Diversion Works

Design of Hydraulic Structures (CVL381)

Saumava Dey

Assistant Professor

Department of Civil Engineering

Block V, Room No. 304

Indian Institute of Technology Delhi

Email: saumavadey@civil.iitd.ac.in

Canals

- What is a canal?

  "An artificial or human-made waterway"

- Why are canals built?

1. **To transport water from a river for irrigation**

✓ *Indira Gandhi Canal, Rajasthan (longest canal in India)*

✓ *Buckingham canal, Andhra Pradesh*

✓ *Sirhind canal, Punjab*

✓ *Agra canal, Uttar Pradesh*

2. **To allow boats or ships to pass from one waterbody to another**

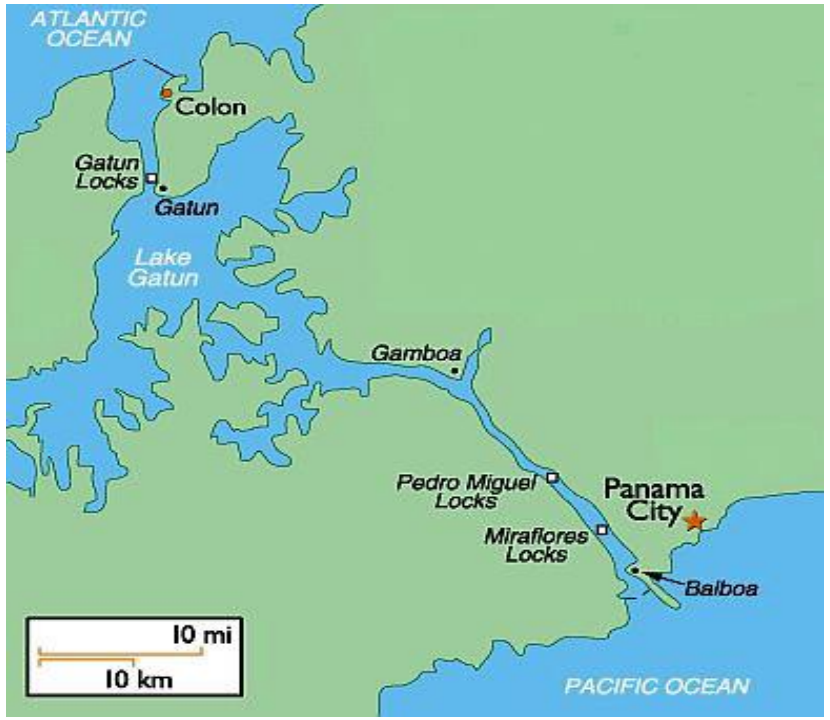
✓ *Panama canal in Panama connecting the Atlantic Ocean with the Pacific Ocean*

✓ *Suez Canal in Egypt connecting the Mediterranean Sea with the Red Sea*

Indira Gandhi Canal

Panama Canal

- **"Lock-type canal"**
- 82 km long canal connecting the Atlantic ocean with the Pacific ocean
- What led to the construction of Panama canal?
- How does the Panama Canal work?

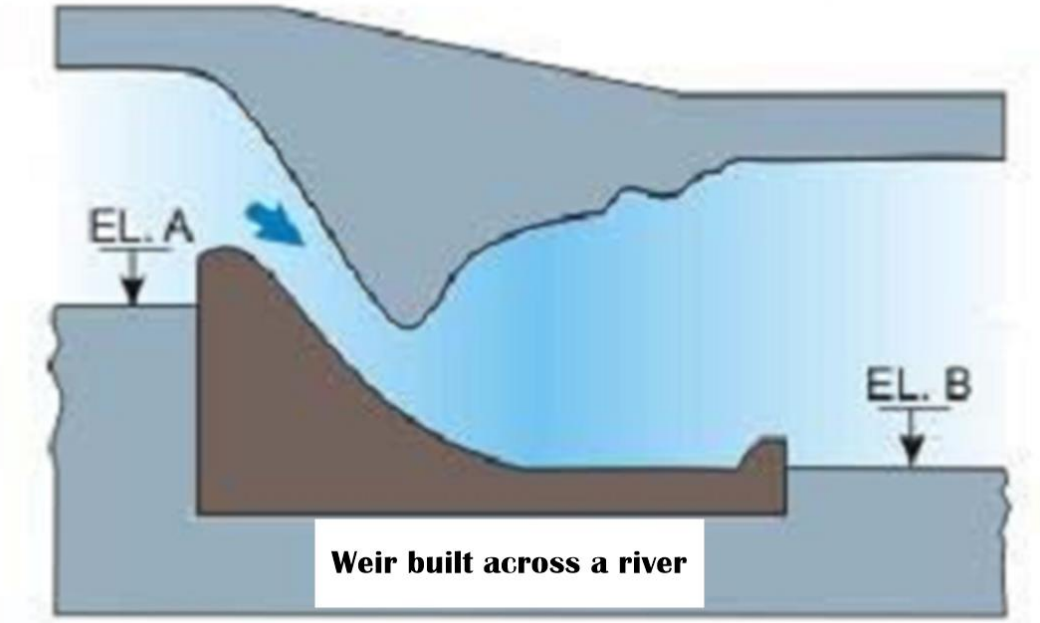


Suez Canal

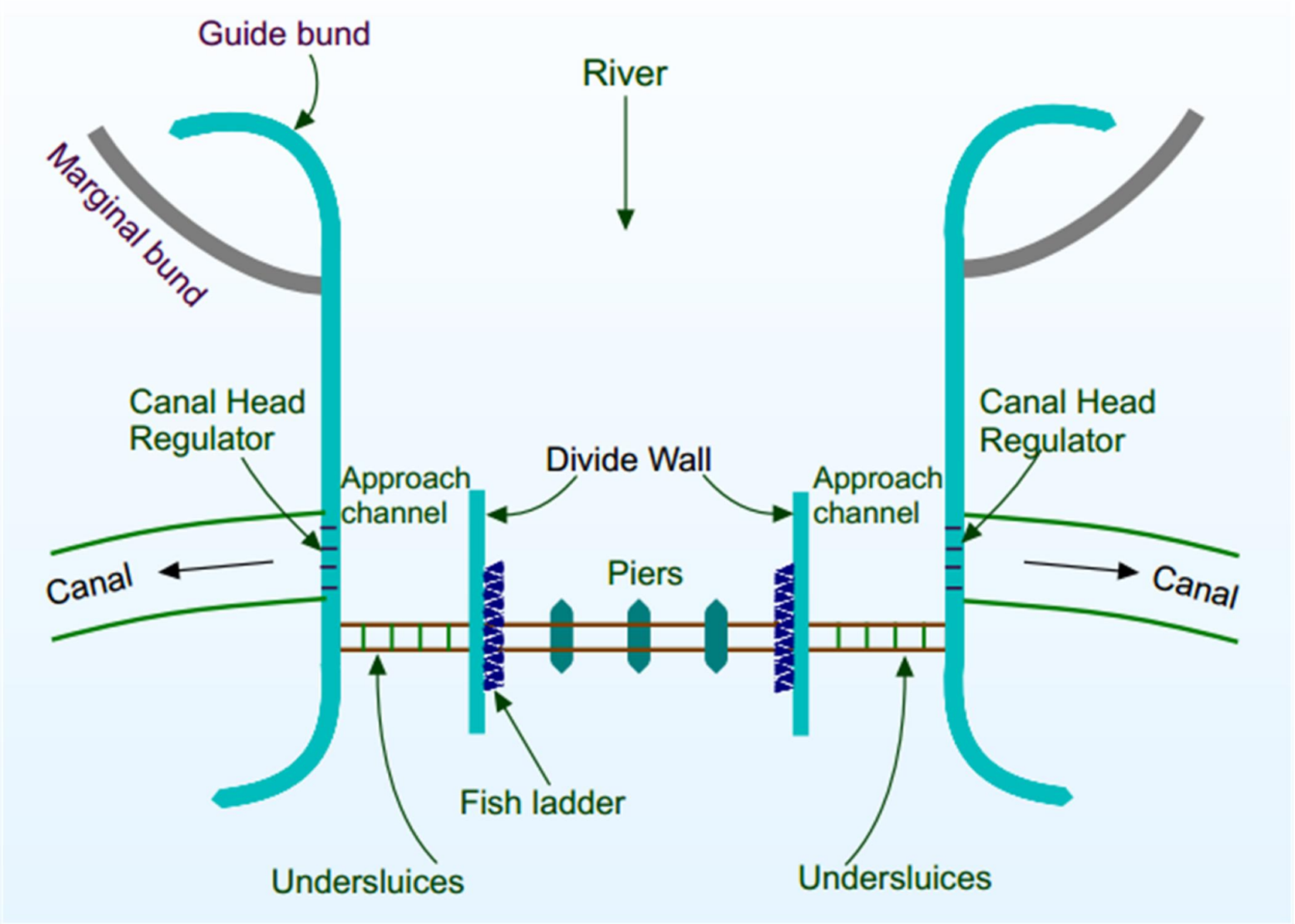
- Connects the Red Sea with the Mediterranean Sea.
- What led to the construction of Suez canal?
- ***How does the Suez Canal differ from the Panama Canal work?***

Canal Headworks

- An irrigation canal draws water from a river for its supply.
- In order to divert water from a river into a canal two types of constructions are required:
  - ✓ **Head Works** – across the main river.
  - ✓ **Head Regulator** – at the canal entrance
- Canal headworks can be classified as:
  1. ***Diversion works*** – *Structures constructed on the main river to raise its normal water level. Increased water level helps in diverting water into the canal with a specified velocity.* (Weir / Barrage)
  2. ***Storage works*** – *Apart from diversion, surplus water is stored to meet the requirements during the low-flow seasons.* (Dams)



Layout of a Diversion Work

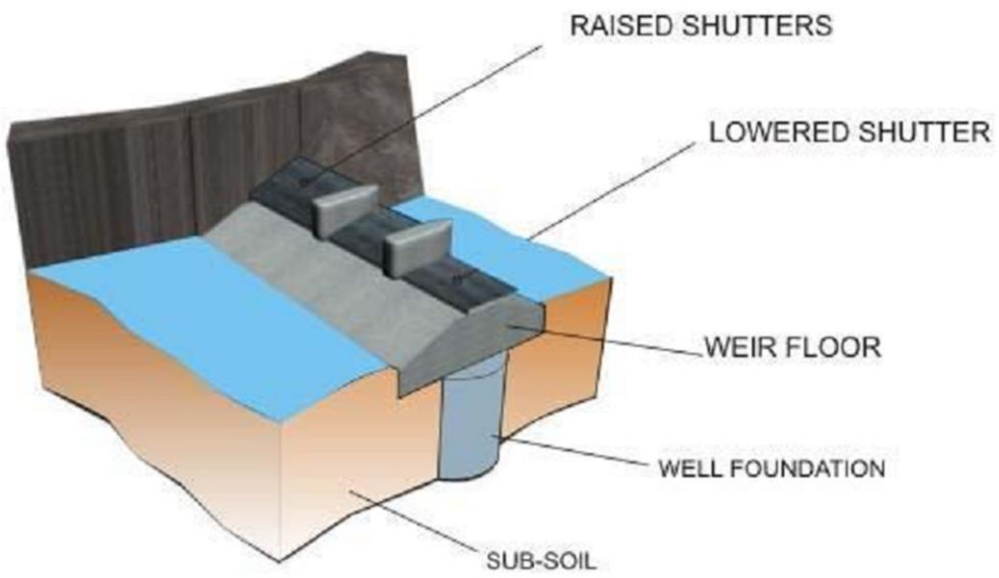


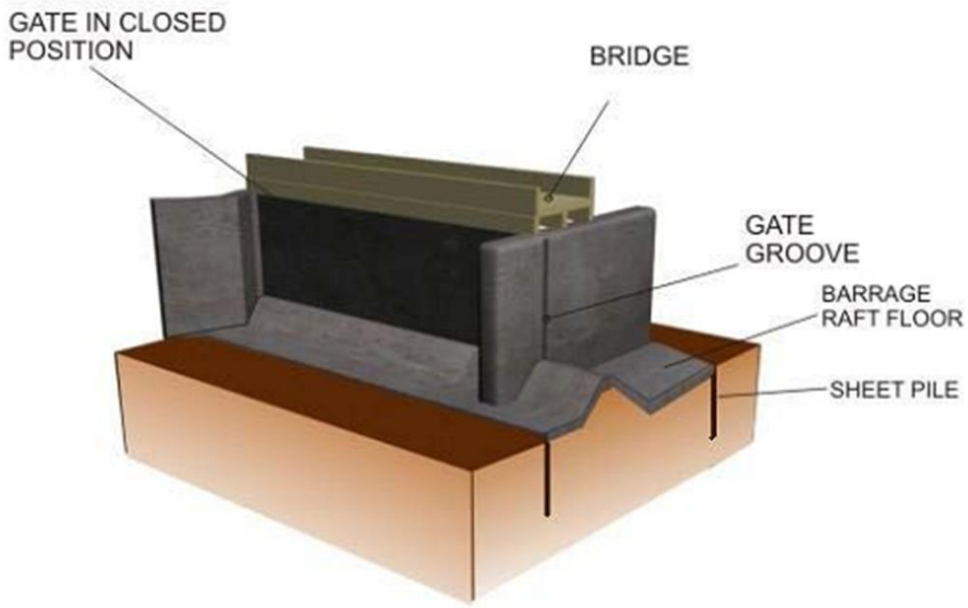
Components:

- Weir/Barrage
- Undersluices & Silt excluder
- Riversluices
- Piers and abutments
- Divide wall or groyne
- Fish ladder
- Approach channel
- Canal Head Regulator
- River Training Works (Marginal bunds, Guide bunds, Spurs, Groynes)

Weir / Barrage

- A diversion structure that slightly raises the water level of the river not for creating storage, but for obtaining a suitable head to divert water through a canal situated at one or both of its banks.





Weir:

- Weir is a raised hump-like structure across a river usually associated with small shutters for flow control.
- Weirs suitable for very small diversion works.

Barrage:

- A barrage is suitable for larger rivers where more flexibility on flow control is desired.
- A barrage is actually a gated form of a weir.

Differences between a weir and a barrage

Weir	Barrage
Low cost structure	High cost of construction and maintenance
Low control on flow	Comparatively higher control on flow and the water level is maintained through operation of gates
No provision for transport communication across the river.	Usually a rail or road transport communication across the river is constructed over the barrage
High chances of siltation on the upstream side of a weir	Siltation on the upstream of a barrage is usually controlled by judicial operation of the gates
Afflux created is high due to relatively high weir crests	Due to low crest of the weirs the afflux during high floods is low since it is controlled mostly by the operation of the gates
Afflux is the rise in the water level on the upstream of the structure after its construction	

Classification of weirs

Based on material of construction:

- *Rockfill weir*
- *Masonry weir*
- *Concrete weir*

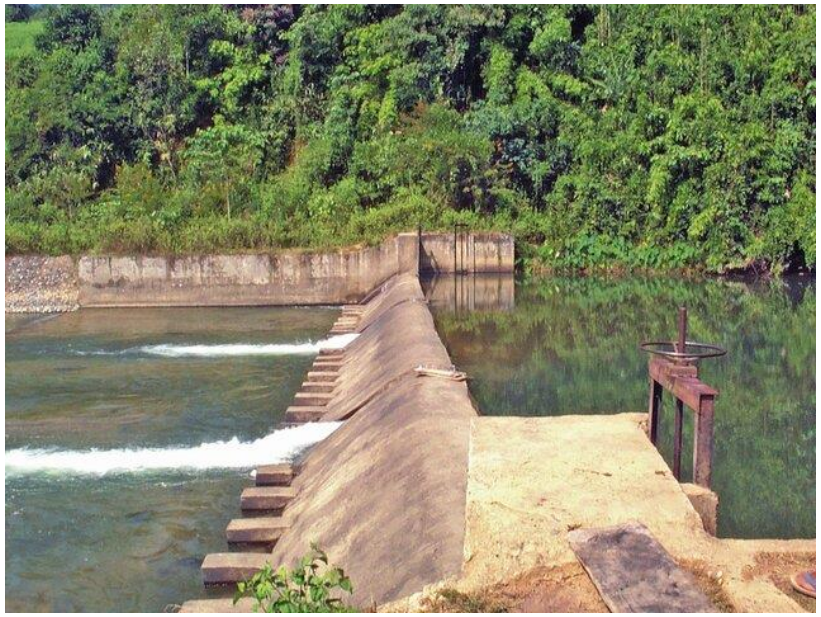
Masonry weir

(Source: www.shutterstock.com)

Rockfill weir

(Source: www.bushheritage.org.au)

Gabion weir



Concrete weir

Classification of weirs

Based on control of surface flow:

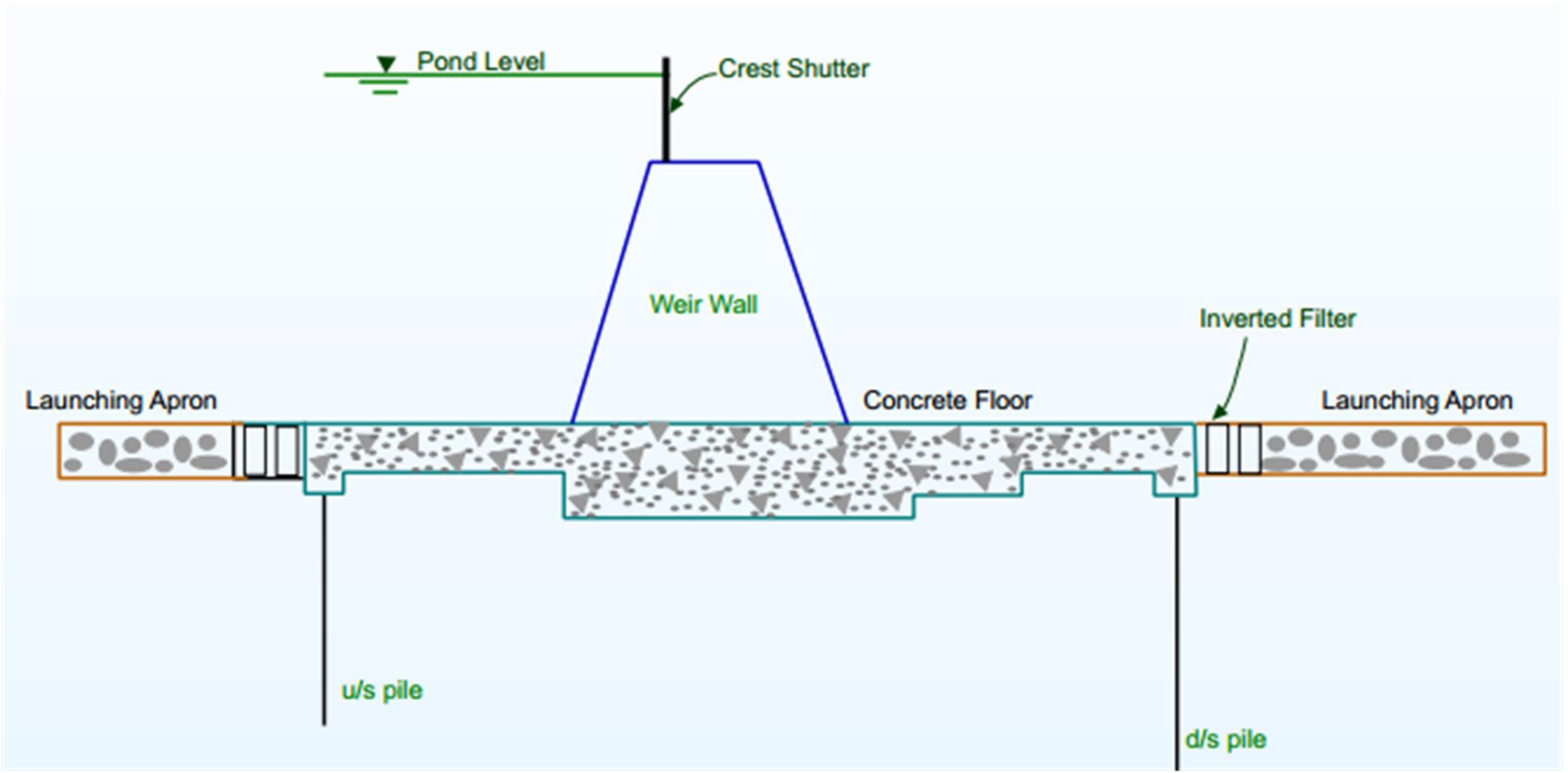
- *Vertical drop weir*
- *Sloping glacis weir*
- *Barrage*

Vertical drop weir

Sloping glacis weir

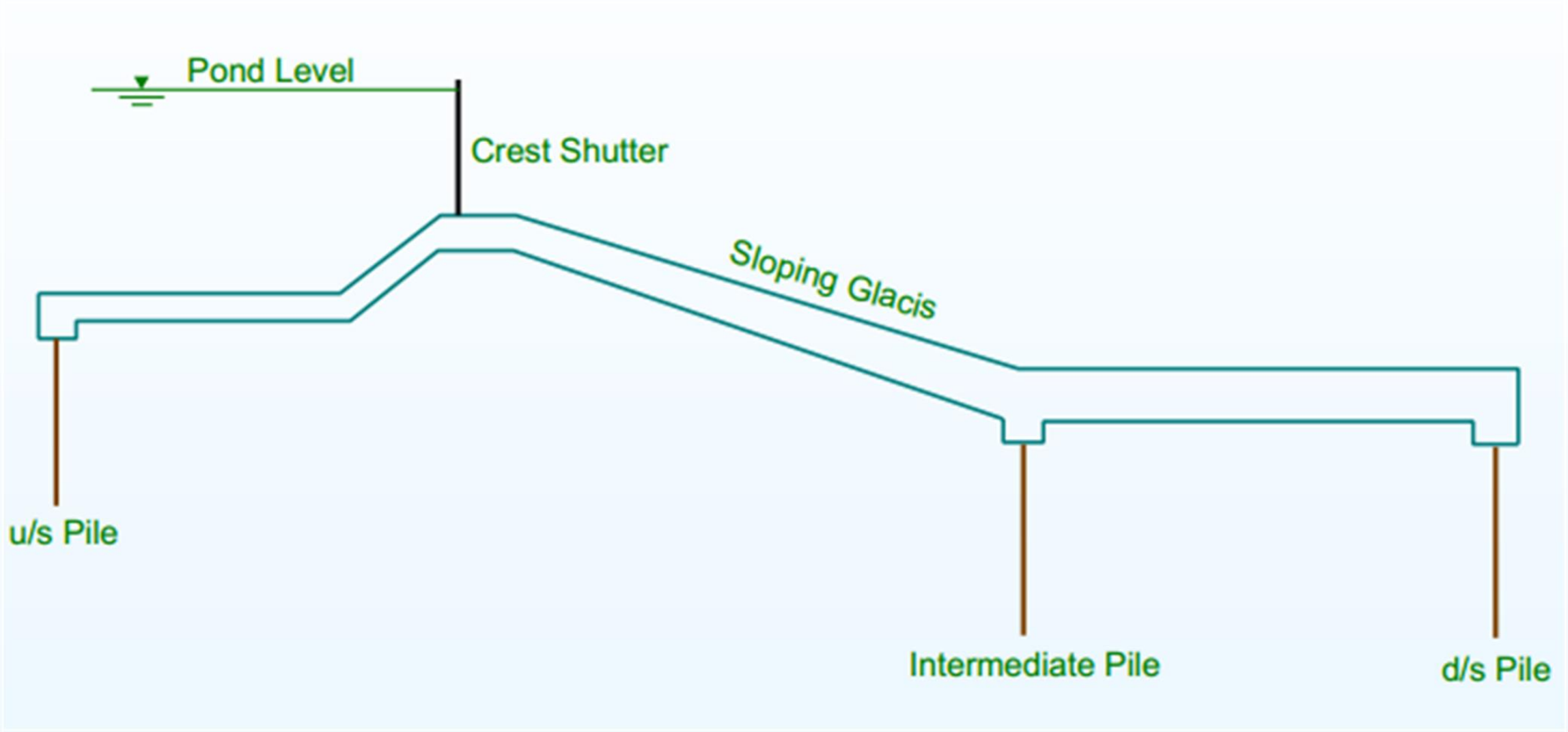
Teesta Barrage at Gajoldoba, West Bengal

Vertical drop weir



Cross-sectional view of a vertical drop weir

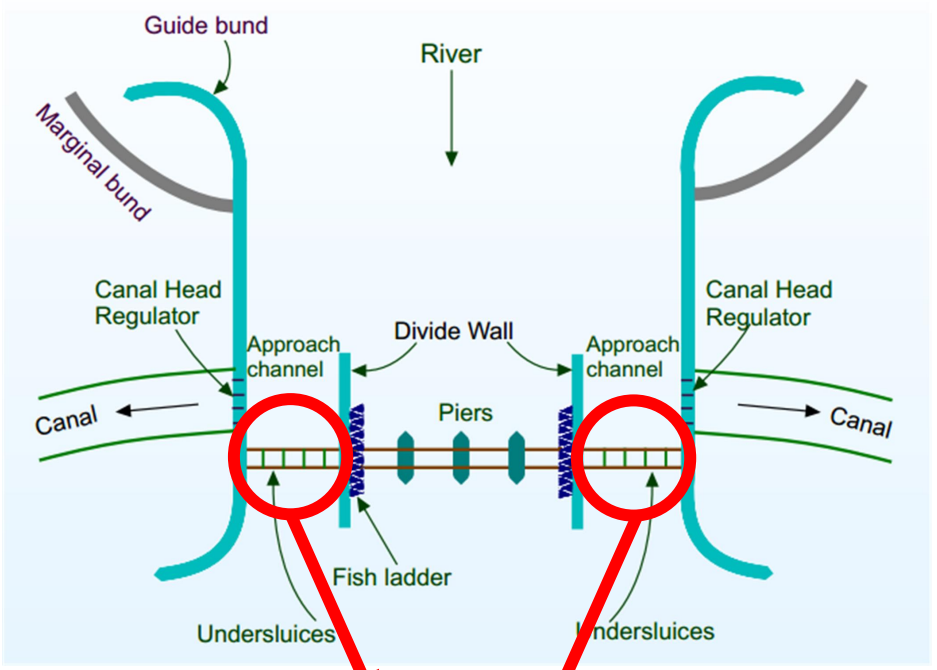
Sloping glacis weir

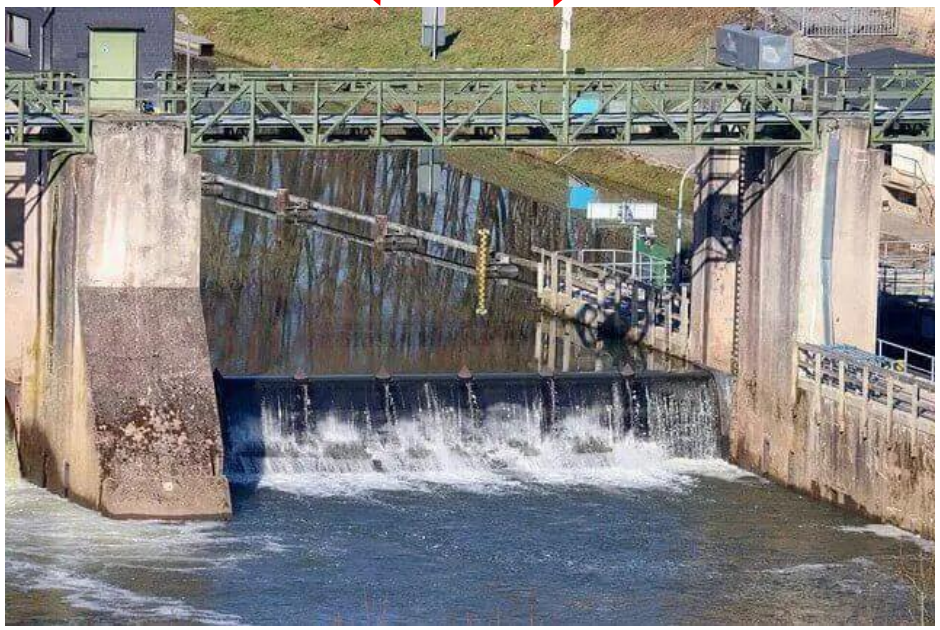


Cross-sectional view of a sloping glacis weir

Undersluices

- Undersluices are the openings which are fully controlled by gates, provided in weir wall with their crest at a low level.
- They are located on the same side as the off-taking canal.
- They are often integrated with RCC tunnels or barrels known as silt excluders, extending up to the width of the canal head regulator. Silt excluders carry the heavier silt from the upstream and discharge it on the downstream, allowing relatively clear water to flow through the canal head regulator.





Functions:

- *Preserve a clear and defined river channel approaching the regulator.*
- *Control the silt entry into the canal.*
- *Pass the low floods without dropping the shutter of the main weir.*
- *Provide greater waterways for floods, thus lowering the high flood levels.*

Design capacity:

- *Twice the maximum discharge in the off-taking canal.*
- *20% of the maximum flood discharge.*
- *Maximum winter discharge.*