

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

**CONTOUR BUFFER STRIPS
(ACRE)
CODE 332**

DEFINITION

Narrow buffer strips of perennial, herbaceous vegetative cover established across the slope and alternated down the slope with parallel, wider cropped strips.

PURPOSES

- To reduce sheet and rill erosion.
- To reduce transport of sediment and other water-borne contaminants downslope, on-site or off-site.
- To enhance upland wildlife habitat.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies on cropland. It is most suitable on uniform slopes ranging from 4 to 8 percent with slope lengths \leq the Critical Slope Length (Critical Slope Length = length of slope above which the practice loses its effectiveness), in regions where rainfall intensities are low to moderate (10 year EI \leq 140). EI = storm energy * intensity.

This practice is not suited to fields with extremely long slopes whose length exceeds the critical slope length for contouring by more than 1.5 times, unless the field slope length is shortened by the installation of other practices (e.g. terraces).

The practice is impractical or unsuitable on undulating to rolling topography because of the difficulty of maintaining parallel strip boundaries across the hill slope or staying within row grade limits.

The narrow strips of permanent vegetative cover are not a part of the normal crop rotation.

This standard does not apply to situations where the width of the buffer strips will be equal to or exceed the width of the adjoining crop strips.

CRITERIA

Criteria Applicable to Both Reducing Sheet and Rill Erosion and Reducing Transport of Sediment And Other Water-Borne Contaminants Down Slope

a. Row Grade, Strip Boundaries, and Baselines

The grade of the cropped strip shall be aligned as closely as possible to the contour to achieve the greatest erosion reduction possible. The maximum grade of rows within the crop strips shall not exceed 1/2 of the up and down hill field slope or 2 percent, whichever is less.

For crops sensitive to ponded water for periods less than 48 hours, design a positive row grade of not less than 0.5 percent from the nose of a hill or ridge toward a stable outlet. Up to 3 percent row grade is allowed for a maximum of 150 feet as crop rows approach a stable outlet.

The grade along the up slope side of the vegetative buffer shall be the same as for the cropped strip directly above it.

When the grade of any crop strip reaches the maximum allowable design grade, a new base line shall be established up or down slope from the last buffer strip and used for the layout of the next strip.

b. Arrangement of Strips

Cropped strips shall be alternated with buffer strips down the hill slope. Normally, a crop strip will occupy the area at the top of the hill.

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service.

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When used in combination with terraces, with underground outlets, diversions, or water and sediment control basins, the layout of buffer strips shall be coordinated with the grade and spacing of the terraces so that strip boundaries will parallel terraces wherever possible. The buffer strip shall occupy the terrace or diversion berm, a channel leading to a water and sediment control basin, or lie immediately up slope of the terrace or diversion channel.

c. Stable Outlets

Surface flow from contoured crop rows must go to a stable outlet. Stable outlets include grassed waterways, underground outlets for terraces or diversions, water and sediment control basins, field borders, headlands or end rows, or similarly stabilized areas.

Additional Criteria to Reduce Sheet and Rill Erosion

a. Width of Strips

The buffer strips shall be of equal width, except when a varying width buffer strip is needed to keep either a cropped strip adjacent to it of uniform width or to maintain the strip boundary grades within the criteria set above. Width of buffer strips at their narrowest point shall be no less than 15 feet for grasses or grass legume mixtures and no less than 30 feet when legumes are used alone.

Cropped strip widths shall be of uniform width between buffer strips and not exceed the lesser of:

- (1) 50 percent of either the slope length (L), used for erosion calculation, or
- (2) 50 percent of the critical slope length for contour buffer strips. *(The critical slope length for contour buffer strips is calculated by multiplying 1.5 times the critical slope length for contour farming as determined by using approved erosion prediction technology).*

Cropped strip width shall be designed to account for some multiple of full equipment width.

Information (tables) pertaining to the calculation of the critical slope length for various land slopes and hydrologic soil groups (for contour farming) is contained in the appendix of this standard.

b. Vegetation

Vegetation grown on buffer strips designed to reduce sheet and rill erosion shall be established to permanent vegetation consisting of permanent grasses, legumes, or grass-legume mixtures, adapted to the site, and tolerant of the anticipated depth of sediment deposition. No plants listed on the noxious weed list of the state will be established in a buffer strip cropping system.

Information pertaining to vegetation establishment such as suitable species, seeding rates and maintenance of grass strips in a contour buffer system can be referenced in the NRCS Standard for Pasture and Hayland Planting (512).

The buffer strips shall have a Vegetative Cover-Management condition of 1 or 2 that provides protective cover and induces sediment deposition during periods when erosion is expected to occur on the cropped strips. Cropped strips will normally be expected to have a Cover-Management Condition 3 through 7. (Cover-Management Conditions are described in Chapter 6, Predicting Soil Erosion by Water: A Guide to Conservation Planning with the Revised Universal Soil Loss Equation "RUSLE.")

The stem density for grass species shall be greater than 50, and for legumes greater than 30 stems per square foot.

No plants listed on the noxious weed list of the state will be established in a buffer strip cropping system.

c. Level of Erosion Control

The level of erosion control achieved by the buffer strip cropping practice shall meet or exceed the soil erosion level specified by the conservation plan objective. It shall be determined using the approved erosion

prediction technology, accounting for the impact of other conservation practices in the system.

d. Headlands or End Rows

On fields where row crops are a part of the rotation, keep headlands or end rows in permanent sod if their row grade would be steeper than the designed grade of the crop strip.

Additional Criteria to Reduce the Transport of Sediment and Other Water-Borne Contaminants Downslope

a. Vegetation

Buffer strips designed to reduce the transport of sediment and other water-borne contaminants shall be established to permanent sod forming vegetation with stiff, upright stems only. No plants listed on the noxious weed list of the state will be established in a buffer strip cropping system.

b. Width of Strips

On sloping cropland exceeding 3 percent, the design shall be based on the minimum criteria given above to reduce sheet and rill erosion. On slopes 3 percent or flatter, the width of the buffer strip shall be 15 feet or wider.

The maximum width of cropped strips between buffer strips shall be $\frac{1}{2}$ of the field slope length not to exceed 150 feet. Cropped strip width shall be designed to account for some multiple of full equipment width.

c. Arrangement of Strips

Buffer strips and crop strips will be alternated down the hill slope. A buffer strip will be established at the bottom of the slope. The width of this buffer strip will be two times the width of the other buffer strips in the system.

d. Headlands or End Rows

Headlands or end rows shall be vegetated and have a minimum width of 15 feet between the end of the tilled strip and the field's edge.

Additional Criteria To Enhance Wildlife Habitat

a. Vegetation

Use permanent grasses, legumes, or grass-legume mixtures, adapted to the site. Native, warm season grass specie mixtures recommended for wildlife purposes are to be used where adapted.

Delay mowing the buffer strips to every other year or every third year depending on geographical location or weed pressure.

Mow only after the desired species of ground nesting birds have hatched. Allow for regrowth before the growing season ends.

b. Strip Width

To enhance wildlife cover, the width of buffer strips will be increased to 30 feet or wider as determined based on the requirements for nesting and escape cover of the target wildlife species.

The maximum width between buffer strips should not exceed 300 feet.

CONSIDERATIONS

Protect areas of existing or potential concentrated flow erosion by any one or more suitable conservation practices, such as grassed waterways, water and sediment control basins, or diversion terraces.

When the slope length exceeds the critical slope length for the cover-management condition that best characterizes the field to be contour buffer stripped, establish structures, such as terraces, to reduce the slope length below critical if the soil loss objective is not reached.

(Design Guidance: Critical slope lengths can be increased by retaining crop residue on the soil surface of the cultivated strips using crop residue management practices. Certain tillage practices can also be used on the cultivated strips to increase random roughness to cause deposition to occur in depressions between soil clods. However, if the cropped strips are kept

very rough in high ridges or under heavy residue cover, the need for contour buffer strips as an erosion and sediment reduction practice will be reduced since less sediment will be delivered to them.)

On fields where row crops are part of the rotation, consider establishing field borders on headlines or end rows, which are steeper than the designed grade of rows in the cropped strip. Where contour row curvature becomes too sharp to keep equipment aligned with rows during field operations, consider establishing grassed waterways at least to the point of sharp curvature. These strips should be wide enough to allow the equipment to be lifted and/or turned to meet the same rows across the turn strip.

Design and install the strip layout to best facilitate operation of all machinery used on the strips. Whenever possible, lay out strips to have some multiple of full implement widths used for the farming operation.

Prior to design and layout, consider removing any obstructions or making changes in field boundaries or shape, where feasible, to improve the effectiveness of the practice and the ease of performing farming operations.

Prior to layout, inspect the field's position on the landscape to find key points for commencing layout or getting the width of one set of strips (one cultivated and one buffer) to pass by an obstruction or ridge saddle. Considering grade limits, whenever possible, run strip boundaries parallel with fence lines or other barriers. Account for uncropped access road widths when they must traverse the field by adjusting strip boundaries on either side accordingly.

Some non-noxious weedy growth may be allowed in the strips as they provide an insect source for young birds. Also, consider adding native forbs to the seeding mixture when they are available.

To enhance wildlife habitat, mow the buffer strips every other year or every third year depending upon geographical location. Generally, more frequent mowing will occur in the Southern climates. Standing residual cover

provides early and late season nesting and escape cover for many species of wildlife displaced from other mowed areas. Schedule mowing operations to allow for regrowth before the growing season ends.

PLANS AND SPECIFICATIONS

Specifications for installation, operation, and maintenance of Contour Buffer Strips shall be prepared for each field according to the Criteria, Considerations, and Operations and Maintenance described in this standard. The specification details shall be recorded on specification sheets, job sheets, narrative statements in conservation plans, or other acceptable documentation.

OPERATION AND MAINTENANCE

Conduct all farming operations parallel to the strip boundaries except on headlands or end rows with gradients less than the criteria set forth in this standard.

Time mowing of buffer strips to maintain appropriate vegetative density and height for optimum trapping of sediment from the upslope cropped strip during the critical erosion period(s). Delay mowing until after ground nesting birds have hatched (usually after July 15).

Fertilize buffer strips as needed to maintain stand density.

Where contour row curvature becomes too sharp to keep equipment aligned with rows during field operations, establish sod turn strips on sharp ridge points. In drainageways, establish grassed waterways at least to the point of sharp curvature. These strips shall be wide enough to allow the equipment to be lifted and/or turned and meet the same rows across the turn strip.

Mow sod turn strips and waterways at least annually. Note: Certain conservation programs may have rules that apply to mowing frequencies.

Spot seed or totally renovate buffer strip systems damaged by herbicide application after residual action of the herbicide is complete.

Redistribute sediment accumulations along the upslope edge of the buffer-crop strip interface upslope over the cultivated strip when needed to maintain uniform sheet flow along the buffer/cropped strip boundary. If sediment accumulates just below the upslope edge of the buffer strip to a depth of six inches or vegetative ground cover falls below 65 percent in the buffer strip, relocate the buffer/cropped strip interface location.

Cultivated strips and buffer strips shall be rotated so that mature stand of protective cover is achieved in a newly established buffer strip immediately below or above the old buffer strip before removing the old buffer to plant an erosion-prone crop. Alternate repositioning of buffer strips to maintain their relative position on the hill slope. Note: Certain conservation programs may have rules that apply to cropping system strategies.

Renovate vegetated headlands or end row area as needed to keep ground cover above 65 percent. Renovation shall only include the immediate seedbed preparation and reseeding to a sod-forming crop with or without a nurse crop. Maintain full headland or end row width to allow farm implements room to double back on the same strip.

REFERENCES

Predicting Soil Erosion by Water: A Guide to Conservation Planning With the Revised Universal Soil Loss Equation (RUSLE).
Agricultural Handbook Number 703.

TECHNICAL EXPLANATION

CRITICAL SLOPE LENGTH FOR CONTOUR FARMING

Background

The new Kentucky NRCS state conservation practice standard for "Contour Buffer Strips" refers to critical slope length. In section "a," under Additional Criteria to Reduce Sheet and Rill Erosion, it defines buffer strip critical slope length as being 1.5 times the critical slope length for contour farming as determined using approved erosion prediction technology. The Revised Universal Soil Loss Equation (RUSLE) is the approved erosion prediction technology. Critical Slope Length is affected by 1) hydrologic group, 2) 10-yr EI, 3) Cover Management Type, and 4) Percent Slope.

Design Considerations

The national and state practice standard for "Contour Buffer Strips" has the following additional criteria categories: To Reduce Sheet and Rill Erosion, To Reduce the Transport of Sediment and Other Water-Borne Contaminants Downslope, and Criteria to Enhance Wildlife Habitat. If the resource concern of "sheet and rill erosion" is the reason for designing a contour buffer system then it is necessary to know the critical slope length for contour farming. (If Cover Management Types 1-3 exist, sheet and rill erosion generally is not considered a resource concern and contour buffer strips would not be designed for this purpose). When a criterion other than sheet and rill erosion is chosen, the critical slope length is not used as a design consideration.

Purpose

These tables are provided so that the conservationist can determine the critical slope length for contour farming in designing contour buffer strips for sheet and rill erosion reduction.

Use of Tables

The tables on subsequent pages have been adapted for use in Kentucky. Tabular data appears for all four hydrologic groups, 10-yr EI's 60 through 100, management cover types 4 through 7, and slopes of 1 through 10 percent. The DOS Version of RUSLE 1.05q was used in the development of these tables. The scope of these tables exceeds the slope range where the practice is to apply. When reading from the table, it is intended that the value be used as a guide and that factors such as width of tillage equipment, row spacing, etc. be taken into account when determining the actual strip spacing. In most cases, the national and state practice standard criteria that "the cropped strip width will not exceed 50 percent of the field slope length used for erosion calculations" will be the limiting factor for determining the maximum allowable width of the cropped strip.

**CONTOURING CRITICAL
SLOPE LENGTHS**

Hydrologic Group "A"

Cover Management Type 7 - Clean-tilled, smooth, fallow

10yrEI	60	70	80	90	100
Slope %					
1%	1000	1000	1000	1000	1000
2%	1000	965	833	735	658
3%	717	601	529	458	410
4%	513	430	371	328	293
5%	395	332	286	253	226
6%	320	268	232	204	183
7%	267	224	194	171	153
8%	229	192	166	146	131
9%	200	168	145	128	114
10%	177	148	128	113	101

Hydrologic Group "A"

Cover Management Type 6 - No cover or minimal roughness or both

10yrEI	60	70	80	90	100
Slope %					
1%	1000	1000	1000	1000	1000
2%	1000	1000	1000	1000	1000
3%	1000	1000	1000	1000	1000
4%	1000	1000	1000	898	780
5%	1000	989	816	693	602
6%	1000	800	660	561	487
7%	846	669	552	469	407
8%	725	573	473	402	349
9%	632	500	412	350	304
10%	560	443	365	310	269

Hydrologic Group "A"

Cover Management Type 5 - Light cover or moderate roughness or both

10yrEI	60	70	80	90	100
Slope %					
1%	1000	1000	1000	1000	1000
2%	1000	1000	1000	1000	1000
3%	1000	1000	1000	1000	1000
4%	1000	1000	1000	1000	1000
5%	1000	1000	1000	1000	1000
6%	1000	1000	1000	1000	1000
7%	1000	1000	1000	1000	980
8%	1000	1000	1000	975	840
9%	1000	1000	1000	851	733
10%	1000	1000	897	753	649

Hydrologic Group "A"

Cover Management Type 4 - Moderate cover or rough or both

10yrEI	60	70	80	90	100
Slope %					
1%	1000	1000	1000	1000	1000
2%	1000	1000	1000	1000	1000
3%	1000	1000	1000	1000	1000
4%	1000	1000	1000	1000	1000
5%	1000	1000	1000	1000	1000
6%	1000	1000	1000	1000	1000
7%	1000	1000	1000	1000	1000
8%	1000	1000	1000	1000	1000
9%	1000	1000	1000	1000	1000
10%	1000	1000	1000	1000	1000

**CONTOURING CRITICAL
SLOPE LENGTHS**

Hydrologic Group "B"

Cover Management Type 7 - Clean-tilled, smooth, fallow

10yrEI	60	70	80	90	100
Slope %					
1%	1000	1000	1000	1000	1000
2%	808	699	618	556	507
3%	503	436	385	347	316
4%	360	312	276	248	226
5%	278	240	213	191	174
6%	225	194	172	154	141
7%	188	162	144	129	118
8%	161	139	123	111	101
9%	140	121	107	97	88
10%	124	107	95	86	78

Hydrologic Group "B"

Cover Management Type 6 - No cover or minimal roughness or both

10yrEI	60	70	80	90	100
Slope %					
1%	1000	1000	1000	1000	1000
2%	1000	1000	1000	1000	1000
3%	1000	959	830	734	659
4%	814	686	594	525	471
5%	628	529	458	405	363
6%	508	428	370	327	294
7%	425	358	310	274	246
8%	364	306	265	234	210
9%	317	267	231	204	184
10%	281	237	205	181	163

Hydrologic Group "B"

Cover Management Type 5 - Light cover or moderate roughness or both

10yrEI	60	70	80	90	100
Slope %					
1%	1000	1000	1000	1000	1000
2%	1000	1000	1000	1000	1000
3%	1000	1000	1000	1000	1000
4%	1000	1000	1000	1000	1000
5%	1000	1000	1000	943	842
6%	1000	1000	869	763	681
7%	1000	847	727	638	569
8%	871	725	623	546	487
9%	760	633	543	477	425
10%	673	560	481	422	377

Hydrologic Group "B"

Cover Management Type 4 - Moderate cover or rough or both

10yrEI	60	70	80	90	100
Slope %					
1%	1000	1000	1000	1000	1000
2%	1000	1000	1000	1000	1000
3%	1000	1000	1000	1000	1000
4%	1000	1000	1000	1000	1000
5%	1000	1000	1000	1000	1000
6%	1000	1000	1000	1000	1000
7%	1000	1000	1000	1000	1000
8%	1000	1000	1000	1000	1000
9%	1000	1000	1000	1000	1000
10%	1000	1000	1000	1000	955

**CONTOURING CRITICAL
SLOPE LENGTHS**

Hydrologic Group "C"

Cover Management Type 7 - Clean-tilled, smooth, fallow

10yrEI	60	70	80	90	100
Slope %					
1%	1000	1000	1000	1000	999
2%	677	595	533	484	445
3%	422	378	332	302	278
4%	302	265	238	216	199
5%	232	204	183	167	153
6%	188	165	148	135	123
7%	157	138	124	113	104
8%	135	118	106	96	89
9%	118	103	92	84	77
10%	104	91	82	75	68

Hydrologic Group "C"

Cover Management Type 6 - No cover or minimal roughness or both

10yrEI	60	70	80	90	100
Slope %					
1%	1000	1000	1000	1000	1000
2%	1000	1000	1000	948	862
3%	865	746	658	591	538
4%	619	534	471	422	385
5%	477	411	363	326	297
6%	386	333	294	264	240
7%	323	278	245	221	201
8%	276	238	210	189	172
9%	241	208	184	165	150
10%	214	184	163	146	133

Hydrologic Group "C"

Cover Management Type 5 - Light cover or moderate roughness of both

10yrEI	60	70	80	90	100
Slope %					
1%	1000	1000	1000	1000	1000
2%	1000	1000	1000	1000	1000
3%	1000	1000	1000	1000	1000
4%	1000	1000	1000	944	856
5%	1000	928	814	728	660
6%	876	751	659	589	534
7%	733	628	551	493	446
8%	628	538	472	421	382
9%	547	469	412	368	334
10%	485	415	365	326	295

Hydrologic Group "C"

Cover Management Type 4 - Moderate cover or rough or both

10yrEI	60	70	80	90	100
Slope %					
1%	1000	1000	1000	1000	1000
2%	1000	1000	1000	1000	1000
3%	1000	1000	1000	1000	1000
4%	1000	1000	1000	1000	1000
5%	1000	1000	1000	1000	1000
6%	1000	1000	1000	1000	1000
7%	1000	1000	1000	1000	1000
8%	1000	1000	1000	1000	928
9%	1000	1000	1000	897	810
10%	1000	1000	892	795	717

**CONTOURING CRITICAL
SLOPE LENGTHS**

Attachment to
NRCS KY Standard
Contour Buffer Strips
August 2001

Hydrologic Group "D"**Cover Management Type 7 - Clean-tilled, smooth, fallow**

10yrEI	60	70	80	90	100
Slope %					
1%	1000	1000	1000	1000	928
2%	612	543	490	448	413
3%	381	338	305	279	257
4%	273	242	218	199	184
5%	210	186	168	154	142
6%	170	151	136	124	115
7%	142	126	113	104	96
8%	122	108	97	89	82
9%	106	94	85	78	72
10%	94	83	75	69	63

Hydrologic Group "D"**Cover Management Type 6 - No cover or minimal roughness or both**

10yrEI	60	70	80	90	100
Slope %					
1%	1000	1000	1000	1000	1000
2%	1000	1000	964	871	796
3%	776	675	601	543	496
4%	555	483	430	388	354
5%	428	372	331	299	273
6%	346	301	268	242	221
7%	289	252	224	202	185
8%	248	216	192	173	158
9%	216	188	167	151	138
10%	191	167	148	134	122

Hydrologic Group "D"**Cover Management Type 5 - Light cover of moderate roughness or both**

10yrEI	60	70	80	90	100
Slope %					
1%	1000	1000	1000	1000	1000
2%	1000	1000	1000	1000	1000
3%	1000	1000	1000	1000	1000
4%	1000	1000	932	840	767
5%	934	810	719	648	592
6%	756	656	582	524	479
7%	632	578	486	438	400
8%	541	470	416	375	343
9%	472	410	363	327	299
10%	418	363	322	290	265

Hydrologic Group "D"**Cover Management Type 4 - Moderate cover or rough or both**

10yrEI	60	70	80	90	100
Slope %					
1%	1000	1000	1000	1000	1000
2%	1000	1000	1000	1000	1000
3%	1000	1000	1000	1000	1000
4%	1000	1000	1000	1000	1000
5%	1000	1000	1000	1000	1000
6%	1000	1000	1000	1000	1000
7%	1000	1000	1000	1000	968
8%	1000	1000	1000	912	830
9%	1000	1000	886	796	724
10%	1000	889	784	704	641