DIVERSION DRAINS

Excessive runoff water entering into an area from upstream / ridge area is often a cause of high soil erosion and land degradation of arable area. Diversion drains, made across the slope at the end of non-arable area or rolling topography can be used in such a situation to divert runoff water away in order to protect the downstream/ arable area and discharge it safely into a protected waterway

SUITABILITY

Diversion drains are suitable at places where runoff from the ridge area situated above is damaging or likely to damage the arable area lying on the downstream side.

DESIGN

a) Diversion drains should be aligned on non-erosive and non-silting grades.

b) The gradient of diversion drain should preferably be kept within 0.5 percent.

A narrow and deep drain does not get silted up as rapidly as a broad and shallow drain of the same cross-sectional area and is, therefore, self-maintaining

Diversion drains are placed at the top of the arable area to intercept the water running from the above slope/ ridge area and divert it across the slope to a grassed waterway. Grassed waterways are used as outlets to safely convey runoff from field surface and sub- surface drainage systems and serve as emergency spillways for farm ponds or other structures. Grassed waterways therefore run down slope and safely dispose the surplus water into natural drainage courses. Though the functional aspects and alignments etc. are different for field channels diversions and grassed waterways their design principles are the same.

ii) SUITABILITY:

a) Diversion drains are provided across the slope on slight gradient. Their capacity is designed for a 10 year recurrence interval storm. Side slopes of 4:1 are provided.

b) Grassed waterways are located in natural depressions wherever possible but occasionally natural channels are reshaped to serve as outlets

c) It may be noted that while grassed waterways are provided along the prevailing slope diversion drains are provided across the slope on a slight gradient.

iii) DESIGN CRITERIA:

The design determines the shape, size and grade of the waterway. The design steps are as follows: **Step 1:** Determine the watershed area draining into waterway from the map

Step 2: Estimate peak rate of runoff Q for a 10 years recurrence interval for the area using rational formula

$$Q = \frac{CIA}{360}$$

Where

Q = peak discharge m^3 / sec, C = Runoff coefficient

I = Maximum rainfall intensity for designed recurrence interval and time of concentration in mm/hr.
and

A = Catchment area of grassed water/diversions drains in ha.

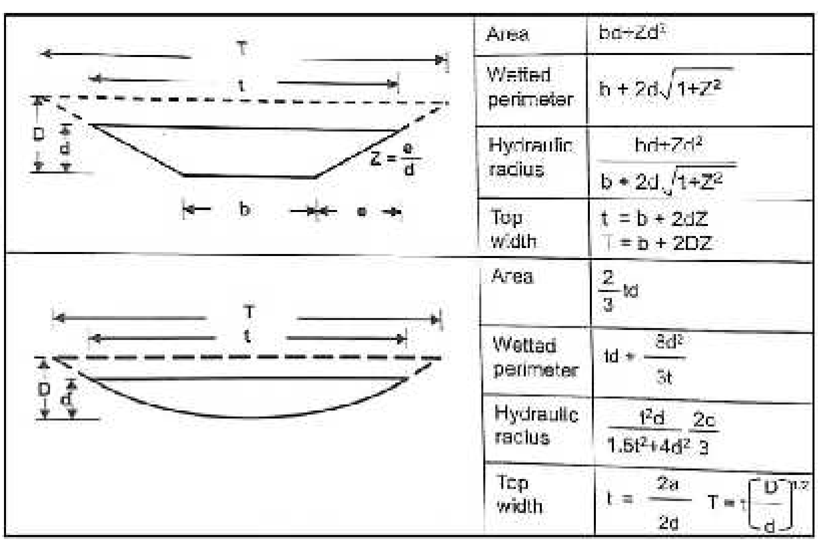
Step 3: Decide the permissible velocity for particular soil type using the following criteria

1.	Very light silty sand	-0.3m/sec
2.	Light loose sand	-0.5m/sec
3.	Coarse sand, sandy and sandy loam	- 0.75m/sec
4.	Silty loam	- 0.9m/sec
5.	Firm clay loam	- 1.0m/sec
6.	Stiff clay/ stiff gravel/ coarse gravel	- 1.5m/sec
7.	Shale, hard pan, soft rock etc.	- 1.8m/sec

Step 4: Usually the shape of waterway may be trapezoidal or parabolic. The parabolic shape is structurally more stable hydro logically more efficient and easy to construct

Step 5: Calculate the approximate cross section area of flow (A) by using the formula Q=AV.

Step 6: Work out the dimensions of the waterway (for proposed shape) by assuming either width or depth of the waterway and find out the other dimensions from the respective formula of cross sectional area equating the area (A) equal to the area obtained in step5, as mentioned in fig below



Basic dimensions of common grassed waterway sections

Step 7: Compute velocity of flow in waterway by using Manning's formula

$V = 1/n\ R2/3\ S1/2$

Where, V is the velocity of flow in the channel (m/sec) R is hydraulic radius (m) S is hydraulic Slope (M/m) and n is the manning's roughness coefficient.

Step 8: Check whether computed velocity of flow is within permissible velocity as obtained in step 3. If yes, the design dimensions of waterway are correct. If not adjust channel dimensions to bring velocity of flow within the permissible limit.

Step 9: compute discharge through waterway Q= AV and check it with estimated discharge as obtained in step 2.

Step 10: Add a suitable free board of 20% as extra depth or minimum 15 cm to the design depth of waterway as obtained above to take care of any higher flood of greater recurrence interval (than the designed one).

iv) ESTIMATION:

Cost of constructing grassed waterway need the length of waterway and the cross-sectional area

Earthwork area (m^3) = length x cross-sectional area

1. Cost of earthwork = rate of earthwork x volume of earthwork
2. Cost of sod ding/seeding= wetted perimeter x length of waterway x cost/sqm.
3. Total cost = 1+2