



Indirect Methods of Streamflow Measurement Formulas

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List of 33 Indirect Methods of Streamflow Measurement Formulas

Indirect Methods of Streamflow Measurement &

Flow Measuring Structures 🗗

1) Discharge at Structure

fx $Q_{\mathrm{f}} = \overline{k \cdot (H^{n_{\mathrm{system}}})}$

Open Calculator

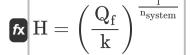
- $ext{ex} \left[35.96325 ext{m}^3/ ext{s} = 2 \cdot \left((3 ext{m})^{2.63}
 ight)
 ight]$
- 2) Free Flow Discharge under Head using Submerged Flow over Weir
- $\mathrm{Q}_{1} = rac{\mathrm{Q}_{\mathrm{S}}}{\left(1-\left(rac{\mathrm{H}_{2}}{\mathrm{H}_{1}}
 ight)^{\mathrm{n}}-\left\{\mathrm{head}
 ight\}
 ight)^{0.385}}$

Open Calculator

 $ag{20.00667 ext{m}^3/ ext{s}} = rac{19 ext{m}^3/ ext{s}}{\left(1-\left(rac{5 ext{m}}{10.01 ext{m}}
ight)^{2.99 ext{m}}
ight)^{0.385}}$



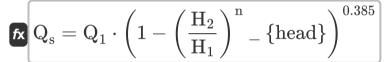
3) Head over Weir given Discharge



Open Calculator 🗗

$$=$$
 $2.800161 \mathrm{m} = \left(rac{30.0 \mathrm{m}^3/\mathrm{s}}{2}
ight)^{rac{1}{2.63}}$

4) Submerged Flow over Weir using Villemonte Formula



Open Calculator 🗗

$$m = 18.99366 m^3/s = 20 m^3/s \cdot \left(1 - \left(rac{5m}{10.01m}
ight)^{2.99m}
ight)^{0.385}$$

Slope-Area Method

5) Eddy Loss 🗗

$$\mathbf{h}_{\mathrm{e}} = (\mathrm{h}_1 - \mathrm{h}_2) + \left(rac{\mathrm{V}_1^2}{2 \cdot \mathrm{g}} - rac{\mathrm{V}_2^2}{2 \cdot \mathrm{g}}
ight) - \mathrm{h}_{\mathrm{f}}$$

Open Calculator

$$\boxed{ 15.96939 = (50\mathrm{m} - 20\mathrm{m}) + \left(\frac{(10\mathrm{m/s})^2}{2 \cdot 9.8\mathrm{m/s^2}} - \frac{(9\mathrm{m/s})^2}{2 \cdot 9.8\mathrm{m/s^2}} \right) - 15 }$$



6) Frictional Loss

 $\mathbf{h}_{\mathrm{f}} = (\mathrm{h}_1 - \mathrm{h}_2) + \left(rac{\mathrm{V}_1^2}{2 \cdot \mathrm{g}} - rac{\mathrm{V}_2^2}{2 \cdot \mathrm{g}}
ight) - \mathrm{h}_{\mathrm{e}}$

Open Calculator

7) Head loss in Reach

 \mathbf{f} $\mathbf{h}_{\mathrm{l}}=\mathbf{Z}_{1}+\mathbf{y}_{1}+\left(rac{\mathbf{V}_{1}^{2}}{2\cdot\mathbf{g}}
ight)-\mathbf{Z}_{2}-\mathbf{y}_{2}-rac{\mathbf{V}_{2}^{2}}{2\cdot\mathbf{g}}$

Open Calculator

ex

 $\left[2.469388 \mathrm{m} = 11.5 \mathrm{m} + 14 \mathrm{m} + \left(rac{\left(10 \mathrm{m/s}
ight)^2}{2 \cdot 9.8 \mathrm{m/s^2}}
ight) - 11 \mathrm{m} - 13 \mathrm{m} - rac{\left(9 \mathrm{m/s}
ight)^2}{2 \cdot 9.8 \mathrm{m/s^2}}
ight]$

Non-Uniform Flow

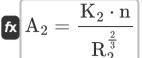
8) Area of Channel with known Conveyance of Channel at Section 1

 $\mathbf{K}\mathbf{A}_1 = rac{\mathbf{K}_1 \cdot \mathbf{n}}{\mathbf{R}_{\cdot \mathbf{r}}^{rac{2}{3}}}$

Open Calculator

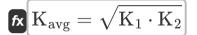


9) Area of Channel with known Conveyance of Channel at Section 2



Open Calculator

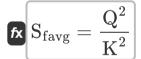
10) Average Conveyance of Channel for Non-Uniform Flow



Open Calculator

 $\boxed{1780.481 = \sqrt{1824 \cdot 1738}}$

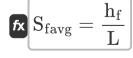
11) Average Energy Slope given Average Conveyance for Non-Uniform Flow



Open Calculator

 $= \frac{0.140625 = \frac{(3.0 \text{m}^3/\text{s})^2}{(8)^2} }{(8)^2}$

12) Average Energy Slope given Frictional Loss 🗗



Open Calculator

 $\boxed{0.15 = \frac{15}{100 \text{m}}}$





13) Conveyance of Channel at End Sections at 1

 $\mathbf{K} = \left(rac{1}{n}
ight) \cdot \mathbf{A}_1 \cdot \mathbf{R}_1^{rac{2}{3}}$

Open Calculator

14) Conveyance of Channel at End Sections at 2

 $\mathbf{K}_2 = \left(rac{1}{\mathrm{n}}
ight) \cdot \mathrm{A}_2 \cdot \mathrm{R}_2^{rac{2}{3}}$

Open Calculator

ex $1738.954 = \left(\frac{1}{0.412}\right) \cdot 478 \text{m}^2 \cdot (1.835 \text{m})^{\frac{2}{3}}$

15) Conveyance of Channel for Non-Uniform Flow for End Section 🖸

 $K_2 = rac{\mathrm{K}_{\mathrm{avg}}^2}{\mathrm{K}_1}$

Open Calculator

 $\boxed{1737.061 = \frac{\left(1780\right)^2}{1824}}$

16) Conveyance of Channel for Non-Uniform Flow for End Sections

$$K_1 = rac{\mathrm{K}_{\mathrm{avg}}^2}{\mathrm{K}_2}$$

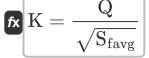
Open Calculator







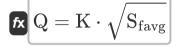
17) Conveyance of Channel given Discharge in Non-Uniform Flow



Open Calculator 🗗

ex $2.44949 = \frac{3.0 \mathrm{m}^3/\mathrm{s}}{\sqrt{1.5}}$

18) Discharge in Non-Uniform Flow by Conveyance Method



Open Calculator 🗗

 $= 8 \cdot \sqrt{1.5}$

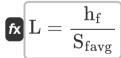
19) Frictional Loss given Average Energy Slope

 \mathbf{f} $\mathbf{h}_{\mathrm{f}} = \mathrm{S}_{\mathrm{favg}} \cdot \mathrm{L}$

Open Calculator

 $150 = 1.5 \cdot 100 \text{m}$

20) Length of Reach given Average Energy Slope for Non-Uniform Flow



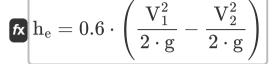
Open Calculator

 $\boxed{10\text{m} = \frac{15}{1.5}}$



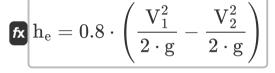
Eddy Loss

21) Eddy Loss for Abrupt Contraction Channel Transition



Open Calculator

22) Eddy Loss for Abrupt Expansion Channel Transition



Open Calculator

 $= 0.77551 = 0.8 \cdot \left(\frac{\left(10 \text{m/s}\right)^2}{2 \cdot 9.8 \text{m/s}^2} - \frac{\left(9 \text{m/s}\right)^2}{2 \cdot 9.8 \text{m/s}^2} \right)$

23) Eddy Loss for Gradual Contraction Channel Transition 🔄

$$\mathbf{h}_{\mathrm{e}} = 0.1 \cdot \left(rac{\mathrm{V}_{1}^{2}}{2 \cdot \mathrm{g}} - rac{\mathrm{V}_{2}^{2}}{2 \cdot \mathrm{g}}
ight)$$

 $\boxed{ 0.096939 = 0.1 \cdot \left(\frac{\left(10 \text{m/s}\right)^2}{2 \cdot 9.8 \text{m/s}^2} - \frac{\left(9 \text{m/s}\right)^2}{2 \cdot 9.8 \text{m/s}^2} \right) }$





24) Eddy Loss for Gradual Expansion Channel Transition

 $\mathbf{h}_{\mathrm{e}} = 0.3 \cdot \left(rac{\mathrm{V}_{1}^{2}}{2 \cdot \mathrm{g}} - rac{\mathrm{V}_{2}^{2}}{2 \cdot \mathrm{g}}
ight)$

Open Calculator

 $\boxed{ 0.290816 = 0.3 \cdot \left(\frac{\left(10 \text{m/s}\right)^2}{2 \cdot 9.8 \text{m/s}^2} - \frac{\left(9 \text{m/s}\right)^2}{2 \cdot 9.8 \text{m/s}^2} \right) }$

25) Eddy Loss for Non-uniform Flow

 $\mathbf{h}_{\mathrm{e}} = \mathrm{K}_{\mathrm{e}} \cdot \left(rac{\mathrm{V}_{1}^{2}}{2 \cdot \mathrm{g}} - rac{\mathrm{V}_{2}^{2}}{2 \cdot \mathrm{g}}
ight)$

Open Calculator

 $= 0.95 = 0.98 \cdot \left(\frac{\left(10 \text{m/s}\right)^2}{2 \cdot 9.8 \text{m/s}^2} - \frac{\left(9 \text{m/s}\right)^2}{2 \cdot 9.8 \text{m/s}^2} \right)$

Uniform Flow

26) Area of Channel with known Conveyance of Channel



Open Calculator

 $oxed{f ex} egin{aligned} 40.66151 {
m m}^2 = rac{8}{(0.33 {
m m})^{rac{2}{3}}} \cdot \left(rac{1}{0.412}
ight) \end{aligned}$



Open Calculator 2

Open Calculator

Open Calculator

Open Calculator

27) Conveyance of Channel

 $\mathbf{K} = \left(rac{1}{n}
ight) \cdot \mathbf{A} \cdot \mathbf{r}_{\mathrm{H}}^{rac{2}{3}}$

28) Conveyance of Channel given Energy Slope

 $\mathbf{K} = \sqrt{rac{\mathrm{Q}^2}{\mathrm{S}_c}}$

 $= \sqrt{\frac{(3.0 \text{m}^3/\text{s})^2}{0.140}}$

29) Discharge for Uniform Flow given Energy Slope

fx $m Q = K \cdot \sqrt{S_f}$

 $|\mathbf{ex}| \, 2.993326 \mathrm{m}^3/\mathrm{s} = 8 \cdot \sqrt{0.140}$

30) Energy Slope for Uniform Flow

 $extbf{K} extbf{S}_{ ext{f}} = rac{ ext{Q}^2}{ ext{K}^2}$

$$oxed{ex} 0.140625 = rac{(3.0 \mathrm{m}^3/\mathrm{s})^2}{{(8)}^2}$$







31) Frictional Loss given Energy Slope

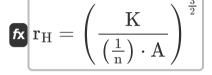
fx $h_f = S_f \cdot L$

Open Calculator

Open Calculator 🚰

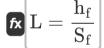
Open Calculator 2

- $| 14 = 0.140 \cdot 100 \mathrm{m}$
- 32) Hydraulic Radius given Conveyance of Channel for Uniform Flow



 $oxed{egin{aligned} egin{aligned} \mathbf{ex} \ 0.143949 \mathrm{m} = \left(rac{8}{\left(rac{1}{0.412}
ight) \cdot 12.0 \mathrm{m}^2}
ight)^{rac{3}{2}} \end{aligned}}$

33) Length of Reach by Manning's Formula for Uniform Flow





Variables Used

- A Cross-Sectional Area (Square Meter)
- A₁ Area of Channel Section 1 (Square Meter)
- A₂ Area of Channel Section 2 (Square Meter)
- g Acceleration due to Gravity (Meter per Square Second)
- H Head over Weir (Meter)
- h₁ Height above Datum at Section 1 (Meter)
- H₁ Upstream Water Surface Elevation (Meter)
- h₂ Height above Datum at Section 2 (Meter)
- H₂ Downstream Water Surface Elevation (Meter)
- h Eddy Loss
- h_f Frictional Loss
- h_I Head Loss in Reach (Meter)
- k System Constant k
- K Conveyance Function
- K₁ Conveyance of Channel at End Sections at (1)
- K₂ Conveyance of Channel at End Sections at (2)
- Kavg Average Conveyance of Channel
- K_e Eddy Loss Coefficient
- L Reach (Meter)
- n Manning's Roughness Coefficient
- n_{head} Exponent of Head (Meter)
- n_{system} System Constant n
- Q Discharge (Cubic Meter per Second)



- Q₁ Free Flow Discharge under Head H1 (Cubic Meter per Second)
- **Q**_f Flow Discharge (Cubic Meter per Second)
- Q_s Submerged Discharge (Cubic Meter per Second)
- R₁ Hydraulics Radius of Channel Section 1 (Meter)
- R₂ Hydraulics Radius of Channel Section 2 (Meter)
- **r**_H Hydraulic Radius (Meter)
- Sf Energy Slope
- S_{favq} Average Energy Slope
- V₁ Mean Velocity at End Sections at (1) (Meter per Second)
- V₂ Mean Velocity at End Sections at (2) (Meter per Second)
- **y**₁ Height above Channel Slope at 1 (*Meter*)
- **y₂** Height above Channel Slope at 2 (Meter)
- Z₁ Static Heads at End Sections at (1) (Meter)
- Z₂ Static Head at End Sections at (2) (Meter)





Constants, Functions, Measurements used

- Function: sqrt, sqrt(Number)
 Square root function
- Measurement: Length in Meter (m)
 Length 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





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
- Measurement of Evapotranspiration Formulas
- Precipitation Formulas
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