Practical Aquaculture 3

By

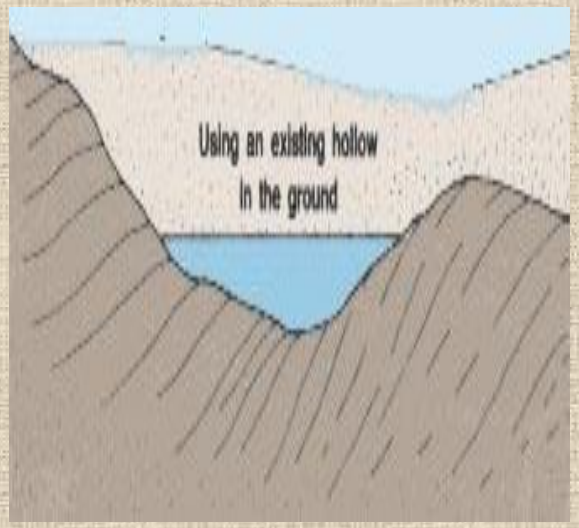
Dr. Adel Al-Dubakel

A fish farm with different types of ponds

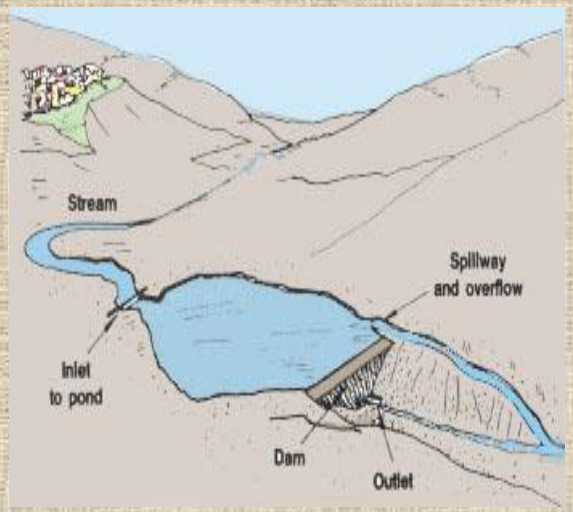
Three basic pond types

depending on the way the pond fits in with the features of the local landscape.

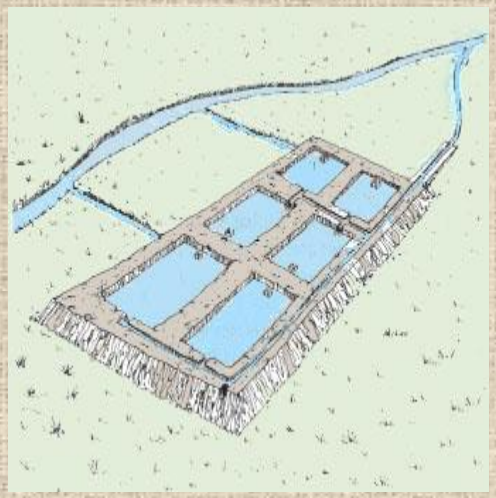
Sunken pond



Barrage pond



Diversion pond **(paddy)**



Advantages and disadvantages of the three basic types of pond

Type	*Advantages*	*Disadvantages*
Sunken pond	No need for dikes except for flood protection No water body to supply water Little skill required for construction	Water level can greatly vary seasonally Requires more work to excavate Undrainable; uncontrolled water supply, unless pumped; pumping may be expensive Low natural productivity of groundwater Pond management difficult
Barrage pond*	Simple to design for small streams Construction costs relatively low unless there are flood defence problems Natural productivity can be high, according to quality of water supply	Dike needs to be carefully anchored Need for a spillway and its drainage canal No control of incoming water supply (quantity, quality, wild fish) Cannot be completely drained except when incoming water supply dries out Pond management difficult (fertilization, feeding) as water supply is variable Irregular shape and size
Diversion pond**	Easy control of water supply Good pond management possible Construction costs higher on flat ground Can be completely drained Regular pond shape and size possible	Construction costs higher than barrage ponds Natural productivity lower, especially if built in infertile soil Construction requires good topographical surveys and detailed staking out

* If the barrage pond is built with a diversion canal, some of the disadvantages may be eliminated (controlled water supply, no spillway, complete drainage, easier pond management), but construction costs can greatly increase if the diversion of a large water flow has to be planned.
** Relative advantages will vary according to the arrangement of the ponds (see Section 16), either in series (pond management is more difficult) or in parallel (both water supply and drainage are independent, which simplifies management).

The physical characteristics of fish ponds

size, shape and water depth

size

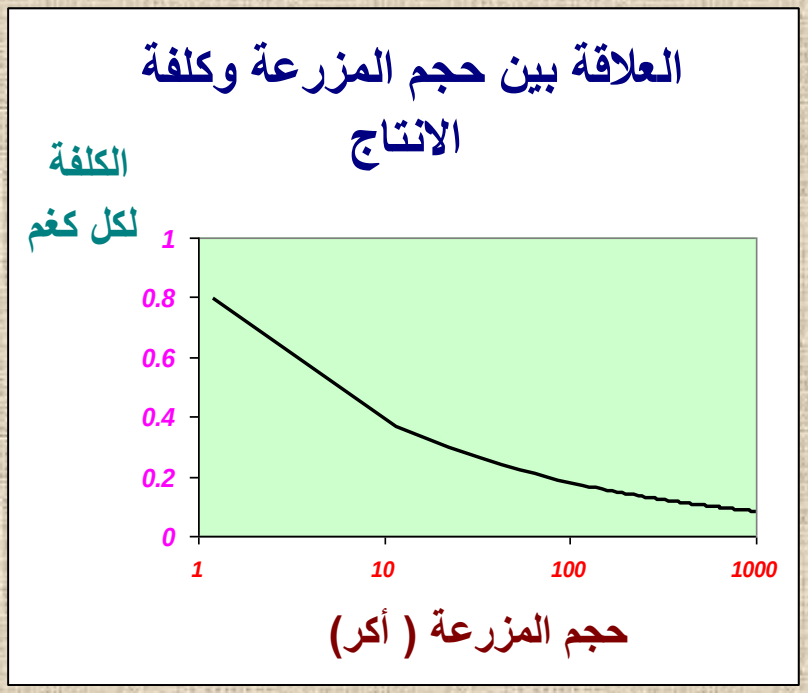
Type of pond	Area (m^2)
Subsistence ponds	100-400
Small-scale commercial ponds	400-1000
Large-scale commercial ponds	1000-5000

shape

Different shapes for a pond of 100 m^2

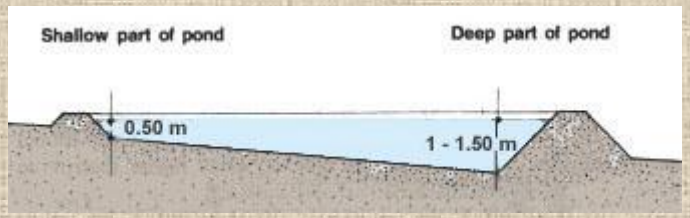
Pond shape	Width (m)	Length (m)	Length of dikes (m)
Square	10	10	20 + 20 = 40
Rectangle	7	14.3	14 + 28.6 = 42.6
	5	20	10 + 40 = 50
	2	50	4 + 100 = 104

square ponds are particularly useful as smaller ponds (up to 400 m2)

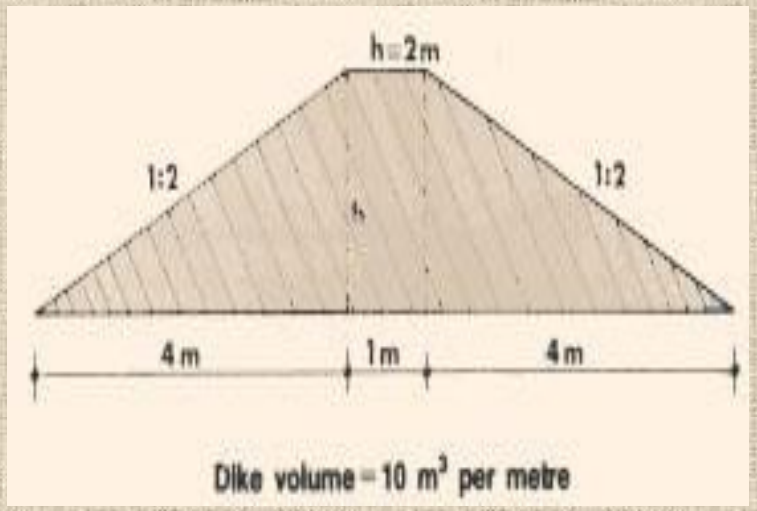


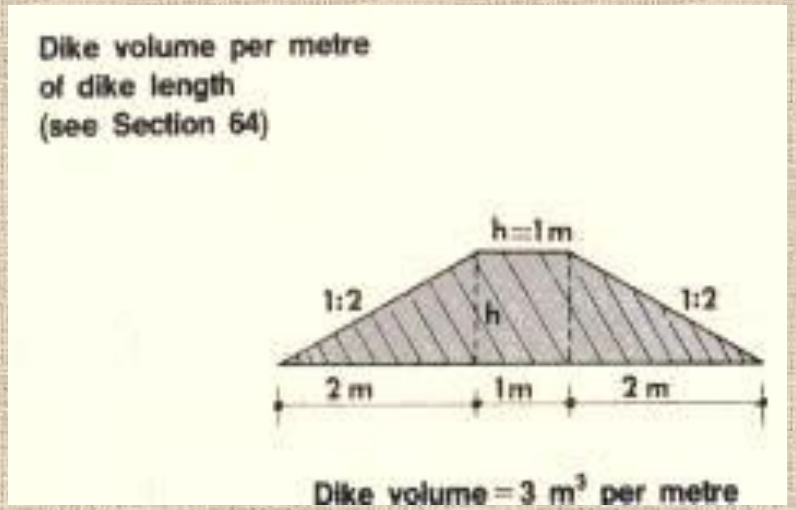
Water depth in fish ponds

fish ponds are generally shallow. Their maximum water depth does not normally exceed 1.50 m. Their shallowest area should be at least 0.50 m deep to limit the growth of aquatic plants. The water depth in small rural ponds normally varies from 0.50 m (shallow area) to 1 m at the most (deep area).



Deeper ponds are much more expensive to build, because the volume of the dikes increases rapidly as you make ponds deeper





Characteristics of shallow and deep ponds

Shallow ponds	Deep ponds
Water warms up rapidly	Deep water warmer in cold season
Great fluctuations of temperature	Water temperature more stable
Greater danger from predatory birds	Less natural food available
Greater growth of water plants	Difficult to seine in deep water
Smaller dikes needed	Strong, high dikes needed

in dry regions where you need to store water through the dry season to make sure there is enough for the fish;
in cold regions where it may be necessary to provide the fish with a refuge in deeper, warmer waters during cold weather.

FISH POND CONSTRUCTION

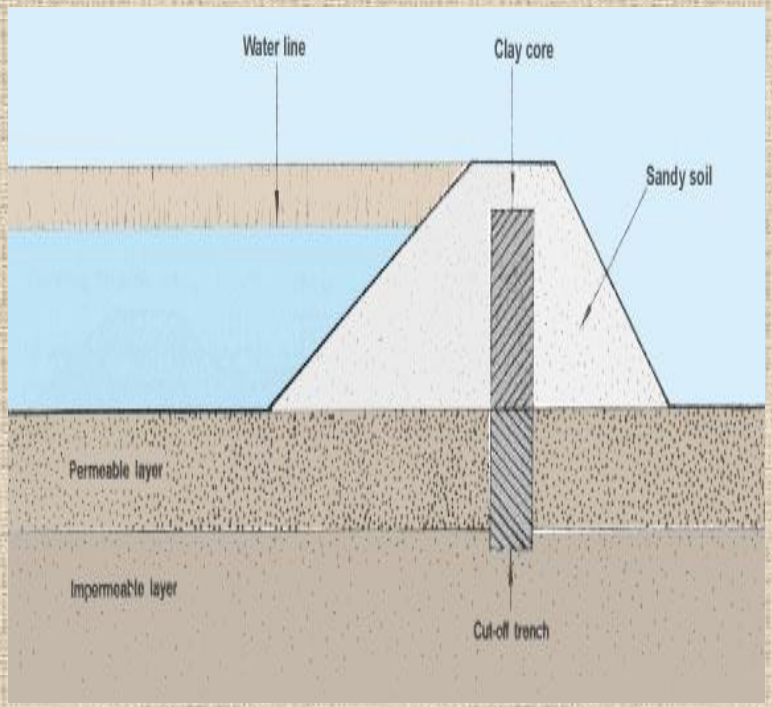
Dikes are the most important part of a fish pond

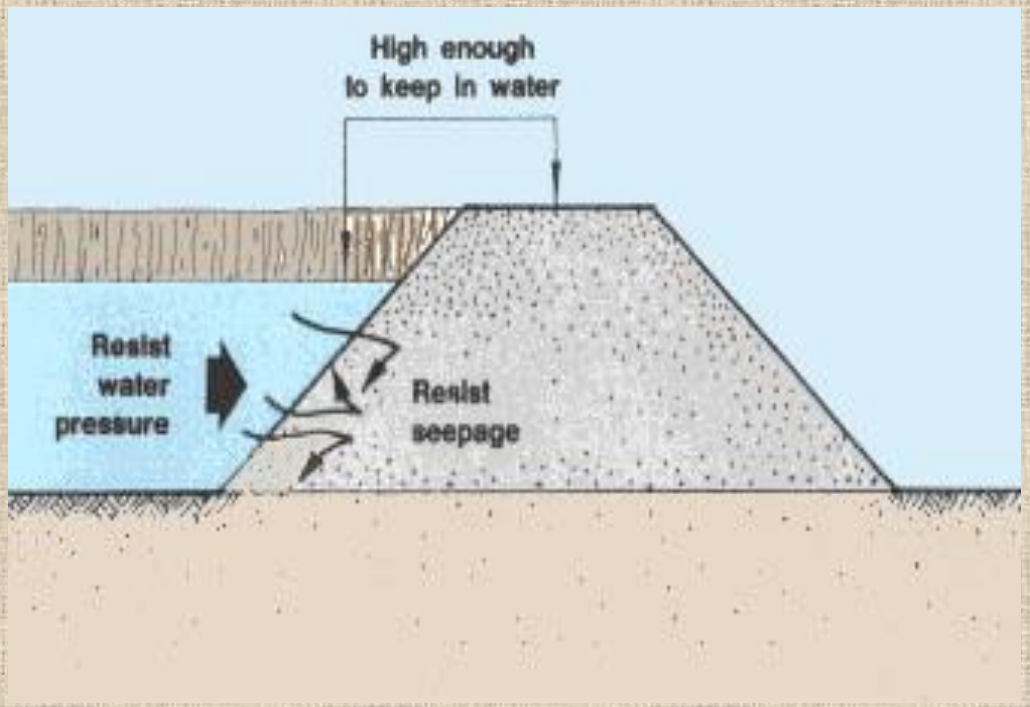
Characteristics of pond dikes It should be

resist the water pressure resulting from the pond water depth

impervious, the water seepage through the dike being kept to a minimum

high enough to keep the pond water from ever running over its top, which would rapidly destroy the dike





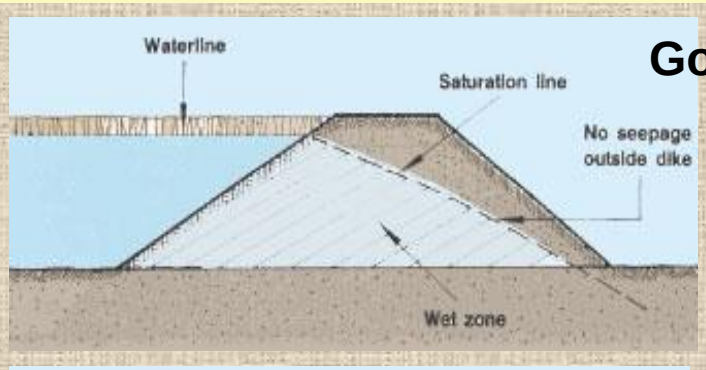
Resisting water pressure

anchoring your dike strongly to its foundations (the soil on which you build it);
constructing your dike large enough to **resist the water pressure** by virtue of its weight

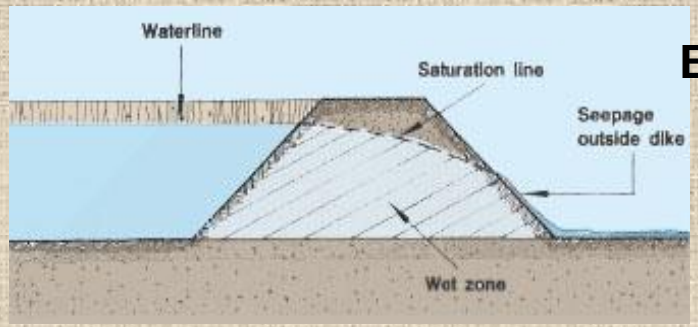
Ensuring impermeability

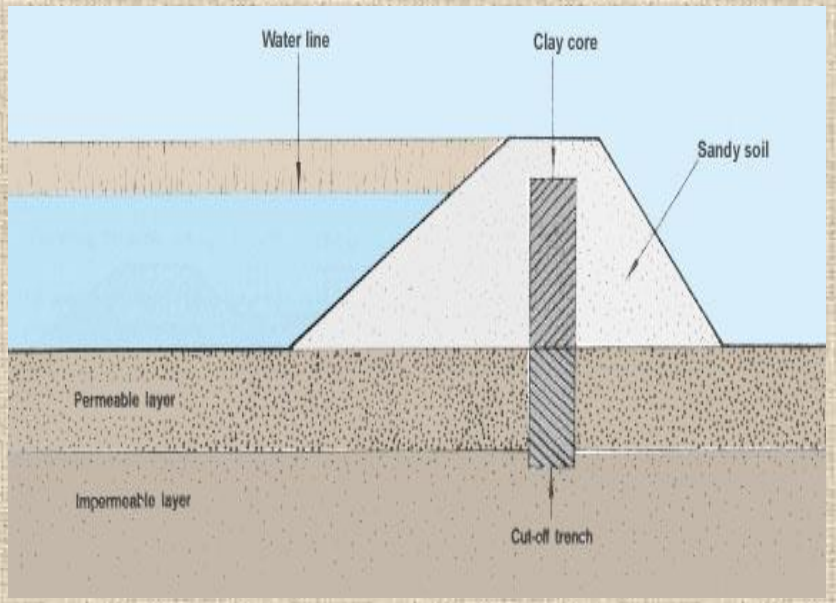
Impermeability of the dike can be ensured by:
using good soil that contains enough clay
building a central **clayey core** when using pervious soil material;
building a **cut-off trench** when the foundation is permeable;
applying good construction practices
ensuring that the thickness of your dike is appropriate.

Good dike



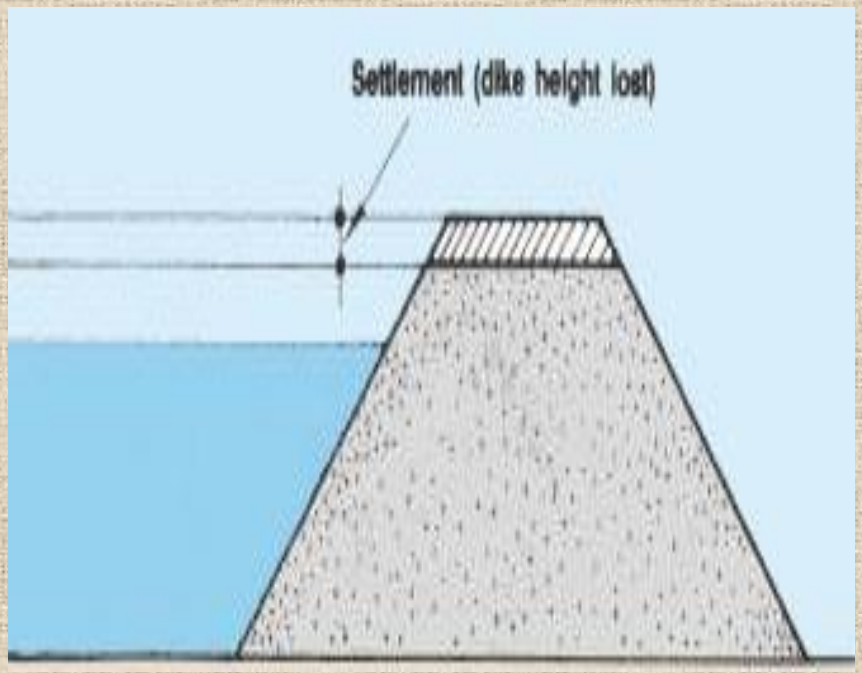
Bad dike

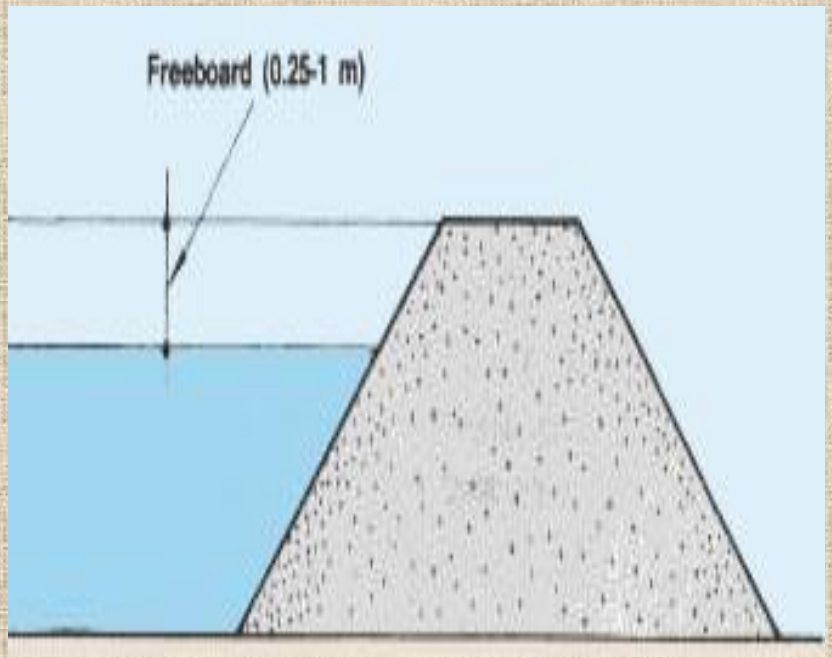




Choosing the right height

To calculate the height of the dike to be built, take into account:
the depth of the water you want in the pond;
the **freeboard***, which is the upper part of a dike and should never be under water. It varies from 0.25 m for very small diversion ponds to 1 m for barrage ponds without a diversion canal;
the dike height that will be lost during **settlement***, taking into account the compression of the subsoil by the dike weight and the settling of fresh soil material. This is the **settlement allowance** which usually varies from 5 to 20 percent of the construction height of the dike

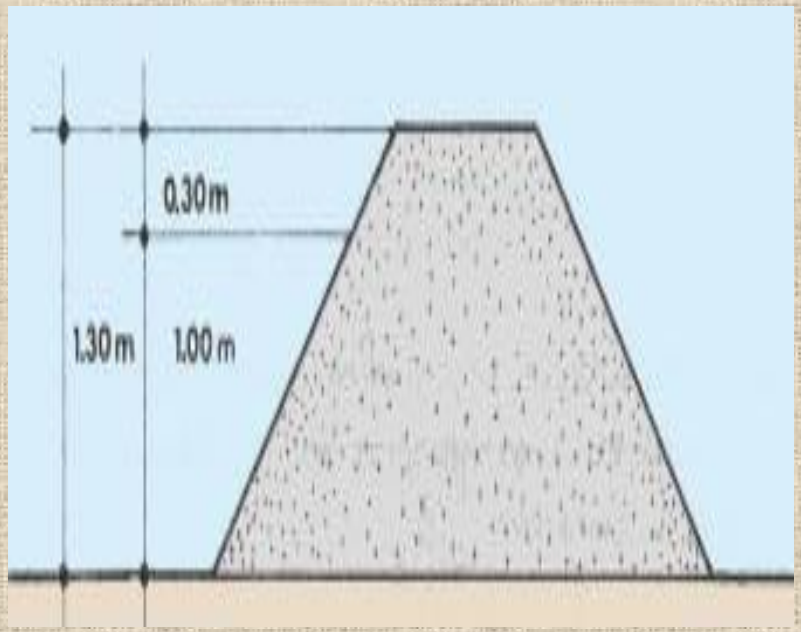




two types of dike height may be defined:
the **design height DH**, which is the height the dike should have after settling down to safely provide the necessary water depth in the pond. It is obtained by adding the water depth and the freeboard;
the **construction height CH**, which is the height the dike should have when newly built and before any settlement takes place. It is equal to the design height plus the settlement height.

to determine the construction height (**CH** in m) simply from the design height (**DH** in m) and the settlement allowance (**SA** in percent) as follows

$$CH = DH \div [(100 - SA) \div 100]$$



Example
If the maximum water depth in a diversion pond of medium size is 1 m and the **freeboard*** 0.3 m, the design height of the dike:
DH = 1 m + 0.30 m = 1.30 m.
If the settlement allowance is estimated to be 15 percent, the required construction height will be
CH = 1.30 m ÷ [(100 - 15) ÷ 100] = 1.30 m ÷ 0.85 = 1.53 m