Formulas according to Honma; information found on the internet:

Quote ---------------------------------

In Mike 11, we are able to choose between different weir formulas to calculate their downstream discharge. We used the weir formula 2 (formula of Honma). This method uses different equations according to flow type, that is, if there is free overflow or submerged flow conditions.

$$Q = wCh_1\sqrt{h_1} \qquad \text{for } \frac{h_2}{h_1} \le 2/3:$$

$$Q = w\frac{3}{2}\sqrt{3}\,Ch_2\sqrt{h_1 - h_2} \quad \text{for } \frac{h_2}{h_1} > 2/3:$$

Where, *w* stands for the width of the weir, *h_1* the depth of water above weir level upstream, *h_2* is the depth of the water above weir level downstream and *C* is the weir coefficient, which accounts for its resistance to the flow.

Unquote------------------------------

Formula of Honma for $\frac{h_2}{h_1} \le \frac{2}{3}$: $Q = w * C * h_1 * \sqrt{h_1}$

Formula of Honma for $\frac{h_2}{h_1} > \frac{2}{3}$: $Q = w * \frac{3}{2} * \sqrt{3} * C * h_2 * \sqrt{(h_1 - h_2)}$

or $Q = 2{,}598 * w * C * h_2 * \sqrt{(h_1 - h_2)}$

$$h_1 - h_2 = \left(\frac{Q}{2{,}598 * w * C * h_2} \right)^2$$

Q = total flow
h1 = upstream depth above weir lip
h2 = downstream depth above weir lip
w = weir width
C = weir coefficient

Formula according to RCooper:

$$Q = 0{,}61 * w * h_2 * \sqrt{2 * g * (h_1 - h_2)}$$

$$h_1 - h_2 = \left(\frac{Q}{0{,}61 * w * h_2} \right)^2 * \frac{1}{2g}$$

Q = total flow
h1 = upstream depth above weir lip
h2 = downstream depth above weir lip
w = weir width
g = gravity = ~ 10

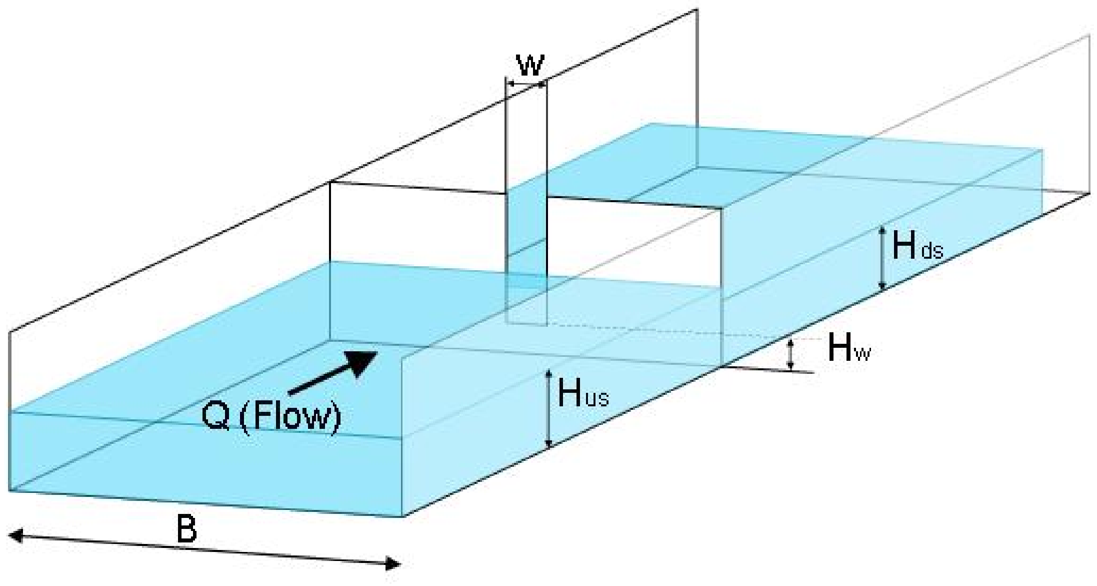
Formula sharp crested weir

$$Q = w * \frac{2}{3} * C * \sqrt{\left(2g * h^3\right)}$$

For a weir with the same width as the channel, C is approx 0,62. For a contracted weir (width of the weir less than width of the channel), C is approx 0,62 * (1 – 0,2 h/w).

This formula does not say anything about level Hds.

Sample calculation



Q = 400 l/h = 0,4 m3/h = 0,000111 m3/sec
B = channel width = 250 mm
C = 0,6 (assumed, based on information found in literature)
Hus = ????
Hds = 75 mm = 0,075 m
Hw = 50 mm = 0,05 m

W = 50 mm = 0,05 m

h1 = Hus – Hw
h2 = Hds – Hw = 25 mm = 0,025 m

Calculate with formula from Honma:

$$h_1 - h_2 = \left(\frac{Q}{2{,}598 * w * C * h_2} \right)^2$$

$$h_1 - h_2 = \left(\frac{0{,}000111}{2{,}598 * 0{,}05 * 0{,}6 * 0{,}025} \right)^2 = 0{,}0032678\, m$$

Calculate with formula from RCooper

$$h_1 - h_2 = \left(\frac{Q}{0{,}61 * w * h_2} \right)^2 * \frac{1}{2g}$$

$$h_1 - h_2 = \left(\frac{0{,}000111}{0{,}61 * 0{,}05 * 0{,}025} \right)^2 * \frac{1}{2 * 10} = 0{,}001059586\, m$$

So one formula gives approx. 3 mm, the other approx 1 mm. The latter seems to correspond better with what we observe in the model. You can barely see that there is a level drop.

RCooper bases his formula on the assumption that the dynamic head upstream and downstream of the weir are identical. As I see it, that means the velocity v is the same before and after the weir. But than, given that the width of the channel B and the flow Q are the same, Hus and Hds should also be the same. That means no level drop.