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SCS-CN Method of Runoff Volume Formulas

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List of 19 SCS-CN Method of Runoff Volume Formulas

SCS-CN Method of Runoff Volume

Basic Theory

1) Actual Infiltration

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

Open Calculator 

$$ex \quad 2.045455m^3 = 2.5m^3 \cdot \left(\frac{9m^3}{16m^3 - 5m^3} \right)$$

2) Cumulative Infiltration given Total Precipitation

$$fx \quad F = P_T - I_a - Q$$

Open Calculator 

$$ex \quad 2m^3 = 16m^3 - 5m^3 - 9m^3$$

3) Direct Surface Runoff given Total Precipitation

$$fx \quad Q = P_T - I_a - F$$

Open Calculator 

$$ex \quad 9m^3 = 16m^3 - 5m^3 - 2m^3$$



4) Equation for Potential Maximum Retention

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

[Open Calculator !\[\]\(cbe80b694ebd74fcfe136a095b608235_img.jpg\)](#)

$$ex \quad 2.444444m^3 = 2m^3 \cdot \left(\frac{16m^3 - 5m^3}{9m^3} \right)$$

5) Initial Abstraction

$$fx \quad I_a = P_T - F - Q$$

[Open Calculator !\[\]\(3e2231b1ad3ca8da8658228c00dd08e0_img.jpg\)](#)

$$ex \quad 5m^3 = 16m^3 - 2m^3 - 9m^3$$

6) Initial Abstraction given Ratio of Infiltration to Retention

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

[Open Calculator !\[\]\(0d5ec72f61334709c3fc9450209b754f_img.jpg\)](#)

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

7) Initial Abstraction given Total Precipitation

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

[Open Calculator !\[\]\(b64b40baaee5acddc1eab8538ba84754_img.jpg\)](#)

$$ex \quad 5m^3 = 16m^3 - 11m^3$$



8) Maximum Potential Runoff

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

[Open Calculator !\[\]\(e78f798d4ea5c530c9db49e7d26e6b95_img.jpg\)](#)

$$ex \quad 11m^3 = 16m^3 - 5m^3$$

9) Precipitation given Maximum Potential Runoff

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

[Open Calculator !\[\]\(05be7c7a8995decd503647c99211f7c2_img.jpg\)](#)

$$ex \quad 16m^3 = 11m^3 + 5m^3$$

10) Precipitation given Potential Maximum Retention

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

[Open Calculator !\[\]\(fe3aebe81acea8d45108cd2768939da7_img.jpg\)](#)

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

11) Water Balance Equation for Rainfall

$$fx \quad P_T = I_a + F + Q$$

[Open Calculator !\[\]\(899d8b7697d64725bf017d3296cfcf1b_img.jpg\)](#)

$$ex \quad 16m^3 = 5m^3 + 2m^3 + 9m^3$$



Curve Number (CN)

12) Curve Number

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

[Open Calculator !\[\]\(74d4806277d7e73349d8e8c0897931e9_img.jpg\)](#)

$$ex \quad 12.00378 = \frac{25400}{1862mm + 254}$$

13) Curve Number for Antecedent Moisture Condition One

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

[Open Calculator !\[\]\(8bba887393ca45b761e5cb49e755e762_img.jpg\)](#)

$$ex \quad 3.672218 = \frac{8}{2.281 - 0.01281 \cdot 8}$$

14) Curve Number for Antecedent Moisture Condition-III

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

[Open Calculator !\[\]\(0fb13ad0bfa3d86868cdd3883e5665b3_img.jpg\)](#)

$$ex \quad 16.91904 = \frac{8}{0.427 + 0.00573 \cdot 8}$$



15) Potential Maximum Retention

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

[Open Calculator !\[\]\(d3fb9f94af8b26d1c844efa9a98805b0_img.jpg\)](#)

$$ex \quad 1862.667\text{mm} = \left(\frac{25400}{12} \right) - 254$$

16) Potential Maximum Retention given Curve Number

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

[Open Calculator !\[\]\(e1d6102fe77919492c04879c8450f1f5_img.jpg\)](#)

$$ex \quad 1862.667\text{mm} = 254 \cdot \left(\frac{100}{12} - 1 \right)$$

SSC-CN Equation for Indian Conditions

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

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

[Open Calculator !\[\]\(104fbf564e2e5a8fbd84f31656d114c7_img.jpg\)](#)

$$ex \quad 13.10211\text{m}^3 = \frac{(16\text{m}^3 - 0.3 \cdot 2.5\text{m}^3)^2}{16\text{m}^3 + 0.7 \cdot 2.5\text{m}^3}$$




18) Daily Runoff in Smaller Catchments under SCS 

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

[Open Calculator](#) 

$$\text{ex } 13.34722\text{m}^3 = \frac{(16\text{m}^3 - 0.2 \cdot 2.5\text{m}^3)^2}{16\text{m}^3 + 0.8 \cdot 2.5\text{m}^3}$$

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

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

[Open Calculator](#) 

$$\text{ex } 13.59247\text{m}^3 = \frac{(16\text{m}^3 - 0.1 \cdot 2.5\text{m}^3)^2}{16\text{m}^3 + 0.9 \cdot 2.5\text{m}^3}$$



Variables Used

- **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

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



Check other formula lists

- [Empirical Equations of Runoff Volume Formulas](#) 
- [SCS-CN Method of Runoff Volume Formulas](#) 

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