APPENDIX A
REVISED UNIVERSAL SOIL LOSS EQUATION (RUSLE)

CONTENTS

Section prepared by:

Frederick B. Gaffney, Former Conservation Agronomist
USDA—Natural Resources Conservation Service,
Syracuse, New York

and

Donald W. Lake Jr., P.E., CPESC, CPSWQ
Former Engineering Specialist
New York State Soil & Water Conservation Committee

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REVISED UNIVERSAL SOIL LOSS EQUATION (RUSLE)

Introduction

The science of predicting soil erosion and sediment delivery has continued to be refined to reflect the importance of different factors on soil erosion and runoff. The Revised Universal Soil Loss Equation (RUSLE) has improved the effects of soil roughness and the effects of local weather on the prediction of soil loss and sediment delivery.

The importance of estimating erosion and sediment delivery has long been recognized to minimize pollution by sediments and the chemicals carried by soil particles. The visual effects of erosion include rills and gullies along with sediment blockages found in culverts or drainage ditches. A well planned, engineered and implemented erosion control and/or water management plan will alleviate many concerns about construction site erosion and potential pollution.

Why use RUSLE?

RUSLE is a science-based tool that has been improved over the last several years. RUSLE is a computation method which may be used for site evaluation and planning purposes and to aid in the decision process of selecting erosion control measures. It provides an estimate of the severity of erosion. It will also provide quantifiable results to substantiate the benefits of planned erosion control measures, such as the advantage of adding a diversion ditch or mulch. For example, a diversion may shorten the length of slope used in calculating a LS factor. Also, the application of mulch will break raindrop impact and reduce runoff (See discussion of L,S and C factors).

This section provides a method to calculate soil loss. Following the step-by-step procedure will provide estimated erosion in 'tons per acre per year', which can be converted to the more usable measurement, cubic yards of soil.

Other erosion prediction methods such as computer models are also available. Examples are the USDA-NRCS RUSLE 2 at **http://fargo.nserl.purdue.edu/rusle2_dataweb/RUSLE2_Index.htm** and USDA-ARS Water Erosion Prediction Project (WEPP) at **http://www.ars.usda.gov/News/docs.htm?docid=10621**.

Soil Erosion Estimates Using Revised Universal Soil Loss Equation For Sheet and Rill Erosion

As mentioned above, soil losses on construction sites can be predicted by using the Revised Universal Soil Loss Equation (RUSLE). The equation is as follows:
A = RK(LS) for bare ground conditions of graded areas of construction sites. Referring to the examples above, the benefit of mulch can be predicted by multiplying the above by an appropriate cover or C-value. The benefit of a diversion ditch can be illustrated by comparing the original LS with the shorter slope length LS created when adding this practice.

Equation: A=RK(LS)C P Where:

A is the computed soil loss per acre per year in units of tons. This quantity may be converted to cubic yards by using conversion factors shown in Table A.3.

R is the rainfall value reflecting the energy factor multiplied by the intensity factor. The R-values for each county are provided in Figure A.3. EI is the abbreviation for energy and intensity and is called the Erosion Index. The energy component is related to the size of the raindrops while the intensity is the maximum intensity for a 30-minute interval and is measured in inches per hour. EI is frequently illustrated in graphs by showing the percent of EI that occurs within a period of days or months. From the index, one can determine the period when the most intense storms are likely to occur. See Figure A.1 and A.2.

K is the soil erodibility factor. The value for the subsoil condition, usually encountered in construction sites, can be determined based on soil texture (relative percent of sand, silt, and clay) or from most county soil surveys, found in the table providing Physical and Chemical Properties of Soils. However, K values for subsoils are not always available. If the soil survey does not list a subsoil K for the soil series encountered, use the surface K value unless there is an obvious change from sand or gravel to silt or clay. Contact the local SWCD or NRCS office for an appropriate K value when in question. Approximated K values for some representative soils on construction sites in NY can be found in Table A.1. The most current K values for all New York soils are contained in the USDA-NRCS soil database on their website at: **http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx**.

L is the horizontal length of slope measured in feet. It is the point of origin where water will begin flowing down the slope to the point where concentrated flow begins, such as where water flows into a ditch, or deposition occurs and water disperses. S is the slope gradient. Slopes may be uniform, concave (flattening toward the lower end) or convex (steepening toward the lower end). Table A.2 assumes a uniform slope. If the slope is concave, the LS factor will be slightly lower. If convex, then the LS will be slightly higher. These factors are interrelated and the LS factor can be obtained from Table A.2. This LS table is specific for construction sites with little or no cover.

C is the factor to reflect the planned cover over the soil surface. Most construction sites are void of vegetation and therefore would have a value of one (1). On construction sites where mulch or fabrics are used, the benefit derived from intercepting the erosive raindrop impact on the soil surface is calculated. For example, the value of two tons of straw uniformly covering a slope results in a C-value of 0.1. (see Tables A.5-A.7 at back of this section) Therefore, mulching can substantially reduce the predicted soil loss.

P is the factor that represents management operations and support practices on a construction site. Table A.8 lists P factors for surface conditions on construction sites in relation to bare soils.

Step-by-Step, How to Use RUSLE

1. Determine the County. Use Figure A.3 to determine the R-value.
2. Determine the soil erodibility factor based on the soil series or the texture. Determine the appropriate K-value for subsoil by using the estimated K values shown in Table A.1. Updated K values can be found using web soil survey or by contacting your local NRCS office.
3. Measure the horizontal length (plan view) of slope (in feet) from the top of the slope to the bottom. The bottom is either a ditch bank (concentration of water) or flatter slope where deposition occurs and water disperses (actual field measurement).
4. Determine the percent slope (actual topographic measurement).
5. Look up LS value in Table A.2. Interpolate if necessary to use the measured length and percent slope obtained by field measurement.
6. Determine the Cover (C) factor—Most construction sites are void of vegetation and therefore would have a value of one (1). For values of other cover conditions contact your local SWCD or NRCS office.
7. Multiply the R*K*(LS) to obtain soil loss in tons/acre/ year.
8. Convert to cubic yards if desired. Refer to the conversion factors based on soil texture (Table A.3).
9. Review the examples that follow for specific field conditions where RUSLE may be useful.

Examples

The following are examples showing how the Revised Universal Soil Loss Equation is used for estimating soil losses:

Assume Cortland, New York, as the locale of a construction site. The disturbed site is 50 acres in size, with an average gradient of 8% and an average slope length of 500 feet. The soil is a Schoharie silt loam with a K value of 0.49 in both the B and C horizons (The K value is obtained from Table A.1). The LS value is 3.11 and is obtained from Table A.2.

1. Compute soil losses from this unprotected surface for a 12 month period. The average annual rainfall erosion index (R) is 80.

   R = 80 C = 1
   K = 0.49
   LS = 3.11 (Interpolate between 400’ and 600’ at 8%)

   A = RK(LS)C = 122 T/ac/yr

   50 ac x 122 Tons/ac/yr = 6100 Tons/yr

   Convert to cu yds: 6100 T/yr x 0.87 cu yds /Y = 5307 cu yds/yr

   (0.87 cu yds/T is obtained from Table A.3, silt loam)

2. Compute soil losses from this unprotected surface for a 3 month period (June, July, August). This EI value is obtained as follows: Refer to the erosion index distribution curve applicable to Cortland, New York, Figure A.1. The EI reading for June 1 is 17% and for September 1 is 76%. The percent of average annual index for this period is 76% - 17% or 59%. Since the annual erosion index for this location is 80, the EI value for the 3 month period is 59% of 80 or 47.2.

R = 80	C = 1
K = 0.49	LS = 3.11
Annual EI (R) = 80	3 month EI = 47.2

   A = (EI)K(LS)C = 72 Tons/ac/3 mo.

   50 ac x 72 Tons/ac/3 mo. = 3600 Tons/3 mo.

   Convert to cu yds: 0.87 cu yds/Tons x 3600 Tons/3 mo. = 3132 cu yds/3 mo

3. Compute soil losses for the 1 year out of 5 when the rainfall intensity (R) will increase from the normal average annual value of 80 to an annual value of 129 (the latter value is from Table A.4).

R = 129 (Change R from 80 to 129)	K = 0.49
LS = 3.11	C = 1

   A = RK(LS)C

   A = 129 x 0.49 x 3.11 = 197 Tons/ac/yr

   50ac x 197 Tons/ac/yr = 9850 Tons/yr

   Convert to cu yds = 0.87 cu yds/Tons x 9850 Tons/yr = 8570 cu yds/yr

Examples (continued)

4. Compute soil losses for the 1 year out of 20 when the rainfall intensity (R) will increase from the average annual R of 80 to an R of 197 (the latter value is from Table A.4).

   R = 197   (Change R from 80 to 197)
   K = 0.49
   LS = 3.11   C = 1

   A = RK(LS)C = 300 Tons/ac/yr

   50 ac x 300 Tons/ac/yr = 15,000 Tons/yr

   Convert to cu yds = 0.87 cu yds/Tons x 15,000 Tons/yr =13,050 cu yds/yr

5. Compute soil losses from the expected magnitude of a single storm that may occur once in 5 years. Looking at Table A.4, the expected magnitude, or EI value, is 38.

   EI (R) = 38   C = 1
   K = 0.49
   LS = 3.11

   A = (EI)K(LS)C = 38 x 0.49 x 3.11 = 58 Tons/ac/yr

   50 ac x 58 Tons/ac/yr = 2900 Tons/yr

   Convert to cu yds = 0.87 cu yds/Tons x 1650 Tons/yr = 2523 cu yds/yr

6. Compute soil losses from the expected magnitude of a single storm that may occur once in 10 years. The EI value of this storm is 51. (Obtained from Table A.4.)

   EI (R) = 51   C = 1
   K = 0.49
   LS = 3.11

   A = (EI)K(LS)C = 78 Tons/ac/yr

   50 ac x 78 Tons/ac/yr = 3900 Tons/yr

   Convert to cu yds = 0.87 cu yds/Tons x 3900 Tons/yr = 3393 cu yds/yr

7. Compute soil losses from the expected magnitude of a single storm that may occur once in 20 years. The EI value of this storm is 65. (Obtained from Table A.4.)

   EI (R) = 65   C = 1
   K = 0.49
   LS = 3.11

   A = (EI)K(LS)C = 99 Tons/ac/yr

   50 ac x 99 Tons/ac/yr = 4950 Tons/yr

   Convert to cu yds = 0.87 cu yds x 4950 Tons/yr = 4307 cu yds/yr

Sediment Yield—MUSLE

The Modified Universal Soil Loss Equation (MUSLE), developed by Williams and Berndt, 1976, can be used to calculate sediment yields from drainage basins to specific locations for selected storm events.

The formula is given as:

$T = 95(V \times Qp)^{0.56} \times K \times LS \times C \times P$

Where:

T = sediment yield per storm event in tons
V = volume of runoff per storm event in acre-feet
Qp = peak flow per storm event in cubic feet per second
K, LS, C, and P are RUSLE factors

Values for V and Qp are determined from the sites drainage analysis.

Example

Compute the sediment yield volume to a basin from a drainage area of 10 acres under construction (all disturbed) for a 2 inch rainfall.

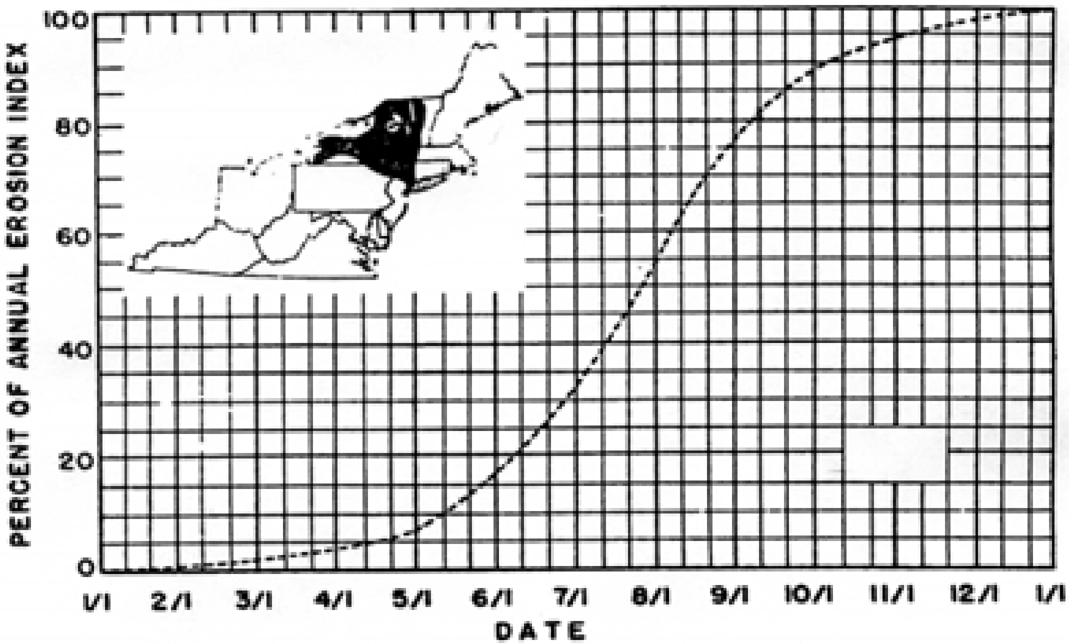
The soil (sandy loam) K = 0.43, LS = 2.34, the volume of runoff is 1.5 acre-feet and the peak discharge for the storm is 5 cubic feet per second.

$T = 95(1.5x5)^{0.56}(0.43)(2.34)(1)(1)$

T = 295.4 tons

295.4 tons x 0.70 cy/ton = 206.99 cubic yards

Figure A.1 (USDA - NRCS)
Monthly Percent of Annual Erosion Index—New York



New York State except Long Island

Figure A.2 (USDA - NRCS)
Monthly Percent of Annual Erosion Index—Long Island

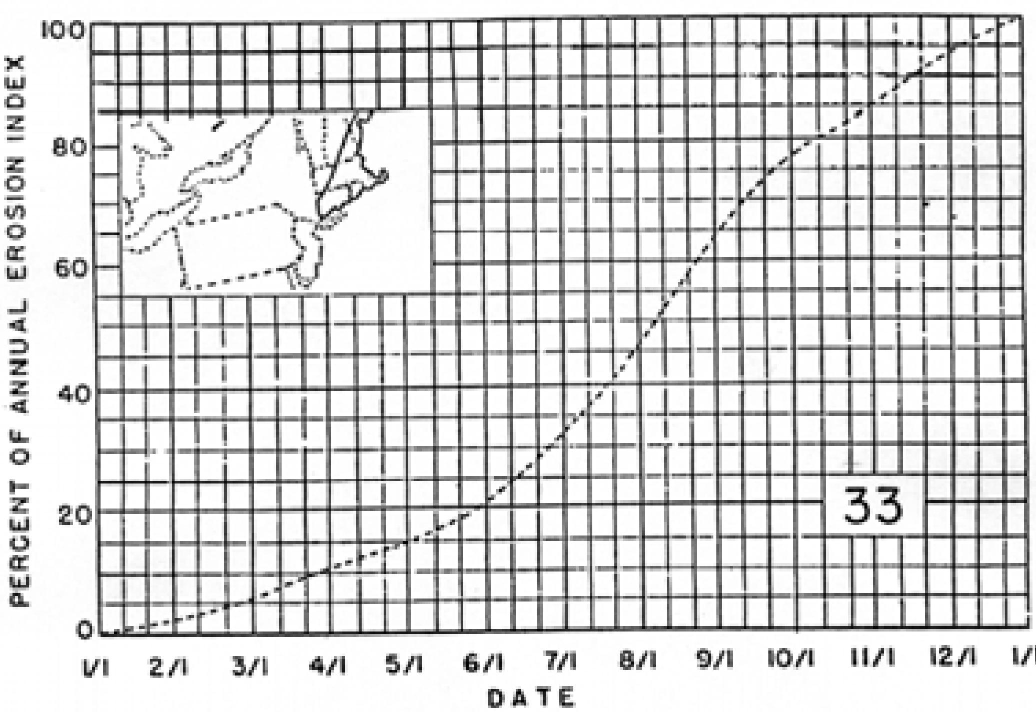


Figure A.3
Average Annual Rainfall - Runoff Erosivity Factor ®
For the Northeast

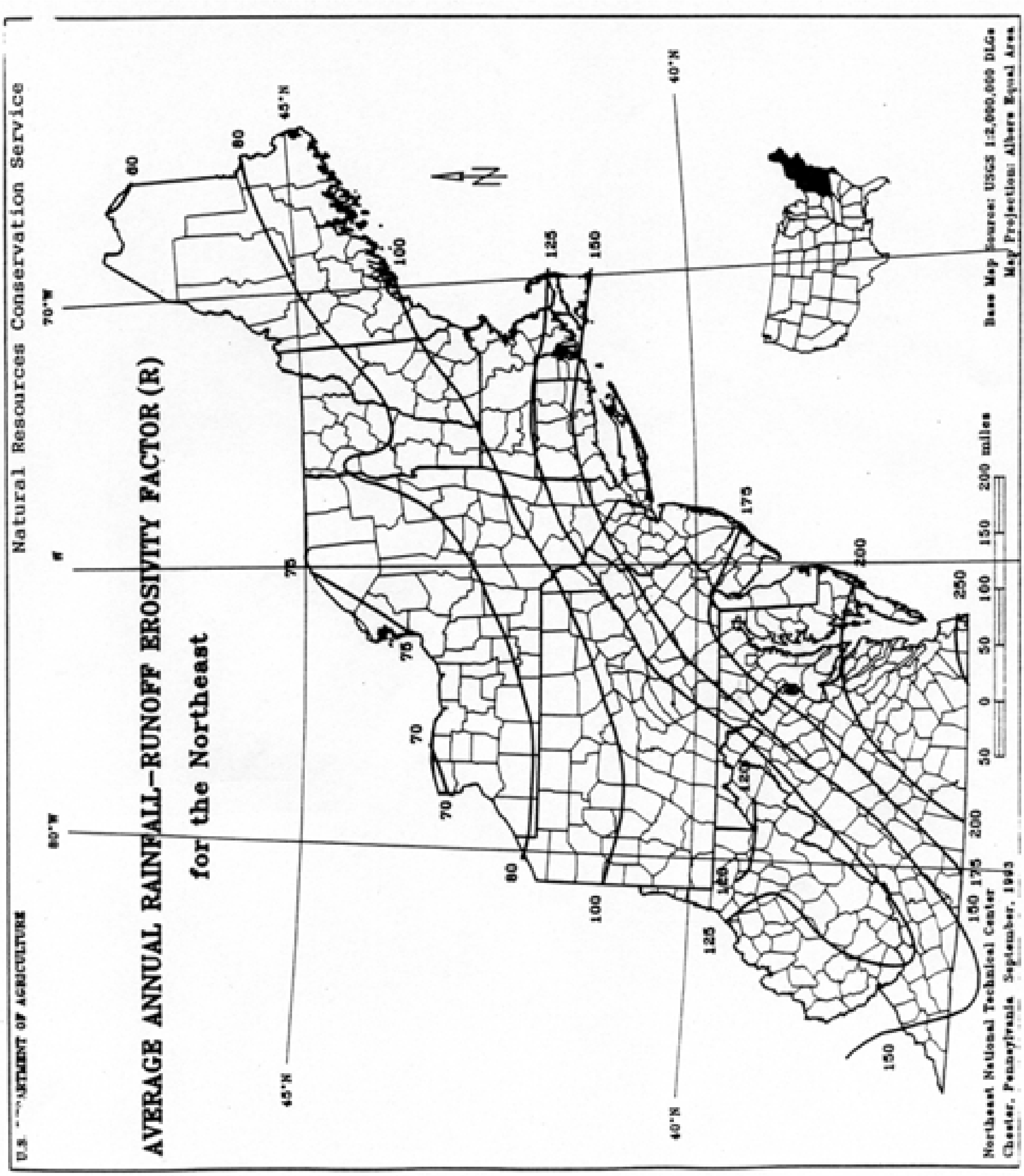


Table A.1
Approximated K Values for Some Representative Soils on Construction Sites in New York

(These K values and K values for soils not shown in these tables should be verified at the USDA-NRCS website, **http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx**.)

Depositional Unit Family Texture Class and Representative Series	Hoizon[1]	Texture[2] Class	Erosion Potential	Construction Site K Values
I. Glacial Till				
SANDY SKELETAL				
Glouster	A	sl	Low	.17
	B&C	vglcs	Low	
SANDY w/PAN				
Essex	A	sl	Low	20
	B	gls	Low	
	Cx	glcs	Low	
COURSE LOAMY w/PAN				
Empeyville	A	stl	Medium	.17
	B	stsl	Medium	
	Bx C	vstsl vstsl	Low Low	
Mardin	A	ch sil	Low	.28
	B	ch sil-1	Medium	
	Bx & C	v ch 1	Medium	
Paxton	A	fsl	Medium	.24
	B	gfsl	Medium	
	Cx	gfsl	High	
Crary	A	sil	Medium	.43
	B	vfsl	High	
	IIBx, Cx, C	st fsl	Medium	
COARSE LOAMY w/Bt				
Madrid	A	fsl	Medium	28
	Bt	gfsl	Medium	
	C	gfsl	Medium	
COARSE LOAM, 20 TO 40" over BEDROCK				
Lordstown	A	ch sil	Low	.43
	B	ch sil	High	
	C	v ch 1	Low	
	R		Siltstone or sandstone bedrock 20—40" below surface	

Table A.1 (cont'd)
Approximated K Values for Some Representative Soils on Construction Sites in New York

(These K values and K values for soils not shown in these tables should be verified at the USDA-NRCS website, http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx.)

Depositional Unit Family Texture Class and Representative Series	Hoizon[1]	Texture[2] Class	Erosion Potential	Construction Site K Values
FINE LOAMY w/Bt				
Ontario	A	l	Medium	.28
	Bt	gl	Medium	
	C	gl	Medium	
Cazenovia	A	sil	High	.43
	Bt	sicl	High	
	C	gsil	Medium	
Nunda	Ap	ch sil	High	.49
	B2	ch sil	High	
	IIB2t	gcl	Medium	
	IIC	gl	Medium	
FINE				
Hornell	A	sil	Medium	.43
	B	sic	High	
	C	sh sic	Medium	
	R		Shale bedrock 20—40" below surface	
Remsen	A	sicl	High	.43
	Bt	c	Medium	
	C	c	High	
Churchville	A	sil	High	.49
	Bt	sic	Medium	
	IIC	gl	Medium	
COARSE LOAMY, NO PAN				
Charlton	A	fsl	Low	.43
	B	fsl	High	
	C	gfsl	Medium	
Nellis	A	l	Medium	.43
	B	l	High	
	C	gl	Medium	

Table A.1 (cont'd)
Approximated K Values for Some Representative Soils on Construction Sites in New York

(These K values and K values for soils not shown in these tables should be verified at the USDA-NRCS website, http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx.)

Depositional Unit Family Texture Class and Representative Series	Hoizon[1]	Texture[2] Class	Erosion Potential	Construction Site K Values
COARSE LOAMY, NO PAN (Cont'd)				
Pittsfield	A	l	Medium	.43
	B	gfsl	Low	
	C	gfsl	High	
COARSE LOAMY/SAND or SANDY SKELETAL				
Canton	A	fsl	Medium	.64
	B	fsl	Very High	
	IIC	vgls	Low	
COARSE SILTY w/PAN				
Canaseraga	A	sil	High	.49
	B	sil	Very High	
	IIBx & C	ch	High	
LOAMY SKELETAL				
Manlius	A	ch sil	Medium	.28
	B	vsh sil	Low	
	C	fract'd shales w/ silty fines	Low	
	R		Shale bedrock 20-40" below surface	
FINE LOAMY w/PAN				
Volusia	A	ch sil	Low	.43
	Bx	ch sil	High	
	C	vch l	Medium	
FINE LOAMY, NO PAN				
Kendaia	A	sil	Medium	.28
	B	gsil	Medium	
	C	gl	Medium	

Table A.1 (cont'd)
Approximated K Values for Some Representative Soils on Construction Sites in New York

(These K values and K values for soils not shown in these tables should be verified at the USDA-NRCS website, http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx.)

Depositional Unit Family Texture Class and Representative Series	Hoizon[1]	Texture[2] Class	Erosion Potential	Construction Site K Values
II. Glacial Outwash and Water Worked Morainic Deposits				
SANDY SKELETAL				
Hinckley	A	gls	Low	.17
	B	gls	Low	
	C	gls	Low	
SANDY				
Colonie	A	lfs	Medium	.24
	B	fs	Low	
	C	fs	Low	
LOAMY SKELETAL				
Chenango	A	gl	Low	.24
	B	vgl	Low	
	C	gls	Low	
FINE LOAMY/SANDY or SANDY SKELETAL				
Palmyra	A	gl	Medium	.28
	B	gl	Low	
	IIC	g & s	Low	
LOAMY SKELETAL/CLAYEY				
Varysburg	A	gl	Low	.28
	B2t	vgl	Low	
	IIB2t	sic	Medium	
	IIC	layered sic, sil sicl	High	
COARSE LOAMY				
Riverhead	A	sl	Low	.17
	B	sl	Low	
	C	s w/ thin layers of g	Low	

Table A.1 (cont'd)
Approximated K Values for Some Representative Soils on Construction Sites in New York

(These K values and K values for soils not shown in these tables should be verified at the USDA-NRCS website, http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx.)

Depositional Unit Family Texture Class and Representative Series	Hoizon[1]	Texture[2] Class	Erosion Potential	Construction Site K Values
II. Glacial Outwash and Water Worked Morainic Deposits (Cont'd)				
COARSE LOAMY/SANDY or SANDY SKELETAL				
Haven	A	l	High	.43
	B	l	High	
	IIC	gs	Low	
III. Lacustrine or Stream Terrace Deposits				
COARSE SILTY				
Unadilla	A	sil	High	.64
	B	sil	Very High	
	C	sil	Very High	
COARSE SILTY w/FRAGIPAN				
Williamson	A	sil	High	.64
	Bx	sil	Very High	
	C	sil	Very High	
COARSE SILTY/SANDY or SANDY SKELETAL				
Allard	A	sil	High	.64
	B	sil	Very High	
	IIC	vgls	Low	
FINE SILTY w/Bt				
Collamer	A	sil	High	.64
	Bt	sil	High	
	C	Layers of sl, vfs	Very High	
FINE				
Schoharie	A	sicl	High	.49
	Bt	sic	Medium	
	C	sic	High	

Table A.1 (cont'd)
Approximated K Values for Some Representative Soils on Construction Sites in New York

(These K values and K values for soils not shown in these tables should be verified at the USDA-NRCS website, http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx.)

Depositional Unit Family Texture Class and Representative Series	Hoizon[1]	Texture[2] Class	Erosion Potential	Construction Site K Values
III. Lacustrine or Stream Terrace Deposits (Con't)				
VERY FINE				
Vergennes	A	c	High	.49
	Bt	c	Low	
	C	c	Low	
SANDY o/CLAYEY				
Claverack	A	lfs	Medium	.43
	B	lfs	Low	
	IIC	sic	High	
	R			
COARSE LOAMY o/CLAYEY				
Elmwood	A	fsl	Medium	.43
	B	sl	Low	
	C	sicl	High	

1 The thickest B and C horizons in the official series were used in making the K value determinations.

2 Soil texture class abbreviations:

Gravel……………….……..g	Fine sandy loam……….fsl	Sandy clay loam………..…..scl
Very coarse sand……….…..vcos	Very fine sandy loam….vfsl	Stoney clay loam………..…..stcl
Coarse sand…………….…..cos	Gravelly sandy loam…..gs	Silty clay…………………..…sic
Sand………………………..…..s	Loam…………………..g	Clay………………………..…c
Fine sand…………………..…fs	Gravelly loam…………gl	Channery……………………ch
Very fine sand……………...vfs	Stoney loam………..….stl	Shaly…………………………sh
Loamy coarse sand..……….lcos	Silt……………………..si	Very channery………………..vch
Loamy sand………………..ls	Silt loam……………….sil	Very shaly……………………vsh
Loamy fine sand………..…lfs	Clay loam……………...cl	Sandy loam…………………..sl
Silty clay loam…………….…sisl		

Table A.2 (USDA - NRCS)
Values for Topographic Factor, LS, for High Ratio of Rill to Interrill Erosion[1]

Values for topographic factor, LS, for high ratio of rill to interrill erosion.[1]

Slope (%)	Horizontal slope length (ft) <3	6	9	12	15	25	50	75	100	150	200	250	300	400	600	800	1000
0.2	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06
0.5	0.07	0.07	0.07	0.07	0.07	0.07	0.08	0.08	0.09	0.09	0.10	0.10	0.10	0.11	0.12	0.12	0.13
1.0	0.09	0.09	0.09	0.09	0.09	0.10	0.13	0.14	0.15	0.17	0.18	0.19	0.20	0.22	0.24	0.26	0.27
2.0	0.13	0.13	0.13	0.13	0.13	0.16	0.21	0.25	0.28	0.33	0.37	0.40	0.43	0.48	0.56	0.63	0.69
3.0	0.17	0.17	0.17	0.17	0.17	0.21	0.30	0.36	0.41	0.50	0.57	0.64	0.69	0.80	0.96	1.10	1.23
4.0	0.20	0.20	0.20	0.20	0.20	0.26	0.38	0.47	0.55	0.68	0.79	0.89	0.98	1.14	1.42	1.65	1.86
5.0	0.23	0.23	0.23	0.23	0.23	0.31	0.46	0.58	0.68	0.86	1.02	1.16	1.28	1.51	1.91	2.25	2.55
6.0	0.26	0.26	0.26	0.26	0.26	0.36	0.54	0.69	0.82	1.05	1.25	1.43	1.60	1.90	2.43	2.89	3.30
8.0	0.32	0.32	0.32	0.32	0.32	0.45	0.70	0.91	1.10	1.43	1.72	1.99	2.24	2.70	3.52	4.24	4.91
10.0	0.35	0.37	0.38	0.39	0.40	0.57	0.91	1.20	1.46	1.92	2.34	2.72	3.09	3.75	4.95	6.03	7.02
12.0	0.36	0.41	0.45	0.47	0.49	0.71	1.15	1.54	1.88	2.51	3.07	3.60	4.09	5.01	6.67	8.17	9.57
14.0	0.38	0.45	0.51	0.55	0.58	0.85	1.40	1.87	2.31	3.09	3.81	4.48	5.11	6.30	8.45	10.40	12.23
16.0	0.39	0.49	0.56	0.62	0.67	0.98	1.64	2.21	2.73	3.68	4.56	5.37	6.15	7.60	10.26	12.69	14.96
20.0	0.41	0.56	0.67	0.76	0.84	1.24	2.10	2.86	3.57	4.85	6.04	7.16	8.23	10.24	13.94	17.35	20.57
25.0	0.45	0.64	0.80	0.93	1.04	1.56	2.67	3.67	4.59	6.30	7.88	9.38	10.81	13.53	18.57	23.24	27.66
30.0	0.48	0.72	0.91	1.08	1.24	1.86	3.22	4.44	5.58	7.70	9.67	11.55	13.35	16.77	23.14	29.07	34.71
40.0	0.53	0.85	1.13	1.37	1.59	2.41	4.24	5.89	7.44	10.35	13.07	15.67	18.17	22.95	31.89	40.29	48.29
50.0	0.58	0.97	1.31	1.62	1.91	2.91	5.16	7.20	9.13	12.75	16.16	19.42	22.57	28.60	39.95	50.63	60.84
60.0	0.63	1.07	1.47	1.84	2.19	3.36	5.97	8.37	10.63	14.89	18.92	22.78	26.51	33.67	47.18	59.93	72.15

[1]Such as for freshly prepared construction and other highly disturbed soil conditions with little or no cover (not applicable to thawing soil)

Table A.3 (USDA - NRCS)
Factors for Converting Soil Losses (Air-Dry) from Tons (T) to Cubic Yards (Cu. Yds.)

Sands, loamy sands	)
Sandy loam	) - Multiply soil losses in T by 0.70 (105)[1]
Fine sandy loam	)
Loams, sandy clay loams	)
Sandy clay	) - Multiply soil losses in T by 0.87 (85)
Silt loam	)
Silty clay loam, silty clay	)
Clay loam	) - Multiply soil losses in T by 1.06 (70)
Clay	)

[1]The number in parentheses is the air-dry weight of the soil in pounds per cubic foot. The conversion factors were calculated from these air-dry weights using: soil loss (tons) x (2000 lbs/ton) x (ft^3/dry density lbs) x (cubic yard/$27ft^3$).

Table A.4
El Values of Certain Key Cities in the New York Area[1]

Location[2]	EI Values at 20% and 5% Probability Levels Probability (EI)		Expected Magnitude of a Single Storm EI Value Normally Exceeded Once in—		
	20%*	5%**	5 Years	10 Years	20 Years
New York					
Albany	114	159	38	47	56
Binghamton	106	146	36	47	58
Buffalo	96	139	36	49	61
Geneva	106	152	—	—	—
Marcellus	112	167	38	49	62
Rochester	101	151	38	54	75
Salamanca	106	157	32	40	49
Syracuse	129	197	38	51	65
Pennsylvania					
Erie	181	331	—	—	—
Scranton	140	188	44	53	63
Vermont					
Burlington	114	178	35	47	58
Connecticut					
New Haven	222	310	73	96	122
New Jersey					
Atlantic City	229	311	77	97	117
Marlboro	254	343	85	111	136
Trenton	216	308	76	102	131

* Once each five years
** Once each twenty years
[1] From Agricultural Handbook No. 537
[2] For additional cities, refer to Agricultural Handbook 537, Tables 17 & 18.

Table A.5
Construction Site Mulching C Factors
(Data from Wischmeier and Smith 1978, Pitt 2004)

Type of Mulch	Mulch Rate (tons per acre)	Land Slope (%)	Mulching C Factor	Length Limit (ft)[1]
None	0	all	1.0	n/a
Straw or hay, tied down by anchoring and tacking equipment	1.0	1-5	0.20	200
	1.0	6-10	0.20	100
	1.5	1-5	0.12	300
	1.5	6-10	0.12	150
	2.0	1-5	0.06	400
	2.0	6-10	0.06	200
	2.0	11-15	0.07	150
	2.0	16-20	0.11	100
	2.0	21-25	0.14	75
	2.0	26-33	0.17	50
	2.0	34-50	0.20	35
Wood Chips	7	<16	0.08	75
	7	16-20	0.08	50
	12	<16	0.05	150
	12	16-20	0.05	100
	12	21-33	0.05	75
	25	<16	0.02	200
	25	16-20	0.02	150
	25	21-33	0.02	100
	25	34-50	0.02	75

[1] Maximum slope lengths for which the specified mulch rate is considered effective. If these limits are exceeded, either a higher application rate or mechanical shortening of the effective slope length is required (such as with terracing).

Table A.6
Cover Factor C Values for Different Growth Periods for Planted Cover Crops for Erosion Control at Construction Sites

(Data from Wischmeier and Smith 1978, Pitt 2004)

	SB (seedbed preparation)	**Period 1** (establishment)	**Period 2** (development)	**Period 3a** (maturing crop)	**Period 3b** (maturing crop)	**Period 3c** (maturing crop)
Crop Canopy [1]	0-10%	10-50%	50-75%	75-80%	80-90%	90-96%
Seeding on topsoil, without mulch	0.79	0.62	0.42	0.17	0.11	0.06
Seeding on a desurfaced area, where residual effects of prior vegetation are no longer significant	1.0	0.75	0.50	0.17	0.11	0.06
Sod	0.01	0.01	0.01	0.01	0.01	0.01

[1] Percent canopy cover is the percentage of the land surface that would not be hit by directly falling rain drops because the drops would be intercepted by the plant. It is the portion of the soil surface that would be covered by shadows if the sun were directly overhead.

Table A.7
Cover Factor C Values for Existing Established Plants

(data from NRCS NEH Chapter 3 and Wischmeier and Smith 1978)

			Percentage of surface covered by residue in contact with the soil					
	Percent Cover[1]	**Plant Type**	**0%**	**20**	**40**	**60**	**80**	**95+**
C factor for grass, grasslike plants, or decaying compacted plant litter	0	Grass	0.45	0.20	0.10	0.042	0.013	0.0003
C factor for broadleaf herbaceous plants (including most weeds with little lateral root networks), or undecayed residues	0	Weeds	0.45	0.24	0.15	0.091	0.043	0.011
Tall weeds or short brush with average drop height[2] of =20 inches	25	Grass	0.36	0.17	0.09	0.038	0.013	0.003
	25	Weeds	0.36	0.20	0.13	0.083	0.041	0.011
	50	Grass	0.26	0.13	0.07	0.035	0.012	0.003
	50	Weeds	0.26	0.16	0.11	0.076	0.039	0.011
	75	Grass	0.17	0.12	0.09	0.068	0.038	0.011
	75	Weeds	0.17	0.12	0.09	0.068	0.038	0.011
Mechanically prepared sites, with no live vegetation and no topsoil, and no litter mixed in.	0	None	0.94	0.44	0.30	0.20	0.10	Not given

[1] Percent cover is the portion of the total area surface that would be hidden from view by canopy if looking straight downward.
[2] Drop height is the average fall height of water drops falling from the canopy to the ground.

Table A.8 (USDA-NRCS)
Construction Site P Practice Factors

<table>
<tr><th colspan="2">Surface Condition</th><th>P Factor</th></tr>
<tr><td colspan="2">Bare Soil Loose</td><td>1.0</td></tr>
<tr><td colspan="2">Freshly disked or rough irregular surface</td><td>0.9</td></tr>
<tr><td colspan="2">Compact smooth by equipment up and down hill</td><td>1.3</td></tr>
<tr><td colspan="2">Compact smooth by equipment across slope</td><td>1.2</td></tr>
<tr><td colspan="3">Contoured Furrows:</td></tr>
<tr><th>Slope (%)</th><th>Maximum Downslope Length (ft)</th><th>P Factor</th></tr>
<tr><td>1-2</td><td>350</td><td>0.6</td></tr>
<tr><td>3-5</td><td>250</td><td>0.5</td></tr>
<tr><td>6-8</td><td>200</td><td>0.5</td></tr>
<tr><td>9-12</td><td>125</td><td>0.6</td></tr>
<tr><td>13-16</td><td>75</td><td>0.7</td></tr>
<tr><td>17-20</td><td>60</td><td>0.8</td></tr>
<tr><td>>20</td><td>50</td><td>0.8</td></tr>
<tr><td colspan="3">Maximum slope lengths for which the specified mulch rate is considered effective. If these limits are exceeded, either a higher application rate or mechanical shortening of the effective slope length is required (such as with terracing).</td></tr>
</table>

Source: USDA-NRCS; HDI, 1987; Wischmeier and Smith, 1978

References

1. Predicting Soil Erosion by Water: A Guide to Conservation Planning With the Revised Universal Soil Loss Equation (RUSLE). USDA-Agricultural Research Service Agric. Hdbk. No. 703. Renard, K.G., G. R. Foster, G.A. Weesies, D.K. McCool, and D.C. Yoder. 1997.

2. (data from Wischmeier and Smith 1978)

3. Construction Site Erosion and Sediment Controls: Planning, Design and Performance. R. Pitt, S. Clark, and D. Lake. 2007.

4. USDA-NRCS, web soil survey database at www.websoilsurvey.sc.egov.usda/App/HomePage.htm.