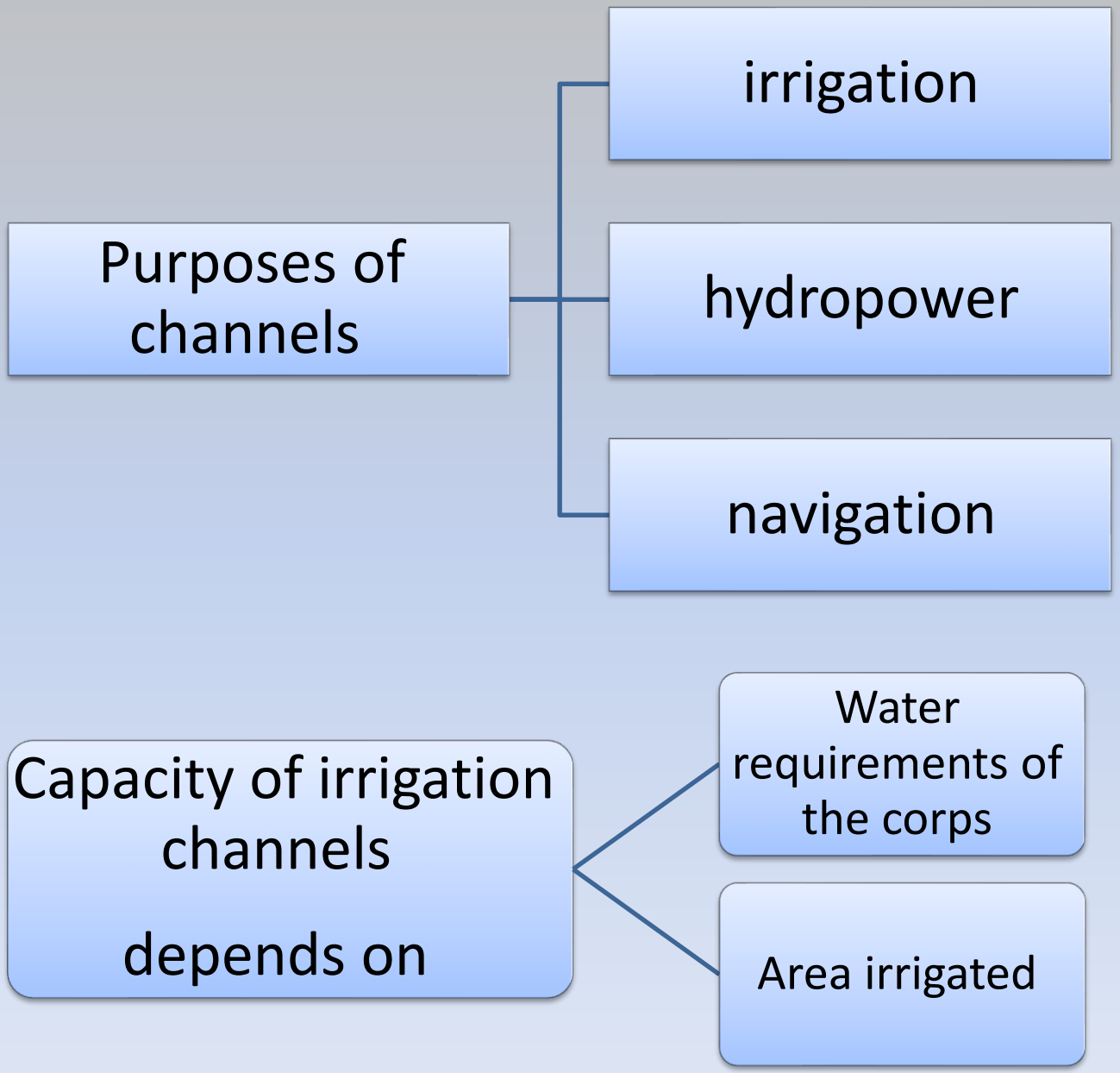
Lecture One

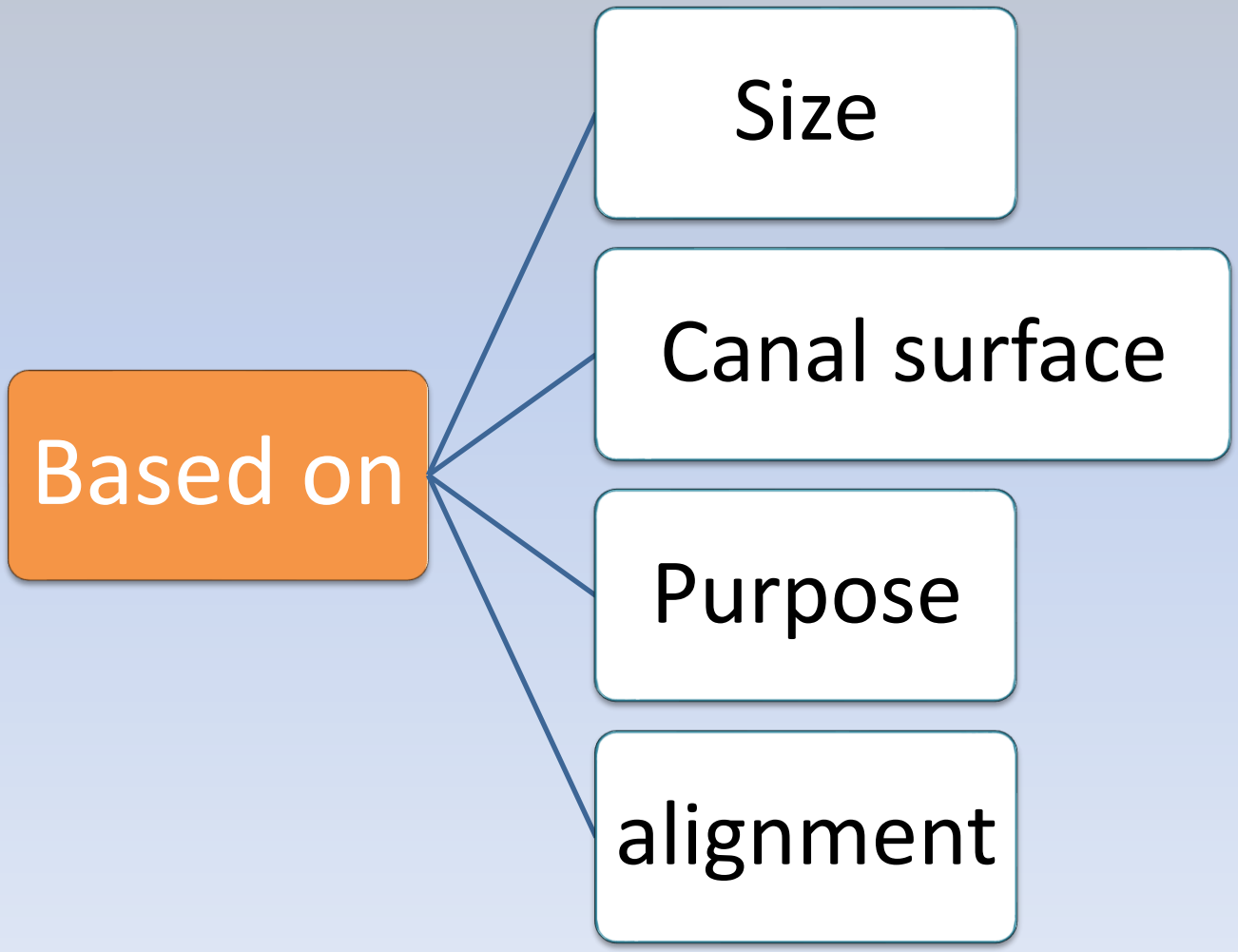
Design of Channels

Lecturer: Reem J. Channo
Civil Eng. / Engineering college / University of Baghdad

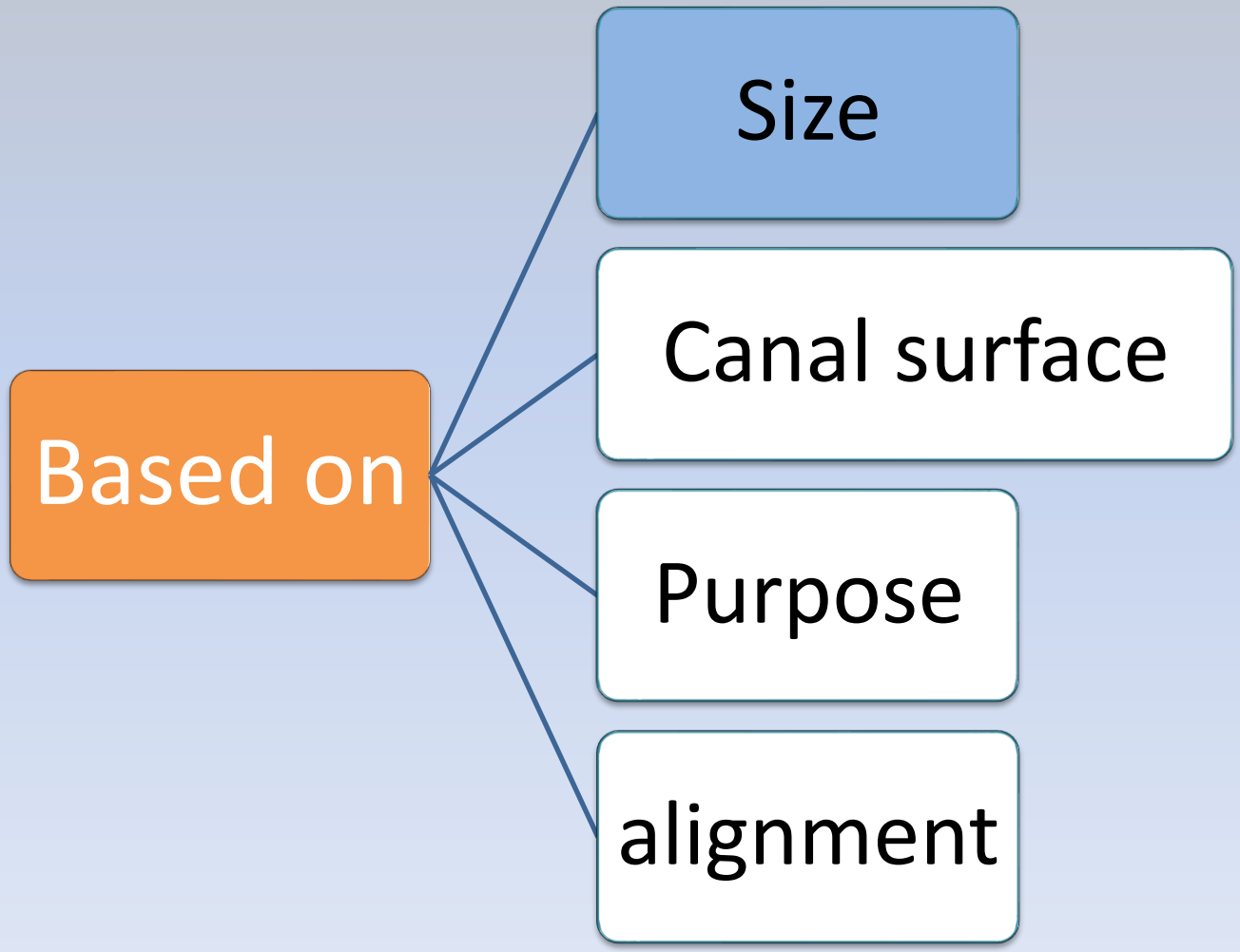
Canal is an artificial channel, generally trapezoidal in section, constructed to carry water to fields from source (River/ Reservoir)


Purposes of channels
irrigation
hydropower
navigation
Capacity of irrigation channels
depends on
Water requirements of the corps
Area irrigated

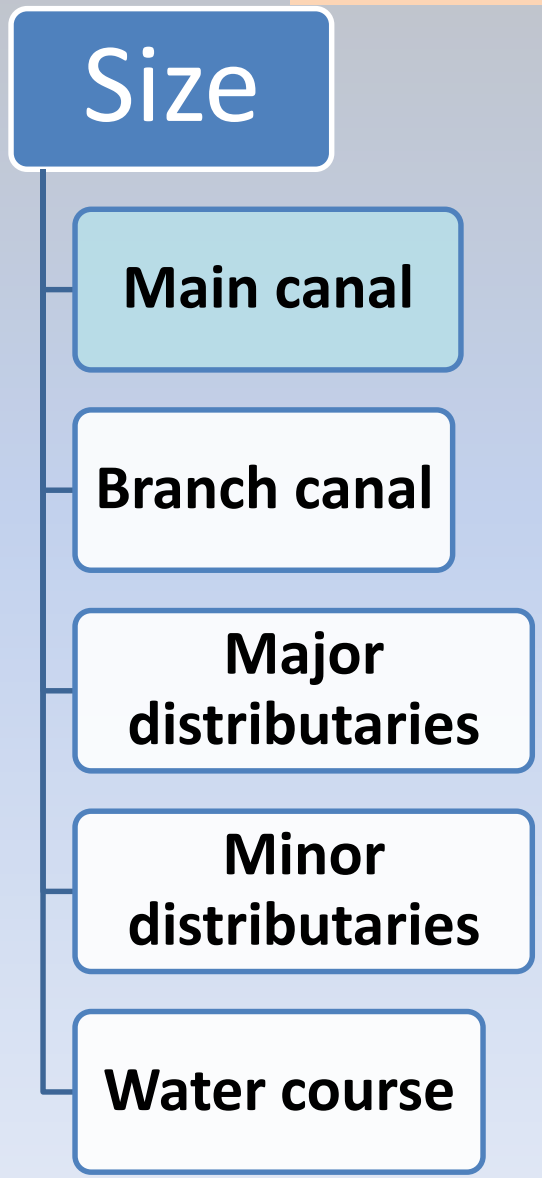
Types of canals



Types of canals



Types of canals



➢ **Main canal**

- Largest canal in the system
- Takes off directly from canal headwork, do not supply water directly to fields
- L.M.C & R.M.C
- Q will be in range of 30 – 150 cumecs

Types of canals

- Size
  - Main canal
  - Branch canal
  - Major distributaries
  - Minor distributaries
  - Water course

➢ Branch canal

- Takes off from a main canal or another branch canal on either sides
- Not for direct irrigation.
- They are feeder canals & supply water to major and minor
- Carry discharge (10 – 30) m^3/sec

Types of canals

- Size
  - Main canal
  - Branch canal
  - Major distributaries
  - Minor distributaries
  - Water course

➢ **Major distributaries**

- Carry discharge (0.25 - 5 m^3/sec)

Types of canals

- Size
  - Main canal
  - Branch canal
  - Major distributaries
  - Minor distributaries
  - Water course

➢ **Major distributaries**

- Carry discharge 0.25 - 5 m^3/sec

➢ **Minor distributaries**

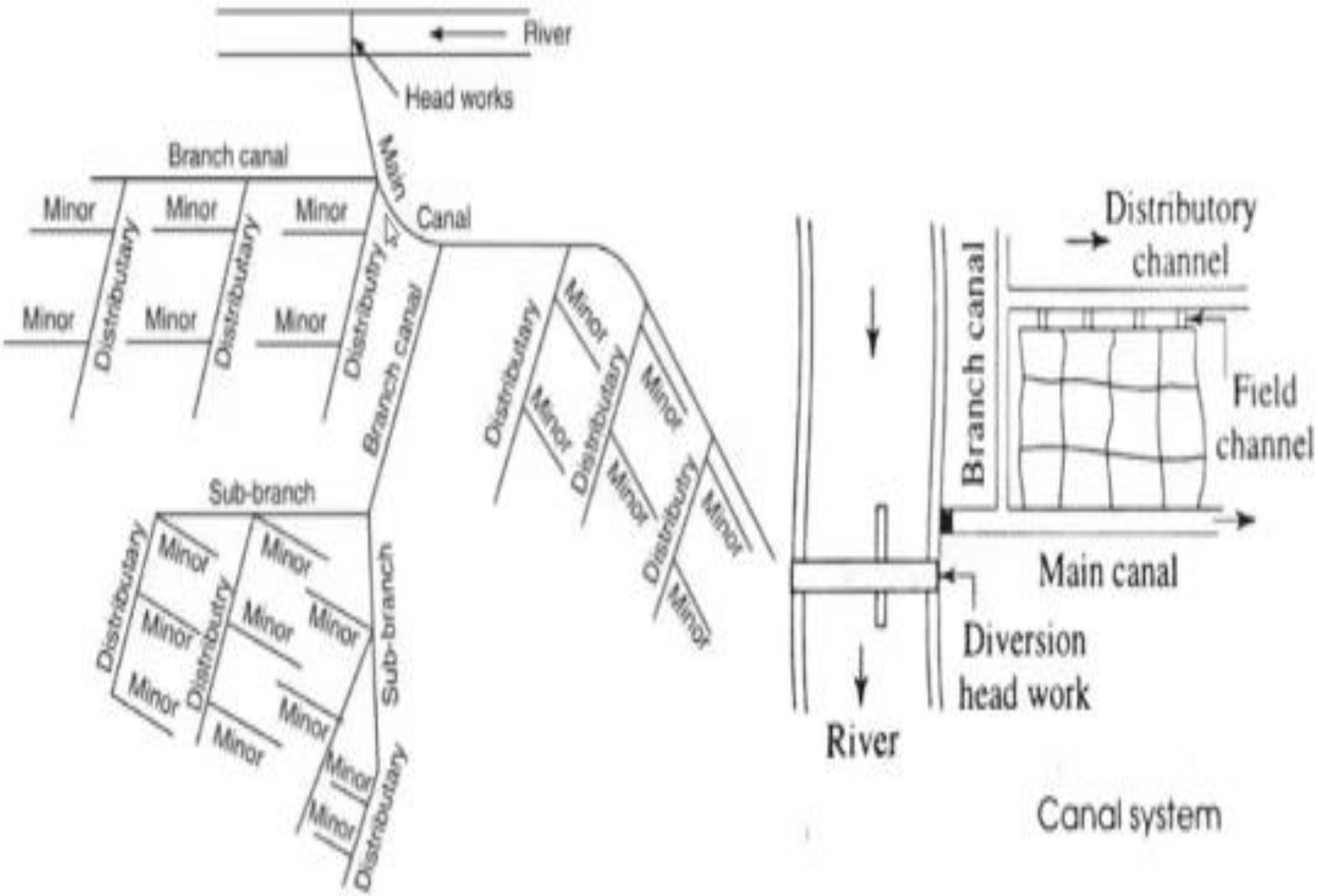
- Carry discharge < 0.25 m^3/sec

Types of canals

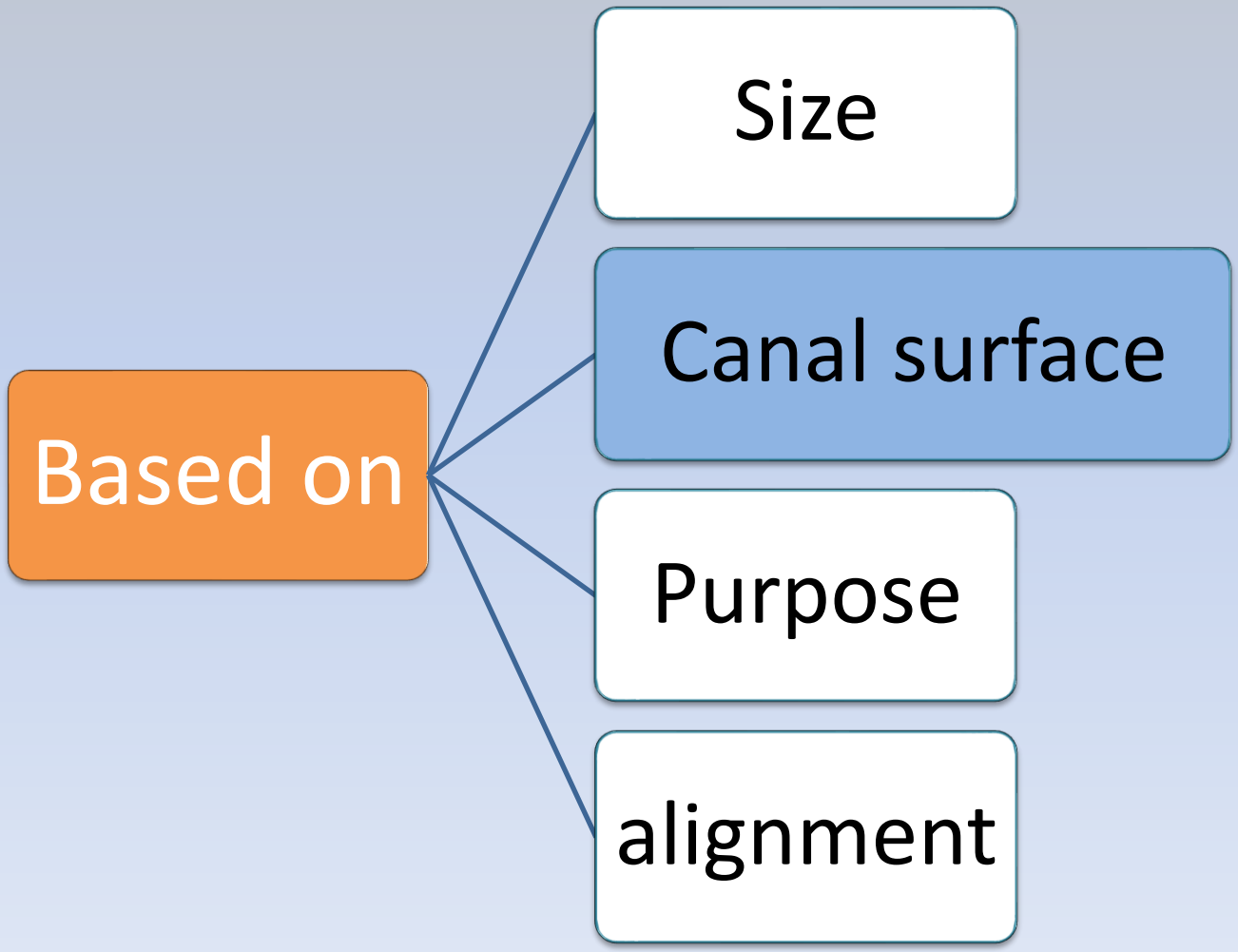
- Size
  - Main canal
  - Branch canal
  - Major distributaries
  - Minor distributaries
  - Water course

➢ **Water course**

- Water course or filled canal or gulls
- Small canal
- Takes water from other canals
- Supply water to the agricultural fields


River
Head works
Main Canal
Branch canal
Minor
Distributary
Sub-branch
Distributory channel
Field channel
Main canal
Diversion head work
River
Canal system

Types of canals



Types

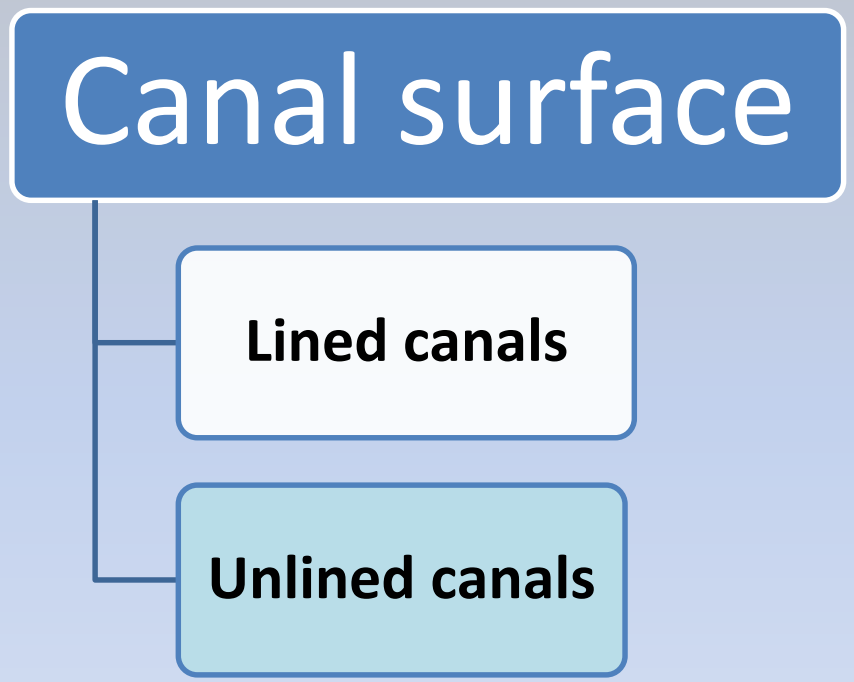
Canal surface

- **Lined canals**
- **Unlined canals**

➢ **Lined canals**

- Have surface lined with an impervious material on its bed and sides to prevent seepage of water
- Seepage losses in lined canal are small
- High velocity can be permitted and hence the cross-sectional area is less which doesn't allow the silt to get deposit

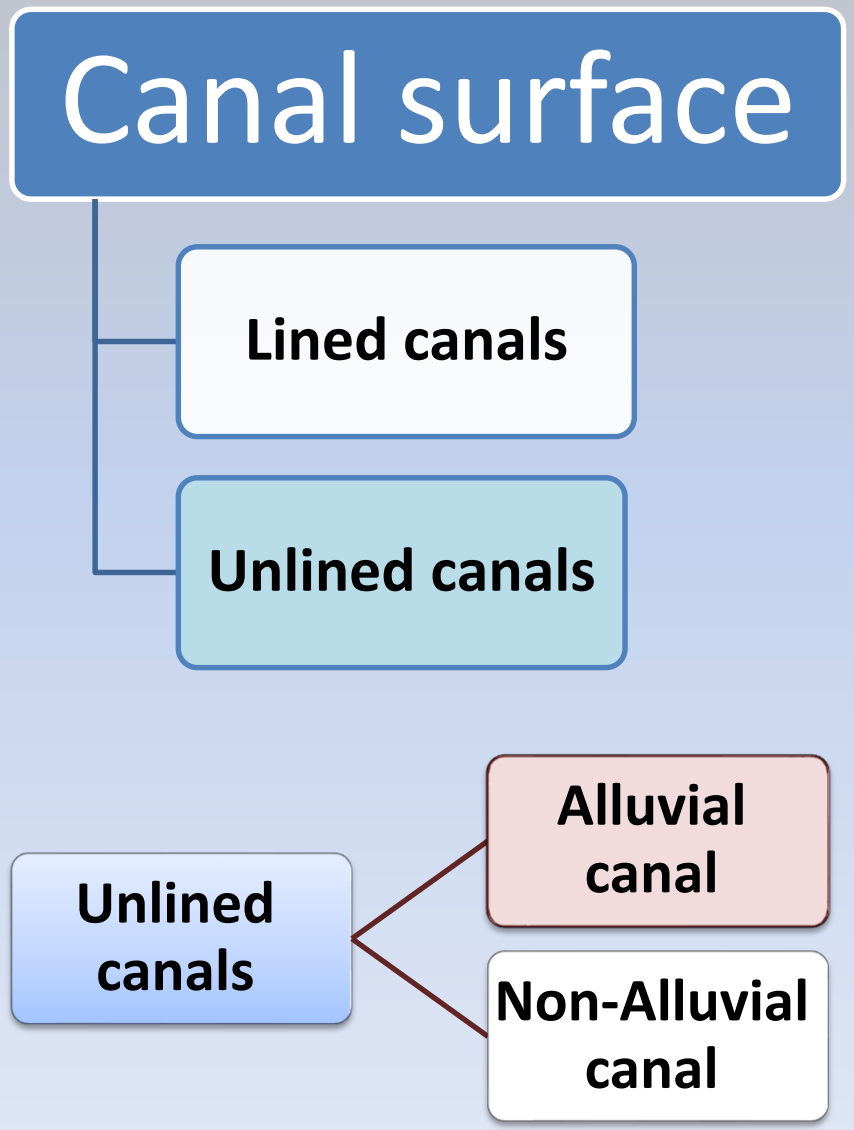
Types of canals



➢ **Unlined canals**

- Have surface with natural material through which it constructed
- Seepage losses in unlined canal are large

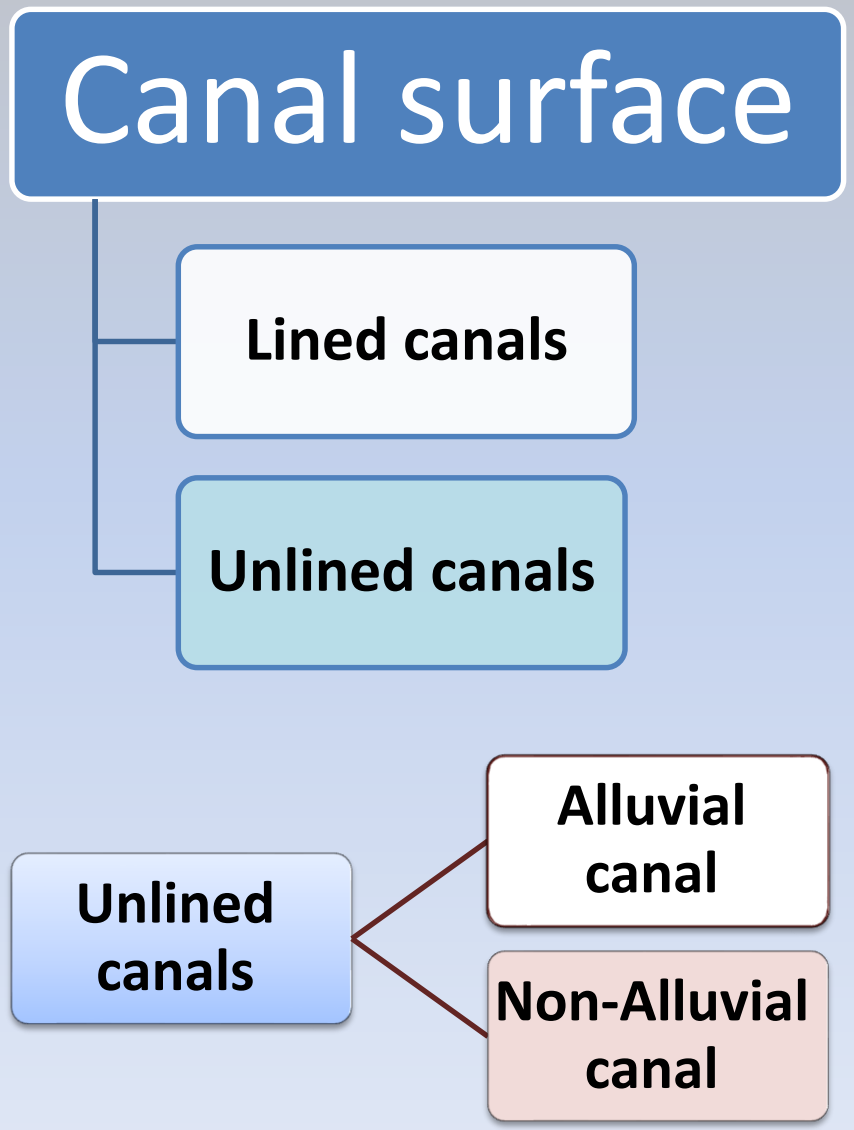
Types of canals



➢ Alluvial canal

- constructed through the alluvial soils deposited by rivers such as silt
- The alluvial soils are disjointed silt soils which can be easily scoured as well as deposited
- Designed so that there is neither scouring nor silting
- The velocity in these canals is quite low and therefore, the cross-sectional area is large

Types of canals



➢ **Non-Alluvial canal**

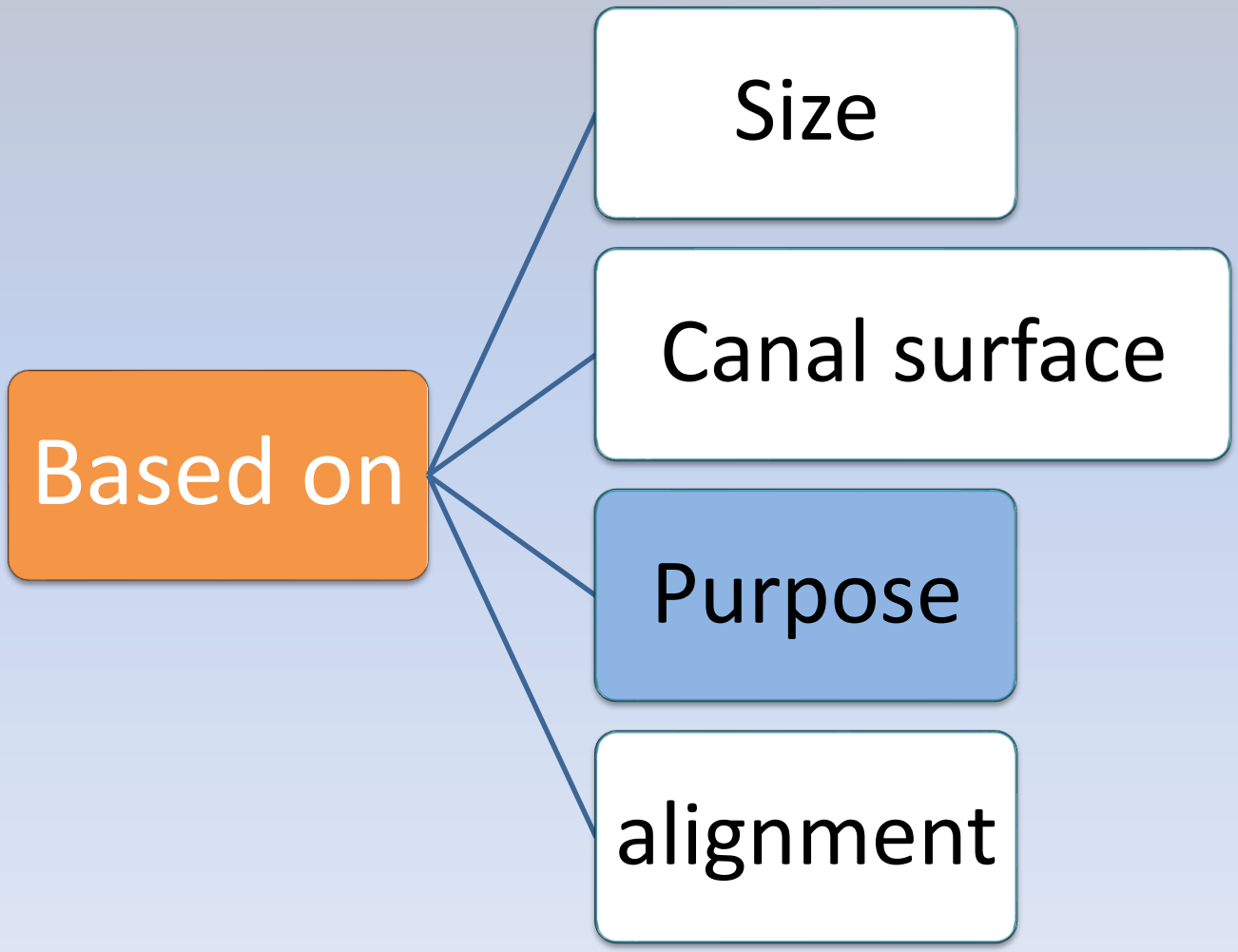
- constructed through hard soils (loam, clay) or disintegrated rocks
- Since the canal surface is hard, scouring normally does not occur
- The velocity in these canals is high

Types of canals

Canal surface

- Lined canals
- Unlined canals
  - Alluvial canal
  - Non-Alluvial canal

Types of canals



Types of canals

- Purpose
  - Irrigation canal
  - Power canal
  - Navigation canal
  - Water supply canal
  - Feeder canal
  - Carrier canal
  - Multipurpose canal

Types of canals

- Purpose
  - Irrigation canal
  - Power canal
  - Navigation canal
  - Water supply canal
  - Feeder canal
  - Carrier canal
  - Multipurpose canal

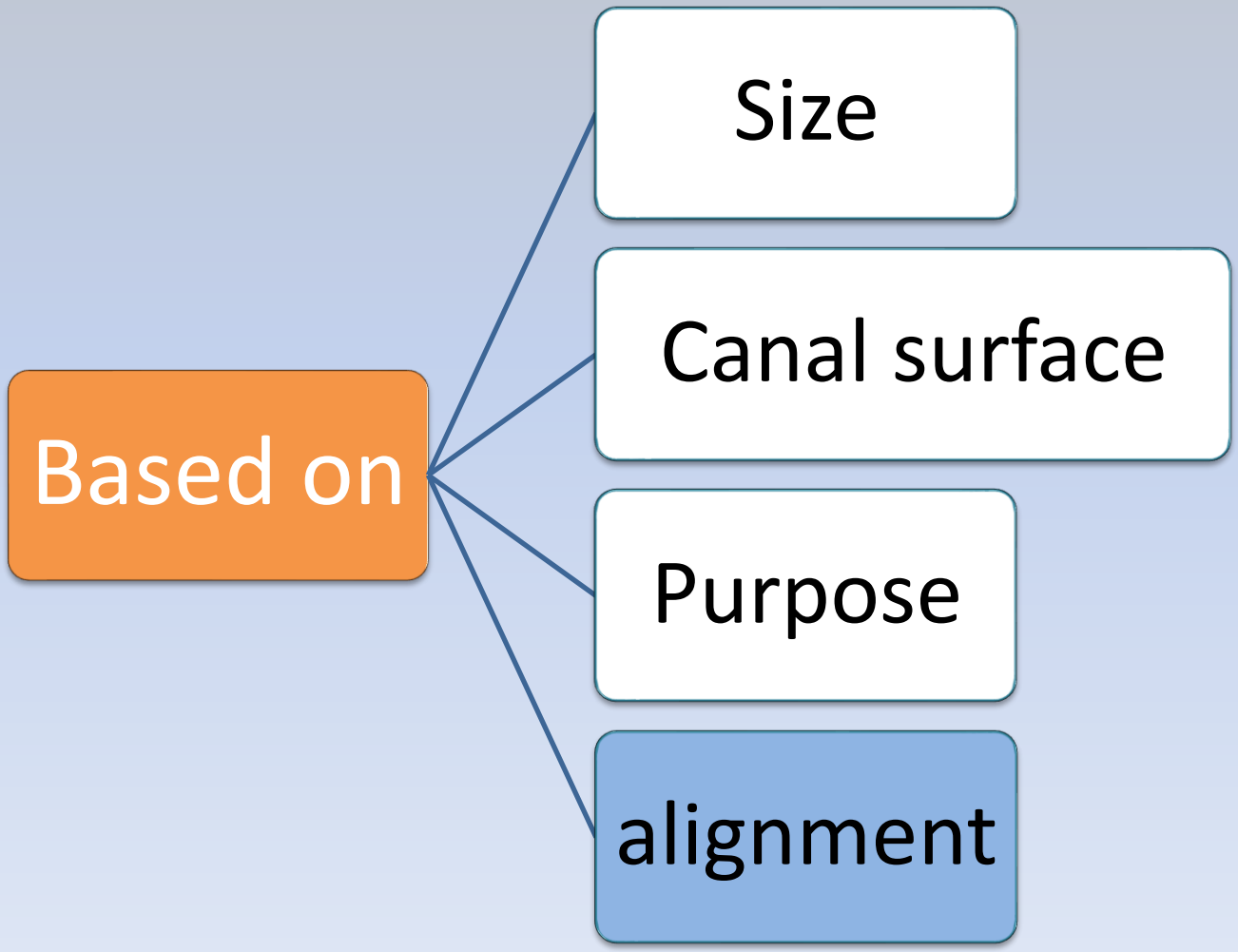
Types of canals

- Purpose
  - Irrigation canal
  - Power canal
  - Navigation canal
  - Water supply canal
  - Feeder canal
  - Carrier canal
  - Multipurpose canal

Types of canals

- Purpose
  - Irrigation canal
  - Power canal
  - Navigation canal
  - Water supply canal
  - Feeder canal
  - Carrier canal
  - Multipurpose canal

Types of canals



Types of canals

Alignment

- **Watershed (Ridge canal)**
- **Contour canal**
- **Side slop canal**

Types of canals

Alignment

- **Watershed (Ridge canal)**
- **Contour canal**
- **Side slop canal**

➢ **Watershed canal**

- Aligned along a watershed or ridge
- Can irrigate on both sides of the ridge by gravity
- Suitable for plain areas, where slopes are relatively flat and uniform

Watershed canals have minimum number of cross-drainage works, because most of the drainages originate from the ridge and do not cross the canal

Types of canals

Alignment

- Watershed (Ridge canal)
- Contour canal
- Side slop canal

➢ **Contour canal**

- Aligned almost parallel to the contours of area
- Can irrigate only on one side because the land on the other side is higher

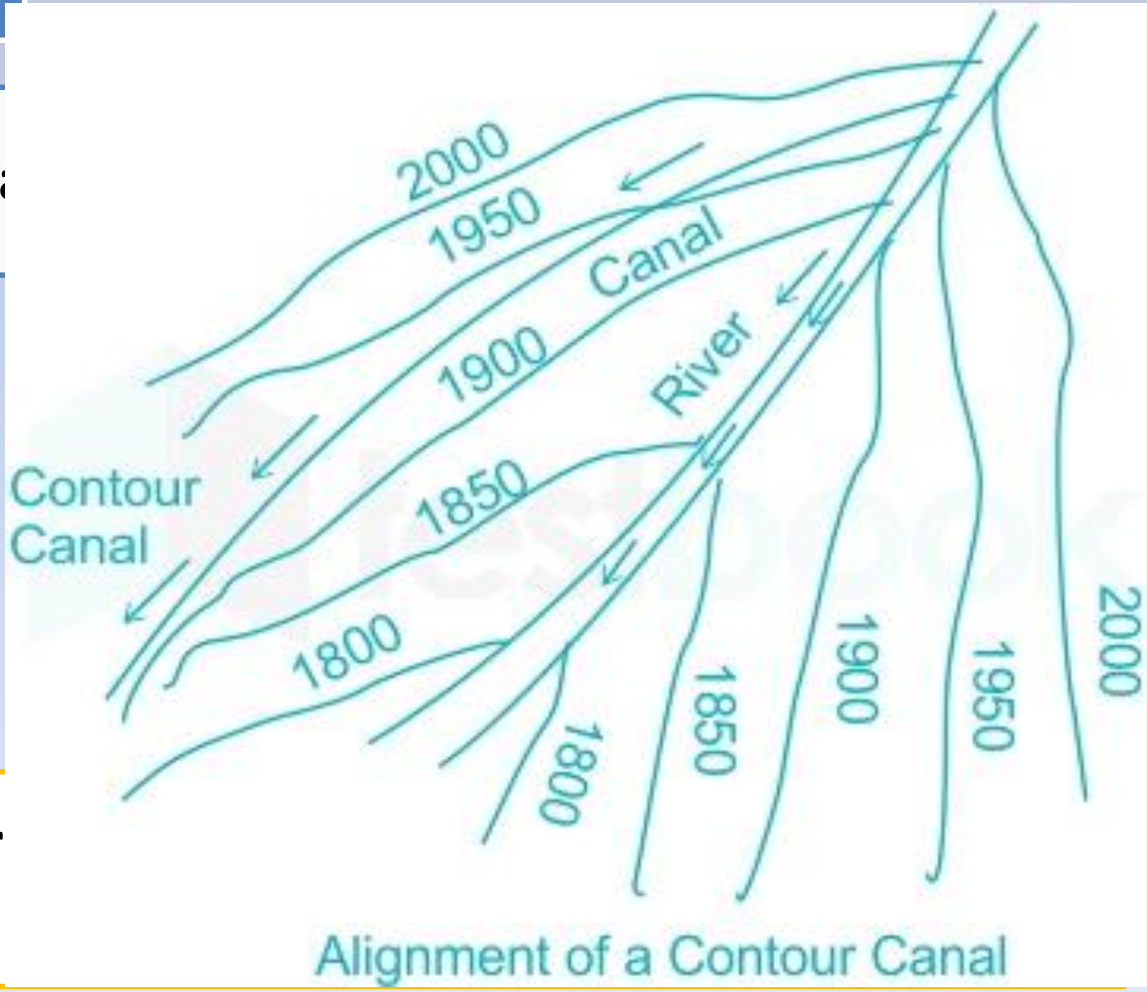
In a contour canal, there are a large number of cross-drainage works because all the drainages are at right angles to the contours

Types of canals

Alignment

- Watershed (Ridge cana
- Contour canal
- Side slop canal

➢ **Contour canal**



Alignment of a Contour Canal

In a contour canal, there ar
because <u>all the drainages</u> a

Types of canals

Alignment

- Watershed (Ridge cana
- Contour canal
- Side slop canal

➢ **Contour canal**

Types of canals

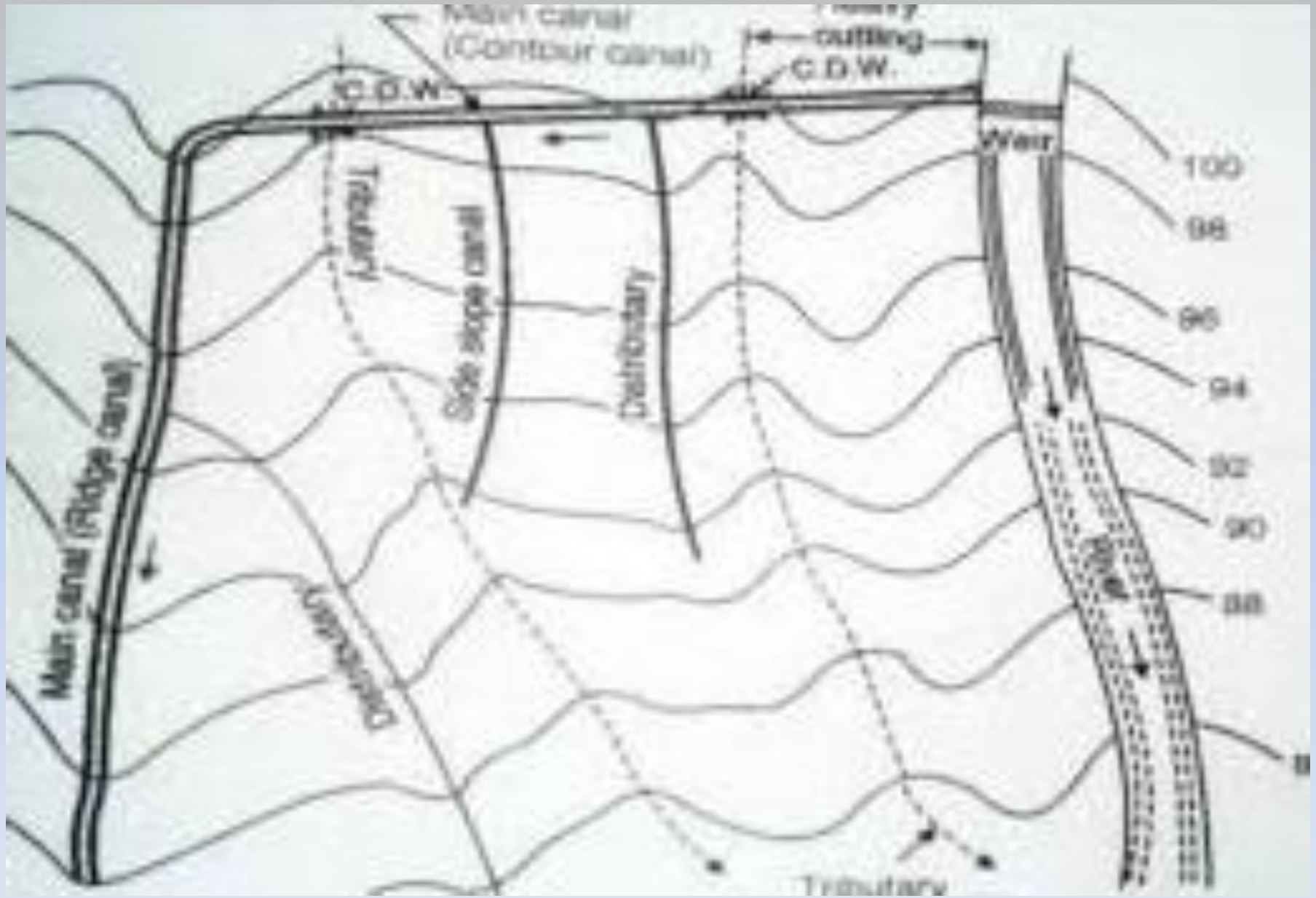
Alignment

- **Watershed (Ridge canal)**
- **Contour canal**
- **Side slop canal**

➢ **Side slop canal**

- Aligned at right angles to the contour lines along the side slopes of the terrain
- Nearly perpendicular to the contour of the area, parallel to the natural drainage line
- It can irrigate only on one side

Because drainages also run at right angles to the contours, a side-slope canal does not normally intercept drainages, and therefore, no cross-drainage work is required

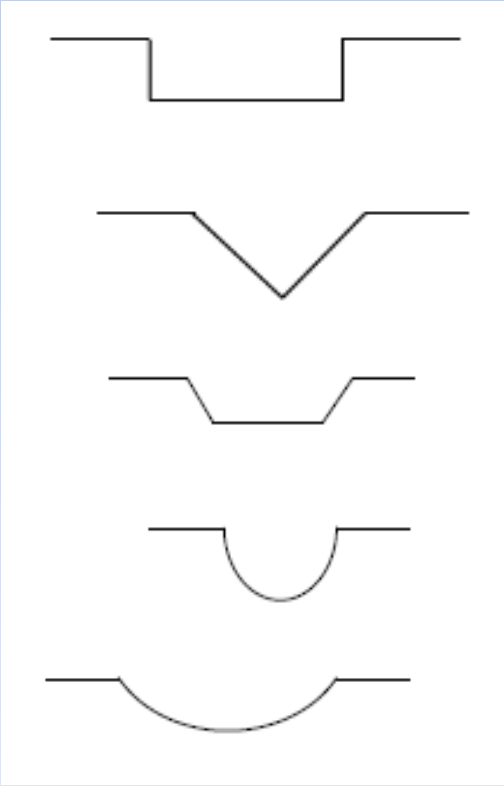

Main canal
(Contour canal)
C.D.W.
cutting
C.D.W.
Weir
Tributary
Side slope canal
Distributary
Main canal (Ridge canal)
Contour
Tributary
100
98
96
94
92
90
88

Design of canals

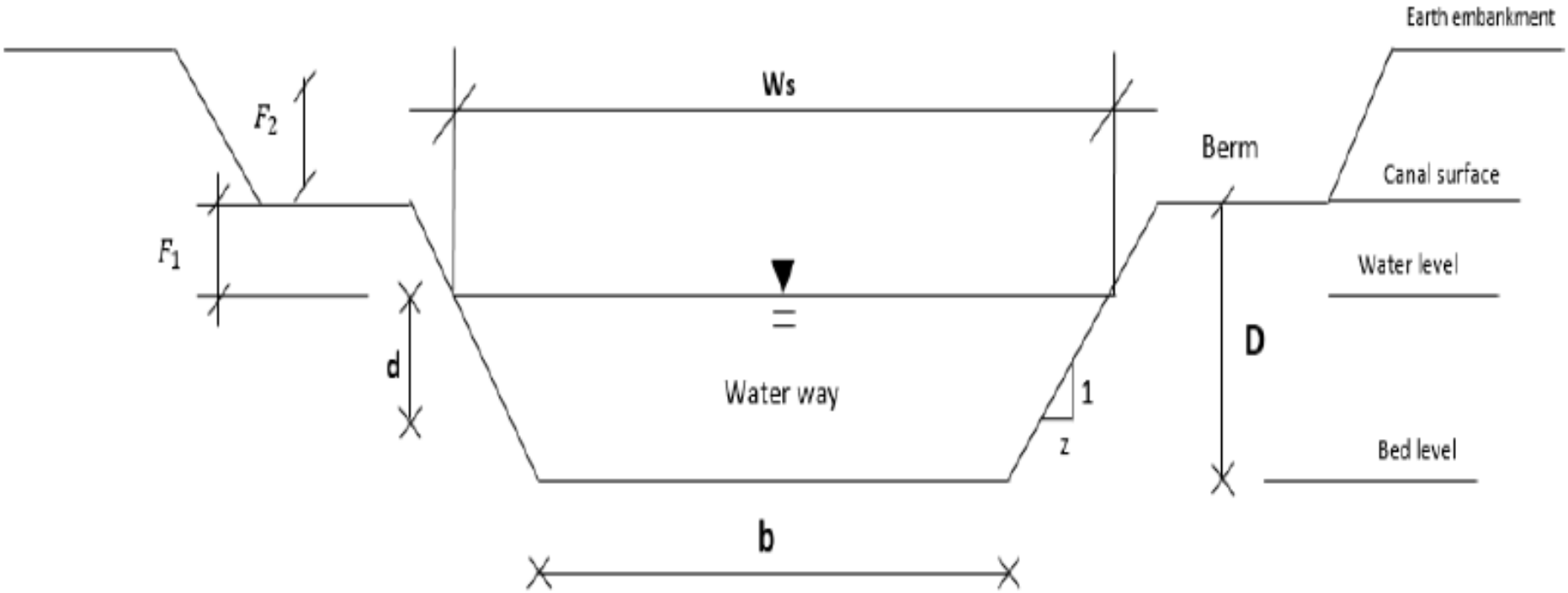
The design of the canal is mainly governed by the quantity of silt in the water and the type of boundary surface of the canal.

Shapes of cross-section of the canal

- **Rectangle**
- **Triangle**
- **Trapezoidal**
- **Semi-circle**
- **Parabola**



Design of canals



b = bed width (m)

Ws = water surface width (m)

Y,d = water depth (m)

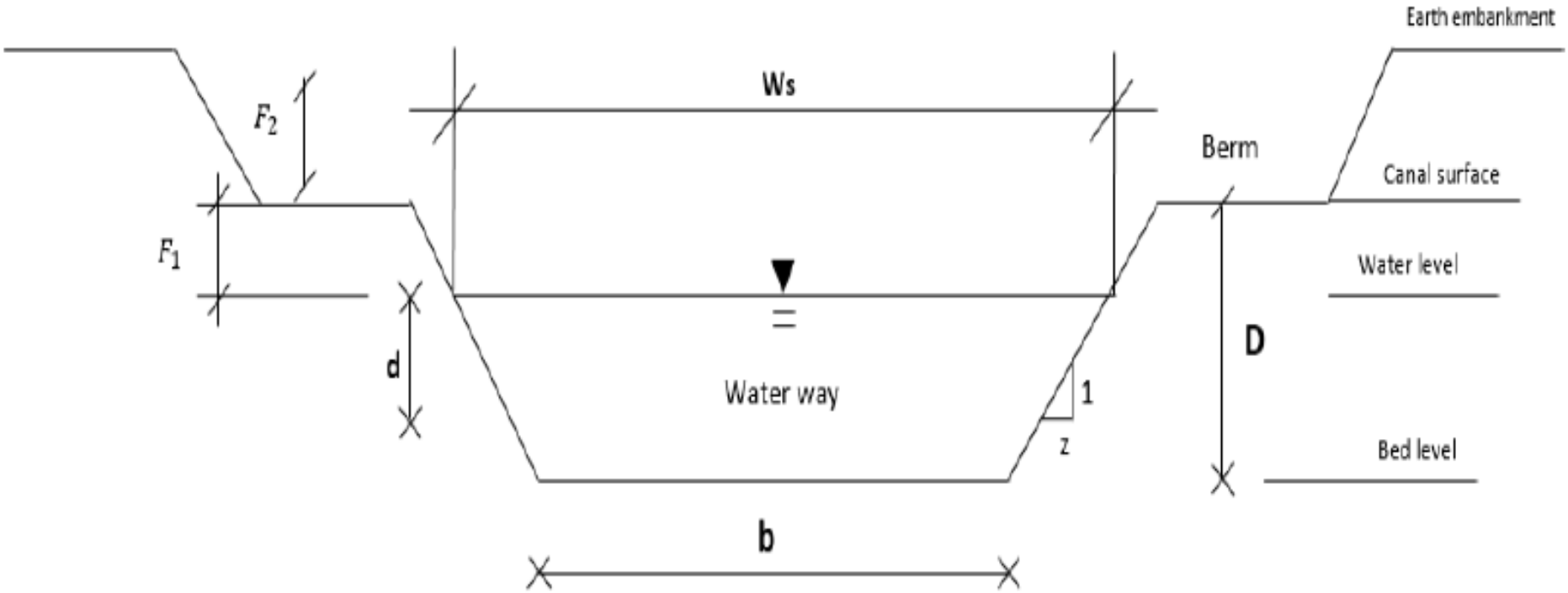
D = total depth of the canal (m)

1:z = side slope of the canal

F_1,F_2 = free board (m)

S = longitudinal slope

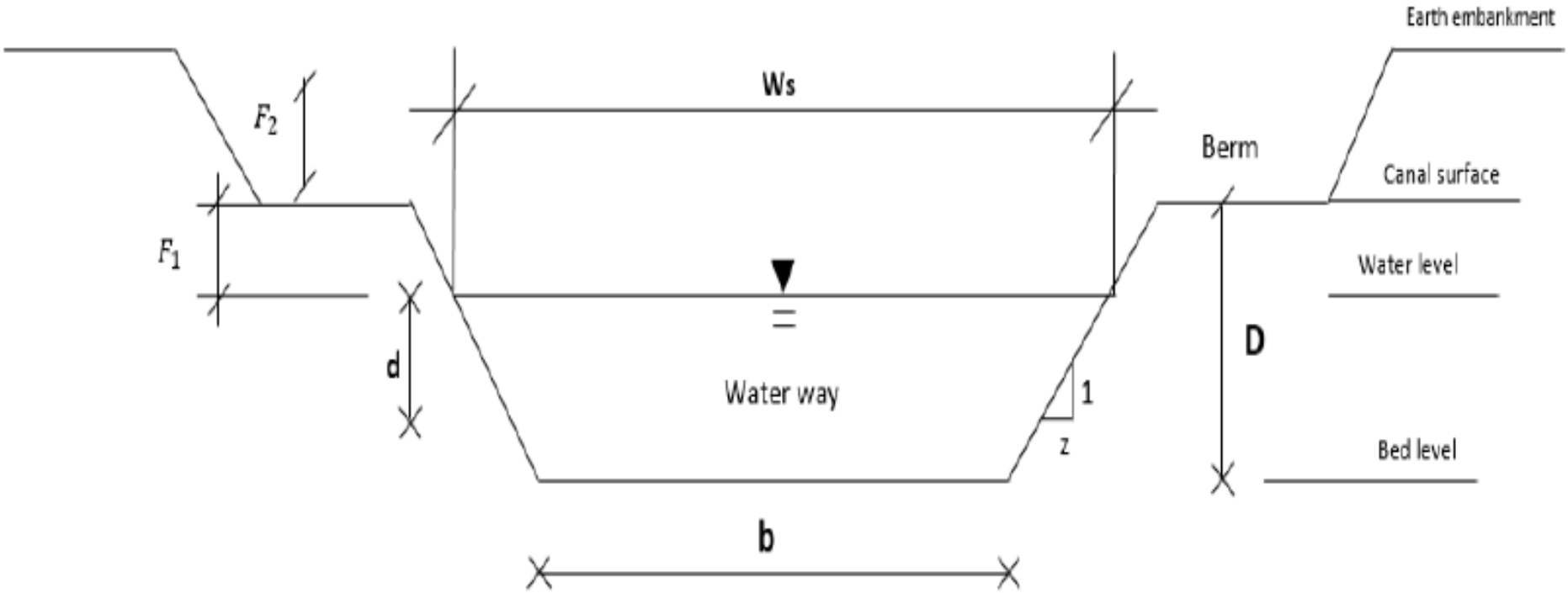
Design of canals



Water way: the part of the canal cross-section in which the water flow.

Berm: the area between the canal cross-section and the side embankment used as a road or for maintains.

Design of canals



F1: the distance between the water surface and the canal surface used for the protection from overtopping (flooding).

F2: the distance between the canal surface and the embankment level, used for protecting from flooding.

Basic design assumption (simplified assumption)

a. The flow is due to gravity

b. The flow is uniform and steady state