

Important SCS-CN Method of Runoff Volume Formulas PDF



Formulas Examples with Units

List of 19 Important SCS-CN Method of Runoff Volume Formulas

1) Basic Theory Formulas

1.1) Actual Infiltration Formula

Formula

$$F = S \cdot \left(\frac{Q}{P_T - I_a} \right)$$

Example with Units

$$2.0455 \text{ m}^3 = 2.5 \text{ m}^3 \cdot \left(\frac{9 \text{ m}^3}{16 \text{ m}^3 - 5 \text{ m}^3} \right)$$

Evaluate Formula

1.2) Cumulative Infiltration given Total Precipitation Formula

Formula

$$F = P_T - I_a - Q$$

Example with Units

$$2 \text{ m}^3 = 16 \text{ m}^3 - 5 \text{ m}^3 - 9 \text{ m}^3$$

Evaluate Formula

1.3) Direct Surface Runoff given Total Precipitation Formula

Formula

$$Q = P_T - I_a - F$$

Example with Units

$$9 \text{ m}^3 = 16 \text{ m}^3 - 5 \text{ m}^3 - 2 \text{ m}^3$$

Evaluate Formula

1.4) Equation for Potential Maximum Retention Formula

Formula

$$S = F \cdot \left(\frac{P_T - I_a}{Q} \right)$$

Example with Units

$$2.4444 \text{ m}^3 = 2 \text{ m}^3 \cdot \left(\frac{16 \text{ m}^3 - 5 \text{ m}^3}{9 \text{ m}^3} \right)$$

Evaluate Formula

1.5) Initial Abstraction Formula

Formula

$$I_a = P_T - F - Q$$

Example with Units

$$5 \text{ m}^3 = 16 \text{ m}^3 - 2 \text{ m}^3 - 9 \text{ m}^3$$

Evaluate Formula

1.6) Initial Abstraction given Ratio of Infiltration to Retention Formula

Formula

$$I_a = P_T - \left(Q \cdot \frac{S}{F} \right)$$

Example with Units

$$4.75 \text{ m}^3 = 16 \text{ m}^3 - \left(9 \text{ m}^3 \cdot \frac{2.5 \text{ m}^3}{2 \text{ m}^3} \right)$$

Evaluate Formula



1.7) Initial Abstraction given Total Precipitation Formula

Formula

$$I_a = P_T - R_{\max}$$

Example with Units

$$5 \text{ m}^3 = 16 \text{ m}^3 - 11 \text{ m}^3$$

Evaluate Formula 

1.8) Maximum Potential Runoff Formula

Formula

$$R_{\max} = P_T - I_a$$

Example with Units

$$11 \text{ m}^3 = 16 \text{ m}^3 - 5 \text{ m}^3$$

Evaluate Formula 

1.9) Precipitation given Maximum Potential Runoff Formula

Formula

$$P_T = R_{\max} + I_a$$

Example with Units

$$16 \text{ m}^3 = 11 \text{ m}^3 + 5 \text{ m}^3$$

Evaluate Formula 

1.10) Precipitation given Potential Maximum Retention Formula

Formula

$$P_T = \left(Q \cdot \frac{S}{F} \right) + I_a$$

Example with Units

$$16.25 \text{ m}^3 = \left(9 \text{ m}^3 \cdot \frac{2.5 \text{ m}^3}{2 \text{ m}^3} \right) + 5 \text{ m}^3$$

Evaluate Formula 

1.11) Water Balance Equation for Rainfall Formula

Formula

$$P_T = I_a + F + Q$$

Example with Units

$$16 \text{ m}^3 = 5 \text{ m}^3 + 2 \text{ m}^3 + 9 \text{ m}^3$$

Evaluate Formula 

2) Curve Number (CN) Formulas

2.1) Curve Number Formula

Formula

$$CN = \frac{25400}{S_{CN} + 254}$$

Example with Units

$$12.0038 = \frac{25400}{1862 \text{ mm} + 254}$$

Evaluate Formula 

2.2) Curve Number for Antecedent Moisture Condition One Formula

Formula

$$CN = \frac{CN_{11}}{2.281 - 0.01281 \cdot CN_{11}}$$

Example

$$3.6722 = \frac{8}{2.281 - 0.01281 \cdot 8}$$

Evaluate Formula 

2.3) Curve Number for Antecedent Moisture Condition-III Formula

Formula

$$CN = \frac{CN_{11}}{0.427 + 0.00573 \cdot CN_{11}}$$

Example

$$16.919 = \frac{8}{0.427 + 0.00573 \cdot 8}$$

Evaluate Formula 



2.4) Potential Maximum Retention Formula

Formula

$$S_{CN} = \left(\frac{25400}{CN} \right) - 254$$

Example with Units

$$1862.6667 \text{ mm} = \left(\frac{25400}{12} \right) - 254$$

Evaluate Formula 

2.5) Potential Maximum Retention given Curve Number Formula

Formula

$$S_{CN} = 254 \cdot \left(\frac{100}{CN} - 1 \right)$$

Example with Units

$$1862.6667 \text{ mm} = 254 \cdot \left(\frac{100}{12} - 1 \right)$$

Evaluate Formula 

3) SSC-CN Equation for Indian Conditions Formulas

3.1) Daily Runoff for Black Soils Type I and Soil having AMC of Type I, II and III for Indian Conditions Formula

Formula

$$Q = \frac{(P_T - 0.3 \cdot S)^2}{P_T + 0.7 \cdot S}$$

Example with Units

$$13.1021 \text{ m}^3 = \frac{(16 \text{ m}^3 - 0.3 \cdot 2.5 \text{ m}^3)^2}{16 \text{ m}^3 + 0.7 \cdot 2.5 \text{ m}^3}$$

Evaluate Formula 

3.2) Daily Runoff in Smaller Catchments under SCS Formula

Formula

$$Q = \frac{(P_T - 0.2 \cdot S)^2}{P_T + 0.8 \cdot S}$$

Example with Units

$$13.3472 \text{ m}^3 = \frac{(16 \text{ m}^3 - 0.2 \cdot 2.5 \text{ m}^3)^2}{16 \text{ m}^3 + 0.8 \cdot 2.5 \text{ m}^3}$$

Evaluate Formula 

3.3) Daily Runoff valid for Black Soils under AMC of type I and II for Indian Conditions Formula

Formula

$$Q = \frac{(P_T - 0.1 \cdot S)^2}{P_T + 0.9 \cdot S}$$

Example with Units

$$13.5925 \text{ m}^3 = \frac{(16 \text{ m}^3 - 0.1 \cdot 2.5 \text{ m}^3)^2}{16 \text{ m}^3 + 0.9 \cdot 2.5 \text{ m}^3}$$

Evaluate Formula 



Variables used in list of SCS-CN Method of Runoff Volume Formulas above

- **CN** Curve Number
- **CN₁₁** Runoff Curve Number
- **F** Cumulative Infiltration (*Cubic Meter*)
- **I_a** Initial Abstraction (*Cubic Meter*)
- **P_T** Total Precipitation (*Cubic Meter*)
- **Q** Direct Surface Runoff (*Cubic Meter*)
- **R_{max}** Maximum Potential Runoff (*Cubic Meter*)
- **S** Potential Maximum Retention (*Cubic Meter*)
- **S_{CN}** Potential Maximum Retention (Curve Number) (*Millimeter*)

Constants, Functions, Measurements used in list of SCS- CN Method of Runoff Volume Formulas above

- **Measurement: Length** in Millimeter (mm)
Length Unit Conversion 
- **Measurement: Volume** in Cubic Meter (m³)
Volume Unit Conversion 



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