Additions to RUSLE2 Users Guide
Guidelines for Use of Factors

1. Dates used in Management Templates for Crop Management Zones:

These dates are based on long term averages across the entire CMZ. For purposes of consistency in using the program, these planting and harvesting dates are to be the **same** for the entire management zone. These dates have been set and the templates for each crop have been developed. Field offices are to use the single crop templates that have been developed for their zone to build rotations, or use the multi-year rotations that have already been developed for each zone. As was discussed in the initial training, these dates are set for each zone and are **NOT to be changed** except on vary rare occasions. Consult with the State Agronomist before making any changes.

2. Guidelines for Estimating Soil Erosion with Terraces Using RUSLE2

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If Terraces Already Exist

1. Select a slope length and steepness down to the first terrace, or the terrace interval.
2. Select a contouring row grade from the drop-down choice list for *Contouring*.
3. Select a terrace at the bottom of the slope from the drop-down choice list for *Diversion/terrace, sediment basin*

NOTE: If terraces already exist on the RUSLE2 slope, we need to take credit for remote deposition that occurs in the terrace channel outlet. Therefore, we must place the terrace at the bottom of the RUSLE2 slope as instructed above. If the grade of the outlet channel is sufficiently flat, RUSLE2 gives partial credit for this deposition, and the RUSLE2 erosion rate and sediment delivery values will be reduced.

If Terraces Are Being Planned But Are Not Installed

1. Select a slope length from the point where runoff begins to the point where deposition occurs or to a concentrated flow channel. Since terraces do not yet exist, measure the entire RUSLE2 slope.
2. Select a contouring row grade from the drop-down choice list for *Contouring*.
3. Select a terrace system for the RUSLE2 slope. From the drop-down choice list for *Diversion/terrace, sediment basin*, choose a system of one or more terraces and an appropriate channel grade that best matches the system planned.

3. Rock Cover - Guidelines for Estimating Rock Cover in the Field

Introduction: The RUSLE2 computer program has an input box on the Profile screen for *"Rock cover, %"*. This document offers guidelines for making estimates in the field for the percent cover from rock, rock fragments, or coarse fragments. Coarse fragments on the soil surface effect the Cover and Management factor in RUSLE2. Rock cover does not effect the Soil Erodibility factor.

Caution - Use Good Judgement: Research data shows that the presence of rock cover can significantly reduce soil erosion, and the RUSLE2 model accounts for this effect. However, users should be cautioned to exercise good judgement when developing conservation planning alternatives that reflect the presence of surface rock fragments. For example, a rock cover entry in RUSLE2 that reduces soil loss to acceptable levels should be re-considered if the hillslope shows clear evidence of severe, active erosion.

In Minnesota, we have not determined any soils or locations where rock cover is a significant concern or should be measured. If this changes in the future, the following information will apply:

Minimum Size Requirement: Count rock fragments that are larger than 10-mm (0.3937 in, or 2/5 in). On undisturbed land in the western U.S., count rock fragments that are larger than 5-mm (0.19685 in, or 1/5 in). Professional judgement is needed when rocks are flat or light in weight. The defining criteria are whether it is easily moved by runoff during a storm event. *(See footnote at bottom)*

Most Erosive Period: The estimate of rock cover should represent the range in rock cover over the 3 or 4 month period that is most erosive. "Most erosive" should include consideration of both the period of highest rainfall erosivity and the vulnerable management period. Since field measurements cannot always be made during this period, additional guidelines may need to be issued by the state.

Measuring Rock Cover: Whenever possible, measure rock cover using the line-transect method.

Rock Cover on Entire "L": The percent rock cover should be based on the entire eroding hillslope profile, or "'L". We are evaluating soil loss on the entire RUSLE2 hillslope profile. Avoid overestimating the rock cover based on a segment of the slope that contains the largest percent of rock cover.

Represent Field or Portion Thereof: Adjust the rock cover estimate to represent the field or portion of the field represented by the hillslope profile if rock cover is significantly more or less on the representative hillslope compared to the rest of the field.

Ignore Overlap with Residue: When measuring or estimating rock cover, ignore any overlap with residue cover**.** Count the surface rock cover even if it lies above or below residue. RUSLE2 takes into account the overlap of different types of ground cover. For example, if rock cover is 15% and corn stalks provide 40% cover, the total cover considered by RUSLE2 is 49%. RUSLE2 properly takes into account the nonlinear mathematics of the combination of rock cover and crop residue.

FOOTNOTE on Minimum Size Requirement: States should develop practical field measurement guides for minimum size requirements of rock fragments. Field users should be encouraged to use (or should be given) a practical tool for use in measuring the 10-mm or 5-mm size. This could be a drill bit, stove bolt, plastic ruler or a paper scaled-

drawing. For the 10-mm size, the minimum size rock should be slightly larger than a 3/8-in drill bit, or slightly smaller than a ½-in drill bit; and for the 5-mm size, the minimum rock size should compare with the ¼-in drill bit. Where rock fragments are flat, a conversion should be developed at the state level, since the 10-mm and 5-mm size in these requirements are meant to apply to a more rounded or blocky shape. Dimensions for flat rock measurement should take into account comparable weight of blocky or rounded rock vs. flat rock, keeping in mind the ability of the flat rock to remain in place and reduce runoff during a storm event.
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4. Contouring: The program gives you choices of two types of contouring: relative row grade and absolute row grade. Relative row grade is the ratio of the row grade to the land slope. For example, if your land slope (which you entered in step 3) was 6%, a relative row grade of 1% (from the drop down menu under contouring) would represent 1% of 6, or a row grade of 0.06%. This approach gives the same relative benefit to row grade regardless of land slope steepness. However it can be confusing.

Absolute row grade is easier to understand, and it is recommended to use this choice most of the time. This is the actual grade of the contour line that you laid out, or the actual grade of the row.

There is a help menu available for all of the options in step 5, and it is accessed by highlighting the option (for example, highlight the word "contouring") and right clicking. A window will pop up with "help" as the first choice.

5. Filter Strips: Only use this factor if the filter strip occurs on the "L" you have described in Step 3 – on the slope that you are using to figure the soil erosion. Do not make any entry for this factor if the filter strip is along the ditch or creek farther on in the field, and not on the slope you are modeling. More information about filter strips is available from the help menu explained above.

6. Subsurface Drainage: this button currently is not working. It is intended to be tied to the hydrologic class of the soils, and be available for soils where there is more than one hydrologic class, depending on if the soils is drained or not. This is planned to be used at some point in the future.

7. Additions of Manure: This is done in Step 4a, base management. There are some templates that have already been built in the multi-year rotation folder (folder b) for adding manure before a corn crop. You need to go into the template and choose the type of manure (liquid, moderate bedding, poultry, semi-solid, slurry or solid with significant bedding) that is being added. Then on the profile screen, under step 4c "Adjust external residue additions", enter a value to represent the dry weight of the manure applied, in pounds per acre. If liquid manure is being applied, this must be converted to pounds per acre of dry weight, which can be hard to do.

Caution: only add manure into your management record if it is applied on the field you are modeling on a regular, consistent basis. Ignore the addition of manure if it is only done on part of the field, or if it is only done some of the time or on an irregular basis.

8. **Estimating Soil Erosion with Ridges** and **Beds**

With Additional Notes on Sediment Delivery and Plastic Mulch 7/16/04 gaw

Ridges and Beds, Defined for Purpose of RUSLE2 Applications

For the purpose of RUSLE2 application, ridges are a series of reoccurring ridges and furrows left by tillage implements such as chisel plows, hippers and disk hillers. The top of these ridges are not flat for any appreciable length. Beds, for the purpose of RUSLE2 application, differ from ridges in that the raised areas (top of the beds) are commonly several feet across the top, and must be at least one foot wide across.

Representing Beds Using RUSLE2

RUSLE2 does not calculate soil loss in the furrows of these beds. Therefore, the topographic inputs must represent the flow path across the bed, then down the side of the bed to the furrow.

This implies that either 1) RUSLE2 provides reasonably good erosion and sediment yield results when minimal erosion occurs in furrows because of high residue cover in the furrows or low furrow grades; or 2) the furrow carries excessive runoff and experiences excessive erosion, a process more closely resembling concentrated flow erosion, a process that RUSLE2 does not currently model.

When Beds are Generally Up-Down the Hillslope:

Represent the cross-section from the middle of one bed to the middle of the next bed. The RUSLE2 output represents runoff and erosion from the middle of the bed to the furrow. Typically, water does not run along the top of the bed for any appreciable length, and instead will run off the side and into the furrow. In the table below, the top of one bed is represented with a 1% grade and 2-ft length, and the sideslope of that bed is represented with a 50% grade and 1-ft length. The adjacent bed across the furrow is represented with similar, but negative values.

SEGMENT	STEEPNESS (%)	LENGTH (ft)
1	1	2
2	50	1
3	-50	1
4	-1	2

When Beds are On or Near the Contour:

Represent the flow path across a bed and down the bed's sideslope to the furrow. An example is illustrated in the table below in which runoff across the top of the bed is represented with a 2% grade and a 4-ft length; and runoff down the bed's sideslope to the furrow is represented with a 50% grade and 1-ft length.

SEGMENT	STEEPNESS (%)	LENGTH (ft)
1	2	4
2	50	1

Representing Ridges Using RUSLE2

Represent the topography up-and-down the hillslope in the path the runoff would follow if the soil surface were flat (as if ridges were not present). If the ridges are on contour/near contour, select the row grade from the drop-down menu for *Contouring*.

***NOTE**: The science in RUSLE2, in most instances, is adequate to represent ridge-furrow systems because it is based on research data on ridge-furrow systems with a "normal spacing." But RUSLE2 does not adequately represent "abnormally" wide beds, and the subsequent wider spacing of furrows because runoff comes from a larger area on the bed and flow concentrates in the furrow.*

A Ridge factor built into RUSLE2 "enhances" erosion when ridges are up-down but "diminishes" it with contouring.

Sediment Delivery in Furrows

RUSLE2 will model sediment deposition in the furrow resulting from low channel grade, but not deposition resulting from increased roughness such as from high residue in the furrow. Currently we have no way of modeling the channel shape and roughness, and the effects of different residue levels in the furrow compared to the ridge or bed.

In eroding landscapes, furrow grades are often too steep for deposited sediment to remain in the furrows. Therefore the sediment delivery value is the same as the soil loss value. However, if the furrow grade is sufficiently flat (often associated with low runoff and/or residue in the furrow), sediment delivery to the end of the furrow will be less than the soil loss value.

Plastic Mulch on Beds and Ridges

Select the Plastic Mulch Application Operation that best represents the percent cover provided by the plastic mulch to the field. So, the estimate of percent cover must include the furrow areas as well as the beds or ridges.