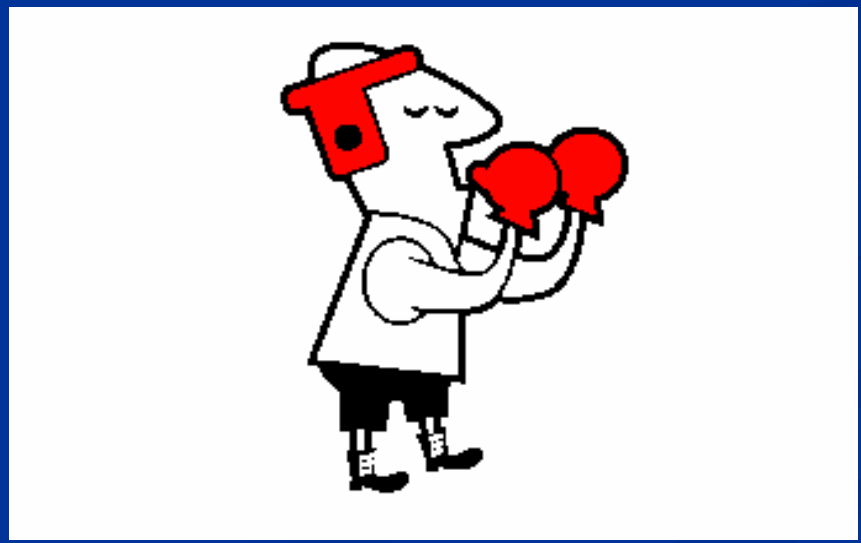
Slope Lengths & Considerations

What criteria do we use to measure slope length?

- *General Discussion*

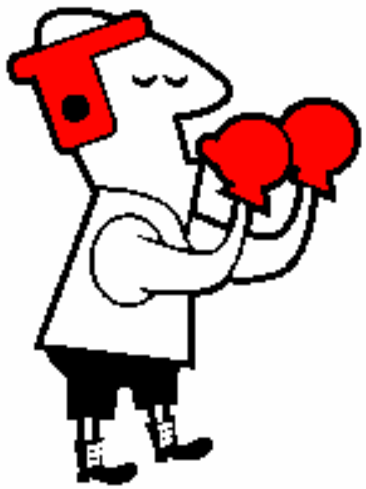
Slope Length

- RUSLE2 VS USLE



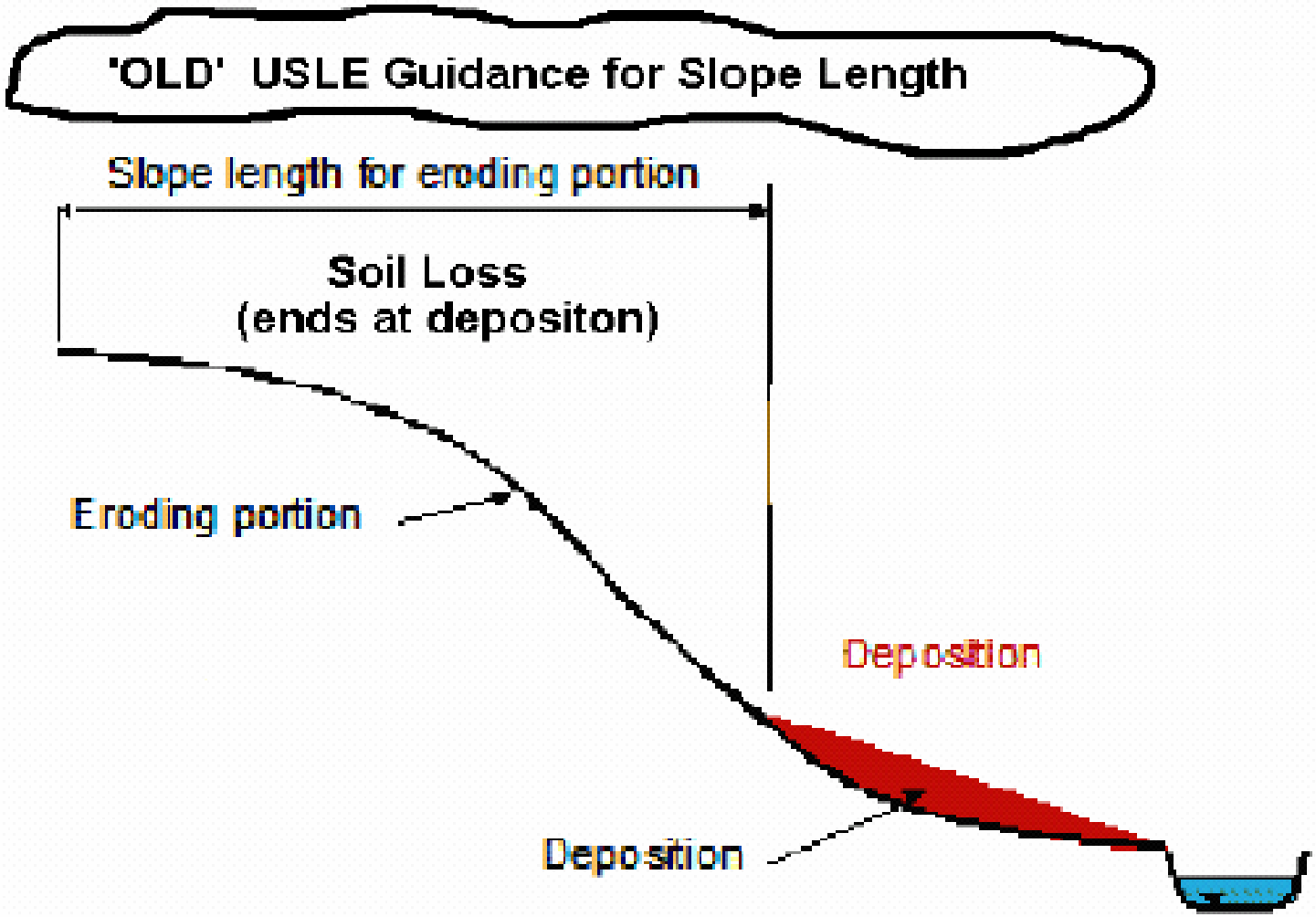
USLE SLOPE DEFINITION

- Overland flow to
  - concentrated flow
  - or deposition



  - However
    - Overland flow continued beyond the point of deposition

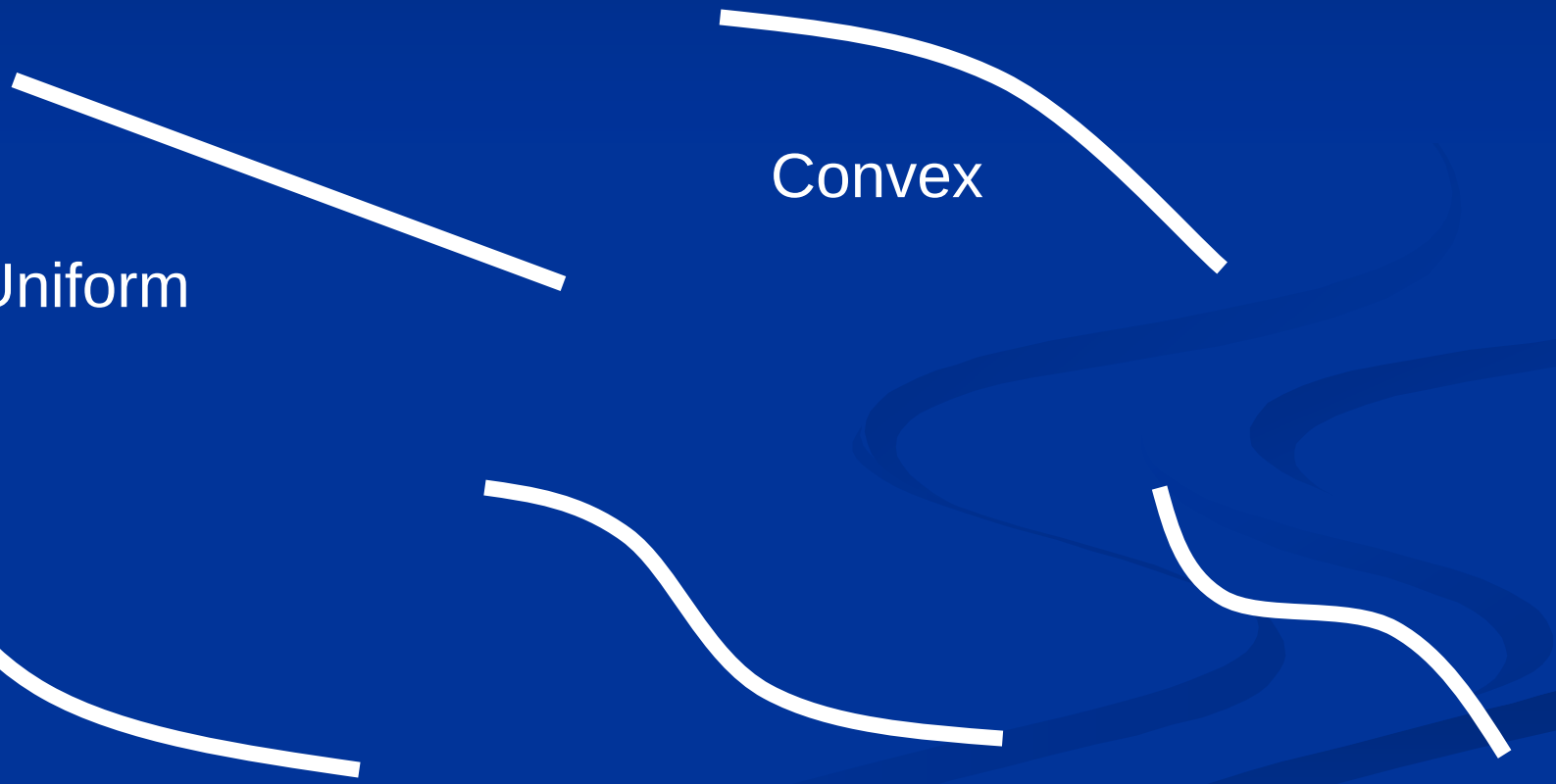
'OLD' USLE Slope Length Guidance (1980s vintage)



RUSLE2 TOPOGRAPHY

- Overland flow path length
- Slope lengths for eroding portions of hillslopes
- Steepness
- Hillslope shape

Hillslope Shape



Overland Flow Path Length

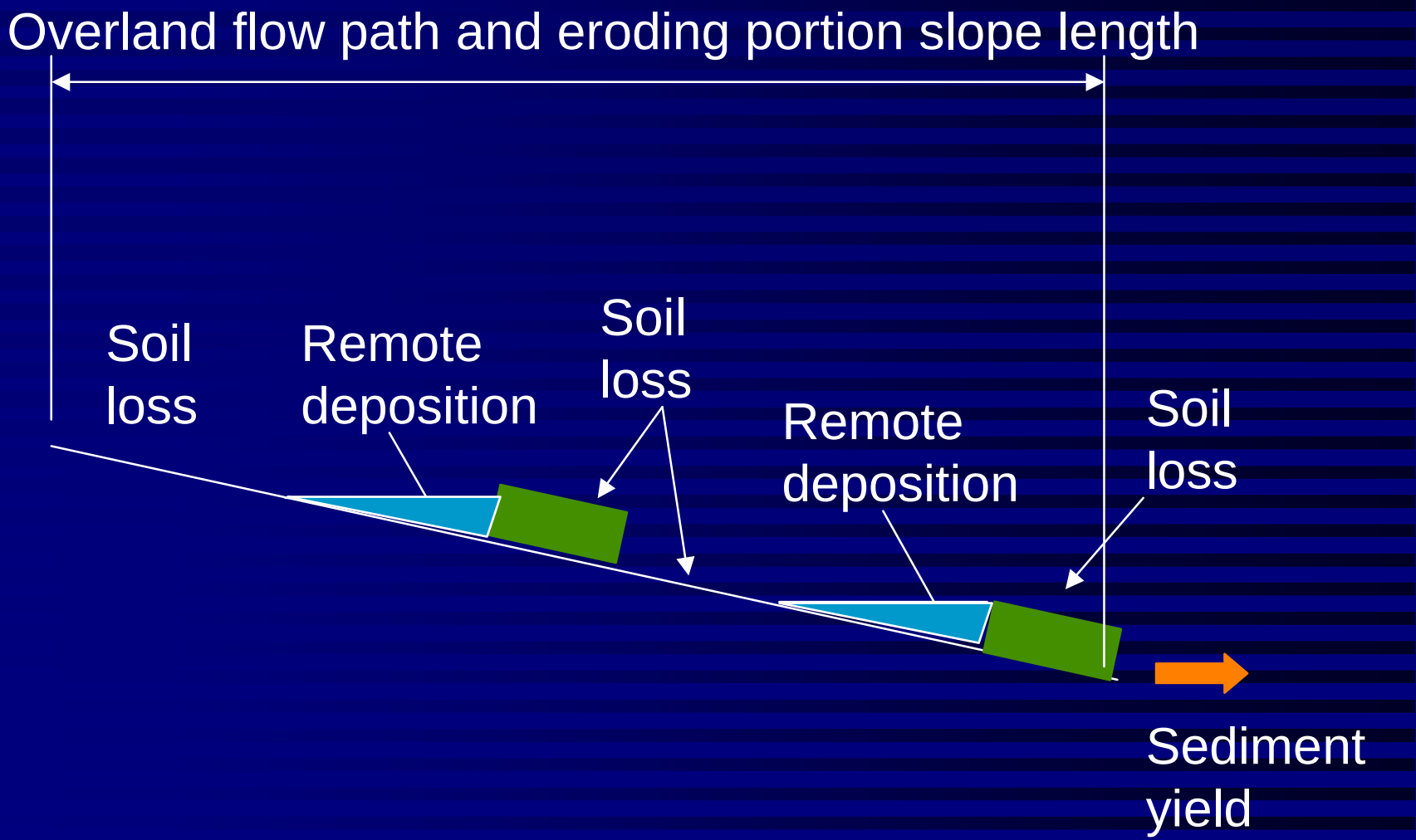
- Distance from the origin of overland flow to a concentrated flow area

- This length used when the analysis requires that the entire flow path length be considered.

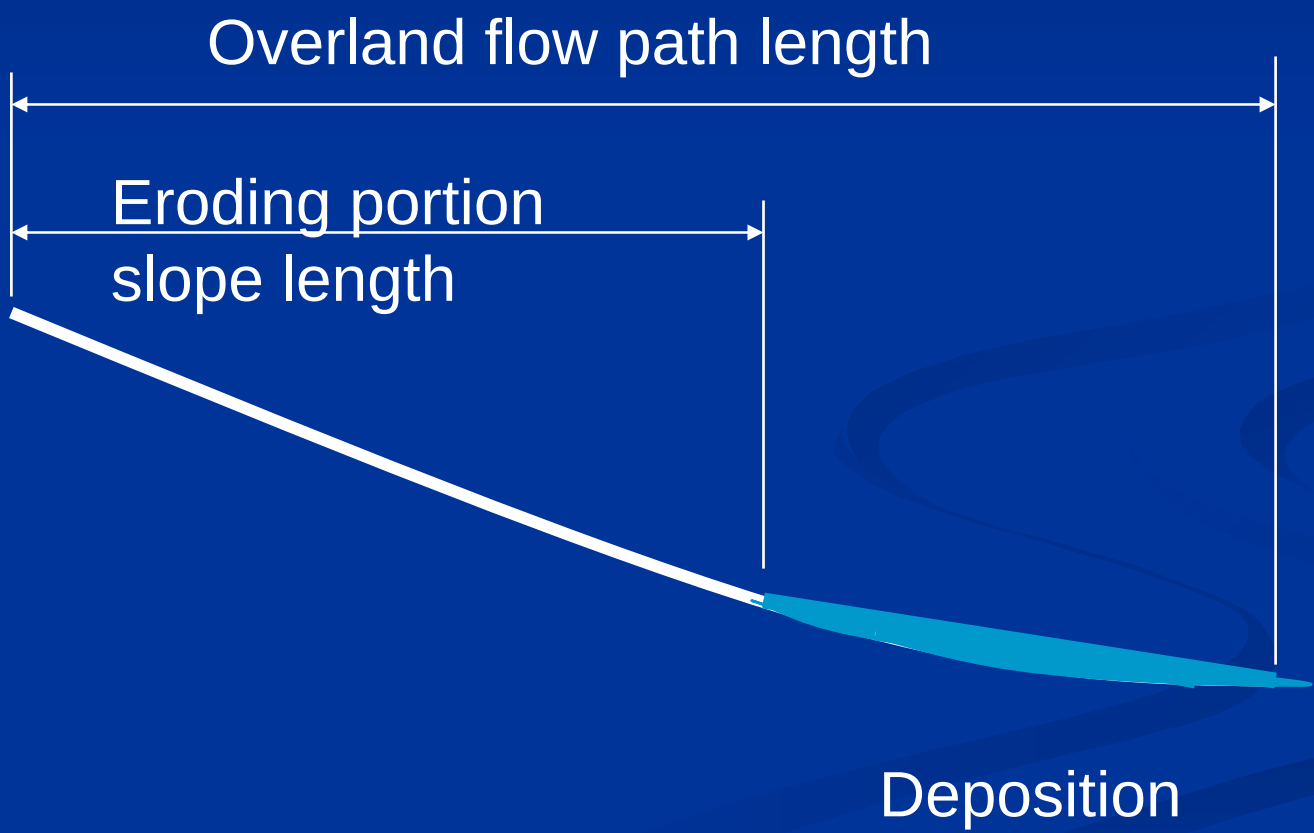
Slope Length for Eroding Portion of Slope

- Only works for simple slopes
- Traditional definition
  - Distance from origin of overland flow to concentrated flow or to where deposition begins
  - Definition is flawed for strips and concave:convex slopes
- Best approach: Use overland flow path length and examine RUSLE2 segment erosion rate values

Slope Lengths for Strips



Slope Length for Concave Slope



Rule of Thumb for Deposition Beginning on Concave Slopes

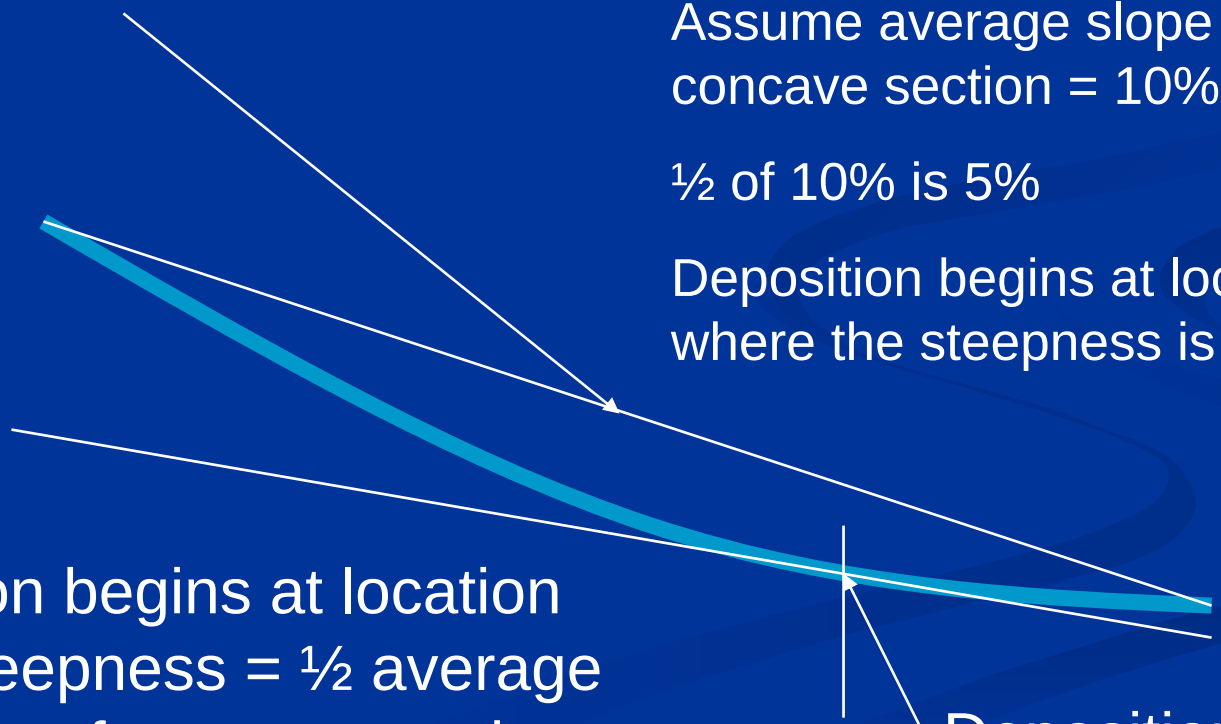
Average steepness of concave portion

Example:

Assume average slope of concave section = 10%

½ of 10% is 5%

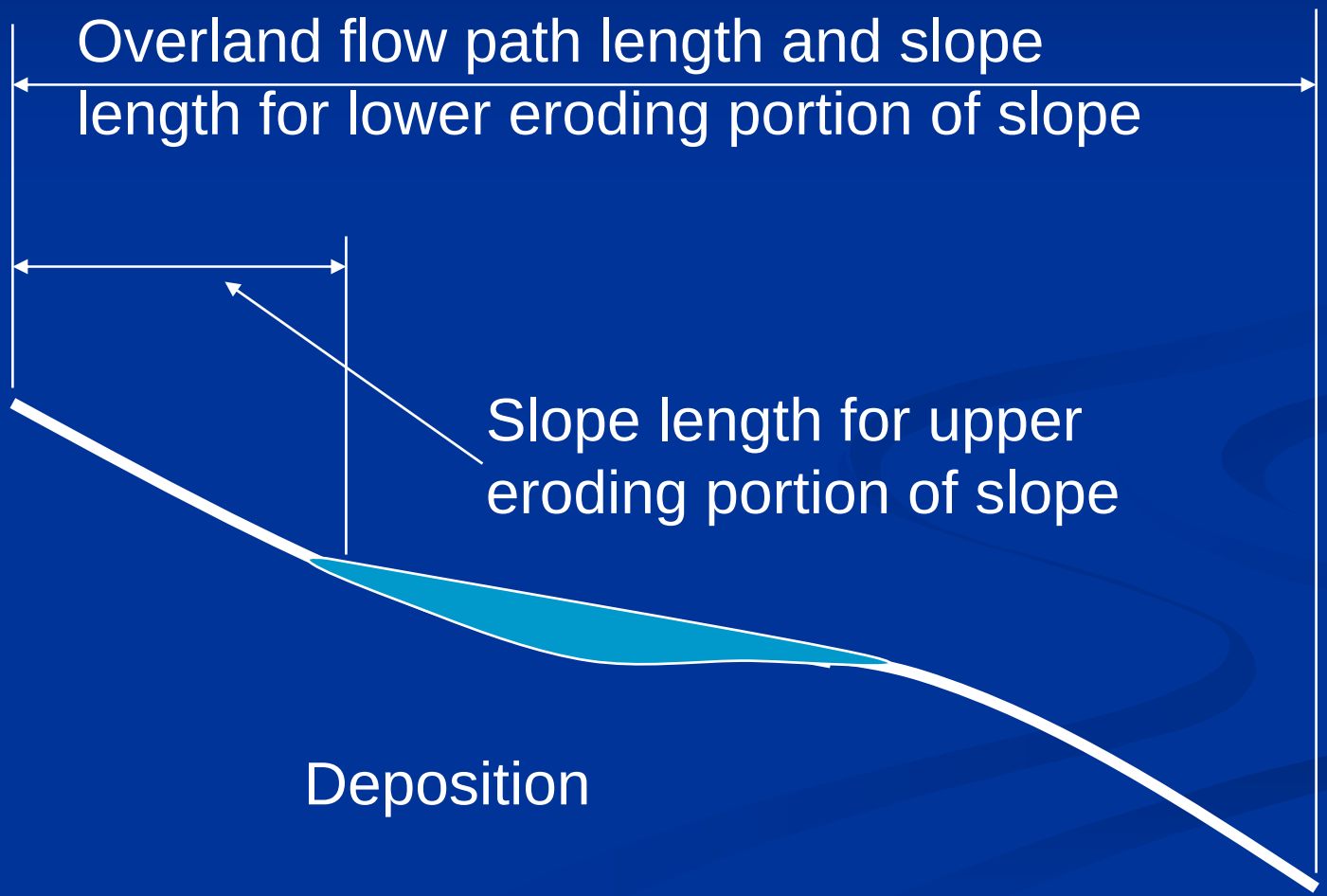
Deposition begins at location where the steepness is 5%



Deposition begins at location where steepness = ½ average steepness of concave portion

Deposition begins

Slope Length for Concave:Convex Slope



Basic Principles

- Sediment load accumulates along the slope because of detachment
- Transport capacity function of distance along slope (runoff), steepness at slope location, cover-management, storm severity (10 yr 24 hr precip)
- Deposition occurs where sediment load becomes greater than transport capacity

Slope Length Effects

- Slope length effect is greater on slopes where rill erosion is greater relative to interrill erosion
- Examples:
  - Steep slopes
  - Soils susceptible to rill erosion
  - Soils recently tilled
  - Low soil biomass

What type(s) of Erosion Does **RUSLE(2)** measure?

RUSLE2 estimates rates of:

rill and interrill (sometimes referred to as **sheet erosion)** caused by **rainfall** and its associated **overland flow**.

Rill Erosion

- **Rill erosion** is the removal of soil by concentrated water running through little streamlets. As detachment continues or flow increases, rills will become wider and deeper.

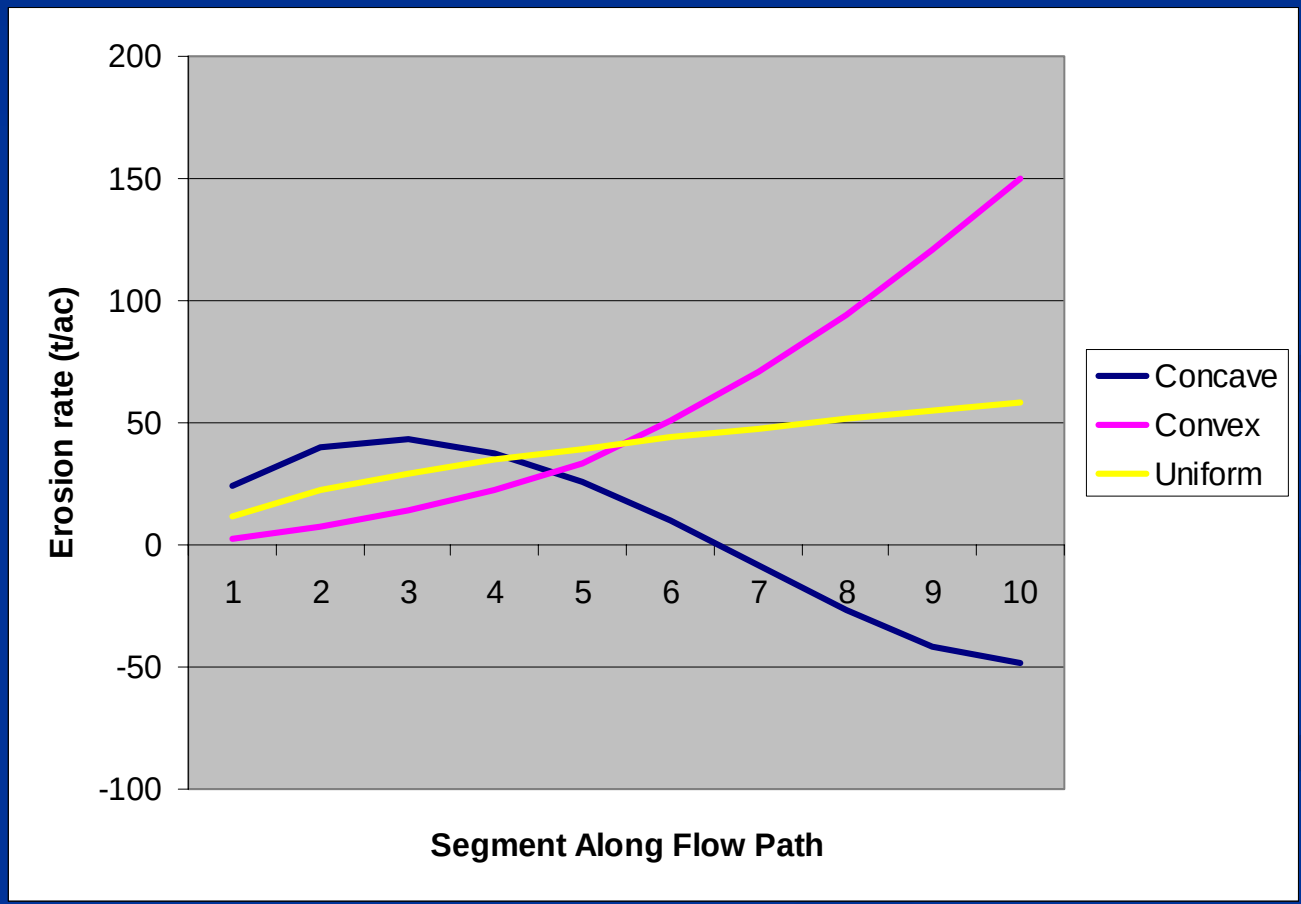
- Rill erosion is one of the most common forms of erosion. **The rill channels can temporarily be obliterated by tillage.** Tillage loosens the soil making it more susceptible to rill erosion. Thus, every time they are destroyed - the rills can reform, resulting in much more soil lost.

Interrill Erosion

- Erosion on the areas between the rills, the *interrill areas*, is called interrill erosion.

Effect of Slope Shape on Erosion

100 ft long, 1% to 19% steepness range



RUSLE(2) Slope Length Ends at Concentrated Flow

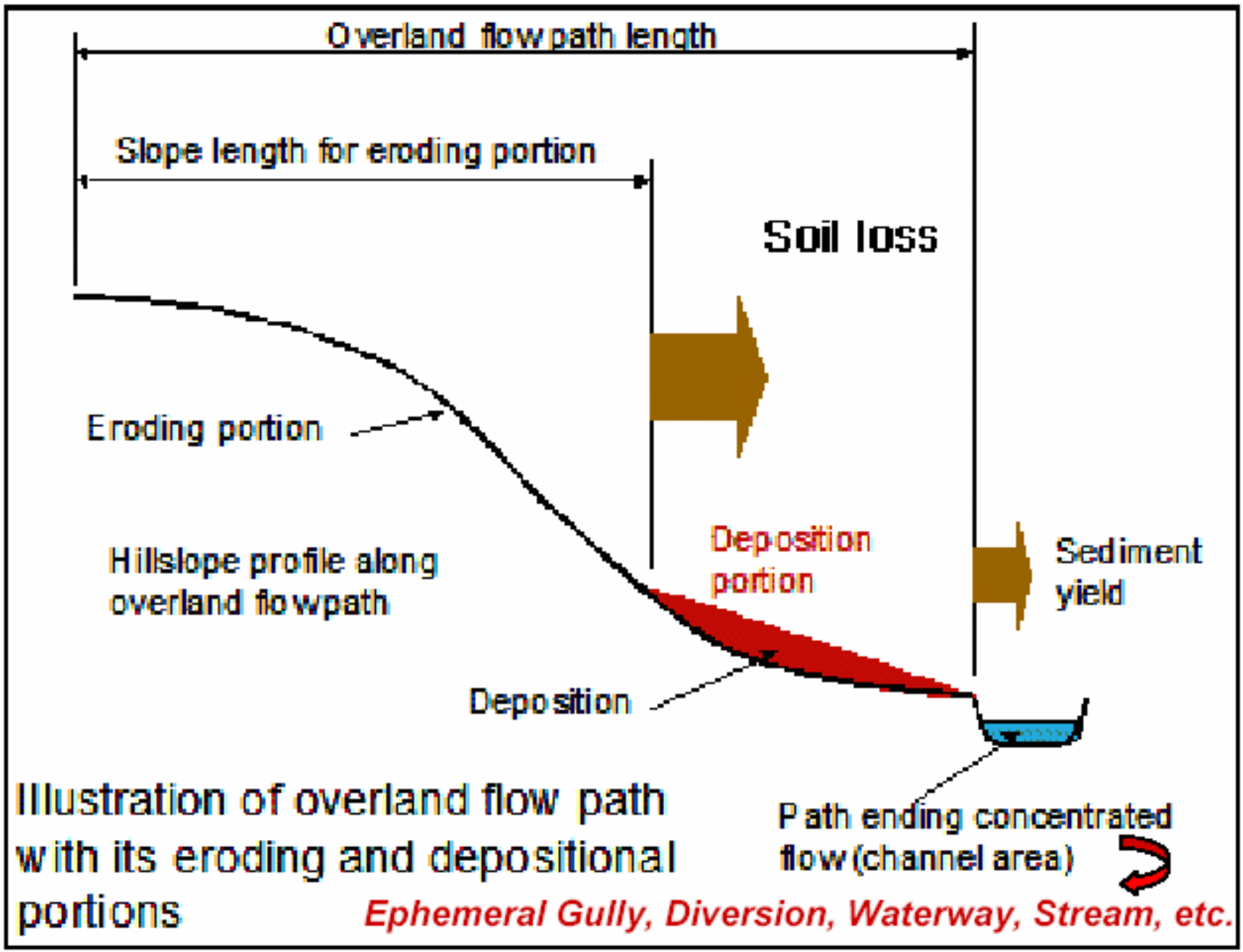


Illustration of overland flow path with its eroding and depositional portions

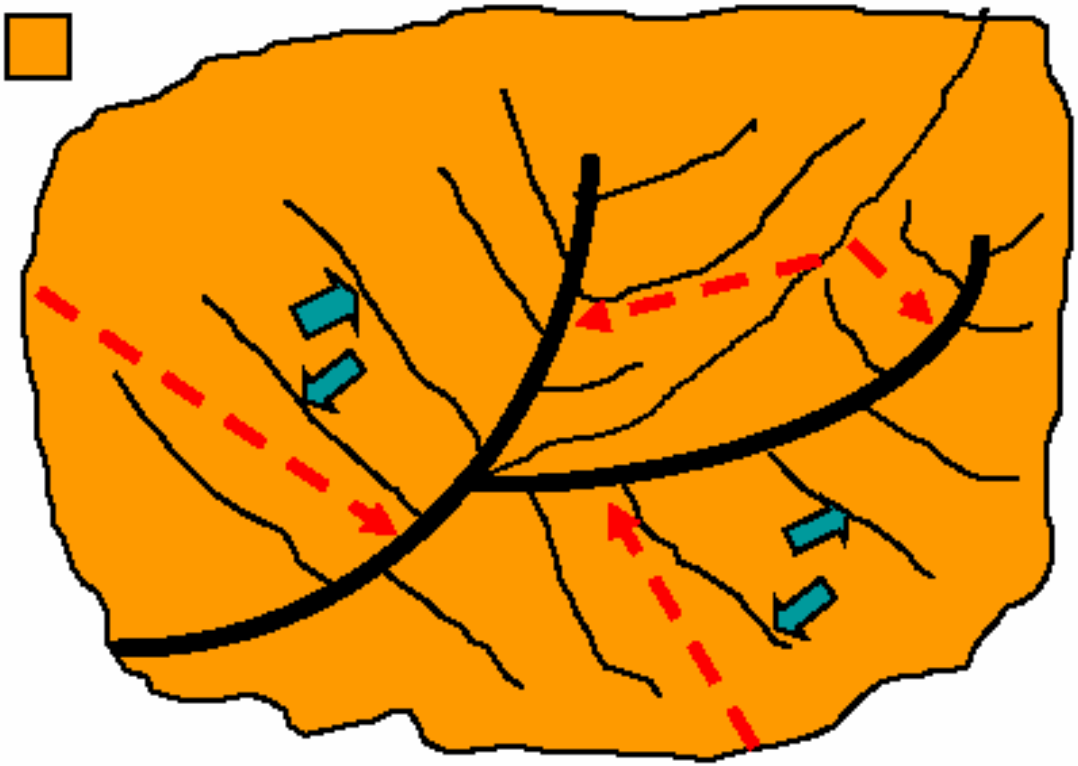
Landscape

Overland flow

Interrill

Rill

Ephemeral Gully (Concentrated flow)



Erosion Types

Rusle2 slope Length

Critical Slope Lengths

- Critical Slope Length is a determining factor for the Stripcropping-585 Standard.

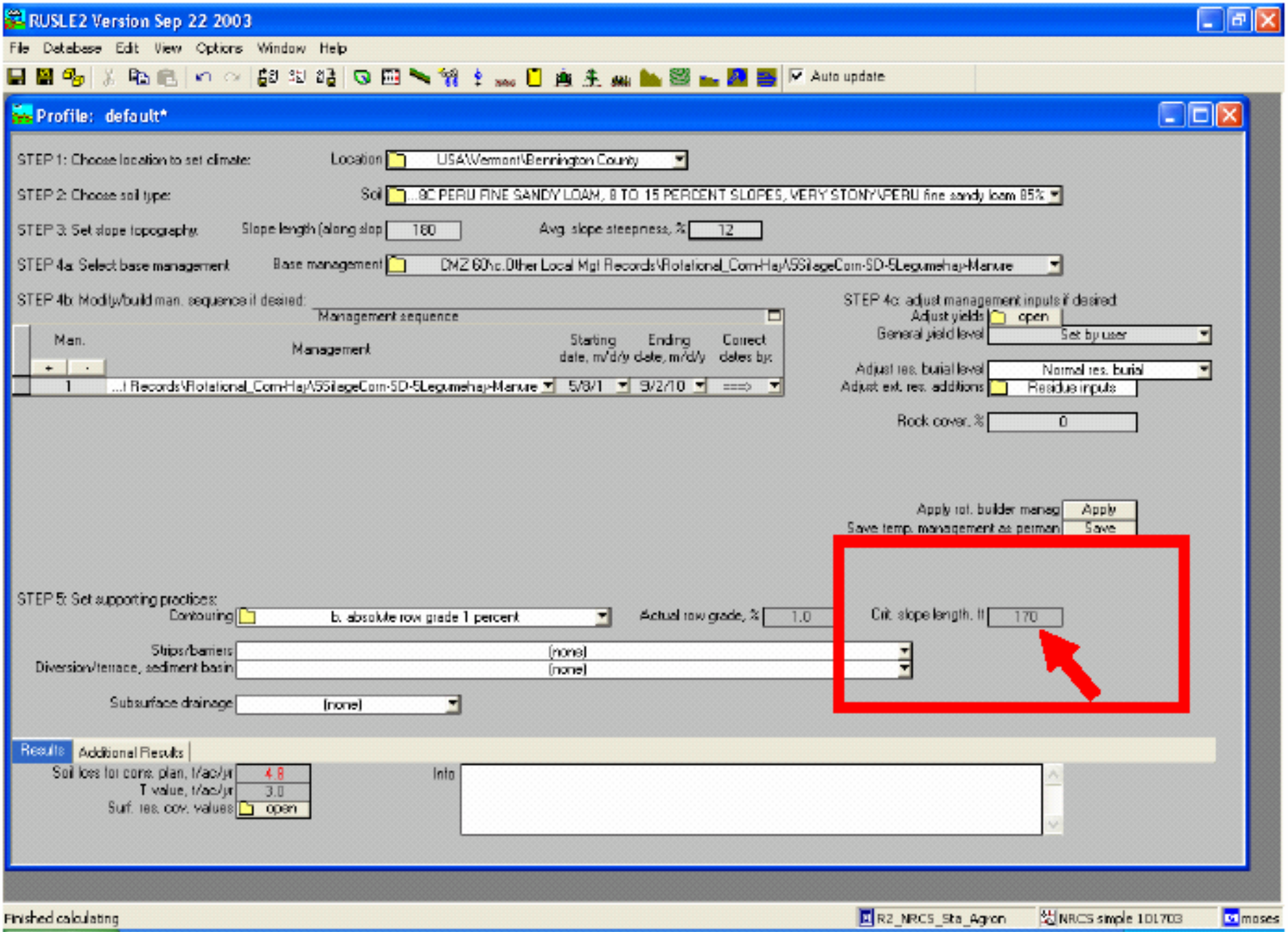
- At long slope lengths, contouring (contour farming, row arrangement, etc) loses its effectiveness. Critical slope lengths are those beyond which contouring is assumed to lose much of its effectiveness.

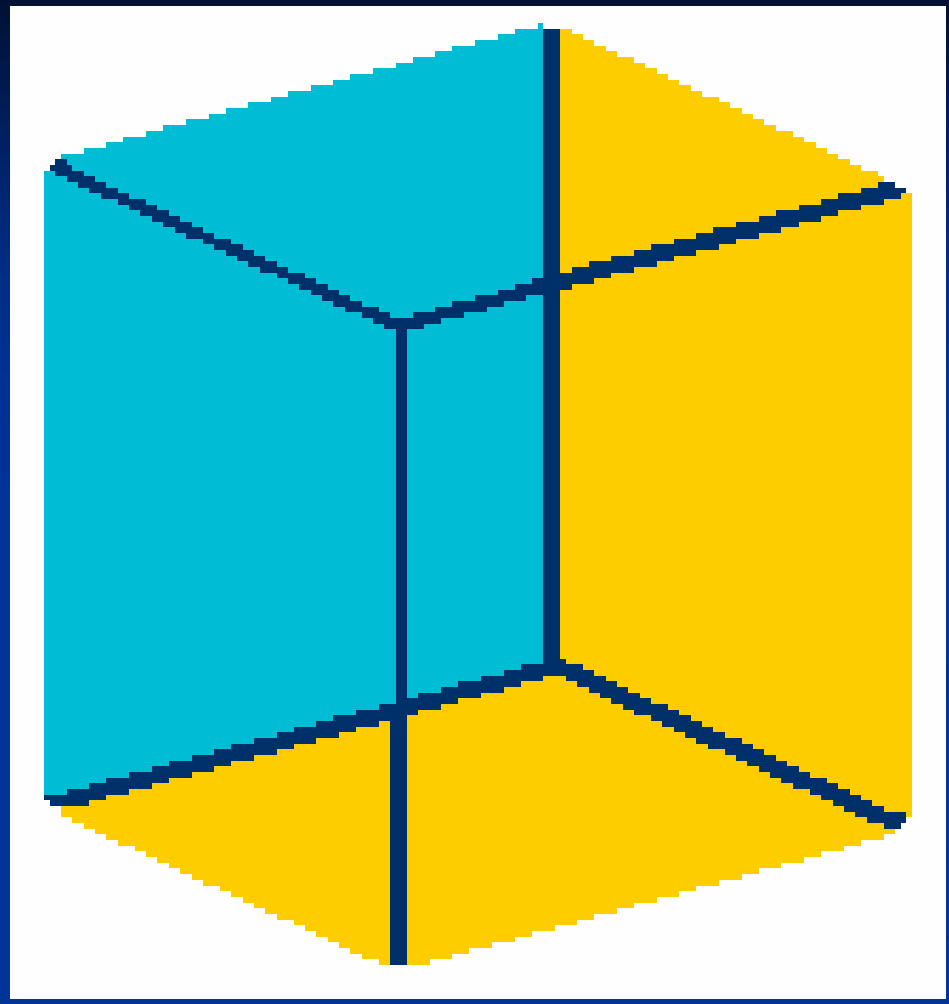
- Critical slope length increases based on residue cover (typically above 50%)

- Critical slope length is affected by soil hydrologic group (based on shear stress exerted by the runoff on the soil).

- To Find Critical Slope Length in Rusle2: Must have **Contouring** specified. Find Critical Slope in the **PROFILE** view.

RUSLE2 Profile View





Is the blue on the inner left back or the outer left front?