UNIT - IV

CANAL IRRIGATION

TYPES OF IMPOUNDING STRUCTURES: -

1. Weir : -

A weir is an obstruction constructed across the river to effect ~~to~~ a pondage & rise water level locally & to divert part or all the supplies into the canal.

The weir is of height limited to 6m & the volume & duration of pondage is comparatively small.

Ponding of water is done against a rised crest & partly against shutter 1 to 2 m ht.

Salient Features of weir: -

The crest level usually high set, is determined by the permissible afflux under maximum floods the discharge intensity per meter run & pond level.

The crest level is either constructed with top @ pond level such that ponding is done against it or @ a lower level. supplemented by shutter or counter balanced gate.

Advantages of weir :-

Low initial cost.
Simple in construction.

Disadvantages of weir :-

Lakes in speed & effective control possible with a gated weir.
Operation of shutter involves considerably time & labours.
Excessive afflux in floods.
silting upstream due to high set crest.
Control over river flow can not be had fully as in the case of barrages.

Classification of weir :-

1. classification According to design of flood floor.
   a. Gravity weir
   b. Non Gravity weir.
2. According to material of Construction.
   a. Rock fill weir
   b. Concrete weir.
   c. masonary weir.

3. Based on Control of Surface flow 2

a. vertical drop weir.
b. sloping glacis weir.
c. Barrage.

4. According to function Served.

a. Storage weir.
b. waste weir.
c. Pickup weir
d. Diversion weir.

a. Barrage :-

It is defined as a diversion structure across a river fitted with a series of gates over its entire length for creating the required pondage & for relating flood discharge to regulate the water surface level above it & pattern of flow upstream.

Advantages :-

Better control on the river in flood both inflow & outflow are regulated by means of operation of gates.

Efficient controll of the river channel leading to the under sluices.

Better Control over silt entry into the Canal.

Improved facilities of inspection & repaires.

Controll over flow conditions.

Lesser afflux due to optimum water way with low set crest.

Disadvantages :-

High cost.

Longer Construction period.

Differentiate b/w Barrage & weir :-

Barrage	Weir
1. Low set crest	High set crest.
2. Ponding is done by means of gates.	Ponding is done against the raised crest or partly against crest & partly by shutters.
3. Gated over entire length	Shutters in part length.
4. Gates are of greater height	Shutters are of smallest height upto 2m.

Barrage	Weir
5. Gates are rised clear off the high flood to pass flood.	Shutters are dropped to pass flood.
6. Perfect Control on river flood.	No control of river low flood.
7. Gate Convenient to operates.	Operation of Shuttering is slow, involve labour & time.
8. High flood can be passed with minimum afflux	High flood can be excessive afflux.
9. Less Silting upstream due to low set crest.	Rised crest passing silt in upstream.
10. Longer construction period	Shorter construction period.
11. Silt removal done through under sluice.	No means for silt disposal.
12. Road & rail bridge can be constructed at low crest.	No possible to provide road, rail bridge.
13. Costly structure.	Relatively Cheaper structure.

Dam :-

A dam may be defined as hydraulic structure constructure across the river to store the supply for a longer duration & release through design outlet.

Gravity Dam :-

It is a structure, so it is rest their own weight of the forces acting upon it.

It requires minimum maintenance and most commonly used dams. The ratio of base width & height is less than 1:1.

Types of Gravity Dam :-

Stone masonry gravity dam.
Brick masonry gravity dam
Rock " " "
Concrete gravity dam.

Forces Acting on Gravity Dam :-

1. weight of the dam.
2. water pressure.
3. Uplift pressure.

4. Wave pressure.
5. Silt pressure.
6. Wind pressure.
7. Ice or Snow pressures.

Causes of failure of Gravity Dam:-

Over turning
Sliding
Cracking
Over stressing.

Advantages of Gravity Dam:-

More strong & stability of structure.
More suitable as an overflow spillway crest.
Can be constructed to any height of foot foundation.
Require least maintenance.
It is used for heavy rainfall area.
Failure of dam, if any is not sudden

Disadvantages:-

High initial cost.
Required skilled labour.

More time for construction.
Design is very difficult.
Required sound rock foundation.

Conditions or Application of Gravity Dam: -

Reduce the cost & length.
Construction material is easily available.
Good rock is available for foundation.
Surplus weir exist on the ground.

Diversion Head works: -

Any hydraulic structure which supplies water to the off taking canal is called head work.

The Diversion head work serves to divert the required supply into the canal from the river.

Objectives: -

To raise the water level at the head work.

To control the entry of silt into canal and to control ~~development~~ deposition of silt at the

head of the canal.

To control the fluctuation of water level in the river during different seasons.

Selection of Site for Diversion Head Works :-

At the site, the river should be straight and narrow.

The river banks should be well defined.

The valuable land should not be submerged when the weir or barrage is constructed.

The elevation of the site should be much higher than the area to be irrigated.

The site should be easily accessible by roads or railways.

The materials of ~~construction~~ Construction should be available in vicinity of the site.

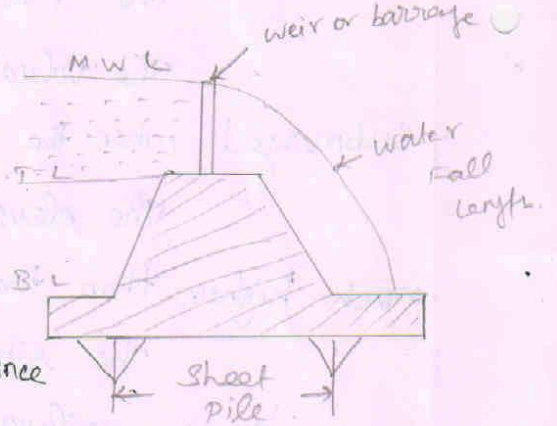
The site should not be fair away from the command area of the project to avoid transmission loss.

Canal Drops :-

These hydraulic structure provided at suitable point to escape the difference in bed slope and ground slope and to bring the water down the canal bed line.

Types of Canal Drops (or) Fall :-

1. Ogee Canal fall :-



This type of fall has Convex & Concave curve with an aim to provide smooth transportation of water & to reduce disturbance & impact.

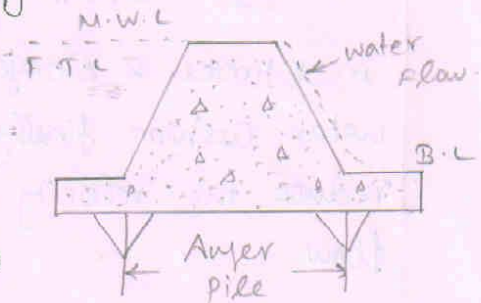
Ogee fall had a following defects

1. There was consider draw down effect on the upstream resulting is bed erosion.
2. Due to smooth transportation kinetic energy was preserved till sufficient & depth of water.

2. Rapid Canal Fall :-

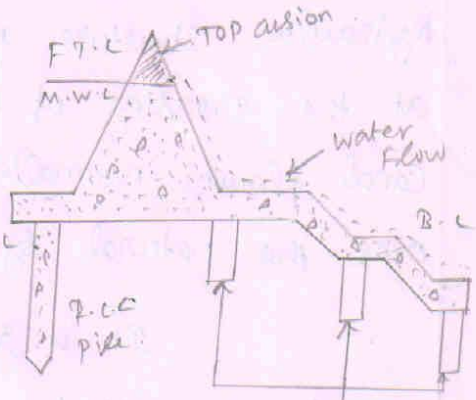
It consists of sloping at one vertical to Horizontal the general slope admitted timber traffic.

The cost of construction is very high.



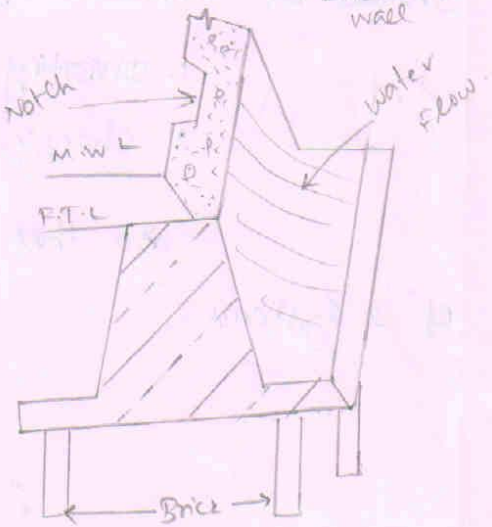
3. Stepped Fall :-

It was development of rapid fall such type of wall provided at the main canal escape.



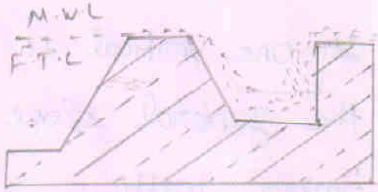
4. Notch Fall :-

The fall consists of one or more trapezoidal notches in high crest wall.



5. Sarda fall :-

It consists of falling in 2 times & storage in water cushion finally and reduce the velocity of water flow.



Cross Drainage works :-

The cross drainage works is a hydraulic structure which needs to be constructed at the crossing of natural stream and an irrigation canal flowing normally at right angle under near or over the natural system.

It is generally a very costly items & should be avoided by,

1. Diverting one stream into another.
2. Changing the alignment of canal so that it crosses below the junction of 2 systems.

Necessity of Cross Drainage work :-

The water shed canal don't cross natural drainage. But in actual orientation of the canal network this ideal condition may not be available & the obstacles like natural drainage may be present across the canal.

So the cross drainage work must be provided for running the irrigation system.

At the crossing point, the water of the canal & the drainage get intermixed, so far the smooth running of the canal with it's designed discharge the cross drainage work are required.

The site condition of the crossing point may be such that without any suitable structure the water of canal & drainage cannot be diverted to their natural direction, so the cross drainage work must be provided to maintain the natural drainage of flow. natural direction of flow.

Types of Cross Drainage works :-

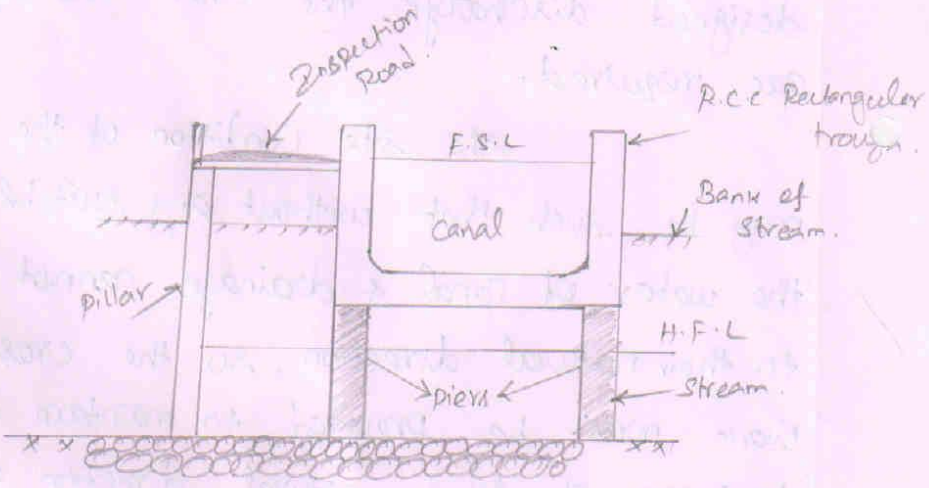
1. Canal passing over the natural drain.

Aqueduct

Syphon Aqueduct.

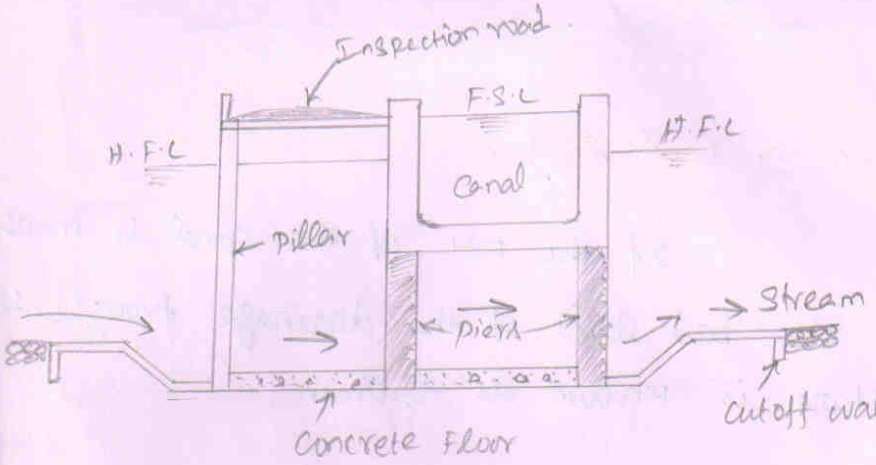
Aqueduct :-

When the HFL of the drain is sufficiently below the bottom of the canal such that the drainage water flows freely under gravity, the structure is known as Aqueduct.



Syphon Aqueduct :-

If HFL of the dam is much higher above the canal bed & water runs under syphonic action through the aqueduct barrels, the structure is known as syphon aqueduct.

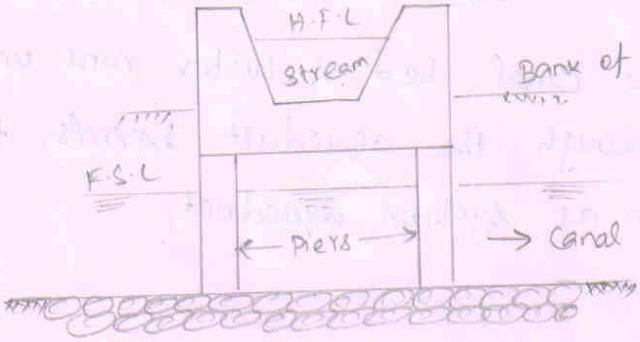


d. Canal Passing below the natural drain :-

Super passage.
Syphon or canal syphon

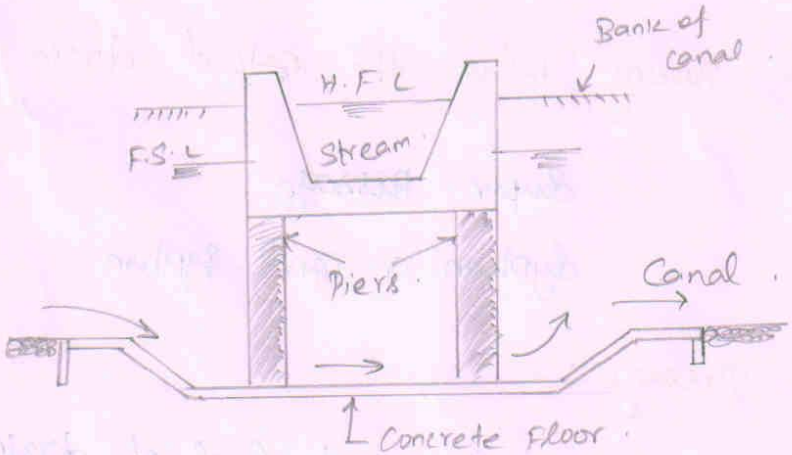
Super Passage :-

If the bed level of drainage is sufficiently above the full supply level of the canal, the structure is known as super passage.



Syphon or Canal Syphon :-

If the FSL of the canal is much above the bed level of the drainage trough, the structure is known as Syphon.



3. Canal & Natural Drain Intersecting Each Other 9

At the same Level.

Level crossing

Inlet & Outlet.

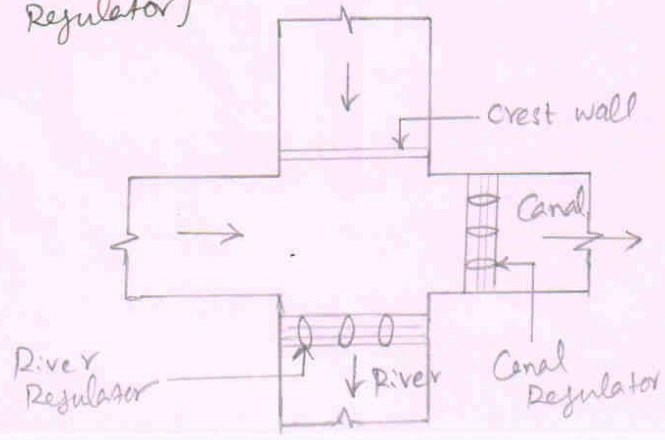
Level crossing :-

when the bed level of canal & the drain are approximately the same and discharge in drain is high, the cross drainage work constructed is called Level crossing.

Where water of canal & drain is allowed to mix and water is disposed through canal & drain in required quantity with the help of regulators.

Crest wall - Construct across drainage just at upstream side.

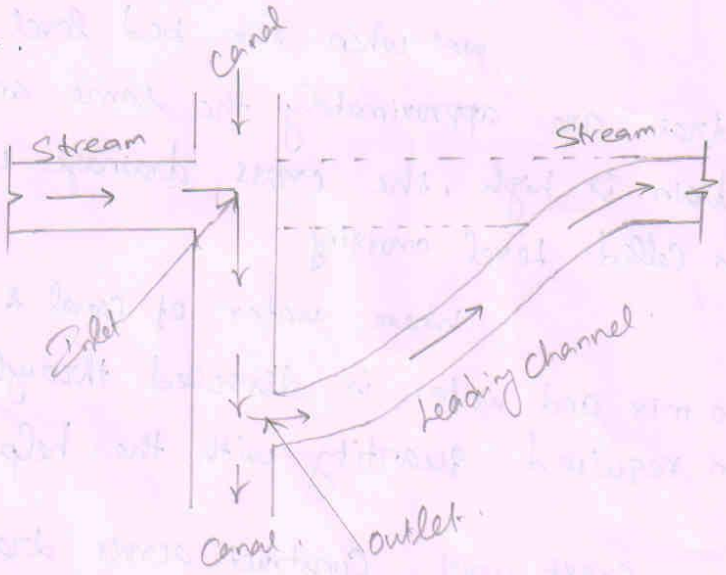
Drainage Regulator & Canal Regulator } - provided across the drainage just at Down stream side.



Inlets & Outlets : –

When canal meets a small drain at same level, water from drain is allowed to enter the canal as inlet.

At some distance from this inlet point, some amount of water is allowed to drain as outlet.



Canal Lining or River Training work :-

Objectives :-

- To controll seepage
- To prevent water logging
- To increase the capacity of canal.
- To increase grass command area.
- To protect the canal from the damage flood
- To Controll the growth of weeds

Types of Canal Lining or River Training work :-

- Plain cement concrete.
- Brick lining.
- Reinforced concrete lining.

Factors Affecting types of Lining :-

- Imperviousness.
- Smoothness.
- Durability.
- Economic.
- Site Condition.
- Life of project.
- Availability of Construction material.

Advantages :-

It reduce the maintence cost of canal.

It prevent the subsoil salt to come in with the canal water.

It provides the stable section of the canal.

The increase velocity, the possibility of silting canal.

It controll the water logging & hence the bad effect of water logging / eliminating.

Disadvantages :-

It takes too much time to complete the project work.

It involves may difficulty for damage section of lining.