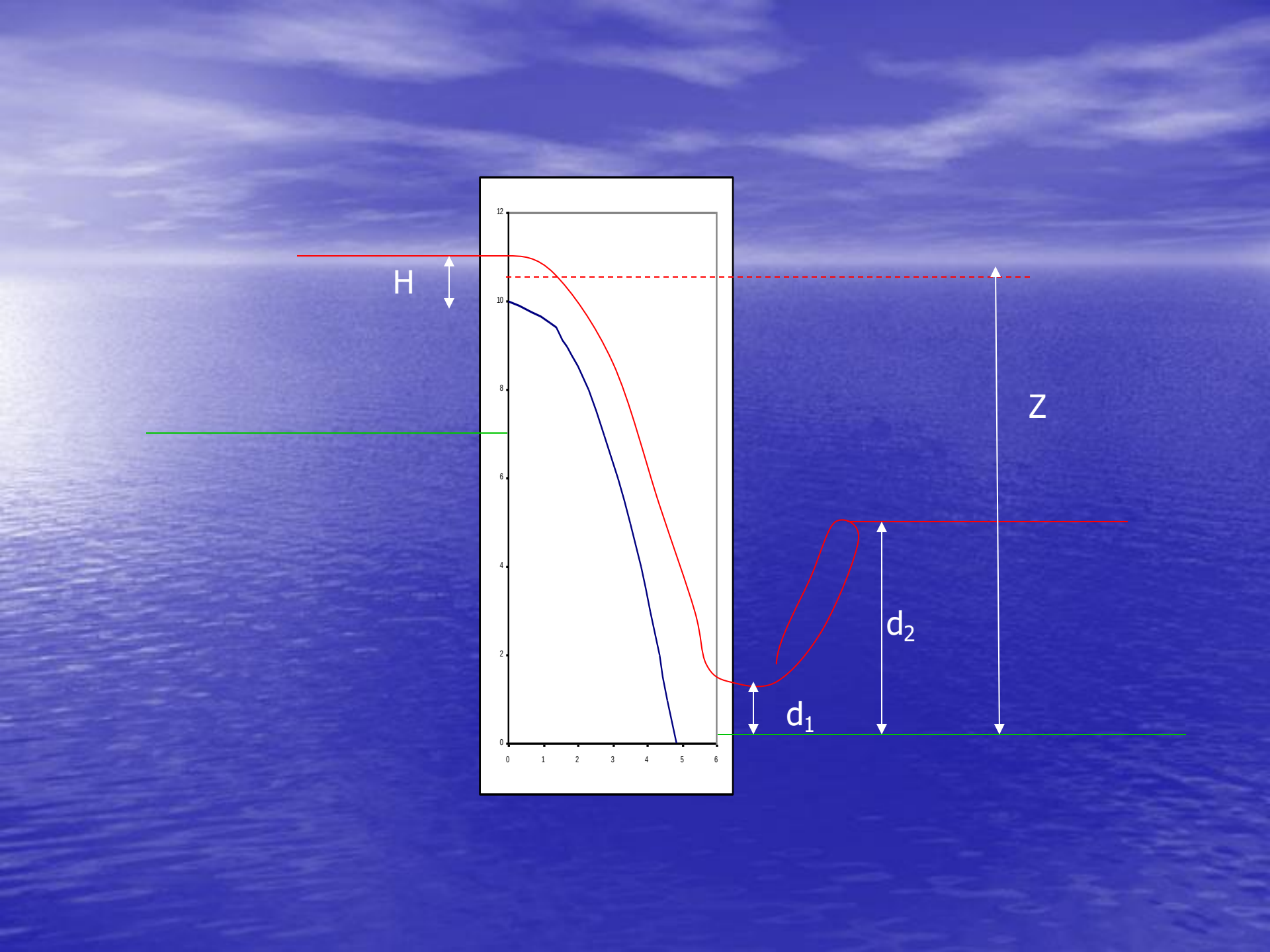
Miscellaneous Structures

- Stilling Basin

  Stilling basin is used at the end of an Ogee type weir to reduce the velocity of the running water down the weir to prevent scour to the downstream channel.


H
Z
d_2
d_1
12
10
8
6
4
2
0
0
1
2
3
4
5
6

- To design the stilling basin, one must calculate the exit velocity, i.e. the velocity at the foot of the basin, the water depth and the Froude number. Following the illustration in the previous page,

$$V = C_v \sqrt{(2\, g\, Z)}$$

$$d_1 = Q/(VB)$$

$$F = V/\sqrt{(g\, d_1)}$$

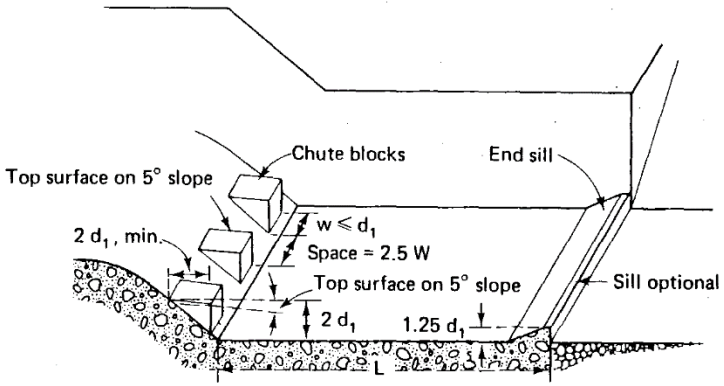
where

C_v is the velocity coefficient (0.97)

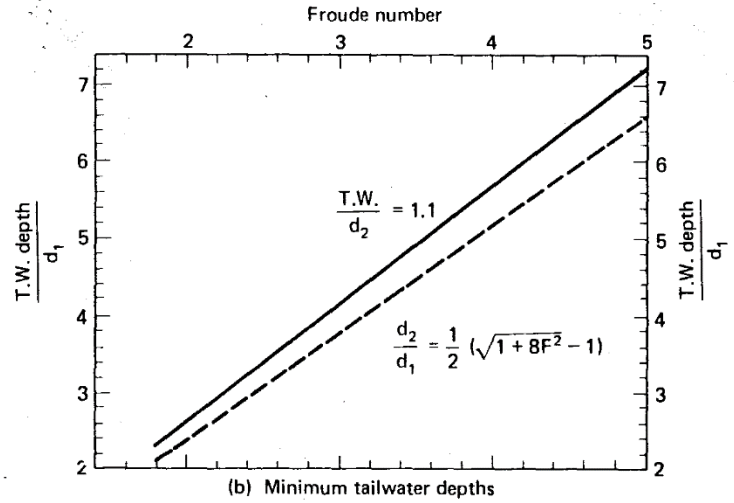
B is the spillway width

- Based on the Froude number, one may select the suitable basin type.

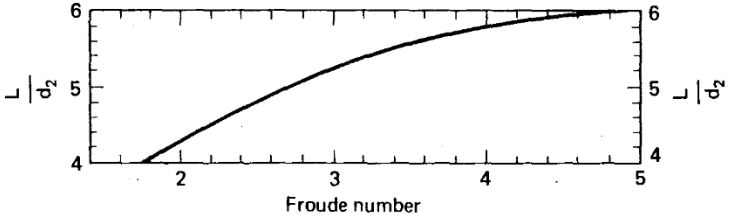
Froude No.	Type
2.5 – 4	IV
> 4 V< 20 m/s	III
> 4, V> 20 m/s	II



(a) Type IV basin dimensions



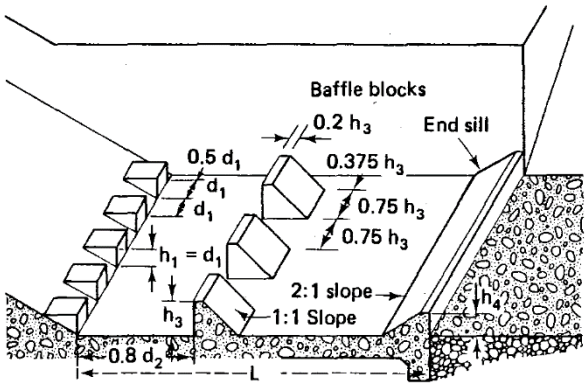
(b) Minimum tailwater depths



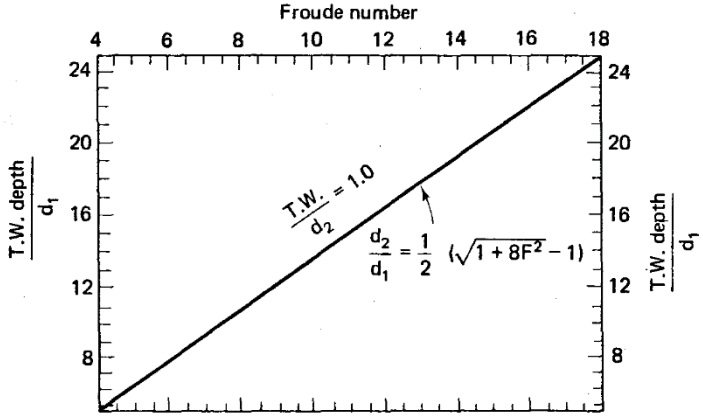
(c) Length of jump

5.1

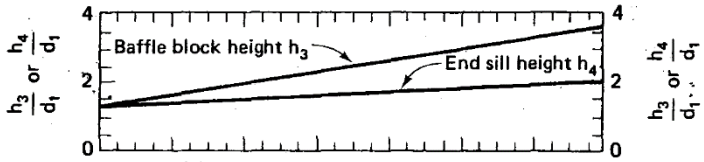
Fig. Energy dissipator. The U.S. Bureau of Reclamation Type IV (for approaching Froude number between 2.5 and 4.5). (Courtesy of U.S. Bureau of Reclamation.)



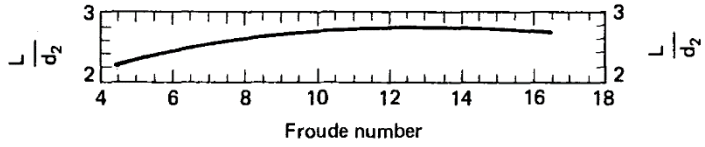
(a) Type III basin dimensions



(b) Minimum tailwater depths



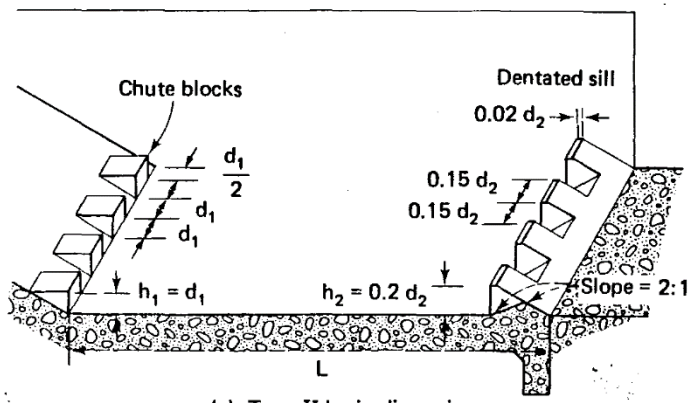
(c) Height of baffle blocks and end sill



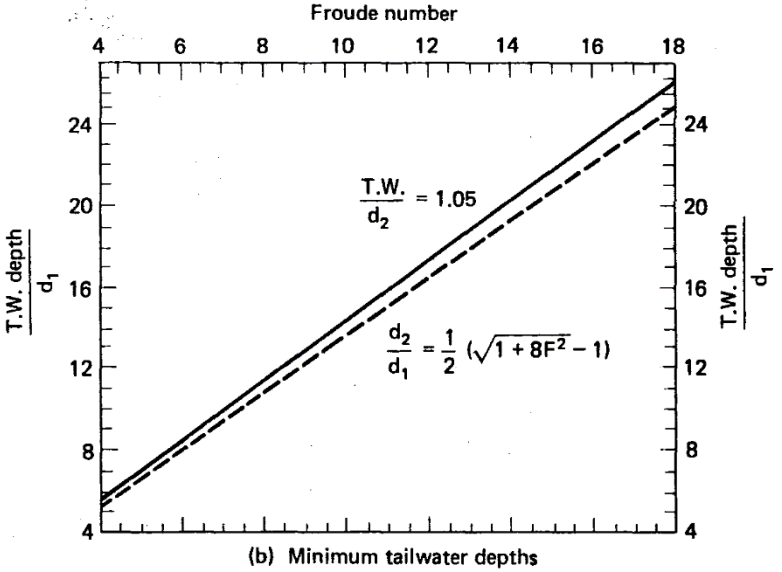
(d) Length of jump

5.2

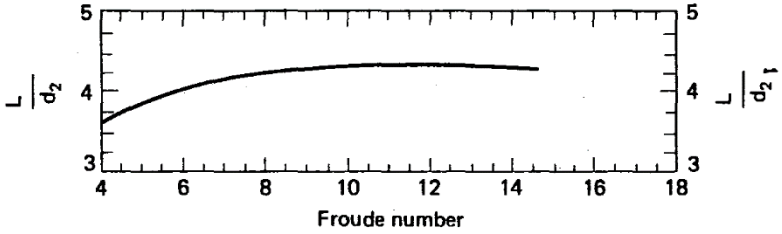
Fig. Energy dissipator. The U.S. Bureau of Reclamation Type III (for Froude number above 4.5 and approaching velocity less than 20 m/s). (Courtesy of U.S. Bureau of Reclamation.)



(a) Type II basin dimensions



(b) Minimum tailwater depths



(c) Length of jump

5.3

Fig. Energy dissipator. The U.S. Bureau of Reclamation Type II (for Froude number above 4.5). (Courtesy of U.S. Bureau of Reclamation.)

- Example:

  Design a stilling basin based on the following data;

  $Z = 15$ m; $Q = 50$ m^3/sec; $B = 20$ m

- Sol.

  $V = 0.97 \sqrt{(2*9.81*15)} = 16.64$ m/sec

  $d_1 = 50/(16.64*20) = 0.15$ m

  $F = 16.64/\sqrt{(9.81*0.15)} = 13.7$

  Then select type III

from curve (b)

T.W. depth = d_2

T.W. depth/ d_1 = 18.5

T.W. depth d_2 = 18.5*0.15 = 2.78 m

from curve (c)

h_3/d_1 = 3 ; h_4/d_1 = 1.8

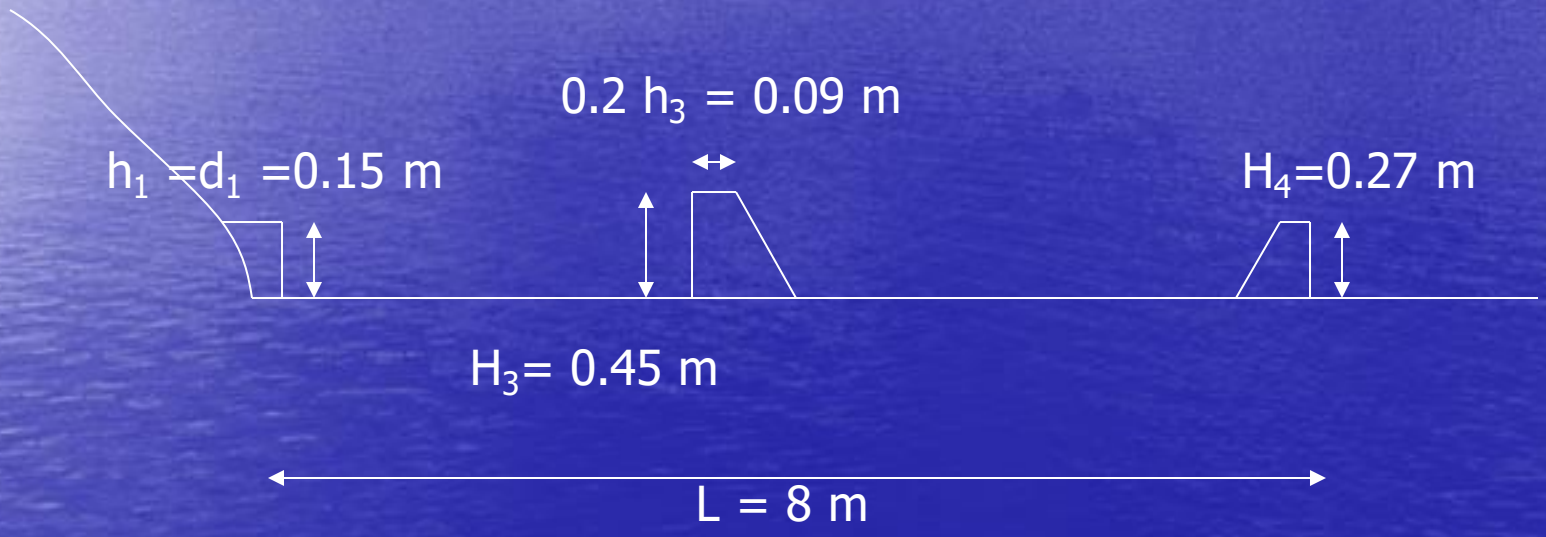
Baffle block height h_3 =3*0.15=0.45 m

End sill height h_4 = 1.8*0.15 = 0.27 m

from curve (d)

L/d_2 = 2.8

Stilling basin length L = 2.8*2.78 ≈ 8 m


0.2 h3 = 0.09 m
h1 =d1 =0.15 m
H4=0.27 m
H3= 0.45 m
L = 8 m