NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

TERRACE
(ft.)
CODE 600

DEFINITION

An earth embankment, or a combination ridge and channel, constructed across the field slope.

PURPOSE

The purposes of this practice are:

Reduce soil erosion;

Retain runoff for moisture conservation.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies where:

Soil erosion by water is a problem;

There is a need to conserve water;

Terraces can be constructed and farmed with reasonable effort;

A suitable outlet can be provided;

Excess runoff is a problem.

CRITERIA

Laws and regulations. This practice must conform to all federal, state, and local laws and regulations. Laws and regulations of particular concern include those involving drainage, water rights, land use, pollution control, property easements, wetlands, preservation of cultural resources, and endangered species.

Spacing. Maximum terrace spacing shall be determined by methods 1 or 2 as follows:

1. Vertical interval in feet = 0.8 S + Y
   S = land slope in percent
   Y = A variable between 1.0 and 4.0

Y			
Ground Cover	erodibility factor K		
	0-0.20	0.20-0.28	0.28-0.64
10%	2.5	1.75	1.0
40%	3.25	2.5	1.75
80%	4.0	3.25	2.5

Note - interpolate as appropriate

Exception: Horizontal spacing less than 90 feet is not required.

2. Revised Universal Soil Loss Equation (RUSLE) may be used to determine maximum terrace spacing for erosion control. The spacing shall not exceed the slope length determined by using the allowable soil loss, the most intensive use planned, the expected level of management, and the terrace P factor (see Table 1).

For either method, the steepest significant land slope within the terrace interval shall be used to determine the terrace spacing. Figures 1 and 2 show the horizontal interval or erosion length to be used in calculating terrace spacing (figure 3). The vertical interval from the high point of the area to be terraced to the top terrace may be up to 1 1/2 times the normal vertical interval provided the drainage area above the top terrace does not exceed the drainage area between terraces of the same length.

Except as noted above, maximum horizontal spacing shall be as shown in Table 2. These maximum limits may not be exceeded when making the following adjustments.

Spacing may be increased 10 percent to provide better alignment or location, to adjust for farm machinery, or to reach a satisfactory outlet. The likelihood of benching of steep slopes by tillage, land forming, and erosion shall be considered.

For level terraces used for erosion control and water conservation, maximum spacing shall not exceed 600 feet.

Alignment. Cropland terraces shall be as parallel as practicable. Curves shall be long and gentle to accommodate farm machinery.

Capacity. Terraces shall have enough capacity to control the runoff from a 10-year frequency, 24-hour storm without overtopping. For terraces with underground outlets, the capacity shall be increased by the estimated 10-year sediment accumulation, unless sediment is removed

through maintenance. Terrace systems designed to provide flood protection or to function with other structures shall have the appropriate design capacity consistent with the application. When the capacity is determined by the formula Q=AV and the velocity V is calculated by Manning's formula, an "n" value of 0.035 or higher shall be used for bare channels. SCS-TP-61 Handbook of Channel Design for Soil and Water Conservation, or Agricultural Handbook Number 667, Stability Design of Grass-lined Open Channels, or other appropriate reference shall be used for vegetated channels.

Cross-section. The terrace cross section shall be proportioned to fit the land slope, crops grown, and farm machinery used. Additional height shall be added if necessary to provide for settlement, channel sediment deposits, ridge erosion, tillage effects, and safety. The terrace ridge shall have a minimum width of three feet at design elevation. Terrace ridge slopes shall be two horizontal to one vertical, or flatter. All farmed terrace slopes shall be flat enough to allow safe operation of farm machinery. The outlet opening of gradient and open-end level terraces shall have a cross section equal to the terrace channel cross section.

End closures. Level terraces may have open ends, partial end closures, or complete closures. Partial and complete end closures shall be used only where underground outlets are provided or where stored water will be absorbed without appreciable crop damage.

Specified terrace end closures must be constructed before terrace completion. End closures shall be designed for flow over the end closure before the terrace ridge is overtopped.

Partial end closures must not be more than half the terrace ridge effective height. Complete end closures are more than half the terrace ridge effective height.

Channel grade. For permanently vegetated channels, maximum channel velocity shall not exceed velocities used for grassed waterways.

For cultivated channels, maximum channel velocity shall be non-erosive for the soil and planned treatment. This velocity shall be computed by Manning's formula using an "n" value of 0.035 or lower as appropriate.

For short distances and in upper reaches, channel grades or velocities may be increased to improve alignment. If terraces have an underground outlet, water and sediment will pond in the lower reaches of the channel, reducing the velocity and allowing steeper channel grades within the impoundment area. Ponding must not cause farming delays or serious crop damage.

Level terrace length. The volume of water stored in level terraces is proportional to terrace length. To reduce potential damage, unblocked level terrace length shall not exceed 3,500 feet.

Outlets. All terraces must have adequate, stable outlets. Outlets must convey runoff to a point where outflow will not cause damage.

Vegetated outlets may be used for gradient or open-end level terraces. Where necessary to provide a stable outlet or to insure establishment of vegetative cover, vegetated outlets shall be installed and vegetated before the terrace is constructed. At design flow, the water surface in the terrace shall not be below the water surface in the outlet.

Underground outlets may be used on gradient or level terraces. The 10-year frequency, 24-hour duration storm must not overtop the terrace or significantly damage crops. Where more than one terrace discharges into the same conduit, a restricted inlet, increase in conduit size or other method must be installed as needed to prevent reduced or reverse flow at a lower inlet.

Underground conduits shall meet requirements for Underground Outlet (620) or Subsurface Drain (606). Conduits must be installed deep enough to prevent damage from tillage equipment. The inlet shall be located uphill of the front slope of the terrace ridge, if farmed, to permit passage of farm machinery and, if necessary, provide for sediment accumulation. The outlet of the conduit shall have adequate capacity for the design flow without causing erosion. Blind inlets may be used where they are effective.

Soil infiltration may be used as the outlet for level terraces. Soil infiltration must permit drainage of the design storm from the terrace channel soon enough to prevent significant crop damage.

Outlet types may be combined as needed.

Vegetation. Vegetation shall be established on specified areas as soon as practical after construction.

CONSIDERATIONS

Consider adjusting terrace spacing to allow an even number of trips with farm equipment to be used.

PLANS AND SPECIFICATIONS

Plans and specifications for installing terraces shall meet this standard and shall describe the requirements for applying this practice to achieve its intended purpose.

OPERATION AND MAINTENANCE

An Operation and Maintenance Plan shall be prepared for the operator. It must include:

Inspection of terraces occasionally, especially following large runoff events. Repair damage.

Maintenance of terrace ridge height, slopes, outlet elevations and vegetation.

Removal of accumulated sediment. Maintain design terrace channel elevations. Clean inlets to underground outlets.

Table 1 - Terrace P Factors[1/]

Horizontal Interval, feet	Closed Outlets[2/]	Open outlets with percent grade of:[3/] 0.1 - 0.3	0.4 - 0.7	0.8
<110	0.5	0.6	0.7	1.0
110 - 140	0.6	0.7	0.8	1.0
140 - 180	0.7	0.8	0.9	1.0
180 - 225	0.8	0.8	0.9	1.0
225 - 300	0.9	0.9	1.0	1.0
> 300	1.0	1.0	1.0	1.0

Note: If contouring or stripcropping P factors are appropriate, they can be multiplied by the terrace P factor for the composite P factor.

[1/] These figures are not appropriate for sediment yield estimates.

[2/] "P" factors for closed outlet terraces also apply to terraces with underground outlets and to level terraces with open outlets.

[3/] The channel grade is measured on the 300 feet of terrace or the one-third of total terrace length closest to the outlet, whichever is less.

Table 2 - Maximum Horizontal Spacing for Terraces

Slope	RUSLE, R factor of: 0 - 35	35 - 175	> 175	With contour stripcropping	Concentrated flow control
Percent	Feet	Feet	Feet	Feet	Feet
0 - 2	700	500	450	600	700
2 -4	700	400	300	600	700
4 - 6	600	400	200	600	600
6 - 9	400	300	150	400	500
9 - 12	400	250	150	250	500
12 - 18	250	200	150	150	400
> 18	250	200	150	150	300
Min. spacing required, all slopes	200	150	90	90	200

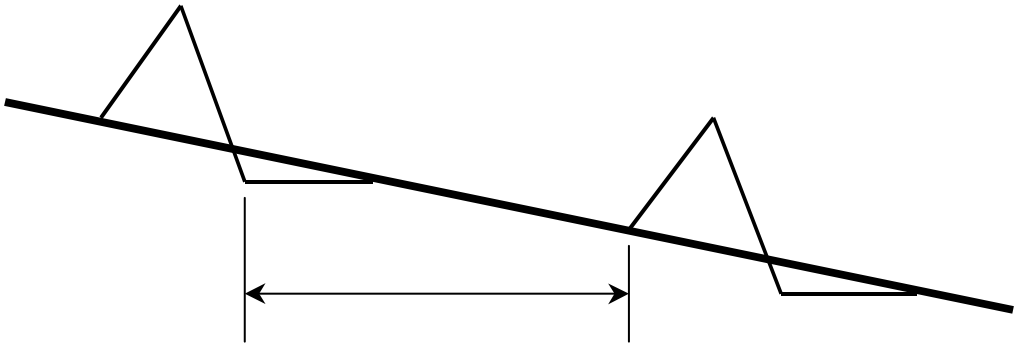

Figure 1. Horizontal Interval for Steep Back-slope Terraces

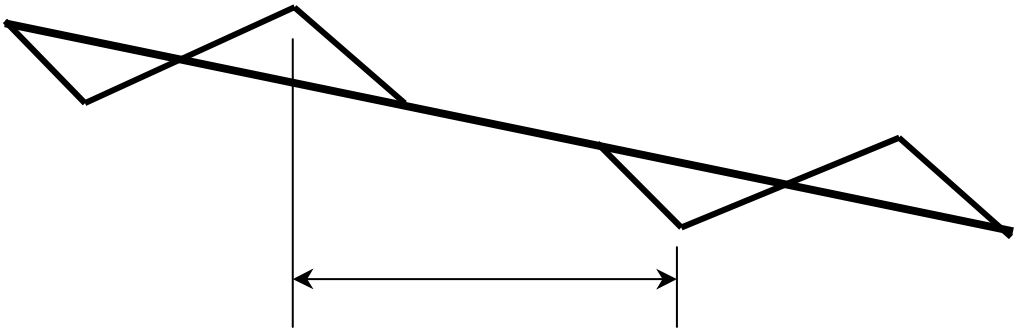

Figure 2. Horizontal Interval for Broad-Based Terraces

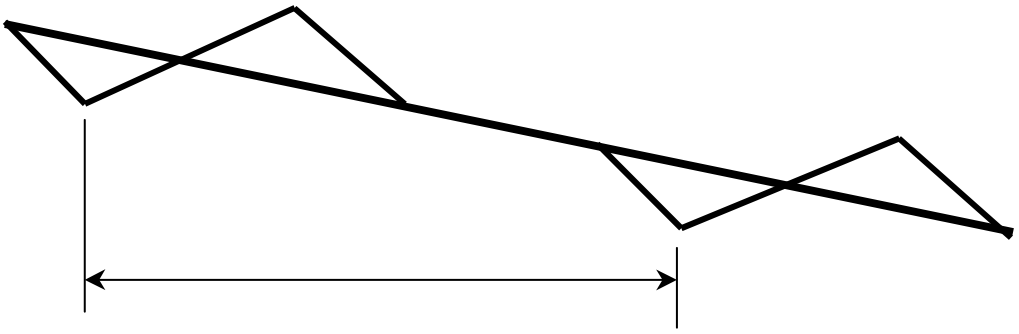

Figure 3. Terrace Spacing