COMPUTING EROSION AND SEDIMENT STORAGE REQUIREMENTS FOR SMALL STRUCTURES

This procedure uses the Universal Soil Loss Equation (USLE) to determine sheet erosion. It allows incorporation of gully and streambank erosion, where necessary, and ultimately computes delivered sediment quantities and storage space required.

This procedure is recommended for estimating sediment storage on structures within certain limits: 1) drainage area less than 2 square miles; 2) hazard class "a". Larger drainage areas and higher hazard classifications can be analyzed, but an SCS geologist should be consulted first. The geologists are also available for technical assistance on the smaller sites.

The form "Estimated Sediment Requirements" should be filed with other basic structural data for the site.

(a) Completing the Form, "Estimated Sediment Requirements"

(1) Data block I provides information on land use and the factors necessary to use the USLE.

(i) Land use is broken into three general categories: terraced and unterraced cropland and pasture. The pasture category includes other potential land uses such as woodland, farmsteads, or urban. In addition, a fourth category (line 4) has been provided to account for the sediment-trapping effects of impoundment or storage-type terrace systems (such as flat channel or tile outlet terraces).

(ii) Determine the dominant soil mapping unit in each land-use category. If a published soil survey is available, this will be the best source. If there is no published survey, consult with the district conservationist or a soil scientist. The dominant mapping unit is simply the one most common within a given land-use area. This is necessary to arrive at the K value in the USLE.

(iii) Values for the different factors in the USLE are now entered onto the form for each land-use category:

- "R" factor (rainfall): See Figure 1.
- "K" factor (soil erodibility): Using the dominant soil mapping unit in each land-use category, refer to the publication "Guide to Soil Erosion Factors and Hydrologic Groups of Nebraska Soils" which should be available in all district offices or from soil scientists. This publication lists "K" factors for all soils found in Nebraska.
- "L" and "S" factors (slope length and gradient): Based upon field examination of the land-use categories in the drainage area, select a representative slope length and gradient for each category. Convert to an "LS" factor by using Figure 2.
- "C" factor (cropping management): Consult with the district conservationist to get one representative "C" factor for each land-use category.
- "P" factor (erosion control practice): Again, consult with the district conservationist for a representative "P" factor for cropland categories. Pasture will have a "P" factor of 1.

(iv) With values for all the LISLE factors, multiply through to determine soil loss for each land-use category in tons/acre/year.

(v) For any areas controlled by storage or impoundment terraces, enter the acres in line 4. Then take 10% of soil loss calculated for terraced cropland (line 1) and enter that as the soil loss value in line 4.

(2) Data block II allows computation of delivered sediment from all erosion sources.

(i) Transfer figures from the "acres" and "soil loss" columns of lines 1, 2, and 3 in block I to the appropriate spaces in lines 1, 2, and 3 of block II.

(ii) In each line, multiply "acres" by "soil loss" to determine total tons eroded per year from each land-use category.

(iii) Add the "total tons" figures together from lines 1 through 3 and enter that into line 4. This is the total sheet erosion from the drainage area.

(iv) Select a delivery ratio from the curves on Figure 3. If there is area controlled by storage terraces, subtract this area from the total drainage area before plugging into the delivery ratio curve.

(v) If present, transfer "acres" and "soil loss" from line 4, block I, to the appropriate spaces in line 5. Multiply to get "total tons/year." Since delivery ratio is already incorporated into the storage terrace concept, it is not recomputed here and total tons is also delivered tons.

(vi) For gully or streambank erosion, use the following procedure to determine an amount for block II, line 6:

- If gully/streambank erosion is nonexistent or very low, enter nothing in this line.
- If gully/streambank erosion is slight to moderate, enter 10% of the "total tons/year" figure from block II, line 4.
- If gully/streambank erosion is severe, enter 15% of the "total tons/year" figure from block II, line 4.
- "Clues for Recognizing Bank Erosion" on page NB 2A-4 will help in deciding how severe the gully/streambank erosion problem is. The geologists also are available for assistance on this phase.

  Since a 100% delivery ratio has been preselected, total tons are also the delivered tons.
- Add the delivered tons from sheet erosion plus storage terraces (if present) plus gully/streambank erosion to determine total delivered sediment at the site.

(3) In data block III, the sediment storage required at the site is computed.

(i) Transfer total "annual delivered tons" (block II, "total") to block III.

(ii) Enter the design life of the structure. Multiply it by "annual delivered tons" to arrive at "total delivered tons."

(iii) Select a volume weight from Table 1 and enter it.

(iv) Divide "total delivered tons" by the volume weight to arrive at storage required in acre-feet.

If you desire the answer in watershed inches, use the following conversion:

watershed inches =

$$\frac{0.01875 * acre - ft\ of\ storage}{drainage\ area\ in\ square\ miles}$$

On Page NB 2A-8, a copy of the form "Estimated Sediment Requirements" has been filled out as an example. Note that data from the field examination (LS figures and severity of gully/streambank erosion) are written on the form so that all necessary information is in one place.

(b) Clues For Recognizing Bank Erosion

Slight - There is bare bank, but lateral recession of the bank is not obvious. It would be difficult to measure over a period of 1 or 2 years.

Moderate - This category is characterized by active, eroding banks. There can be exposed tree roots, some fallen trees, and occasional cave-ins. Sometimes changes in cultural features can be noted, such as fence corners missing, leaning fence posts, exposed drainage pipe, or realignment of roads and trails.

Severe - Severe bank erosion is characterized by meandering streams having large washouts and slumps in addition to the characteristics of moderate erosion. Change of stream course is often, but not always, an indication of severe erosion. Severe bank erosion can result from channel straightening.

NEBRASKA

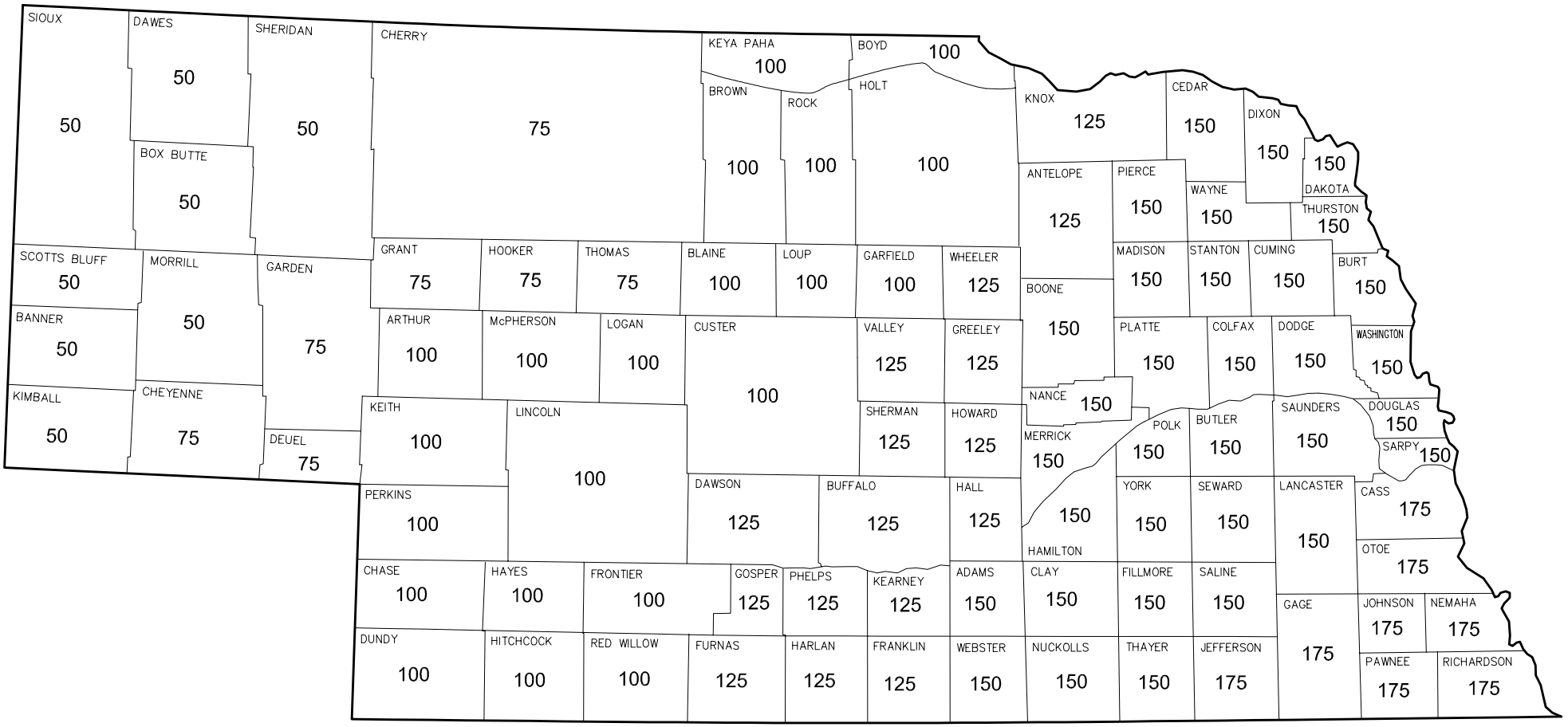

Fig. 1
RAINFALL-EROSION INDEX FACTOR "R" VALUES
By County

USDA—Natural Resources Conservation Service