



Streamflow Measurement Formulas

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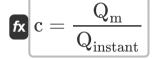




List of 32 Streamflow Measurement Formulas

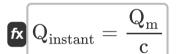
Streamflow Measurement &

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



$$=$$
 $4=rac{120 \mathrm{m}^3/\mathrm{s}}{30 \mathrm{m}^3/\mathrm{s}}$

2) Instantaneous Discharge given Instantaneous Mass Flux 🗗



$$m ex = 30m^3/s = rac{120m^3/s}{4}$$

3) Mass Flux Computation

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

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

An Introduction to River Hydraulics

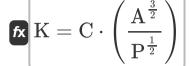
Open Calculator

Open Calculator 2



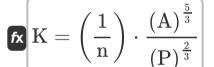
Intermediate and High Flows

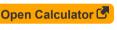
4) Conveyance Function determined by Chezy's Law



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

5) Conveyance Function Determined by Manning's Law





6) Cross-sectional Area using Chezy's Law

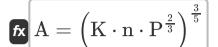
$$\mathbf{K} \mathbf{A} = \left(rac{\mathbf{K} \cdot \mathbf{P}^{rac{1}{2}}}{\mathbf{C}}
ight)^{rac{2}{3}}$$

ex
$$13.15313 ext{m}^2 = \left(rac{8\cdot(80 ext{m})^{rac{1}{2}}}{1.5}
ight)^{rac{2}{3}}$$





7) Cross-sectional Area using Manning's Law



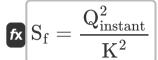
Open Calculator

Open Calculator

Open Calculator

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

8) Friction Slope



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

9) Instantaneous Discharge given Friction Slope 🖸

$$extbf{Q}_{ ext{instant}} = \sqrt{ ext{S}_{ ext{f}} \cdot ext{K}^2}$$

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



10) Wetted Perimeter from Manning's Law 🚰

 $extbf{P} = \left(\left(rac{1}{n}
ight)\cdot\left(rac{A^{rac{5}{3}}}{K}
ight)
ight)^{rac{3}{2}}$

Open Calculator 🖸

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

11) Wetted Perimeter using Chezy's Law

 $\mathbf{F} = \left(\mathbf{C} \cdot \left(rac{\mathbf{A}^{rac{3}{2}}}{\mathbf{K}}
ight)
ight)^2$

Open Calculator

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

Low Flow

12) Cease to Flow Depth given Depth at Gauging Station



Open Calculator

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



13) Depth at Gauging Station

fx $h_{
m G} = h_{
m csf} + H_{
m c} \cdot ({
m Q}) + {
m Q}^2 \; \hat{\ } \; 2$

Open Calculator 🚰

 $\mathbf{ex} \left[6.01 \mathrm{m} = 0.1 \mathrm{m} + 0.05 \mathrm{m} \cdot (3.0 \mathrm{m}^3/\mathrm{s}) + (2.4)^2
ight]$

14) Discharge given Depth at Gauging Station

 $ho = rac{\mathrm{h_G} - \mathrm{h_{csf}} - \mathrm{Q^2 \ \hat{} \ 2}}{\mathrm{H_c}}$

Open Calculator

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

15) Head at Control given Depth at Gauging Station

 $\mathrm{H_c} = rac{\mathrm{h_G} - \mathrm{h_{csf}} - \mathrm{Q^2} \; \hat{\;\;} 2}{\mathrm{Q}}$

Open Calculator 🛂

 $oxed{ex} 0.05 \mathrm{m} = rac{6.01 \mathrm{m} - 0.1 \mathrm{m} - \left(2.4
ight)^2}{3.0 \mathrm{m}^3/\mathrm{s}}$



Dilution Technique of Streamflow Measurements &

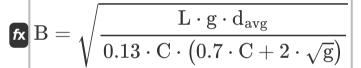
16) Average Depth of Stream given Length of Reach

$$extbf{d}_{ ext{avg}} = rac{0.13 \cdot ext{B}^2 \cdot ext{C} \cdot \left(0.7 \cdot ext{C} + 2 \cdot \sqrt{ ext{g}}
ight)}{ ext{L} \cdot ext{g}}$$

Open Calculator

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

17) Average Width of Stream using Mixing Length



Open Calculator

18) Constant Rate Injection Method or Plateau Gauging

$$oldsymbol{Q}_{
m f} = {
m Q}_{
m s} \cdot rac{{
m C}_2 - {
m C}_0}{{
m C}_1 - {
m C}_2}$$

Open Calculator

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





40) Biack and in Other to be Constant Bata In

19) Discharge in Stream by Constant Rate Injection Method 🗹

 $\left[\mathbf{Q}_{\mathrm{s}} = \mathrm{Q}_{\mathrm{f}} \cdot \left(rac{\mathrm{C}_{1} - \mathrm{C}_{2}}{\mathrm{C}_{2} - \mathrm{C}_{0}}
ight)
ight]$

Open Calculator 🗗

 \mathbf{ex} $60\mathrm{m}^3/\mathrm{s} = 20\mathrm{m}^3/\mathrm{s}\cdot\left(rac{12-6}{6-4}
ight)$

20) Length of Reach

 $\mathbf{L} = rac{0.13 \cdot \mathrm{B}^2 \cdot \mathrm{C} \cdot \left(0.7 \cdot \mathrm{C} + 2 \cdot \sqrt{\mathrm{g}}
ight)}{\mathrm{g} \cdot \mathrm{d}_{\mathrm{avg}}}$

Open Calculator 🗗

Electromagnetic Method 🖸

21) Current in Coil in Electromagnetic Method 🗗

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

Open Calculator

 $extbf{ex} 50.11304 ext{A} = 10 \cdot rac{3.23 ext{m}}{\left(rac{60 ext{m}^3/ ext{s}}{2}
ight)^{rac{1}{2.63}} - 3$





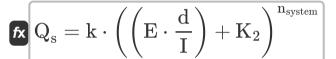
22) Depth of Flow in Electromagnetic Method

 $\mathbf{d} = rac{\left(\left(rac{Q_{\mathrm{s}}}{k}
ight)^{rac{1}{n_{\mathrm{system}}}} - K_{2}
ight) \cdot I}{E}$

Open Calculator

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

23) Measurement for Discharge in Electromagnetic Method



Open Calculator

 $ext{ex} \left[60.00169 ext{m}^3/ ext{s} = 2 \cdot \left(\left(10 \cdot rac{3.23 ext{m}}{50.11 ext{A}}
ight) + 3
ight)^{2.63}$

Stage-Discharge Relationship

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

$$oldsymbol{eta} \mathbf{Q}_{\mathrm{a}} = \mathbf{Q}_{0} \cdot \left(rac{\mathbf{F}}{\mathbf{F}_{\mathrm{o}}}
ight)^{\mathrm{m}}$$

Open Calculator

 $m = 2.001029 m^3/s = 7 m^3/s \cdot \left(rac{2.5 m}{1.512 m}
ight)^{0.5}$





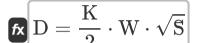
25) Actual Fall at Stage given Actual Discharge 🗗

Open Calculator

$$\mathbf{F} = \mathrm{F_o} \cdot \left(rac{\mathrm{Q_a}}{\mathrm{Q_0}}
ight)^{rac{1}{\mathrm{m}}}$$

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

26) Diffusion Coefficient in Advection Diffusion Flood Routing



Open Calculator

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

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



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



28) Measured Unsteady Flow

 $\mathbf{K} \mathbf{Q}_{\mathrm{M}} = \mathbf{Q}_{\mathrm{n}} \cdot \sqrt{1 + \left(rac{1}{\mathrm{vw} \cdot \mathrm{S}_{\mathrm{o}}}
ight) \cdot \mathrm{dh}_{/\mathrm{dt}}}$

Open Calculator 🗗

$$(v_W \cdot S_o)$$

ex
$$14.4 \mathrm{m}^3/\mathrm{s} = 12 \mathrm{m}^3/\mathrm{s} \cdot \sqrt{1 + \left(rac{1}{50.0 \mathrm{m/s} \cdot 0.10}
ight) \cdot 2.2}$$

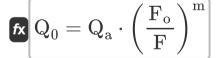
29) Normal Discharge at given Stage under Steady Uniform Flow

 $\boxed{\mathbf{fx}} \mathbf{Q}_n = \frac{\mathbf{Q}_M}{\sqrt{1 + \left(\frac{1}{v_W \cdot S_o}\right) \cdot dh_{/dt}}}$

Open Calculator 🗗

ex
$$12 \mathrm{m}^3/\mathrm{s} = rac{14.4 \mathrm{m}^3/\mathrm{s}}{\sqrt{1 + \left(rac{1}{50.0 \mathrm{m/s} \cdot 0.10}
ight) \cdot 2.2}}$$

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



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



31) Normalized Value of Fall given Discharge



Open Calculator

$$\mathbf{F}_{\mathrm{o}} = \mathrm{F} \cdot \left(rac{\mathrm{Q}_{\mathrm{0}}}{\mathrm{Q}_{\mathrm{a}}}
ight)^{rac{1}{\mathrm{m}}}$$

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

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

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



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



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
- C₀ Initial Concentration of Tracer
- C₁ High Concentration of Tracer at Section 1
- C2 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_{avq} 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
- K₂ 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)
- Q₀ Normalized Discharge (Cubic Meter per Second)
- Qa Actual Discharge (Cubic Meter per Second)
- Qf 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)
- Qn Normal Discharge (Cubic Meter per Second)
- Q_s Discharge in Stream (Cubic Meter per Second)
- Q² Terms of Order
- **Š** Bed Slope
- Sf Friction Slope
- So 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
 - Measurement of Evapotranspiration Formulas
- Precipitation Formulas
- Streamflow Measurement Formulas

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