Important Notches and Weirs Formulas PDF

Formulas
Examples
with Units

List of 27
Important Notches and Weirs Formulas

1) Discharge Formulas

1.1) Coefficient of Discharge for Time Required to Empty Reservoir Formula

Evaluate Formula

Formula

$$C_d = \frac{3 \cdot A}{t_a \cdot L_w \cdot \sqrt{2 \cdot [g]}} \cdot \left(\frac{1}{\sqrt{H_f}} - \frac{1}{\sqrt{H_i}} \right)$$

Example with Units

$$0.0389 = \frac{3 \cdot 50\,\mathrm{m^2}}{82\,\mathrm{s} \cdot 25\,\mathrm{m} \cdot \sqrt{2 \cdot 9.8066\,\mathrm{m/s^2}}} \cdot \left(\frac{1}{\sqrt{0.17\,\mathrm{m}}} - \frac{1}{\sqrt{186.1\,\mathrm{m}}} \right)$$

1.2) Discharge over Broad-Crested Weir Formula

Evaluate Formula

Formula

$$Q = 1.705 \cdot C_d \cdot L_w \cdot H^{\frac{3}{2}}$$

Example with Units

$$1078.3367\,\mathrm{m^3/s} = 1.705 \cdot 0.8 \cdot 25\,\mathrm{m} \cdot 10\,\mathrm{m}^{\frac{3}{2}}$$

1.3) Discharge over Broad-Crested Weir for Head of Liquid at Middle Formula

Evaluate Formula

Formula

$$Q = C_d \cdot L_w \cdot \sqrt{2 \cdot [g] \cdot \left(h^2 \cdot H - h^3 \right)}$$

Example with Units

$$797.1643\,\mathrm{m^3/s} = 0.8 \cdot 25\,\mathrm{m} \cdot \sqrt{2 \cdot 9.8066\,\mathrm{m/s^2} \cdot \left(9\,\mathrm{m}^2 \cdot 10\,\mathrm{m} - 9\,\mathrm{m}^3 \right)}$$

1.4) Discharge over Broad-Crested Weir with Velocity of Approach Formula

Evaluate Formula

Formula

$$Q = 1.705 \cdot C_d \cdot L_w \cdot \left(\left(H + h_a \right)^{\frac{3}{2}} - h_a^{\frac{3}{2}} \right)$$

Example with Units

$$1233.3232\,\mathrm{m^3/s} = 1.705 \cdot 0.8 \cdot 25\,\mathrm{m} \cdot \left(\left(10\,\mathrm{m} + 1.2\,\mathrm{m} \right)^{\frac{3}{2}} - 1.2\,\mathrm{m}^{\frac{3}{2}} \right)$$

1.5) Discharge over Rectangle Notch or Weir Formula

Evaluate Formula

Formula

$$Q_{th} = \frac{2}{3} \cdot C_d \cdot L_w \cdot \sqrt{2 \cdot [g]} \cdot H^{\frac{3}{2}}$$

Example with Units

$$1867.2999\,\mathrm{m^3/s} = \frac{2}{3} \cdot 0.8 \cdot 25\,\mathrm{m} \cdot \sqrt{2 \cdot 9.8066\,\mathrm{m/s^2}} \cdot 10\,\mathrm{m}^{\frac{3}{2}}$$

1.6) Discharge over Rectangle Weir Considering Bazin's formula Formula

Evaluate Formula

Formula

$$Q = \left(0.405 + \frac{0.003}{H} \right) \cdot L_w \cdot \sqrt{2 \cdot [g]} \cdot H^{\frac{3}{2}}$$

Example with Units

$$1419.0312\,\mathrm{m^3/s} = \left(0.405 + \frac{0.003}{10\,\mathrm{m}} \right) \cdot 25\,\mathrm{m} \cdot \sqrt{2 \cdot 9.8066\,\mathrm{m/s^2}} \cdot 10\,\mathrm{m}^{\frac{3}{2}}$$

1.7) Discharge over Rectangle Weir Considering Francis's formula Formula

Evaluate Formula

Formula

$$Q' = 1.84 \cdot L_w \cdot \left(\left(H_i + H_f \right)^{\frac{3}{2}} - H_f^{\frac{3}{2}} \right)$$

Example with Units

$$116939.2298\,\mathrm{m^3/s} = 1.84 \cdot 25\,\mathrm{m} \cdot \left(\left(186.1\,\mathrm{m} + 0.17\,\mathrm{m} \right)^{\frac{3}{2}} - 0.17\,\mathrm{m}^{\frac{3}{2}} \right)$$

1.8) Discharge over Rectangle Weir for Bazin's formula with Velocity of Approach Formula

Evaluate Formula

Formula

$$Q = \left(0.405 + \frac{0.003}{H + h_a}\right) \cdot L_w \cdot \sqrt{2 \cdot [g]} \cdot \left(H + h_a\right)^{\frac{3}{2}}$$

Example with Units

$$1681.8395\,\mathrm{m^3/s} = \left(0.405 + \frac{0.003}{10\,\mathrm{m} + 1.2\,\mathrm{m}}\right) \cdot 25\,\mathrm{m} \cdot \sqrt{2 \cdot 9.8066\,\mathrm{m/s^2}} \cdot \left(10\,\mathrm{m} + 1.2\,\mathrm{m}\right)^{\frac{3}{2}}$$

1.9) Discharge over Rectangle Weir with Two End Contractions Formula

Evaluate Formula

Formula

$$Q = \frac{2}{3} \cdot C_d \cdot \left(L_w - 0.2 \cdot H\right) \cdot \sqrt{2 \cdot [g]} \cdot H^{\frac{3}{2}}$$

Example with Units

$$1717.9159\,\mathrm{m^3/s} = \frac{2}{3} \cdot 0.8 \cdot \left(25\,\mathrm{m} - 0.2 \cdot 10\,\mathrm{m}\right) \cdot \sqrt{2 \cdot 9.8066\,\mathrm{m/s^2}} \cdot 10\,\mathrm{m}^{\frac{3}{2}}$$

1.10) Discharge over Trapezoidal Notch or Weir Formula

Evaluate Formula

Formula

$$Q_{th} = \frac{2}{3} \cdot C_{d1} \cdot L_w \cdot \sqrt{2 \cdot [g]} \cdot H^{\frac{3}{2}} + \frac{8}{15} \cdot C_{d2} \cdot \tan\left(\frac{\angle A}{2}\right) \cdot \sqrt{2 \cdot [g]} \cdot H^{\frac{5}{2}}$$

Example with Units

$$2880.4872\,\mathrm{m^3/s} = \frac{2}{3} \cdot 0.63 \cdot 25\,\mathrm{m} \cdot \sqrt{2 \cdot 9.8066\,\mathrm{m/s^2}} \cdot 10\,\mathrm{m}^{\frac{3}{2}} + \frac{8}{15} \cdot 0.65 \cdot \tan\left(\frac{142°}{2}\right) \cdot \sqrt{2 \cdot 9.8066\,\mathrm{m/s^2}} \cdot 10\,\mathrm{m}^{\frac{5}{2}}$$

1.11) Discharge over Triangular Notch or Weir Formula

Evaluate Formula

Formula

$$Q_{th} = \frac{8}{15} \cdot C_d \cdot \tan\left(\frac{\angle A}{2}\right) \cdot \sqrt{2 \cdot [g]} \cdot H^{\frac{5}{2}}$$

Example with Units

$$1735.3705\,\mathrm{m^3/s} = \frac{8}{15} \cdot 0.8 \cdot \tan\left(\frac{142°}{2}\right) \cdot \sqrt{2 \cdot 9.8066\,\mathrm{m/s^2}} \cdot 10\,\mathrm{m}^{\frac{5}{2}}$$

1.12) Discharge with Velocity of Approach Formula

Evaluate Formula

Formula

$$Q' = \frac{2}{3} \cdot C_d \cdot L_w \cdot \sqrt{2 \cdot [g]} \cdot \left(\left(H_i + H_f \right)^{\frac{3}{2}} - H_f^{\frac{3}{2}} \right)$$

Example with Units

$$150112.3659 \, m^3/s = \frac{2}{3} \cdot 0.8 \cdot 25 \, m \cdot \sqrt{2 \cdot 9.8066 \, m/s^2} \cdot \left(\left(186.1 \, m + 0.17 \, m \right)^{\frac{3}{2}} - 0.17 \, m^{\frac{3}{2}} \right)$$

1.13) Discharge without Velocity of Approach Formula

Evaluate Formula

Formula

$$Q' = \frac{2}{3} \cdot C_d \cdot L_w \cdot \sqrt{2 \cdot [g]} \cdot H_i^{\frac{3}{2}}$$

Example with Units

$$149911.0451 \, m^3/s = \frac{2}{3} \cdot 0.8 \cdot 25 \, m \cdot \sqrt{2 \cdot 9.8066 \, m/s^2} \cdot 186.1 \, m^{\frac{3}{2}}$$

1.14) Head of Liquid above V-notch Formula

Evaluate Formula

Formula

$$H = \left(\frac{Q_{th}}{\frac{8}{15} \cdot C_d \cdot \tan\left(\frac{\angle A}{2}\right) \cdot \sqrt{2 \cdot [g]}} \right)^{0.4}$$

Example with Units

$$3.0615 \, m = \left(\frac{90 \, m^3/s}{\frac{8}{15} \cdot 0.8 \cdot \tan\left(\frac{142^\circ}{2}\right) \cdot \sqrt{2 \cdot 9.8066 \, m/s^2}} \right)^{0.4}$$

1.15) Head of Liquid at Crest Formula

Evaluate Formula

Formula

$$H = \left(\frac{Q_{th}}{\frac{2}{3} \cdot C_d \cdot L_w \cdot \sqrt{2 \cdot [g]}} \right)^{\frac{2}{3}}$$

Example with Units

$$1.3244 \, m = \left(\frac{90 \, m^3/s}{\frac{2}{3} \cdot 0.8 \cdot 25 \, m \cdot \sqrt{2 \cdot 9.8066 \, m/s^2}} \right)^{\frac{2}{3}}$$

1.16) Time Required to Empty Reservoir Formula

Evaluate Formula

Formula

$$t_a = \left(\frac{3 \cdot A}{C_d \cdot L_w \cdot \sqrt{2 \cdot [g]}} \right) \cdot \left(\frac{1}{\sqrt{H_f}} - \frac{1}{\sqrt{H_i}} \right)$$

Example with Units

$$3.9832\,\text{s} = \left(\frac{3 \cdot 50\,\text{m}^2}{0.8 \cdot 25\,\text{m} \cdot \sqrt{2 \cdot 9.8066\,\text{m/s}^2}} \right) \cdot \left(\frac{1}{\sqrt{0.17\,\text{m}}} - \frac{1}{\sqrt{186.1\,\text{m}}} \right)$$

1.17) Time Required to Empty Tank with Triangular Weir or Notch Formula

Evaluate Formula

Formula

$$t_a = \left(\frac{5 \cdot A}{4 \cdot C_d \cdot \tan\left(\frac{\angle A}{2}\right) \cdot \sqrt{2 \cdot [g]}} \right) \cdot \left(\frac{1}{H_f^{\frac{3}{2}}} - \frac{1}{H_i^{\frac{3}{2}}} \right)$$

Example with Units

$$86.6565\,\text{s} = \left(\frac{5 \cdot 50\,\text{m}^2}{4 \cdot 0.8 \cdot \tan\left(\frac{142°}{2}\right) \cdot \sqrt{2 \cdot 9.8066\,\text{m/s}^2}} \right) \cdot \left(\frac{1}{0.17\,\text{m}^{\frac{3}{2}}} - \frac{1}{186.1\,\text{m}^{\frac{3}{2}}} \right)$$

2) Geometric DImension Formulas

2.1) Length of Crest of Weir or Notch Formula

Evaluate Formula

Formula

$$L_w = \frac{3 \cdot A}{C_d \cdot t_a \cdot \sqrt{2 \cdot [g]}} \cdot \left(\frac{1}{\sqrt{H_f}} - \frac{1}{\sqrt{H_i}} \right)$$

Example with Units

$$1.2144\,\text{m} = \frac{3 \cdot 50\,\text{m}^2}{0.8 \cdot 82\,\text{s} \cdot \sqrt{2 \cdot 9.8066\,\text{m/s}^2}} \cdot \left(\frac{1}{\sqrt{0.17\,\text{m}}} - \frac{1}{\sqrt{186.1\,\text{m}}} \right)$$

2.2) Length of Section for Discharge over Rectangle Notch or Weir Formula

Evaluate Formula

Formula

$$L_w = \frac{Q_{th}}{\frac{2}{3} \cdot C_d \cdot \sqrt{2 \cdot [g]} \cdot l_a^{\frac{3}{2}}}$$

Example with Units

$$0.6559\,\text{m} = \frac{90\,\text{m}^3/\text{s}}{\frac{2}{3} \cdot 0.8 \cdot \sqrt{2 \cdot 9.8066\,\text{m/s}^2} \cdot 15\,\text{m}^{\frac{3}{2}}}$$

2.3) Length of Weir Considering Bazin's formula with Velocity of Approach Formula

Evaluate Formula

Formula

$$L_n = \frac{Q}{0.405 + \frac{0.003}{l_a + h_a}} \cdot \sqrt{2 \cdot [g]} \cdot \left(l_a + h_a\right)^{\frac{3}{2}}$$

Example with Units

$$28507.1822\,\text{m} = \frac{40\,\text{m}^3/\text{s}}{0.405 + \frac{0.003}{15\,\text{m} + 1.2\,\text{m}}} \cdot \sqrt{2 \cdot 9.8066\,\text{m/s}^2} \cdot \left(15\,\text{m} + 1.2\,\text{m}\right)^{\frac{3}{2}}$$

2.4) Length of Weir Considering Bazin's formula without Velocity of Approach Formula

Evaluate Formula

Formula

$$L_n = \frac{Q}{0.405 + \frac{0.003}{l_a}} \cdot \sqrt{2 \cdot [g]} \cdot l_a^{\frac{3}{2}}$$

Example with Units

$$25398.1906\,\text{m} = \frac{40\,\text{m}^3/\text{s}}{0.405 + \frac{0.003}{15\,\text{m}}} \cdot \sqrt{2 \cdot 9.8066\,\text{m/s}^2} \cdot 15\,\text{m}^{\frac{3}{2}}$$

2.5) Length of Weir Considering Francis's formula Formula

Evaluate Formula

Formula

$$L_w = \frac{Q}{1.84 \cdot \left(\left(H_i + h_a\right)^{\frac{3}{2}} - h_a^{\frac{3}{2}}\right)}$$

Example with Units

$$0.0085\,\text{m} = \frac{40\,\text{m}^3/\text{s}}{1.84 \cdot \left(\left(186.1\,\text{m} + 1.2\,\text{m}\right)^{\frac{3}{2}} - 1.2\,\text{m}^{\frac{3}{2}}\right)}$$

2.6) Length of Weir for Broad-Crested Weir and Head of Liquid at Middle Formula

Evaluate Formula

Formula

$$L_w = \frac{Q}{C_d \cdot \sqrt{2 \cdot [g] \cdot \left(h^2 \cdot l_a - h^3\right)}}$$

Example with Units

$$0.5121\,\text{m} = \frac{40\,\text{m}^3/\text{s}}{0.8 \cdot \sqrt{2 \cdot 9.8066\,\text{m/s}^2 \cdot \left(9\,\text{m}^2 \cdot 15\,\text{m} - 9\,\text{m}^3\right)}}$$

2.7) Length of Weir for Broad-Crested Weir with Velocity of Approach Formula

Evaluate Formula

Formula

$$L_w = \frac{Q}{1.705 \cdot C_d \cdot \left(\left(l_a + h_a\right)^{\frac{3}{2}} - h_a^{\frac{3}{2}}\right)}$$

Example with Units

$$0.459\,\text{m} = \frac{40\,\text{m}^3/\text{s}}{1.705 \cdot 0.8 \cdot \left(\left(15\,\text{m} + 1.2\,\text{m}\right)^{\frac{3}{2}} - 1.2\,\text{m}^{\frac{3}{2}}\right)}$$

2.8) Length of Weir for Discharge over Broad-Crested Weir Formula

Evaluate Formula

Formula

$$L_w = \frac{Q}{1.705 \cdot C_d \cdot l_a^{\frac{3}{2}}}$$

Example with Units

$$0.5048\,\text{m} = \frac{40\,\text{m}^3/\text{s}}{1.705 \cdot 0.8 \cdot 15\,\text{m}^{\frac{3}{2}}}$$

2.9) Length of Weir or Notch for Velocity of Approach Formula

Evaluate Formula

Formula

$$L_w = \frac{Q}{\frac{2}{3} \cdot C_d \cdot \sqrt{2 \cdot [g]} \cdot \left(\left(H_i + H_f\right)^{\frac{3}{2}} - H_f^{\frac{3}{2}}\right)}$$

Example with Units

$$0.0067\,\text{m} = \frac{40\,\text{m}^3/\text{s}}{\frac{2}{3} \cdot 0.8 \cdot \sqrt{2 \cdot 9.8066\,\text{m/s}^2} \cdot \left(\left(186.1\,\text{m} + 0.17\,\text{m}\right)^{\frac{3}{2}} - 0.17\,\text{m}^{\frac{3}{2}}\right)}$$

2.10) Length of Weir or Notch without Velocity of Approach Formula

Evaluate Formula

Formula

$$L_w = \frac{Q}{\frac{2}{3} \cdot C_d \cdot \sqrt{2 \cdot [g]} \cdot H_i^{\frac{3}{2}}}$$

Example with Units

$$0.0067\,\text{m} = \frac{40\,\text{m}^3/\text{s}}{\frac{2}{3} \cdot 0.8 \cdot \sqrt{2 \cdot 9.8066\,\text{m/s}^2} \cdot 186.1\,\text{m}^{\frac{3}{2}}}$$

Variables used in list of Notches and Weirs Formulas above

- **∠A** Angle A *(Degree)*
- **A** Area of Weir *(Square Meter)*
- C_d Coefficient of Discharge
- C_{d1} Coefficient of Discharge Rectangular
- C_{d2} Coefficient of Discharge Triangular
- **h** Head of Liquid Middle *(Meter)*
- **H** Head of Liquid *(Meter)*
- h_a Head Due to Velocity of Approach *(Meter)*
- H_f Final Height of Liquid *(Meter)*
- H_i Initial Height of Liquid *(Meter)*
- l_a Arc Length of Circle *(Meter)*
- L_n Length of Notches *(Meter)*
- L_w Length of Weir *(Meter)*
- **Q** Discharge Weir *(Cubic Meter per Second)*
- **Q'** Discharge *(Cubic Meter per Second)*
- Q_{th} Theoretical Discharge *(Cubic Meter per Second)*
- t_a Total Time Taken *(Second)*

Constants, Functions, Measurements used in list of Notches and Weirs Formulas above

- constant(s): **[g]**, 9.80665
  Gravitational acceleration on Earth
- 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.
- Functions: **tan**, tan(Angle)
  The tangent of an angle is a trigonometric ratio of the length of the side opposite an angle to the length of the side adjacent to an angle in a right triangle.
- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Time** in Second (s)
  Time Unit Conversion
- Measurement: **Area** in Square Meter (m²)
  Area Unit Conversion
- Measurement: **Angle** in Degree (°)
  Angle Unit Conversion
- Measurement: **Volumetric Flow Rate** in Cubic Meter per Second (m³/s)
  Volumetric Flow Rate Unit Conversion

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