Important Critical Flow and its Computation Formulas PDF

Formulas
Examples
with Units

List of 20
Important Critical Flow and its Computation Formulas

1) Critical Depth for Parabolic Channel Formula

Evaluate Formula

Formula

$$h_p = \left(3.375 \cdot \frac{\left(\frac{Q}{S}\right)^2}{[g]} \right)^{\frac{1}{4}}$$

Example with Units

$$143.2921\,\text{m} = \left(3.375 \cdot \frac{\left(\frac{14\,\text{m}^3/\text{s}}{0.0004}\right)^2}{9.8066\,\text{m/s}^2} \right)^{\frac{1}{4}}$$

2) Critical Depth for Rectangular Channel Formula

Evaluate Formula

Formula

$$h_r = \left(\frac{q^2}{[g]} \right)^{\frac{1}{3}}$$

Example with Units

$$2.1829\,\text{m} = \left(\frac{10.1\,\text{m}^2/\text{s}^2}{9.8066\,\text{m/s}^2} \right)^{\frac{1}{3}}$$

3) Critical Depth for Triangular Channel Formula

Evaluate Formula

Formula

$$h_t = \left(2 \cdot \frac{\left(\frac{Q}{S}\right)^2}{[g]} \right)^{\frac{1}{5}}$$

Example with Units

$$47.8111\,\text{m} = \left(2 \cdot \frac{\left(\frac{14\,\text{m}^3/\text{s}}{0.0004}\right)^2}{9.8066\,\text{m/s}^2} \right)^{\frac{1}{5}}$$

4) Critical Depth given Critical Energy for Rectangular Channel Formula

Evaluate Formula

Formula

$$h_r = \frac{E_r}{1.5}$$

Example with Units

$$2.16\,\text{m} = \frac{3.24\,\text{m}}{1.5}$$

5) Critical Depth given Critical Energy for Triangular Channel Formula

Evaluate Formula

Formula

$$h_t = \frac{E_t}{1.25}$$

Example with Units

$$48\,\text{m} = \frac{60\,\text{m}}{1.25}$$

6) Critical Depth of Flow given Critical Energy for Parabolic Channel Formula

Evaluate Formula

Formula

$$h_p = \frac{E_c}{\frac{4}{3}}$$

Example with Units

$$142.5\,\text{m} = \frac{190\,\text{m}}{\frac{4}{3}}$$

7) Critical Energy for Parabolic Channel Formula

Evaluate Formula

Formula

$$E_c = \left(\frac{4}{3}\right) \cdot h_p$$

Example with Units

$$190.6667\,\text{m} = \left(\frac{4}{3}\right) \cdot 143\,\text{m}$$

8) Critical Energy for Rectangular Channel Formula

Evaluate Formula

Formula

$$E_r = 1.5 \cdot h_r$$

Example with Units

$$3.27\,\text{m} = 1.5 \cdot 2.18\,\text{m}$$

9) Critical Energy for Triangular Channel Formula

Evaluate Formula

Formula

$$E_t = h_t \cdot 1.25$$

Example with Units

$$59.75\,\text{m} = 47.8\,\text{m} \cdot 1.25$$

10) Critical Section Factor Formula

Evaluate Formula

Formula

$$Z = \frac{Q}{\sqrt{[g]}}$$

Example with Units

$$4.4706\,\text{m\^2.5} = \frac{14\,\text{m}^3/\text{s}}{\sqrt{9.8066\,\text{m/s}^2}}$$

11) Discharge given Critical Depth for Parabolic Channel Formula

Evaluate Formula

Formula

$$Q = \sqrt{\left(h_p^{\,4}\right) \cdot \left(\left(S\right)^2\right) \cdot 0.29629629629 \cdot [g]}$$

Example with Units

$$13.943\,\text{m}^3/\text{s} = \sqrt{\left(143\,\text{m}^{\,4}\right) \cdot \left(\left(0.0004\right)^2\right) \cdot 0.29629629629 \cdot 9.8066\,\text{m/s}^2}$$

12) Discharge given Critical Depth for Triangular Channel Formula

Evaluate Formula

Formula

$$Q = \sqrt{\left(h_t^{\,5}\right) \cdot \left(\left(S\right)^2\right) \cdot 0.5 \cdot [g]}$$

Example with Units

$$13.9918\,\text{m}^3/\text{s} = \sqrt{\left(47.8\,\text{m}^{\,5}\right) \cdot \left(\left(0.0004\right)^2\right) \cdot 0.5 \cdot 9.8066\,\text{m/s}^2}$$

13) Discharge given Critical Section Factor Formula

Evaluate Formula

Formula

$$Q = Z \cdot \sqrt{[g]}$$

Example with Units

$$21.2946\,\text{m}^3/\text{s} = 6.8\,\text{m\^2.5} \cdot \sqrt{9.8066\,\text{m/s}^2}$$

14) Discharge per unit Width given Critical Depth for Rectangular Channel Formula

Evaluate Formula

Formula

$$q = \left(\left(h_r^{\,3}\right) \cdot [g]\right)^{\frac{1}{2}}$$

Example with Units

$$10.0796\,\text{m}^2/\text{s} = \left(\left(2.18\,\text{m}^{\,3}\right) \cdot 9.8066\,\text{m/s}^2\right)^{\frac{1}{2}}$$

15) Side Slope of Channel given Critical Depth for Parabolic Channel Formula

Evaluate Formula

Formula

$$S = \left(3.375 \cdot \frac{\left(Q\right)^2}{\left(h_p^{\,4}\right) \cdot [g]}\right)^{\frac{1}{2}}$$

Example with Units

$$0.0004 = \left(3.375 \cdot \frac{\left(14\,\text{m}^3/\text{s}\right)^2}{\left(143\,\text{m}^{\,4}\right) \cdot 9.8066\,\text{m/s}^2}\right)^{\frac{1}{2}}$$

16) Side Slope of Channel given Critical Depth for Triangular Channel Formula

Evaluate Formula

Formula

$$S = \left(2 \cdot \frac{\left(Q\right)^2}{\left(h_t^{\,5}\right) \cdot [g]}\right)^{\frac{1}{2}}$$

Example with Units

$$0.0004 = \left(2 \cdot \frac{\left(14\,\text{m}^3/\text{s}\right)^2}{\left(47.8\,\text{m}^{\,5}\right) \cdot 9.8066\,\text{m/s}^2}\right)^{\frac{1}{2}}$$

17) Section Factor Formulas

17.1) Hydraulic Depth given Section Factor Formula

Evaluate Formula

Formula

$$D_{Hydraulic} = \left(\frac{Z}{A}\right)^2$$

Example with Units

$$0.074\,\text{m} = \left(\frac{6.8\,\text{m\^2.5}}{25\,\text{m}^2}\right)^2$$

17.2) Section Factor in open channel Formula

Evaluate Formula

Formula

$$Z = 0.544331054 \cdot T \cdot \left(d_f^{\,1.5}\right)$$

Example with Units

$$6.8526\,\text{m\^2.5} = 0.544331054 \cdot 2.1\,\text{m} \cdot \left(3.3\,\text{m}^{\,1.5}\right)$$

17.3) Top Width given Section Factors Formula

Evaluate Formula

Formula

$$T = \frac{A^3}{Z^2}$$

Example with Units

$$337.9109\,\text{m} = \frac{25\,\text{m}^2\,^3}{6.8\,\text{m\^2.5}^{\,2}}$$

17.4) Wetted Area given Section Factor Formula

Evaluate Formula

Formula

$$A = \frac{Z}{\sqrt{D_{Hydraulic}}}$$

Example with Units

$$3.926\,\text{m}^2 = \frac{6.8\,\text{m}^{\wedge}2.5}{\sqrt{3\,\text{m}}}$$

Variables used in list of Critical Flow and its Computation Formulas above

- **A** Wetted Surface Area of Channel *(Square Meter)*
- d_f Depth of Flow *(Meter)*
- $D_{Hydraulic}$ Hydraulic Depth *(Meter)*
- E_c Critical energy of Parabolic Channel *(Meter)*
- E_r Critical Energy of Rectangular Channel *(Meter)*
- E_t Critical Energy of Triangular Channel *(Meter)*
- h_p Critical Depth of Parabolic Channel *(Meter)*
- h_r Critical Depth of Rectangular Channel *(Meter)*
- h_t Critical Depth of Triangular Channnel *(Meter)*
- **q** Discharge per unit Width *(Square Meter per Second)*
- **Q** Discharge of Channel *(Cubic Meter per Second)*
- **S** Bed Slope
- **T** Top Width *(Meter)*
- **Z** Section Factor *(Meter^2.5)*

Constants, Functions, Measurements used in list of Critical Flow and its Computation 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.
- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Area** in Square Meter (m²)
  Area Unit Conversion
- Measurement: **Volumetric Flow Rate** in Cubic Meter per Second (m³/s)
  Volumetric Flow Rate Unit Conversion
- Measurement: **Kinematic Viscosity** in Square Meter per Second (m²/s)
  Kinematic Viscosity Unit Conversion
- Measurement: **Section Factor** in Meter^2.5 (m^2.5)
  Section Factor Unit Conversion

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