NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

CONTOUR BUFFER STRIPS

(Ac.)

CODE 332

DEFINITION

Narrow strips of permanent, herbaceous vegetative cover established around the hill slope, and alternated down the slope with wider cropped strips that are farmed on the contour.

PURPOSE

This practice is applied to achieve one or more of the following:

- Reduce sheet and rill erosion.
- Reduce transport of sediment and other water-borne contaminants.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies on all sloping cropland, including orchards, vineyards and nut crops.

This practice differs from Virginia Practice Standard *Contour Farming (Code 330)* only in that this practice requires permanent vegetated strips of minimum width alternating with cropped areas. The substantive criteria for contouring of cropped areas in this Standard are the same as those found under *Contour Farming.*

Where the width of buffer strips will be equal to or exceed the width of adjoining crop strips, the Virginia Practice Standard *Stripcropping (Code 585)* applies.

CRITERIA

General Criteria Applicable to All Purposes

Strip Arrangement

Buffer strips of permanent herbaceous vegetation shall be established across the field slope and alternated with wider crop strips farmed on the contour.

Buffer strips are not part of the normal crop rotation, and shall remain in the location they were originally established until they need to be renovated or re-established.

Buffer strips shall not be used as travel lanes for livestock or equipment.

Permanent vegetated buffer strips shall serve as permanent contour or row markers to help guide the farmer in maintaining design row grades during field operations.

A minimum of one buffer strip shall be established.

A crop strip shall occupy the area at the top of the hill, unless unusually complex topography requires establishing a buffer strip in that area in order to establish a farmable system.

The grade along the upper boundary of any buffer strip shall be the same as the grade along the lower boundary of the cropped strip directly above it.

When used in combination with terraces, diversions or water and sediment control basins, the layout of the buffer strips shall be coordinated with the grade and spacing of the terraces so that the buffer strip boundaries will parallel the terraces as closely as possible. The buffer strip shall be located immediately upslope from the terrace channel or the storage area of the water and sediment control basin.

Buffer Strip Vegetation:

Buffer strips shall be established to permanent vegetation consisting of grasses, legumes or grass-legume mixtures.

The species established shall be adapted to the site, tolerant of the anticipated depth of sediment deposition, and appropriate for any secondary planned harvest or wildlife use.

Conservation practice standards are reviewed periodically and updated if needed. To obtain the current version of this standard, contact your Natural Resources Conservation Service State Office or visit the Field Office Technical Guide.

Once established, buffer strips shall have at least 95% ground cover during periods of highest erosion risk in crop strips.

The stem density for grasses and grass-legume mixtures shall be at least 50 stems per square foot, and for pure legume stands at least 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.

Buffer Strip Width:

The minimum width of buffer strips shall be

- at least than 15 feet wide for strips planted to grasses or grass-legume mixtures with at least 50% grass and
- At least 30 feet wide when legumes are used alone or legumes make up more than 50% of the stand.

Buffer strip widths shall be increased as needed to keep the width of cropped strips uniform.

The width of a vegetated buffer strip may vary as it proceeds across the slope.

Crop Strip Width:

All cropped strips shall be of uniform width.

The maximum width of cropped strips will not exceed the smaller of either of the following:

a) Half of the slope length used for soil loss calculations;

b) The widths shown below:

Percent Field Slope (used for soil loss calculations)	Maximum Width of Cropped Strip (ft.)
1 thru 2	130
3 thru 8	100
9 thru 16	80
17 thru 20	60
21 thru 25	50

The width of the cropped strip shall be selected to accommodate a multiple of the width of the farming equipment to be used in the strip system. The limits on crop strip width above may be adjusted to the nearest multiple of equipment width as needed.

Minimum Row Grade:

Crop rows must have sufficient slope or grade to ensure that runoff water does not pond and cause unacceptable crop damage (i.e., perfect contouring or 0% row grade is not desirable).

Maximum Row Grade:

Representative field slope length and steepness (“LS”) values for use in RUSLE2 sheet & rill erosion calculations shall be determined for each area to be treated. Field slope steepness values shall then be used as the basis for determining maximum allowable design row grades for the contouring system as explained below.

At least 75% of the cropped area to be contoured shall have rows with a maximum design grade of either (a) 2% or (b) ½ of the field slope steepness, whichever is less.

The remaining 25% or less of the cropped area to be contoured shall have rows with a maximum design grade of either (a) 3% or (b) ½ of the field slope steepness, whichever is less.

This “25% or less” portion of the contoured area need not be a single continuous block; it may be made up of multiple areas randomly distributed throughout the field, which taken together do not exceed 25% of the total acreage to be contoured.

The maximum allowable design row grade (i.e., the grade in the “25% or less area”) is only permitted within 150 feet of a stable outlet (grassed waterway, etc.) capable of handling the higher flow velocities resulting from the steeper row grades.

System Layout

Maximum erosion reduction will be achieved if crop rows follow the contour as closely as possible. The planner must carefully balance the goal of maximizing erosion reduction with the requirement that water must not pond. In certain cases, such as when a crop with low tolerance to “wet feet” such as tobacco is grown on soils with poor internal drainage, simply laying out a system with the steepest design row grades allowed under this standard may be an acceptable solution.

When the row grade of any crop strip reaches the maximum allowable design grade, a buffer strip will be established and grade corrected for the layout of the next crop strip.
Planned contour row curvature must not be too sharp for machinery to follow the row effectively. Establish sod turn strips on sharp turns or otherwise modify the planned system as needed.

Row Markers

Permanent vegetated buffer strips shall serve as permanent contour or row markers.

Additional row markers consisting of field boundaries, hedgerows, fence lines, access lanes, terraces, etc. may be established as needed.

Existing features proposed to be used as permanent row markers shall meet the row grade criteria of this standard, with the exception of terraces or diversions. Terraces and diversions shall meet the design, layout, and construction requirements set forth in their respective Conservation Practice Standard.

Stable Outlets

All concentrated runoff from furrows in contouring systems shall flow to properly-designed stable outlets. Stable outlets include grassed waterways, terraces, diversions, sediment basins, field borders, filter strips and other similar measures.

Minimum Ridge Height.

For crops with row spacing greater than 10 inches, ridge height in crop strips shall be at least two (2) inches.

For crops with row spacing 10 inches or less (including solid-seeded crops such as small grains) ridge height in crop strips shall be at least one (1) inch.

The above minimum ridge heights are not required for any crop that is no-tilled/strip-tilled in accordance with Virginia Practice Standard *Residue and Tillage Management No Till/Strip Till/Direct Seed (Code 329).*

Sediment Redistribution

Sediment that accumulates along the upslope edge of the buffer strip/crop strip boundary must be redistributed as needed to maintain uniform sheet flow across the boundary. This sediment shall be spread evenly upslope over the cultivated strip.

If sediment accumulates in the upslope area of buffer strips to a depth of 6 inches or more, or stem density falls below required levels, the buffer/cropped strip interface shall be relocated.

When strips must be renovated/relocated, cultivated strips and buffer strips shall be rotated so that a mature stand of protective cover is achieved in a new buffer strip immediately below or above the old buffer strip before removing the old buffer to plant an erosion-prone crop.

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

Strip Arrangement/Layout

In addition to the buffer strips established on the hillside, a buffer strip will be established at the bottom of the slope. This strip shall be two times the width of the narrowest buffer strip in the system.

Buffer Strip Vegetation:

The primary vegetation in buffer strips designed for this purpose shall be permanent sod-forming grasses.

Minimum buffer strip width and other general criteria above pertaining to grass strips shall apply.

CONSIDERATIONS

This practice is not well suited to rolling topography with a high degree of slope irregularity, which is common in Virginia. On such landscapes it is often difficult to lay off contoured rows that both achieve row grade criteria and that are straight enough to be effectively farmed with modern equipment. Good planning in these instances often means finding a compromise solution that is both “farmable” and still results in a meaningful reduction in erosion risk.

This practice is most effective on slopes between 4 and 10 percent where crop strips are farmed using intensive tillage resulting in raised ridges or beds that can channel runoff.

This contouring portion of this practice will likely produce limited additional benefits for farming systems with no ridges and a high proportion of crops no-tilled into heavy residue.

This practice is most effective in regions with 10-year, 24-hour rainfall values less than 6.5

inches. According to RUSLE2, most key crop production regions in central and eastern Virginia have 10-year, 24-hour rainfall values approaching 6 inches. This is a reminder of the limitations of contouring and contour buffer strip systems as stand-alone practices in Virginia – include complementary practices in the system.

This practice is most effective on slopes lengths between 100 and 400 feet. As slopes lengthen, the volume and velocity of overland flow are more likely to overwhelm the capacity of contour ridges and narrow buffer strips to contain them. Additional residue cover and other conservation techniques (including widening buffer strips) will decrease overland flow velocities, thus increasing the length of slope on which this practice is effective.

For each site-specific scenario, a maximum slope length exists beyond which contouring will theoretically fail (i.e., overland flow will exceed the capacity of ridges to contain it). This value is referred to as the "critical slope length" for contouring.

A value for critical slope length may be calculated for every field to be contoured using RUSLE2. All factors affecting runoff volume and velocity, including average local rainfall intensity, soil type and slope, residue levels and other crop management factors, will influence RUSLE2's answer for critical slope length.

Any planned contouring system can and should be modeled using RUSLE2 in order to determine critical slope length and average predicted sheet & rill erosion. The results should be used as follows:

1. When planned buffer strips are included in the model, compare the actual field slope length where contouring is planned to the calculated critical slope length. If the actual slope length approaches or exceeds the calculated critical slope length value (i.e., the system is predicted to fail near bottom of slope), add complementary practices that "break" the slope (e.g., terraces, more buffer strips) and/or reduce runoff velocity (e.g., increasing residue levels, increase buffer width).
2. Compare estimated sheet & rill soil loss for the contoured system to the site-specific planning objective. If the soil loss objective is not met, add complementary conservation practices. If soil loss objectives are met, make note of the key crop management factors such as crop rotation, ridge height, etc. that were modeled.
3. Use the above to develop recommendations for the grower regarding complementary practices that must be included in the contouring system to achieve overall conservation objectives.

Contouring reduces overland flow and associated sheet & rill erosion, but may increase the potential for concentrated flow and associated gully erosion which RUSLE2 ignores. Therefore, look beyond RUSLE2 and consider adequacy of gully control measures when assessing the performance of contour systems.

Prior to design and layout, removal of obstructions in the field and changes in field boundaries or shape may significantly 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 starting layout or getting the width of one set of strips (one cultivated and one buffer) to pass by an obstruction or ridge saddle.

In the layout process, parallel lines (within the crop strip) to each crop strip/buffer baseline should be temporarily flagged and their grades checked to assure positive row drainage whenever shallow depressions are encountered.

Where contour row curvature becomes too sharp to keep equipment aligned with rows during field operations, increasing the buffer strip width can help avoid sharp ridge points. In drainage ways, establishing grassed waterways at least up to the point of sharp curvature can allow the equipment to be lifted and/or turned to meet the same rows across the turn strip.

When the intersection of crop rows with the field edge is not perpendicular, a Field Border *(VA Code 386)* may be needed to allow farm implements room to turn.

Consider the wildlife habitat potential of buffer strips when planning species and management for these permanent vegetation areas.

PLANS AND SPECIFICATIONS

Specifications for establishment of this practice shall be prepared for each field or Conservation Management Unit (CMU).

Customize the language and level of detail in specifications as needed for each particular case. Focus above all on providing the practical guidance needed to effectively put the practice on the ground.

Specifications shall be recorded and conveyed using approved job sheets and/or narrative statements in the conservation plan.

Specifications shall at a minimum include all of the following elements:

1. A list of the field(s) and/or CMU(s) where this practice will be implemented.
2. Representative field slope length and steepness ("LS") values used as the basis for determining maximum design row grades.
3. Minimum and maximum design row grades planned for the system
4. Detailed sketch(es) or map(s) showing key features of the planned contour system including, but not limited to:
    a. Location and width of buffer strips and other permanent row markers.
    b. Location and type of stable outlets.
    c. Locations within 150 feet of stable outlets suitable for maximum allowable row grades.
5. Establishment plans for buffer strips or other permanent row markers. Specify type of vegetation, planting specifications, etc.
6. Establishment plans and/or designs, if any, for stable outlets. Specify designs, type of vegetation, planting specifications, etc.
7. Targets for crop rotation, residue levels, ridge heights, etc. in crop strips that must be achieved in order for the contouring system to function as planned.
8. Any additional recommendations related to design, installation, and complementary practices that will increase likelihood of successful practice implementation.

In those cases where RUSLE2 is used to aid in designing the contour buffer strip system and in validating the conservation performance of the overall system, document planned conservation objectives as well as inputs and outputs for RUSLE2. Key inputs include planned crop rotation and management; key outputs include critical slope length and predicted soil loss numbers.

OPERATION AND MAINTENANCE

Requirements and recommendations for operation and maintenance (O&M) of this practice shall be provided to every client.

Customize the choice of language and level of detail as needed for each particular case. Focus above all on providing the client with the practical guidance needed to ensure the long-term effectiveness of the practice.

O&M recommendations shall be recorded and conveyed using approved job sheets and/or narrative statements in the conservation plan.

Provide at a minimum the following O&M recommendations:

1. Conduct all tillage, planting, and other field operations parallel to buffer strip boundaries or other established row markers in order to maintain planned row grades.
2. Retain and maintain original width and alignment of buffer strips and all row markers in accordance with the original system design and layout.
3. Maintain a vigorous stand of vegetation on permanent buffer strips. Use mowing heights and other management appropriate to the species selected. Control weeds and woody growth, soil test, and lime/fertilize as needed.
4. Inspect established buffer strips periodically for damage caused by erosion, drought, livestock, herbicides, etc. Promptly correct any problems identified.
5. Inspect the system periodically for sediment accumulation above or just below upslope edge of buffer strips. Spread sediment evenly upslope in crop strips or relocate/renovate buffer strips as needed.
6. Continuously monitor the contoured crop strips for row breakovers and/or excessive scouring along row furrows. Take steps to

correct any problems detected as soon as possible.

7. Maintain diversions or terraces installed in conjunction with a contour farming system in accordance with their respective original design, layout, and construction.
8. Periodically inspect and maintain grassed waterways, field borders, filter strips, turn strips, or other measures used to receive and convey runoff from the field and/or used to facilitate equipment operation.
9. Carry out key crop management recommendations on crop strips necessary for successful performance of the overall contouring system. This includes implementing planned crop rotations and maintaining adequate ridge heights.

REFERENCES

Foster, G.R. Revised Universal Soil Loss Equation, Version 2 (RUSLE2) Science Documentation (In Draft). USDA-ARS, Washington, DC. 2005.

Renard, K.G., G.R. Foster, G.A. Weesies, D.K. McCool, and D.C. Yoder, coordinators. 1997. Predicting soil erosion by water: A guide to conservation planning with the Revised Universal Soil Loss Equation (RUSLE).U.S. Department of Agriculture, Agriculture Handbook 703.

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