RHEM Equation Summary

Updated: 01/22/2015

Ft (friction factor)

Ft = 10^{−0.109+(1.425*littercover)*+(0.442 **rockcover*)+(1.764*(*basalcover*+ *cryptogams*))+2.068S}

Note: Friction factor is being used to calculate the overland flow (CHEZY) coefficient and the concentrated flow (RCHEZY) coefficient used in the input .PAR file.

Ke (Effective Hydraulic Conductivity)

Sand	Keb = 24 * {exp^[0.3483 * (*basalcover* + *littercover*)]}
Loamy Sand	Keb = 10 * {exp^[0.8755 * (*basalcover* + *littercover*)]}
Sandy Loam	Keb = 5 * {exp^[1.1632 * (*basalcover* + *littercover*)]}
Loam	Keb = 2.5 * {exp^[1.5686 * (*basalcover* + *littercover*)]}
Silt Loam	Keb = 1.2 * {exp^[2.0149 * (*basalcover* + *littercover*)]}
Silt	Keb = 1.2 * {exp^[2.0149 * (*basalcover* + *littercover*)]}
Sandy Clay Loam	Keb = 0.80 * {exp^[2.1691 * (*basalcover* + *littercover*)]}
Clay Loam	Keb = 0.50 * {exp^[2.3026 * (*basalcover* + *littercover*)]}
Silty Clay Loam	Keb = 0.40 * {exp^[2.1691 * (*basalcover* + *littercover*)]}
Sandy Clay	Keb = 0.30 * {exp^[2.1203 * (*basalcover* + *littercover*)]}
Silty Clay	Keb = 0.25 * {exp^[1.7918 * (*basalcover* + *littercover*)]}
Clay	Keb = 0.2 * {exp^[1.3218 * (*basalcover* + *littercover*)]}

Shrub Vegetation Community
Ke = Keb * 1.2
Sod Grass Vegetation Community
Ke = Keb * 0.8
Bunch Grass Vegetation Community
Ke = Keb * 1.0
Forbs Vegetation Community
Ke = Keb * 1.0

Kss (Splash and Sheet erosion parameter)

F = Foliar Cover, G = Ground Cover, S = Slope Steepness
Note: foliar cover and ground cover are specified as fractions, slope (mm^{-1})

1. Calculate Kss for each vegetation community using total foliar cover and calculate Kss at total foliar cover equal to 0
   a) Calculate *Kss* for each vegetation community:

Bunch Grass:

$$\text{Kss} = 10\text{^}\begin{cases} 4.154 - 2.547 * G - 0.7822 * F + 2.5535 * S & \text{if } G < 0.475 \\ 3.1726975 - 0.4811 * G - 0.7822 * F + 2.5535 * S & \text{if } G \geq 0.475 \end{cases}$$

Sod Grass:

$$Kss = 10\text{^}\begin{cases} 4.2169 - 2.547 * G - 0.7822 * F + 2.5535 * S & \text{if } G < 0.475 \\ 3.2355975 - 0.4811 * G - 0.7822 * F + 2.5535 * S & \text{if } G \geq 0.475 \end{cases}$$

Shrub:

$$\text{Kss} = 10\text{^}\begin{cases} 4.2587 - 2.547 * G - 0.7822 * F + 2.5535 * S & \text{if } G < 0.475 \\ 3.2773975 - 0.4811 * G - 0.7822 * F + 2.5535 * S & \text{if } G \geq 0.475 \end{cases}$$

Forbs:

$$\text{Kss} = 10\text{^}\begin{cases} 4.1106 - 2.547 * G - 0.7822 * F + 2.5535 * S & \text{if } G < 0.475 \\ 3.1292975 - 0.4811 * G - 0.7822 * F + 2.5535 * S & \text{if } G \geq 0.475 \end{cases}$$

b) Calculate Kss at total foliar cover = 0 from the shrub equation:

$$\text{Kss(Shrub 0)} = 10\text{^}\begin{cases} 4.2587 + 2.5535 * S - 2.547 * G & \text{if } G < 0.475 \\ 3.2773975 + 2.5535 * \text{S} - 0.4811 * \text{G} & \text{if } G \geq 0.475 \end{cases}$$

2. Calculate average Kss when total foliar cover is close to 0:

a) If F < 0.02 then:
$Kss\,(\text{average}) = F/0.02*[(\text{Shrub } F/\text{Total } F)*Kss\,(\text{Shrub})+(\text{Sod } F/\text{Total } F)*Kss\,(\text{Sod})+(\text{Bunch } F/\text{ Total } F)*Kss\,(\text{Bunch})+(\text{Forbs } F/\text{ Total } F)*Kss(\text{Forbs})]+ (0.02\text{-Total } F)/0.02*\ Kss\,(\text{Shrub 0})$

b) If F >= 0.02 then:
$\text{Kss(averge)} = (\text{Shrub } F/\text{Total } F)*\text{Kss(Shrub)}+(\text{Sod } F/\text{Total } F)*\text{Kss(Sod)}+(\text{Bunch } F/\text{ Total } F)*\text{Kss(Bunch)}+(\text{Forbs } F/\text{ Total } F)*\text{Kss(Forbs)}$

3. Calculate *Kss* used for RHEM (with canopy cover == 0 and canopy cover > 0):

a) If *G* < 0.475 then
Kss (RHEM) = *G*/0.475* *Kss*(average) + (0.475-*G*)/0.475**Kss*(Shrub)

b) If *G* >= 0.475 then
Kss (RHEM) = Kss(average)

Kss for all cases is multiplied by the factors 1.3 and 2.0 (2.6) in order to account for the bias in the log transformation and calibration:

[Duan, Naihua. 1983. Smearing Estimate: A Nonparametric Retransformation Method, *Journal of the American Statistical Association*, Vol., 78, No. 3838. (Sep., 1983), pp. 605-610.]