PROCEDURE FOR ESTIMATING SOIL LOSS RESULTING FROM WATER EROSION IN THE KANSAS CITY URBANIZING AREA

This procedure can be used to estimate average annual water erosion (sheet and rill) in the Kansas City urbanizing area. It is based upon the Universal Soil Loss Equation, A = RKLSCP, where:

A = the predicted average annual soil loss expressed in tons per acre per year.

R = the rainfall factor. A value of 200 will be used. This is the number of erosion –index units in an average year's rain. The erosion index is a measure of the erosion force of specific rainfall.

K = the soil-erodibility factor. It is the erosion rate per unit of erosion index for a specific soil. A constant K value of .32 will be used in this procedure in the Kansas City area because most of the soils in the area have a k value of .32, detailed soils information is not presently available on some sites, and because the soils are mixed during cut and fill operations during construction.

L = the slope length factor. Slope length is the distance from the point of origin of overland flow to (1) the point where the slope decreases to the extent that deposition begins, or (2) the point where runoff enters a defined channel.

S = the slope-gradient factor. The slope gradient is measured and expressed as percent slope, e.g., the vertical elevation difference in feet per 100 feet horizontal distance.

The slope gradient factor and the slope length factor are combined as one LS factor in this procedure. The LS factor is determined from Table 1.

C = the plant cover factor. It is the ratio of soil loss from an area with a specific plant or soil cover to that from bare soil.

The C factor has been combined with RK and P, since they will be considered constant in this particular urbanizing area, to expedite computations. Tables 2, 3a, b, c, d, and e give RKCP values for various types of soil cover and for various seeding dates.

P = the erosion control practice or contouring factor. A constant value of 1.0 will be used.

<u>Field Procedure to Determine Soil Loss</u> – The attached worksheet outlines the computations and procedure necessary to arrive at the soil loss estimate. Additional instructions are on the back of the worksheet.

The Universal Soil Loss Equation predicts the average sheet and rill erosion (resulting form water) on a particular area or slope. It does not predict the amount of sediment which leaves the total field or construction site consisting of several slope combinations, drainage ways, gullies, etc.

On small, somewhat uniform areas, the amount of sheet and rill soils erosion and quantity of sediment leaving may be nearly the same.

On larger construction sites or fields, the amount of sheet and rill erosion and quantity of sediment leaving the site may be different. On some sites, gully erosion, which is not predicted with the Universal Soil Loss Equation may exist. This will increase the amount of sediment. In complex topography, some of the eroded soil (sheet and rill) will deposit naturally on flat slopes, in drainageways, etc., within the field or construction site. This decreases amount of sediment leaving the site. The size of the area, topography, soils, characteristics of the development, and conservation measures will influence both of these factors.

In this procedure, the average annual soil loss predicted by the Universal Soil Loss Equation may be adjusted by a sediment yield factor, Y (Table 4) to arrive at the estimated average annual quantity of sediment leaving the field or construction site.

TABLE 1 SOIL LOSS RATIO (LS)
(REV. 3-75)

LENGTH OF SLOPE (L)	PERCENT SLOPE (S)																					
	0.2	0.3	0.4	0.5	1	2	3	4	5	6	8	10	12	14	16	18	20	25	30	40	50	60
20	0.05	0.05	0.06	0.06	0.08	0.12	0.18	0.21	0.24	0.30	0.44	0.61	0.81	1.00	1.20	1.60	1.80	2.60	3.50	5.50	8.00	10.00
40	0.06	0.07	0.07	0.08	0.10	0.15	0.22	0.28	0.34	0.43	0.63	0.87	1.20	1.40	1.80	2.20	2.60	3.50	5.00	8.00	11.00	15.00
60	0.07	0.08	0.08	0.08	0.11	0.17	0.25	0.33	0.41	0.52	0.77	1.00	1.40	1.80	2.20	2.60	3.00	4.50	6.00	10.00	14.00	18.00
80	0.08	0.08	0.09	0.09	0.12	0.19	0.27	0.37	0.48	0.60	0.89	1.20	1.60	2.00	2.60	3.00	3.50	5.50	7.00	11.00	16.00	21.00
100	0.08	0.09	0.09	0.10	0.13	0.20	0.29	0.40	0.54	0.67	0.99	1.40	1.80	2.20	2.80	3.50	4.00	6.00	8.00	13.00	18.00	23.00
110	0.08	0.09	0.10	0.10	0.13	0.21	0.30	0.42	0.56	0.71	1.00	1.40	1.80	2.40	3.00	3.50	4.50	6.00	8.00	13.00	19.00	24.00
120	0.09	0.09	0.10	0.10	0.14	0.21	0.30	0.43	0.59	0.74	1.00	1.60	2.00	2.60	3.00	4.00	4.50	6.00	9.00	14.00	20.00	25.00
130	0.09	0.09	0.10	0.11	0.14	0.22	0.31	0.44	0.61	0.77	1.20	1.60	2.00	2.60	3.00	4.00	4.50	7.00	9.00	14.00	20.00	26.00
140	0.09	0.10	0.10	0.11	0.14	0.22	0.32	0.46	0.63	0.80	1.20	1.60	2.20	2.80	3.50	4.00	5.00	7.00	9.00	15.00	21.00	27.00
150	0.09	0.10	0.11	0.11	0.15	0.23	0.32	0.47	0.66	0.82	1.20	1.60	2.20	2.80	3.50	4.00	5.00	7.00	10.00	15.00	22.00	28.00
160	0.09	0.10	0.11	0.11	0.15	0.23	0.33	0.48	0.68	0.85	1.20	1.80	2.20	3.00	3.50	4.50	5.00	7.00	10.00	16.00	23.00	29.00
180	0.10	0.10	0.11	0.12	0.15	0.24	0.34	0.51	0.72	0.90	1.40	1.80	2.40	3.00	4.00	4.50	5.50	8.00	11.00	17.00	24.00	31.00
200	0.10	0.11	0.11	0.12	0.16	0.25	0.35	0.53	0.76	0.95	1.40	2.00	2.60	3.00	4.00	5.00	6.00	8.00	11.00	18.00	25.00	33.00
300	0.11	0.12	0.13	0.14	0.18	0.28	0.40	0.62	0.93	1.20	1.80	2.40	3.00	4.00	5.00	6.00	7.00	10.00	14.00	22.00	31.00	40.00
400	0.12	0.13	0.14	0.15	0.20	0.31	0.44	0.70	1.00	1.40	2.00	2.80	3.50	4.50	5.50	7.00	8.00	12.00	16.00	25.00	36.00	46.00
500	0.13	0.14	0.15	0.16	0.21	0.33	0.47	0.76	1.20	1.60	2.20	3.00	4.00	5.00	6.00	8.00	9.00	13.00	18.00	28.00	40.00	52.00
600	0.14	0.15	0.16	0.17	0.22	0.34	0.49	0.82	1.40	1.60	2.40	3.50	4.50	5.50	7.00	8.00	10.00	14.00	19.00	31.00	44.00	57.00
700	0.15	0.16	0.17	0.18	0.23	0.36	0.52	0.87	1.40	1.80	2.60	3.50	5.00	6.00	8.00	9.00	11.00	16.00	21.00	33.00	47.00	61.00
800	0.15	0.16	0.17	0.18	0.24	0.38	0.54	0.92	1.60	2.00	2.80	4.00	5.00	6.00	8.00	10.00	12.00	17.00	22.00	36.00	50.00	65.00
900	0.16	0.17	0.18	0.19	0.25	0.39	0.56	0.96	1.60	2.00	3.00	4.00	5.50	7.00	9.00	10.00	12.00	18.00	24.00	38.00	53.00	69.00
1000	0.16	0.18	0.19	0.20	0.26	0.40	0.57	1.00	1.60	2.20	3.00	4.50	5.50	7.00	9.00	11.00	13.00	19.00	25.00	40.00	56.00	73.00
1100	0.17	0.18	0.19	0.20	0.27	0.41	0.59	1.00	1.80	2.20	3.50	4.50	6.00	8.00	9.00	11.00	14.00	20.00	26.00	42.00	59.00	77.00
1200	0.17	0.18	0.20	0.21	0.27	0.42	0.61	1.00	1.80	2.40	3.50	4.50	6.00	8.00	10.00	12.00	14.00	20.00	28.00	44.00	62.00	80.00
1300	0.18	0.19	0.20	0.21	0.28	0.43	0.62	1.20	2.00	2.40	3.50	5.00	7.00	8.00	10.00	12.00	15.00	21.00	29.00	46.00	64.00	83.00
1400	0.18	0.19	0.21	0.22	0.29	0.44	0.63	1.20	2.00	2.60	3.50	5.00	7.00	9.00	11.00	13.00	15.00	22.00	30.00	47.00	67.00	87.00
1500	0.19	0.20	0.21	0.22	0.29	0.45	0.65	1.20	2.00	2.60	4.00	5.50	7.00	9.00	11.00	13.00	16.00	23.00	31.00	49.00	69.00	90.00
1600	0.19	0.20	0.21	0.23	0.30	0.46	0.66	1.20	2.20	2.60	4.00	5.50	7.00	9.00	11.00	14.00	16.00	24.00	32.00	51.00	71.00	93.00
1700	0.19	0.21	0.22	0.23	0.30	0.47	0.67	1.20	2.20	2.80	4.00	5.50	7.00	9.00	12.00	14.00	17.00	24.00	33.00	52.00	73.00	95.00
2000	0.20	0.22	0.23	0.24	0.32	0.49	0.71	1.40	2.40	3.00	4.50	6.00	8.00	10.00	13.00	15.00	18.00	26.00	36.00	57.00	80.00	104.00

CONTOUR LIMITS – 2 percent 400 feet, 8 percent 200 feet, 10 percent 100 feet, 14-24 percent 60 feet. The effectiveness of contouring beyond these limits is speculative. When the length of slope exceeds 400 feet and (or) percent of slope exceeds 24 percent, soil loss estimates are speculative as these values are beyond the range of research data.

Table 2 – Monthly and Annual RKCP Values for Estimating Soil Losses on Bare Soil, Straw Mulched Areas with no Seeding, Permanent Sod, and on Areas Covered with Annual Weeds.

	Bare	Straw Mulched (Without Seeding)					Permanent Meadow or Sod			[3] Weeds This Stand	[3] Weeds Thick Stand
		Rate In Tons					[2] Good	Fair	Poor		
		.50	1.00	1.50	2.00	3.00					
JAN	1.28	.45	.23	.13	.08	.04	.01	.13	.26	.46	.20
FEB	1.28	.45	.23	.13	.08	.04	.01	.13	.26	.46	.20
MAR	2.56	.90	.46	.26	.15	.08	.03	.26	.51	.92	.40
APR	3.84	1.34	.69	.38	.23	.12	.04	.38	.77	1.38	.61
MAY	6.40	2.24	1.15	.64	.38	.19	.06	.64	1.28	2.30	1.02
JUN	12.80	4.48	2.30	1.28	.77	.38	.13	1.28	2.56	4.61	2.05
JUL	12.80	4.48	2.30	1.28	.77	.38	.13	1.28	2.56	4.61	2.05
AUG	8.96	3.13	1.61	.90	.54	.27	.09	.90	1.79	3.23	1.43
SEP	6.40	2.24	1.15	.64	.38	.19	.06	.64	1.28	2.30	1.02
OCT	3.84	1.34	.69	.38	.23	.12	.04	.38	.77	1.38	.61
NOV	2.56	.90	.46	.26	.15	.08	.03	.26	.51	.92	.41
DEC	1.28	.45	.23	.13	.08	.04	.01	.13	.26	.46	.20
[1]ANNUAL	64.00	22.40	11.50	6.40	3.80	1.9	.64	6.40	12.80	23.00	10.20

1. Total for 12 consecutive month period.

2. Good Sod – Greater than 80% ground cover or 2,000 lbs. air dry annual production.
   Fair Sod – 40 – 80% ground cover or 1,000 lbs. air dry annual production.
   Poor Sod – 20 – 40% ground cover or 500 lbs. air dry annual production.

3. Thin Stand of Weeds – 25% canopy of tall weeds or 10% of soil surface covered with short broadleaf herbaceous plants. Use on eroded or excavated sites.

   Thick Stand of Weeds – 50% canopy of tall weeds and 20% of soil surface covered with short herbaceous plants. Use on uneroded productive sites.

Note: "C" factors in tables 2b and 2c of Estimating Soil Loss Resulting From Water and Wind Erosion in the Midwest, USDA-SCS, Midwest TSC, Lincoln, Nebraska, July, 1973, may also be used. To obtain annual RKCP values, multiply "C" values in tables 2b and 2c by 64. To obtain RKCP values for specific month(s), multiply "C" values by the appropriate monthly values for Bare Soil in the above table by 2. The monthly values in this table are not accumulative. To compute an RKCP value for a time period of two or more months, the RKCP for each individual month involved must be added together.

[1] Tables 3 – Accumulative RKCP Values for Estimating Monthly and Portions of Annual Soil Losses for Seeding Permanent or temporary Cover Without Mulch on Bare Soil or with 0.5 Tons, 1.0 Tons, 1.5 Tons, and 2.0 Tons of Straw Mulch in Kansas City Urbanizing Areas.

Table 3-a – Seeding Without Mulch on Bare Soil

Date of Seeding (1st of Month)	*Ending Date (Last day of month)*											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
JAN	1.3	2.6	5.1	8.7	12.2	16.1	17.9	18.6	18.8	18.8	18.8	18.8
FEB	17.6	1.3	3.8	7.4	10.9	14.7	16.7	17.3	17.5	17.5	17.5	17.6
MAR	16.3	16.3	2.6	6.1	9.6	13.5	15.4	16.0	16.2	16.2	16.3	16.3
APR	13.8	13.8	13.8	3.5	7.1	10.9	12.8	13.4	13.6	13.7	13.8	13.8
MAY	18.7	18.7	18.8	18.8	5.9	12.9	16.8	18.1	18.6	18.7	18.7	18.7
JUN	23.4	23.4	23.5	23.5	23.6	11.8	18.8	22.0	22.9	23.2	23.3	23.3
JUL	22.9	23.0	23.1	23.3	23.3	23.5	11.8	18.4	21.9	22.5	22.7	22.8
AUG	15.9	16.0	16.4	16.7	16.9	17.3	17.4	8.2	13.0	15.1	15.5	15.7
SEP	9.5	9.9	10.7	11.3	11.7	12.1	12.2	12.3	5.9	8.0	8.8	9.2
OCT	6.8	7.5	8.9	10.1	11.0	11.9	12.3	12.4	12.5	3.5	5.4	6.1
NOV	4.7	5.9	8.3	11.1	14.6	16.5	17.4	17.7	17.8	17.8	2.4	3.5
DEC	2.6	3.8	6.4	9.9	13.5	17.3	19.2	19.8	20.0	20.1	20.1	1.3

Table 3-b – Seeding With 0.5 Ton of Straw Mulch

Date of Seeding (1st of Month)	*Ending Date (Last day of month)*											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
JAN	.45	.90	1.80	3.14	5.38	9.22	11.14	11.77	11.96	12.00	12.03	12.04
FEB	11.60	.45	1.35	2.69	4.93	8.77	10.69	11.32	11.51	11.55	11.58	11.39
MAR	11.15	11.16	.90	2.24	4.48	8.32	10.24	10.87	11.06	11.10	11.13	11.14
APR	10.33	10.34	10.37	1.34	3.58	7.42	9.34	9.97	10.16	10.28	10.31	10.32
MAY	12.52	12.53	12.56	12.60	2.24	6.72	10.56	11.90	12.35	12.47	12.50	12.51
JUN	13.49	13.53	13.61	13.65	13.71	4.48	8.96	12.10	13.06	13.33	13.42	13.45
JUL	10.80	10.89	10.07	11.19	11.23	11.38	4.48	7.62	9.86	10.44	10.62	10.71
AUG	7.48	7.67	8.05	8.32	8.51	8.89	9.02	3.14	5.38	6.72	7.10	7.29
SEP	5.11	5.49	6.26	6.84	7.29	7.67	7.80	7.89	2.24	3.58	4.35	4.73
OCT	3.14	3.59	4.49	5.64	6.60	7.50	7.88	7.97	8.03	1.34	2.24	2.69
NOV	1.80	2.25	3.15	4.49	6.73	8.65	9.55	9.82	9.88	9.92	.90	1.35
DEC	.90	1.35	2.25	3.59	5.83	9.67	11.59	12.22	12.41	12.45	12.48	.45

Table 3-c – Seeding With 1.0 Ton of Straw Mulch

Date of Seeding (1st of Month)	*Ending Date (Last day of month)*											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
JAN	.23	.46	.92	1.61	2.76	5.06	6.98	7.61	7.80	7.84	7.87	7.88
FEB	7.66	.23	.69	1.38	2.53	4.83	6.75	7.38	7.57	7.61	7.64	7.65
MAR	7.43	7.44	.46	1.15	2.30	4.60	6.52	7.15	7.34	7.38	7.41	7.42
APR	7.05	7.06	7.09	.69	1.84	4.14	6.06	6.69	6.88	7.00	7.03	7.04
MAY	7.71	7.72	7.75	7.79	1.15	3.45	5.75	7.09	7.54	7.66	7.69	7.70
JUN	7.60	7.64	7.72	7.76	7.82	2.30	4.60	6.21	7.17	7.44	7.52	7.56
JUL	6.00	6.09	6.27	6.39	6.45	6.58	2.30	3.91	5.06	5.64	5.82	5.91
AUG	4.21	4.40	4.78	5.05	5.24	5.62	5.75	1.61	2.76	3.45	3.83	4.02
SEP	2.76	2.99	3.45	4.03	4.48	4.86	4.99	5.08	1.15	1.84	2.30	2.53
OCT	1.61	1.84	2.30	2.99	3.95	4.85	5.23	5.32	5.38	.69	1.15	1.38
NOV	.92	1.15	1.61	2.30	3.45	5.37	6.27	6.54	6.60	6.64	.46	.69
DEC	.46	.69	1.15	1.84	2.99	5.29	7.21	7.84	8.03	8.07	8.10	.23

Table 3-d – Seeding With 1.5 Ton of Straw Mulch

Date of Seeding (*1st of Month*)	*Ending Date (Last day of month)*											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
JAN	.13	.26	.52	.90	1.54	2.82	4.10	4.73	4.92	4.96	4.99	5.00
FEB	4.88	.13	.39	.77	1.41	2.69	3.97	4.60	4.79	4.83	4.86	4.87
MAR	4.75	4.76	.26	.64	1.28	2.56	3.84	4.47	4.66	4.70	4.73	4.74
APR	4.57	4.58	4.61	.38	1.02	2.30	3.58	4.21	4.40	4.52	4.55	4.56
MAY	4.72	4.73	4.76	4.80	.64	1.92	3.20	4.10	4.55	4.67	4.70	4.71
JUN	4.53	4.57	4.65	4.69	4.75	1.28	2.56	3.46	4.10	4.37	4.45	4.49
JUL	3.56	3.65	3.83	3.95	4.01	4.14	1.28	2.18	2.82	3.20	3.38	3.47
AUG	2.44	2.57	2.83	3.10	3.29	3.67	3.80	.90	1.54	1.92	2.18	2.31
SEP	1.54	1.67	1.93	2.31	2.76	3.14	3.27	3.36	.64	1.02	1.28	1.41
OCT	.90	1.03	1.29	1.67	2.31	3.21	3.59	3.68	3.74	.38	.64	.77
NOV	.52	.65	.91	1.29	1.93	3.21	4.11	4.38	4.44	4.48	.26	.39
DEC	.26	.39	.65	1.03	1.67	2.95	4.23	4.86	5.05	5.09	5.12	.13

Table 3-e – Seeding With 2.0 Ton of Straw Mulch

Date of Seeding (1st of Month)	*Ending Date (Last day of month)*											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
JAN	.08	.16	.31	.54	.92	1.69	2.46	3.00	3.19	3.23	3.26	3.27
FEB	3.20	.08	.23	.46	.84	1.61	2.38	2.92	3.11	3.15	3.18	3.19
MAR	3.12	3.13	.15	.38	.76	1.53	2.30	2.84	3.03	3.07	3.10	3.11
APR	3.05	3.06	3.09	.23	.61	1.38	2.15	2.69	2.83	3.00	3.03	3.04
MAY	3.01	3.02	3.05	3.09	.38	1.15	1.92	2.46	2.84	2.96	2.99	3.00
JUN	2.66	2.70	2.78	2.82	2.88	.77	1.54	2.08	2.46	2.58	2.61	2.62
JUL	2.23	2.31	2.46	2.58	2.64	2.77	.77	1.31	1.69	1.92	2.07	2.15
AUG	1.46	1.54	1.69	1.92	2.11	2.49	2.62	.54	.92	1.15	1.30	1.33
SEP	.92	1.00	1.15	1.38	1.76	2.14	2.27	2.36	.38	.61	.76	.84
OCT	.54	.62	.77	1.00	1.38	2.15	2.53	2.62	2.68	.23	.38	.46
NOV	.31	.39	.54	.77	1.15	1.92	2.69	2.96	3.02	3.06	.15	.23
DEC	.16	.24	.39	.62	1.00	1.77	2.54	3.08	3.27	3.31	3.34	.08

[1]To determine RKCP for any time period not in excess of 1 year, find month of seeding in left vertical column (use month in which first day is nearest seeding date) and read across to appropriate ending month.

Example: To find RKCP value for the first six months of a temporary seeding made on September 1 on bare soil, read down left column of Table 3a to September and across to February. RKCP for that six months is 9.90.

To find RKCP value for the first year of a new seeding completed on may 1 with 2.0 tons of mulch, read down left column of Table 3e to May and across to April (12 month period). RKCP for first year of establishment is 3.09.

Table 4 – Sediment Yield Factor, Y
(Estimated Percent of Soil Loss from
Sheet and Rill Erosion Leaving the Site)

Drainage Area Acres	**Sediment Yield Factor Y**
0—1	1.00
1—5	.70
5—15	.60
15—60	.50
60—250	.40
greater than 250	.30