Sediment Storage Requirements

This procedure is applicable to determination of size of sediment basin or the allocation of sediment storage in ponds and reservoirs.

Two principal sources of sediment must be considered, (1) sheet and rill erosion and (2) gully erosion. Each must be determined separately.

Sheet and Rill Erosion

Soil loss from sheet and rill erosion is evaluated by the Universal Soil Loss Equation (USLE). It is applicable to agricultural land uses and construction sites. USDA Agricultural Handbook No. 537, "Predicting Rainfall Erosion Losses", explains USLE and special adaptations for construction sites. Rills include all channels less than one foot deep.

Only part of the sheet and rill erosion actually travel very far from its source. The amount of sediment which reaches a given point downstream is influenced by several factors. These have been combined into the delivery ratio.

Sheet and rill erosion obtained by use of USLE must be converted to tons for the respective area(s) and time period(s). Multiply the total tons obtained by the appropriate sediment delivery ratio from Table 1 to obtain tons expected to reach the sediment storage point.

Table 1 Sediment Delivery Ratio for Sheet and Rill Erosion

Drainage Area Acre	Sediment Texture		
	Sands - Sandy	Mixture Fine Sand, Silt, and Clay	Silty-Clayey
0.1 - 1	1.0 to 0.70	1.00	1.00
2 - 4	0.50	0.80	0.95
5 - 10	0.40	0.65	0.90
10 - 40	0.30	0.50	0.85
40 - 100	0.25	0.42	0.80
100 - 300	0.20	0.36	0.70
300 - 600	0.17	0.32	0.60

Gully Erosion

Gully erosion may be read directly from Table 2 except for construction sites. Delivery ratio has been included in the table rates. Gully erosion includes erosion from all channel one foot or more in depth.

Table 2 Gully Erosion Tons/Acre/Year

Drainage Area Acre	Gully Erosion Class in the Drainage Area			
	Slight	Moderate	Severe	Very Severe
1 - 10	0.7 to 0.5	3 to 2	15 to 9	50 to 35
11 - 20	0.5	1.8	8	32
21 - 40	0.4	1.6	7	25
40 - 100	0.3	1.3	6	20
100 - 200	0.3	1.1	5	16
200 - 400	0.3	1.0	4	13
400 - 600	0.2	0.9	3	11

Gully Erosion Class Descriptions for Use With Table 2

Gully Erosion Class	Description of Gully Erosion or Erosive Activity for a Gully Segment	Density of Gully Segments	
		No.	Total Drainage Area - Acre
Very Severe	Head cuts sharp and advancing, and banks are eroding for approximately 200 feet below head cut. or No head cut but severe bank erosion. Gully is widening one foot or more per year for 3000 to 3500 feet or equivalent.	1 2 5 8 11 14	15 40 150 300 400 600
Severe	Same as for very severe.	1 2 4	100 200 600
Moderate	Head cuts active but stepped and gully banks below head cut mostly stable. or No head cuts but gully banks are eroding. Gully widening at 0.5 foot per year for 350 to 400 feet or equivalent. This may be evident in form of cave-in, fallen vegetation or freshly exposed tree roots.	1 3 5 8 14 20	15 50 100 200 400 600

Gully Erosion Class Descriptions for Use With Table 2 (cont'd)

Slight	No head cuts. There are bare banks but gully widening would be difficult to measure in a two year period.		

Gully Erosion on Construction Sites

The gully erosion rates in Table 2 are not applicable to small construction sites where surface disturbance will remove or destroy soil cover or the gully is disturbed. Gully erosion on small construction sites must be estimated with little or no specific data for a guide.

Gully erosion will be insignificant except where: (1) Site will be open and inactive (rills not filled and smoothed after each rain). (2) Concentrated drainage crosses a disturbed area. (3) Soil material is very erosive (sands and silts). (4) Construction will be during period of intense rain. (5) Combination of these factors. Keeping these factors in mind estimate gully erosion in tons delivered or a percent of sheet erosion computed for the site. Table 2 may be a help where item 2 above will be the main source of gully erosion. For other conditions gully erosion may vary from 25 to 100 percent of sheet erosion.

Conversion to Volume

Erosion in tons per acre per year must be converted to tons for the respective area(s) and time period(s).

Use Table 3 to convert sediment from tons to storage volume required.

Table 3 Volume Per Ton

Sediment Material	Wet Pool		Dry Pool	
	Cu. Ft.	Ac-Ft	Cu. Ft.	Ac-Ft.
Sands - Sandy	21	.00048	19	.00043
Mixture-Fine Sand, Silt, Clay	28	.00064	20	.00045
Silty - Clayey	31	.00071	21	.00048

Sample Computation

A 50 acre drainage area contains one sharp advancing head cut in a gully and USLE indicates there will be seven tons per acre sheet erosion. What annual sediment storage volume is required for a dry pool and mixed sediment material?

Gully erosion falls between severe and very severe. From Table 2, 40-100 ac. line select between 6 and 20 ton/ac/yr. Use 15.

15 x 50 = 750 tons per year.

Sheet erosion

7 x 50 = 350 tons per year
From Table 1 delivery ratio = 0.42
350 x 0.42 = 147 tons per year.

Total sediment

750 + 147 = 897 tons/yr to pool.
Volume = 897 x .00045 (from Table 3) = 0.4 Ac-Ft.
Note: Total volume should be rounded to 0.1 Ac-Ft.