Important Hydrodynamics of Tidal Inlets-2 Formulas PDF

Formulas
Examples
with Units

List of 23
Important Hydrodynamics of Tidal Inlets-2 Formulas

1) Hydrodynamic and Sediment Interaction at Tidal Inlets Formulas

1.1) Tidal Dispersion and Mixing Formulas

1.1.1) Average Volume of Bay over Tidal Cycle given Residence Time Formula

Evaluate Formula

Formula

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

Example with Units

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

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

Evaluate Formula

Formula

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

Example with Units

$$0.7031 = \frac{180\,\text{m}^3/\text{hr} \cdot 2\,\text{Year}}{32\,\text{m}^3 \cdot 16\,\text{Year}}$$

1.1.3) Residence Time Formula

Evaluate Formula

Formula

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

Example with Units

$$16.0714\,\text{Year} = 2\,\text{Year} \cdot \left(\frac{180\,\text{m}^3/\text{hr}}{0.7 \cdot 32\,\text{m}^3}\right)$$

1.1.4) Tidal Period given Residence Time Formula

Evaluate Formula

Formula

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

Example with Units

$$1.9911\,\text{Year} = \frac{16\,\text{Year} \cdot 0.7 \cdot 32\,\text{m}^3}{180\,\text{m}^3/\text{hr}}$$

1.1.5) Tidal Prism given Residence Time Formula

Evaluate Formula

Formula

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

Example with Units

$$32.1429\,\text{m}^3 = \frac{2\,\text{Year} \cdot 180\,\text{m}^3/\text{hr}}{16\,\text{Year} \cdot 0.7}$$

1.2) Tidal Prism Formulas

1.2.1) Average Area over Channel Length given Tidal Prism Formula

Evaluate Formula

Formula

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

Example with Units

$$12.2599\,\text{m}^2 = \frac{32\,\text{m}^3 \cdot 3.1416}{2\,\text{Year} \cdot 4.1\,\text{m/s}}$$

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

Evaluate Formula

Formula

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

Example with Units

$$12.3825\,\text{m}^2 = \frac{32\,\text{m}^3 \cdot 3.1416 \cdot 1.01}{2\,\text{Year} \cdot 4.1\,\text{m/s}}$$

1.2.3) Depth of Water at Current Meter Location Formula

Evaluate Formula

Formula

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

Example with Units

$$8.1011\,\text{m} = \frac{0.33\,\text{m}}{\left(\frac{3\,\text{m/s}}{25.34\,\text{m/s}}\right)^{\frac{3}{2}}}$$

1.2.4) Hydraulic Radius of Entire Cross-Section Formula

Evaluate Formula

Formula

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

Example with Units

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

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

Evaluate Formula

Formula

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

Example with Units

$$6.2832\,\text{m/s} = \frac{32\,\text{m}^3 \cdot 3.1416}{2\,\text{Year} \cdot 8\,\text{m}^2}$$

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

Evaluate Formula

Formula

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

Example with Units

$$6.346\,\text{m/s} = \frac{32\,\text{m}^3 \cdot 3.1416 \cdot 1.01}{2\,\text{Year} \cdot 8\,\text{m}^2}$$

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

Evaluate Formula

Formula

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

Example with Units

$$50.7681\,\text{m}^3/\text{s} = \frac{32\,\text{m}^3 \cdot 3.1416 \cdot 1.01}{2\,\text{Year}}$$

1.2.8) Maximum Instantaneous Ebb Tide Discharge given Tidal Prism Formula

Evaluate Formula

Formula

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

Example with Units

$$50.2655\,\text{m}^3/\text{s} = 32\,\text{m}^3 \cdot \frac{3.1416}{2\,\text{Year}}$$

1.2.9) Maximum Velocity Averaged over Entire Cross-Section Formula

Evaluate Formula

Formula

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

Example with Units

$$3.0003\,\text{m/s} = 25.34\,\text{m/s} \cdot \left(\frac{0.33\,\text{m}}{8.1\,\text{m}}\right)^{\frac{2}{3}}$$

1.2.10) Point Measurement of Maximum Velocity Formula

Evaluate Formula

Formula

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

Example with Units

$$25.3378\,\text{m/s} = \frac{3\,\text{m/s}}{\left(\frac{0.33\,\text{m}}{8.1\,\text{m}}\right)^{\frac{2}{3}}}$$

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

Evaluate Formula

Formula

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

Example with Units

$$2.0307\,\text{Year} = \frac{32\,\text{m}^3 \cdot 3.1416 \cdot 1.01}{50\,\text{m}^3/\text{s}}$$

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

Evaluate Formula

Formula

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

Example with Units

$$3.065\,\text{Year} = \frac{32\,\text{m}^3 \cdot 3.1416}{4.1\,\text{m/s} \cdot 8\,\text{m}^2}$$

1.2.13) Tidal Period given Maximum Instantaneous Ebb Tide Discharge and Tidal Prism Formula

Evaluate Formula

Formula

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

Example with Units

$$2.0106\,\text{Year} = \frac{32\,\text{m}^3 \cdot 3.1416}{50\,\text{m}^3/\text{s}}$$

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

Evaluate Formula

Formula

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

Example with Units

$$3.0956\,\text{Year} = \frac{32\,\text{m}^3 \cdot 3.1416 \cdot 1.01}{4.1\,\text{m/s} \cdot 8\,\text{m}^2}$$

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

Evaluate Formula

Formula

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

Example with Units

$$31.5158\,\text{m}^3 = \frac{2\,\text{Year} \cdot 50\,\text{m}^3/\text{s}}{3.1416 \cdot 1.01}$$

1.2.16) Tidal Prism filling Bay given Maximum Ebb Tide Discharge Formula

Evaluate Formula

Formula

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

Example with Units

$$31.831\,\text{m}^3 = 2\,\text{Year} \cdot \frac{50\,\text{m}^3/\text{s}}{3.1416}$$

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

Evaluate Formula

Formula

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

Example with Units

$$31.5158\,\text{m}^3 = 2\,\text{Year} \cdot \frac{50\,\text{m}^3/\text{s}}{3.1416 \cdot 1.01}$$

1.2.18) Tidal Prism given Average Area over Channel Length Formula

Evaluate Formula

Formula

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

Example with Units

$$20.8811\,\text{m}^3 = \frac{2\,\text{Year} \cdot 4.1\,\text{m/s} \cdot 8\,\text{m}^2}{3.1416}$$

Variables used in list of Hydrodynamics of Tidal Inlets-2 Formulas above

- 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 in list of Hydrodynamics of Tidal Inlets-2 Formulas above

- constant(s): **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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