Green–Ampt Infiltration and Ponding Time

Cumulative infiltration and infiltration rate by the Green–Ampt model, with the ponding time under steady rain, from conductivity, suction head and moisture deficit.

Method: Green–Ampt infiltration with the Mein–Larson ponding time

Input parameters

Unit system: SI

Parameter	Value	Unit
Saturated hydraulic conductivity	6.5000	mm/h
Wetting front suction head	110.00	mm
Moisture deficit (porosity minus initial content)	30.000	%
Time	1.0000	h
Rainfall intensity (0 for ponded from the start)	0	mm/h

Calculated results

Parameter	Value	Unit
Cumulative infiltration	25.254	mm
Infiltration rate	14.994	mm/h
Ponding time (0 if ponded from the start)	0	h
Infiltration at ponding	0	mm

Notes for this case

• Green–Ampt: piston wetting front, F − ψΔθ ln(1 + F/ψΔθ) = K(t − t_0), solved by Newton's method. After ponding under rain the time is shifted so the curve passes through F_p at t_p.

Formula and method

$$F - \psi\Delta\theta \ln\left(1 + \frac{F}{\psi\Delta\theta}\right) = Kt, \quad f = K\left(1 + \frac{\psi\Delta\theta}{F}\right), \quad t_p = \frac{K\psi\Delta\theta}{i(i-K)}$$

Variables

K	Saturated hydraulic conductivity	m/s
ψ	Wetting front suction head	m
$\Delta\theta$	Moisture deficit (porosity minus initial content)	-
t	Time	s
i	Rainfall intensity (0 for ponded from the start)	m/s
F	Cumulative infiltration	m
f	Infiltration rate	m/s
t_p	Ponding time (0 if ponded from the start)	s
F_p	Infiltration at ponding	m

Method and standards

Physically based infiltration model.

Assumptions and limits

- Homogeneous soil, sharp wetting front, ponded water depth negligible.

References

Green–Ampt infiltration with the Mein–Larson ponding time

Report details

Report reference	FCC-3XM2-0JH2 (the same inputs always give the same reference)
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Release checks	4 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/civil/hydraulics/green-ampt-infiltration

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.