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AN INITIATIVE BY VETRII IAS

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KURUKSHETRA

JUNE - 2019

044-26265326 / 98400 97666 / 96001 24042

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ENSURING SAFE AND ADEQUATE DRINKING WATER:

- The Constitution of India with **Article 47** confers the duty of providing clean drinking and improving public health standards to the State.
- United Nations Conference on Environment and Development has rightly themed this year's Water Day as "**leaving no one behind**".
- The Sustainable Development Goals 2015-2030, a successor to Millennium Development Goals, include Goal 6 for clean water and sanitation for ensuring their availability and sustainable management.
- According to global reports released by UN, 2.1 billion people live without safe drinking water at home and 80% of those who drink unsafe water are from rural area.
- 700 children from rural area die due to diarrhoea and drinking unsafe water.
- Nearly 2/3 of the population face severe water crisis, for at least 31 days per year.

Water Availability in Rural Areas:

- India is among world's most water- stressed countries. India had 3000-4000 cubic meters of water per person and this has fallen to 1000 cubic meters today.

Reasons:

1. Increasing population
2. Water resources are unevenly distributed
3. India's annual precipitation falls in just 15 rain-soaked days making floods and droughts a fact of life in the country.

- The National Sample Survey Office states that 88.5% of the households in rural India had improved source of drinking water and among these 85.8% have sufficient drinking water.
- And 46.1% of the rural household do not have access to safe drinking water.

Government Initiatives:

- **Bhore Committee** in 1946: It was a health survey taken by a development committee to assess health condition of India. The committee consisted of pioneers in the healthcare field who met frequently for two years and submitted their report in 1946.

Accelerated Rural Water Supply Programme

- The Accelerated Rural Water Supply Programme (ARWSP): The Accelerated Rural Water Supply Programme (ARWSP) was introduced in 1972-73 by the Government of India to assist the States and Union Territories (UTs) to accelerate the pace of coverage of drinking water supply.

- **Swajal Dhara' Scheme** (1999) by Empowering and involving local communities in tackling water and sanitation issues.
- In 1981 GOI launched **International Water Supply and Sanitation Decade programme** targeted to cover 100% of the rural and urban population, to provide them with drinking water supply facilities.
- **Bharat Nirman** is a branded programme launched by the Government of India in 2005. It is now 8 years old, taking huge strides into rural development with the flagship of volunteering.
- Bharat Nirman plans to distribute safe drinking water to all the underdeveloped areas. Other developmental steps include telephone access covering 40% of the rural areas of India by the year 2014 and Internet access to 2.5 lakh panchayats. Currently, as many as 66,822 villages are without telephone connection.
- Bharat Nirman has further plans of constructing all weather roads connecting all the population wise major villages of rural India and provides electricity to all the rural areas of India. The Plan also aims to add a sizeable portion of irrigational land to the existing farming lands of rural India.
- The aim and objective of **National Rural Drinking Water Programme (NRDWP)** is to provide every rural person with adequate safe water for drinking, cooking and other basic domestic needs on a sustainable basis, with a minimum water quality standard, which should be conveniently accessible at all times and in all situations. Achieving this aim and objective is a continuous process. The Ministry is aspiring to achieve "**Har Ghar Jal"** by 2030 in line with UN's Sustainable Development goals.
- NRDWP now targets providing rural populations with 40 litres of water daily to cover domestic uses. January 2019, 18% of the rural households had been provided with **PIPED WATER SUPPLY** household connections.
- The **Swajal scheme** was launched by the government for sustained water supply in rural areas. 90 per cent of this project is funded by the government and 10 per cent is funded by the beneficiary communities. The management of this operation is managed by local villagers and hundreds of technicians will be trained under this scheme to maintain and operate the units.
- All the villages will get water supplied through fitted pipes. This will ensure that the water is not contaminated. The maintenance of these pipes will be taken care of by the technicians.

Atal Bhujal Yojana

- Aims to tackle ever-deepening crisis of depleting groundwater level

Scheme:

1. The objective of scheme is to recharge ground water and create sufficient water storage for agricultural purposes.

2. It also focuses on revival of surface water bodies so that ground water level can be increased, especially in the rural areas.
3. It will give emphasis to recharging ground water sources and ensure efficient use of water by involving people at local level.
4. The scheme after Cabinet's clearance will soon be launched in water-stressed states: Gujarat, Haryana, Karnataka, Maharashtra, Uttar Pradesh, Rajasthan and Madhya Pradesh.
5. It will cover 78 districts, 193 blocks and more than 8,300-gram panchayats across these states.
6. Centre will support half of the total project cost and rest of the budgetary cost will be shared by the World Bank.
7. The scheme is to be implemented over a period of five years from 2018-19 to 2022-23
8. Programme National Rural Drinking Water Quality Monitoring and Surveillance has been launched in 2006, to train 5 persons in each Gram Panchayat to carry out regular surveillance of drinking water sources.

COMMUNITY PARTICIPATION AND QUALITY DRINKING WATER SUPPLY

- The community participation enhances the economic viability of operation and maintenance, it also increases the life span of the system. Under the 73rd constitutional amendment, Gram Panchayats have been assigned planning and managing rural water supply and sanitation systems.
- **WASMO** as Special Purpose Vehicle for Facilitating Reform Process. Government of Gujarat State with determination to bring reforms in community managed programme in drinking water sector established Water and Sanitation Management Organization (WASMO) as a Special Purpose Vehicle (SPV) in the year. 2002 to facilitate the community in development of water supply facilities in rural areas of Gujarat. WASMO is registered as a society under the Societies Registration Act, 1860 and also as a Public Charitable Trust.

WASMO's Vision:

- To enable communities to have adequate, safe and sustainable drinking water supply and improved habitat by ensuring empowerment and active community management of natural resources, leading to an improvement in their living standards

Mission:

- Empowering communities to plan, manage, maintain and own their water supply and sanitation facilities. Ensuring participation of communities and women in managing their own water supply.

- Attaining drinking water security through a combination of local and bulk water supply systems and village level infrastructure.
- Encouraging communities to adopt best practices on local water resource management, including rainwater harvesting
- Bridging the existing knowledge gap amongst communities on water resource
- management, water conservation, safe drinking water, hygiene and
- sanitation issues
- Creating a manpower pool and strong knowledge base in the water and sanitation sector.
- WASMO's **Earthquake Rehabilitation and Reconstruction** (ERR) Project aims to restore and develop water supply and sanitation facilities in all 1,260 villages of the drought-prone Jamnagar, Kutch, Patan and Surendranagar districts that were affected by the January 26, 2001 earthquake. This five-year project, starting from October 2002, incorporates the principles of decentralized, demand-driven, and community managed water and sanitation systems.

The primary objectives of the programme were:

- Restore water supply to all earthquake-affected villages by establishing decentralized, demand-driven, community-owned rural water supply and sanitation systems, planned, approved, implemented, operated and managed by the local community, thus ensuring sustainability
- Provide drinking water security through an integrated combination of pipe, local traditional water sources and multiple sources for alternative use
- Conserve water through water resource management that includes rainwater harvesting and artificial recharge, conservation and renovation of traditional water sources
- Build effective community institutions at the local level by supporting capacity building and empowerment. Ensure that all community groups, including women, are able to participate in the decision-making processes and benefit from programme improvements and
- Improve household and community environments with sanitation improvement and increased hygiene awareness in communities.

Water Quality Issues:

- The ever-growing dependence on ground water and its unsustainable over- extraction are lowering the groundwater table and adversely impacting the quality of rural drinking water supply.
- The Erstwhile Planning Commission had found that between 1995-2004 , the proportion of unsafe districts (semi-critical, critical, over exploited) , the proportion of area affected and population affected had grown from 9% to 31% , from 5% to 33% and from 7% to 35% .
- The quality of water is deteriorating in rural areas due to the following major factors.

1. Rapid depletion of groundwater
2. Uncontrolled construction activities in rural areas
3. Siltation of rural water bodies and reduction of water -bodies
4. Erratic rainfall and droughts or drought- like conditions
5. Water pollution due incessant and increased use of pesticides, fertilisers and effluents coming from industry.

TECHNOLOGY INNOVATIONS FOR SAFE DRINKING WATER SUPPLY

WATER QUALITY: A MAJOR CONCERN

The steps Taken by the GOI to check water quality:

- Water quality has emerged as a major issue in rural drinking water supply. Many public authorities are involved in the supply of rural water. Central Water Commission regulates the use of water to irrigate surface waters, the industry and potable water. It also mediates in disputes related to inter-state water allocation.
- Central Groundwater Board monitors groundwater levels and rates of depletion and production of water resource inventories and maps.
- National Rivers Conservation Directorate oversees the implementation of Action Plans to improve the quality of the rivers in India.
- Central Pollution Control Board promotes basin- wide pollution Control Boards for laying down standards for treatment of sewage and effluents.
- The Ministry of Drinking Water and Sanitation is the nodal ministry for the overall policy, planning funding and co-ordination of the National Rural Drinking Water Programme for rural water supply in the country.
- The Central Bureau of Health Intelligence performs the collection, compilation, analysis and dissemination of the information on health conditions in the country.
- Bureau of Indian Standards is responsible for the drafting of standards pertaining to drinking water quality.

WATER SECURITY AND SUSTAINED DRINKING WATER SUPPLY

Introduction:

- For making India a water secured Nation, especially the rural regions of the country, a lot of challenges need to be addressed. Demand pressures from various sectors, changing cropping pattern, high rate of urbanization and industrialization and most importantly, climate change are some of the factors that need to be addressed. Water pollution is another big challenge that India is facing today.

Drinking Water Situation in Rural India:

- Rural regions in India, which primarily have agricultural and domestic water requirements, suffer from many challenges such as water pollution and decreasing groundwater level. Arsenic and Fluoride contamination is very high in some parts of the country.

National Rural Drinking Water Programme:

- The Comptroller and Auditor General (CAG) of India submitted its report on 'National Rural Drinking Water Programme' on August 7, 2018. National Rural Drinking Water Programme (NRDWP) was launched in 2009.
- It aims to provide safe and adequate water for drinking, cooking and other domestic needs to every rural person on a sustainable basis. The audit was conducted for the period 2012-17.
- **Key findings and recommendations of the CAG Include:**
- Underperformance of the scheme: By 2017, NRDWP aimed to achieve certain objectives. However, by December 2017, these objectives were not completely attained. It aimed to provide all rural habitations, government schools, and anganwadis access to safe drinking water. Of this, only 44% of rural households and 85% of government schools and anganwadis were provided access.
- It also aimed to provide 50% of rural population potable drinking water (55 litres per capita per day) by piped water supply. Of this, only 18% of rural population was provided potable drinking water. It also sought to give household connections to 35% of rural households. Of this, only 17% of rural households were given household connections.
- Planning and delivery mechanism: The CAG noted deviations from the programme guidelines in the planning and delivery framework established at the centre and states. 21 states had not framed water security plans. Deficiencies were found in the preparation and scrutiny of annual action plans such as:
- (i) lack of stakeholder and community participation,
- (ii) non-inclusion of minimum service level of water in schemes, and
- (iii) absence of approval of State Level Scheme Sanctioning Committee for schemes included in the plans. The apex level National Drinking Water and Sanitation Council set up to co-ordinate and ensure convergence remained largely non-functional.
- State level agencies important for planning and execution of the programme, such as the State Water and Sanitation Mission, State Technical Agency, and Block Resources Centres were either not set up or were under-performing.
- The CAG recommended that the Ministry of Drinking Water and Sanitation should review the feasibility and practicality of the planning and delivery mechanisms to ensure that they serve the intended purposes.

- It also suggested that the water security plans and annual action plans must be prepared with community participation. This will ensure that schemes are aligned to community requirements and utilise water resources in an optimum and sustainable manner.
- Fund management: Between 2012-17, total allocation of Rs 89,956 crore (central share of 43,691 crore and state share of Rs 46,265 crore) was provided for the programme. Of this, Rs 81,168 crore (90%) was spent during this period.
- The availability of funds declined during 2013-14 and 2016-17 due to reduced central allocation and inability of states to increase their own financial commitment.
- The CAG noted delays of over 15 months in release of central share to nodal/implementing agencies in states. It recommended that allocation of resources should be dynamic and based on a clear assessment of requirements and achievements under each component of the scheme.
- Programme implementation: NRDWP failed to achieve its targets due to deficiencies in implementation, such as: (i) incomplete, abandoned and non-operational works, (ii) unproductive expenditure on equipment, (iii) non-functional sustainability structures, and (iv) gaps in contractual management, with a total financial implication of Rs 2,212 crore.
- There was inadequate focus on surface water-based schemes and 98% of the schemes, including piped water schemes continued to be based on ground water resources.
- The CAG also noted that operation and maintenance plans were either not prepared in most states or they had deficiencies in them.
- This led to schemes becoming non-functional. The CAG recommended that focus should be placed on effective works and contract management to ensure that works are completed in time as per the contractual terms. Delays attributable to contractors should be penalised and accountability should be enforced.

ACCESS TO DRINKING WATER AND PUBLIC HEALTH

- Clean, accessible water for all is an essential part of the world we want to live in and there is sufficient fresh water on the planet to achieve this. However, due to bad economics or poor infrastructure, millions of people including children die every year from diseases associated with inadequate water supply, sanitation and hygiene.
- Water scarcity, poor water quality and inadequate sanitation negatively impact food security, livelihood choices and educational opportunities for poor families across the world. At the current time, more than 2 billion people are living with the risk of reduced access to freshwater resources and by 2050, at least one in four people is likely to live in a country affected by chronic or recurring shortages of fresh water.

- Drought in specific afflicts some of the world's poorest countries, worsening hunger and malnutrition. Fortunately, there has been great progress made in the past decade regarding drinking sources and sanitation, whereby over 90% of the world's population now has access to improved sources of drinking water.
- To improve sanitation and access to drinking water, there needs to be increased investment in management of freshwater ecosystems and sanitation facilities on a local level in several developing countries within Sub-Saharan Africa, Central Asia, Southern Asia, Eastern Asia and South-Eastern Asia.

Global Facts and Figures:

- 1 in 4 health care facilities lacks basic water services
- 3 in 10 people lack access to safely managed drinking water services and 6 in 10 people lack access to safely managed sanitation facilities.
- At least 892 million people continue to practice open defecation.
- Women and girls are responsible for water collection in 80 per cent of households without access to water on premises.
- Between 1990 and 2015, the proportion of the global population using an improved drinking water source has increased from 76 per cent to 90 per cent
- Water scarcity affects more than 40 per cent of the global population and is projected to rise. Over 1.7 billion people are currently living in river basins where water use exceeds recharge.
- 2.4 billion people lack access to basic sanitation services, such as toilets or latrines
- More than 80 per cent of wastewater resulting from human activities is discharged into rivers or sea without any pollution removal
- Each day, nearly 1,000 children die due to preventable water and sanitation-related diarrheal diseases
- Approximately 70 per cent of all water abstracted from rivers, lakes and aquifers is used for irrigation. Floods and other water-related disasters account for 70 per cent of all deaths related to natural disasters

GOALS:

- By 2030, achieve universal and equitable access to safe and affordable drinking water for all
- By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations.
- By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally

- By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity
- By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate
- By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes
- By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies
- Support and strengthen the participation of local communities in improving water and sanitation management

WORLD ENVIRONMENT DAY

- Every year World Environment day is celebrated on 5th June to spread awareness, to encourage people, take action and to protect the environment. The Current theme of World Environment day is Air Pollution.
- World Environment Day is celebrated since 1974, it is widely celebrated in over 100 countries. It is the "People's day" to do something to take care of earth and the environment. This is really important to know the ways to protect the environment, let us see in detail about the objectives, themes and history of World environment day.
- For healthy living, environment plays an important role. It provide us air, food, etc. It is correctly said that ' the difference between animals and humans is that animals change themselves for the environment, but humans change the environment for themselves'. Environment is just like our neighbourhood; its surrounding conditions influence us and modify growth and development.
- World Environment Day is promoted by the United Nation and for 2019 China being the host country. World Environment Day is also known as the Environment Day, Eco Day. This day is celebrated to spread awareness about the Environment and its effects on the daily life of the people.
- Environment is the surrounding or conditions in which a person, animal or plant lives or operates. It is necessary to understand the importance of environment and lots of activities are done by the people to preserve and conserve the unique and life nurturing nature.

- People are more reluctant today to save the Environment for the future and then only it will be possible for the people to focus on the developmental activities in the country.

World Environment Day 2019: Theme

- The theme for the World Environment Day 2019 is "Air Pollution".
- Air pollution is increasing day by day and it seems complex to control it but nothing is impossible we should come together to combat it. And for this it is necessary to understand different types of pollution, how it affects our health and environment will help us to steps towards improving the air around us.
- We can't stop breathing but we can do something to improve the quality of air that we breathe. From air pollution approximately 7 million people in the world die due to air pollution and out of 7 million, 4 million occur in Asia-Pacific.

Facts related to Air pollution:

- Around 92 percent of the people worldwide do not breathe clean air.
- Every year, Air pollution costs the global economy $5 Trillion in welfare costs.
- By 2030, ground-level ozone pollution is expected to reduce the staple crop yields by 26 percent. The theme for the World Environment Day 2018 is “Beat Plastic Pollution”.
- We know that it is not possible to reuse plastic, they are non-biodegradable. So, it’s better not to use it. Plastics consist of several chemicals which are toxic or disrupt hormones. Plastics can also serve as a magnet for other pollutants, including dioxins, metals and pesticides.
- Therefore, it is necessary to call the people from all over the world to come and combat single-use plastic pollution which harms our ecosystem and consequently us.

TOILETS HELP REVIVE WEAVING INDUSTRY

- The district is the hub of Sambalpuri handloom fabric in western Odisha and is home to predominantly a tribal community, one of the poorest in the State. According to official data, the district is home to 132991 households out of which about 21,310 families are engaged in weaving. Prior to the commencement of the Swachh Bharat Mission Grameen (SBM-G) in October 2014, sanitation coverage of the district was a meager 3.94 per cent. Barely 5243 homes had their own toilets. Further, as 40% of the villages were situated near the river banks it took a long time for people to stop the practice of defecating in the open near the river banks where there was easy access to water. Also, coming from economically weaker families, they were unable to construct their toilets.
- To overcome these challenges, the district SBM team engaged in intensive behaviour change IEC and IPC campaigns during which communities were mobilized to construct and use toilets.

Sambalpur:

- Swachhagrahis were trained and Nigrani Committees were formed in all villages to rigorously carry out morning and evening follow up in common open defecation areas. In addition, they organized various awareness building activities such as sanitation rallies, village awareness drives, focused group discussions, etc. Convergence with SANJOG partners went a long way to motivate village opinion leaders who cooperated with the team SBM to stop the practice of open defecation.
- Over the last two years, as many as 1,27,748 individual household toilets were built, ensuring 100% sanitation coverage. Sonepur was declared open defecation free (ODF) on 31st March 2019.
- Significantly, toilets came as a critical game changer for handloom weaving families in the deep rural pockets of Sonepur district. "It saved valuable time owing to which the families could spend more productive time on weaving which resulted in increased household income," said by Mr. Dayasagar Meher, IEC and HRD Consultant, DWSM, Subarnapur.
- A few years ago, most of the families did not have access to toilets or safe sanitation. It meant family members had to go out to defecate and in the process waste precious income generation time. In addition, health impacts and issue of women dignity always existed.
- Access to toilets is saving significant time for weaving communities which can be used to take up more saree orders. This has inspired other families in their gram panchayats to regularly use toilets.

REVIVAL OF TRADITIONAL RAINWATER HARVESTING STRUCTURES

- Water has been harvested in India since antiquity, with our ancestors perfecting the art of water management. Many water harvesting structures and water conveyance systems specific to the eco-regions and culture has been developed.
- They harvested the rain drop directly. From rooftops, they collected water and stored it in tanks built in their courtyards. From open community lands, they collected the rain and stored it in artificial wells.
- They harvested monsoon runoff by capturing water from swollen streams during the monsoon season and stored it various forms of water bodies.
- They harvested water from flooded rivers

The Different Types of Traditional Water Harvesting:

1. **Jhalara**

BAWDI-WATER-CONSERVATION

- Jhalaras are typically rectangular-shaped stepwells that have tiered steps on three or four sides. These stepwells collect the subterranean seepage of an upstream reservoir or a lake. Jhalaras were built to ensure easy and regular supply of water for religious rites, royal ceremonies and community use. The city of Jodhpur has eight jhalaras, the oldest being the Mahamandir Jhalara that dates back to 1660 AD.

2. Talab /Bandhi

TALAB

- Talabs are reservoirs that store water for household consumption and drinking purposes. They may be natural, such as the pokhariyan ponds at Tikamgarh in the Bundelkhand region or man made, such as the lakes of Udaipur. A reservoir with an area less than five bighas is called a talai, a medium sized lake is called a bandhi and bigger lakes are called sagar or samand.

3. Bawari

JAIPUR-NAHARGARH-FORT BAWARI

- Bawaris are unique stepwells that were once a part of the ancient networks of water storage in the cities of Rajasthan. The little rain that the region received would be diverted to man-made tanks through canals built on the hilly outskirts of cities. The water would then percolate into the ground, raising the water table and recharging a deep and intricate network of aquifers. To minimise water loss through evaporation, a series of layered steps were built around the reservoirs to narrow and deepen the wells.

4. Taanka

- Taanka is a traditional rainwater harvesting technique indigenous to the Thar desert region of Rajasthan. A Taanka is a cylindrical paved underground pit into which rainwater from rooftops, courtyards or artificially prepared catchments flows.
- Once completely filled, the water stored in a taanka can last throughout the dry season and is sufficient for a family of 5-6 members. An important element of water security in these arid regions, taankas can save families from the everyday drudgery of fetching water from distant sources.

5. Ahar Pynes

- Ahar Pynes are traditional floodwater harvesting systems indigenous to South Bihar. Ahars are reservoirs with embankments on three sides that are built at the end of diversion channels like pynes.
- Pynes are artificial rivulets led off from rivers to collect water in the ahars for irrigation in the dry months. Paddy cultivation in this relatively low rainfall area depends mostly on ahar pynes.

6. Johads

- Johads, one of the oldest systems used to conserve and recharge ground water, are small earthen check dams that capture and store rainwater. Constructed in an area with naturally high elevation on three sides, a storage pit is made by excavating the area, and excavated soil is used to create a wall on the fourth side.
- Sometimes, several johads are interconnected through deep channels, with a single outlet opening into a river or stream nearby. This prevents structural damage to the water pits that are also called madakas in Karnataka and pemghara in Odisha.

7. Panam Keni

- The Kuruma tribe (a native tribe of Wayanad) uses a special type of well, called the panam keni, to store water. Wooden cylinders are made by soaking the stems of toddy palms in water for a long time so that the core rots away until only the hard-outer layer remains.
- These cylinders, four feet in diameter as well as depth, are then immersed in groundwater springs located in fields and forests. This is the secret behind how these wells have abundant water even in the hottest summer months.

8. Khadin

- Khadins are ingenious constructions designed to harvest surface runoff water for agriculture. The main feature of a khadin, also called dhora, is a long earthen embankment that is built across the hill slopes of gravelly uplands. Sluices and spillways allow the excess water to drain off and the water-saturated land is then used for crop production.
- First designed by the Paliwal Brahmins of Jaisalmer in the 15th century, this system is very similar to the irrigation methods of the people of ancient Ur (present Iraq).

9. Kund

- A kund is a saucer-shaped catchment area that gently slope towards the central circular underground well. Its main purpose is to harvest rainwater for drinking. Kunds dot the sandier tracts of western Rajasthan and Gujarat. Traditionally, these well-pits were covered in disinfectant lime and ash, though many modern kunds have been constructed simply with cement.
- Raja Sur Singh is said to have built the earliest known kunds in the village of Vadi Ka Melan in the year 1607 AD.

10. Bali

- Built by the nobility for civic, strategic or philanthropic reasons, baolis were secular structures from which everyone could draw water. These beautiful stepwells typically have beautiful arches, carved motifs and sometimes, rooms on their sides.

- The locations of baolis often suggest the way in which they were used. Baolis within villages were mainly used for utilitarian purposes and social gatherings. Baolis on trade routes were often frequented as resting places. Stepwells used exclusively for agriculture had drainage systems that channelled water into the fields.

11. Nadi

- Found near Jodhpur in Rajasthan, nadis are village ponds that store rainwater collected from adjoining natural catchment areas.
- The location of a nadi has a strong bearing on its storage capacity and hence the site of a nadi is chosen after careful deliberation of its catchment and runoff characteristics. Since nadis received their water supply from erratic, torrential rainfall, large amounts of sandy sediments were regularly deposited in them, resulting in quick siltation. A local voluntary organisation, the Mewar Krishak Vikas Samiti (MKVS) has been adding systems like spillways and silt traps to old nadis and promoting afforestation of their drainage basin to prevent siltation.

12. Bhandara Phad

- Phad, a community-managed irrigation system, probably came into existence a few centuries ago. The system starts with a bhandhara (check dam) built across a river, from which kalvas (canals) branch out to carry water into the fields in the phad (agricultural block).
- Sandams (escapes outlets) ensure that the excess water is removed from the canals by charis (distributaries) and sarangs (field channels). The Phad system is operated on three rivers in the Tapi basin – Panjhra, Mosam and Aram – in the Dhule and Nasik districts of Maharashtra.

13. Zing

- Zings, found in Ladakh, are small tanks that collect melting glacier water. A network of guiding channels brings water from the glacier to the tank. A trickle in the morning, the melting waters of the glacier turn into a flowing stream by the afternoon.
- The water, collected by evening, is used in the fields on the following day.
- A water official called a Chirpun is responsible for the equitable distribution of water in this dry region that relies on melting glacial water to meet its farming needs.

14. Kuhls

- Kuhls are surface water channels found in the mountainous regions of Himachal Pradesh. The channels carry glacial waters from rivers and streams into the fields. The Kangra Valley system has an estimated 715 major kuhls and 2,500 minor kuhls that irrigate more than 30,000 hectares in the valley.

- An important cultural tradition, the kuhls were built either through public donations or by royal rulers. A kohli would be designated as the master of the kuhl and he would be responsible for the maintenance of the kuhl.

15. Zibo

- The Zabo (meaning 'impounding run-off') system combines water conservation with forestry, agriculture and animal care. Practised in Nagaland, Zabo is also known as the Ruza system. Rainwater that falls on forested hilltops is collected by channels that deposit the run-off water in pond-like structures created on the terraced hillsides.
- The channels also pass through cattle yards, collecting the dung and urine of animals, before ultimately meandering into paddy fields at the foot of the hill. Ponds created in the paddy field are then used to rear fish and foster the growth of medicinal plants.

16. Bamboo Drip Irrigation

- Bamboo Drip irrigation System is an ingenious system of efficient water management that has been practised for over two centuries in northeast India. The tribal farmers of the region have developed a system for irrigation in which water from perennial springs is diverted to the terrace fields using varying sizes and shapes of bamboo pipes.
- Best suited for crops requiring less water, the system ensures that small drops of water are delivered directly to the roots of the plants. This ancient system is used by the farmers of Khasi and Jaintia hills to drip-irrigate their black pepper cultivation.

17. Jackwells

- The Shompen tribe of the Great Nicobar Islands lives in a region of rugged topography that they make full use of to harvest water.
- In this system, the low-lying region of the island is covered with jackwells (pits encircled by bunds made from logs of hard wood). A full-length bamboo is cut longitudinally and placed on a gentle slope with the lower end leading the water into the jackwell.
- Often, these split bamboos are placed under trees to collect the runoff water from leaves. Big jackwells are interconnected with more bamboos so that the overflow from one jackwell leads to the other, ultimately leading to the biggest jackwell.

18. Ramtek Model

- The Ramtek model has been named after the water harvesting structures in the town of Ramtek in Maharashtra.
- An intricate network of groundwater and surface water bodies, this system was constructed and maintained mostly by the malguzars (landowners) of the region.

- In this system, tanks connected by underground and surface canals form a chain that extends from the foothills to the plains. Once tanks located in the hills are filled to capacity, the water flows down to fill successive tanks, generally ending in a small waterhole. This system conserves about 60 to 70 % of the total runoff in the region!

19. Pat System

- The Pat system, in which the peculiarities of the terrain are used to divert water from hill streams into irrigation channels, was developed in the Bhitada village in Jhabua district of Madhya Pradesh. Diversion bunds are made across a stream near the village by piling up stones and then lining them with teak leaves and mud to make them leak-proof.
- The Pat channel then passes through deep ditches and stone aqueducts that are skilfully cut info stone cliffs to create an irrigation system that the villagers use in turn.

20. Eri

- The Eri (tank) system of Tamil Nadu is one of the oldest water management systems in India. Still widely used in the state, eris act as flood-control systems, prevent soil erosion and wastage of runoff during periods of heavy rainfall, and also recharge the groundwater.
- Eris can either be a system eri, which is fed by channels that divert river water, or a non-system eri, that is fed solely by rain. The tanks are interconnected in order to enable access to the farthest village and to balance the water level in case of excess supply. The eri system enables the complete use of river water for irrigation and without them, paddy cultivation would have been impossible in Tamil Nadu.
- There are several other hyperlocal versions of the traditional method of tank irrigation in India. From keres in Central Karnataka and cheruvus in Andhra Pradesh to dongs in Assam, tanks are among the most common traditional irrigation systems in our country.
- These ecologically safe traditional systems are viable and cost-effective alternatives to rejuvenate India's depleted water resources.
- Productively combining these structures with modern rainwater-saving techniques, such as percolation tanks, injection wells and subsurface barriers, could be the answer to India's perennial water woes.