhbum	36	Koylanchal

12	Karnataka	1	Belgaum	39	North East Karnataka
12	Karnataka	2	Bagalkot	39	North East Karnataka
12	Karnataka	3	Bijapur	39	North East Karnataka
12	Karnataka	4	Gulbarga	39	North East Karnataka
12	Karnataka	5	Bidar	39	North East Karnataka
12	Karnataka	6	Raichur	39	North East Karnataka
12	Karnataka	7	Koppal	39	North East Karnataka
12	Karnataka	8	Gadag	39	North East Karnataka
12	Karnataka	9	Dharwad	39	North East Karnataka
12	Karnataka	10	Uttara Kannada	38	Coastal Karnataka/ Malayanad
12	Karnataka	11	Haveri	39	North East Karnataka
12	Karnataka	12	Bellary	39	North East Karnataka
12	Karnataka	13	Chitradurga	39	North East Karnataka
12	Karnataka	14	Davanagere	39	North East Karnataka
12	Karnataka	15	Shimoga	39	North East Karnataka
12	Karnataka	16	Udupi	38	Coastal Karnataka/ Malayanad
12	Karnataka	17	Chikmagalu	40	Pahadi Pathari
12	Karnataka	18	Tumkur	40	Pahadi Pathari
12	Karnataka	19	Kolar	37	Central Karnataka
12	Karnataka	20	Bangalore	37	Central Karnataka
12	Karnataka	21	Bangalore Rural	37	Central Karnataka
12	Karnataka	22	Mandya	37	Central Karnataka
12	Karnataka	23	Hassan	40	Pahadi Pathari
12	Karnataka	24	Dakshina Kannada	38	Coastal Karnataka
12	Karnataka	25	Kodagu	40	Pahadi Pathari
12	Karnataka	26	Mysore	37	Central Karnataka
12	Karnataka	27	Chamarajnagar	37	Central Karnataka
13	Kerala	1	Kasaragod	42	Coastal Kerala
13	Kerala	2	Kannur	42	Coastal Kerala
13	Kerala	3	Wayanad	42	Coastal Kerala
13	Kerala	4	Kozhikod	42	Coastal Kerala
13	Kerala	5	Malappuran	42	Coastal Kerala
13	Kerala	6	Palakkad	43	Hilly & Plateau Kerala
13	Kerala	7	Thrissur	42	Coastal Kerala
13	Kerala	8	Ernakulam	42	Coastal Kerala
13	Kerala	9	Idukki	43	Hilly & Plateau Kerala
13	Kerala	10	Kottayan	42	Coastal Kerala

13	Kerala	11	Alappuzha	42	Coastal Kerala
13	Kerala	12	Pathanamthitta	43	Hilly & Plateau Kerala
13	Kerala	13	Kollam	42	Coastal Kerala
13	Kerala	14	Thiruvananthapuram	42	Coastal Kerala
14	Madhya Pradesh	1	Sheopur	46	Bundelkhand - Chambal
14	Madhya Pradesh	2	Morena	46	Bundelkhand - Chambal
14	Madhya Pradesh	3	Bhind	46	Bundelkhand - Chambal
14	Madhya Pradesh	4	Gwalior	46	Bundelkhand - Chambal
14	Madhya Pradesh	5	Datia	46	Bundelkhand - Chambal
14	Madhya Pradesh	6	Shivpuri	46	Bundelkhand
14	Madhya Pradesh	7	Guna	46	Bundelkhand
14	Madhya Pradesh	8	Tikamgarh	46	Bundelkhand
14	Madhya Pradesh	9	Chhatarpur	46	Bundelkhand
14	Madhya Pradesh	10	Panna	47	Madhya Bharat Region
14	Madhya Pradesh	11	Sagar	47	Bundelkhand
14	Madhya Pradesh	12	Damoh	47	Bundelkhand
14	Madhya Pradesh	13	Satna	44	Baghelkhand
14	Madhya Pradesh	14	Rewa	44	Baghelkhand
14	Madhya Pradesh	15	Umaria	44	Baghelkhand
14	Madhya Pradesh	16	Sadole	44	Baghelkhand
14	Madhya Pradesh	17	Sidhi	44	Baghelkhand
14	Madhya Pradesh	18	Neemuch	49	Malva Region
14	Madhya Pradesh	19	Mandsaur	49	Malva Region
14	Madhya Pradesh	20	Ratlam	49	Malva Region
14	Madhya Pradesh	21	Ujjain	49	Malva Region
14	Madhya Pradesh	22	Shajapur	49	Malva Region
14	Madhya Pradesh	23	Dewas	49	Malva Region
14	Madhya Pradesh	24	Jhabua	49	Malva Region
14	Madhya Pradesh	25	Dhar	49	Malva Region
14	Madhya Pradesh	26	Indore	49	Malva Region
14	Madhya Pradesh	27	West Nimar	45	Nimad Region
14	Madhya Pradesh	28	Barwani	45	Nimad Region
14	Madhya Pradesh	29	East Nimar	45	Nimad Region
14	Madhya Pradesh	30	Rajgarh	46	Bundelkhand
14	Madhya Pradesh	31	Vidisha	47	Madhya Bharat Region
14	Madhya Pradesh	32	Bhopal	47	Madhya Bharat Region
14	Madhya Pradesh	33	Sehore	47	Madhya Bharat Region

14	Madhya Pradesh	34	Eaiseri	47	Madhya Bharat Region
14	Madhya Pradesh	35	Betul	48	Satpuda - Narmada Region
14	Madhya Pradesh	36	Harda	48	Satpuda - Narmada Region
14	Madhya Pradesh	37	Hoshangabad	48	Satpuda - Narmada Region
14	Madhya Pradesh	38	Katni	47	Madhya Bharat Region
14	Madhya Pradesh	39	Jabalpur	18	Mahakaushal
14	Madhya Pradesh	40	Narsimhapur	48	Satpuda - Narmada Region
14	Madhya Pradesh	41	Dindori	18	Mahakaushal
14	Madhya Pradesh	42	Mandla	18	Mahakaushal
14	Madhya Pradesh	43	Chhindwara	48	Satpuda - Narmada Region
14	Madhya Pradesh	44	Seoni	18	Mahakaushal
14	Madhya Pradesh	45	Balaghat	18	Mahakaushal
15	Maharashtra	1	Nandurbar	53	Khan Desh
15	Maharashtra	2	Dhule	53	Khan Desh
15	Maharashtra	3	Jalgaon	53	Khan Desh
15	Maharashtra	4	Buldana	50	Vidharbha Region
15	Maharashtra	5	Akola	50	Vidharbha Region
15	Maharashtra	6	Washim	50	Vidharbha Region
15	Maharashtra	7	Amravati	50	Vidharbha Region
15	Maharashtra	8	Wardha	50	Vidharbha Region
15	Maharashtra	9	Nagpur	50	Vidharbha Region
15	Maharashtra	10	Bhandara	50	Vidharbha Region
15	Maharashtra	11	Gondiya	50	Vidharbha Region
15	Maharashtra	12	Gadchiroli	50	Vidharbha Region
15	Maharashtra	13	Chandrapur	50	Vidharbha Region
15	Maharashtra	14	Yavatmal	50	Vidharbha Region
15	Maharashtra	15	Nanded	52	Marathwada
15	Maharashtra	16	Hingoli	52	Marathwada
15	Maharashtra	17	Parbhani	52	Marathwada
15	Maharashtra	18	Jalna	52	Marathwada
15	Maharashtra	19	Aurangabad	52	Marathwada
15	Maharashtra	20	Nashik	53	Khan Desh
15	Maharashtra	21	Thane	54	Coastal Region
15	Maharashtra	22	Mumbai (Suburban)	54	Coastal Region
15	Maharashtra	23	Mumbai	54	Coastal Region
15	Maharashtra	24	Raigarh	54	Coastal Region
15	Maharashtra	25	Pune	51	Central Region

15	Maharashtra	26	Ahmadnagar	51	Central Region
15	Maharashtra	27	Bid	52	Marathwada
15	Maharashtra	28	Latur	52	Marathwada
15	Maharashtra	29	Osmanabad	52	Marathwada
15	Maharashtra	30	Solapur	52	Marathwada
15	Maharashtra	31	Satara	52	Marathwada
15	Maharashtra	32	Ratnagiri	54	Coastal Region
15	Maharashtra	33	Sindhudurg	52	Marathwada
15	Maharashtra	34	Kolhapur	52	Marathwada
15	Maharashtra	35	Sangli	52	Marathwada
16	Manipur	1	Sonapati	55	Madu Tai Region
16	Manipur	2	Tamenglong	55	Madu Tai Region
16	Manipur	3	Charachandpur	55	Madu Tai Region
16	Manipur	4	Bishnupur	55	Madu Tai Region
16	Manipur	5	Thoubal	55	Madu Tai Region
16	Manipur	6	Imphal West	55	Madu Tai Region
16	Manipur	7	Imphal East	55	Madu Tai Region
16	Manipur	8	Ukhrul	55	Madu Tai Region
16	Manipur	9	Chandel	55	Madu Tai Region
17	Meghalaya	1	West Garo Hills	57	Goro Land
17	Meghalaya	2	East Garo Hills	57	Goro Land
17	Meghalaya	3	South Garo Hills	57	Goro Land
17	Meghalaya	4	West Khasi Hills	56	Khasi Land
17	Meghalaya	5	Bi Bhoi	56	Khasi Land
17	Meghalaya	6	East Khasi Hills	56	Khasi Land
18	Mizoram	1	Mamit	58	Mizoram
18	Mizoram	2	Kolasib	58	Mizoram
18	Mizoram	3	Aizawl	58	Mizoram
18	Mizoram	4	Champhai	58	Mizoram
18	Mizoram	5	Serchhip	58	Mizoram
18	Mizoram	6	Lunglei	58	Mizoram
18	Meghalaya	7	Lawngtlai	56	Mizoram
18	Mizoram	7	Jaintia Hills	58	Khasi Land
18	Mizoram	8	Saiha	58	Mizoram
19	Nagaland	1	Mon	59	Nagaland
19	Nagaland	2	Tuensang	59	Nagaland
19	Nagaland	3	Mokokochung	59	Nagaland

19	Nagaland	4	Zunheboto	59	Nagaland
19	Nagaland	5	Wokha	59	Nagaland
19	Nagaland	6	Dimapur	59	Nagaland
19	Nagaland	7	Kohima	59	Nagaland
19	Nagaland	8	Phek	59	Nagaland
20	Orissa	1	Bargarh	64	North Region
20	Orissa	2	Jharsuguda	64	North Region
20	Orissa	3	Sambalpur	64	North Region
20	Orissa	4	Debagarh	64	North Region
20	Orissa	5	Sundargarh	64	North Region
20	Orissa	6	Kendujhar	64	North Region
20	Orissa	7	Mayurbhanj	64	North Region
20	Orissa	8	Baleshwar	65	Coastal Dandiya
20	Orissa	9	Bhadrak	65	Coastal Dandiya
20	Orissa	10	Kendrapara	65	Coastal Dandiya
20	Orissa	11	Jagatsinghapur	65	Coastal Dandiya
20	Orissa	12	Cuttack	65	Coastal Dandiya
20	Orissa	13	Jajapur	62	Parimi Dadiya Region
20	Orissa	14	Dhenkanal	62	Parimi Dadiya Region
20	Orissa	15	Anugui	62	Parimi Dadiya Region
20	Orissa	16	Nayagarh	62	Parimi Dadiya Region
20	Orissa	17	Khordha	65	Coastal Dandiya
20	Orissa	18	Puri	65	Coastal Dandiya
20	Orissa	19	Ganjam	65	Coastal Dandiya
20	Orissa	20	Gajapati	63	south Region
20	Orissa	21	Kandhamal	62	Parimi Dadiya Region
20	Orissa	22	Baudh	62	Parimi Dadiya Region
20	Orissa	23	Sonapur	62	Parimi Dadiya Region
20	Orissa	24	Balangir	62	Parimi Dadiya Region
20	Orissa	25	Nuapada	62	Parimi Dadiya Region
20	Orissa	26	Kalahandi	63	south Region
20	Orissa	27	Rayagada	63	south Region
20	Orissa	28	Nabarangapur	63	south Region
20	Orissa	29	Koraput	63	south Region
20	Orissa	30	Malkangiri	63	south Region
21	Punjab	1	Godaspur	30	Shivalik
21	Punjab	2	Amritsar	86	Majha Region

21	Punjab	3	Kapurthala	66	Doaba Region
21	Punjab	4	Jalandhar	66	Doaba Region
21	Punjab	5	Hoshiarpur	66	Doaba Region
21	Punjab	6	Nawanshahar	66	Doaba Region
21	Punjab	7	Rupnagar	68	Puad Region
21	Punjab	8	Fatehgarh Sahib	68	Puad Region
21	Punjab	9	Ludhiana	67	Malva Region
21	Punjab	10	Moga	67	Malva Region
21	Punjab	11	Firozpur	67	Malva Region
21	Punjab	12	Muktsar	67	Malva Region
21	Punjab	13	Faridkot	67	Malva Region
21	Punjab	14	Bathinda	67	Malva Region
21	Punjab	15	Mansa	67	Malva Region
21	Punjab	16	Sangrur	67	Malva Region
21	Punjab	17	Patiala	68	Puad Region
22	Rajasthan	1	Ganganagar	69	Thar Region
22	Rajasthan	2	Hanumangarh	69	Thar Region
22	Rajasthan	3	Bikaner	69	Thar Region
22	Rajasthan	4	Churu	73	Shekhawati Region
22	Rajasthan	5	Jhunjhunun	73	Shekhawati Region
22	Rajasthan	6	Alwar	71	Dundhad Region
22	Rajasthan	7	Bharatpur	19	Dundhad Region
22	Rajasthan	8	Dhaulpur	19	Dundhad Region
22	Rajasthan	9	Kaurali	71	Dundhad Region
22	Rajasthan	10	Sawai Madhopur	71	Dundhad Region
22	Rajasthan	11	Dausa	71	Dundhad Region
22	Rajasthan	12	Jaipur	71	Dundhad Region
22	Rajasthan	13	Sikar	73	Shekhawati Region
22	Rajasthan	14	Nagaur	74	Marwar Region
22	Rajasthan	15	Jodhpur	74	Marwar Region
22	Rajasthan	16	Jaisalmer	74	Marwar Region
22	Rajasthan	17	Barmer	74	Marwar Region
22	Rajasthan	18	Jalor	74	Marwar Region
22	Rajasthan	19	Sirohi	74	Marwar Region
22	Rajasthan	20	Pali	74	Marwar Region
22	Rajasthan	21	Ajmer	71	Dundhad Region
22	Rajasthan	22	Tonk	71	Dundhad Region

22	Rajasthan	23	Bundi	72	Hadoti Region
22	Rajasthan	24	Bhilwara	70	Mewar Region
22	Rajasthan	25	Rajsamand	70	Mewar Region
22	Rajasthan	26	Udaipur	70	Mewar Region
22	Rajasthan	27	Dungarpur	70	Mewar Region
22	Rajasthan	28	Banswara	70	Mewar Region
22	Rajasthan	29	Chittaurgarh	70	Mewar Region
22	Rajasthan	30	Kota	72	Hadoti Region
22	Rajasthan	31	Baran	72	Hadoti Region
22	Rajasthan	32	Jhalawar	72	Hadoti Region
23	Sikkim	1	North Sikkim	75	Sikkim
23	Sikkim	2	West Sikkim	75	Sikkim
23	Sikkim	3	South Sikkim	75	Sikkim
23	Sikkim	4	East Sikkim	75	Sikkim
24	Tamil Nadu	1	Thiruvallur	76	Coastal Region
24	Tamil Nadu	2	Cheenai	76	Coastal Region
24	Tamil Nadu	3	Kancheepuram	76	Coastal Region
24	Tamil Nadu	4	Vellore	77	South Hilly & Plateau Region
24	Tamil Nadu	5	Dharmapuri	77	South Hilly & Plateau Region
24	Tamil Nadu	6	Tiruvanamalai	77	South Hilly & Plateau Region
24	Tamil Nadu	7	Viluppuram	76	Coastal Region
24	Tamil Nadu	8	Salem	77	South Hilly & Plateau Region
24	Tamil Nadu	9	Namakkal	77	South Hilly & Plateau Region
24	Tamil Nadu	10	Erose	77	South Hilly & Plateau Region
24	Tamil Nadu	11	The Nilgiris	77	South Hilly & Plateau Region
24	Tamil Nadu	12	Coimbatore	77	South Hilly & Plateau Region
24	Tamil Nadu	13	Dindigul	77	South Hilly & Plateau Region
24	Tamil Nadu	14	Karur	77	South Hilly & Plateau Region
24	Tamil Nadu	15	Tiruchirappalli	77	South Hilly & Plateau Region
24	Tamil Nadu	16	Perambalur	77	South Hilly & Plateau Region
24	Tamil Nadu	17	Ariyalur	77	South Hilly & Plateau Region
24	Tamil Nadu	18	Cuddalore	76	Coastal Region
24	Tamil Nadu	19	Nagapattinam	76	Coastal Region
24	Tamil Nadu	20	Thiruvarur	76	Coastal Region
24	Tamil Nadu	21	Thanjavur	76	Coastal Region
24	Tamil Nadu	22	Pudukkottai	76	Coastal Region
24	Tamil Nadu	23	Sivaganga	77	South Hilly & Plateau Region

24	Tamil Nadu	24	Madurai	77	South Hilly & Plateau Region
24	Tamil Nadu	25	Theni	77	South Hilly & Plateau Region
24	Tamil Nadu	26	Virudhunagar	77	South Hilly & Plateau Region
24	Tamil Nadu	27	Ramnathpuram	76	Coastal Region
24	Tamil Nadu	28	Toothukudi	76	Coastal Region
24	Tamil Nadu	29	Tirunelveli	76	Coastal Region
24	Tamil Nadu	30	Kanniyakumari	76	Coastal Region
25	Tripura	1	West Tripura	78	Tripura
25	Tripura	2	South Tripura	78	Tripura
25	Tripura	3	Dhalai	78	Tripura
25	Tripura	4	North Tripura	78	Tripura
26	Uttar Pradesh	1	Saharanpur	81	Tarai Region
26	Uttar Pradesh	2	Muzaffarnagar	81	Tarai Region
26	Uttar Pradesh	3	Bijnor	81	Tarai Region
26	Uttar Pradesh	4	Moradabad	81	Tarai Region
26	Uttar Pradesh	5	Rampur	81	Tarai Region
26	Uttar Pradesh	6	Jyotiba Phule Nagar	41	Doab Region
26	Uttar Pradesh	7	Meerut	41	Doab Region
26	Uttar Pradesh	8	Baghpat	41	Doab Region
26	Uttar Pradesh	9	Ghaziabad	41	Doab Region
26	Uttar Pradesh	10	Gautam Budaha Nagar	41	Doab Region
26	Uttar Pradesh	11	Bulandshahar	41	Doab Region
26	Uttar Pradesh	12	Aligarh	41	Doab Region
26	Uttar Pradesh	13	Hathras	19	Biruj
26	Uttar Pradesh	14	Mathura	19	Biruj
26	Uttar Pradesh	15	Agra	19	Biruj
26	Uttar Pradesh	16	Firozabad	79	Purvanchal & Vindhayancha
26	Uttar Pradesh	17	Etah	79	Purvanchal & Vindhayancha
26	Uttar Pradesh	18	Mainpuri	79	Purvanchal & Vindhayancha
26	Uttar Pradesh	19	Budaun	79	Purvanchal & Vindhayancha
26	Uttar Pradesh	20	Bareilly	81	Tarai Region
26	Uttar Pradesh	21	Pilibhit	81	Tarai Region
26	Uttar Pradesh	22	Shahjahanpur	79	Purvanchal & Vindhayancha
26	Uttar Pradesh	23	Kheri	81	Tarai Region
26	Uttar Pradesh	24	Sitapur	79	Purvanchal & Vindhayancha
26	Uttar Pradesh	25	Hardoi	79	Purvanchal & Vindhayancha
26	Uttar Pradesh	26	Unnao	79	Purvanchal & Vindhayancha

26	Uttar Pradesh	27	Lucknow	79	Purvanchal & Vindhayancha
26	Uttar Pradesh	28	Flae Barsli	79	Purvanchal & Vindhayancha
26	Uttar Pradesh	29	Farrukhabad	79	Purvanchal & Vindhayancha
26	Uttar Pradesh	30	Kannauj	79	Purvanchal & Vindhayancha
26	Uttar Pradesh	31	Etawah	79	Purvanchal & Vindhayancha
26	Uttar Pradesh	32	Auraiya	79	Purvanchal & Vindhayancha
26	Uttar Pradesh	33	Kanpur Dehat	79	Purvanchal & Vindhayancha
26	Uttar Pradesh	34	Kanpur Nagar	79	Purvanchal & Vindhayancha
26	Uttar Pradesh	35	Jalavn	46	Bundelkhand
26	Uttar Pradesh	36	Jhansi	46	Bundelkhand
26	Uttar Pradesh	37	Lalitpur	46	Bundelkhand
26	Uttar Pradesh	38	Hamirpur	46	Bundelkhand
26	Uttar Pradesh	39	Mahoba	46	Bundelkhand
26	Uttar Pradesh	40	Banda	46	Bundelkhand
26	Uttar Pradesh	41	Chitrakoot	46	Bundelkhand
26	Uttar Pradesh	42	Fatehpur	79	Purvanchal & Vindhayancha
26	Uttar Pradesh	43	Pratapgarh	79	Purvanchal & Vindhayancha
26	Uttar Pradesh	44	Kaushambi	79	Purvanchal & Vindhayancha
26	Uttar Pradesh	45	Allahabad	79	Purvanchal & Vindhayancha
26	Uttar Pradesh	46	Barabanki	79	Purvanchal & Vindhayancha
26	Uttar Pradesh	47	Faizabad	79	Purvanchal & Vindhayancha
26	Uttar Pradesh	48	Ambedkar nagar	79	Purvanchal & Vindhayancha
26	Uttar Pradesh	49	Sultanpur	79	Purvanchal & Vindhayancha
26	Uttar Pradesh	50	Bahraich	81	Tarai Region
26	Uttar Pradesh	51	Shrawasti	81	Tarai Region
26	Uttar Pradesh	52	Balrampur	81	Tarai Region
26	Uttar Pradesh	53	Siddhrthnagar	79	Purvanchal & Vindhayancha
26	Uttar Pradesh	54	Siddharthnagar	81	Tarai Region
26	Uttar Pradesh	55	Basti	79	Purvanchal & Vindhayancha
26	Uttar Pradesh	56	Sant Kabir Nagar	79	Purvanchal & Vindhayancha
26	Uttar Pradesh	57	Maharajganj	81	Tarai Region
26	Uttar Pradesh	58	Gorakhpur	79	Purvanchal & Vindhayancha
26	Uttar Pradesh	59	Kushinagar	79	Purvanchal & Vindhayancha
26	Uttar Pradesh	60	Deoria	79	Purvanchal & Vindhayancha
26	Uttar Pradesh	61	Azamgarh	79	Purvanchal & Vindhayancha
26	Uttar Pradesh	62	Mad	79	Purvanchal & Vindhayancha
26	Uttar Pradesh	63	Ballia	79	Purvanchal & Vindhayancha

26	Uttar Pradesh	64	Jaunpur	79	Purvanchal & Vindhayancha
26	Uttar Pradesh	65	Ghazipur	79	Purvanchal & Vindhayancha
26	Uttar Pradesh	66	Chandauli	79	Purvanchal & Vindhayancha
26	Uttar Pradesh	67	Varanasi	79	Purvanchal & Vindhayancha
26	Uttar Pradesh	68	Sant Ravidas nagar	79	Purvanchal & Vindhayancha
26	Uttar Pradesh	69	Mirzapur	79	Purvanchal & Vindhayancha
26	Uttar Pradesh	70	Sonbhadra	79	Purvanchal & Vindhayancha
27	Uttaranchal	1	Uttarkshi	80	Gadwal Region
27	Uttaranchal	2	Chamoli	80	Gadwal Region
27	Uttaranchal	3	Rudraprayag	80	Gadwal Region
27	Uttaranchal	4	Tehti Garhwal	80	Gadwal Region
27	Uttaranchal	5	Dhtandun	80	Gadwal Region
27	Uttaranchal	6	Garhwal	80	Gadwal Region
27	Uttaranchal	7	Pithoragarh	82	Kumayon
27	Uttaranchal	8	Bageshwar	82	Kumayon
27	Uttaranchal	9	Almora	82	Kumayon
27	Uttaranchal	10	Champawat	82	Kumayon
27	Uttaranchal	11	Nainthal	82	Kumayon
27	Uttaranchal	12	Udham singh Nagar	81	Tarai Region
27	Uttaranchal	13	Hardwar	81	Tarai Region
28	West Bengal	1	Darjiling	85	Koch Hilly Region
28	West Bengal	2	Jalpaiguri	85	Tarai & Flat Region
28	West Bengal	3	Koch Bihar	85	Tista River Basin Flat Agricultural Land
28	West Bengal	4	Uttear Dinajpur	85	Tista River Basin Flat Agricultural Land
28	West Bengal	5	Dakshin Dinajpur	85	Tista River Basin Flat Agricultural Land
28	West Bengal	6	Maldah	85	Kunch Bihar Flat Region
28	West Bengal	7	Murshibad	85	Flat Region Ganga
28	West Bengal	8	Birbhum	85	Flat Region Forest
28	West Bengal	9	Barddhaman	85	Kunch Bihar Flat Region
28	West Bengal	10	Nadla	85	Flat Region Ganga
28	West Bengal	11	North Twenty Four Pargana	85	Flat Region Lower Ganga
28	West Bengal	12	Hugli	85	Flat Region Lower Damodar, Agricultural
28	West Bengal	13	Bankura	83	Pateau Region
28	West Bengal	14	Puruliya	83	Pateau Region
28	West Bengal	15	Medinipur	83	Pateau Region
28	West Bengal	16	Haora	84	Sea Delta Region
28	West Bengal	17	Kolkata	84	Sea Delta Region
28	West Bengal	18	SouthTwenty Four Pargana	84	Sea Delta Region
29	Chandigarh	1	Chandigarh	66	Doaba Region

30	Delhi	1	North West	60	Indraprastha
30	Delhi	2	North	60	Indraprastha
30	Delhi	3	North East	60	Indraprastha
30	Delhi	4	East	61	Khandavprastha
30	Delhi	5	New Delhi	61	Khandavprastha
30	Delhi	6	Central	60	Indraprastha
30	Delhi	7	West	61	Khandavprastha
30	Delhi	8	South West	61	Khandavprastha
30	Delhi	9	South	61	Khandavprastha
31	Daman and Diu	1	Diu	25	Saurashtra
31	Daman and Diu	2	Daman	22	South Gujarat
32	Dadra and Nagar Ha	1	Dadra and Nagar Haveli	22	South Gujarat
33	Lakshadweep	1	Lakshadweep	10	Lakshadweep Region
34	Andaman and Nicoba	1	Andamans	20	Andaman and Nicobar Region
34	Andaman and Nicoba	2	Nicobars	20	Andaman and Nicobar Region
35	Pondicherry	1	Pondicherry	2	Kaling Coastal & Delta Krishna-Godawari
35	Pondicherry	2	Karaikal	76	Coastal Region
35	Pondicherry	3	Mahe	42	Coastal Kerala
35	Pondicherry	4	Yanam	76	Coastal Region

- Drinking water programmes must be connected to issues of sustainability of resource
- Drinking water programmes have to be connected to programmes of land-water management
- Drinking water programmes not about ownership of handpump or pipe. But about ownership of land-water surrounding village.
- All drinking water programmes must include rainwater harvesting and recharge component. This must be mandatory.
- All these schemes must look at the catchment of the water – recharge is only possible if catchment is protected – from roof to hill
- Develop the aquifers with recharge strategy
- Upgrade and develop wells as the main source of drawal and protect it by regulating drawal in adjoining connected wells.
- Rejuvenate the traditional talabs, Johads, Junds, etc., if possible separate for livestock and human use.
- Use of solar energy for pumping water instead of diesel pumps (making the cast of pumping viable for the village community, ensuring their ownership and control, and taking case of uncertain electricity supply in villages)

Changing the mindset

- Changing the mind-set: Communities believe that water is the sole responsibility of the state; State believes that water from local sources cannot meet the growing need, and only centralized systems can fulfill this; NGOs more comfortable in the role of implementers rather than socio-technical facilitators.

- Since water from centralized sources are so heavily subsidized, there is a disincentive to develop, self-manage, and govern their domestic water sources/needs
- Doubts on the reliable availability of water through local sources in arid areas; then doubts on its replicability; then doubts on its upscaling potential
- Developing a methodology and system for integrating traditional wisdom/knowledge with advanced technical and scientific expertise/knowledge; for learning and delearning.
- Developing a sustaining solution by taking the existing and projected needs as a given – not the entire catchment as the base premise
- Using the guideline as a GUIDELINE; not as a rule book for context specific, varied micro conditions.
- Undertaking detailed decentralized geo-hydrological planning with Gram Panchayats – considering water budgeting,traditional sources, salinity patterns, overall water quality, and potential technological alternatives – at the village level, cluster of villages, block, and district.
- Setting up a 'college' of rural youth as para water engineers who can motivate, and facilitate basic planning, implementation, and management of the developed drinking water source at the village level.
- Foster multi-stakeholder partnership based on known strengths – State, Coordinating Agency, Technical Resource Group, Handholding organisations, and implementing bodies (Gram Panchayats, and Pani Samitis)
- Gram panchayats: Governance of implementation, management and protection of their water resources.
- Protection of aquifers from competing users – especially industries and agriculturists.

- Demarcation of acquifers within the village
- Protective legal frameworks for Gram Panchayats especially
- Not adequately recognizing the growing pace of urbanization of rural areas which increases the stress on centrally managed drinking water supply schemes. (And therefore the need to develop local sources as the primary source, and centrally managed schemes as the back –up support system).
- Urgent need to introduce a pricing policy which loads the incentive towards use of local source as primary source
- Construction of resource well
- Construction of mini percolation tank to recharge the resource well
- Subsurface barrier to arrest out flow from the aquifer
- Pipe line to supply water to the village through gravity

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