

$$Arf = 1 - (0.044A^{0.275})$$

**Equation 1.1: Estimated  $A_{rf}$  based on storm rainfall records and statistical calculations for East Africa**

Where: A = area in km<sup>2</sup>

The Engineer shall only apply the  $A_{rf}$  to catchments greater than 25 km<sup>2</sup>.

### **A5.1.1.2. Design Flow Calculation**

For the hydrological parameters and peak design calculations refer to chapter 3 of this manual.

### **A5.1.1.3. Channel design criteria**

Open channel design criteria are as follows:

Preferred cross section of a ditch is trapezoidal; however, a V-ditch may be used where ROW is limited and/or the design requirements can still be met. Note that channel depth shall be sufficient to remove the water whilst maintaining the required design water surface clearance below the pavement base courses.

1. Channels shall normally be designed for smooth, laminar subcritical flows as the normal flow depth is greater than critical flow.
2. Channel side slopes shall be stable throughout the entire length and side slopes shall depend on the channel material. Generally for all ditches, the maximum side slope of earth channels shall be 3 horizontal to 1 vertical (3h: 1v), depending on the soil type and geotechnical study requirements. Otherwise the ditch shall be lined using riprap or concrete.
3. Larger diversion or main outfall channels shall not be located parallel to the roadway, unless it is offset by at least the clear zone distance, as required by the Road Geometric Design Manual . Otherwise, the traffic shall be protected by use of guardrail or traffic barrier.
4. Roadside ditches are part of the roadway cross section, which typically have a maximum side slope of 4h: 1v for the side adjacent to the traffic or as otherwise required by the Road Geometric Design Manual.
5. Refer to [Table A5.1](#) for drainage feature design values for maintenance consideration. Ditches and outfalls must be provided with beams and other physical access devices that facilitate maintenance activities.

**Table A5-1: Drainage features design value for maintenance consideration**

Feature	Absolute minimum	Standard	Desirable
Ditch geometry			
Ditch side slopes	1.5h:1v (Rigid linings) <sup>a</sup>	4h:1v <sup>b</sup>	6h:1v <sup>b</sup>
	2h:1v (gravel and vegetative linings) <sup>a</sup> , 3h:1v minimum for natural non-cohesive soils		
Ditch bottom width	1.5 m or 0.6 m greater than the culvert	Required by flow	Min. width to drive in for cleaning