

* Varies with grid type.

** Higher velocities acceptable with energy dissipaters and additional lining bedding and filter fabrics.

8. Minimum channel slopes are typically 0.3 percent for roadside collectors, medians, and main outfall channels. The Design Engineer shall maintain a flushing velocity for the design storm. This may require that larger channels contain a separate low-flow area located within the channel bottom. Minimum flushing velocity for lined channels is 0.6 m per second. Minimum velocity for bare earth channels shall not be less than 0.4 m per second.
9. Roadside ditch longitudinal slope usually follows the profile slope of the road for a uniform depth below the pavement level. The Drainage Design Engineer shall provide separate profile details for roadside ditches that require a different longitudinal slope (depth below pavement level varies) either to steepen the grade or for a reverse flow direction. Minimum flushing velocity shall be maintained.
10. Channel stabilisation (rock riprap or other lining) shall be provided where there is any flow disturbance, such as at contractions, drops, junctions, expansions, or for concentrated flows entering the channel from the side. Concentrated side flows may originate from storm drain outlets, concentrated over-the-bank flows, or side channels. Bank stabilisation shall cover the local side, bottom, and side slopes, including short sections up- and downstream of the affected flow disturbance area. Length of protection shall extend through the velocity transition, from uniform flow upstream to uniform flow downstream channel sections. Typically this will be at least 2.5 times the channel bottom width up- and downstream of the actual channel transition area.

Longitudinal slopes of channels can be stepped such that non-erosive velocities are maintained in areas with steeply sloping terrain. Step or drop points between the grades shall be designed using energy dissipation, drop structure techniques. The Design Engineer shall refer to a speciality technical publication on this subject, such as the FHWA publication, HEC-14.

11. Open-channel drainage systems shall be sized to handle design storms, as mentioned in Table 1.3 with a 0.3-m freeboard. Channel depths shall allow the sufficient removal of water whilst maintaining the required high-water surface clearance below the pavement sub-base.

Table A5.3: Design recurrence interval for Ditches

Type of Ditch	Design storm return period (years)*
Ditches – roadside, median, and interceptor	Freeways, expressways, and arterials: 10 years Collector and local roads: 5 years
Ditches – outfall	Freeways, expressways, and arterials: 25 years Collector and local roads: 10 years

12. Design Engineer shall check the 50-year design storm hydraulics for main diversion and outfall channels. Routing analysis through the channel system shall determine if the 50-year frequency storm flow levels impacts any adjacent structures, causing excessive channel flows or overtopping that can erode and damage the roadway facilities.
13. Whilst not required for roadside ditches, larger diversion and outfall channels shall have their bends designed with sufficient radius to avoid additional freeboard requirements due to super elevation. Minimum radius (for channel velocities within the minimum and