**Lecture 3 Irrigation Projects**

**3.1 Irrigation Projects**

In India irrigation has always been the largest user of water. Irrigation projects mainly consists engineering (or hydraulic) structures which collect, convey, and deliver water to areas on which crops are grown.

Irrigation projects may range from a small farm unit to those serving extensive areas of millions of hectares. A small irrigation project may consist of a low diversion weir or an inexpensive pumping plant along with small ditches (channels) and some minor control structures. A large irrigation project includes a large storage reservoir, a huge dam, hundreds of kilometres of canals, branches and distributaries, control structures, and other works (Asawa, 2005).

**3.2 Irrigation Projects Classification**

Irrigation projects are classified in different ways, however, in Indian context it is usually classified as follows:

**3.2.1 Based on Cultural Command Area (CCA)**

* Major Irrigation Projects: The area envisaged to be covered under irrigation is of the order over 10000 hectare (CCA>10,000 ha). This type of project consist huge storage reservoirs, flow diversion structures and a large network of canals. These are often multi-purpose projects serving other aspects like flood control and hydro power.
* Medium Irrigation Projects: Projects having CCA less than 10,000 ha but more than 2,000 ha are classified as medium irrigation projects. These are also multi-purpose surface water projects. Medium size storage, diversion and distribution structures are the main components of this type of project.
* Minor Irrigation Projects: Projects having CCA less than or equal to 2,000 ha are termed as minor irrigation project. The main sources of water are tanks, small reservoirs and groundwater pumping. A number of minor irrigation projects may exist individually within the command area of a major or medium irrigation project.

The Major and Medium Irrigation (MMI) projects are further classified into two types based on irrigation method adopted.

* Direct Irrigation method: In this method water is directly diverted from the river into the canal by the construction of a diversion structure like weir or barrage across the stream without attempting to store water. This method is practiced where the stream has adequate perennial supply. Direct irrigation is usually practiced in deltaic tracts that is, in areas having even and plane topography.
* Indirect or Storage Irrigation Method: In this system, water is stored in a reservoir during monsoon by construction of a dam across the river. The stored water is diverted to the fields through a network of canals during the dry period. Evidently indirect irrigation is adopted where the river is not perennial or flow in the river is inadequate during lean period.

**3.2.2 Based on the Way of Water Application**

The Irrigation schemes are classified into two types based on way of water application.

* Gravity/Flow Irrigation Scheme: This is the type of irrigation system in which water is stored at a higher elevation so as to enable supply to the land by gravity flow. Such irrigation schemes consists head works across river to store the water and canal network to distribute the water. The gravity irrigation scheme is further classified as:
	1. Perennial Irrigation Scheme: In this scheme assured supply of water is made available to the command area throughout the crop period to meet irrigation requirement of the crops.
	2. Non-Perennial Irrigation (Restricted Irrigation) Scheme: Canal supply is generally made available in non-monsoon period from the storage.
* Lift Irrigation Scheme: Irrigation systems in which water has to be pumped to the field or canal network form lower elevations are categorised as lift irrigation schemes.

**3.3 Some of the Major Irrigation Projects**

Since independence, India has developed several major irrigation projects. Some of the major irrigation projects are listed in Table 3.1 and also shown in Fig. 3.1.

 Table 3.1.  Major irrigation projects of India

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | River | State | CCA, ha | Year of completion |
| Bhakra Nangal Project | Sutlej | Punjab and Himachal Pradesh | 40,00,000 | 1963 |
| Beas Project | Beas River | Punjab, Haryana and Rajasthan | 21,00,000 | 1974 |
| Indira Gandhi Canal | Harike (Satlej and Beas) | Punjab | 5, 28,000 | 1965 |
| Koshi Project | Kosi River | Bihar and Nepal | 8.48,000 | 1954 |
| Hirakund Project | Mahanadi | Orisa | 10,00,000 | 1957 |
| Tungabhadra project | Tungbhadra -Krishna | AP-Karnataka | 5,74,000 | 1953 |
| Nagarjuna Sagar Project | Krishna | AP | 13,13,000 | 1960 |
| Chambal Project | Chambal | Rajasthan and Madhya Pradesh | 5,15,000 | 1960 |
| Damodar valley project | Damodar | Jharkhand, West Bengal | 8,23,700 | 1948 |
| Gandak project | Gandak | Bihar-UP | 16,51,700 | 1970 |
| Kakrapar project | Tapti | Gujarat | 1,51,180 | 1954 |
| Koyna Project | Koyna- krishna | Maharashtra |   | 1964 |
| Malprabha project | Malprabha | Karnataka | 2,18,191 | 1972 |
| Mayurakshi Project | Mayurakshi | West Bengal | 2,40,000 | 1956 |
| Kangsabati project | Kangsabati and Kumari river | West Bengal | 3,48,477 | 1956 |

 

Fig. 3.1. Major Irrigation Projects of India.

(Source: <http://dilipkumar.in/india/rivers/dams.php>: accessed on June 17, 2013)

**3.3.1 Major, Medium and Minor Irrigation Projects - Potential Created and Utilized**

Demand for irrigation water in India is huge; however, the limits to storage and transfer of water restrict the potential for irrigation. The assessment of Ultimate Irrigation Potential (UIP) needs to be periodically reviewed to account for revision in scope, technological advancement, inter basin transfer of water, induced recharging of ground water, etc. The UIP of projects covered under the Accelerated Irrigation Benefit Program (AIBP) is of the order of 139.9 Mha. Potential Created (PC) & Potential Utilised (PU) up to end of IXth Plan are given in Table 3.2.

 Table 3.2. Sector wise UIP, PC and PU Till end of IXth Plan (in Mha)

|  |  |  |  |
| --- | --- | --- | --- |
| Sector | UIP | PC | PU |
| MMI | 58.47 | 37.05 | 31.01 |
| Minor Irrigation (MI) |
| Surface water | 17.38 | 13.6 | 11.44 |
| Ground water | 64.05 | 43.3 | 38.55 |
| Sub-Total | 81.43 | 56.9 | 49.99 |
| Total | 139.9 | 93.95 | 81.00 |

**3.3.2 Procedure for Setting up a MMI Project in India**

The state planning to start a new irrigation project shall have to prepare a report based on “Guidelines for Submission, Appraisal and Clearance of Irrigation and Multipurpose Projects” brought out by the Central Water Commission (CWC). This report has to be sent to the project appraisal organization of the CWC for the clearance with a note certifying the following:

1. All necessary surveys and investigations for planning of the proposed irrigation project and establishing its economic feasibility have been carried out depending on certain guidelines.
2. 10% of the command area of the proposed project has been investigated in details in three patches of land representing terrain conditions in the command for estimation of the conveyance system up to the last farm outlets.
3. 10% of the canal structures have been investigated in full detail.
4. Detailed hydrological, geological, construction material investigations have been carried out for all major structures, that is, dams, weirs (or barrages, as the case may be), main canal, branch canal up to distributaries carrying a discharge of 10 m3s-1.
5. Soil survey of the command area has been carried out as per IS 5510-1969.
6. Necessary designs for the various components of the project have been done in accordance with the guidelines and relevant Indian standards.Necessary studies for utilization of ground water have been done with special regard to the problem of water logging and suitable provisions have been made for conjunctive use of ground water and drainage arrangements.
7. The cost estimates and economic evaluations were carried out as per guidelines issued by the CWC.

It may be noted that similar report has to be made even for multipurpose projects having irrigation as a component. Apart from the above techno-economic studies carried out by the state design organization, the project report should be examined by the state-level project appraisal/technical advisory committee comprising representatives of irrigation, agriculture, fisheries, forests, soil conservation, ground water, revenue and finance departments and state environmental management authority. The techno-economic feasibility report should also be supplemented with “Environmental Impact Assessment Report” and “Relief and Rehabilitation Plan” because of major impact of an irrigation project on environment.

The project proposal submitted to the CWC shall be circulated amongst the members of the advisory committee of the ministry of water resources for scrutiny. Once the project is found acceptable it shall be recommended for investment clearance to the planning commission and inclusion in the five year plan/annual plan.

**3.3 Environmental Impact of Irrigation Projects**

All water resource projects, whether for irrigation or for hydro-electric power or for flood control or for water supply, are constructed for the well-being of human beings and have definite impact on the surrounding ecosystems and environment. If the projects are properly planned and suitably designed, the adverse impacts can be minimized. Environmental evaluation or assessment is generally done at the planning and design stages of the project. There is a need to develop a complete checklist of the impacts and an environmental evaluation system to quantify the impacts of irrigation projects.

The purpose of the assessment is to ensure that decision makers consider the ensuing environmental impacts when deciding whether or not to proceed with a project. The International Association for Impact Assessment (IAIA) defines an environmental impact assessment (EIA) as "the process of identifying, predicting, evaluating and mitigating the biophysical, social, and other relevant effects of development proposals prior to major decisions being taken and commitments made." EIAs are unique in that they do not require adherence to a predetermined environmental outcome, but rather they require decision ­makers to account for environmental values in their decisions and to justify those decisions in light of detailed environmental studies and public comments on the potential environmental impacts of the proposal.