Practical Aquaculture 4

By

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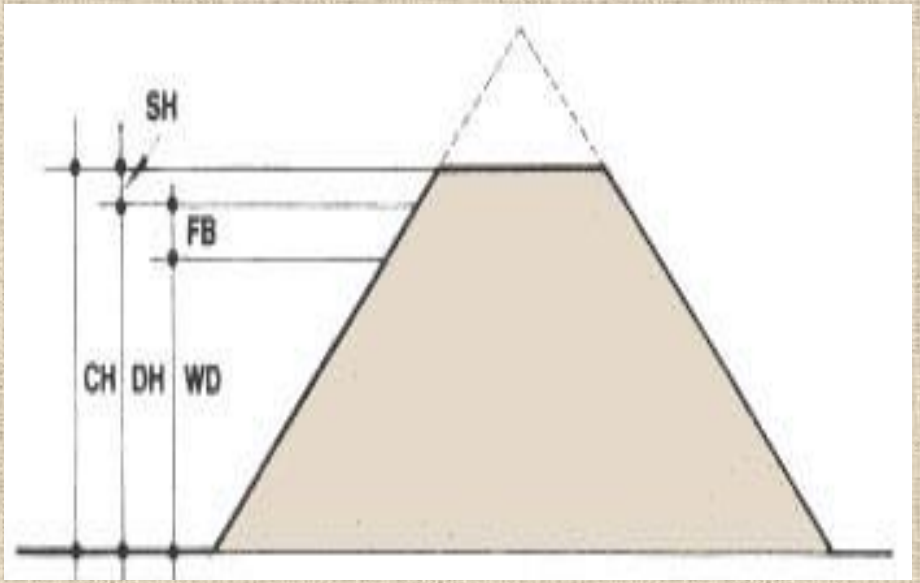
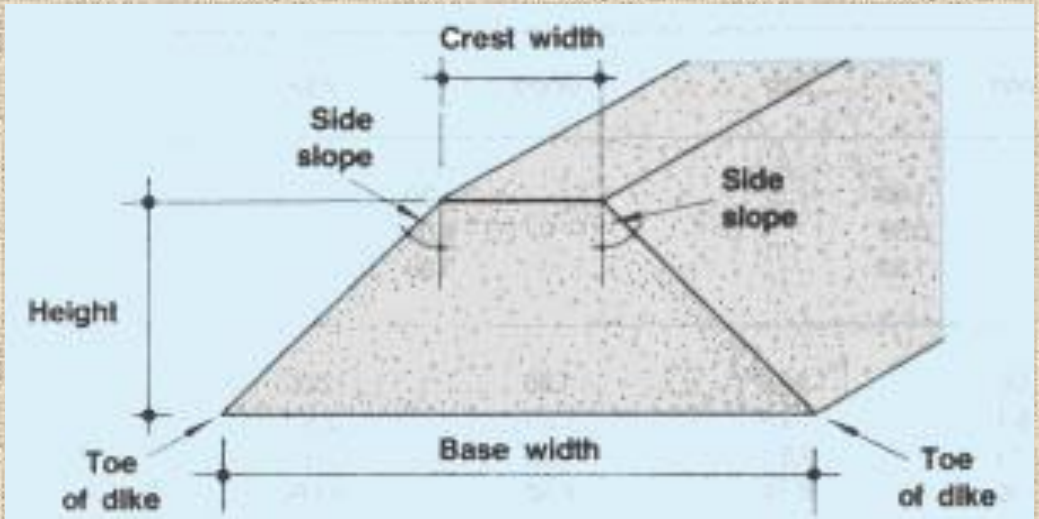
WD =Water depth
FB = Freeboard
DH =Design height
SH = Settlement height
CH = Construction height



Determining dike thickness

A dike rests on its base. It should taper upward to the dike top, also called the **crest** or crown. The thickness of the dike thus depends on: the width of the crest; and the slope of its two sides.

This, together with the height of the dike, will determine the width of the **dike base**



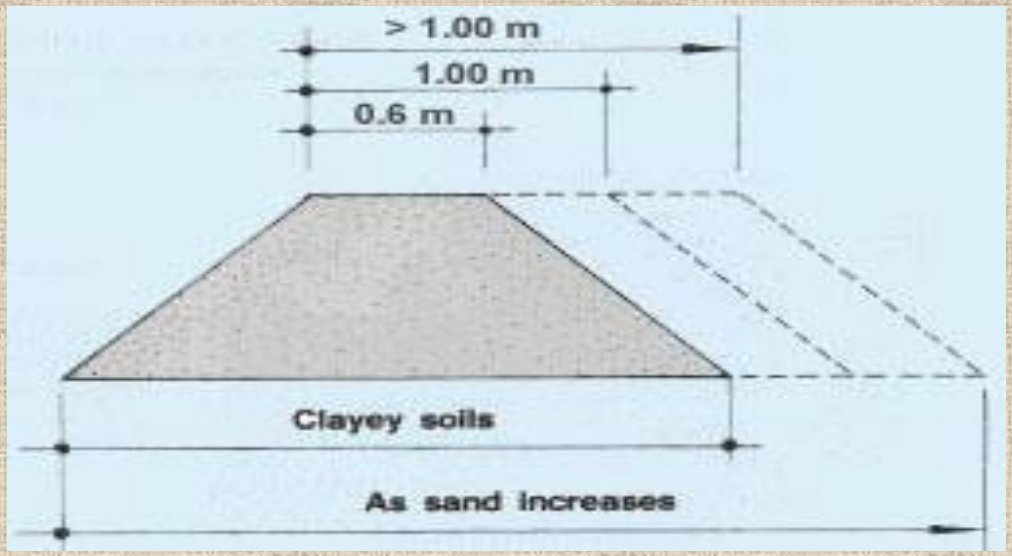
Determine the **width of the crest** according to the water depth and the role the dike will play for transit and/or transport.

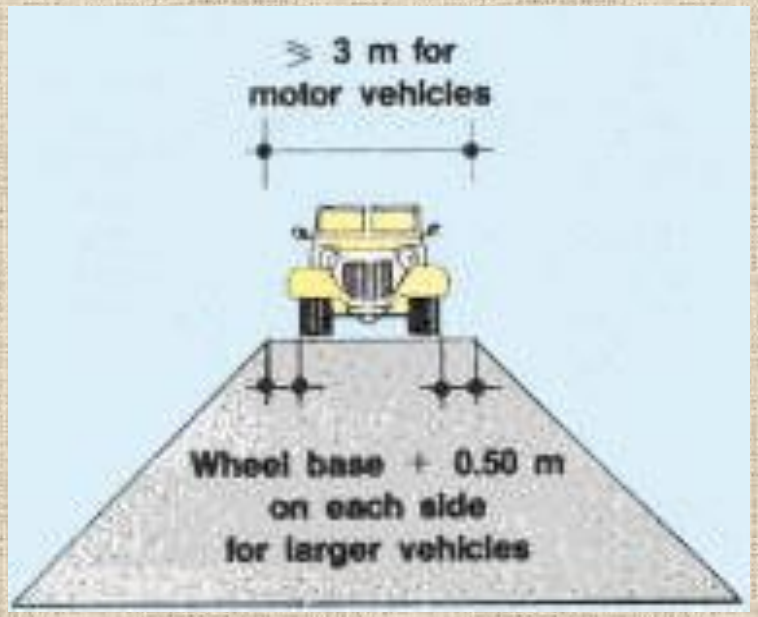
It should be at least equal to the water depth, but not less than 0.60 m in clayey soil or 1 m in somewhat sandy soil.

It should be even wider as the amount of sand in the soil increases.

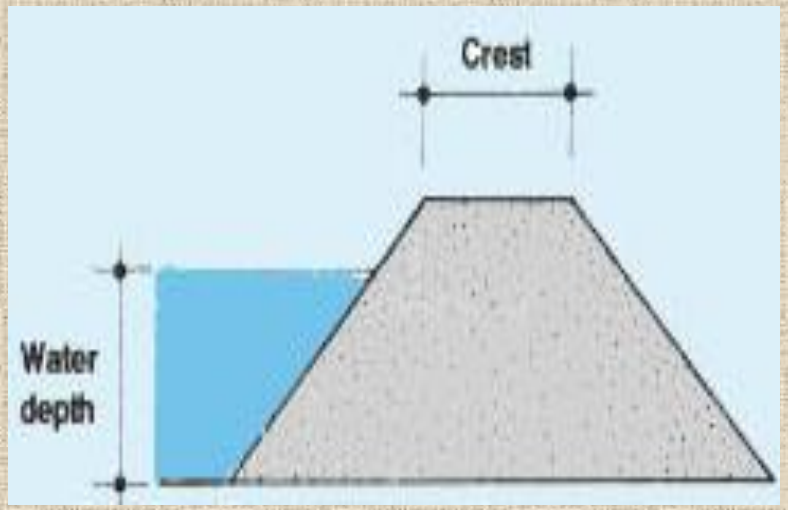
It should be safe for the transport you plan to use over it: at least 3 m for motor vehicles; for larger vehicles at least the wheel base plus 0.50 m on each side.

Note: these dimensions may be slightly reduced for very small rural ponds.





Crest width at least equals water depth

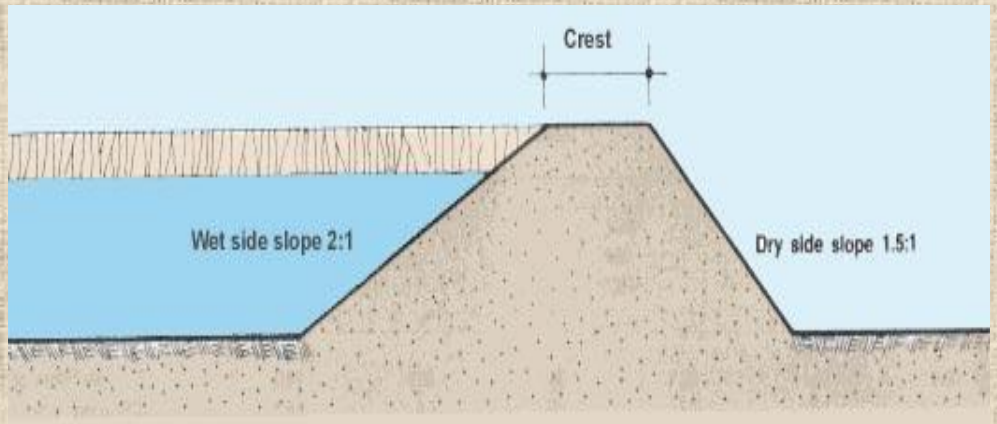


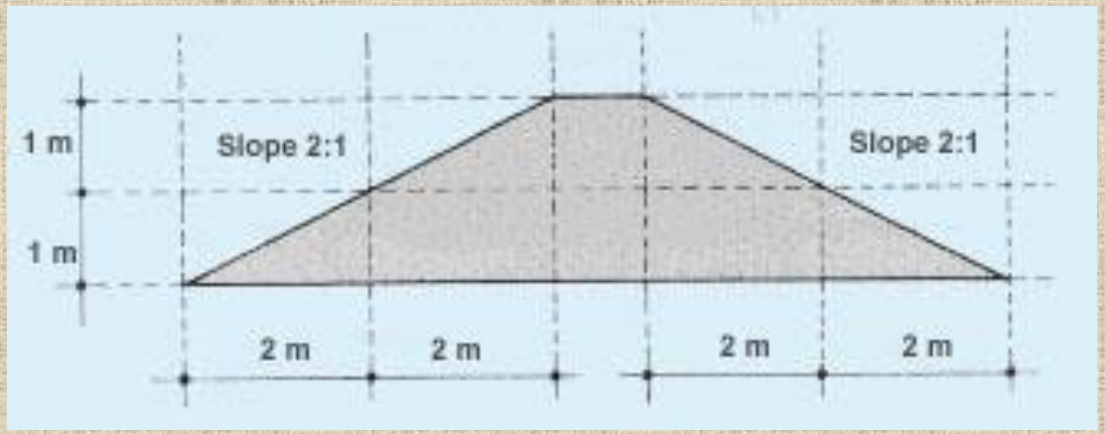
Examples of dimensions of dikes

Individual pond size (m^2)	200		400-600		1000-2500	
Quality of soil[1]	Good	Fair	Good	Fair	Good	Fair
Water depth (max. m)	0.80		1.00		1.30	
Freeboard (m)	0.25		0.30		0.50	
Height of dike[2] (m)	1.05		1.30		1.80	
Top width[3] (m)	0.60	0.80	1.00	1.30	1.50	2.00
Dry side, slope (SD)	1.5:1	2:1	1.5:1	2:1	1.5:1	2.5:1
Wet side, slope (SW)	1.5:1	2:1	2:1	2.5:1	2:1	3:1
Base width[4] (m)	4.53	6.04	6.36	8.19	8.92	13.66
Settlement allowance (%)	20	20	15	15	15	15
Construction height[5] (m)	1.31	1.31	1.53	1.53	2.12	2.12
Cross-section area (m^2)	3.3602	4.4802	5.6266	7.2560	11.0452	16.5996

In individual ponds, dikes have two faces, **the wet side** inside the pond and **the dry side** or external side. These two sides should taper from the base to the top at an angle that is usually expressed as a ratio defining the change in horizontal distance (z in m) per meter of vertical distance as, for example, 2:1 or 1.5:1.

Slope (ratio)	Slope (%)	Slope (degrees, approximate)
1:1	100	45
1.5:1	66	34
2:1	50	27
2.5:1	40	22
3:1	33	18





Calculating dike and excavation volumes

1-Before starting the construction of your pond, you should calculate how much soil you will need to build its dikes. Then, you will need to estimate the excavation volume necessary to provide such soil volume. According to the topography of the construction site and the type of pond to be built, you should select the best method to be used. You should estimate and you should also use standard settlement allowances

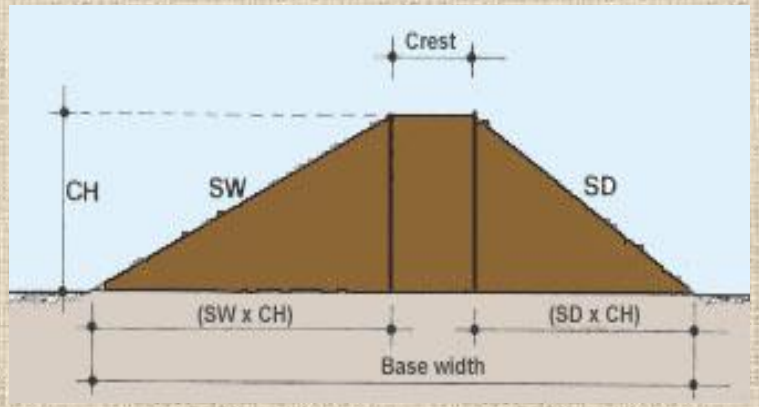
2. Multiply excavation volume by the expansion factor to obtain the expanded volume. This expanded volume is then used in the construction volume of the dike. After compaction and settlement, as estimated by the compaction potential, it should reach the design volume required.

Calculating the width of the dike base

crest width (in m);

- **construction height (CH in m) multiplied by slope ratio of dry side (SD);**
- **construction height (CH in m) multiplied by slope ratio of wet side (SW).**

Base width = crest width + (CH x SD) + (CH x SW)



Example

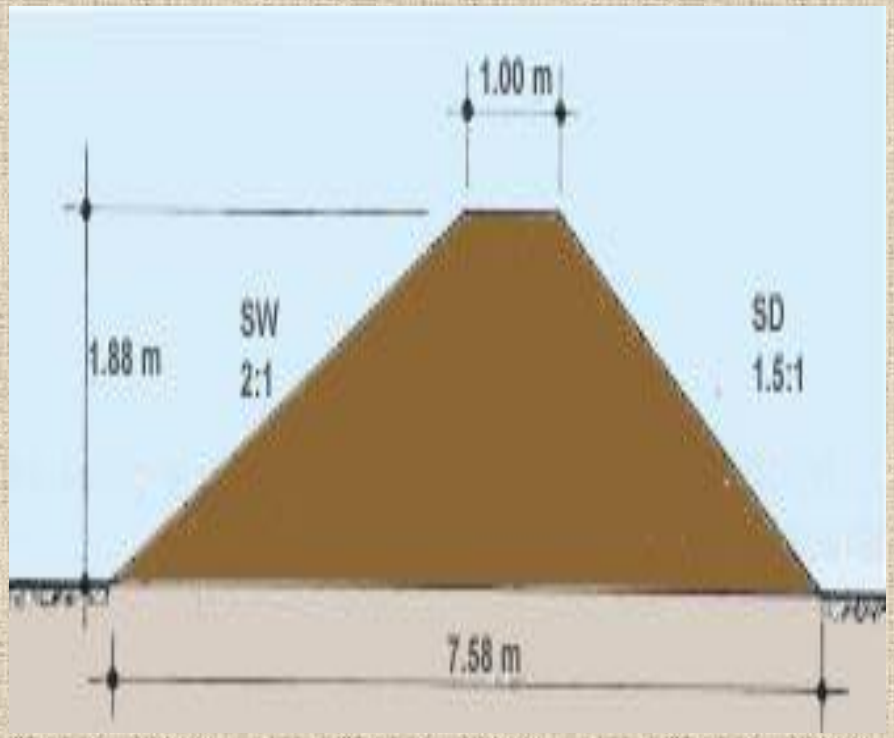
A 0.04-ha pond (400 m2) has to be built in clayey soil with dikes 1.50 m high and 1 m wide at the top, according to the design. If SD = 1.5:1 and SW = 2:1, calculate the base width of the dikes.

(a) From Table estimate the settlement allowance of the expanded clay volume (20 percent for medium clay soils).

(b) Consider the design height = (100% - 20%) = 80 percent of construction height.

(c) Obtain the construction height = 1.50 m ÷ 0.80 = 1.88 m.

(d) Calculate dike base width = 1 m + (1.88 m x 1.5) + (1.88 m x 2) = 1 m + 2.82 m + 3.76 m = 7.58 m



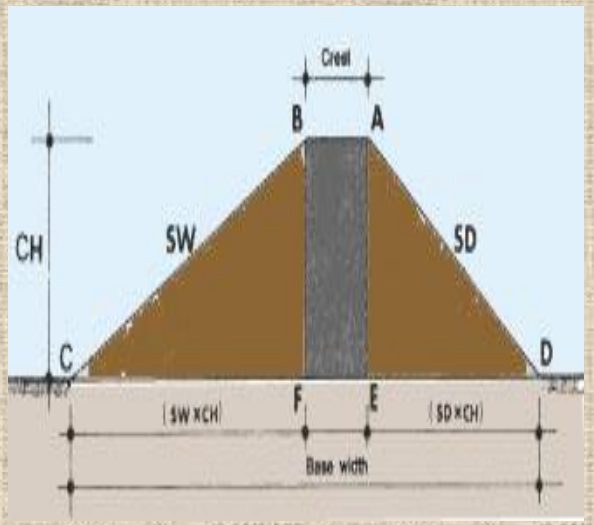
Calculating the cross-section of a dike on horizontal ground

The size of the **cross-section of a dike** on horizontal ground (ABCD in m2) (see diagram) is obtained by adding:

1-area ABFE (in m2) = crest width (AB) x construction height (CH);

2-area AED (in m2) = ED x (AE ÷ 2)= (SD x CH) x (CH ÷ 2);

3-area BFC (in m2) = FC x (BF ÷ 2)= (SW x CH) x (CH ÷ 2).



Example

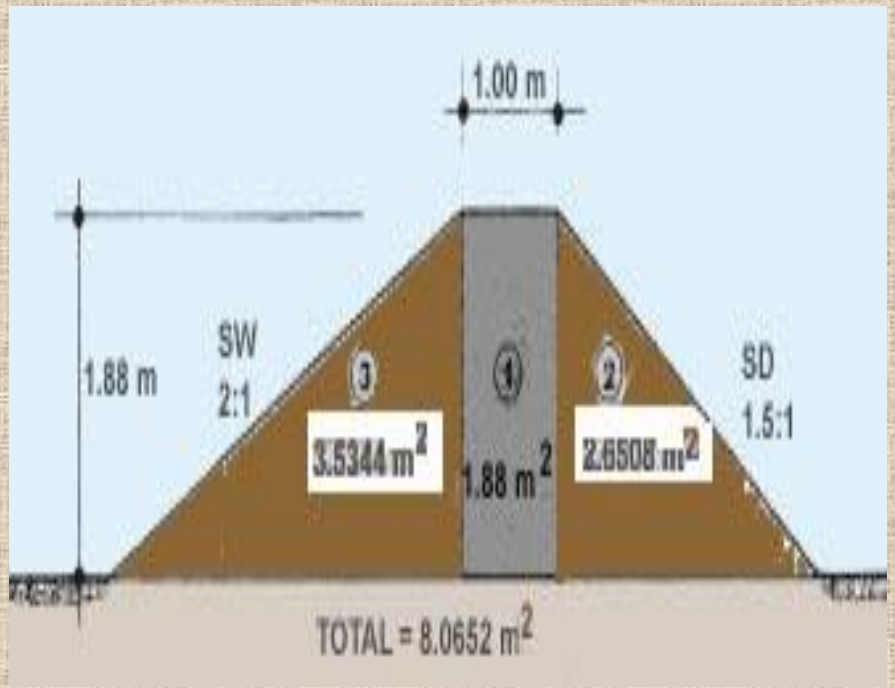
For the above 0.04-ha pond to be built in clayey soil, calculate the size of the cross-section of the dike as:

area 1 = 1 m x 1.88 m = 1.88 m2;

area 2 = (1.5 x 1.88 m) x (1.88 m ÷ 2) = 2.6508 m2;

area 3 = (2 x 1.88 m) x (1.88 m ÷ 2) = 3.5344 rn2

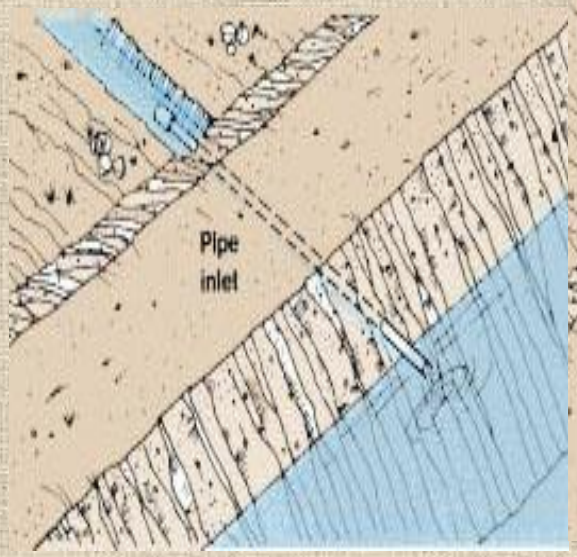
cross-section = 1.88 m2 + 2.6508 m2 + 3.5344 m2 = 8.0652 m2.



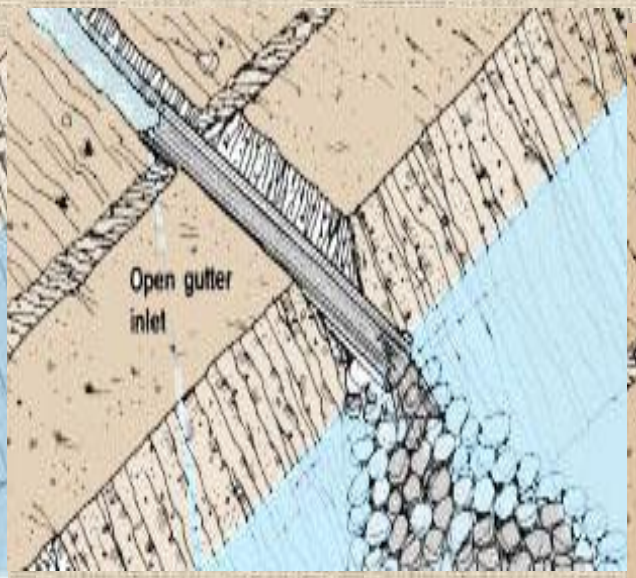
محاضرة 3

POND INLET STRUCTURES

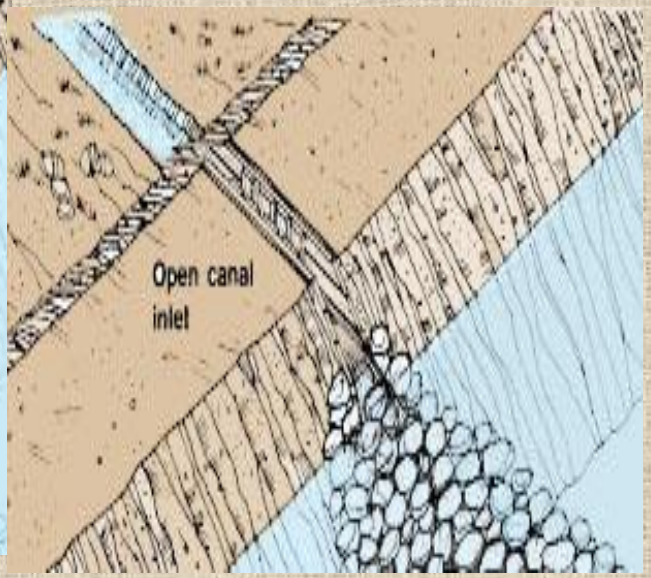
There are **three main types** of inlet structures:
pipe inlets;
open gutter inlets;
canal inlets



pipe inlets



open gutter inlets



canal inlets

Designing inlets

(a) Place the inlet **at the shallow end** of the pond.
(b) **Design its bottom level** to be at the same level as the bottom of the water feeder canal and ideally **at least 10 cm** above the maximum level of the water in the pond.
(c) Design the inlet structure **to be horizontal**, with no slope.
(d) Try to arrange the structure so that **water splashes** and mixes as much as possible when entering the pond.
(e) Remember that you have **to keep** unwanted fish **out** of your pond. Design your pond inlet accordingly

Example
Your pond has an area of 200 m2 and an average water depth of 0.75 m. You wish to fill it within 6 hours.
Total water volume required: 200 m2 x 0.75 m = 150 m3 = 150000 litres
Total time available: 6 hours = 360 minutes = 21600 seconds
Inlet capacity required: 150000 l ÷ 21600 s = 6.94 l/s, either = 7 l/s
If you have this water flow available when you fill the pond, you can go ahead with this estimate and plan on filling your pond within 6 hours.