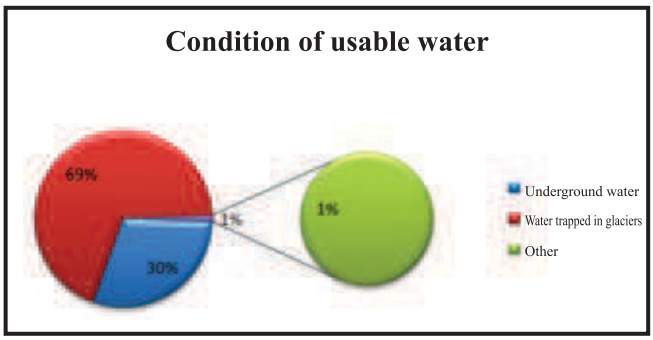
Lesson 8

Water Resources

Introduction-

Water is the incomparable gift of nature, which provides base to all the activities on the earth. Water resource is a primary necessity for socio-economic development of any country. In the ancient time river values remain the places of development of human civilization.

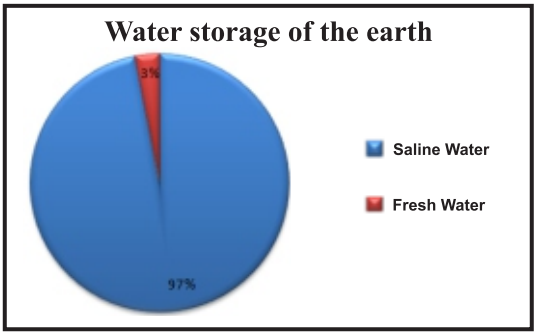
Water constitutes 71% and land constitutes 29% of the total surface of the earth. Out of the total water resource available on the earth 97% of this water exists in the form of saline water in the oceans and the remaining 3% is usable fresh water. Out of this usable water 69% of this water remains in ice form and 30% in the form of underground water. The remaining 1% of water is used by man for drinking, irrigation and other economic activities.



Diag. 8.1 : Condition of usable water

According to the water resource ministry of Government of India, availability of total usable water in India is 1869 billion cubic meter, out of which only 1123 billion cubic meter is used. Out of this human consumable water, 690 billion cubic meter is a part of surface water and 433 million cubic meter is a part of groundwater, the total need of water in India in the year 2000 was 634 million cubic meter per year and it will rise to 1023 billion cubic meter by the year 2025.

The proper management and conservation of water has become essential due to the pressure on the water resources because of the rapid growth in population and global warming.



Diag. 8.2 : Water storage of the earth

Water Management

One side due to increase in the size of human population, modern life style and non-scientific use of water have raised the pressure on water resources. On the other side the maximum amount of rain water reaches to the oceans through surface flow by rivers without its proper utilisation. In this situation it is dire need of the time to ensure the supply of water by adopting water management techniques.

In this direction it is first requirement to manage rain water. The proper utilisation of this water is essential in order to meet the needs of the growing population and its management is essential in order to tackle the consequences of

famine and drought resulting from the uncertainty and irregularity of the monsoon. Several multipurpose projects launched after independence in the Five Year Plans which resulted in solving the problems of flood and drought and supported the production of hydro-electricity, drinking water supply, irrigation, fisheries and environmental management. The first Prime Minister of India Pandit Jawaharlal Nehru called these multi purpose projects as "The temples of modern India".

In India, these projects are run by state and Central Government.

The execution of important projects such as Bhakra-Nangal, Rihand, Damodar HeeraKund, Kosi, Tehri is being done by the Central Government.

The Chambal project in Rajasthan, Nagarjuna Sagar project(Andhra Pradesh), Tungabhadra project (Andhra Pradesh and Karnataka)Sardar Sarovar project (Gujarat, MP and Rajasthan) Mayoorakshi and Farakka project (West Bengal,) Mahi project (Gujarat and Rajasthan) Gandak project (Bihar and UP), Machhkunda Project (Andhra Pradesh, Orissa) etc. are being done by the state governments.

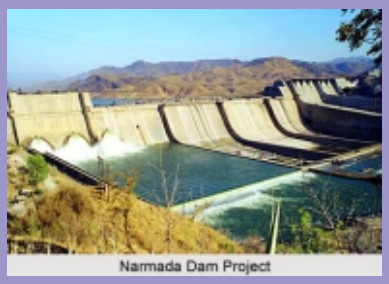
Bhakhra Nangal Project-

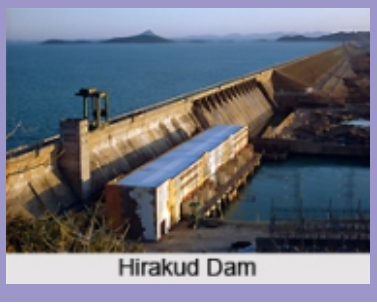
It is the biggest and the most important multiporpose project of the country, which had

Multipurpose Projects

In a multipurpose projects more then one objectives are fulfilled. For example :-

Supply of water for irrigation purpose
Production of hydroelectricity
Flood control and drought management
Supply of water for industrial use
Supply of drinking water
Fishing
Water sports and tourism


Narmada Dam Project


Hirakud Dam

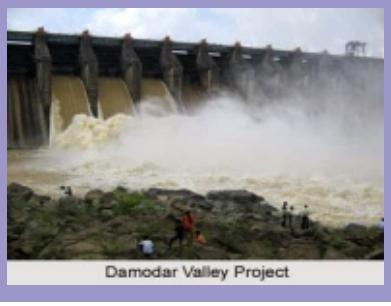
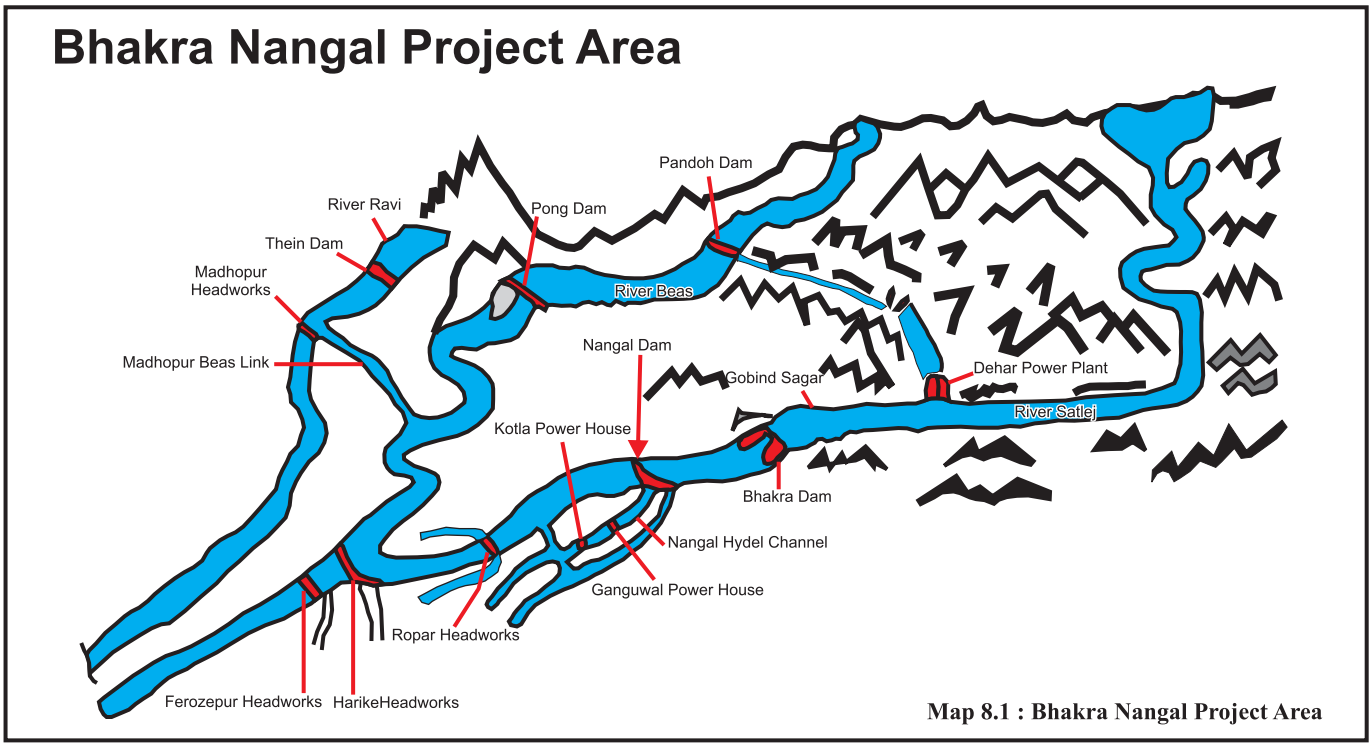
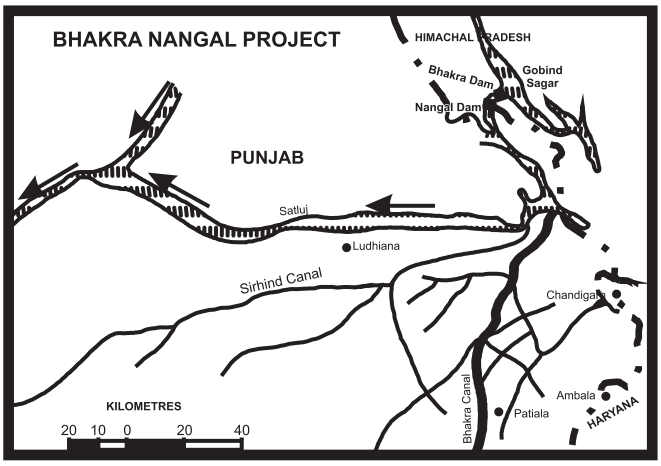

Damodar Valley Project

Fig. 8.1 : Multipurpose projects of the country



Map 8.1 : Bhakra Nangal Project Area



Map 8.2 : Bhakra Nangal Project

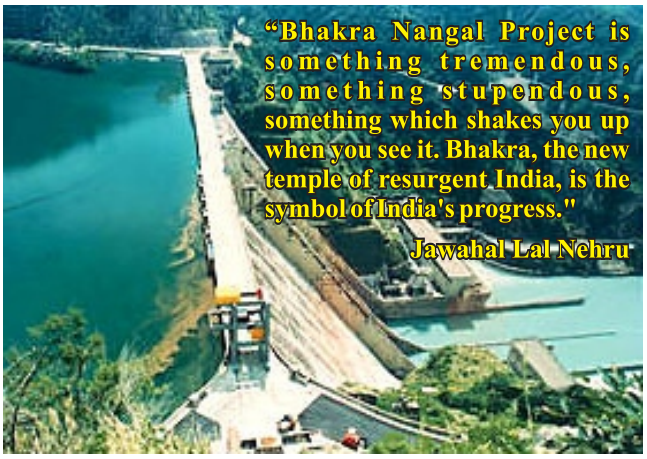


Fig. 8.2 : Bhakra Nangal Dam

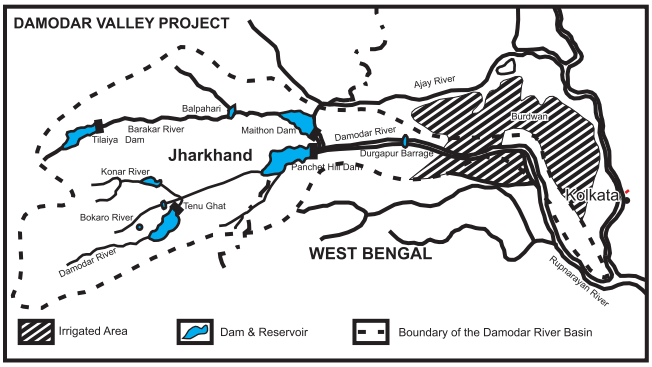
started in 1948 and completed in 1963 and is established near Bilaspur on the river Satluj in Himachal Pradesh.

It is a joint venture of Punjab Haryana and Rajasthan. Its objective is to get the mid parts of satluj and Yamuna developed economicly through hydro-electricity, irrigation and drinking water supply. Under this project, two dams have been built in Ambala district of Punjab. The first dam is Bhakra dam which is 518.16 meter long and of 226 meter height. This is the hightest gravity dam in the world made up of cement and concrete. The second dam has been built 13 km downwards from the Bhakra dam and its purpose is to store the surplus water of the Bhakra Dam. Bhakra, Surhind, Nangal, Bist Doab and Narvana canals have been derived from these dams and power houses have been built at Kotla, Roopnagar and Gangwal.

Damodar Vally Project-

The first major project of independent India which is a joint venture of West Bengal and Jharkhand, it was started in 1948 on the river Damodar, also known as the Sorrow of Bengal. This River was known for route diversion, erosion

and floods in West Bengal after flowing 493 kilometers in Bihar and Jharkhand and 240 kilometers in West Bengal, this river falls into the Hooghly river towards the Eastern part of Chota Nagpur Plateau Barakar, Bokaro and Konar are the tributaries of the river Damodar Approximately 18000 square kilometers of area is affected by the floods and erosion caused by it. For this reason Government of India has established Damodar Valley Corporation (DVC) on the framework of the Tennessee Valley Authority (TVA) of America. The objective of this project is to improve the standards of the living of local people by the economic development of the river valleys of West Bengal and Jharkhand. Under this project Methan and Tilleiya dams on river Baraker, Konar dam on river Konar and Panchet Pahadi dam and Durgapur barrage on river Damodar have been constructed. Many hydro power plants have been established at Bokaro, Chandrapur, Tilleiya, Methan, Panchet Pahadi and Durgapur and an extensive canal network system has been developed.

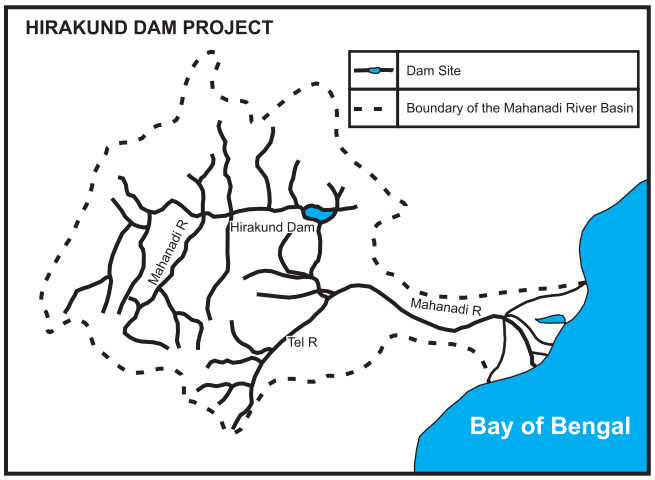


Map 8.3 : Damodar Valley Project

Hirakund Project-

It is an ambitious project of peninsular India which has been established by government of India on river Mahanadi, which is known as Sorrow of Orissa. River Mahanadi originates from Bastar hills of Chhattisgarh state and than flow through Orissa. It causes floods in the river valley areas during the monsoons and the situation of famine and drought develops during the rest of the Year. The Government of India has built the Hirakund Dam 14 Km. upstream from Sambalpur on this river, so that the about stated problems can be solved and ensure the availability of water for irrigation and drinking purpose.

It is the longest dam of the world with a length of 4801 meters and of 61 meters high. The water storage lake behind the dam is having capacity to store 810 crore cubic meter water. Besides this dam two other dams have been built at Tikarpada and Naraaz. This project has been completed in two phases, the 1st Phase- Hirakud Dam was built in the Sambalpur district of Orissa with the construction of Borgadh canal at right side and Sesan and Sambalpur canal system on left side while four power plants were built in the second phase.



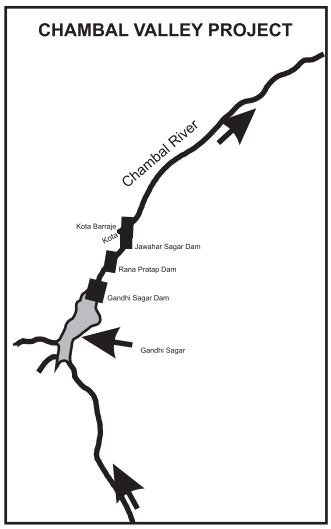
Map 8.4 : Hirakund Dam Project

Fig. 8.3 : Hirakund Dam

Multi-Purpose Hydro Projects in Rajasthan-

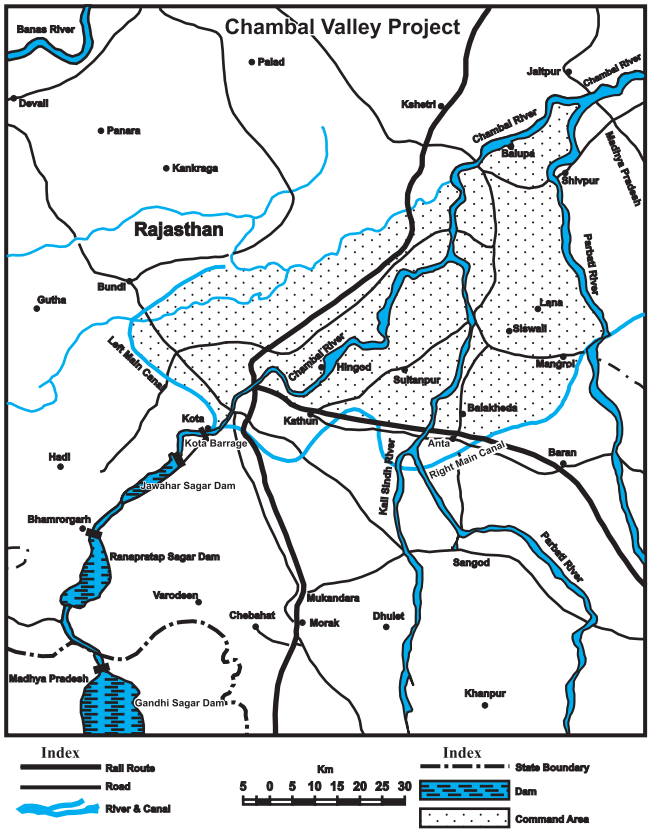
Chambal Valley Project-

A joint venture of Rajasthan and Madhya Pradesh started in 1953 on the river Chambal. It was started in three phases in order to solve the problem of soil erosion and floods caused by river Chambal and the other related losses. In the first



Map 8.5 : Chambal Valley Project

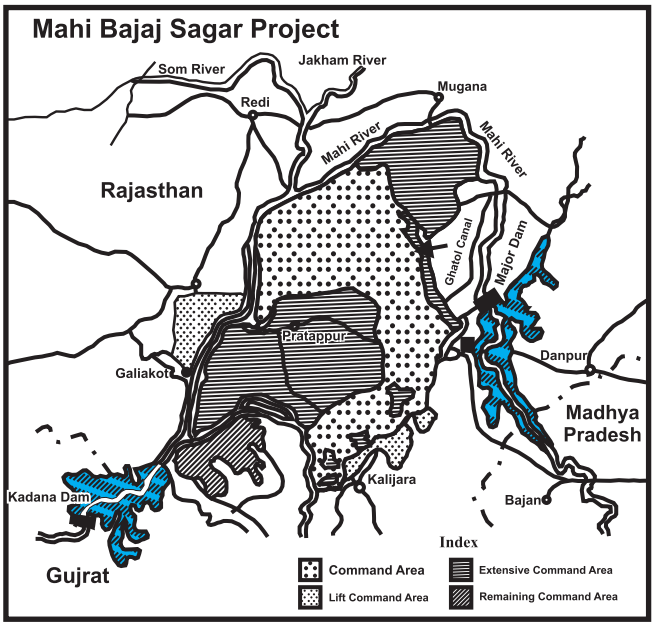
phase of this project Gandhi Sagar dam in Mandsaur district of MP and canal system were built. In the 2nd phase Rana Pratap Sagar dam at Rawatbhata in Chittorgarh district of Rajasthan and hydro-electricity production and in the 3rd phase Jawahar Sagar pick up Dam on the border of Kota and Bundi districts with power houses were built. In 1960s, Kota Barrage was constructed and canal irrigation area in Rajasthan was increased by this.



Map 8.6 : Chambal Valley Project

Mahi Bajaj Sagar Project-

It is a joint venture of Rajasthan and Gujarat states. For this, in the year 1966 an agreement was sign by both they states for this new project on river Mahi, originating from the Vindhyachal mountains. This project was initiated for the development of economic, irrigation, and power facilities of tribal regions situated in the flow area of river Mahi in Dungarpur and Banswara. Mahi Bajaj Sagar dam was built at Borkhera in Banswara district of Rajasthan and Kadana Dam was built in Gujarat by the government of Gujarat. Aiming to develop the canal system, Kagdi pick up Dam was built at 500m downstream of the main dam and two hydro electric power plants were also built for the development of power facilities.



Map 8.7 : Mahi Bajaj Sagar Project

Bisalpur Project 1997 to 1998-

It is a multipurpose project for irrigation and drinking water supply. The project comprises concrete dam 574 meters long with a maximum height of 39.5 meters across the river Banas, at a place called Bisalpur near the town of Todaraisingh in Tonk district of Rajasthan. Two canals have been taken out from the left and right side of this dam. Irrigation in Sawai Madhopur and drinking water supply to Jaipur city, Ajmer, Kekri, Sawar, Beawar and the enroute villages and irrigation in 256 villages of Tonk district will be provided under this project.

Other projects of Rajasthan-

Rajasthan Canal or Indira Gandhi Canal Project-

It has been taken out from the Harike Barrage built at the confluence point of the Sutluj and Beas rivers with the purpose of water supply, utilisation of waste land and settlement of population at the international border. It is the biggest man made Canal not only in India but also in Asia, with a length of 649 km out of which 169 km is in Punjab, 14 km is in Haryana and the rest is in Rajasthan. Water is provided to 9 districts, 29 towns and 3461 villages of Rajasthan. This canal was completed in two stages, ie. Rajasthan Feeder Canal and Main Canal. Rajasthan Feeder is a part from the starting point to Masitawali and the main Canal is a part from Masitawali to the end point of Mohangarh, which are 204 km and 445 km long respectively. Several branches and lift canals have been taken out of this canal in order to develop the irrigated land in the Thar Desert. 9 branches alike the droop on western international boarder and in the small canals by the lifts on eastern side due to the extra height, water is raised and shifted. By these canals drinking water is made available to several towns and cities. The total number of lift canals is seven. Lakes of hectare land is irrigated by this canal. This project has now been extended up to Gadra road in Barmer.

Fig. 8.4 : Indira Gandhi Canal

Jakham Project-

Jakham Dam has been built in Anooppura across the river Jakham for irrigation of the tribal areas of Chittorgarh, Udaipur and Pratapgarh. Canal system has been developed by pick up technique in the village Nagaria at a distance of 13 km from this Dam.

Som -Amba -Kamla Project-

A dam has been built across the river som in the village of Kamla Amba. Irrigation facilities will be given to the villages of Aaspur and Salumber block of Dungarpur and Udaipur districts respectively.

Meja Dam-

Meja Dam has been built for irrigation purpose on the river Kothari, in village Meja of Mandalgarh Block in Bhilwara. Fisheries and Canal system have also been developed by the dam.

Sidhmukh Project-

Under this project the surplus water of Ravi-Beas is utilised to irrigate 33000 hectare land of Nohar-Bhadra and Taranagar - Rajgarh blocks of Shriganganagar, Hanumangarh and Churu districts respectively.

Narmada Project-

Drinking water supply is made to Barmer and Jalore by the water of Sardar Sarovar Dam.

Jawai Dam Project-

Dam has been built in Arinpura (Pali) across the river Jawai, a tributary of the river Luni in Western Rajasthan. Irrigation is done in Pali and Jalore by a 176 km long canal taken out from this dam.

Panchana Dam-

A dam of clay has been constructed on the confluence point of five rivers Barkhera, Bhadravati, Machi, Bhaisawat and Ata, near Gudla village of Karauli district. The villages of Todabhim, Hindaun and Gangapur are irrigated by

means of this dam.

Narayan Sagar Dam-

This is the biggest dam of Ajmer constructed on the Khari river at Jalia-II village of this district. The are two canals taken out of this dam are (1) Khutia and (2) Badi canal.

Besides the above mentioned projects, approximately 40 mini projects are also operational in several areas of Rajasthan where water management is performed at the local level.

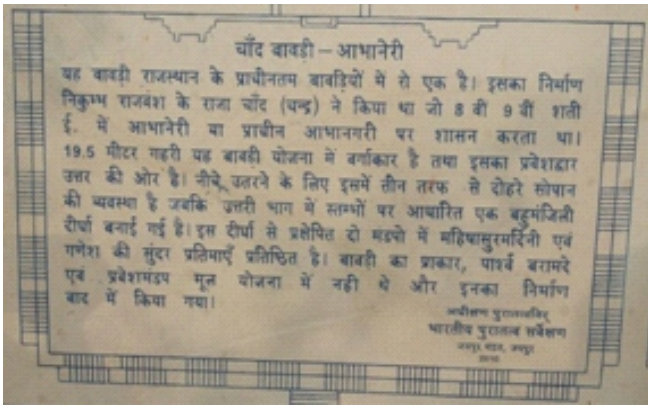
Water Conservation-

The main objective of water conservation techniques is to ensure the judicious use of natural water and proper management of water resources. To collect rain water and its proper management is also the part of water conservation. The axis water of monsoon season can be stored in dams, ponds, lakes and other small water bodies and this can be used during the lean season. Water is considered as nectar in Indian culture and tradition. Owing to sensitivity towards water resources the rulers, money lenders and the local citizens have constructed wells, bawris (step wells), ponds and lakes in villages and towns. Prestige was always there in ancient India towards the conservation of water Due to the same reason evidences of wells, reservoirs and Canals have been found in the excavation of the Sindhu Valley Civilization in India. According to the Arthashastra of Kautilya, the Sudarshan Lake was constructed by Chandragupta Maurya. Several ancient dams and anicuts were built by the Chalukya rulers in Southern India. Sensitivity towards water conservation has been a tradition in Rajasthan because of the scarcity of rainfall and resultant famines. For the same reason, Bawri, Jhalra Nadi, Wells, Kui (small wells)and Johads were built by the local rulers and moneylenders, which have been a source of drinking water for the local public. At the same time, dams, khadin and anicuts have also been useful for irrigation and drinking water.

Forms of traditional water conservation in Rajasthan-

1. Bawri (step Wells)-

A source of water built in quadrilateral, round or circular shape where bricks and artistic stones are used from the entrance to the midpoint. Bricks, and quadrangle shaped parts are adjacent to it . There are stairs to reach these parts. The stairs are studded with designer Mehraabs consisting Towers and skylights. There are idols of regional deities on the skylights. In Rajasthan the construction of Bawris was done for individual and social use. Bawri are found in all districts of the state. The city of Bundi is known as the city of stepwells due to the prominence of Bawris there. Besides this the Tapi Bawri of Jodhpur, Bhandarej Bawri of Dousa, Binota Bawri of Chittor and Chand Bawri of Abhaneri are the famous ones.


चाँद बावड़ी – आभानेरी

यह बावड़ी राजस्थान के प्राचीनतम बावड़ियों में से एक है। इसका निर्माण निकुम्भ राजवंश के राजा चाँद (चन्द्र) ने किया था जो 8 वीं 9 वीं शती ई. में आभानेरी या प्राचीन आभानगरी पर शासन करता था। 19.5 मीटर गहरी यह बावड़ी योजना में वर्गाकार है तथा इसका प्रवेशद्वार उत्तर की ओर है। नीचे उतरने के लिए इसमें तीन तरफ से दोहरे सोपान की व्यवस्था है जबकि उत्तरी भाग में स्तम्भों पर आधारित एक बहुमंजिली दीर्घा बनाई गई है। इस दीर्घा से प्रक्षेपित दो मंडपों में महिषासुरमर्दिनी एवं गणेश की सुंदर प्रतिमाएँ प्रतिष्ठित है। बावड़ी का प्राकार, पार्श्व बरामदे एवं प्रवेशमंडप मूल योजना में नहीं थे और इनका निर्माण बाद में किया गया।

भारतीय पुरातत्व सर्वेक्षण

Fig. 8.5 : Abhaneri's Chand Bawri (Step well) & its description

2. Ponds-

The rain water is collected in the ponds which has been a source of drinking water for men and animals. Most of the ponds are built adjacent to slanting land. Religious and social sentiments are attached to the construction of these ponds. For this very reason their safety and conservation becomes very easy. The major ponds of Rajasthan which have been a source of drinking water in past are- Hemabas in Pali, Sareri and Meja in Bhilwara, Bankiya and Senapani in Chittorgarh and Gadisar and Gajroopsagar of Jaisalmer.

Fig. 8.6 : Pond

3. Lakes-

Lakes have been the most popular source of conservation of running water in Rajasthan These lakes were built by regional rulers, money lenders and nomads. They have served the purpose of irrigation besides drinking water. Irrigation was made in the nearby areas by taking out canals from these lakes. These lakes which have been helpful

Fig. 8.7 : Pushkar Lake

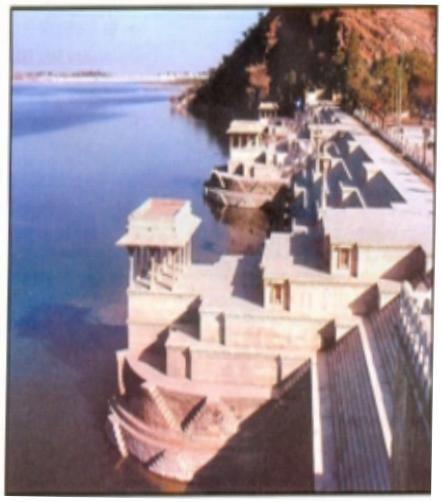


Fig. 8.8 : Rajsamsand's Nou Chouki Lake

in the regional economic and social development, at same the time were life giving during drought and famine. Ana Sagar of Ajmer, Pichola and Fatehsagar of Udaipur, Tal chhapar of Churu, Bakli dam of Jalore, Tordi Sagar of Tonk, Sardar Samand of Pali, Navlekha lake of Bundi and Nauchouki lake of Rajsamand are some of the famous ones.

4. Nadi -

It is a short form of pond, found mostly in Western Rajasthan. In a Nadi rain water is collected in the sandy plain area. Normally it is 4 to 5 meters deep. The rain water gets collected in it for some time due to its small size, low depth and the accumulated soil brought with rain water. The depth of these Nadi's is raised by digging out the soil every year. They have been a major source of drinking water for rural population, animals and wildlife in Western Rajasthan.

Fig. 8.9 : Nadi

5. Taanka-

It is a traditional source of storage and conservation of water in western Rajasthan which is built by digging up the ground 5-6 meter deep in every house or field. Its upper part is covered with stones or other available resources. The rain water received from the terrace of the houses is stored in it. Its internal part is coated with mixture of sand and ash, which prevents leakage of water and the erosion at bottom. These Taankas are being built under Jal Swavalamban Yojana and other projects in Rajasthan.

Fig. 8.10 : Taanka with Aagor (upper part is covered with platform of stones or other available material)

Fig. 8.11 : Modern Taanka

6. Johad-

It is a source of rain water storage in Shekhawati region and Haryana. it is basically similar to the Taanka in form. But its upper part is

Fig. 8.12 : Square shaped Johad

Fig. 8.13 : Rounded Johad

bigger than taanka and also circular and open, so that the flowing rainwater of surrounding area could be accumulated in it. These Johads are a very good source of drinking water for animals and human beings

7. Beri-

They are built in Western Rajasthan by digging up the ground 5-6 meter deep near pond and Khadin having the diameter of 2 to 3 feet with masonry walls of stones to facilitate the seeping underground water. They are used in summer seasons after drying up of rainwater. People call it Beri in native language, they are found in Barmer and Jaisalmer of Rajasthan.

8. Khadin -

Having been adopted by the Paliwal Brahmins in Jaisalmer during the mediaeval age, it refers to a technique of conservation and

management of water also considered as the most appropriate technique for agriculture and drinking water purpose. Under this the flowing water in rainy season is stopped on slopes in mountainous areas by making walls and boundaries, and the surplus water is discarded from a part of this boundary wall to provide water to another adjoining khadin land. In the khadin land the level of ground water rises due to rains, and in this soil

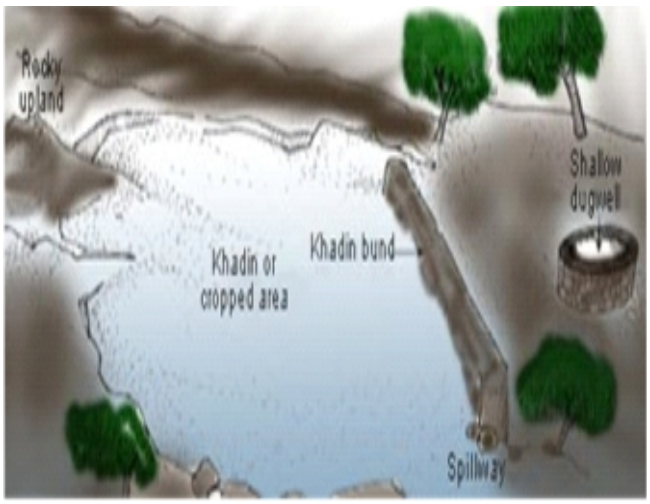


Fig. 8.14 : Khadin

conservation technique moisture of soil is also retained, The khadin land facilitates both Rabi and kharif crops and make drinking water available during summers by the beris built on corners. The conservation and management of water has been traditional in Rajasthan because of the frequent droughts and famines. That is why, the native people and rulers gave importance to such techniques, with the aim of utilising each and every drop of rain water to its maximum. Religious faith has made the conservation a natural process, due to which these sources have been supplying drinking water to the natives, animals, plants and human beings for a long period of time,

Water Self-reliance -

At present due to decreasing ground water and worst condition of the traditional resources of water at local level with increasing level of silt in dams and also due to the scarcity of rainfall, adverse conditions of water crisis are cropping up. Problem is getting more serious owing to the increased demand of water by the ever increasing population. For this reason Jal Kranti Abhiyan (water Revolution mission) and Mukhyamantri Jal Swavalamban (chief minister's water self-reliance program) have been started by the government of India and the government of Rajasthan respectively. The proper management of water at the local level is the main aim behind the initiation of these programs. Generally the management and conservation of water has been adopted traditionally in various forms as Nadi, Ponds, Wells, Bawris (step Wells) and Beris etc. in every village and town. These water resources were the remarkable examples of management and conservation of water at the local level in the ancient times and had provided water for a long time at the local level. The well organised traditional techniques of water management facilitated availability of adequate water in the western part of Rajasthan even during the period of drought, but the lesser utility of these sources at present and due to the lack of effective management, their conditions have deteriorated. Water self Reliance has become essential for the solving the water crisis emerging due to the shortage of water which includes the saving of water at local level, to systematize the use of water and to preserve and manage the rain water properly .These traditional sources should be redeveloped and used for irrigational and other purposes locally. At the same time the rain water and groundwater should be used in such a manner that it remains available in future at the local level.

Chief Minister Water Self Reliance Plan (Mukhyamantri Jal Swavalamban Yojana)-

The task in Mukhyamantri Jal Swavalamban Yojana of Rajasthan government is to make water catchment areas self-reliant by water management treating them as natural resources at rural level by the help of state government and with the philanthropists. Under this Yojana, works such as raising the ground water level and improvement of its quality besides rejuvenation of wells, ponds,

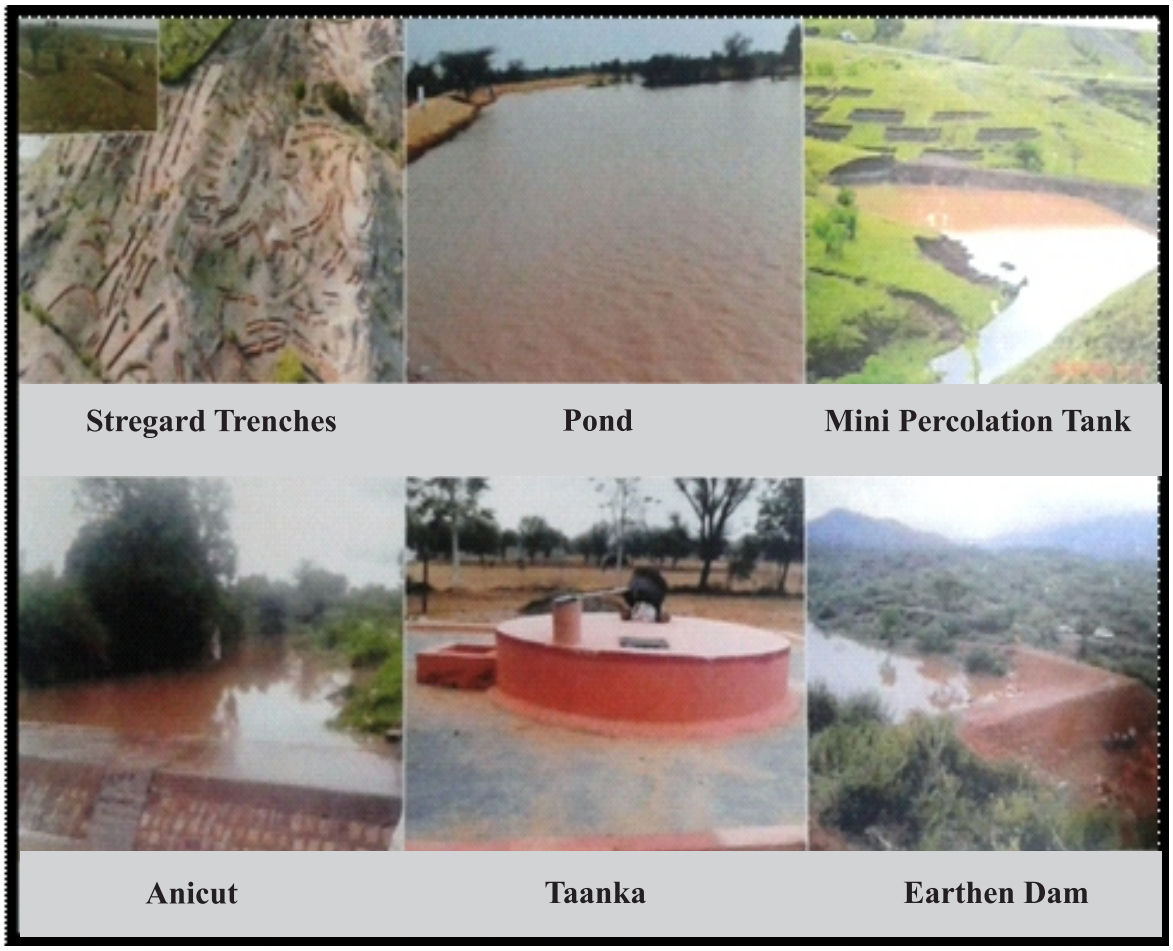


Fig. 8.15 : Various forms of Water Conservation

nadis and other water resources which are on the verge of extinction, will be done. The digging of nadis, wells and ponds at the block level and the repairing of their walls and the work of repairing the water receiving areas by removing obstacles from water receiving areas of these water resources are to be done. In this program, with the participation of NGOs religious trusts, non-residential rural Indians and local villagers the treatment of water catchment areas will be made. Construction of deep continuous contour, trenches, staggered , Farm pond, Mini percolation tank, sunken gully pit, Khadin, Johad and taankas will also be made. Small anicuts in a chain, raw check dams and water storage structures, drain fixation works are also to be undertaken in this program. Besides all these, repairing of minor irrigation tanks, renewal and reinforcement works and connection of water resources to the ravines, grassland development and plantation works, refilling of artificial groundwater refilling structures and promotion of advanced techniques in cropping and gardening will be made. At the same time, awareness will be created by the means of Nukkad Nataks, fairs and rallies amongst the rural population towards the conservation of water resources and their importance.

Important Points

1. Only 1% of the total water available on the earth is useful for drinking, irrigation and economic activities.
2. All the techniques and plans for the distribution, development and orderly use of water are included in water management, which establish a coordination in the demand and supply of water.

3. The techniques and methods to store rainwater at the local level comes under water conservation.
4. Water self-reliance involves the self-reliance in management and conservation of groundwater and surface water at the local level.
5. Bhakhra Dam, which is 518.16 meters long with the height of 167.64 meters, is the largest rising dam in the world ,made up of cement and concrete.
6. Hirakud Dam, which is the longest dam in the world with a length of 4801 meters, stores 810 crore cubic meters of water.
7. The First Prime Minister of India, Pandit Jawaharlal Nehru has called the river valley projects as the 'Modern Temples of India'.
8. The function of a pickup dam is to stop the water emitted out of various dams, later it is distributed equally
9. Barrage refers to the place where the canals are taken out for irrigation, like Harike Barrage and Kota Barrage.
10. Indira Gandhi Canal--Not only of India it is also the longest man made Canal of Asia with the total length of 649 km.
11. Panchana Dam- dam built with clay at the confluence point of five rivers Berkheda, Bhadravati, Machi, Bhaisavat and Ata near Gudla village of Karauli district.
12. Khadin- It is basically the agricultural land adopted by the Paliwal brahmins during the medieval age in Jaisalmer .it is the most appropriate technique of water conservation and water management for agriculture and drinking purposes.
13. Johad- A form of water collection in the Shekhawat area- Sikar, Jhunjhunu and Churu.
14. With the objective of water self-reliance, Jal Kranti Abhiyan and Mukhyamantri Jal Swavlamban programs have been started by Government of India and the Government of Rajasthan respectively.

EXERCISE

Very Short Answer type Questions

1. What is meant by 'Water Management '?
2. Which is the longest man made canal of India?
3. Which is the longest dam of India?
4. What meant by "Barrage"?
5. In which regions of Rajasthan the Taanakas are built for the storage of rain water?
6. In which districts Gadisar and Gajroopsagar are famous?
7. Which multipurpose project is famous for the development of tribal areas in Rajasthan?
8. Which dam is built of clay?

Short Answer Type Questions-

1. Which projects in India are operated through state and Central Governments?
2. Why there is a need for water self reliance?
3. What is Bawri ? Explain.
4. What is Khadin? Explain.
5. Describe Bhakhra Nangal Project.
6. Why the water conservation technique is adopted in Rajasthan?
7. Throw light on Bisalpur Project.

Essay Type Questions-

1. Discuss about various types of water conservation in Rajasthan?
2. Discuss about Indira Gandhi Canal Project in Rajasthan.
3. Discuss about Chief Minister Water Self-reliance Program.
4. Discuss any two major projects of Government of India in detail.