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Streamflow Measurement Formulas

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List of 32 Streamflow Measurement Formulas

Streamflow Measurement

1) Concentration of Variable of Interest given Instantaneous Discharge and Mass Flux

Open Calculator

fx $c = \dfrac{Q_m}{Q_{instant}}$

ex $4 = \dfrac{120 \text{m}^3/\text{s}}{30 \text{m}^3/\text{s}}$

2) Instantaneous Discharge given Instantaneous Mass Flux

Open Calculator

fx $Q_{instant} = \dfrac{Q_m}{c}$

ex $30 \text{m}^3/\text{s} = \dfrac{120 \text{m}^3/\text{s}}{4}$

3) Mass Flux Computation

Open Calculator

fx $Q_m = c \cdot Q_{instant}$

ex $120 \text{m}^3/\text{s} = 4 \cdot 30 \text{m}^3/\text{s}$

An Introduction to River Hydraulics

Intermediate and High Flows 📲

4) Conveyance Function determined by Chezy's Law 📲

Open Calculator 📲

fx $K = C \cdot \left(\dfrac{A^{\frac{3}{2}}}{P^{\frac{1}{2}}} \right)$

ex $6.97137 = 1.5 \cdot \left(\dfrac{(12.0\text{m}^2)^{\frac{3}{2}}}{(80\text{m})^{\frac{1}{2}}} \right)$

5) Conveyance Function Determined by Manning's Law 📲

Open Calculator 📲

fx $K = \left(\dfrac{1}{n} \right) \cdot \dfrac{(A)^{\frac{5}{3}}}{(P)^{\frac{2}{3}}}$

ex $8.222645 = \left(\dfrac{1}{0.412} \right) \cdot \dfrac{(12.0\text{m}^2)^{\frac{5}{3}}}{(80\text{m})^{\frac{2}{3}}}$

6) Cross-sectional Area using Chezy's Law 📲

Open Calculator 📲

fx $A = \left(\dfrac{K \cdot P^{\frac{1}{2}}}{C} \right)^{\frac{2}{3}}$

ex $13.15313\text{m}^2 = \left(\dfrac{8 \cdot (80\text{m})^{\frac{1}{2}}}{1.5} \right)^{\frac{2}{3}}$

7) Cross-sectional Area using Manning's Law [↗]

Open Calculator [↗]

fx $A = \left(K \cdot n \cdot P^{\frac{2}{3}} \right)^{\frac{3}{5}}$

ex $11.80398 \text{m}^2 = \left(8 \cdot 0.412 \cdot (80\text{m})^{\frac{2}{3}} \right)^{\frac{3}{5}}$

8) Friction Slope [↗]

Open Calculator [↗]

fx $S_f = \dfrac{Q_{\text{instant}}^2}{K^2}$

ex $14.0625 = \dfrac{(30\text{m}^3/\text{s})^2}{(8)^2}$

9) Instantaneous Discharge given Friction Slope [↗]

Open Calculator [↗]

fx $Q_{\text{instant}} = \sqrt{S_f \cdot K^2}$

ex $29.93326 \text{m}^3/\text{s} = \sqrt{14 \cdot (8)^2}$

10) Wetted Perimeter from Manning's Law ⤤

Open Calculator ⤤

fx $$P = \left(\left(\frac{1}{n} \right) \cdot \left(\frac{A^{\frac{5}{3}}}{K} \right) \right)^{\frac{3}{2}}$$

ex $$83.3628\text{m} = \left(\left(\frac{1}{0.412} \right) \cdot \left(\frac{(12.0\text{m}^2)^{\frac{5}{3}}}{8} \right) \right)^{\frac{3}{2}}$$

11) Wetted Perimeter using Chezy's Law ⤤

Open Calculator ⤤

fx $$P = \left(C \cdot \left(\frac{A^{\frac{3}{2}}}{K} \right) \right)^{2}$$

ex $$60.75\text{m} = \left(1.5 \cdot \left(\frac{(12.0\text{m}^2)^{\frac{3}{2}}}{8} \right) \right)^{2}$$

Low Flow ⤤

12) Cease to Flow Depth given Depth at Gauging Station ⤤

Open Calculator ⤤

fx $$h_{csf} = h_G - H_c \cdot (Q) - Q^2 \,\hat{}\, 2$$

ex $$0.1\text{m} = 6.01\text{m} - 0.05\text{m} \cdot (3.0\text{m}^3/\text{s}) - (2.4)^2$$

13) Depth at Gauging Station ↗

Open Calculator ↗

fx $h_G = h_{csf} + H_c \cdot (Q) + Q^2 \char94 2$

ex $6.01m = 0.1m + 0.05m \cdot (3.0m^3/s) + (2.4)^2$

14) Discharge given Depth at Gauging Station ↗

Open Calculator ↗

fx $Q = \dfrac{h_G - h_{csf} - Q^2 \char94 2}{H_c}$

ex $3m^3/s = \dfrac{6.01m - 0.1m - (2.4)^2}{0.05m}$

15) Head at Control given Depth at Gauging Station ↗

Open Calculator ↗

fx $H_c = \dfrac{h_G - h_{csf} - Q^2 \char94 2}{Q}$

ex $0.05m = \dfrac{6.01m - 0.1m - (2.4)^2}{3.0m^3/s}$

Dilution Technique of Streamflow Measurements 🔗

16) Average Depth of Stream given Length of Reach 🔗

Open Calculator 🔗

$$fx \quad d_{avg} = \frac{0.13 \cdot B^2 \cdot C \cdot \left(0.7 \cdot C + 2 \cdot \sqrt{g}\right)}{L \cdot g}$$

$$ex \quad 15.15352m = \frac{0.13 \cdot (50m)^2 \cdot 1.5 \cdot \left(0.7 \cdot 1.5 + 2 \cdot \sqrt{9.8m/s^2}\right)}{24m \cdot 9.8m/s^2}$$

17) Average Width of Stream using Mixing Length 🔗

Open Calculator 🔗

$$fx \quad B = \sqrt{\frac{L \cdot g \cdot d_{avg}}{0.13 \cdot C \cdot \left(0.7 \cdot C + 2 \cdot \sqrt{g}\right)}}$$

$$ex \quad 49.74608m = \sqrt{\frac{24m \cdot 9.8m/s^2 \cdot 15m}{0.13 \cdot 1.5 \cdot \left(0.7 \cdot 1.5 + 2 \cdot \sqrt{9.8m/s^2}\right)}}$$

18) Constant Rate Injection Method or Plateau Gauging 🔗

Open Calculator 🔗

$$fx \quad Q_f = Q_s \cdot \frac{C_2 - C_0}{C_1 - C_2}$$

$$ex \quad 20m^3/s = 60m^3/s \cdot \frac{6 - 4}{12 - 6}$$

19) Discharge in Stream by Constant Rate Injection Method ⎘

Open Calculator ⎘

fx $$Q_s = Q_f \cdot \left(\frac{C_1 - C_2}{C_2 - C_0} \right)$$

ex $$60 \text{m}^3/\text{s} = 20 \text{m}^3/\text{s} \cdot \left(\frac{12 - 6}{6 - 4} \right)$$

20) Length of Reach ⎘

Open Calculator ⎘

fx $$L = \frac{0.13 \cdot B^2 \cdot C \cdot (0.7 \cdot C + 2 \cdot \sqrt{g})}{g \cdot d_{avg}}$$

ex $$24.24563 \text{m} = \frac{0.13 \cdot (50\text{m})^2 \cdot 1.5 \cdot (0.7 \cdot 1.5 + 2 \cdot \sqrt{9.8 \text{m/s}^2})}{9.8 \text{m/s}^2 \cdot 15\text{m}}$$

Electromagnetic Method ⎘

21) Current in Coil in Electromagnetic Method ⎘

Open Calculator ⎘

fx $$I = E \cdot \frac{d}{\left(\frac{Q_s}{k} \right)^{\frac{1}{n_{system}}} - K_2}$$

ex $$50.11304 \text{A} = 10 \cdot \frac{3.23\text{m}}{\left(\frac{60\text{m}^3/\text{s}}{2} \right)^{\frac{1}{2.63}} - 3}$$

22) Depth of Flow in Electromagnetic Method ⤴

fx $d = \dfrac{\left(\left(\frac{Q_s}{k}\right)^{\frac{1}{n_{system}}} - K_2\right) \cdot I}{E}$ **Open Calculator** ⤴

ex $3.229804m = \dfrac{\left(\left(\frac{60m^3/s}{2}\right)^{\frac{1}{2.63}} - 3\right) \cdot 50.11A}{10}$

23) Measurement for Discharge in Electromagnetic Method ⤴

fx $Q_s = k \cdot \left(\left(E \cdot \dfrac{d}{I}\right) + K_2\right)^{n_{system}}$ **Open Calculator** ⤴

ex $60.00169m^3/s = 2 \cdot \left(\left(10 \cdot \dfrac{3.23m}{50.11A}\right) + 3\right)^{2.63}$

Stage-Discharge Relationship ⤴

24) Actual Discharge from Backwater Effect on Rating Curve Normalized Curve ⤴

fx $Q_a = Q_0 \cdot \left(\dfrac{F}{F_o}\right)^m$ **Open Calculator** ⤴

ex $9.001029m^3/s = 7m^3/s \cdot \left(\dfrac{2.5m}{1.512m}\right)^{0.5}$

25) Actual Fall at Stage given Actual Discharge 🔗

Open Calculator 🔗

fx $$F = F_o \cdot \left(\frac{Q_a}{Q_0} \right)^{\frac{1}{m}}$$

ex $$2.499429m = 1.512m \cdot \left(\frac{9m^3/s}{7m^3/s} \right)^{\frac{1}{0.5}}$$

26) Diffusion Coefficient in Advection Diffusion Flood Routing 🔗

Open Calculator 🔗

fx $$D = \frac{K}{2} \cdot W \cdot \sqrt{S}$$

ex $$800m^2/s = \frac{8}{2} \cdot 100m \cdot \sqrt{4.0}$$

27) Gauge Height given Discharge for Non-Alluvial Rivers 🔗

Open Calculator 🔗

fx $$G = \left(\frac{Q_s}{C_r} \right)^{\frac{1}{\beta}} + a$$

ex $$10.20546m = \left(\frac{60m^3/s}{1.99} \right)^{\frac{1}{1.6}} + 1.8$$

28) Measured Unsteady Flow ⤴

fx $Q_M = Q_n \cdot \sqrt{1 + \left(\dfrac{1}{v_W \cdot S_o}\right) \cdot dh_{/dt}}$

Open Calculator ⤴

ex $14.4\text{m}^3/\text{s} = 12\text{m}^3/\text{s} \cdot \sqrt{1 + \left(\dfrac{1}{50.0\text{m/s} \cdot 0.10}\right) \cdot 2.2}$

29) Normal Discharge at given Stage under Steady Uniform Flow ⤴

fx $Q_n = \dfrac{Q_M}{\sqrt{1 + \left(\dfrac{1}{v_W \cdot S_o}\right) \cdot dh_{/dt}}}$

Open Calculator ⤴

ex $12\text{m}^3/\text{s} = \dfrac{14.4\text{m}^3/\text{s}}{\sqrt{1 + \left(\dfrac{1}{50.0\text{m/s} \cdot 0.10}\right) \cdot 2.2}}$

30) Normalized Discharge of Backwater Effect on Rating Curve Normalized Curve ⤴

fx $Q_0 = Q_a \cdot \left(\dfrac{F_o}{F}\right)^m$

Open Calculator ⤴

ex $6.9992\text{m}^3/\text{s} = 9\text{m}^3/\text{s} \cdot \left(\dfrac{1.512\text{m}}{2.5\text{m}}\right)^{0.5}$

31) Normalized Value of Fall given Discharge 🔗

Open Calculator 🔗

fx $$F_o = F \cdot \left(\frac{Q_0}{Q_a} \right)^{\frac{1}{m}}$$

ex $$1.512346m = 2.5m \cdot \left(\frac{7m^3/s}{9m^3/s} \right)^{\frac{1}{0.5}}$$

32) Relationship between Stage and Discharge for Non-Alluvial Rivers 🔗

Open Calculator 🔗

fx $$Q_s = C_r \cdot (G - a)^{\beta}$$

ex $$59.93768m^3/s = 1.99 \cdot (10.2m - 1.8)^{1.6}$$

Variables Used

- **a** Constant of Gauge Reading
- **A** Cross-Sectional Area *(Square Meter)*
- **B** Average Width of Stream *(Meter)*
- **c** Concentration of Variable of Interest
- **C** Chézy's Coefficients
- C_0 Initial Concentration of Tracer
- C_1 High Concentration of Tracer at Section 1
- C_2 Concentration Profile of Tracer at Section 2
- C_r Rating Curve Constant
- **d** Depth of Flow *(Meter)*
- **D** Diffusion Coefficient *(Square Meter Per Second)*
- d_{avg} Average Depth of Stream *(Meter)*
- $dh_{/dt}$ Rate of Change of Stage
- **E** Signal Output
- **F** Actual Fall *(Meter)*
- F_o Normalized Value of Fall *(Meter)*
- **g** Acceleration due to Gravity *(Meter per Square Second)*
- **G** Gauge Height *(Meter)*
- H_c Head at Control *(Meter)*
- h_{csf} Cease-to-Flow Depth *(Meter)*
- h_G Depth at Gauging Station *(Meter)*
- **I** Current in Coil *(Ampere)*

- **k** System Constant k
- **K** Conveyance Function
- **K_2** System Constant K2
- **L** Mixing Length *(Meter)*
- **m** Exponent on Rating Curve
- **n** Manning's Roughness Coefficient
- **n_{system}** System Constant n
- **P** Wetted Perimeter *(Meter)*
- **Q** Discharge *(Cubic Meter per Second)*
- **Q_0** Normalized Discharge *(Cubic Meter per Second)*
- **Q_a** Actual Discharge *(Cubic Meter per Second)*
- **Q_f** Constant Discharge Rate at C1 *(Cubic Meter per Second)*
- **$Q_{instant}$** Instantaneous Discharge *(Cubic Meter per Second)*
- **Q_m** Instantaneous Mass Flux *(Cubic Meter per Second)*
- **Q_M** Measured Unsteady Flow *(Cubic Meter per Second)*
- **Q_n** Normal Discharge *(Cubic Meter per Second)*
- **Q_s** Discharge in Stream *(Cubic Meter per Second)*
- **Q^2** Terms of Order
- **$\bar{S}$** Bed Slope
- **S_f** Friction Slope
- **S_o** Channel Slope
- **v_W** Velocity of Flood Wave *(Meter per Second)*
- **W** Width of Water Surface *(Meter)*
- **β** Rating Curve Constant Beta

Constants, Functions, Measurements used

- Function: **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: **Electric Current** in Ampere (A)
  Electric Current Unit Conversion ⬀
- Measurement: **Area** in Square Meter (m²)
  Area 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 ⬀
- Measurement: **Diffusivity** in Square Meter Per Second (m²/s)
  Diffusivity Unit Conversion ⬀

Check other formula lists

- **Abstractions from Precipitation Formulas** 🔗
- **Area-Velocity and Ultrasonic Method of Streamflow Measurement Formulas** 🔗
- **Indirect Methods of Streamflow Measurement Formulas** 🔗
- **Losses from Precipitation Formulas** 🔗
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