Open Channel Flow by Manning's Equation

Flow and velocity in a rectangular, trapezoidal or part-full circular channel or drain by Manning's equation, with the hydraulic radius and Froude number.

Method: Manning's equation (SI)

Input parameters

Unit system: SI

Parameter	Value	Unit
Channel shape	Trapezoidal	
Bottom width (rectangular, trapezoidal)	1.0000	m
Side slope, horizontal per 1 vertical (trapezoidal)	1.5000	
Pipe diameter (circular)	600.00	mm
Flow depth	0.40000	m
Manning roughness coefficient From a hydraulics table for the lining; smooth concrete is lower than earth or rubble.	0.015000	
Bed slope	0.10000	%

Calculated results

Parameter	Value	Unit
Flow area	0.64000	m²
Wetted perimeter	2.4422	m
Hydraulic radius	0.26206	m
Mean velocity	0.86332	m/s
Flow	0.55253	m³/s
Froude number	0.51113	

Notes for this case

- Uniform steady flow; Manning's equation in SI units (n in s/m^(1/3)).

Formula and method

$$v = \frac{1}{n} R^{2/3} S^{1/2}, \quad R = A/P$$

$$Q = vA$$

$$Fr = \frac{v}{\sqrt{gA/T}}$$

Variables

shape	channel shape	-
b	bottom width	m
z	side slope (H per 1 V)	-
D	pipe diameter	m
y	flow depth	m
n	Manning roughness	s/m^(1/3)
S	bed slope	-
A	flow area	m²

P	wetted perimeter	m
R	hydraulic radius	m
$\mathcal{V}$	mean velocity	m/s
Q	flow	m^3/s
Fr	Froude number	-
T	top width	m
g	standard gravity	m/s^2

Method and standards

Manning's empirical equation for uniform flow, in SI units. Area, wetted perimeter and top width come from the section geometry; for a part-full pipe the central angle θ = 2 arccos(1 − 2y/D).

Assumptions and limits

- Uniform, steady flow; slope and section constant along the reach.

References

- Manning's equation (SI)

Report details

Report reference	FCC-HBXY-PPWA (the same inputs always give the same reference)
Generated	17 November 2026, 19:46 UTC
Calculator	Open Channel Flow by Manning's Equation
Method last reviewed	12 November 2026
Software release	FireCAD Calc, release of 17 November 2026
Release checks	3 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/manning-open-channel-flow

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.