Module 1

Principles of Water Resources Engineering

Lesson 3

National Policy For Water Resources Development

Instructional Objectives

On completion of this lesson, the student shall be able to:

1. Appreciate the policy envisaged by the nation to develop water resources within the country
2. Conventional and non-conventional methods in planning water resources projects
3. Priorities in terms of allocation of water for various purposes
4. Planning strategies and alternatives that should be considered while developing a particular project
5. Management strategies for excess and deficit water imbalances
6. Guidelines for projects to supply water for drinking and irrigation
7. Participatory approach to water management
8. Importance of monitoring and maintaining water quality of surface and ground water sources.
9. Research and development which areas of water resources engineering need active
10. Agencies responsible for implementing water resources projects in our country
11. Constitutional provision guiding water resource development in the county
12. Agencies responsible for monitoring the water wealth of the country and plan scientific development based on the National Policy on water

1.3.0 Introduction

Water, though commonly occurring in nature, is invaluable! It supports all forms of life in conjunction with air. However, the demand of water for human use has been steadily increasing over the past few decades due to increase in population. In contrast, the total reserve of water cannot increase. Hence each nation, and especially those with rapidly increasing population like India, has to think ahead for future such that there is equitable water for all in the years to come. This is rather difficult to achieve as the water wealth varies widely within a country with vast geographical expanse, like India. Moreover, many rivers originate in India and flow through other nations (Pakistan and Bangladesh) and the demands of water in those counties have to be honored before taking up a project on such a river. Similarly there are rivers which originate form other counties (Nepal, Bhutan and China) and flow through India.

All these constraints have led to the formulation of the national water policy which was drafted in 1987 keeping in mind national perspective on water resource planning, development and management. The policy has been revised in 2002, keeping in mind latest objectives. It is important to know the essentials of the national policy as it has significant bearing on the technology or engineering that would be applied in developing and managing water resources projects.

This section elucidates the broad guidelines laid own in the National Water Policy (2002) which should be kept in mind while planning any water resource project in our country.

1.3.1 Water Resources Planning

Water resources development and management will have to be planned for a hydrological unit such as a drainage basin as a whole or a sub-basin. Apart from traditional methods, non-conventional methods for utilization of water should be considered, like

- Inter-basin transfer
- Artificial recharge of ground water
- Desalination of brackish sea water
- Roof-top rain water harvesting

The above options are described below in some detail:

Inter-basin transfer: Basically, it's the movement of surface water from one river basin into another. The actual transfer is the amount of water not returned to its source basin. The most typical situation occurs when a water system has an intake and wastewater discharge in different basins. But other situations also cause transfers. One is where a system's service area covers more than one basin. Any water used up or consumed in a portion of the service area outside of the source basin would be considered part of a transfer (e.g. watering your yard). Transfers can also occur between interconnected systems, where a system in one basin purchases water from a system in another basin.

Artificial recharge of ground water: Artificial recharge provides ground water users an opportunity to increase the amount of water available during periods of high demand--typically summer months. Past interest in artificial recharge has focused on aquifers that have declined because of heavy use and from which existing users have been unable to obtain sufficient water to satisfy their needs.

Desalination of brackish sea water: Water seems to be a superabundant natural resource on the planet earth. However, only 0.3 per cent of the world's total amount of water can be used as clean drinking water. Man requires huge amounts of drinking water every day and extracts it from nature for innumerable purposes. As natural fresh water resources are limited, sea water plays an important part as a source for drinking water as well. In order to use this water, it has to be desalinated. Reverse osmosis and electro dialysis is the preferred methods for desalination of brackish sea water.

Roof-top rain water harvesting: In urban areas, the roof top rain water can be conserved and used for recharge of ground water. This approach requires connecting the outlets pipe from roof top to divert the water to either existing well/tube wells/bore wells or specially designed wells/ structures. The Urban housing complexes or institutional buildings have large roof area and can be utilized for harvesting the roof top rain water to recharge aquifer in urban areas.

One important concept useful in water resources planning is ***Conjunctive*** or combined use of both surface and ground water for a region has to be planned for sustainable development incorporating quantity and quality aspects as well as environmental considerations. Since there would be many factors influencing the decision of projects involving conjunctive use of surface and ground water, keeping in mind the underlying constraints, the entire system dynamics should be studied to as detail as practically possible. The uncertainties of rainfall, the primary source of water, and its variability in space and time has to be borne in mind while deciding upon the planning alternatives.

It is also important to pursue watershed management through the following methodologies:

- Soil conservation
  This includes a variety of methods used to reduce soil erosion, to prevent depletion of soil nutrients and soil moisture, and to enrich the nutrient status of a soil.

- Catchment area treatment
  Different methods like protection for degradation and treating the degraded areas of the catchment areas, forestation of catchment area.

- Construction of check-dams
  Check-dams are small barriers built across the direction of water flow on shallow rivers and streams for the purpose of water harvesting. The small dams retain excess water flow during monsoon rains in a small catchment area behind the structure. Pressure created in the catchment area helps force the impounded water into the ground. The major environmental benefit is the replenishment of nearby groundwater reserves and wells. The water entrapped by the dam, surface and subsurface, is primarily

intended for use in irrigation during the monsoon and later during the dry season, but can also be used for livestock and domestic needs.

1.3.2 Water allocation priorities

While planning and operation of water resource systems, water allocation priorities should be broadly as follows:

- Drinking water
- Irrigation
- Hydropower
- Ecology
- Industrial demand of water
- Navigation

The above demands of water to various sectors are explained in the following paragraphs.

Drinking water: Adequate safe drinking water facilities should be provided to the entire population both in urban and in rural areas. Irrigation and multipurpose projects should invariably include a drinking water component, wherever there is no alternative source of drinking water. Drinking water needs of human beings and animals should be the first charge on any available water.

Irrigation: Irrigation is the application of water to soil to assist in the production of crops. Irrigation water is supplied to supplement the water available from rainfall and ground water. In many areas of the world, the amount and timing of the rainfall are not adequate to meet the moisture requirements of crops. The pressure for survival and the need for additional food supplies are causing the rapid expansion of irrigation throughout the world.

Hydropower: Hydropower is a clean, renewable and reliable energy source that serves national environmental and energy policy objectives. Hydropower converts kinetic energy from falling water into electricity without consuming more water than is produced by nature.

Ecology: The study of the factors that influence the distribution and abundance of species.

Industrial demand of water: Industrial water consumption consists of a wide range of uses, including product-processing and small-scale equipment cooling, sanitation, and air conditioning. The presence of industries in or near the city has great impact on water demand. The quantity of water required depends on the type of the industry. For a city with moderate factories, a provision of 20 to 25 percent of per capita consumption may be made for this purpose.

Navigation: Navigation is the type of transportation of men and goods from one place to another place by means of water. The development of inland water transport or navigation is of crucial importance from the point of energy conservation as well.

1.3.3 Planning strategies for a particular project

Water resource development projects should be planned and developed (as far as possible) as ***multi-purpose projects*** . The study of likely impact of a project during construction and later on human lives, settlements, socio-economic, environment, etc., has to be carried out before hand. Planning of projects in the hilly areas should take into account the need to provide assured drinking water, possibilities of hydropower development and irrigation in such areas considering the physical features and constraints of the basin such as steep slopes, rapid runoff and possibility of soil erosion.

As for ground water development there should be a periodical reassessment of the ground water potential on a scientific basis, taking into consideration the quality of the water available and economic viability of its extraction. Exploitation of ground water resources should be so regulated as not to exceed the recharging possibilities, as also to ensure social equity. This engineering aspect of ground water development has been dealt with in Lesson 8.1.

Planning at river basin level requires considering a complex large set of components and their interrelationship. Mathematical modelling has become a widely used tool to handle such complexities for which simulations and optimization techniques are employed. One of the public domain software programs available for carrying out such tasks is provided by the United States Geological Survey at the following web-site http://water.usgs.gov/software/. The software packages in the web-site are arranged in the following categories:

- Ground Water
- Surface Water
- Geochemical
- General Use
- Statistics & Graphics

There are private companies who develop and sell software packages. Amongst these, the DHI of Denmark and Delft Hydraulics of Netherlands provide comprehensive packages for many water resources applications.

Note:

Multi-purpose projects: Many hydraulic projects can serve more than one of the basic purposes-water supply, irrigation, hydroelectric power, navigation, flood control, recreation, sanitation and wild life conservation. Multiple use of project of facilities may increase benefits without a proportional increase in costs and thus enhance the economic justification for the project. A project which is which is designed for single purpose but which produces incidental benefits for other purposes should not, however, be considered a multi-purpose project. Only those projects which are designed and operated to serve two or more purposes should be described as multi-purpose.

1.3.4 Guidelines for drinking and irrigation water projects

The general guidelines for water usage in different sectors are given below:

1.3.4.1 *Drinking water*

Adequate safe drinking water facilities should be provided to the entire population both in urban and rural areas. Irrigation and multi purpose projects should invariably include a drinking water component wherever there is no alternative source of drinking water.

Primarily, the water stored in a reservoir has to be extracted using a suitable pumping unit and then conveyed to a water treatment plant where the physical and chemical impurities are removed to the extent of human tolerance. The purified water is then pumped again to the demand area, that is, the urban or rural habitation clusters. The source of water, however, could as well be from ground water or directly from the river.

The aspect of water withdrawal for drinking and its subsequent purification and distribution to households is dealt with under the course Water and Waste Water Engineering. The following books may be useful to consult.

- Waster Water Engineering by B C Punmia and A K jain
- Water and waste water engineering by S P Garg

1.3.4.2 *Irrigation*

Irrigation planning either in an individual project or in a basin as whole should take into account the irrigability of land, cost of effective irrigation options possible from all available sources of water and appropriate irrigation techniques for optimizing water use efficiency. ***Irrigation intensity*** should be such as to extend the benefits of irrigation to as large as number of farm families as possible, keeping in view the need to maximize production.

- ***Water allocation*** in an irrigation system should be done with due regard to equity and social justice. Disparities in the availability of water between head-reach and tail-end farms and (in respect of canal irrigation) between large and small farms should be obviated by adoption of a ***rotational water distribution system*** and supply of water on a ***volumetric basis*** subject to certain ceilings and rational water pricing.

- Concerned efforts should be made to ensure that the ***irrigation potential*** created is fully utilized. For this purpose, the ***command area development*** approach should be adopted in all irrigation projects.

- Irrigation being the largest consumer of freshwater, the aim should be to get optimal productivity per unit of water. Scientific water management, farm practices and ***sprinkler*** and ***drip*** system of irrigation should be adopted wherever possible.

The engineering aspects of irrigation engineering have been discussed in Section 6.

Some terms defined in the above passages are explained below:

Water allocation: Research on institutional arrangements for water allocation covers three major types of water allocation: public allocation, user-based allocation, and market allocation. This work includes attention to water rights and to the organizations involved in water allocation and management, as well as a comparative study of the consequences of water reallocation from irrigation to other sectors. A key aspect of this research is the identification of different stakeholders' interests, and the consequences of alternative institutions for the livelihoods of the poor.

Rotational water distribution system: Water allocated to the forms one after the other in a repeated manner.

Volumetric basis: Water allocated to each farm a specified volume based on the area of the farm, type of crop etc.

Irrigation Potential: Irrigation is the process by which water is diverted from a river or pumped from a well and used for the purpose of agricultural production. Areas under irrigation thus include areas equipped for full and partial control irrigation, spate irrigation areas, equipped wetland and inland valley bottoms, irrespective of their size or management type. It does not consider techniques related to on-farm water conservation like water harvesting. The area which can potentially be irrigated depends on the physical resources 'soil' and 'water', combined with the irrigation water requirements as determined by the cropping patterns and climate. However, environmental and socioeconomic constraints also have to be taken into consideration in order to guarantee a sustainable use of the available physical resources. This means that in most cases the possibilities for irrigation development would be less than the physical irrigation potential.

Command area development: The command area development programme aims mainly at reducing the gap between the potential created for irrigation to achieve higher agriculture production thereof. This is to be achieved through the integrated development of irrigated tracks to ensure efficient soil land use and water management for ensuring planned increased productivity.

Sprinkler irrigation: Sprinkler irrigation offers a means of irrigating areas which are so irregular that they prevent use of any surface irrigation methods. By using a low supply rate, deep percolation or surface runoff and erosion can be minimized. Offsetting these advantages is the relatively high cost of the sprinkling equipment and the permanent installations necessary to supply water to the sprinkler lines. Very low delivery rates may also result in fairly high evaporation from the spray and the wetted vegetation. It is impossible to get completely uniform distribution of water around a sprinkler head and spacing of the heads must be planned to overlap spray areas so that distribution is essentially uniform.

Drip: The drip method of irrigation, also called trickle irrigation, originally developed in Israel, is becoming popular in areas having water scarcity and salt problems. The method is one of the most recent developments in irrigation. It involves slow and frequent application of water to the plant root zone and enables the application of water and fertilizer at optimum rates to the root system. It minimizes the loss of water by deep percolation below the root zone or by evaporation from the soil surface. Drip irrigation is not only economical in water use but also gives higher yields with poor quality water.

1.3.5 Participatory approach to water resource management

Management of water resources for diverse uses should incorporate a participatory approach; by involving not only the various government agencies but also the users and other stakeholders in various aspects of planning, design, development and management of the water resources schemes. Even private sector participation should be encouraged, wherever feasible.

In fact, private participation has grown rapidly in many sectors in the recent years due to government encouragement. The concept of “Build-Own-Transfer (BOT)” has been popularized and shown promising results. The same concept may be actively propagated in water resources sector too. For example, in water scarce regions, recycling of waste water or desalinization of brackish water, which are more capital intensive (due to costly technological input), may be handed over to private entrepreneurs on BOT basis.

1.3.6 Water quality

The following points should be kept in mind regarding the quality of water:

1. Both surface water and ground water should be regularly monitored for quality.
2. Effluents should be treated to acceptable levels and standards before discharging them into natural steams.
3. Minimum flow should be ensured in the perennial streams for maintaining ecology and social considerations.

Since each of these aspects form an important segment of water resources engineering, this has been dealt separately in course under water and waste water engineering.

The technical aspects of water quality monitoring and remediation are dealt with in the course of Water and Waste – Water Engineering. Knowledge of it is essential for the water resources engineer to know the issues involved since, even polluted water returns to global or national water content.

Monitoring of surface and ground water quality is routinely done by the Central and State Pollution Control Boards. Normally the physical, chemical and biological parameters are checked which gives an indication towards the acceptability of the water for drinking or irrigation. Unacceptable pollutants may require remediation, provided it is cost effective. Else, a separate source may have to be investigated. Even industrial water also require a standard to be met, for example, in order to avoid scale formation within boilers in thermal power projects hard water sources are avoided.

The requirement of effluent treatment lies with the users of water and they should ensure that the waste water discharged back to the natural streams should be within acceptable limits. It must be remembered that the same river may act as source of drinking water for the inhabitants located down the river. The following case study may provoke some soul searching in terms of the peoples' responsibility towards preserving the quality of water, in our country:

Under the Ganga Action Plan (GAP) initiated by the government to clean the heavily polluted river, number of Sewage Treatment Plants (STPs) have been constructed all along the river Ganga. The government is also laying the main sewer lines within towns that discharge effluents into the river. It is up to the individual house holders to connect their residence sewer lines up to the trunk sewer, at some places with government subsidy. However, public apathy in many places has resulted in only a fraction of the houses being connected to the trunk sewer line which has resulted in the STPs being run much below their capacity.

Lastly, it must be appreciated that a minimum flow in the rivers and streams, even during the low rainfall periods is essential to maintain the ecology of the river and its surrounding as well as the demands of the inhabitants located on the downstream. It is a fact that excessive and indiscriminate withdrawal of water has been the cause of drying up of many hill streams, as for example, in the Mussourie area. It is essential that the decision makers on water usage should ensure that the present usage should not be at the cost of a future sacrifice. Hence, the policy should be towards a sustainable water resource development.

1.3.7 Management strategies for excess and deficit water imbalances

Water is essential for life. However, if it is present in excess or deficit quantities than that required for normal life sustenance, it may cause either ***flood*** or ***drought***. This section deals with some issues related to the above imbalance of water, and strategies to mitigate consequential implications. Much detailed discussions is presented in Lesson 6.2.

1.3.7.1 Flood control and management

- There should be a master plan for flood control and management for each flood prone basin.
- Adequate ***flood-cushioning*** should be provided in water storage projects, wherever feasible, to facilitate better flood management.
- While physical flood protection works like ***embankments and dykes*** will continue to be necessary, increased emphasis should be laid on non-structural measures such as ***flood forecasting and warning***, ***flood plain zoning***, and ***flood proofing*** for minimization of losses and to reduce the recurring expenditure on flood relief.

1.3.7.2 Drought prone area development

- Drought-prone areas should be made less vulnerable to drought associated problems through ***soil conservation measures***, ***water harvesting practices***, ***minimization of evaporation losses***, and ***development of ground water potential*** including ***recharging*** and ***transfer of surface water*** from surplus areas where feasible and appropriate.

Terms referred to above are explained below:

Flood cushioning: The reservoirs created behind dams may be emptied to some extent, depending on the forecast of impending flood, so that as and when the flood arrives, some of the water gets stored in the reservoir, thus reducing the severity of the flood.

Embankments and dykes: Embankments & dykes also known as levees are earthen banks constructed parallel to the course of river to confine it to a fixed course and limited cross-sectional width. The heights of levees will be higher than the design flood level with sufficient free board. The confinement of the river to a fixed path frees large tracts of land from inundation and consequent damage.

Flood forecast and warning: Forecasting of floods in advance enables a warning to be given to the people likely to be affected and further enables civil-defence measures to be organized. It thus forms a very important and relatively inexpensive nonstructural flood-control measure. However, it must be realized that a flood warning is meaningful if it is given sufficiently in advance. Also, erroneous warnings will cause the populace to loose faith in the system. Thus the dual requirements of reliability and advance notice are the essential ingredients of a flood-forecasting system.

Flood plain zoning: One of the best ways to prevent trouble is to avoid it and one of the best ways to avoid flood damage is to stay out of the flood plain of streams. One of the forms of the zoning is to control the type, construction and use of buildings within their limits by zoning ordinances. Similar ordinances might prescribe areas within which structures which would suffer from floods may not be built. An indirect form of zoning is the creation of parks along streams where frequent flooding makes other uses impracticable.

Flood proofing: In instances where only isolated units of high value are threatened by flooding, they may sometimes by individually flood proofed. An industrial plant comprising buildings, storage yards, roads, etc., may be protected by a ring levee or flood wall. Individual buildings sufficiently strong to resist the dynamic forces of the flood water are sometimes protected by building the lower stories (below the expected high-water mark) without windows and providing some means of watertight closure for the doors. Thus, even though the building may be surrounded by water, the property within it is protected from damage and many normal functions may be carried on.

Soil conservation measures: Soil conservation measures in the catchment when properly planned and effected lead to an all-round improvement in the catchment characteristics affecting abstractions. Increased infiltration, greater evapotranspiration and reduced soil erosion are some of its easily identifiable results. It is believed that while small and medium floods are reduced by soil conservation measures, the magnitude of extreme floods are unlikely to be affected by these measures.

Water harvesting practices: Technically speaking, water harvesting means capturing the rain where it falls, or capturing the run-off in one's own village or town. Experts suggest various ways of harvesting water:

- Capturing run-off from rooftops;
- Capturing run-off from local catchments;
- Capturing seasonal flood water from local streams; and
- Conserving water through watershed management.

Apart from increasing the availability of water, local water harvesting systems developed by local communities and households can reduce the pressure on the state to provide all the financial resources needed for water supply. Also, involving people will give them a sense of ownership and reduce the burden on government funds.

Minimization of evaporation losses: The rate of evaporation is dependent on the vapour pressures at the water surface and air above, air and water temperatures, wind speed, atmospheric pressure, quality of water, and size of the water body. Evaporation losses can be minimized by constructing deep reservoirs, growing tall trees on the windward side of the reservoir, plantation in the area adjoining the reservoir, removing weeds and water plants from the reservoir periphery and surface, releasing warm water and spraying chemicals or fatty acids over the water surface.

Development of groundwater potential: A precise quantitative inventory regarding the ground-water reserves is not available. Organization such as the Geographical Survey of India, the Central Ground-Water Board and the State Tube-Wells and the Ground-Water Boards are engaged in this task. It has been estimated by the Central Ground-Water Board that the total ground water reserves are on the order of 55,000,000 million cubic meters out of which 425,740 million cubic meters have been assessed as the annual recharge from rain and canal seepage. The Task Force on Ground-Water Reserves of the Planning Commission has also endorsed these estimates. All recharge to the ground-water is not available for withdrawal, since part of it is lost as sub-surface flow. After accounting from these losses, the gross available ground-water recharge is about 269,960 million cubic meters per annum. A part of this recharge (2,460 million cubic meters) is in the saline regions of the country and is unsuitable for use in agriculture owing to its poor quality. The net recharge available for ground-water development in India, therefore, is of the magnitude of about 267,500 million cubic meters per annum. The Working Group of the Planning Commission Task Force Ground-Water Reserves estimated that the usable ground-water potential would be only 75 to 80 per cent of the net ground-water recharge available and recommended a figure of 203,600 million cubic meters per annum as the long-term potential for ground-water development in India.

Recharging: Artificial recharge provides ground water users an opportunity to increase the amount of water available during periods of high demand--typically summer months. Past interest in artificial recharge has focused on aquifers that have declined because of heavy use and from which existing users have been unable to obtain sufficient water to satisfy their needs.

Transfer of surface water: Basically, it's the movement of surface water from one river basin into another. The actual transfer is the amount of water not returned to its source basin. The most typical situation occurs when a water system has an intake and wastewater discharge in different basins. But other situations also cause transfers. One is where a system's service area covers more than one basin. Any water used up or consumed in a portion of the service area outside of the source basin would be considered part of a transfer (e.g. watering your yard). Transfers can also occur between interconnected systems, where a system in one basin purchases water from a system in another basin.

1.3.8 Implementation of water resources projects

Water being a state subject, the state governments has primary responsibility for use and control of this resource. The administrative control and responsibility for development of water rests with the various state departments and corporations. Major and medium irrigation is handled by the irrigation / water resources departments. Minor irrigation is looked after partly by water resources department, minor irrigation corporations and zilla parishads / panchayats and by other departments such as agriculture. Urban water supply is generally the responsibility of public health departments and panchayatas take care of rural water supply. Government tube-wells are constructed and managed by the irrigation/water resources department or by the tube-well corporations set up for the purpose. Hydropower is the responsibility of the state electricity boards.

Due to the shared responsibilities, as mentioned above, for the development of water resources projects there have been instances of conflicting interests amongst various state holders.

1.3.9 Constitutional provisions for water resources development

India is a union of states. The Constitutional provisions in respect of allocation of responsibilities between the State and Center fall into three categories: the Union List (List-I), the State List (List-II) and the Concurrent List (List-III). Article 246 of the Constitution deals with subject matter of laws to be made by the Parliament and by Legislature of the States. As most of the rivers in the country are inter-State, the regulation and development of waters of these rivers is a source of inter-State differences and disputes. In the Constitution, water is a matter included in entry 17 of List-II i.e., State List. This entry is subject to provision of entry 56 of List-I i.e., Union List. The specific provisions in this regard are as under:

- Article 246
  Notwithstanding anything in clauses (2) and (3), Parliament has exclusive power to make laws with respect to any of the matters enumerated in List-I in the seventh schedule (in this Constitution referred to as the "Union List").
  1) Notwithstanding anything in clauses (3), Parliament, and, subject to clause (1), the Legislature of any State also, have power to make laws with respect to any of the matters enumerated in List-III in the seventh schedule (in this Constitution referred to as the "Concurrent List").
  2) Subject to clauses (1) and (2), the Legislature of any state has exclusive power to make laws for such state or any part thereof with respect to any of the matters enumerated in List-II in the seventh schedule (in this Constitution referred to as the "State List").
  3) Parliament has power to make laws with respect to any matter for any part of the territory of India not included in a State notwithstanding that such matter is a matter enumerated in the State List.

- Article 262
  In case of disputes relating to waters, article 262 provides:
  1) Parliament may by law provide for the adjudication of any dispute or complaint with respect to the use, distribution or control of the waters of, or in, any inter-State river or river-valley.
  2) Notwithstanding anything in this Constitution, Parliament may, by law provide that neither the Supreme Court nor any other Court shall exercise jurisdiction in respect of any such dispute or complaint as is referred to in clause (1).

- Entry 56 of list I of seventh schedule
  Entry 56 of List I of seventh schedule provides that "Regulation and development of inter-State rivers and river valleys to the extent to which

such regulation and development under the control of the Union are declared by Parliament by law to be expedient in the public interest".

- Entry 17 under list II of seventh schedule
  Entry 17 under List II of seventh schedule provides that "Water, that is to say, water supplies, irrigation and canals, drainage and embankments, water storage and water power subjects to the provisions of entry 56 of List I".
  As such, the Central Government is conferred with powers to regulate and develop inter-State rivers under entry 56 of List I of seventh schedule to the extent declared by the Parliament by law to be expedient in the public interest.
  It also has the power to make laws for the adjudication of any dispute relating to waters of Inter-State River or river valley under article 262 of the Constitution.

1.3.10 Central agencies in water resources sector

Some of the important offices working under the Ministry of Water Resources, Government of India (website of the ministry: http://wrmin.nic.in) which plays key role in assessing, planning and developing the water resources of the country are as follows:

- Central Water Commission (CWC)
- Central Ground Water Board (CGWB)
- National Water Development Agency (NWDA)
- Brahmaputra Board
- Central Water and Power Research Station (CWPRS)
- Central Soil and Materials Research Station (CSMRS)
- National Institute of Hydrology (NIH)
- Ganga Flood Control Commission (GFCC)
- Water and Power Consultancy Services (India) ltd (WAPCOS)
- National Projects Construction Corporation ltd (NPCC)

Detailed activities of the above departments may be obtained from the Ministry of Water Resources web-site.

Although not directly under the ministry of water resources, the National Hydropower Corporation (NHPC) as well as Rail India Technical Engineers Services (RITES) also actively participate in water resources development projects.