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Hydrodynamics of Tidal Inlets-2 Formulas

Calculators! Examples! Conversions!

List of 23 Hydrodynamics of Tidal Inlets-2 Formulas

Hydrodynamics of Tidal Inlets-2

Hydrodynamic and Sediment Interaction at Tidal Inlets

Tidal Dispersion and Mixing

1) Average Volume of Bay over Tidal Cycle given Residence Time

Open Calculator

fx $$V = \frac{T_r \cdot \varepsilon \cdot P}{T}$$

ex $$179.2\text{m}^3/\text{hr} = \frac{16\text{Year} \cdot 0.7 \cdot 32\text{m}^3}{2\text{Year}}$$

2) Fraction of New Water Entering Bay from Sea each Tidal Cycle given Residence Time

Open Calculator

fx $$\varepsilon = \frac{V \cdot T}{P \cdot T_r}$$

ex $$0.703125 = \frac{180\text{m}^3/\text{hr} \cdot 2\text{Year}}{32\text{m}^3 \cdot 16\text{Year}}$$

3) Residence Time

Open Calculator

$$T_r = T \cdot \left(\frac{V}{\varepsilon \cdot P} \right)$$

$$16.07143\text{Year} = 2\text{Year} \cdot \left(\frac{180\text{m}^3/\text{hr}}{0.7 \cdot 32\text{m}^3} \right)$$

4) Tidal Period given Residence Time

Open Calculator

$$T = \frac{T_r \cdot \varepsilon \cdot P}{V}$$

$$1.991111\text{Year} = \frac{16\text{Year} \cdot 0.7 \cdot 32\text{m}^3}{180\text{m}^3/\text{hr}}$$

5) Tidal Prism given Residence Time

Open Calculator

$$P = \frac{T \cdot V}{T_r \cdot \varepsilon}$$

$$32.14286\text{m}^3 = \frac{2\text{Year} \cdot 180\text{m}^3/\text{hr}}{16\text{Year} \cdot 0.7}$$

Tidal Prism

6) Average Area over Channel Length given Tidal Prism

Open Calculator

fx $$A_{avg} = \frac{P \cdot \pi}{T \cdot V_m}$$

ex $$12.25987\text{m}^2 = \frac{32\text{m}^3 \cdot \pi}{2\text{Year} \cdot 4.1\text{m/s}}$$

7) Average Area over Channel Length given Tidal Prism of Non-Sinusoidal Prototype Flow

Open Calculator

fx $$A_{avg} = \frac{P \cdot \pi \cdot C}{T \cdot V_m}$$

ex $$12.38247\text{m}^2 = \frac{32\text{m}^3 \cdot \pi \cdot 1.01}{2\text{Year} \cdot 4.1\text{m/s}}$$

8) Depth of Water at Current Meter Location

Open Calculator

fx $$D = \frac{r_H}{\left(\frac{V_{avg}}{V_{meas}}\right)^{\frac{3}{2}}}$$

ex $$8.101062\text{m} = \frac{0.33\text{m}}{\left(\frac{3\text{m/s}}{25.34\text{m/s}}\right)^{\frac{3}{2}}}$$

9) Hydraulic Radius of Entire Cross-Section

Open Calculator

$$r_H = D \cdot \left(\frac{V_{avg}}{V_{meas}} \right)^{\frac{3}{2}}$$

$$0.329957\text{m} = 8.1\text{m} \cdot \left(\frac{3\text{m/s}}{25.34\text{m/s}} \right)^{\frac{3}{2}}$$

10) Maximum Cross-Sectionally Averaged Velocity during Tidal Cycle given Tidal Prism

Open Calculator

$$V_m = \frac{P \cdot \pi}{T \cdot A_{avg}}$$

$$6.283185\text{m/s} = \frac{32\text{m}^3 \cdot \pi}{2\text{Year} \cdot 8\text{m}^2}$$

11) Maximum Cross-Sectionally Averaged Velocity given Tidal Prism of Non-sinusoidal Prototype Flow

Open Calculator

$$V_m = \frac{P \cdot \pi \cdot C}{T \cdot A_{avg}}$$

$$6.346017\text{m/s} = \frac{32\text{m}^3 \cdot \pi \cdot 1.01}{2\text{Year} \cdot 8\text{m}^2}$$

12) Maximum Ebb Tide Discharge Accounting for Non-Sinusoidal Character of Prototype Flow by Keulegan

Open Calculator

fx $$Q_{max} = \frac{P \cdot \pi \cdot C}{T}$$

ex $$50.76814 \text{m}^3/\text{s} = \frac{32 \text{m}^3 \cdot \pi \cdot 1.01}{2 \text{Year}}$$

13) Maximum Instantaneous Ebb Tide Discharge given Tidal Prism

Open Calculator

fx $$Q_{max} = P \cdot \frac{\pi}{T}$$

ex $$50.26548 \text{m}^3/\text{s} = 32 \text{m}^3 \cdot \frac{\pi}{2 \text{Year}}$$

14) Maximum Velocity Averaged over Entire Cross-Section

Open Calculator

fx $$V_{avg} = V_{meas} \cdot \left(\frac{r_H}{D}\right)^{\frac{2}{3}}$$

ex $$3.000262 \text{m/s} = 25.34 \text{m/s} \cdot \left(\frac{0.33 \text{m}}{8.1 \text{m}}\right)^{\frac{2}{3}}$$

15) Point Measurement of Maximum Velocity

Open Calculator

fx $$V_{meas} = \frac{V_{avg}}{\left(\frac{r_H}{D}\right)^{\frac{2}{3}}}$$

ex $$25.33778\text{m/s} = \frac{3\text{m/s}}{\left(\frac{0.33\text{m}}{8.1\text{m}}\right)^{\frac{2}{3}}}$$

16) Tidal Period Accounting for Non-sinusoidal Character of Prototype Flow by Keulegan

Open Calculator

fx $$T = \frac{P \cdot \pi \cdot C}{Q_{max}}$$

ex $$2.030725\text{Year} = \frac{32\text{m}^3 \cdot \pi \cdot 1.01}{50\text{m}^3/\text{s}}$$

17) Tidal Period given Maximum Cross-sectionally Averaged Velocity and Tidal Prism

Open Calculator

fx $$T = \frac{P \cdot \pi}{V_m \cdot A_{avg}}$$

ex $$3.064968\text{Year} = \frac{32\text{m}^3 \cdot \pi}{4.1\text{m/s} \cdot 8\text{m}^2}$$

18) Tidal Period given Maximum Instantaneous Ebb Tide Discharge and Tidal Prism

Open Calculator

fx $$T = \frac{P \cdot \pi}{Q_{max}}$$

ex $$2.010619\text{Year} = \frac{32\text{m}^3 \cdot \pi}{50\text{m}^3/\text{s}}$$

19) Tidal Period when Tidal Prism Accounting for Non-sinusoidal Prototype Flow by Keulegan

Open Calculator

fx $$T = \frac{P \cdot \pi \cdot C}{V_m \cdot A_{avg}}$$

ex $$3.095618\text{Year} = \frac{32\text{m}^3 \cdot \pi \cdot 1.01}{4.1\text{m/s} \cdot 8\text{m}^2}$$

20) Tidal Prism Filling Bay Accounting for Non-sinusoidal Prototype Flow by Keulegan

Open Calculator

fx $$P = \frac{T \cdot Q_{max}}{\pi \cdot C}$$

ex $$31.51583\text{m}^3 = \frac{2\text{Year} \cdot 50\text{m}^3/\text{s}}{\pi \cdot 1.01}$$

21) Tidal Prism filling Bay given Maximum Ebb Tide Discharge

Open Calculator

$$P = T \cdot \frac{Q_{max}}{\pi}$$

$$31.83099\text{m}^3 = 2\text{Year} \cdot \frac{50\text{m}^3/\text{s}}{\pi}$$

22) Tidal Prism for Non-sinusoidal character of Prototype Flow by Keulegan

Open Calculator

$$P = T \cdot \frac{Q_{max}}{\pi \cdot C}$$

$$31.51583\text{m}^3 = 2\text{Year} \cdot \frac{50\text{m}^3/\text{s}}{\pi \cdot 1.01}$$

23) Tidal Prism given Average Area over Channel Length

Open Calculator

$$P = \frac{T \cdot V_m \cdot A_{avg}}{\pi}$$

$$20.88113\text{m}^3 = \frac{2\text{Year} \cdot 4.1\text{m/s} \cdot 8\text{m}^2}{\pi}$$

Variables Used

- A_{avg} Average Area over the Channel Length *(Square Meter)*
- C Keulegan Constant for Non-sinusoidal Character
- D Depth of Water at Current Meter Location *(Meter)*
- P Tidal Prism Filling Bay *(Cubic Meter)*
- Q_{max} Maximum Instantaneous Ebb Tide Discharge *(Cubic Meter per Second)*
- r_H Hydraulic Radius *(Meter)*
- T Tidal Duration *(Year)*
- T_r Residence Time *(Year)*
- V Average Volume of Bay over Tidal Cycle *(Cubic Meter per Hour)*
- V_{avg} Max Velocity averaged Over Inlet Cross Section *(Meter per Second)*
- V_m Maximum Cross Sectional Average Velocity *(Meter per Second)*
- V_{meas} Point Measurement of Maximum Velocity *(Meter per Second)*
- ε Fraction of New Water entering the Bay

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Time** in Year (Year)
  Time Unit Conversion
- Measurement: **Volume** in Cubic Meter (m^3)
  Volume Unit Conversion
- Measurement: **Area** in Square Meter (m^2)
  Area Unit Conversion
- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion
- Measurement: **Volumetric Flow Rate** in Cubic Meter per Hour (m^3/hr), Cubic Meter per Second (m^3/s)
  Volumetric Flow Rate Unit Conversion

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- Density Currents in Rivers Formulas
- Dredging Equipment Formulas
- Estimating Marine and Coastal Winds Formulas
- Hydrodynamic Analysis and Design Conditions Formulas
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- Meteorology and Wave Climate Formulas

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