Stormwater Drainage Quick Reference

System types · runoff coefficients · Rational Method · storm sewer pipe capacity

TYPES OF STORMWATER DRAINAGE

- **Surface (open):** curb and gutter, roadside ditches, grass swales, channel drains.
- **Subsurface:** French drains, perforated underdrains behind walls and under pavements.
- **Piped storm sewer:** inlets and catch basins feed pipes, joined at manholes, ending at an outfall.
- **Separate vs combined:** new work keeps stormwater out of the sanitary sewer; combined sewers overflow in heavy rain.
- **Storage:** detention (holds and releases slowly) and retention (keeps a permanent pool or infiltrates).
- **Green infrastructure:** rain gardens, bioswales, permeable paving, green roofs.

RATIONAL METHOD (PEAK FLOW)

`US: Q = C · i · A`

Q in cfs, i in in/hr, A in acres (1 acre-in/hr ≈ 1.008 cfs).

`SI: Q = C · i · A / 360`

Q in m³/s, i in mm/h, A in hectares.

Use i for a storm lasting the time of concentration (Tc), from your local IDF curve. Best for areas up to about 200 acres (80 ha); larger catchments need a hydrograph method such as NRCS TR-55.

Example: 2-acre parking lot, C = 0.90, i = 4 in/hr → Q = 0.90 × 4 × 2 = **7.2 cfs**. An 18 in pipe at 1% (10.5 cfs) works; a 15 in pipe (6.5 cfs) does not.

Runoff coefficient C

typical ranges, ASCE Manual 37

Surface or land use	C
Asphalt or concrete pavement	**0.70–0.95**
Roofs	**0.75–0.95**
Downtown business area	**0.70–0.95**
Neighbourhood business	**0.50–0.70**
Apartments, multi-family	**0.50–0.70**
Single-family residential	**0.30–0.50**
Light industrial	**0.50–0.80**

Surface or land use	C
Heavy industrial	**0.60–0.90**
Parks, cemeteries	**0.10–0.25**
Lawn, sandy soil, flat (<2%)	**0.05–0.10**
Lawn, sandy soil, steep (>7%)	**0.15–0.20**
Lawn, clay soil, flat (<2%)	**0.13–0.17**
Lawn, clay soil, steep (>7%)	**0.25–0.35**

For mixed areas use a weighted C = Σ(C·A) / ΣA. Use the upper end for steep, clayey or long-return-period design.

Storm sewer pipe capacity

round concrete pipe flowing full, n = 0.013, slope 1%

Diameter	Capacity (US)	Capacity (SI)	Velocity full
12 in (305 mm)	**3.6** cfs	0.10 m³/s	4.5 ft/s
15 in (381 mm)	**6.5** cfs	0.18 m³/s	5.3 ft/s
18 in (457 mm)	**10.5** cfs	0.30 m³/s	5.9 ft/s
24 in (610 mm)	**22.6** cfs	0.64 m³/s	7.2 ft/s
30 in (762 mm)	**41.0** cfs	1.16 m³/s	8.4 ft/s
36 in (914 mm)	**66.7** cfs	1.89 m³/s	9.4 ft/s

Capacity scales with √slope: at 0.5% multiply by 0.71, at 2% by 1.41. Manning: $Q = (1.486/n)\, A\, R^{2/3}\, S^{1/2}$ (US) or $Q = (1/n)\, A\, R^{2/3}\, S^{1/2}$ (SI).

COMMON DESIGN CRITERIA

- **Minor system** (inlets, pipes): often a 2- to 10-year storm.
- **Major system** (streets, overland routes): safe passage of the 100-year storm.
- **Velocity:** at least 2–3 ft/s (0.6–0.9 m/s) to self-clean; keep below about 10–15 ft/s.
- **Minimum pipe:** many agencies use 12–18 in (300–450 mm).
- **Manholes:** at every change of size, slope or direction, and at set spacing.

DETENTION VS RETENTION

- **Detention (dry pond):** empties within hours to a few days; cuts the peak flow.
- **Retention (wet pond):** keeps a permanent pool; adds settling and water quality.
- **Infiltration:** dry wells, trenches and basins that soak water into the ground; need permeable soil and a safe depth to groundwater.

For guidance only. Local drainage criteria, the project specification and the engineer of record take priority. Prepared by TheCivilStudies, November 2026.