Name	Yaseen Kamal
ID #	7794
Semister	6th
Section	A
Final paper	Irrigation Engineering

QNO.1): Explain anti-Water Logging Measure?

Ans: Anti-Water logging Measure:

- Quantity of water into soil below is reduced.
- Inflow into underground reservoir is reduced and outflow should be increased.

Methods of Control of Water Logging:

1- Lining of Canals and water courses:
It reduces seepage of water.

2- Reducing Intensity of Irrigation:
- Only small portion of land should receive canal water in one particular season.
- Remaining areas can receive water in next season by rotation.

3- By Introducing crop rotation:
- High water requiring crop should be followed by one requiring less water, and then by one requiring almost no water.

Example: Rice followed by wheat and then by cotton.

4-Optimum Use of Water: Certain amount of water gives the best result. Less or more water reduce the yield. Cultivat-ors should be educated so that not to use more water.
- Revenue should be charged on the basis of quantity of water rather than the area of land.

5- Improving natural drainage of Area:
- Water should not be allowed to stay in on one area.
- Natural flow is provided by bush and

and jungle cutting.

6- pumping or Tubewells or vertical Drainage. canal irrigation may be substituted by tube well irrigation.

7- Economical use of water according to need.

8- Adoption of sprinkler method of Irrigation.

- Only predetermined amount of water is supplied to land.
- No percolation losses from water courses.

QNO.1):

(b):

Ans:

Saline Soil	Alkaline Soil
• Saline soils are the soils that have a PH in between 7 and 8.5 an exchangeable sodium percentage below 15%.	• Alkaline soils are the soils that have a PH greater than 8.5 and an exchangeable sodium percentage greater than 51%.
• PH less than 8.5.	• PH creater than 8.5.
• sodium percentage less then 15%.	• sodium percentage Geeater then 15%.
• Electricity Conductivity is 4 or more mmhos/cm.	• usually less than 4 mmhos/cm.
• organic matter content is high in saline soil.	• organic matter content is low in alkaline soil.
• saline salt are white or light gray in colour.	• Alkaline soil are black in colour.

QNO.1):

(C):

Ans: Reclamation of Salt affected lands:

- By maintaining the water table sufficiently below the roots.
- Hence all the measures which were suggested for preventing water logging hold good for preventing salinity of lands.
- An efficient drainage (surface and subsurface) must be provided to lower the water table in saline soils.

Leaching:

In this process:

1) Land is flooded with water.
2) Alkaline Salt are dissolved in water.
3) percolation to the ground water.
4) Drained by sub surface drains.

→ High salt resistant crops like rice are grown on leached land for 1 or 2 seasons.

→ Then ordinary crops like wheat or cotton are grown.

→ The the land is said to have reclaimed.

→ When sodium carbonate is present in soil, gypsum is added before leaching.

→ Sodium sulphate is formed which

is leached out easily.

$Na_2CO_3 + CaSO_4 \longrightarrow Na_2SO_4 + CaCO_3.$

QNO.2):
(a):
Ans: Designing of an Irrigation Canal by Kednedy's Theory:
Step #01: Assume the trial value of D and put in eqn.1 and determine

$$V_o = 0.546\, m D^{0.64}$$

Step #02: In Eqn.1

$$Q = AV$$

$$A = Q/V$$

$$A = BD + D^2/2$$

$$P = B + D\sqrt{5}^{-1/2}$$

For assumed D determine B.
Find $R = A/P$
Step#03: Substitude the value of R in eqn.2 (Kutters and Chazys Eqn). to obtain V which will be actual velocity for assumed dimensions.
Step#04: If the velocity worked out from Eqn.2 aggrees with that obtained with Eqn.3 (Kennedeys of Eqn). Then the assumed depth is correct. Other wise repeat the procedure with changed value of D.

QUESTION NO 2: (PART B)

Design an irrigation channel by Kenedy's theory to carry a discharge of 30 m3/sec with CVR of 1 and N as 0.0225 and bed slope of 1 in 5000. Assume the depth (D) as 2.3m.

GIVEN DATA:

Discharge (Q) = 30 m^3/sec

CVR (m) = 1

N : 0.0225

Bed slope = 1 in 5000

Depth (D) = 2.3m

SOLUTION:

Finding velocity

By formula,

$V_k = 0.546\, m D^{0.64}$

$V_k = 0.546 (1)(2.3)^{0.64}$

$V_k = 0.930$ m

Now calculating area of canal:

By Formula,

$Q = AV \Rightarrow A = Q/V$

$A = 30/0.930$

Area = 32.25 m^2

Now we have to calculate B, By using formula.

$A = BD + \frac{D^2}{2} \Rightarrow BD + 0.5D^2$

By Putting values,

$A = BD + 0.5D^2$

$32.25 = B(2.3) + 0.5(2.3)^2$

$32.25 - 2.645 = 2.3 (B)$

$29.605 = 2.3 (B)$

$\Rightarrow$ **B = 12.87m**

Now we have to calculate wetted Perimeter,
So BY Formula,

$P = B + \sqrt{5} D$

$= 12.87 + \sqrt{5} (2.3)$

Now we have to calculate Hydraulic Radius,

$R = A / P$

$= 32.25 / 18.01 \Rightarrow$ **R = 1.79m**

Now calculating mean velocity from Chezy equation,

$V_C = C (RS)^{1/2}$

where

$$C = \frac{1/n + \left(23 + \frac{0.00155}{S}\right)}{1 + \left(23 + \frac{0.00155}{S}\right) \frac{n}{\sqrt{R}}}$$

$$= \frac{\frac{1}{0.0235} + \left(23 + \frac{0.00155}{1/5000}\right)}{1 + \left(\frac{23 + 0.00155}{1/5000}\right) \times \left(\frac{0.0225}{\sqrt{1.79}}\right)}$$

$C = \frac{75.19}{1.517} = 49.56.$

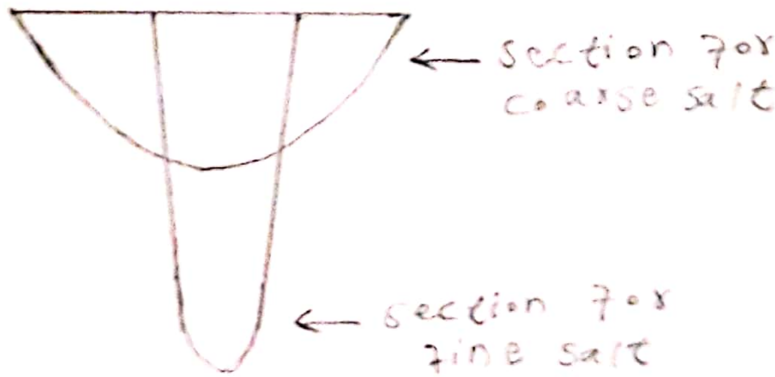
$V_c = 49.56 \left(1.79 \left(1/5000\right)\right)^{1/2}$

$V_c = 0.93$

RESULT: **VC = 0.93m**

QNO.3):
(a):
Ans: Lacey's Theory:

- According to Kennedy, a channel is regime (No silting, No scouring) but according to Lacey even though channel with no silting or scouring may actually be not in regime.
- Initial Regime: When only bed slop of channel changes but the cross section remains same then also no silting or scouring take place. But this is rare.
- Final Regime: If all parameters (perimeter, depth and slope) have have equally free to vary and adjust according to discharge and silt grades then the channel is said to have final regime.
- In final regime the cross section assumes semi-ellipse shape.



QUESTION NO. 3

PART . B

GIVEN DATA:

$Q = 30\ m^3/sec$

$m = 0.56\ mm$

SOLUTION:

Silt Factor $= f = 1.76 \times m^{0.5}$

$f = 1.76 \times (0.56)^{0.5}$

$f = 1.3$

$V_m = [Qf^2/140]^{1/6}$

$= \left(\frac{30 \times (1.3)^2}{140}\right)^{1/6}$

$V_m = 0.844$

$Q = AV \Rightarrow A = Q/V = 30/0.844$

$A = 35.54$

$P = 4.75\sqrt{Q}$

$P = 4.75\sqrt{30}$

$P = 26.01$

$R = 5/2 \times \frac{V^2}{f} = 5/2 \times \frac{(0.844)^2}{1.3}$

$R = 1.36$

$A = BD + D^2/2$

$35.54 = BD + D^2/2 \longrightarrow ①$

$P = B + D\sqrt{5}$

$26.01 = B + 2.236D \longrightarrow ②$

Put Eq ② in Eq ①

$35.54 = (26.01 - 2236D)D = D^2/2$

$35.54 = 26.01D = 2.236D^2 + D^2/2$

$35.54 = 26.01D - 2.236D^2 + 0.5D^2$

$35.54 = 26.01D - 1.736D^2$

$\underbrace{-1.736D^2}_{a} + \underbrace{26.01D}_{b} \underbrace{- 35.54}_{c} = 0$

$a = -1.736 \quad b = 26.01 \quad c = -35.54$

By Quadratic equation.

$$D = \frac{-(26.01) + \sqrt{(26.01)^2 - 4(-1.736)(-35.54)}}{2(-1.736)}$$

$\boxed{D = 1.52}$

Put in Eq ②

$B = 26.01 - 2.236(1.52)$

$B = 22.611$

$$S = \frac{f^{(5/3)}}{3340Q^{1/6}}$$

$$S = \frac{(1.3)^{5/3}}{3340(30)^{1/6}}$$

$\boxed{S = 0.00026}$

QNO.4):
(a):
Ans: Components of Head Work:
• Any hydraulic structure which supplies water to the off-taking canal is called head work.
• Head Work may be divided into two components.
→ Storage headwork
→ Diversion headwork.

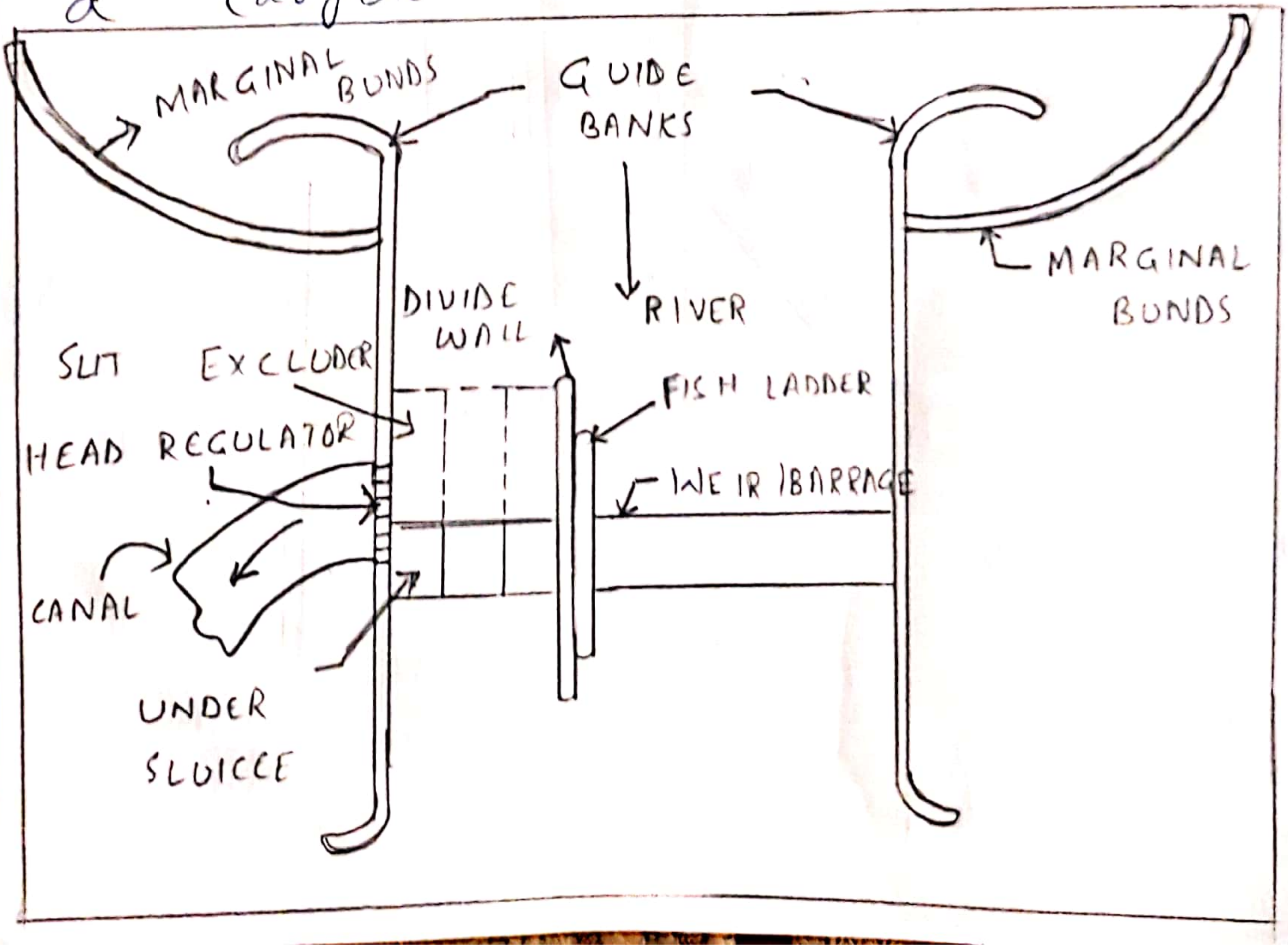
Storage HeadWork: Dam is constructed across a river valley to form storage reservoir, known as storage head works. Water is supplied to the canal from this reservoir through canal regulator. These serves for multipurpose function like hydro-electric power generation, flood control, fishery.

Diversion HeadWork: Weir or barrage is constructed across a perennial river to raise water level and to raise water level and to divert the water to canals is known as diversion head work. Flow of water in the canal is controlled by canal head regulator.

• Objective of diversion headwork:
It raised the water level on its upstream side. It regulates the supply of water into canals.

It controls the entry of silt into canals. It creates a small pond (not reservoir) on its upstream and provides some pondage. It helps in controlling the fluctuation of water level in river during different seasons.

• Site selection of Diversion head Work: The river section at the site should be narrow and well defined. The river should have high, well defined, inerodible and non-submersible bank so that the cost of river training works is minimum. The canals taking off from the diversion head works should be quite economical and should have a large commanded area.



Diversion

⇒ Components of Headwork:

- Weir or barrage
- under sluices
- Divide Wall.
- Fish ladder
- Canal head regulator.
- Silt excluders/ Silt prevention devices.
- River training Works (Marginal bunds and guide banks)

Weir: Normally the water level of any perennial river is such that it cannot be diverted to the irrigation canal. The bed level of the canal may be higher than the existing water level of the river. In such cases weir is constructed across the river to raise the water level. Surplus water pass over the crest of weir. Adjustable shutters are provided on the crest to raise the water level to some required height.

Barrage: When the water level on the up stream side of the weir is required to be raised to different levels at different times barrage is constructed. Barrage is an arrangement of adjustable gates or shutters at different tires over the weir.

Under Sluices: Also known as scouring sluices. The under sluices are the openings provided at the base of Weir or barrage. These openings are provided with adjustable gates. Normally the gates are kept closed. The suspended silt goes on depositing in front of the canal head regulator.

- When the silt deposition becomes appreciable the gates are opened and the deposited silt is loosened with an agitator mounting on a boat.

Divide Wall: The divide wall is a long wall constructed at right angles in the weir or barrage, it may be constructed with stone masonry or cement concrete. On the upstream side, the wall is extended just to cover the canal head regulator and on the downstream side it is extended up to the launching apron.

Fish ladder: The fish ladder is provided just by the side of the divide wall for the free movement of fishes. The important source of Rivers are the fishes.

- In fish ladder, the fable walls are constructed in a zigzag manner so that the velocity of flow within the ladder does not exceed 3 m/sec.
- The width, length and height of the fish ladder depend on the

nature of the river and type of weir or barrage.

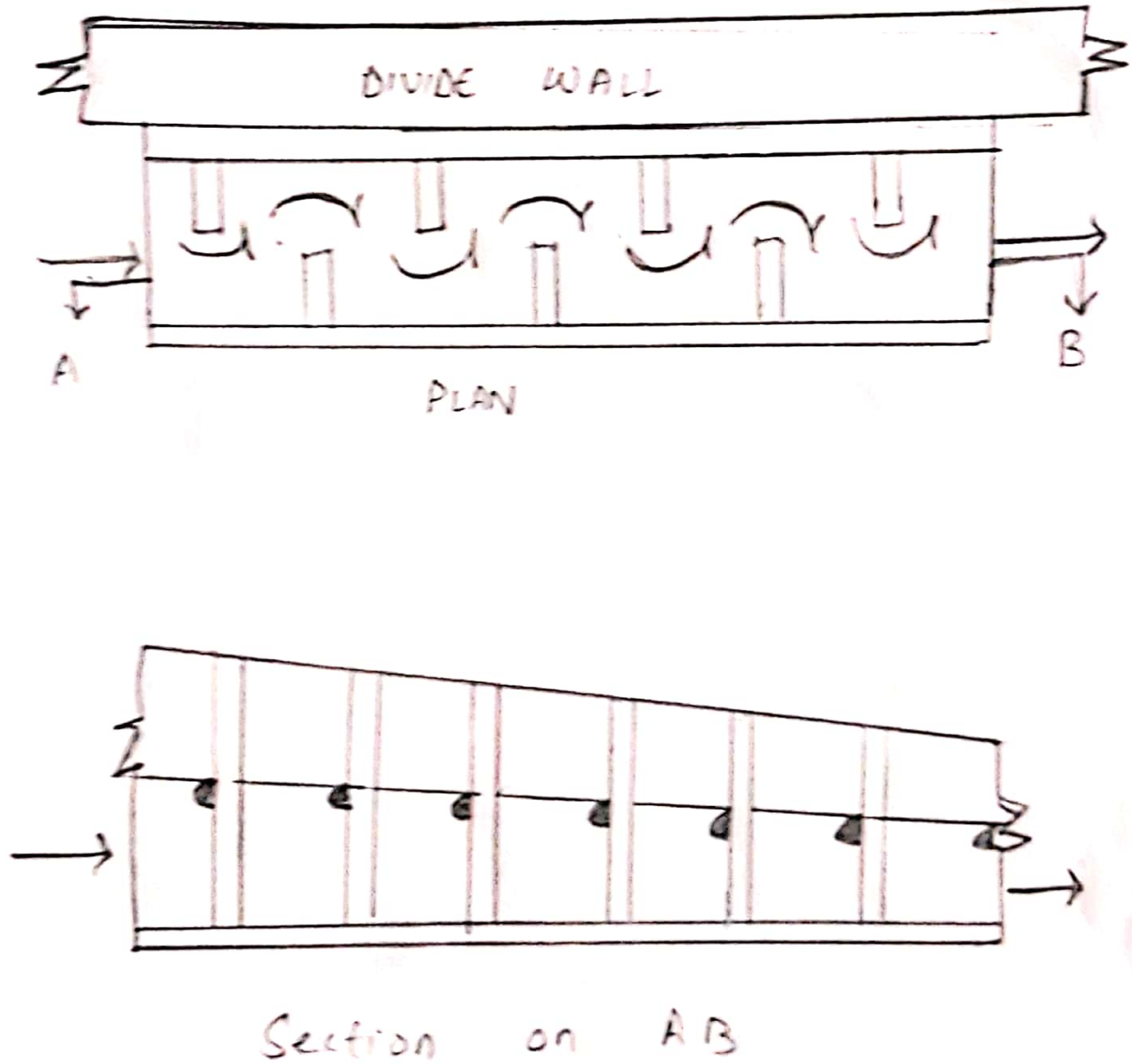


Fig: Fish Ladder

QNO.4):

(b):

Ans: Function of Canal Head Regulators:

- It regulates the supply of water entering the canal. It controls the entry of silt in the canal. It prevents the river floods from entering the canal.

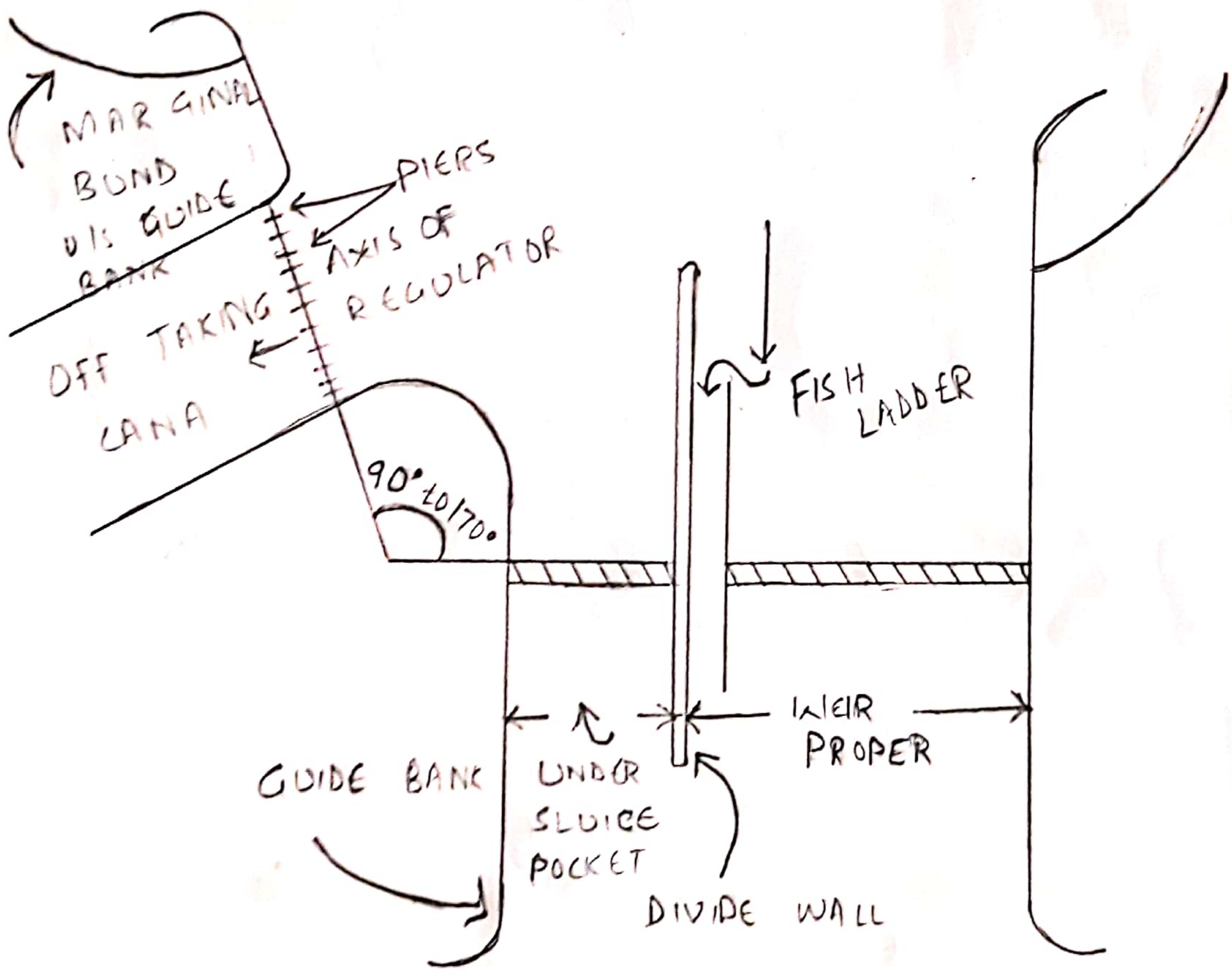


Fig: "Aligment of a canal head regulator"

• Silt regulation Works: The entry of silt into a canal, which takes off from a head works, can be reduced by constructed certain special works, called silt control. Works. These works may be classified into the following two types:

(a) silt Excluders (b) silt Ejectors

• Silt Ejectors: silt ejectors, also called silt extractors, are those devices which extract the silt from the canal water after the silted water has travelled a certain distance in the off take canal. These works are therefore constructed on the bed of the canal, and little distance downstream from the head regulator.

• River Training Works: River training work are required near the weir site in order to ensure a smooth and an axial flow of water, and thus to prevent the river from outflanking the works due to a change in its course. The river training works required on a canal headwork are.

(a) Guide banks (b) Marginal buds

(c) spurs or groynes.

• Guide Bank: When a barrage is constructed across a river which flows through the alluvial soil, the guide banks must be constructed on both the approches to protect the structure from erosion. Guide bank serves the following purposes:

→ It protects the barrage from the effect of scouring and erosion.

→ It provides a straight approach towards the barrage.

→ It control the tendency of changing the course of the river.

→ It controls the velocity of flow near the structure.

• Marginal Bunds: The marginal bunds are earthen embankments which are constructed parallel to the river bank on one or both the banks according to the condition. The top width is generally 3m to 4m. The side slope on the river side is generally 1.5:1 and that on the country side is 2:1.