Important Submerged Weirs Formulas PDF

Formulas
Examples
with Units

List of 17
Important Submerged Weirs Formulas

1) Coefficient of Discharge given Discharge through Drowned Portion Formula

Evaluate Formula

Formula

$$C_d = \frac{Q_2}{\left(L_w \cdot h_2\right) \cdot \sqrt{2 \cdot g \cdot \left(H_{Upstream} - h_2\right)}}$$

Example with Units

$$0.66 = \frac{99.96\,\text{m}^3/\text{s}}{\left(3\,\text{m} \cdot 5.1\,\text{m}\right) \cdot \sqrt{2 \cdot 9.8\,\text{m/s}^2 \cdot \left(10.1\,\text{m} - 5.1\,\text{m}\right)}}$$

2) Coefficient of Discharge given Discharge through Free Weir Portion Formula

Evaluate Formula

Formula

$$C_d = \frac{3 \cdot Q_1}{2 \cdot L_w \cdot \sqrt{2 \cdot g} \cdot \left(H_{Upstream} - h_2\right)^{\frac{3}{2}}}$$

Example with Units

$$0.5061 = \frac{3 \cdot 50.1\,\text{m}^3/\text{s}}{2 \cdot 3\,\text{m} \cdot \sqrt{2 \cdot 9.8\,\text{m/s}^2} \cdot \left(10.1\,\text{m} - 5.1\,\text{m}\right)^{\frac{3}{2}}}$$

3) Coefficient of Discharge if Velocity is Approached for Submerged Weir Formula

Evaluate Formula

Formula

$$C_d = \frac{Q_2}{L_w \cdot h_2 \cdot \left(\sqrt{2 \cdot g \cdot \left(H_{Upstream} - h_2\right) + v_{su}^2}\right)}$$

Example with Units

$$0.6097 = \frac{99.96\,\text{m}^3/\text{s}}{3\,\text{m} \cdot 5.1\,\text{m} \cdot \left(\sqrt{2 \cdot 9.8\,\text{m/s}^2 \cdot \left(10.1\,\text{m} - 5.1\,\text{m}\right) + 4.1\,\text{m/s}^2}\right)}$$

4) Coefficient of Discharge if Velocity is Approached given Discharge through Free Weir Formula

Evaluate Formula

Formula

$$C_d = \frac{3 \cdot Q_1}{2 \cdot L_w \cdot \sqrt{2 \cdot g} \cdot \left(\left(\left(H_{Upstream} - h_2 \right) + \left(\frac{v_{su}^2}{2 \cdot g} \right) \right)^{\frac{3}{2}} - \left(\frac{v_{su}^2}{2 \cdot g} \right)^{\frac{3}{2}} \right)}$$

Example with Units

$$0.4228 = \frac{3 \cdot 50.1\,\text{m}^3/\text{s}}{2 \cdot 3\,\text{m} \cdot \sqrt{2 \cdot 9.8\,\text{m/s}^2} \cdot \left(\left(\left(10.1\,\text{m} - 5.1\,\text{m} \right) + \left(\frac{4.1\,\text{m/s}^2}{2 \cdot 9.8\,\text{m/s}^2} \right) \right)^{\frac{3}{2}} - \left(\frac{4.1\,\text{m/s}^2}{2 \cdot 9.8\,\text{m/s}^2} \right)^{\frac{3}{2}} \right)}$$

5) Discharge through Drowned Portion Formula

Evaluate Formula

Formula

$$Q_2 = C_d \cdot \left(L_w \cdot h_2 \right) \cdot \sqrt{2 \cdot g \cdot \left(H_{Upstream} - h_2 \right)}$$

Example with Units

$$99.9651\,\text{m}^3/\text{s} = 0.66 \cdot \left(3\,\text{m} \cdot 5.1\,\text{m} \right) \cdot \sqrt{2 \cdot 9.8\,\text{m/s}^2 \cdot \left(10.1\,\text{m} - 5.1\,\text{m} \right)}$$

6) Discharge through Drowned Portion given Total Discharge over Submerged Weir Formula

Evaluate Formula

Formula

$$Q_2 = Q_T - Q_1$$

Example with Units

$$124.6\,\text{m}^3/\text{s} = 174.7\,\text{m}^3/\text{s} - 50.1\,\text{m}^3/\text{s}$$

7) Discharge through Free Weir if Velocity is Approached Formula

Evaluate Formula

Formula

$$Q_1 = \left(\frac{2}{3} \right) \cdot C_d \cdot L_w \cdot \sqrt{2 \cdot g} \cdot \left(\left(\left(H_{Upstream} - h_2 \right) + \left(\frac{v_{su}^2}{2 \cdot g} \right) \right)^{\frac{3}{2}} - \left(\frac{v_{su}^2}{2 \cdot g} \right)^{\frac{3}{2}} \right)$$

Example with Units

$$78.2074\,\text{m}^3/\text{s} = \left(\frac{2}{3} \right) \cdot 0.66 \cdot 3\,\text{m} \cdot \sqrt{2 \cdot 9.8\,\text{m/s}^2} \cdot \left(\left(\left(10.1\,\text{m} - 5.1\,\text{m} \right) + \left(\frac{4.1\,\text{m/s}^2}{2 \cdot 9.8\,\text{m/s}^2} \right) \right)^{\frac{3}{2}} - \left(\frac{4.1\,\text{m/s}^2}{2 \cdot 9.8\,\text{m/s}^2} \right)^{\frac{3}{2}} \right)$$

8) Discharge through Free Weir Portion Formula

Evaluate Formula

Formula

$$Q_1 = \left(\frac{2}{3}\right) \cdot C_d \cdot L_w \cdot \sqrt{2 \cdot g} \cdot \left(H_{Upstream} - h_2\right)^{\frac{3}{2}}$$

Example with Units

$$65.3367\,m^3/s = \left(\frac{2}{3}\right) \cdot 0.66 \cdot 3\,m \cdot \sqrt{2 \cdot 9.8\,m/s^2} \cdot \left(10.1\,m - 5.1\,m\right)^{\frac{3}{2}}$$

9) Discharge through Free Weir Portion given Total Discharge over Submerged Weir Formula

Evaluate Formula

Formula

$$Q_1 = Q_T - Q_2$$

Example with Units

$$74.74\,m^3/s = 174.7\,m^3/s - 99.96\,m^3/s$$

10) Discharge through Submerged Weir if Velocity is Approached Formula

Evaluate Formula

Formula

$$Q_2 = C_d \cdot L_w \cdot h_2 \cdot \left(\sqrt{2 \cdot g \cdot \left(H_{Upstream} - h_2\right) + v_{su}^2}\right)$$

Example with Units

$$108.1995\,m^3/s = 0.66 \cdot 3\,m \cdot 5.1\,m \cdot \left(\sqrt{2 \cdot 9.8\,m/s^2 \cdot \left(10.1\,m - 5.1\,m\right) + 4.1\,m/s^2}\right)$$

11) Head on Downstream Weir for Discharge through Free Weir Portion Formula

Evaluate Formula

Formula

$$h_2 = -\left(\frac{3 \cdot Q_1}{2 \cdot C_d \cdot L_w \cdot \sqrt{2 \cdot g}}\right)^{\frac{2}{3}} + H_{Upstream}$$

Example with Units

$$5.9112\,m = -\left(\frac{3 \cdot 50.1\,m^3/s}{2 \cdot 0.66 \cdot 3\,m \cdot \sqrt{2 \cdot 9.8\,m/s^2}}\right)^{\frac{2}{3}} + 10.1\,m$$

12) Head on Upstream Weir for Discharge through Drowned Portion Formula

Evaluate Formula

Formula

$$H_{Upstream} = \left(\frac{Q_2}{C_d \cdot L_w \cdot h_2} \right)^2 \cdot \left(\frac{1}{2 \cdot g} \right) + h_2$$

Example with Units

$$10.0995\,\text{m} = \left(\frac{99.96\,\text{m}^3/\text{s}}{0.66 \cdot 3\,\text{m} \cdot 5.1\,\text{m}} \right)^2 \cdot \left(\frac{1}{2 \cdot 9.8\,\text{m/s}^2} \right) + 5.1\,\text{m}$$

13) Head on Upstream Weir given Discharge through Free Weir Portion Formula

Evaluate Formula

Formula

$$H_{Upstream} = \left(\frac{3 \cdot Q_1}{2 \cdot C_d \cdot L_w \cdot \sqrt{2 \cdot g}} \right)^{\frac{2}{3}} + h_2$$

Example with Units

$$9.2888\,\text{m} = \left(\frac{3 \cdot 50.1\,\text{m}^3/\text{s}}{2 \cdot 0.66 \cdot 3\,\text{m} \cdot \sqrt{2 \cdot 9.8\,\text{m/s}^2}} \right)^{\frac{2}{3}} + 5.1\,\text{m}$$

14) Length of Crest for Discharge through Drowned Portion Formula

Evaluate Formula

Formula

$$L_w = \frac{Q_2}{C_d \cdot h_2 \cdot \left(\sqrt{2 \cdot g \cdot \left(H_{Upstream} - h_2 \right) + v_{su}^2} \right)}$$

Example with Units

$$2.7715\,\text{m} = \frac{99.96\,\text{m}^3/\text{s}}{0.66 \cdot 5.1\,\text{m} \cdot \left(\sqrt{2 \cdot 9.8\,\text{m/s}^2 \cdot \left(10.1\,\text{m} - 5.1\,\text{m} \right) + 4.1\,\text{m/s}^2} \right)}$$

15) Length of Crest for Discharge through Free Weir Formula

Evaluate Formula

Formula

$$L_w = \frac{3 \cdot Q_1}{2 \cdot C_d \cdot \sqrt{2 \cdot g} \cdot \left(\left(\left(H_{Upstream} - h_2 \right) + \left(\frac{v_{su}^2}{2 \cdot g} \right) \right)^{\frac{3}{2}} - \left(\frac{v_{su}^2}{2 \cdot g} \right)^{\frac{3}{2}} \right)}$$

Example with Units

$$1.9218\,\text{m} = \frac{3 \cdot 50.1\,\text{m}^3/\text{s}}{2 \cdot 0.66 \cdot \sqrt{2 \cdot 9.8\,\text{m/s}^2} \cdot \left(\left(\left(10.1\,\text{m} - 5.1\,\text{m} \right) + \left(\frac{4.1\,\text{m/s}^2}{2 \cdot 9.8\,\text{m/s}^2} \right) \right)^{\frac{3}{2}} - \left(\frac{4.1\,\text{m/s}^2}{2 \cdot 9.8\,\text{m/s}^2} \right)^{\frac{3}{2}} \right)}$$

16) Length of Crest for Discharge through Free Weir Portion Formula

Evaluate Formula

Formula

$$L_w = \frac{3 \cdot Q_1}{2 \cdot C_d \cdot \sqrt{2 \cdot g} \cdot \left(H_{Upstream} - h_2 \right)^{\frac{3}{2}}}$$

Example with Units

$$2.3004\,\text{m} = \frac{3 \cdot 50.1\,\text{m}^3/\text{s}}{2 \cdot 0.66 \cdot \sqrt{2 \cdot 9.8\,\text{m/s}^2} \cdot \left(10.1\,\text{m} - 5.1\,\text{m} \right)^{\frac{3}{2}}}$$

17) Total Discharge over Submerged Weir Formula

Evaluate Formula

Formula

$$Q_T = Q_1 + Q_2$$

Example with Units

$$150.06\,\text{m}^3/\text{s} = 50.1\,\text{m}^3/\text{s} + 99.96\,\text{m}^3/\text{s}$$

Variables used in list of Submerged Weirs Formulas above

- C_d Coefficient of Discharge
- g Acceleration due to Gravity *(Meter per Square Second)*
- h_2 Head on Downstream of Weir *(Meter)*
- $H_{Upstream}$ Head on Upstream of Weir *(Meter)*
- L_w Length of Weir Crest *(Meter)*
- Q_1 Discharge through Free Portion *(Cubic Meter per Second)*
- Q_2 Discharge through Drowned Portion *(Cubic Meter per Second)*
- Q_T Total Discharge of Submerged Weir *(Cubic Meter per Second)*
- v_{su} Velocity over Submerged Weir *(Meter per Second)*

Constants, Functions, Measurements used in list of Submerged Weirs Formulas above

- Functions: **sqrt**, sqrt(Number)
  A square root function is a function that takes a non-negative number as an input and returns the square root of the given input number.
- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion
- Measurement: **Acceleration** in Meter per Square Second (m/s²)
  Acceleration Unit Conversion
- Measurement: **Volumetric Flow Rate** in Cubic Meter per Second (m³/s)
  Volumetric Flow Rate Unit Conversion

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