

POWER POINT PRESENTATION

ON

IRRIGATION ENGINEERING

IRRIGATION ENGINEERING

It may be defined as the science of artificial application of water to soil for raising crops.

OR

It is the science dealing with planning, designing, construction, operation and maintenance of various irrigation works.

NECESSITY OF IRRIGATION

The crops need adequate water at the various stages of its growth. The nature supply of water to the agricultural land is through rain. If the rainfall is sufficient to meet the total water requirements of the crop and it occurs at the time when the crops require it, then there is no need of irrigation.

But, India is a tropical country with a vast diversity of climate, topography and vegetation. In India, rainfall varies to a large extent from place to place. It also varies in amount of rainfall at different places. To get the maximum yield of crop, it becomes necessary to supply the optimum quantity of water at the right times as per the requirement of the crop. This is possible only through a systematic irrigation system.

HISTORY OF DEVELOPMENT OF IRRIGATION IN INDIA

History of irrigation can be summarised as give below.

1. Irrigation in Ancient India: *In the ancient days irrigation works in our country comprised dug wells, small tanks and diversion works on perennial rivers. People in vedic period were dependent on rainfall but they also used to irrigate their crops with dug wells and inundated waters. In 10th and 13 th century period, various irrigation works were carried out in Tamil Nadu and Andhra Pradesh such as veeranarayana tank and Anantara Sagar respectively.*

2. Irrigation development during British Period: During British period (1800-1947), the Britishers also initiated activities in the field of irrigation. In the first half of nineteenth century, various canals were remodelled, renovated and converted into perennial canals.

The major canal works like sirhind, the Agra and the Mathura canals and the periyar Dam and canals were constructed during British rule.

3. Development of Irrigation after Independence: At the time of independence net irrigated area was about 28.2 million hectares which after partition remained only 19.4 million hectares. Major canal systems including Sutlej and Indus systems went to West Pakistan and the area of fertile Ganga, Brahmaputra delta region went to East Pakistan, which is presently Bangladesh.

1. Major Irrigation Projects: The irrigation projects which cover an area of more than 10,000 hectare are classified as major projects.

Major irrigation projects in India are as follow:

(1.) Bhakra Nangal Project

(2.) Indira Gandhi Canal Project

(3.) Beas Project

(4.) Chambal Project

(5.) Hirakund Project

2. Medium Irrigation Projects: *The irrigation projects which cover area between 2000 ha to 10,000 ha are classified as medium projects. Small dams and small canals networks are under medium irrigation projects.*

3. Minor Irrigation Projects: *The irrigation projects which cover area less than 2000 ha are classified as minor projects. Minor irrigation schemes includes the construction of open wells, tube wells, small canals and tanks. it serves a substantial part of the total irrigation in the country.*

WATER REQUIREMENT OF CROPS

- *Due to the presence of a wide range of geological and climatic conditions, Indian agriculture is diverse and complex with both irrigated and dry land areas, capable of producing most of the food and horticultural crops of the world.*
- *1. Crop period: Crop period is the time in days that a crop takes from the instant of its sowing to that of its harvesting.*
- *2. Base period: Base period of a crop refers to the whole period of cultivation from the time when irrigation water is first issued for preparation of the ground for planting the crop to last watering.*
- *3. Delta: Delta is the total depth of water required by a crop during the entire period of the crop in the field . For example, if a crop requires about*
- *12 watering at an interval of 10 days and a water depth of 10 cm in every watering, than the delta is 12 multiply 10 = 120cm.*

4. Duty : Duty is defined as the number of hectares/acres that one cumec or cusec of water can irrigate during the base period.

5. Relation between duty and delta:

$$\text{Delta} = 8.64 \times (B/D) \text{ metres}$$

where D = duty in hectares/ cumec

B = base period in days

6. Gross Command Area (GCA) : The GCA is the total area lying between drainage boundaries which can be commanded or irrigated by canals.

7. Culturable Command Area (CCA): The CCA also contains unfertile barren land, alkaline soil, local ponds, villages, etc. These are known as unculturable areas. The remaining area is called CCA.

Therefore, $CCA = GCA + \text{Unculturable area}$

PRINCIPAL CROPS IN INDIA

Food and Non-food supplying plants grown over soil are called crops. In india, more than 70% of the population is directly or indirectly connected with agriculture.

Crops are mainly classified as

- 1. Kharif crops**
- 2. Rabi crops**

- 1. Kharif crops :** *The crops which are grown in kharif crop season (summer season) is known as kharif crops. For ex Rice, Maize, Jowar, Arhar etc.*
- 2. Rabi crops :** *The crops which are grown in rabi crops season (winter season) are known as Rabi crops. For ex Wheat, Barley, Gram, Peas, Potatoes.*

METHOD OF IRRIGATION

The success of crops in most areas is dependent on timely monsoon and sufficient rainfall spread through most of the growing season. Hence, poor monsoon cause crop failure.

India has a wide variety of water resources and a highly varied climate. Several different kinds of irrigation systems or methods are adopted to supply water to agriculture land depending on the kinds of water resources available.

IRRIGATION METHOD

The method of applying water to the land may be of there types:

- 1. Surface irrigation methods.*
- 2. Sub-surface irrigation methods.*
- 3. Sprinkler irrigation methods.*

1. Surface irrigation methods: In this method irrigation water is applied by spreading in the form of sheet or small streams on the land to be irrigated.

- (a) Free flooding method
- (b) Boarder flooding method

2. Sub- surface irrigation methods: In this method, the water is applied only to the root zone of the crops with the help of underground perforated or perforated or porous pipe line network in the ground.

Flow irrigation: It is that process of irrigation in which water flows from its source to the field by gravity. Flow irrigation is also known as canal irrigation. It may further be classified as given below.

- 1. Perennial Irrigation.
- 2. Non-perennial Irrigation.



Sprinkler Irrigation: Water is applied to the land in the form of spray through networks of pipe. It resembles a light rainfall in the form of a drizzle. The sprinkler irrigation is also known as overhead irrigation. The greatest advantage of this type of irrigation is the adaptabilities to use under conditions where surface irrigation methods are not efficient.



Lift Irrigation: The process of supplying water to the field for irrigation crops by lifting it from its sources of supply is called lift irrigation. The sources may be tube well or well in which water comes from underground water resources.

1. ***Tube well irrigation***
2. ***Submersible pump***



Drip Irrigation: In this method water is applied in the form of drops directly near the base or roots of the plants through a special outlet device called an emitter or a dipper. These emitters have drip nozzles to supply water drip by drip at a very slow rate. The water applied near the root zone of plants spread laterally as well as vertically because of capillary action in the soil.

Component of a Drip irrigation units:

- 1. Control head.***
- 2. Pipe network.***
- 3. Emitters.***

CANALS

A canal is an artificial channel, generally trapezoidal in shape, constructed on ground to carry water to the fields either from a river or from a tank for various purposes such as irrigation, Power generation, navigation, etc.

1. Irrigation canal

2. Power canal or hydel canal

3. Navigation canal

CANAL LINING

Laying of the impervious layer which protects the bed and sides of the canal is called canal lining.

This layer must be of sufficient strength in order to resist water pressure.

Types of canal lining.

1. Concrete lining. 2. Brick lining

1. Concrete lining:- The lining done by concrete is called concrete lining

2. Brick lining:- The lining done by bricks is known as brick lining.

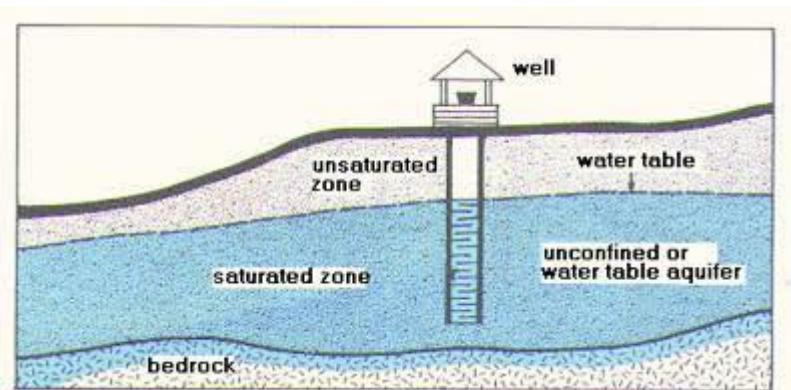
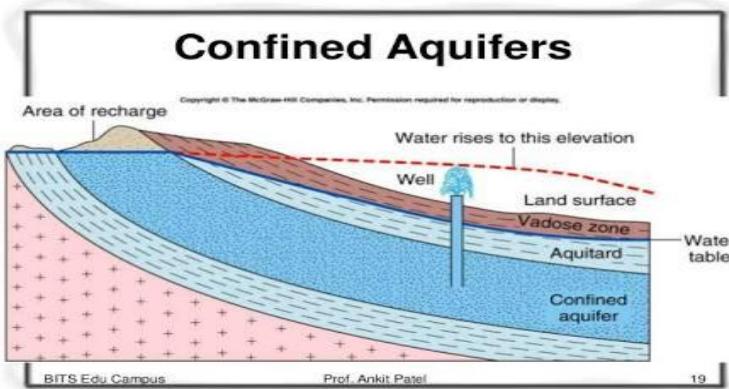
TUBE WELL IRRIGATION

Irrigation is concerned, open wells and tube wells are very popular means of irrigation in different parts of the country. The main source of water supply has been ground water from the beginning of the history.



1. **Water Table**:- *The water table is the surface of a water body which is constantly adjusting itself towards an equilibrium condition.*
2. **Cone of Depression**:- *When the water level in the well decreases due to pumping, the water level in the neighbourhood also falls down.*
3. **Radius of Influence**:- *The base of cone is circle of radius R, known as circle of influence. The radius of circle is called radius of influence.*
4. **Depression Head** :- *Height of cone of depression at some distance from the main well is called depression head.*

- **Confined aquifer:-** It is that aquifer in which groundwater is confined under a pressure more than atmospheric pressure by overlying relatively impermeable strata.
- **Unconfined aquifer:-** It is that aquifer in which water table forms the upper surface of the zone of saturation.



DAMS

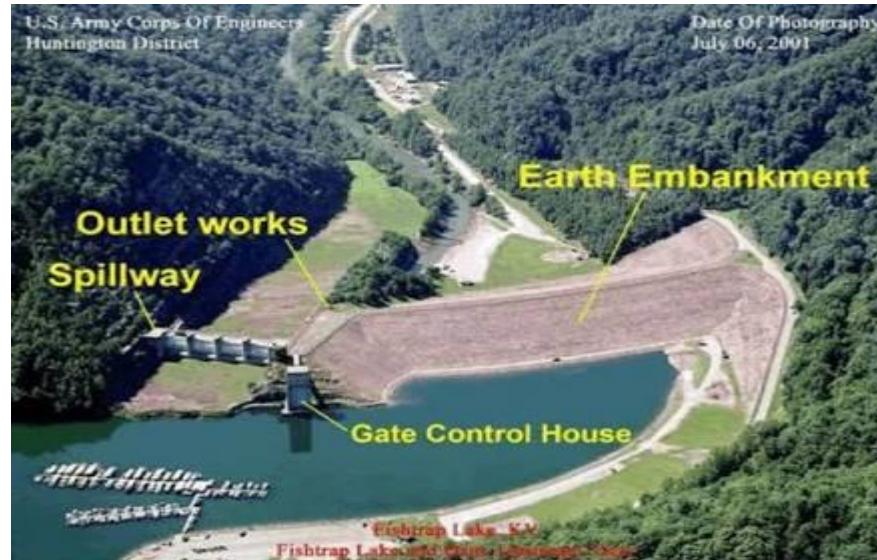
A dam is a hydraulic structure constructed across a river to store water on its upstream side.

Classification of Dams

- 1. Storage dams.*
- 2. Diversion dams.*
- 3. Detention dams.*

EARTH DAMS

Earth dams have been built since the early days of civilization. They are the most ancient types of embankments, as they are built with natural materials such as gravel, sand, silt and clay are called earth dams.

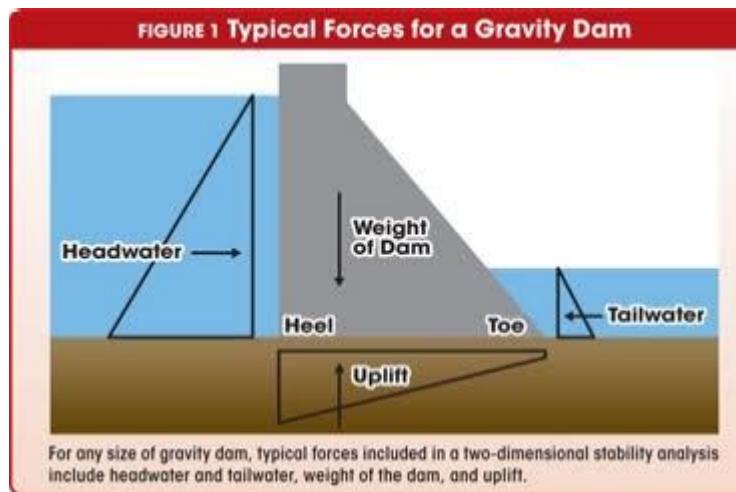


GRAVITY DAM

A gravity dam is the one in which the external forces such as water pressure, wave pressure, silt pressure, uplift pressure etc. are resisted by the weight of the dam itself. The gravity dams may be constructed either of masonry or of concrete.

Types of gravity dam:-

1.Rubble masonry dam 2. Concrete dam



SPILLWAY

A spillway is a structure provided at a dam site, for effectively disposing of the surplus water from the upstream to downstream. Spillways are provided for all dams as a safety measure against overtopping and the consequent damage and failure.

ENERGY DISSIPATORS

The downstream protection work provided for dissipating the energy of water are called energy dissipators or dissipation devices and the process is known as energy dissipation.

CANAL HEADWORKS

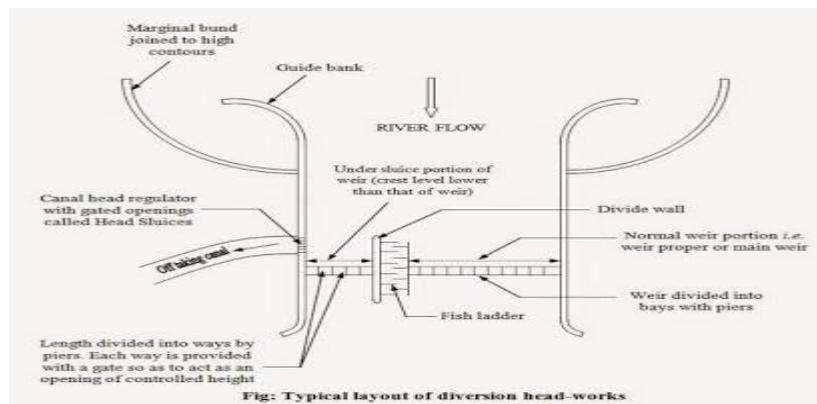
The works, constructed at the head of the main canal for diverting water in it from the river for irrigation purposes, are known as canal headworks.

Weir :- *The weir is a solid construction put across the river to raise its water level and divert the water into the canal.*

Barrage :- *Heading up of water is affected by the gates alone. No solid construction is put across the river. The crest level in the barrage is kept at a low level.*

Fish Ladder: Fish ladder is use to move fishes from upstream to downstream during the beginning of winter season

Divide wall: This wall is use for separate under sluices from rest of the weir



CROSS DRAINAGE WORKS

Cross drainage works are structure constructed for carrying the canal water across the natural drain or river intercepting the canal.

Types of cross drainage works:-

- 1. Aqueduct 2. super passage*
- 3. Level Crossing 4. Inlet and outlet.*

RIVER TRAINING WORKS

The works provided for confining irregularities of rivers within the definite limits and for preventing outflanking of the weir are called river training works.

- 1. Guide Banks: The banks constructed for confining and guiding the flow of the river in a reasonable water way are called guide banks.*
- 2. Pitched islands: An artificially constructed island in the river bed and protected by stone pitching on all sides is known as pitched island.*

WATERLOGGING

An agricultural land is said to be waterlogged when the soil pores within the root zone of the crops are saturated to such an extent that normal circulation of air within the soil pores is totally cut-off and productivity of soil is affected.

- *Causes of Waterlogging: The main factors causing waterlogging are as given below.*
 - 1. Over irrigation*
 - 2. Seepage from canals*
 - 3. Obstruction of a natural drainage*
 - 4. Obliteration of natural drainage.*

- *Remedial measures for the prevention of waterlogging:-*

The following measures can be taken to prevent waterlogging or to relieve the area already affected by waterlogging:

1. *Restricted irrigation*
2. *Efficient surface drainage*
3. *Reducing seepage from canals*
4. *Improving natural drainage of the area*
5. *Prevention of seepage from water reservoir*
6. *Changing the crop pattern.*