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A MANUAL FOR REGIONAL TARGETING OF AGRICULTURAL SOIL EROSION AND SEDIMENT LOADING TO STREAMS

WORKING PAPER NO. 36

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A MANUAL FOR REGIONAL TARGETING OF AGRICULTURAL SOIL EROSION AND SEDIMENT LOADING TO STREAMS

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1.0 PURPOSE

This manual provides a method to locate potentially serious problems of field soil erosion and sediment loading to streams. The level of accuracy is suitable for regional planning. It will map the areas requiring follow-up field work for identification of specific problem sites and appropriate remedial measures. It targets priority management areas where further funds can be most effectively spent.

2.0 THE NEED FOR THIS MANUAL

Erosion losses are costly. A recent study conservatively estimates annual erosion costs in Ontario attributable only to yield, nutrient and pesticides losses to be $68 million (Driver and Wall et al, 1982). G. Wall quoted by Romahn (1982) estimates that at current rates of soil loss, all of the topsoil on soybean and corn-growing land in southwestern Ontario will be gone in 40 to 60 years.

Additional concerns have arisen over the fate of the eroded soil. If sediment reaches a water body it can silt up drains, creeks, lakes, reservoirs and harbours, eliminate wildlife habitat and carry with it damaging amounts of fertilizers and pesticides. Sediment from agricultural fields plays a major role in the pollution of the lower Great Lakes and their tributaries (PLUARG, 1970's).

Research has shown that erosion occurs unevenly across any particular county and that areas contributing the majority of the sediment to a stream often comprise only a small percentage of a watershed.

To most efficiently reduce the erosion and stream sediment problems, funds for remedial measures should be targeted to the major problem areas. This manual provides a cost-effective method to screen out potential problem areas.

3.0 THE OUTPUT

The output will include:

1) Field Soil Loss - specifically Potential Average Annual Soil Loss from Rural Areas, a map classifying areas for their potential to suffer from sheet and rill erosion;
2) Field to Stream Delivery Ratio - specifically Terrain Capability to Transport Sediment to a Stream, a map classifying areas for the ratio of available eroded soil that is likely to reach a stream; and
3) Stream Sediment Load - specifically Priority Management Areas for Diffuse Source Sediment Pollution, a map classifying areas for the volume of sediment that is likely to reach a stream.

The scale of the maps is 1:50,000. This level of detail is appropriate for regional scale planning. The map units are not site specific but reflect the probability of finding site specific problems within each map unit. Each map unit is a size which can be readily checked in the field for precise problem location and yet is easily discernible on a county or regional scale overview map to permit broad scale program planning.

3.1 The Output Can:

1) provide a regional overview of potential rural sheet and rill erosion and diffuse source sediment pollution problems, assuming no remedial measures have been implemented;
2) quantify within a range, potential average annual soil loss from rural sheet and rill erosion;
3) rank as High, Medium or Low the Delivery Ratio, i.e. Terrain Capability to Transport Sediment to a Stream for an average year;
4) on the basis of the potential sediment load to a stream, rank as High, Medium or Low Priority Management Areas for Diffuse Source Sediment Pollution for an average year;
5) greatly reduce the amount of land that

requires field study to pinpoint problems and decide remedial measures, or to which to apply more detailed predictive models.

3.2 The Output Cannot:

1) because of scale limitation, exactly locate specific field level sites of problem soil loss or sediment pollution;
2) predict if remedial measures are in place that would control potential problems;
3) locate gully or stream bank erosion;
4) quantify sediment delivery ratios or sediment volumes reaching a stream;
5) be correct in rankings 100% of the time. It is estimated that the classes are correct about 80% of the time;*
6) catch all the areas within which there are serious problem sites contributing to diffuse source pollution. It is estimated that 65% of the problem sites will be included;*
7) locate all water quality problems. Pollution can be from many sources. This method addresses only potential sediment pollution from diffuse rural sources. It does not relate the ranked sediment loading to the flow of the stream to determine sediment concentration, i.e. whether there is a water quality problem on that stream stretch. A high load to a small stream would cause a greater local problem than the same load to a large river. The manual user could, however, make his own judgements of relative stream size in the study area. This rating used with the manual output of load rating could allow some prioritization of sediment associated water quality problems. Also, in terms of downstream receiving bodies of water, it is the volume of sediment rather than the concentration in the inflow stream that is often a concern;
8) be directly compared to field measurements during any one storm event, season or even year. The results reflect a long term annual value averaged over the order of decades.

4.0 STUDY AREA

The manual can be applied to any study area within southern Ontario south of the Precambrian Shield. The concepts are applicable elsewhere but the data bases used are specific to those available in southern Ontario. Substitution of comparable information bases available in other jurisdictions would expand the area of potential application.

5.0 REQUIREMENTS

5.1 Skills

The manual can be applied by a third year physical geography major student or equivalent. Understanding the concept of contour lines is the major essential knowledge. Some familiarity with the data bases is helpful and is usually provided by third year geography. The ability to perform precise work is a necessary skill. Since colour coding is used, colour blindness could present problems.

5.2 Time

One coloured map copy of

1) Field Soil Loss can be produced at approximately 2,200 hectares/person-day (5,400 acres/person-day or 8.5 square miles/person-day);
2) Field to Stream Delivery Ratio, assuming the data collection for the above soil loss mapping is completed, can be produced at approximately 6,600 hectares/person-day (16,250 acres/person-day or 25.4 square miles/person-day);
3) Stream Sediment Load, given the completion of the above 2 map sets, can be produced at approximately 10,000 hectares/person-day (25,000 acres/person-day or 39 square miles/

*Final accuracy testing will require long term data collection and use of the results of the manual.

person-day).

The rate to complete all map sets is 1,420 ha/person-day (3,500 acres/person-day or 5.5 square miles/person-day). At this rate a township of 200 square kilometers could be completed in 14 person-days.

5.3 Cost

The cost for one coloured copy of

1) Field Soil Loss is about 2.5¢/hectare or 1.0¢/acre;
2) Field to Stream Delivery Ratio, assuming completion of the above set, is 0.9¢/hectare or 0.3¢/acre;
3) Stream Sediment Load, following completion of the above two sets is 0.5¢/hectare or 0.2¢/acre.

The total cost of complete target mapping including one copy of each of the above map sets is approximately 4¢/hectare. This does not include office overhead, supervisory salary, or final cartography. Assuming these items, where necessary, triple the cost, the total cost is about 12¢/hectare.

5.4 Information

For the full targeting process, the following information is required.

INFORMATION	SOURCE (ONTARIO)
County Soils Map Variety of scales. Prior to project, send out for enlargement or reduction to 1:50,000	The Information Branch Ontario Ministry of Agriculture & Food Legislative Buildings Toronto, Ontario M7A 1A5 Approx. $3.00 per county Some counties are out of print but are usually available in university libraries.
R-Factor Map	Enclosed, Page 8
Topographic Maps 1:25,000 if available (2 copies of each) 1:50,000 (2 copies of each)	See Appendix A for a list of suppliers $3.00 per sheet
Land Systems Maps (1:50,000)	Agriculture Resource Inventory Capital Improvements Branch Ontario Ministry of Agriculture & Food 801 Bay Street, 8th Floor Toronto, Ontario M7A 2B2 Order by Township Approx. 70¢ per sheet for paper Approx. $10.00 per township for plastic (Niagara and Ottawa-Carleton Regions from LRRI, Research, Branch, Agriculture Canada, K.W. Neatby Bldg., Ottawa K1A 0C6).
Agriculture Capability Maps Canada Land Inventory (1:50,000)	Graphic Arts Johnson Hall University of Guelph Guelph, Ontario N1G 2W1 Order using National Topographic System coding.

Agricultural Drainage Maps (1:25,000) (required only if 1:25,000 Topographic Maps not available)	Artificial Drainage System Maps Capital Improvement Branch Ontario Ministry of Agriculture & Food 801 Bay Street, 8th Floor Toronto, Ontario M7A 2B2 Order by township Charge after 10 maps of 45¢ per map

5.5 Facilities/Materials

Large well lit table per person.

Stable transparent plastic for overlays - slightly opaque mylar will hold more pen types better. You will require enough to cover the 1:50,000 study area maps 8 times (4 for Soil Loss, 2 for Delivery Ratio, 1 for Sediment Load, 1 to spare).

If you want to produce multiple copies of the final maps, 3 more sets of plastic overlays can be used. For additional background information, however, 3 sets of 1:50,000 National Topographic System positives would be useful base maps.

Markers: Hard lead smudges less.

Colour Pencils: On mylar, hard colour pencils, e.g. Laurentian, Prisma-colour or Verithin.

Erasers: Soft, non gritty, e.g. Pink Pearl or Staedler Mars-Plastic do not smudge or damage material.

Drafting Pens: With fast drying, waterproof, thin ink.

Light Table

6.0 METHODS

6.1 Potential Average Annual Soil Loss from Rural Areas (Field Soil Loss)

6.1.1 Introduction

The Universal Soil Loss Equation (Wischmeier and Smith, 1978) is used. It calculates the average soil loss from sheet and rill erosion in tons/acre/year or in tonnes/hectare/year. Sheet erosion occurs when rain washes a thin layer of soil from a field; rill erosion occurs when the soil is carried away in small water-etched channels. These are the two main modes of soil loss in rural southern Ontario.

The Universal Soil Loss Equation is:

$$A = R \times K \times LS \times C \times P$$

where A is the average soil loss due to sheet and rill erosion in tons per acre per year

R is rainfall - climate factor

K is the soil erodibility factor

LS is the slope factor (including a slope length and slope gradient component)

C is the soil cover, crop or land use factor

P is the erosion control practice factor

To be more specific:

R is the number of rainfall erosion-index units in a normal year's rain plus a factor for runoff from snowmelt. The erosion index is a measure of the erosive force of a specific rain. It reflects the combined ability of raindrop impact to dislodge soil particles and of runoff to transport the soil particles from the field. The R-value reflects locational differences due to total erosivity and distribution of erosive rains and snowmelts.

K is the soil loss per erosion index unit for a specified soil as measured on a plot 72.6 feet long with a uniform 9% slope continuously in clean-tilled fallow. The K-value reflects the ease or resistance of soil to erode when rain falls on fallowed soil.

L is the ratio of soil loss from the field slope length to that from a 72.6 foot length under identical conditions.

S is the ratio of soil loss from the field slope gradient to that from a 9% slope under otherwise identical conditions. These factors are combined into LS-value.

C is the ratio of soil loss from an area with specified cover and management to that from an identical area in tilled continuous fallow. The C value is affected by the distribution of erosive rainfalls during various crop stage periods. In this manual for southern Ontario, the distribution is considered constant relative to the accuracy of the Land Systems used to determine the C-value and one set of ratios is used.

P is the ratio of soil loss with an erosion control practice like contour plowing, strip cropping, or terracing to that with straight row farming up and down the slope.

6.1.2 Methodology

<u>K Factor (Soil Erodibility)</u>

Obtain the county soils map. Reduce or enlarge it to 1:50,000.

The soils series units are listed in the legend. Associated with each series are one or more types. Types are determined by the surface texture. There is a unique symbol for each type. For example, within the Huron series there might be 2 types, Huron clay loam (Huc) and Huron silt loam (Hus). These can be distinguished on the soils map by Huc and Hus respectively. The clay loam and the silt loam are the surface textures.

It is the loss of the surface texture horizon that is of concern. These textures can be classed into 5 soil erodibility potential classes (Wall, Dickinson and Greuel, 1981) - 1) Negligible, 2) Slight, 3) Moderately Severe, 4) Severe, 5) Very Severe as shown in Table 1.

TABLE 1. K Factor (Soil Erodibility) Class by Surface Texture.

Surface Texture Class	K Factor Class
Sand	1
Fine sand	2
Very fine sand	4
Loamy sand	1
Loamy fine sand	2
Loamy very fine sand	4
Sandy loam	2
Fine sandy loam	3
Very fine sandy loam	4
Loam	3
Silt loam	4
Silt	5
Sandy clay loam	2
Clay loam	2
Silty clay loam	3
Sandy clay	1
Silty clay	2
Clay	2
Organic	1

Where:

1 is Negligible, a K-value <.15
2 is Slight a K-value .15-.30
3 is Moderately Severe, a K-value .30-.40
4 is Severe, a K-value .40-.50
5 is Very Severe, a K-value >.50

(Table developed from Wall, Dickinson and Greuel, 1981)

For each township*, overlay a piece of mylar (rough side up) over the 1:50,000 soils map, tape it down, carefully outline the township, mark the north direction and colour each soils unit according to the K-Factor class of its surface texture.

*Throughout the methodology section, for consistency, the study area unit used is a township. In practice, other study area units such as watersheds can replace each township reference.

K-Factor Class:
1) Light Green
2) Leave Blank
3) Light Blue
4) Light Yellow
5) Light Red

A sample soils map and choice of K Factor Class is shown on Figure 1.

R Factor (Rainfall)

The R number can be obtained from Figure 2 (Wall, Dickinson and Greuel, 1983). Note the value applicable to the township on the edge of the coloured township map of the K-Factor Class.

LS Factor (Slope)

There are two components to the LS Factor: slope gradient and slope length.

Slope Gradient

Slope gradient percentages are divided into 7 range classes. To determine a slope class, obtain 1:25,000 NTS maps if available for your area. Otherwise, use 1:50,000 NTS maps.

On the NTS maps a slope class depends on the number of contour lines within a horizontal distance i.e. the rate at which the slope increases.

Table 2 gives the 7 slope classes, the percent slope range each represents and the number of contour lines within a horizontal distance for 1:25,000 map scale and 1:50,000 map scale.

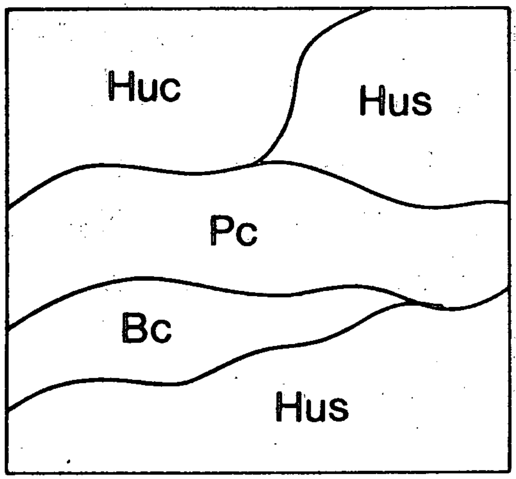
TABLE 2. Contour Intervals for Slope Gradient.

Class	Percent Slope Range	1:25,000 (10 foot contour interval) No. of Contour Lines Within			1:50,000 (25 foot contour interval) No. of Contour Lines Within		
		2000'	1000'	400'	5000'	2500'	1000'
A1	<.5	<2			<2		
A2	.5-2	2-5	$\frac{1}{2}$-3		2-5	$\frac{1}{2}$-3	
B	>2-5	>5-11	>3-6	2-3	>5-11	>3-6	2-3
C	>5-9		>6-10	>3-5		>6-10	>3-5
D	>9-15			>5-7			>5-7
E	>15-30			>7-13			>7-13
F	>30			>13			>13

Using the scale on the 1:25,000 NTS map, on a small piece of plastic mylar draw a template by putting a notch at 0, another at 400 feet (note: the map scale is in yards), at 1000 feet and 2000 feet. For flat slopes, e.g. A1 and A2 you will find it easier to use the 2000 foot distance; for steep slopes, the 400 foot distance will mean less contour line counting.

Place the 0 line on a contour line. It will count as one line. Add the other lines within the horizontal distance to determine the slope range. For example, if within 1000 feet there are 5 lines counting the one where the 0 line is, the slope class is B. Figure 3 illustrates slope gradient assessment.

A similar procedure should be used for the 1:50,000 maps. You will need to draw up another template fitting the different scale and horizontal distances. Use 1:25,000 maps wherever available. They give a more accurate slope gradient.



Map Symbol	Soil Type
Huc	Huron Clay loam
Hus	Huron Silt loam
Pc	Perth Clay loam
Bc	Brookston Clay loam

These are the surface textures needed for the K-Factor. The silt loam is K-Factor class 4; the clay loams are K-Factor class 2.

FIGURE 1. SAMPLE SOIL MAP

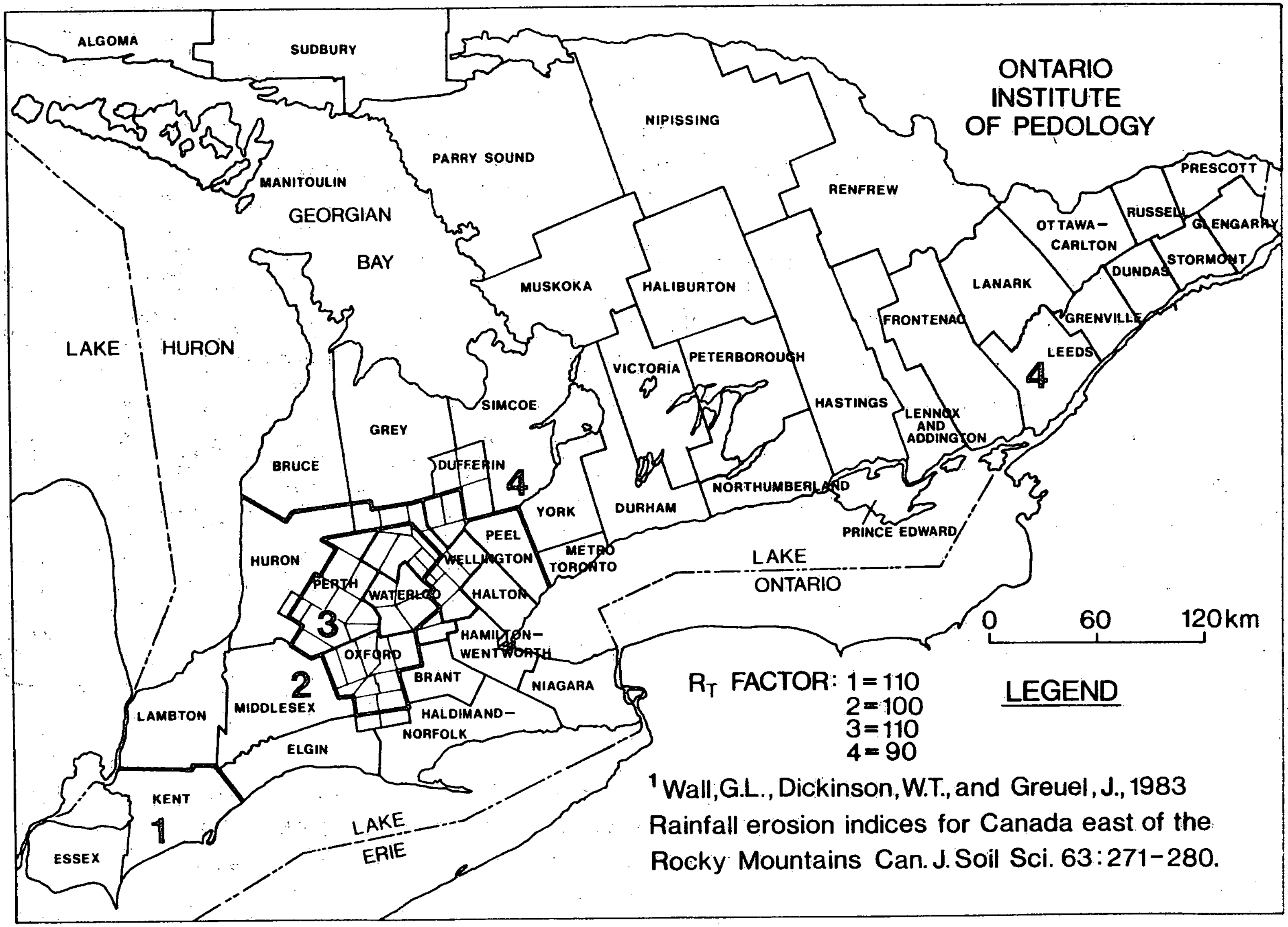


FIGURE 2. RAINFALL EROSION INDICES (R_T) ADJUSTED FOR SNOWMELT CONDITIONS IN SOUTHERN ONTARIO[1]

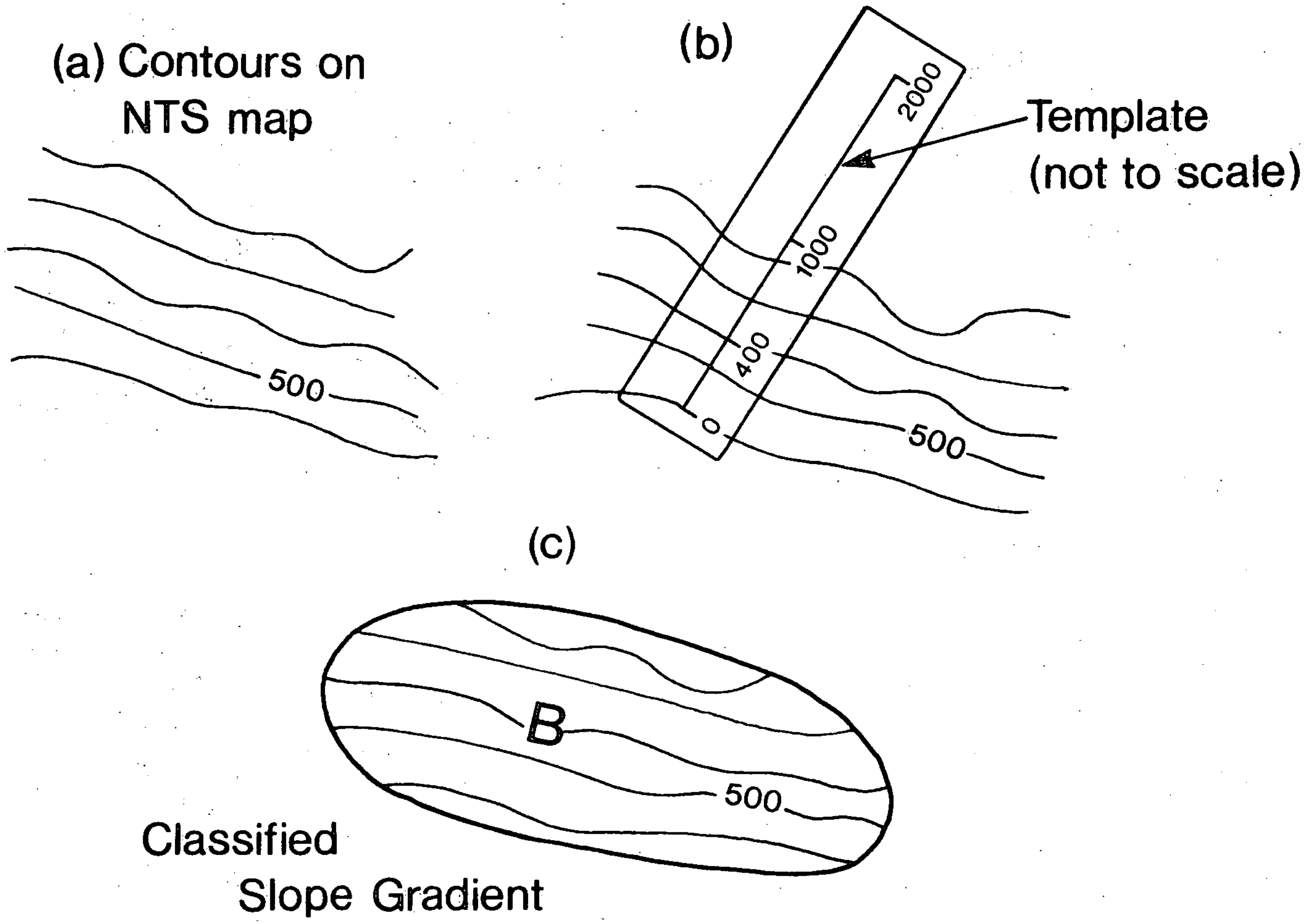


FIGURE 3. SAMPLE SLOPE GRADIENT ASSESSMENT

Classify the whole map by outlining each area with the same contour line density range, referring to the template for guidance. You may find it easier to first outline all very flat areas, e.g. A1 and then pick out the steep areas, e.g. D, E, F that often occur along river banks. This may help the less distinct moderate slope patterns to emerge from what remains. Use pencil since you will probably make changes as you go. Label each unit with the slope class. An excerpt of a slope gradient map is given in Figure 4.

If more than one person is working on this, when you have completed a map trade it to make sure everyone is being consistent and to help catch missed areas.

Consistency can also be checked by comparing boundaries and classes at map margins where they meet the boundaries and classes on a map someone else is doing. Boundaries should meet and classes should correspond. If they do not, recheck everyone's consistency and adjust the boundaries to match.

When a boundary has been checked, adjusted and matched, note this on the margin of both sheets. All four boundaries on each sheet must be checked; matched and so noted.

On 1:25,000 maps, do not outline areas smaller than ½ cm by ½ cm. This is because the maps will be reduced 1:50,000 and the units will become too small. Lump such small units in with an adjoining unit and label the unit by the dominant range class. If two lumped small unit classes are about equal, assign the higher range, i.e. if an area is half a small D unit and half a small E unit, label it E.

Slope Length

Slope length refers to the distance from the top of a slope to a point where water running down a slope would change direction or collect. This can happen at a slight dip or swale in a field, at a fencerow, at a road and not only when water reaches a stream. Before starting this section a brief drive through a rural area will help visualize what is meant. Imagine water flowing over land across a field. It would flow off slopes whether they are high hills or barely noticeable rises in a field. At the bottom of hills or between barely noticeable rises it would collect and change direction. The distance straight down the hill or slight rise from top to collection point is the slope length. You will note that often slopes are crossed by fencerows or roads which would also divert the surface overland flow. The distance from the top of the slope to the fencerow or road is a slope length. Another slope length would be from the fence-row to the first dip or swale collection point or even to another fencerow if that would be encountered before a swale. Figure 5 illustrates the slope length concept.

In southern Ontario many slope lengths will tend to be less than 300 feet. Such lengths can often be interpreted from 1:25,000 maps for the gradient classes steeper than B or C. The approach taken will be to combine some map interpretation and scattered field sample checks. If only 1:50,000 maps are available there is more emphasis on the scattered field checks.

1. Use the maps on which you drew slope gradient units. For each unit you will be estimating a slope length. Some units may have more than one slope length within them and can be divided accordingly. Often, though, the same boundaries can be used.
2. Check for simple regular slopes as often happens along river banks. The contours

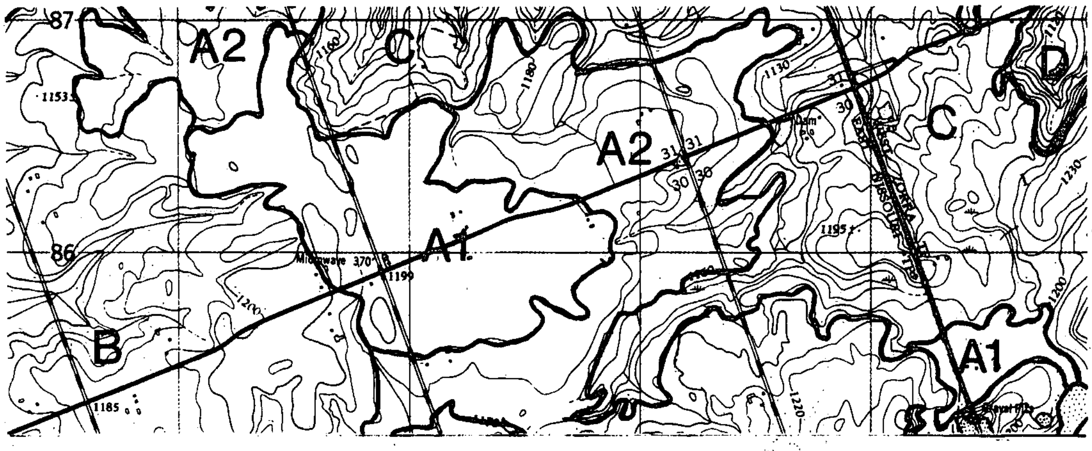


FIGURE 4. SLOPE GRADIENT MAP EXCERPT

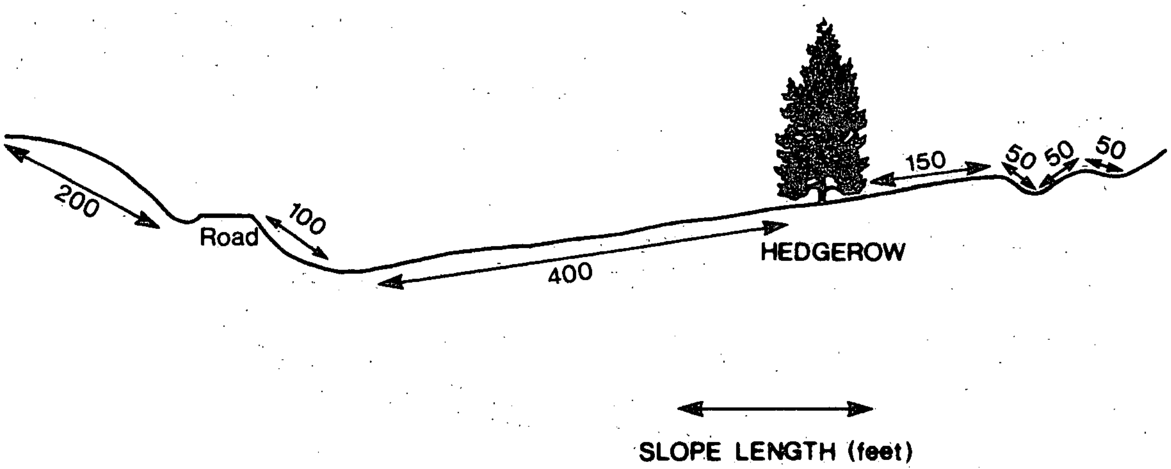
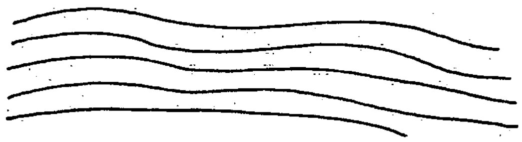


FIGURE 5. LANDSCAPE CROSS-SECTION, SHOWING SLOPE LENGTHS

are relatively straight, parallel and even.

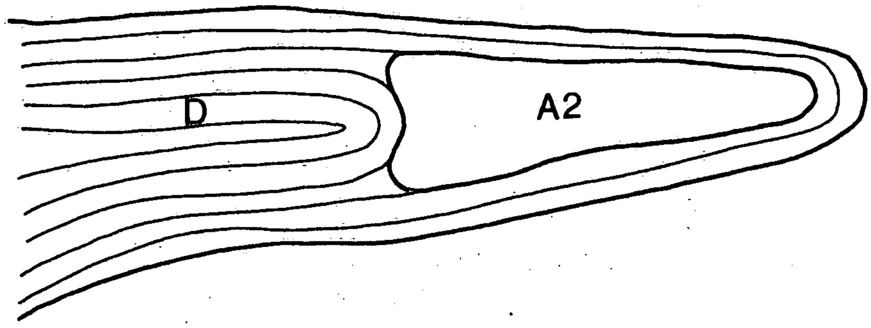
FIGURE.6a



The length is the length of a path a drop of water would follow down that slope from top to bottom, perpendicular to the contour lines. This can be measured from the map scale. Again a template would be useful, possibly one with 100 foot intervals. You can pass it over the map easily estimating lengths. Estimate all lengths to the closest 50 or 100 foot intervals. Label the unit with length in feet.

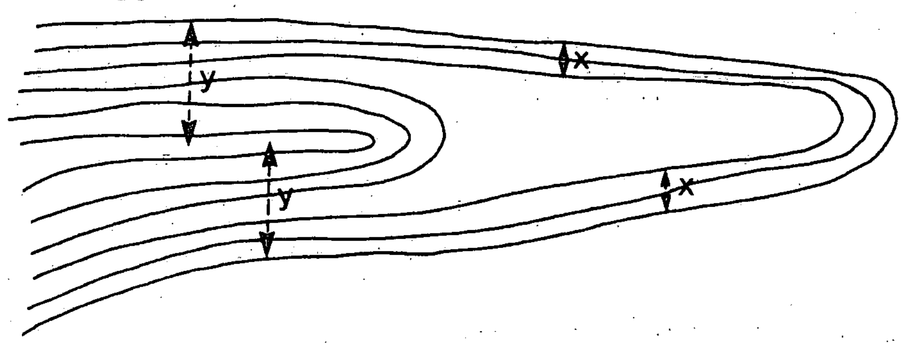
Within one gradient class there can be more than one length. For example, a slope gradient map unit might look like this.

FIGURE. 6b



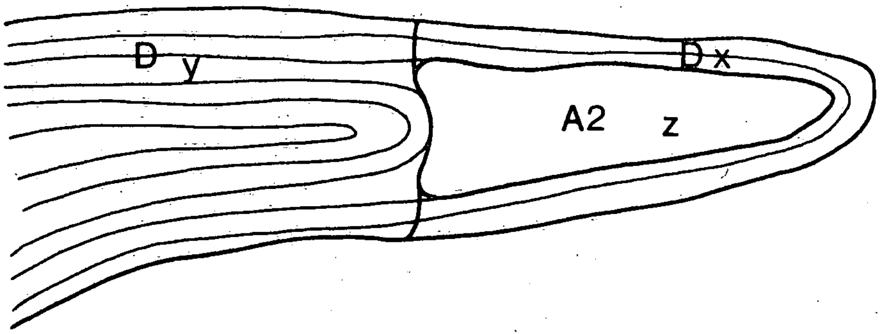
There are 2 major lengths in the D unit, x feet and y feet. Note that the y feet length goes from the top of the hill to the valley bottom. It does <u>not</u> continue up the other side of the valley, just as a drop of water would not. That is another slope length which in this case is also y feet long.

FIGURE.6c



The final map will look like this:

FIGURE.6d



3. For B, C, D, E, F slopes which are not simple regular: within each slope gradient unit randomly pick out a few representative runoff routes and mark them lightly from the top of a rise, perpendicular to the contours, to the bottom of the nearest dip, to the nearest tree row or wherever water might collect in a heavy rainfall.

If the pencil line lengths in the slope unit are approximately equal, the slope length for the whole unit will be the average of pencilled lengths. Label that length in feet under the slope gradient class label.

If there is a definite change in the patterns of the pencil line lengths, for example if most of the lines in one part of the unit are x feet long, while most in another part are approximately y feet long, sketch a boundary line between the sections and label them with the appropriate length. Make sure all new subsections have the slope gradient class label repeated.

If there appears to be a completely random set of pencil line lengths, with no discernable pattern, take what looks to be the average slope length and apply that number to the whole slope gradient class unit. This would be the case in Figure 7 with an average length of about 200 feet.

Now you have done as much interpretation as is possible from the map.

Field checking of sample areas will provide length estimates for A1, A2 and possibly B gradient classes and will check the steeper slopes.

This step will be spot checking only. Pick units representative of different gradient classes and visible from roads along a route through a township. In 2 person team, one driving, one navigating, from the slope map check these units from the road. To estimate lengths, picture a football field which is about 300 feet, and a city lot which may be around 100 feet. Discuss whether it looks like a portion of a football field or a lot or multiples. Agree on an even 50 foot or 100 foot estimate. Note the estimate on the map and drive to the next sample. An average township may be spot sampled in about half a day. If you have only 1:50,000 maps, you may want to spend a bit longer on the field check.

Sample sites should not be wooded and should

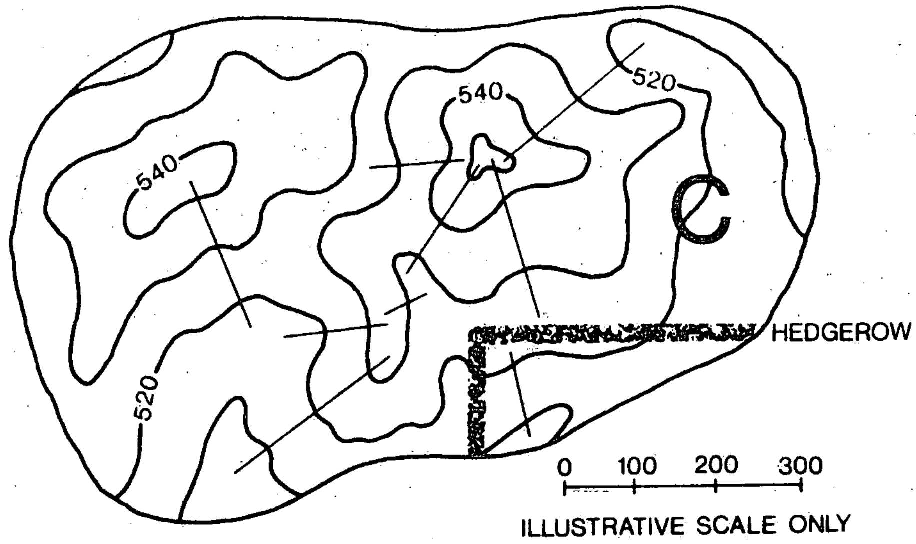


FIGURE 7. SLOPE LENGTH DETERMINATION-COMPLEX IRREGULAR SLOPES

be checked before the crops obscure the rises and dips in the fields, e.g. before July.

The field procedure is the only way to get A1 and A2 lengths. Do not spend a great deal of time on these classes - they are so flat the slope length does not affect the LS factor very much. An average estimate for a township or for half or third of a township if it seems to change would be adequate.

The representative samples lengths can often be applied to the same slope gradient class within the township if no road, fencerow or easily measured simple regular slopes give a deviation within a particular unit.

You are now the expert on slope lengths for the township so adjust the lengths, balancing the map and field information, as you feel is best.

Check each map boundary against the adjoining one to again ensure all unit boundaries meet and that the length estimates correspond. Adjust any that do not correspond by using the estimate on the map on which the larger proportion of the unit lies, or by taking average, or by adding an extra division - whatever seems most appropriate. Note each checked and adjusted boundary on each map to keep track of what has been completed.

As for the slope gradient units keep in mind the minimum unit should not be smaller than ½ cm by ½ cm. Most will be much larger.

LS Factor

Now you are ready to determine the LS factor using the slope gradient class and the slope length noted in each unit. On Table 3 the LS factor is the number where the slope gradient class column and slope length row meet. For example a C slope which is 150 feet long has an LS factor of 1.2. Write the LS factor in each unit in a different colour from the gradient and length notations.

You will need the LS factor mapped at 1:50,000 for a later step. Use a 1:50,000 map which has been kept flat, unrolled and unfolded.

TABLE 3. LS Factor Derived From Slope Length and Slope Gradient Class.

Length of Slope in Feet	A1	A2	B	C	D	E	F
50	.08	.11	.31	.70	1.3	3.5	13
100	.09	.13	.40	.99	1.8	5.0	18
150	.10	.15	.47	1.2	2.2	6.0	22
200	.11	.16	.53	1.4	2.6	7.0	25
250	.12	.17	.58	1.6	2.8	8.0	28
300	.12	.18	.62	1.8	3.0	9.0	31
350	.13	.19	.66	1.9	3.3	9.0	34
400	.13	.20	.70	2.0	3.5	10.0	36
500	.14	.21	.76	2.2	4.0	11.0	40
600	.15	.22	.82	2.4	4.5	12.0	44
700	.16	.23	.87	2.6	5.0	14.0	47
800	.16	.24	.92	2.8	5.0	15.0	50
900	.17	.25	.96	3.0	5.5	15.0	53
1000	.18	.26	1.0	3.0	5.5	16.0	56
1100	.18	.27	1.0	3.5	6.0	17.0	59
1200	.18	.27	1.0	3.5	6.0	17.0	62
1300	.19	.28	1.2	3.5	7.0	18.0	64
1400	.19	.29	1.2	3.5	7.0	18.0	67
1500	.20	.29	1.2	4.0	7.0	20.0	69
1600	.20	.30	1.2	4.0	7.0	20.0	71
1700	.21	.30	1.2	4.0	7.0	21.0	73
2000	.22	.32	1.4	4.5	8.0	22.0	80

When the length of slope exceeds 400 feet and/or the slope gradient class is F, soil loss estimates are speculative as these values are beyond the range of research data.

Lengths greater than 500 feet are rare in southern Ontario and where found would tend to be of shallow slope gradient.

Steep slope gradients tend to have shorter slope lengths.

Adapted from Soil Conservation Service, USDA, 1978 and Wischmeier and Smith, 1978.

Carefully sketch each unit from the 1:25,000 scale to the 1:50,000 scale NTS map. Use landmarks common to both maps, e.g. roads, houses, woodlots, streams to help guide the transfer. Draw in pencil - you will probably need to erase occasionally. Label each unit with the LS factor only.

Shift the map to another team member to check if all units are transferred.

C Factor (Soil Cover, Crop or Land Use)

Obtain the Ontario Ministry of Agriculture and Food Land Systems Maps (for source see Section 5.4). Mylar positives will save transferral of the map to a stable plastic base needed for the final overlay step. They will also avoid distortion that paper may have.

If paper copies are ordered the information must be very carefully transferred to a stable plastic base for use in the final overlay step. Use black drafting ink.

P Factor (Erosion Control Practices)

The manual maps potential soil loss. It assumes no remedial practices. Therefore P is set to a value 1 everywhere and is of no further concern for the potential soil loss mapping. This decision has several reasons.

1. In many areas, there are relatively few practices. A great deal of time could be spent locating them for little overall effect on the mapping.
2. Practices change from year to year. Mapping potential soil loss as opposed to actual soil loss any one year makes the maps more timeless and of longer term usefulness.
3. If upon field checking by staff implementing remedial measures a potentially high soil loss area exhibits appropriate control practices, that area can be dropped from immediate concern.

Mapping of the Potential Average Annual Soil Loss From Rural Areas

This step represents the multiplication of the above factors of the Universal Soil Loss Equation. It is done by overlaying the maps.

1. Tape the coloured K factor map flat on a table.
2. For the same township very carefully line up the LS map to the township boundaries of the K map and tape it down flat.
3. For the same township very carefully line up the Land Systems map to the same boundaries and firmly tape it down along the top only.
4. Overlay a blank piece of mylar on top, again taping only along the top. Carefully trace the township outline in black.
5. From Appendix A of the manual, remove or copy the page which corresponds to the R value noted for the township on the margin of the K map.
6. On this page you will note there are 5 tables, one for each K factor colour. The LS values are down the table; the Land System classes are on the horizontal axis. Not all Land Systems found on the maps are listed on the USLE Category Table (Dell Coleman, 1983). Each Land System has an equivalent on the Table as indicated by Table 4. The USLE Category Table has been multiplied out for the R value, the average

TABLE 4. Land Systems and Appropriate C Values.

Land System Noted on USLE Category Table	Land Systems with Equivalent C Values	Approximate C Value (for interest only - not necessary for method)
P	All K's, e.g. KF, KM, KT, KN	.5
C	-	.35
M	MG	.26
HG	GR	.23
A1	G, R, PE, CH, PC, V, VO, BE	.04
A2	T, Zp, H, O, OV	.015
Z	Z_R, X	.004

(Dell Coleman, 1982).

K value of each of the 5 ranges, and each LS - Land System Class combination.

The final answers are grouped into:

V Very High: >11 tonnes/hectare/year soil loss (>5 tons/acre/year)

H High : 7-11 tonnes/hectare/year soil loss (>3- 5 tons/acre/year)

M Moderate : >2-<7 tonnes/hectare/year soil loss (>1-3 tons/acre/year)

and L Low : ≤2 tonnes/hectare/year soil loss (≤1 ton/acre/year)

The class ranges are chosen on the basis of estimated 'soil tolerance levels'. This term denotes the maximum level of soil erosion that will permit a high level of crop productivity to be sustained economically and indefinitely. A tolerance level commonly used in the U.S.A. is 11 tonnes/hectare/year (5 tons/acre/year). Little research has been done in southern Ontario. It is estimated, however, that since southern Ontario tends to have shallower soil horizons than many American soils, a more realistic tolerance level for the province would be 7 tonnes/hectare/year (3 tons/acre/year) (G. Wall, 1983). Both levels are included.

7. Pick one colour on the K map. In your township, note a Land System class within that colour. Then note the LS factor number on the overlay over the Land System. On the USLE Category Table that corresponds to that K colour go across the Land Systems list to the one you have noted (or to the Land System equivalent shown in the table in Step 6) and down the table to the LS value you have noted (If the map LS value is between 2 values on the table, use the larger table value). The letter where the row and column meet is the potential soil loss group for that particular map unit.

8. Colour the polygon V = Solid Red
   H = Diagonal Hatch Red
   M = Yellow
   L = Green

   This soil loss 'calculation' is illustrated in Figure 8.

   If the Land Systems map indicates B (built-up), E (extractive), colour the polygon Brown. Water areas (W) colour Blue.

9. Repeat this sequence wherever any one of the overlaid maps changes a value. If you encounter a complicated area where you cannot read one of the component maps, lift up the untaped bottom of the top maps to read the information more clearly.

10. Once you have completed this step, you have a Potential Average Annual Soil Loss from Rural Areas map. Label the map with this as well as the township name, a North arrow, and a legend of the colours and what they mean.

Write a short paragraph describing the pattern of soil loss in the township and the reason for the pattern. Which factors cause the Very Highs and Highs and where; which factors cause the Lows? Tape it to the Soil Loss map.

6.2 <u>Terrain Capability to Transport Sediment to a Stream (Field to Stream Delivery Ratio)</u>

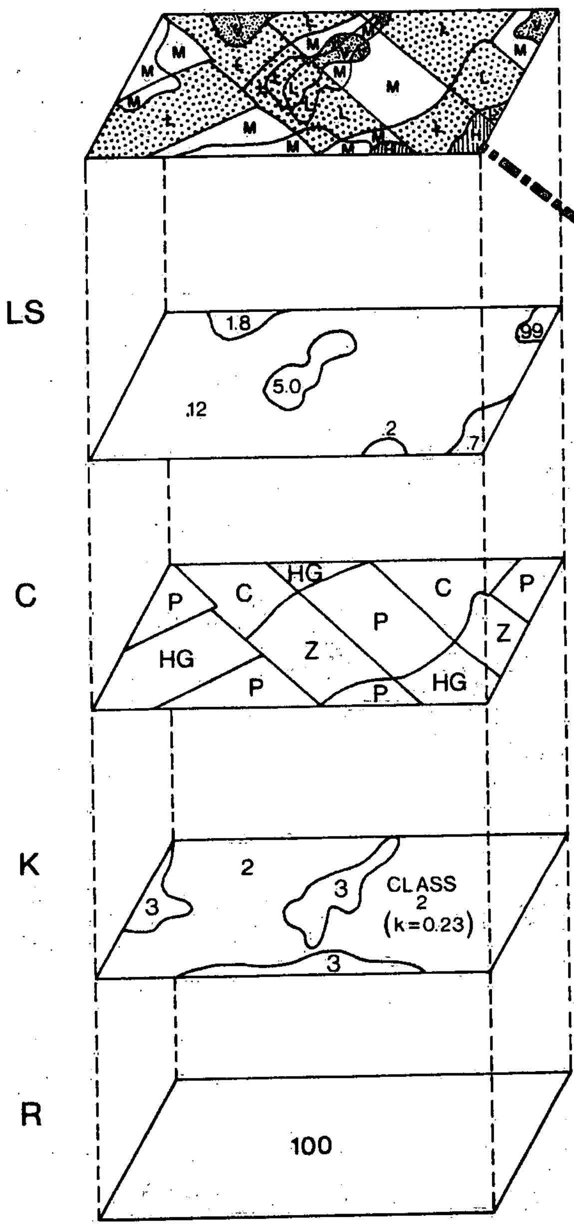
6.2.1 Introduction and Summary

Not all eroded soil reaches a stream. Some settles out in hollows and in thick vegetation. The proportion of available eroded soil which does reach a stream is referred to as the delivery ratio. While delivery ratio alone is not widely used, it is needed to derive more practical parameters. For example, the sediment load to a stream, is the multiple of available eroded soil and the delivery ratio. The relationship of soil loss, delivery ratio

USLE CATEGORY TABLE
R = 100

L = 0 to 1 Ton/Acre/Year (0 to 2 Tonnes/Hectare/Year)
M = >1 to 3 Tons/Acre/Year (>2 to <7 Tonnes/Hectare/Year)
H = >3 to 5 Tons/Acre/Year (7 to 11 Tonnes/Hectare/Year)
V = >5 Tons/Acre/Year (>11 Tonnes/Hectare/Year)

K is Blank (Class 2).



Representative Land System

LS Factor	P	C	M	HG	A1	A2	Z
.10	M	L	L	[illegible]	L	L	L
.11	M	L	L	[illegible]	L	L	L
.12	M	L	L	[illegible]	L	L	L
.14	M	M	L	[illegible]	L	L	L
.15	M	M	L	[illegible]	L	L	L
.17	M	M	M	[illegible]	L	L	L
.19	M	M	M	[illegible]	L	L	L
.21	M	M	M	[illegible]	L	L	L
.23	M	M	M	[illegible]	L	L	L
.25	M	M	M	[illegible]	L	L	L
[illegible]	H	M	M	[illegible]	L	L	L
.31	H	M	M	[illegible]	L	L	L
.35	H	M	M	[illegible]	L	L	L
.38	H	H	M	[illegible]	L	L	L
[illegible]	H	H	M	[illegible]	L	L	L
.47	V	H	M	[illegible]	L	L	L
.52	V	[illegible]	H	[illegible]	L	L	L
.58	V	[illegible]	H	[illegible]	L	L	L
.65	V	V	[illegible]	[illegible]	L	L	L
.72	V	V	H	H	L	L	L
.79	V	V	H	H	L	L	L
.88	V	V	V	H	L	L	L
.98	V	V	V	V	L	L	L
1.03	V	V	V	V	M	L	L
1.20	V	V	V	V	M	L	L
1.33	V	V	V	V	M	L	L
1.48	V	V	V	V	M	L	L
1.64	V	V	V	V	M	L	L
1.82	V	V	V	V	M	L	L
2.02	V	V	V	V	M	L	L
2.24	V	V	V	V	M	L	L
2.48	V	V	V	V	M	L	L
2.75	V	V	V	V	M	L	L
3.05	V	V	V	V	M	M	L
3.39	V	V	V	V	H	M	L
3.76	V	V	V	V	H	M	L
4.17	V	V	V	V	H	M	L
4.62	V	V	V	V	H	M	L
5.13	V	V	V	V	H	M	L
5.69	V	V	V	V	V	M	L
6.31	V	V	V	V	V	M	L
7.00	V	V	V	V	V	M	L
7.76	V	V	V	V	V	M	L
8.61	V	V	V	V	V	M	L
9.55	V	V	V	V	V	H	L
10.59	V	V	V	V	V	H	L
11.75	V	V	V	V	V	H	M
13.03	V	V	V	V	V	H	M
14.45	V	V	V	V	V	H	M
16.03	V	V	V	V	V	V	M
17.76	V	V	V	V	V	V	M

1. Pick USLE Category Table Page for R=100
2. Look through overlay
3. For areas of K-Factor Class 2 (K=.23), pick appropriate table
4. For each unique map unit for K-Factor Class 2, note the C and LS values
5. Read the resultant USLE Category

FIGURE 8. EXAMPLE OF SOIL LOSS CALCULATION

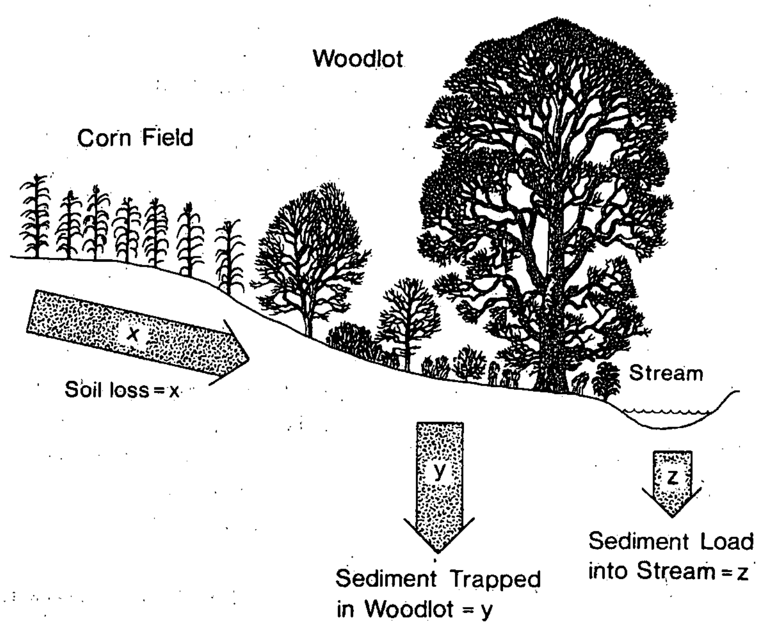
and sediment load is illustrated in Figure 9. In this section, you will qualitatively map the delivery ratio as a necessary step towards working out serious sediment load areas.

Research (Dickinson, 1981) has shown that the delivery ratio for any piece of land depends on 5 main factors:

1. the distance to a stream;
2. the slope;
3. the roughness of the landscape or the amount of vegetation the runoff must flow through;
4. the ability of an area to generate runoff, i.e. if a soil is saturated, water cannot infiltrate and will run off, carrying sediment with it. This characteristic is called the hydrologic activity of an area; and
5. the hydraulic characteristics of the sediment itself. Fine soils will travel farther than coarse soils which drop out more. Some coarse soils encourage infiltration, reducing runoff and its load.

The method uses available data bases for each of these factors. It considers them in a sequence to account for extremes in each. As illustrated in Figure 10 this is done by assuming a landscape has a moderate delivery ratio. If various factors tending to increase delivery exist, the ratio is increased to high; if factors tending to decrease delivery exist, the ratio is reduced to low.

The method is summarized and illustrated by Figure 11.



$z = x - y$, ie the load to the stream is the soil loss minus what is trapped en route.

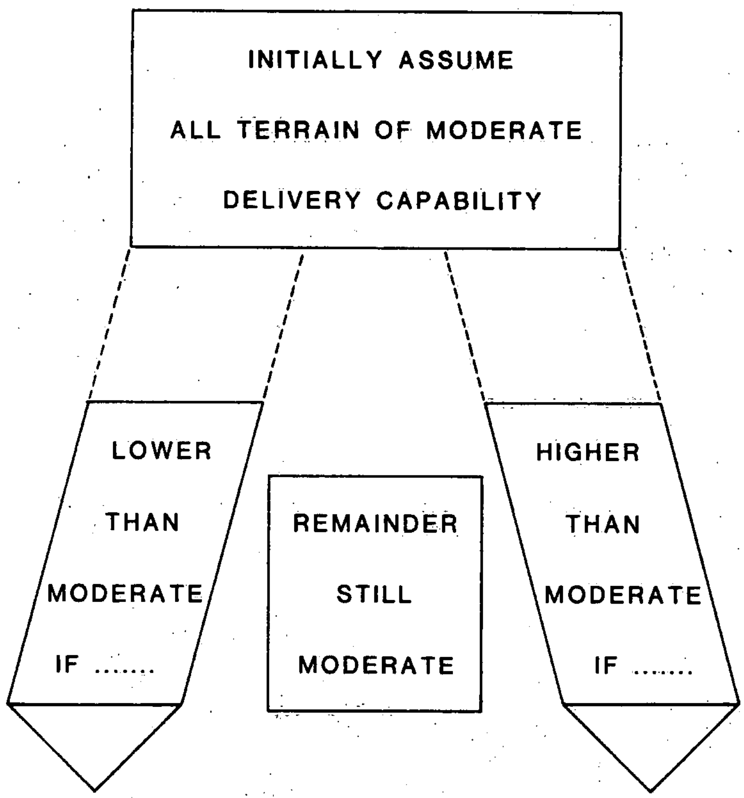
$\frac{z}{x} = \frac{x-y}{x}$, is the proportion of the soil loss which reaches the stream, the Delivery Ratio

Eg. if 100 tons leaves the field and 25 tons reaches the stream, the delivery ratio is 25/100 or 0.25

$z = \text{Delivery Ratio} \times \text{Soil loss} = \frac{z}{x} \times x$

FIGURE 9. ILLUSTRATION OF SOIL LOSS, DELIVERY RATIO AND SEDIMENT LOAD

FIGURE 10. APPROACH TO MAPPING TERRAIN CAPABILITY TO TRANSPORT SEDIMENT TO A STREAM.



COARSE SOIL

MEDIUM TEXTURED SOIL GREATER THAN 500m. FROM STREAM

PERMANENTLY VEGETATED AREA WITHOUT STEEP SLOPES

AREA BUFFERED FROM A STREAM BY PERMANENTLY VEGETATED AREA

ENCLOSED DEPRESSION

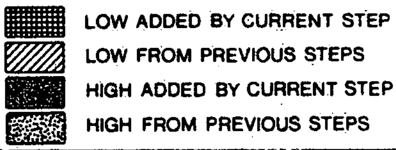
IMMEDIATELY ADJACENT TO A STREAM BUT WITH NONE OF THE CONDITIONS THAT CLASSIFY AN AREA AS LOWER THAN MODERATE

HYDROLOGICALLY ACTIVE AREA

BARE STEEP SLOPES NOT BUFFERED FROM A STREAM BY A WIDE MODERATE OR LOW AREA

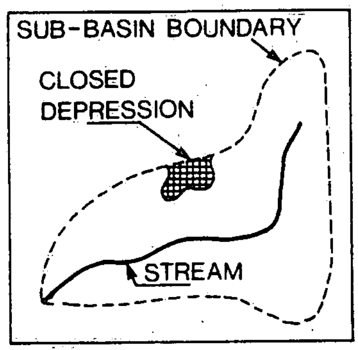
VEGETATED VERY STEEP SLOPES ADJACENT TO A STREAM

FIGURE 11. Methodology Steps for Mapping Terrain Capability to Transport Sediment to a Stream.



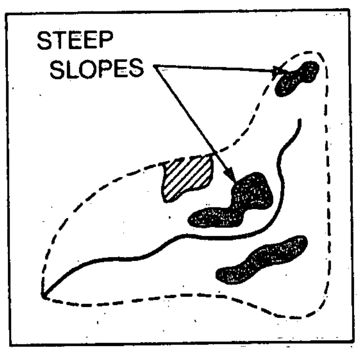
1. Sub-basins for each creek segment and drain are delineated and closed depressions reduced to low delivery.

Figure 11a.



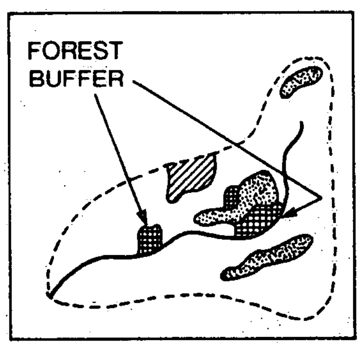
2. Steep slopes are raised to high.

Figure 11b.



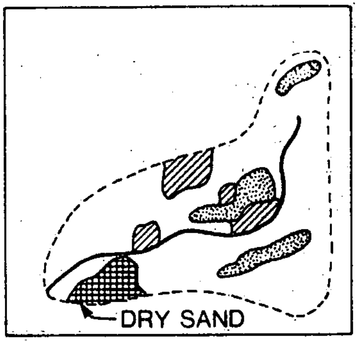
3. Buffer land systems with thick surface cover; e.g. forest or permanent pasture and which are still blank are reduced to low.

Figure 11c.



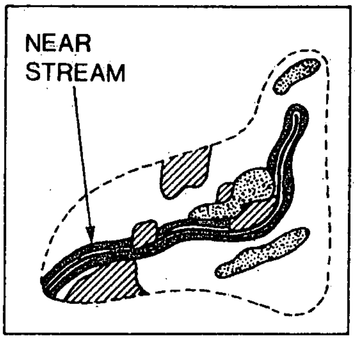
4. High infiltration, coarse soils are reduced to low.

Figure 11d.



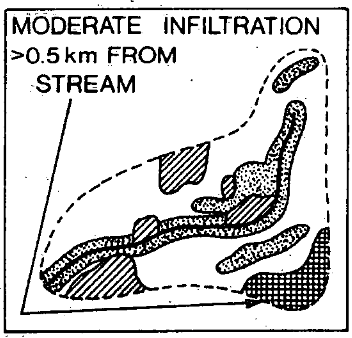
5. Areas within 100 m of a watercourse and which are still blank, are raised to high.

Figure 11e



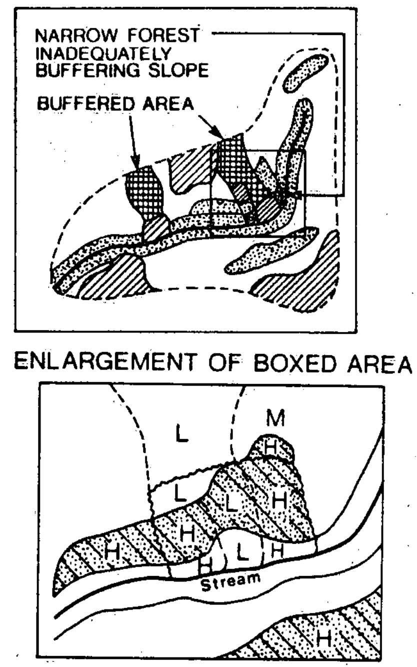
6. Moderate infiltration soils greater than 0.5 km from a stream are reduced to low.

Figure 11f.



7. Very narrow buffers inadequately buffering steep slopes near streams are raised to high.
   Areas buffered by remaining wide buffers are reduced to low. The same steps are applied to areas uphill of high infiltration areas.

Figure 11g.

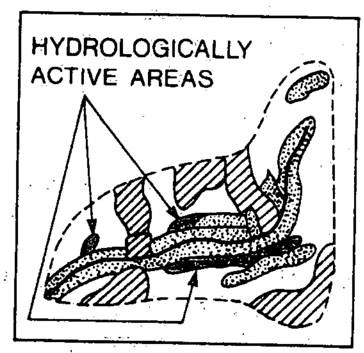


STEEP SLOPES. VEGETATED AND UNVEGETATED

H- HIGH
M- MEDIUM
L- LOW
------ NEW BOUNDARIES ADDED IN THIS STEP
~~~~~ FOREST BOUNDARY

8. Poorly or very poorly drained soils if connected to a stream and close to it (within 250 m) and if still blank are raised to high, as hydrologically active areas (HAAs). The 250 m limit was chosen based on the approximate maximum extent of HAAs in other mapping in southern Ontario (Whiteley and Ghate, 1978).

Figure 11h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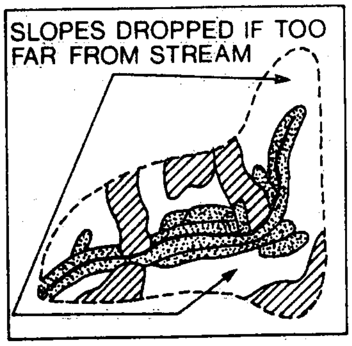
9. High areas due to steep slopes are reduced to moderate if separated from another high area by a blank (i.e. moderate) area over 100 m wide. Otherwise the narrow intervening moderate level is raised to high.

Figure 11i.



6.2.2 Methodology

The methodology assumes availability of 1:25,000 National Topographic Systems (NTS) maps. If only 1:50,000 NTS are available for your study area, the method is the same except for the changes described in Section 6.2.4.

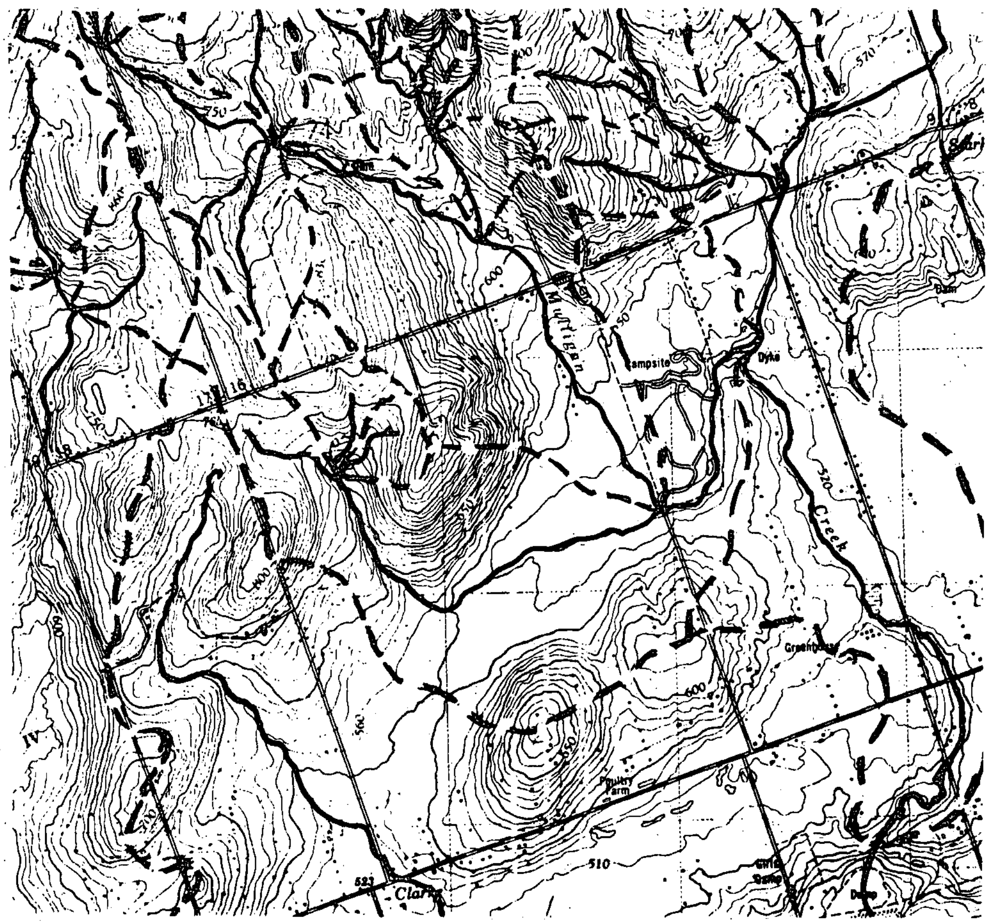
1. (A) On the most recently available 1:25,000 NTS sheet, carefully using contours, draw in the basins for each permanent and ephemeral watercourse and the sub-basins for each branch or tributary (for example, see Figure 12). Use an orange pencil crayon. Any closed depressions or areas draining into ponds will be non-delivery areas. Double hatch in orange any such basins.
   (B) Very carefully transfer in orange all the orange sub-basin boundaries to the 1:50,000 NTS sheet, using roads, streams, landmarks and the UTM grid as guidance.
   (C) Also transfer with blue ink all waterways (permanent and ephemeral) from the 1:25,000 NTS map to 1:50,000 NTS map. If there is a conflict, the route shown at 1:25,000 takes precedence.
   (D) From now on work on a stable mylar or plastic overlay, carefully taped over the flat 1:50,000 NTS sheet, labelled and with corners carefully marked (although removable, because a few steps will require slipping another map under the overlay). Transfer all streams to the overlay with blue ink.
   (E) Transfer orange double hatched areas to the overlay. From now on discard the orange double hatched areas from further consideration.
2. To locate steep slopes which encourage delivery, obtain a copy of the 1:50,000 LS map. Carefully overlay the plastic overlay with the orange double hatched areas. Colour on the overlay all slopes >5% (i.e. slope class C, D, E or F) that are not orange double hatched, light green on that overlay. If only the LS factor is mapped, colour all slopes ≥.7 green.
3. Other non-delivery areas result from a buffering land use which traps sediment. It is assumed that forest or permanent pasture of a width distinguishable on the 1:50,000 Land Systems map would catch a large proportion of the sediment carried by overland runoff.

(A) On a copy of the Land Systems map, double hatch the following symbols as buffer areas:

HG - pasture
G - grazing
A1 - idle 5-10 years
A2 - idle >10 years
Z - woodland
Z_r - reforested
Z_p - pastured woodland
X - wetland
O - hardy fruit orchard
R - recreation (unless it looks like something without much ground cover). To determine this, use NTS sheet as reference.

(B) Place the Land Systems map under the 1:50,000 overlay and transfer each buffer polygon carefully to the overlay where it is still blank. Colour them in yellow.

(C) While the overlay is placed on the Land Systems map, outline in black all B - built-up, E - extractive and W - water polygons on the overlay and label them with the appropriate letter. Include B, E or W areas already coloured green or orange double hatched.



——— Watercourse (Stream, Drain, Ephemeral Stream)
– – – – Sub-basin Boundary

FIGURE 12. EXAMPLE: DRAWING SUB-BASINS - STEP 1

Omit all B, E and W polygons from future consideration in the following steps.

4. (A) This step is concerned with the soil texture characteristics. On the Agricultural Capability maps (1:50,000), double hatch all polygons with an 'm' subclass, brown. ('m' stands for low moisture holding capacity i.e. high infiltration rate). These can be alone, e.g. 2 m or with another subclass, e.g. $4^{f}m$. These are high infiltration areas and coarse soils. Colour all polygons with any of a 'd', 'i', 'r' or 'w' subclass as pink ('d' = low infiltration, heavy structure; 'i' = flooded (in spring); 'r' = shallow over bedrock; 'w' = wet, saturated). These areas have low infiltration. The blank areas have moderate infiltration. Organic soils are not differentiated. Those which are vegetated are buffers from Step 3. Those which are cleared will tend to have a controlled water level and were considered, at least for the critical spring months, to fall into the moderate infiltration class. The user does not need to distinguish them.

   (B) Transfer the brown double hatched areas to the1:50,000 overlay, only where no previous colouring has been added to the overlay. Colour them solid brown on the overlay. Since they will catch runoff by infiltration, they will act like a filter. Also since they are coarse, they will not travel far.

5. Other land uses closer than 100 m to a watercourse are considered potential delivery sites.

   (A) Place the plastic overlay on the 1:50,000 NTS sheet with the orange sub-basin boundaries. With a dark blue pencil crayon follow each watercourse both permanent and ephemeral (including all added from the 1:25,000 sheet in blue ink) colouring in on the overlay 1/10 km on either side of the stream except where the area is in a buffering land use (yellow), a coarse soil (brown), steep (green), or depression (orange double hatch). Do <u>not</u> colour blue uphill of a yellow or brown even if it is within 100 m of the stream. Also do not colour across a sub-basin boundary even if it is within 100 m of the stream.

   (B) In addition, in the spring when most sediment is delivered, roadside and railroad ditches contain flowing runoff water; i.e. they are acting as ephemeral streams. If you feel roadside and railroad ditches are important for carrying spring runoff in your study area, complete Step 5(B). If not, go to Step 6, following completion of Step 5 (A), proximity to watercourses. To incorporate the 100 m area deliverable to these ditches and with complete lack of data on where shallow roadside or railroad ditches are, it is assumed that shallow ditches occur along both sides of every public road (mainly highways and concession roads) and railroad, except where the land abutting the road slopes away from the road.

   Ditches can occur which are not directly connected to a stream. If the roadside contours, instead of leading directly down to a stream, lead:

   1) into a hollow that would flow into

a field ;

2) into a pond, i.e. a sediment trap;

3) into a stream which ends without flowing directly into another stream, by for example, disappearing into a swamp with no blue line on the NTS sheet showing its progression through the swamp;

these ditches would not be delivery sites. On the 1:25,000 NTS map with the orange sub-basin boundaries, follow every road and railroad, colouring in 100 m (remember the scale difference) on either side in light blue unless the land slopes away on one side (in which case delete the ditch on that side) or unless one of the above three conditions occur. (For an example, see Figure 13). Correct completion of this step requires careful interpretation of contours to determine where water will flow and will be assisted by the sub-basin boundaries of Step 1.

Overlay the 1:50,000 plastic overlay on the 1:50,000 NTS sheet. Carefully transfer the light blue indicated on the 1:25,000 NTS map to the 1:50,000 plastic overlay, remembering the scale change. Colour only areas still blank on the overlay.

6. Now returning to non-delivery factors.

(A) Areas of moderate infiltration will be considered non-delivery sites where they are greater than 0.5 km from a stream. The location of moderate infiltration areas is indicated from Step 2 by the blank areas on the coloured Agricultural Capability map. On the 1:50,000 plastic overlay, outline the moderate infiltration areas in pencil.

(B) Place the 1:50,000 plastic overlay on the 1:50,000 NTS map with the orange sub-basin marked. Using the 1:50,000 scale, determine the distance which corresponds to 0.5 km (500 m). With one end of the template at the stream, follow along both sides of every watercourse. Whenever a moderate infiltration area soil is greater than 0.5 km away from the stream it drains to (watch the sub-basin boundaries), draw the 0.5 km contour and on the overlay, double hatch in brown the area greater than 0.5 km from the stream. This too is a non-delivery area. (Step 6 is illustrated in Figure 14). Those areas coloured yellow or green should also be included in the double hatching. An area beyond a roadside ditch (light blue) should be left and the double brown hatching, if it extends to the light blue should stop there and go no further uphill. If this brown double hatching is separated on the uphill side from the sub-basin boundary, double hatch that area immediately between the moderate infiltation area and the sub-basin boundary as well.

7. (A) In the next step, return to the buffer land uses, i.e. to the yellow polygons on the overlay. Keep the overlay on the 1:50,000 NTS sheet with the sub-basins marked. Buffer areas will catch any sediment sent from land areas above it. The only exception is if the buffer between a steep slope and stream is so narrow, runoff from the steep slope can still pass through easily. To locate this situation, check all green polygons. If they are separated from a stream by less than 100 m of

——————— Watercourse
—— —— —— Sub-basin Boundary
▭▭▭▭▭▭▭▭▭▭ 100 m band where 'ditch' meets criteria of step 5

Note: Where the road does not directly intersect a stream within a sub-basin or Where the landscape slopes downhill away from a road, NO 'DITCH' is indicated

FIGURE 13. EXAMPLE : ROADSIDE DITCHES OF CONCERN - PART OF STEP 5

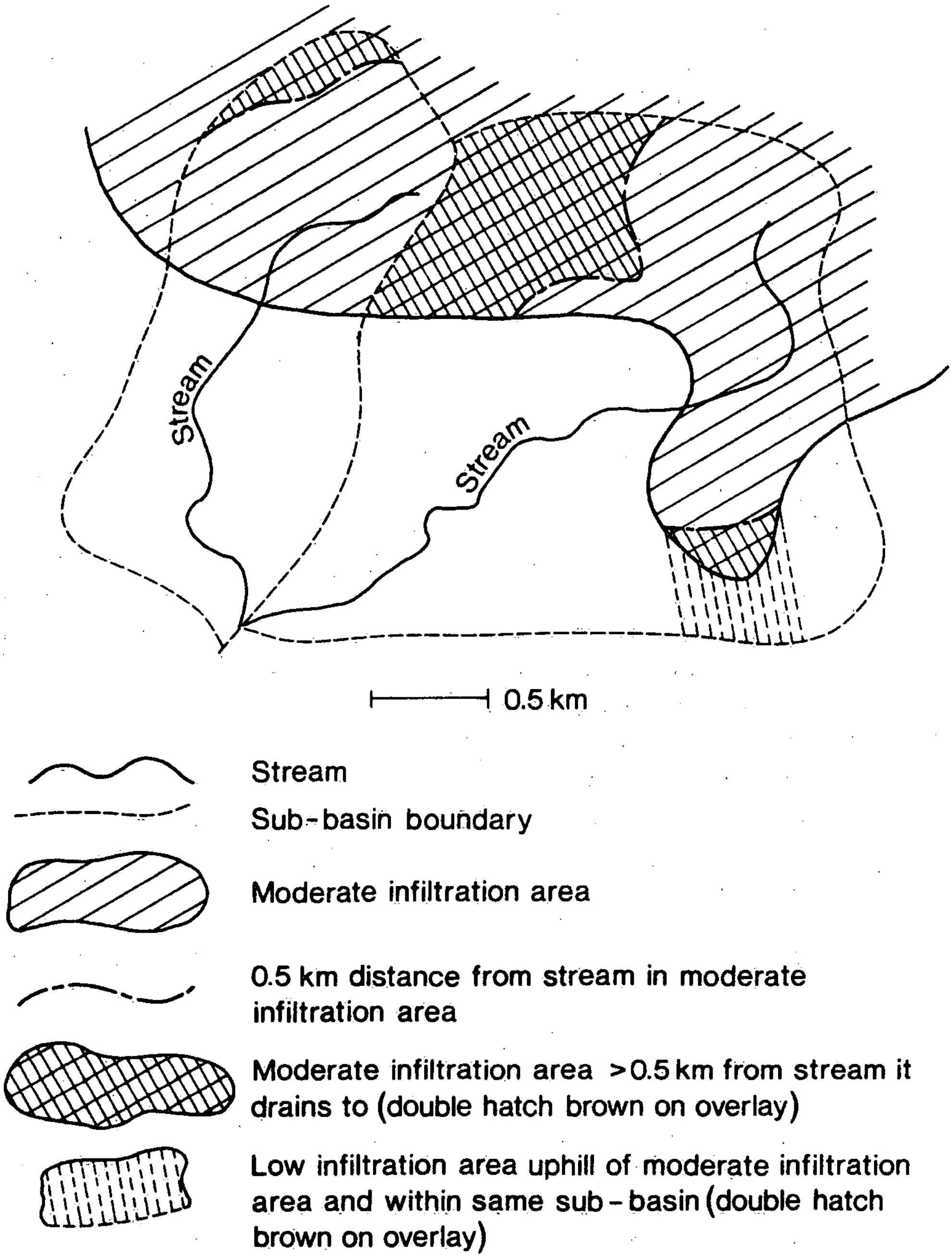


FIGURE 14. ILLUSTRATION OF STEP 6: MODERATE INFILTRATION AREAS FAR FROM A STREAM

yellow, mark over the intervening narrow yellow strip with black double hatch.

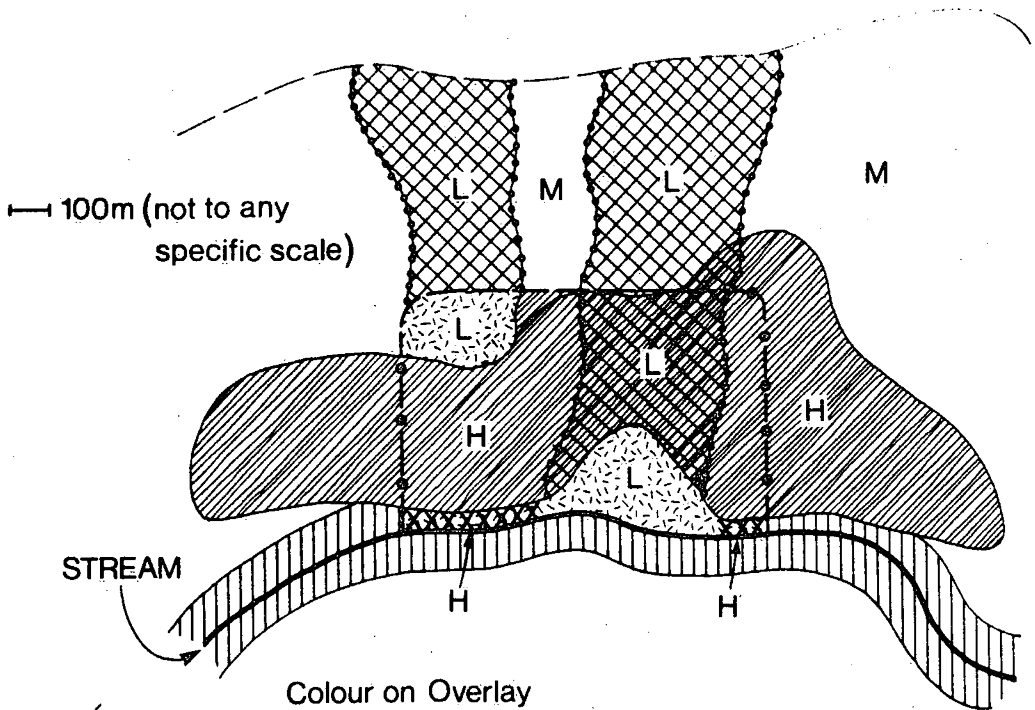
(B) Now for each remaining plain yellow polygons, except those removed from further consideration by brown hatching of Step 6, carefully interpret the contours to determine the 'sub-basin' of land above the buffer and from which runoff will flow into the yellow buffer polygon on route to a stream. Precision for this step will be greatly improved by reference to the 1:25,000 map. Sketch the yellow polygon on it, draw in the 'sub-basin' of land that will contribute runoff through the buffer. Then transfer the 'sub-basin' back to the 1:50,000 overlay and double hatch in yellow. Include yellow double hatching over green polygons if they are in the 'sub-basin' buffered by the solid plain yellow polygon. As you go uphill, do not extend yellow double hatching onto or beyond a brown or brown double hatched area, a light blue area, or an orange sub-basin boundary.
Step 7 is illustrated in Figure 15.
Buffer areas do not eliminate sediment transport from uphill areas which drain into a stream which then flows through a buffer area unless the stream dissipates within the buffer and disappears as a stream. If the stream flows through, it will be assumed that so will the sediment. Figure 16 illustrates the distinction of buffer areas (yellow), buffered areas (yellow double hatched) and non-buffered areas.

(C) Repeat the above steps (A) and (B) for brown polygons instead of yellow. Use the black double hatch for a narrow brown area between a stream and steep slope as described in 7(A). Use brown single hatching for the brown 'sub-basins' hatching. Hatch over green polygons if they are in the 'sub-basin' buffered by the brown area. Stop brown single hatching if you reach a yellow, brown double hatched (either alone or hatched over green or yellow), light blue area or orange sub-basin boundary as you go uphill. (If you extend into yellow double hatching, you have interpreted either the yellow or brown 'sub-basin' incorrectly).

8. This step is to estimate those areas which act as active runoff areas, are connected to a stream and are reasonably close to a stream. This will be done using the finding that poorly drained soils generally correspond well to active runoff areas or hydrologically active areas (Dickinson, 1980).

(A) Obtain the 1:50,000 agricultural capability map for the area. Poorly drained soils are those labelled with a wetness limitation (W following a class number). Single hatch them purple (these soils will be a subset of the pink areas from Step 4).

(B) Place the 1:50,000 overlay on the agricultural capability map. Check the area of each purple hatched polygon to determine if it abuts a dark blue area (100 m from a stream) and is still blank, i.e. no previous conditions coloured in. For those areas within poorly drained polygons, which satisfy <u>both</u> those conditions, colour the poorly drained area red for only 250 m distance back from the creek (i.e. only 150 m beyond the blue). (The soils map



Colour on Overlay

Previous steps:
- Dark Blue (<100 m to stream) - from step 5
- Green (steep slopes) - from step 2
- Yellow (forest buffer) - from step 3

Step 7:
- Yellow with black double hatch (forested strip, between steep slope and stream, that is <100 m, too narrow to act as buffer)
- Yellow double hatch (area buffer<u>ed</u> by wide flat forest)
- Green with yellow double hatch (steep slope buffered by wide flat forest)

H	High Delivery Ratio	- normally added in step 10
M	Moderate Delivery Ratio	- added to illustration to help
L	Low Delivery Ratio	visualize rationale of step 7

- - - Sub-basin boundary

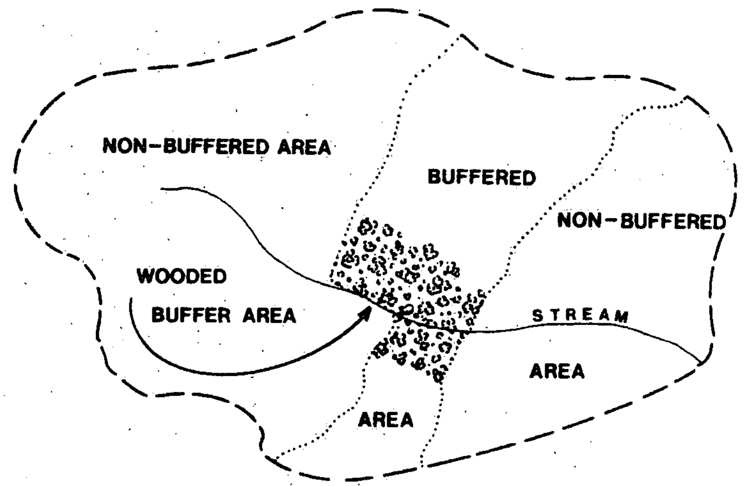
••••••••• Sub-sub-basin boundary of land above buffer

—•— Forest boundary

FIGURE 15. ILLUSTRATION OF STEP 7: BUFFER<u>ED</u> AREAS

FIGURE 16. BUFFER, BUFFERED AND NON-BUFFERED AREAS.

x



can also be interpreted for all poorly drained mineral soils if the agricultural capability map is not available or is older than the soils map). Disregard organic soils.

9. (A) Place the 1:50,000 plastic overlay on the 1:50,000 NTS sheet with the orange sub-basin boundaries. On the overlay mark over with small black x's any steeply sloped area (solid green with no hatching) of which the downslope boundary is buffered by >100 m of blank, before hitting a red, dark blue, or another plain green area.

   (B) For the remainder which on their downslope boundary will either have no gap or a gap <100 m wide until another high factor (red, dark blue or plain green), black double hatch over the small gap. Step 9 is illustrated in Figure 17.

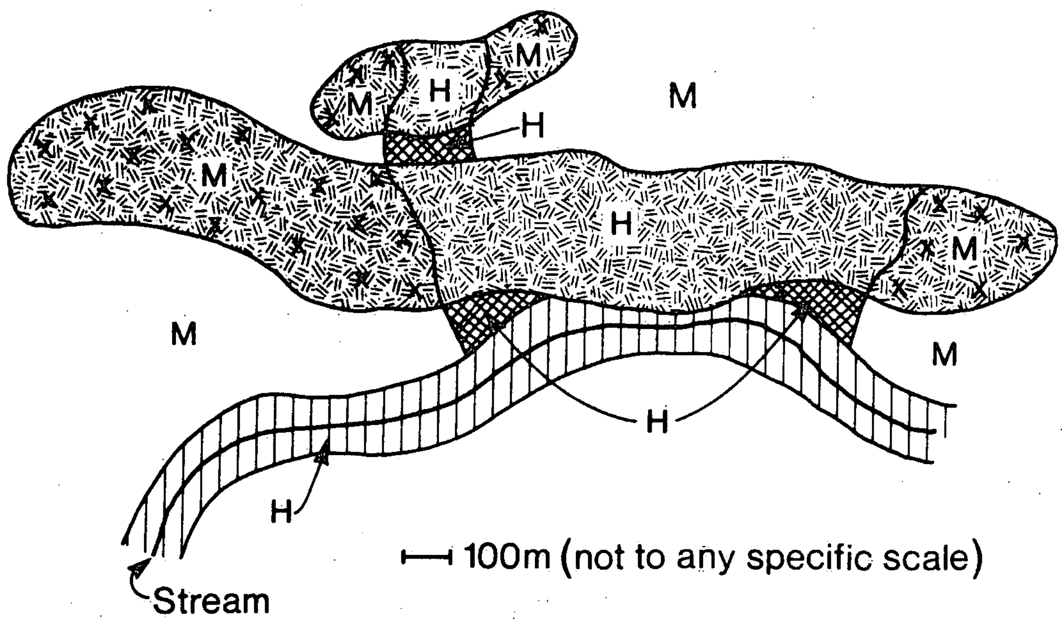
10. You are now ready to produce a final composite overlay and develop the final ranking of terrain capability to deliver sediment to a stream.

   (A) Overlay another piece of plastic over the 1:50,000 overlay. Ensure that it is flat, tape it down and carefully mark the corners.

   (B) Carefully outline in ink every change in colour, colour combination, texture, colour texture combination, texture combination; i.e. every unique homogenous polygon. Ignore the sub-basin boundary unless it coincides with a colour-texture combination boundary.

   (C) Each polygon must be labelled. The label will include both the reason and the ranking for the delivery ratio. All areas with factors retarding delivery will be a low ranking; all areas with factors encouraging delivery will be a high ranking; and all areas remaining neutral for which neither positive or negative factors have been found will be a moderate ranking. Following is the label to be assigned to each colour-texture combination:

Dark Blue	1H
Red	2H
Green	3H
Yellow + Black Double Hatch	4H
Blank + Black Double Hatch	5H
Brown + Black Double Hatch	6H
Light Blue	7M
Blank	8M



Colour on overlay

Previous steps		Dark Blue (<100m to stream) – from step 5
		Green (steep slopes) – from step 2
Step 9		Blank with Black Double Hatch (<100m of blank between slope and another high delivery ratio – dark blue, red or plain green)
		Green with Black X's (steep area buffered by >100m of moderate delivery ratio)
H	High Delivery Ratio	– normally added in step 10
M	Moderate Delivery Ratio	– add to illustration to help visualize rationale of step 9

FIGURE 17. ILLUSTRATION OF STEP 9 – SLOPES SEPARATED FROM OTHER HIGH DELIVERY RATIO AREAS

Solid Green + Black x's	9M
Solid Green + Yellow Double Hatch	10L
Solid Yellow + Brown Double Hatch	11L
Solid Green + Brown Double Hatch	12L
Orange Double Hatch	13L
Solid Brown	14L
Brown Double Hatch	15L
Solid Yellow	16L
Yellow Double Hatch	17L
Brown Single Hatch	18L
Solid Green + Brown Single Hatch	19L

11. The map of Terrain Capability to Transport Sediment to a Stream (Field to Stream Delivery Ratio) is now completed. The map legend is presented in Table 5.

TABLE 5. Legend for Map of Terrain Capability to Transport Sediment to a Stream.

Map Label	Rank	Reason
1H	High	Land close to a watercourse with no factors lowering the ranking.
2H	High	Hydrologically active area with no factors lowering the ranking.
3H	High	Steep slope <100 m uphill of a stream or another High ranking area.
4H	High	Relatively flat vegetated area which is too narrow (<100 m) between a steep slope and watercourse to be an effective buffer.
5H	High	A strip of land between a steep slope and the High ranking areas which is too narrow (<100 m) to substantially reduce delivery from the slope.
6H	High	Relatively flat, high infiltration, coarse soil area which is too narrow (<100 m) between a steep slope and watercourse to be an effective filter.
7M	Moderate	Land without any of the above High delivery factors which is close to a potential roadside ditch that drains directly to a watercourse.
8M	Moderate	Land with no conditions for either a High or Low ranking. If the area is >0.5 km from a watercourse, it has fine textured low infiltration soils.
9M	Moderate	Steep slope but well-separated (>100 m) from another High ranking area. The intervening area reduces the slope delivery ratio to Moderate.
10L	Low	Steep area with a reduced delivery ratio because it drains overland into a wide (>100 m) flat vegetated buffer zone.
11L	Low	Vegetated area which also has moderate infiltration, medium textured soils and is far (≥0.5 km) from a watercourse.
12L	Low	Steep slope which is reduced to a Low ranking because it has moderate infiltration, medium textured soils far (≥0.5 km) from a watercourse.
13L	Low	Closed depression.
14L	Low	Filter area with high infiltration and coarse textured soils.
15L	Low	Moderate infiltration, medium textured soils far (≥0.5 km) from a watercourse.
16L	Low	Relatively flat vegetated area.
17L	Low	A buffered area i.e. drains overland into a vegetated buffer area.
18L	Low	A buffered area i.e. drains overland into a high infiltration coarse textured soil filter area.
19L	Low	Steep area with a reduced delivery ratio because it drains overland into a wide (>100 m) flat,high infiltration,coarse soil,filter zone.
B		Built-up area (not ranked).
E		Extractive area (not ranked).
W		Water.

6.2.3 Check Methodology

The following steps can be followed to help pick up errors.

I. Using the coloured maps

1. Were buffers coloured on the land system maps? Scan the land systems maps to make sure no buffers were missed. Then quickly check the pattern to ensure all coloured polygons have a corresponding yellow on the coloured delivery map (unless it was green already).
2. Check that only dark blue, yellow, green and brown polygons abut streams. Also dark blue should never be separated from a stream by yellow or brown.
3. Double hatch brown never abuts dark blue or red in the same sub-basin (i.e. always >0.5 km from stream).
4. Yellow double hatched (over green or not) and brown single hatch (over green or not) never abuts a stream, i.e. never abuts dark blue (unless there is a sub-basin divide at the boundary of the 2 colours.
5. Are C, D, E, F's slope classes (or LS $\geq$0.7) coloured on the slopes maps? Scan the slopes maps to make sure all 4 classes are coloured. Then quickly scan the coloured delivery maps to check all coloured slope polygons have a corresponding green (no matter what other hatching or x's added).
6. All reds should abut dark blue on at least one side and only go back ½ km (reds never abut double hatched brown i.e. Step 3 above).

II. Overlay the final labelled maps on coloured delivery maps.

1. All black double hatching should be H's
2. All black x's should be M's
3. a) Check all blues are labelled 1H
   b) Check all reds are labelled 2H
   c) Check all greens are labelled 3H

   and so on through the list in Step 10 of the Detailed Methodology for Mapping Terrain Capability to Transport Sediment to a Stream.

III. Using the final labelled maps

1. Overlay on the coloured Agricultural Capability map from Step 4 of the Detailed Methodology.
   - All 14L's should be brown (a few browns might not be 14L)
2. 15 L should always be well back from stream (>½ km)
3. All 2H's should abut 1H's
4. The only L's 1H should abut on its uphill boundary are 13L, 14L and 16L. Otherwise, 1H always abuts M's and H's within its own sub-basin.
5. On the downhill boundary, all 3H's should abut a stream or an H of some number.
6. Within each sub-basin, as one goes from the stream up to the sub-basin boundary or divide, the progression of ranking should be from H to M to L. Steps can be jumped, i.e. H to L, but never should H be uphill from L or M, or M be uphill from L. The progression is illustrated in Figure 18. To facilitate this check, colour in all 1H's, 4H's and 6H's on a 1:50,000 paper copy run off from the final 1:50,000 plastic copy. This will define areas close to watercourses. Then check between water-courses that the ranking progression goes from higher to lower from the watercourse to the drainage basin divide and then rises again as the next watercourse is approached. Any anomolies should be checked and corrected. The check methodology will also help catch unlabelled polygons which should be checked and labelled.

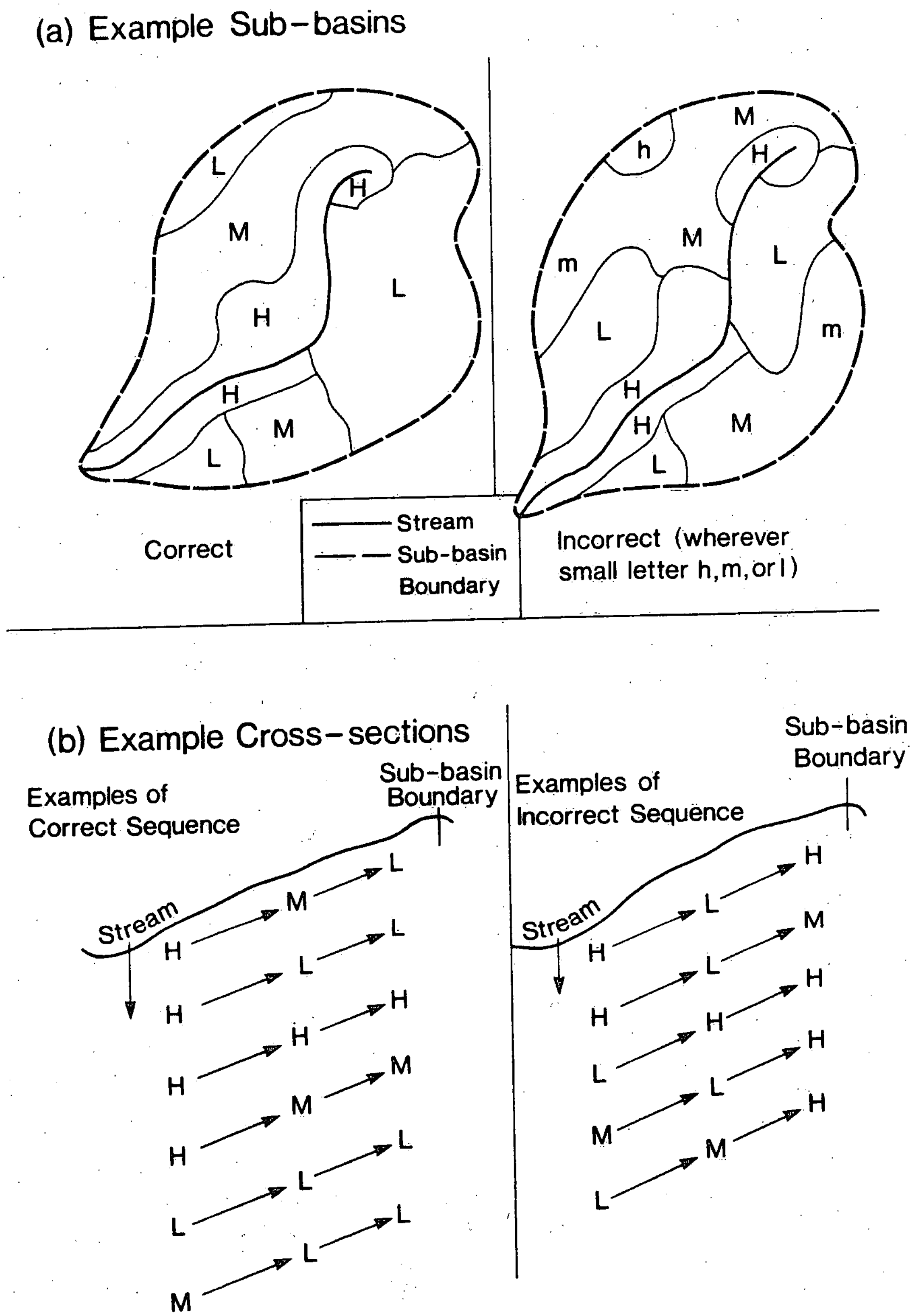


FIGURE 18. ILLUSTRATION OF PROGRESSION REFERRED TO IN CHECK STEP Ⅲ 6

6.2.4 Changes to Methodology, If Only 1:50,000 NTS Maps Available

If only 1:50,000 NTS maps are available, follow the preceding methodology (Section 6.2.2) including the adjustments given below for the appropriate step.

1. To the 1:50,000 NTS sheet, carefully add all ditches and watercourses shown on the 1:25,000 OMAF Drainage maps. Remember to adjust for the scale. Use the roads for guidance. If there appears to be a conflict between the two map sets for the same watercourse, use the most recent information. Draw the sub-basins and depressions described in Step 1 as best you can using the 1:50,000 contour information. The use of the overlay is as described in Step 1. Transfer the orange hatched areas to the overlay.
2. Remains the same.
3. Remains the same.
4. Remains the same.
5. Remains the same for the section to indicate 100 m from a watercourse (dark blue). Draw the 100 m strip along roadside ditches to the same instructions, except directly use the 1:50,000 contour information as best as possible. The 1:25,000 transfer is omitted.
6. Remains the same.
7. Remains the same except the reference to the 1:25,000 maps for extra precision is not possible.
8. Remains the same.
9. Remains the same.
10. Remains the same.

6.3 <u>Priority Management Areas for Diffuse Source Sediment Pollution (Stream Sediment Loads)</u>

6.3.1 Introduction

Many water quality concerns are related to sediment pollution. This section will produce a map rating which land areas are most likely to contribute serious sediment loads to creeks in an average year and which are least likely.

This is done by multiplying the Potential Average Annual Soil Loss by the Delivery Ratio, the proportion of how much of that soil loss reaches a stream. With maps, multiplication is accomplished by overlaying the Soil Loss and Delivery Ratio maps.

The result ranks at a regional level the sediment load to a stream from each unit of land. It does not give the concentration of the sediment in the stream - that depends on both the load and the flow of the stream itself. The larger the flow, the more diluted a large sediment load would be. The load alone is very useful, however. It is the total load that presents problems to downstream water bodies and reservoirs.

The overlay locates areas where the sediment load is high because both the soil loss and delivery ratio are high; and where the load is low because both the soil loss and delivery ratio are low. It also sorts out the other combinations as shown in Table 6.

In developing Table 6, actual numbers were substituted for soil loss and delivery ratios classes to decide how to rank the sediment load.

6.3.2 Methodology

1. For this step, the final labelled Delivery Ratio map should be carefully overlaid on the coloured Soil Loss map so they precisely line up. Tape both down. Stable plastic copy is preferable. If paper copy is used, do not fold or roll. This will minimize distortion. For paper copy a light table may be necessary.

TABLE 6. Overlay Combinations to Rank Sediment Load Priority Management Areas.

Soil Loss	Delivery Ratio	Sediment Load
Very High	High	High
Very High	Moderate	High
Very High	Low	Moderate
High	High	High
High	Moderate	Moderate
High	Low	Moderate
Moderate	High	Moderate
Moderate	Moderate	Moderate
Moderate	Low	Low
Low	High	Low
Low	Moderate	Low
Low	Low	Low

2. Single hatch blue the High areas on the Delivery map, using a different angle than the red single hatched High Soil Loss (so both are visible).
3. Overlay a blank piece of plastic, tape it down and outline the township, watershed or study area in black.
4. Where blue single hatch Delivery Ratio coincides with solid or hatched red Soil Loss, colour the overlay dark brown.
5. Check every solid red without blue single hatch to see if the overlaid Delivery Ratio is M or L. Colour the M ones (over solid red) dark brown on the overlay.
6. Check every yellow without blue single hatch to see if the overlaid Delivery Ratio is M or L. Colour the L ones (over yellow) dark blue on the overlay.
7. Colour all greens (from the Soil Loss), whether blue single hatch over or not, dark blue on the overlay.
8. Outline and label any B, E or W areas.
9. Remove the top overlay plastic. Label it Priority Management Areas for Diffuse Source Sediment Pollution. Add a legend. The brown areas are High; the blank areas are Moderate; the blue areas are Low. B areas are built-up, E areas are extractive land uses and W areas are water. Add the township or study area name, a north arrow and a scale.

In a region of extensive areas of flat topography, the absolute values of each load range are slightly lower than in a region of rolling topography. Highs in rolling topography are of slightly higher priority than those in flat landscapes.

7.0 REFERENCES

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APPENDIX A

NATIONAL TOPOGRAPHIC SYSTEM MAP

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Department of Energy, Mines and
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(Les index sont disponibles gratuitement sur demande.)

SCALE/ÉCHELLE			COLOURS/COULEURS	DIMENSIONS cm X cm	PRICE/PRIX
1: 25 000	1.6 km = 6.42 cm	(1 mi = 2.53")	6	57.15 X 73.66	$ 3.00
1: 50 000	1.6 km - 3.22 cm	(1 mi = 1.27")	6	64.77 X 91.44	3.00
1: 50 000	1.6 km = 3.22 cm	(1 mi = 1.27")	1	64.77 X 91.44	2.50
1: 125 000	3.2 km = 2.54 cm	(2 mi = 1.0")	6	64.77 X 76.2	3.00
1: 250 000	6.4 km = 2.54 cm	(4 mi = 1.0")	6	57.15 X 73.66	3.00
1: 500 000	12.8 km = 2.54 cm	(8 mi = 1.0")	6	64.77 X 76.2	3.00
1: 1 000 000	25.7 km = 2.54 cm	(16 mi = 1.0")	6	64.77 X 76.2	3.00

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- Berriedale Country Store, P.O. Box 605, POA 1CO

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CLOYNE
- Savigny, Real Estate Ltd. Realtor, R.R.#2, (Jct Hwys 41 & 506), KOH 1KO
- Scott's Shopping Centre, R.R. #1, KOH 1KO

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- Elora Books, 38 Mill St.W., N0B 1S0

ESPANOLA
- Highway Confectionery, 456 Station Rd., Box 189, P0P 1C0

ETOBICOKE
- O.G.T. Equipment Supplies and Services Ltd., P.O. Box 71, M9C 4V2

FORT FRANCES
- The Camera Shop Plus, 298 Scott St., P9A 1G7
- District Manager, Min. of Natural Resources, 922 Scott St., P9A 1J4
- The Great Bear, P.O. Box 278, (261 Scott St.), P9A 3M6

GANANOQUE
- Donevan's Pro Hardware, 135 King St.E., P.O. Box 668, K7G 2V2

GERALDTON
- District Manager, Min. of Natural Resources, P.O. Box 640, 208 Beamish Ave. W., P0T 1M0

GODERICH
- Christian R. Kiar Ltd., Surveyors, 41 West St., N7A 2K5

GODFREY
- Babcock's Grocery, c/o Miss Joyce Babcock, R.R. #2, K0H 1T0

GOODERHAM
- Barr's General Merchants, P.O. Box 124 (Main St), K0M 1R0

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Area/Région: ONTARIO

GOWGANDA
- Gowganda Trading, General Delivery, POJ 1J0
- Bullocks, Gowganda Lake Camp, POJ 1J0
- Gow-Ganda & Area Museum, POJ 1J0

GUELPH
- Forum Sport Inc., 127 Wyndham St. N., N1H 4E9

HALIBURTON
- The Municipality of Dysart Et Al, Maple Ave., P.O. Box 389, KOM 1S0
- Kennedy Surplus and Exchange, P.O. Box 630, KOM 1S0

HAWKESBURY
- Massie Sport & Pet Shop, 548 Main St. East, K6A 1B1

HUNTSVILLE
- Chamber of Commerce, P.O. Box 1470, 165 Main St.W., POA 1K0
- Hunstville Discount Drugs, P.O. Box 670, 10 Main St.E., POA 1K0

IGNACE
- Vern's Minnows Ltd, P.O. Box 67, 706 Highway 17 E., POT 1T0

IROQUOIS FALLS
- Judd's Variety Store, P.O. Box 58, 1299 Victoria Rd., POK 1H0

IRON BRIDGE
- Black Creek Store, P.O. Box 597, POR 1H0

KAPUSKASING
- District Manager, Min of Natural Resources, 6-8-10 Gov't Rd., P5N 2W4

KATRINE
- Katrine Lucky Dollar, General Delivery, POL 1L0

KENABEEK
- Mountain Chutes Camp, R.R. #2, POJ 1M0

KENORA
- Min. of Natural Resources, P.O. Box 5080, 808 Robertson St., P9N 3X9
- Strains Stationery Ltd, 213 First St. South, P9N 1C2
- Scott Books, P.O. Box 1050, P8N 3X7

KILLARNEY
- Killarney Mountain Lodge Ltd, 3 Commissioner St., POM 2A0

KINGSTON
- R.W. Alford & Co., 121 Princess St., K7L 1A8

KITCHENER
- Provident Bookstore, 117 King St.W., N2G 4M5

LAKEFIELD
- Nick Nickels Canoe Canada, P.O. Box 479, KOL 2H0

LANCASTER
- Highland Heritage Printers & Stationers Reg'd, 11 Oak Street, P.O. Box 460, KOC 1N0

LINDSAY
- District Manager, Min. of Natural Resources, 322 Kent St.W., K9V 2Z9

LISTOWEL
- Listowel Book Shop, 125 Main St. West, N4W 1A2

LITTLE CURRENT
- Turner's of Little Current Ltd., P.O. Box 429, POP 1K0

LONDON
- Robert Holms Ltd., 240 Dundas St., N6A 2M1
- North Star Media (London) Ltd, 110 Langton Rd., N5V 2M1
- Oxford Book Shops Ltd, 740 Richmond St., N6A 1L6
- The Bookstore, Univ.of Western Ontario, Univ. Community Centre, N6A 3K7
- Prestige Publications Ltd., 105 Falcon St., N5W 4Z2

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Area/Région: ONTARIO

LONGLAC
- Skinners Acre Tourist Service, P.O. Box 153, POT 2A0
LYNDHURST (BLACK RAPIDS)
- Mr. C.W. Shaw, R.R. #1, KOE 1NO
MABERLY
- Parkdale Service Centre, Ben Barbarys Co.Ltd.,Hwy 7,Silver Lake,KOH 2B0
MADOC
- Madoc Sport Centre, P.O. box 85, Russel St. North (Hwy 52), KOK 2KO
MAGNETAWAN
- Magnetawan Marine Service Ltd, P.O. Box 10, POA 1PO
MARATHON
- Marathon Pharmacy, P.O. box 340, POT 2E0
MARKHAM
- Metro Map Publications Ltd, Suite "C", 7280 Victoria Park Ave., L3R 2M5
MARMORA
- Leo's Sport Shop, 12 Forsyth St., KOK 2MO
MARTEN RIVER
- Timberlane Lodge & Gift Shop, POH 1TO
- Trapper Trading Post, Highway #11, POH 1TO
MASSEY
- East Bull Lake Trading Post, P.O. Box 28, POP 1PO
MATHESON
- Ginn McLean Hardware Ltd, P.O. Box 190, POK 1NO
MATTAWA
- Gauthier's Confectionery, P.O. Box 149, 321 Main St., POH 1VO
MCARTHUR'S MILLS
- Slater's Store, KOL 2MO
MILLBROOK
- Voyageur Canoe Co. Ltd., 3 King St., LOA 1GO
MINDEN
- Haliburton Highlands Chamber of Commerce, P.O. Box 147, KOM 2KO
MOUNT FOREST
- Bookcraft, 183 Main St. South, P.O. Box 1051, NOG 2LO
NAKINA
- Nakina Outpost Camp, P.O. Box 126, POT 2HO
- Leuenberger Air Service Ltd., P.O. Box 60, POT 2HO
- Twin Lakes Outfitters and Wildern
NESTOR FALLS
- Maple Leaf Gift Shop, P.O. Box 247, (West Side of Hwy 71), POX 1KO
NIPIGON
- Nipigon Historical Museum, P.O. Box 208, POT 2J0
NOËLVILLE
- Totem Point Lodges, P.O. Box 3, R.R. #1, POM 2NO
NORLAND
- Moore Falls Tackle Shop, 2-19, R.R. #1, KOM 2LO

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Area/Région: ONTARIO

NORTH BAY
- Fosdick's A & N Moyer Ltd., 150 Main St. West, P.O. Box 507, P1B 8J2
- District Manager, Ministry of Natural Resources, P.O. Box 3070, P1B 8K7
- Richardson's (North Bay) Ltd., 188 Main St. W., P1B 2T5
- Lefebvres Sport and Hobby Shop, 131 Main St. West, P1B 2T6
- Bigwood Sporting Goods Ltd., 139 Worthington St. E., P1B 1C4

NORTH ORILLIA
- Ellwood Epps Orillia Ltd., Hwy. 11, R.R. #3, L3V 6H3

OTTAWA
- Trail Head, Black Feather Ltd, 1341 Wellington St., K1Y 3C3
- C.O.P.A., Rm 605, 77 Metcalfe St., K1P 5S4
- E.M.R. Ifnormation & Sales Centre, 580 Booth St., K1A 0E4
- Renouf Publications, 61 Sparks St., K1P 5A5
- Pathfinder Air Surveys Ltd, 3363 Carling Ave., K2H 7V6
- Place Bell Book Store, 175 Metcalfe St. K2P 2E9
- German Book Boutiques Ltd, 37 Queen St., K1P 5C4

OWEN SOUND
- Coates & Best Inc, 883-2nd Ave. East, N4K 2H2
- Eldred's Canoe Sales, 354-26th St.W., N4K 4J3

PARRY SOUND
- The Parry Sound Area Chamber of Commerce, 2 Louisa St., P2A 2V4

PEMBROKE
- Bailey's Sport Centre Ltd, 159 Pembroke St.W., K8A 5M9
- Champlain Air Surveys Ltd, R.R. #6, Pembroke & Area Municipal Airport, K8A 6W7
- District Manager, Min. of Natural Resources, P.O. Box 220, Riverside Dr., K8A 6X4

PERTH
- James Brothers Hardwaree Ltd., P.O. Box 247, 2 Gore St.E., K7H 3E4

PETERBOROUGH
- Pierce & Lyons Inc., 129½ Hunter St.W., K9H 2K7
- Camp Wanapit, Co-Ed Camps Ltd., 7 Engleburn Place, K9H 1C4
- Joyce's Outdoor Store, 87 Hunter St. W., K9H 2K5

PICKERING
- The Village Travel Shoppe, 82 Kingston Rd.W., L1V 1Z4

PORT CARLING
- The Village Place, P.O. Box 477, P0B 1J0

PORT LORING
- Port Loring Wilderness Outfitters, General Delivery, P0H 1Y0

PORT PERRY
- Troski's Tackle & Live Bait Ltd, R.R. #4, L0B 1N0

POWASSAN
- Brushey Home Hardware, P.O. Box 68, 102 King St., P0H 1Z0

RED LAKE
- Red Lake Office Supplies, P.O. Box 1092, Howey St., P0V 2M0

RENFREW
- McPhail Hardware Ltd, 168 Raglan St.S., K7V 1R1

ST CATHARINES
- Beatties Desk & File, 14 Queen St., L2R 5G3
- Peninsula Press Ltd, P.O. Box 334, 39 Ontario St., L2R 6T7

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Area/Région: ONTARIO

SARNIA
- Manleys Ltd., 142 Lochiel St., N7T 4C1

SAULT STE MARIE
- Min. of Natural Resources, P.O. Box 130, 69 Chruch St., P6A 5L5
- Sault Ste Marie & District Chamber of Commerce, 360 Great Northern Rd., P6B 4Z7
- Ron's Live Bait, R.R. #2, Highway 17 N, P6A 5K7

SCARBOROUGH
- Robert B. Mansour Ltd, 250 Midland Ave., M1P 3E6

SHINING TREE
- Lalond Country Store, POM 2X0
- Shining Tree Tourist Camp, General Delivery, POM 2X0
- Spruce Shilling Camp, POM 2X0

SIOUX LOOKOUT
- Ojibway Baits, Box 6, Site 10, POV 2T0
- District Manager, Min. of Natural Resources, P.O. Box 309, POV 2T0

SIOUX NARROWS
- Sioux Narrows Bait Farms Ltd., P.O. Box 98, POX 1N0

SPANISH
- Jodi Cullen Sporting Goods, 2 Cutler Ave., POP 2A0

STOKES BAY
- Joe Southward, Copper Kettle Restaurant, NOH 2M0

STURGEON FALLS
- Shorty'y Conv. 493363 Ontario Ltd., 162 Front St., Hwy. 17 North, P.O. Box 1358, POH 2G0

STRATFORD
- Oxford Book Shops Ltd, Festival Square, 10 Downie St., N5A 7K4

SUDBURY
- Min. of Natural Resources, District Manager, P.O. Box 3500, Stn A, 174 Douglas St. W., P3A 4S2

SWASTIKA
- District Manager, Min. of Natural Resources, P.O. Box 129, POK 1T0

TEMAGAMI
- District Manager, Min. of Natural Resources, P.O. Box 38, POH 2H0
- Keywaydin Camps Ltd, POH 2H0
- Camp Wabun, POH 2H0
- Ted's Store of Little Things, P.O. Box 98, POH 2H0
- Témagami Pharmacy Ltd., P.O. Box 489, POH 2H0

THESSALON
- Peshu Lake Camp, P.O. Box 447, POR 1L0

THUNDER BAY
- Sleeping Giant Scuba Corp., 217 S. McKellar St., P7E 1H6
- Wildwaters, 119 N. Cumberland St., P7A 4M3

TIMMINS
- District Manager, Min. of Natural Resources, 896 Riverside Dr., P4N 3W2

TOBERMORY
- Mariner Chart Shop, P.O. Box 9, NOH 2R0

Area/Région: <u>ONTARIO</u>

<u>TORONTO</u>
- Eddie Bauer, 1020 Lawrence Ave. W., M4W 1A1
- H.M. Dignam Corp. Ltd, 85 Bloor St.E., Suite 404, M4W 1B5
- Min. of Natural Resources, Map Office, Rm 1640, Whitney Block, Queen's Park, M7A 1W3
- Open Air Books & Maps, 10 Adelaide St.E., M5C 1J3
- Perly's Maps Ltd, 1050 Eglinton Ave. W., M6C 2C5
- Renouf Publishing Co., Ontario Ltd, 211 Yonge St., M5B 1N3
- Landridge Ltd, 7 Labatt Ave, M5A 3P2
- The Travel Book Store, 844 A Yonge St., M4W 7H1

<u>TRENTON</u>
- Darlings Stationery, 24 Dundas St.W., P.O. Box 367, K8V 5R6

<u>TWEED</u>
- Guy Hughes Ltd, 316 Victoria St., K0K 3J0

<u>WATERLOO</u>
- Schendel Stationery Ltd, P.O. Box 606, 120 King St.S., N2J 4B9
- University of Waterloo, Bookstore, University Ave., N2L 3G1

<u>WAWA</u>
- Mariette's, 89 Broadway Ave., P.O. Box 185, P0S 1K0
- Chico Outfitters, P.O. Box 1660, P0S 1K0
- Superior Lore, P.O. Box 698, 55 Broadway Ave., P0S 1K0

<u>WEBBWOOD</u>
- Agnew Lake Air Services Ltd., P.O. Box 126, P0P 2G0

<u>WESTPORT</u>
- M.J. Bennett & Son, P.O. Box 173, Main St., K0G 1X0
- Wallace of Westport, P.O. Box 69, 69 Main St., K0G 1X0

<u>WILLOWDALE</u>
- Maps & Charts of Canada, 8 Dunboyne Crescent, M2R 2B7

<u>WINDSOR</u>
- The Bookstore, Windsor Public Library, 850 Ouellette Ave.,N9A 4M9

<u>WOODVIEW</u>
Cedarwood Gift Shop, K0L 3E0

APPENDIX B

USLE CATEGORY TABLES

(D. Coleman, 1983)

USLE CATEGORY TABLE

R = 90

L = 0 to 1 Ton/Acre/Year (0 to 2 Tonnes/Hectare/Year)
M = >1 to 3 Tons/Acre/Year (>2 to <7 Tonnes/Hectare/Year)
H = >3 to 5 Tons/Acre/Year (7 to 11 Tonnes/Hectare/Year)
V = >5 Tons/Acre/Year (>11 Tonnes/Hectare/Year)

K is Light Green

Representative Land System

LS Factor	P	C	M	H G	A 1	A 2	Z
.10	L	L	L	L	L	L	L
.11	L	L	L	L	L	L	L
.12	L	L	L	L	L	L	L
.14	L	L	L	L	L	L	L
.15	L	L	L	L	L	L	L
.17	L	L	L	L	L	L	L
.19	M	L	L	L	L	L	L
.21	M	L	L	L	L	L	L
.23	M	L	L	L	L	L	L
.25	M	L	L	L	L	L	L
.28	M	M	L	L	L	L	L
.31	M	M	L	L	L	L	L
.35	M	M	L	L	L	L	L
.38	M	M	M	L	L	L	L
.43	M	M	M	M	L	L	L
.47	M	M	M	M	L	L	L
.52	M	M	M	M	L	L	L
.58	H	M	M	M	L	L	L
.65	H	M	M	M	L	L	L
.72	H	M	M	M	L	L	L
.79	H	H	M	M	L	L	L
.88	H	H	M	M	L	L	L
.98	V	H	M	M	L	L	L
1.08	V	H	H	M	L	L	L
1.20	V	H	H	H	L	L	L
1.33	V	V	H	H	L	L	L
1.48	V	V	H	H	L	L	L
1.64	V	V	H	H	L	L	L
1.82	V	V	V	H	L	L	L
2.02	V	V	V	V	L	L	L
2.24	V	V	V	V	M	L	L
2.48	V	V	V	V	M	L	L
2.75	V	V	V	V	M	L	L
3.05	V	V	V	V	M	L	L
3.39	V	V	V	V	M	L	L
3.76	V	V	V	V	M	L	L
4.17	V	V	V	V	M	L	L
4.62	V	V	V	V	M	L	L
5.13	V	V	V	V	M	L	L
5.69	V	V	V	V	M	L	L
6.31	V	V	V	V	M	M	L
7.00	V	V	V	V	H	M	L
7.76	V	V	V	V	H	M	L
8.61	V	V	V	V	H	M	L
9.55	V	V	V	V	H	M	L
10.59	V	V	V	V	H	M	L
11.75	V	V	V	V	V	M	L
13.03	V	V	V	V	V	M	L
14.45	V	V	V	V	V	M	L
16.03	V	V	V	V	V	M	L
17.78	V	V	V	V	V	M	L

K is Blank

Representative Land System

LS Factor	P	C	M	H G	A 1	A 2	Z
.10	M	L	L	L	L	L	L
.11	M	L	L	L	L	L	L
.12	M	L	L	L	L	L	L
.14	M	L	L	L	L	L	L
.15	M	M	L	L	L	L	L
.17	M	M	L	L	L	L	L
.19	M	M	M	L	L	L	L
.21	M	M	M	L	L	L	L
.23	M	M	M	M	L	L	L
.25	M	M	M	M	L	L	L
.28	M	M	M	M	L	L	L
.31	H	M	M	M	L	L	L
.35	H	M	M	M	L	L	L
.38	H	M	M	M	L	L	L
.43	H	H	M	M	L	L	L
.47	H	H	M	M	L	L	L
.52	V	H	M	M	L	L	L
.58	V	H	H	M	L	L	L
.65	V	H	H	H	L	L	L
.72	V	V	H	H	L	L	L
.79	V	V	H	H	L	L	L
.88	V	V	H	H	L	L	L
.98	V	V	V	H	L	L	L
1.08	V	V	V	V	L	L	L
1.20	V	V	V	V	M	L	L
1.33	V	V	V	V	M	L	L
1.48	V	V	V	V	M	L	L
1.64	V	V	V	V	M	L	L
1.82	V	V	V	V	M	L	L
2.02	V	V	V	V	M	L	L
2.24	V	V	V	V	M	L	L
2.48	V	V	V	V	M	L	L
2.75	V	V	V	V	M	L	L
3.05	V	V	V	V	M	L	L
3.39	V	V	V	V	M	M	L
3.76	V	V	V	V	H	M	L
4.17	V	V	V	V	H	M	L
4.62	V	V	V	V	H	M	L
5.13	V	V	V	V	H	M	L
5.69	V	V	V	V	H	M	L
6.31	V	V	V	V	V	M	L
7.00	V	V	V	V	V	M	L
7.76	V	V	V	V	V	M	L
8.61	V	V	V	V	V	M	L
9.55	V	V	V	V	V	M	L
10.59	V	V	V	V	V	H	L
11.75	V	V	V	V	V	H	L
13.03	V	V	V	V	V	H	M
14.45	V	V	V	V	V	H	M
16.03	V	V	V	V	V	H	M
17.78	V	V	V	V	V	V	M

K is Light Blue

Representative Land System

LS Factor	P	C	M	H G	A 1	A 2	Z
.10	M	M	L	L	L	L	L
.11	M	M	L	L	L	L	L
.12	M	M	M	L	L	L	L
.14	M	M	M	M	L	L	L
.15	M	M	M	M	L	L	L
.17	M	M	M	M	L	L	L
.19	M	M	M	M	L	L	L
.21	H	M	M	M	L	L	L
.23	H	M	M	M	L	L	L
.25	H	M	M	M	L	L	L
.28	H	H	M	M	L	L	L
.31	H	H	M	M	L	L	L
.35	V	H	M	M	L	L	L
.38	V	H	H	M	L	L	L
.43	V	H	H	H	L	L	L
.47	V	V	H	H	L	L	L
.52	V	V	H	H	L	L	L
.58	V	V	H	H	L	L	L
.65	V	V	V	H	L	L	L
.72	V	V	V	V	L	L	L
.79	V	V	V	V	M	L	L
.88	V	V	V	V	M	L	L
.98	V	V	V	V	M	L	L
1.08	V	V	V	V	M	L	L
1.20	V	V	V	V	M	L	L
1.33	V	V	V	V	M	L	L
1.48	V	V	V	V	M	L	L
1.64	V	V	V	V	M	L	L
1.82	V	V	V	V	M	L	L
2.02	V	V	V	V	M	L	L
2.24	V	V	V	V	M	M	L
2.48	V	V	V	V	H	M	L
2.75	V	V	V	V	H	M	L
3.05	V	V	V	V	H	M	L
3.39	V	V	V	V	H	M	L
3.76	V	V	V	V	H	M	L
4.17	V	V	V	V	V	M	L
4.62	V	V	V	V	V	M	L
5.13	V	V	V	V	V	M	L
5.69	V	V	V	V	V	M	L
6.31	V	V	V	V	V	M	L
7.00	V	V	V	V	V	H	L
7.76	V	V	V	V	V	H	L
8.61	V	V	V	V	V	H	M
9.55	V	V	V	V	V	H	M
10.59	V	V	V	V	V	V	M
11.75	V	V	V	V	V	V	M
13.03	V	V	V	V	V	V	M
14.45	V	V	V	V	V	V	M
16.03	V	V	V	V	V	V	M
17.78	V	V	V	V	V	V	M

K is Light Yellow

Representative Land System

LS Factor	P	C	M	H G	A 1	A 2	Z
.10	M	M	M	L	L	L	L
.11	M	M	M	M	L	L	L
.12	M	M	M	M	L	L	L
.14	M	M	M	M	L	L	L
.15	H	M	M	M	L	L	L
.17	H	M	M	M	L	L	L
.19	H	M	M	M	L	L	L
.21	H	M	M	M	L	L	L
.23	H	H	M	M	L	L	L
.25	V	H	M	M	L	L	L
.28	V	H	M	M	L	L	L
.31	V	H	H	M	L	L	L
.35	V	H	H	H	L	L	L
.38	V	V	H	H	L	L	L
.43	V	V	H	H	L	L	L
.47	V	V	H	H	L	L	L
.52	V	V	V	H	L	L	L
.58	V	V	V	V	L	L	L
.65	V	V	V	V	M	L	L
.72	V	V	V	V	M	L	L
.79	V	V	V	V	M	L	L
.88	V	V	V	V	M	L	L
.98	V	V	V	V	M	L	L
1.08	V	V	V	V	M	L	L
1.20	V	V	V	V	M	L	L
1.33	V	V	V	V	M	L	L
1.48	V	V	V	V	M	L	L
1.64	V	V	V	V	M	L	L
1.82	V	V	V	V	H	M	L
2.02	V	V	V	V	H	M	L
2.24	V	V	V	V	H	M	L
2.48	V	V	V	V	H	M	L
2.75	V	V	V	V	H	M	L
3.05	V	V	V	V	V	M	L
3.39	V	V	V	V	V	M	L
3.76	V	V	V	V	V	M	L
4.17	V	V	V	V	V	M	L
4.62	V	V	V	V	V	M	L
5.13	V	V	V	V	V	H	L
5.69	V	V	V	V	V	H	L
6.31	V	V	V	V	V	H	M
7.00	V	V	V	V	V	H	M
7.76	V	V	V	V	V	H	M
8.61	V	V	V	V	V	V	M
9.55	V	V	V	V	V	V	M
10.59	V	V	V	V	V	V	M
11.75	V	V	V	V	V	V	M
13.03	V	V	V	V	V	V	M
14.45	V	V	V	V	V	V	M
16.03	V	V	V	V	V	V	M
17.78	V	V	V	V	V	V	M

K is Light Red

Representative Land System

LS Factor	P	C	M	H G	A 1	A 2	Z
.10	M	M	M	M	L	L	L
.11	M	M	M	M	L	L	L
.12	H	M	M	M	L	L	L
.14	H	M	M	M	L	L	L
.15	H	M	M	M	L	L	L
.17	H	M	M	M	L	L	L
.19	H	H	M	M	L	L	L
.21	V	H	M	M	L	L	L
.23	V	H	M	M	L	L	L
.25	V	H	H	M	L	L	L
.28	V	H	H	H	L	L	L
.31	V	V	H	H	L	L	L
.35	V	V	H	H	L	L	L
.38	V	V	H	H	L	L	L
.43	V	V	V	H	L	L	L
.47	V	V	V	V	L	L	L
.52	V	V	V	V	M	L	L
.58	V	V	V	V	M	L	L
.65	V	V	V	V	M	L	L
.72	V	V	V	V	M	L	L
.79	V	V	V	V	M	L	L
.88	V	V	V	V	M	L	L
.98	V	V	V	V	M	L	L
1.08	V	V	V	V	M	L	L
1.20	V	V	V	V	M	L	L
1.33	V	V	V	V	M	L	L
1.48	V	V	V	V	H	M	L
1.64	V	V	V	V	H	M	L
1.82	V	V	V	V	H	M	L
2.02	V	V	V	V	H	M	L
2.24	V	V	V	V	H	M	L
2.48	V	V	V	V	V	M	L
2.75	V	V	V	V	V	M	L
3.05	V	V	V	V	V	M	L
3.39	V	V	V	V	V	M	L
3.76	V	V	V	V	V	M	L
4.17	V	V	V	V	V	H	L
4.62	V	V	V	V	V	H	L
5.13	V	V	V	V	V	H	M
5.69	V	V	V	V	V	H	M
6.31	V	V	V	V	V	H	M
7.00	V	V	V	V	V	V	M
7.76	V	V	V	V	V	V	M
8.61	V	V	V	V	V	V	M
9.55	V	V	V	V	V	V	M
10.59	V	V	V	V	V	V	M
11.75	V	V	V	V	V	V	M
13.03	V	V	V	V	V	V	M
14.45	V	V	V	V	V	V	M
16.03	V	V	V	V	V	V	H
17.78	V	V	V	V	V	V	H

USLE CATEGORY TABLE

R = 100

L = 0 to 1 Ton/Acre/Year (0 to 2 Tonnes/Hectare/Year)
M = >1 to 3 Tons/Acre/Year (>2 to <7 Tonnes/Hectare/Year)
H = >3 to 5 Tons/Acre/Year (7 to 11 Tonnes/Hectare/Year)
V = >5 Tons/Acre/Year (>11 Tonnes/Hectare/Year)

K is Light Green

Representative Land System

LS Factor	P	C	M	H G	A 1	A 2	Z
.10	L	L	L	L	L	L	L
.11	L	L	L	L	L	L	L
.12	L	L	L	L	L	L	L
.14	L	L	L	L	L	L	L
.15	L	L	L	L	L	L	L
.17	M	L	L	L	L	L	L
.19	M	L	L	L	L	L	L
.21	M	L	L	L	L	L	L
.23	M	L	L	L	L	L	L
.25	M	M	L	L	L	L	L
.28	M	M	L	L	L	L	L
.31	M	M	L	L	L	L	L
.35	M	M	M	L	L	L	L
.38	M	M	M	M	L	L	L
.43	M	M	M	M	L	L	L
.47	M	M	M	M	L	L	L
.52	H	M	M	M	L	L	L
.58	H	M	M	M	L	L	L
.65	H	M	M	M	L	L	L
.72	H	H	M	M	L	L	L
.79	H	H	M	M	L	L	L
.88	V	H	M	M	L	L	L
.98	V	H	H	M	L	L	L
1.08	V	H	H	H	L	L	L
1.20	V	V	H	H	L	L	L
1.33	V	V	H	H	L	L	L
1.48	V	V	H	H	L	L	L
1.64	V	V	V	H	L	L	L
1.82	V	V	V	V	L	L	L
2.02	V	V	V	V	M	L	L
2.24	V	V	V	V	M	L	L
2.48	V	V	V	V	M	L	L
2.75	V	V	V	V	M	L	L
3.05	V	V	V	V	M	L	L
3.39	V	V	V	V	M	L	L
3.76	V	V	V	V	M	L	L
4.17	V	V	V	V	M	L	L
4.62	V	V	V	V	M	L	L
5.13	V	V	V	V	M	L	L
5.69	V	V	V	V	M	M	L
6.31	V	V	V	V	H	M	L
7.00	V	V	V	V	H	M	L
7.76	V	V	V	V	H	M	L
8.61	V	V	V	V	H	M	L
9.55	V	V	V	V	H	M	L
10.59	V	V	V	V	V	M	L
11.75	V	V	V	V	V	M	L
13.03	V	V	V	V	V	M	L
14.45	V	V	V	V	V	M	L
16.03	V	V	V	V	V	M	L
17.76	V	V	V	V	V	H	L

K is Blank

Representative Land System

LS Factor	P	C	M	H G	A 1	A 2	Z
.10	M	L	L	L	L	L	L
.11	M	L	L	L	L	L	L
.12	M	L	L	L	L	L	L
.14	M	M	L	L	L	L	L
.15	M	M	L	L	L	L	L
.17	M	M	M	L	L	L	L
.19	M	M	M	L	L	L	L
.21	M	M	M	M	L	L	L
.23	M	M	M	M	L	L	L
.25	M	M	M	M	L	L	L
.28	H	M	M	M	L	L	L
.31	H	M	M	M	L	L	L
.35	H	M	M	M	L	L	L
.38	H	H	M	M	L	L	L
.43	H	H	M	M	L	L	L
.47	V	H	M	M	L	L	L
.52	V	H	H	M	L	L	L
.58	V	H	H	H	L	L	L
.65	V	V	H	H	L	L	L
.72	V	V	H	H	L	L	L
.79	V	V	H	H	L	L	L
.88	V	V	V	H	L	L	L
.98	V	V	V	V	L	L	L
1.08	V	V	V	V	M	L	L
1.20	V	V	V	V	M	L	L
1.33	V	V	V	V	M	L	L
1.48	V	V	V	V	M	L	L
1.64	V	V	V	V	M	L	L
1.82	V	V	V	V	M	L	L
2.02	V	V	V	V	M	L	L
2.24	V	V	V	V	M	L	L
2.48	V	V	V	V	M	L	L
2.75	V	V	V	V	M	L	L
3.05	V	V	V	V	M	M	L
3.39	V	V	V	V	H	M	L
3.76	V	V	V	V	H	M	L
4.17	V	V	V	V	H	M	L
4.62	V	V	V	V	H	M	L
5.13	V	V	V	V	H	M	L
5.69	V	V	V	V	V	M	L
6.31	V	V	V	V	V	M	L
7.00	V	V	V	V	V	M	L
7.76	V	V	V	V	V	M	L
8.61	V	V	V	V	V	M	L
9.55	V	V	V	V	V	H	L
10.59	V	V	V	V	V	H	L
11.75	V	V	V	V	V	H	M
13.03	V	V	V	V	V	H	M
14.45	V	V	V	V	V	H	M
16.03	V	V	V	V	V	V	M
17.76	V	V	V	V	V	V	M

K is Light Blue

Representative Land System

LS Factor	P	C	M	H G	A 1	A 2	Z
.10	M	M	L	L	L	L	L
.11	M	M	M	L	L	L	L
.12	M	M	M	M	L	L	L
.14	M	M	M	M	L	L	L
.15	M	M	M	M	L	L	L
.17	M	M	M	M	L	L	L
.19	H	M	M	M	L	L	L
.21	H	M	M	M	L	L	L
.23	H	M	M	M	L	L	L
.25	H	H	M	M	L	L	L
.28	H	H	M	M	L	L	L
.31	V	H	M	M	L	L	L
.35	V	H	H	M	L	L	L
.38	V	H	H	H	L	L	L
.43	V	V	H	H	L	L	L
.47	V	V	H	H	L	L	L
.52	V	V	H	H	L	L	L
.58	V	V	V	H	L	L	L
.65	V	V	V	V	L	L	L
.72	V	V	V	V	M	L	L
.79	V	V	V	V	M	L	L
.88	V	V	V	V	M	L	L
.98	V	V	V	V	M	L	L
1.08	V	V	V	V	M	L	L
1.20	V	V	V	V	M	L	L
1.33	V	V	V	V	M	L	L
1.48	V	V	V	V	M	L	L
1.64	V	V	V	V	M	L	L
1.82	V	V	V	V	M	L	L
2.02	V	V	V	V	M	M	L
2.24	V	V	V	V	H	M	L
2.48	V	V	V	V	H	M	L
2.75	V	V	V	V	H	M	L
3.05	V	V	V	V	H	M	L
3.39	V	V	V	V	H	M	L
3.76	V	V	V	V	V	M	L
4.17	V	V	V	V	V	M	L
4.62	V	V	V	V	V	M	L
5.13	V	V	V	V	V	M	L
5.69	V	V	V	V	V	M	L
6.31	V	V	V	V	V	H	L
7.00	V	V	V	V	V	H	L
7.76	V	V	V	V	V	H	M
8.61	V	V	V	V	V	H	M
9.55	V	V	V	V	V	V	M
10.59	V	V	V	V	V	V	M
11.75	V	V	V	V	V	V	M
13.03	V	V	V	V	V	V	M
14.45	V	V	V	V	V	V	M
16.03	V	V	V	V	V	V	M
17.76	V	V	V	V	V	V	M

K is Light Yellow

Representative Land System

LS Factor	P	C	M	H G	A 1	A 2	Z
.10	M	M	M	M	L	L	L
.11	M	M	M	M	L	L	L
.12	M	M	M	M	L	L	L
.14	H	M	M	M	L	L	L
.15	H	M	M	M	L	L	L
.17	H	M	M	M	L	L	L
.19	H	M	M	M	L	L	L
.21	H	H	M	M	L	L	L
.23	V	H	M	M	L	L	L
.25	V	H	M	M	L	L	L
.28	V	H	H	M	L	L	L
.31	V	H	H	H	L	L	L
.35	V	V	H	H	L	L	L
.38	V	V	H	H	L	L	L
.43	V	V	H	H	L	L	L
.47	V	V	V	H	L	L	L
.52	V	V	V	V	L	L	L
.58	V	V	V	V	M	L	L
.65	V	V	V	V	M	L	L
.72	V	V	V	V	M	L	L
.79	V	V	V	V	M	L	L
.88	V	V	V	V	M	L	L
.98	V	V	V	V	M	L	L
1.08	V	V	V	V	M	L	L
1.20	V	V	V	V	M	L	L
1.33	V	V	V	V	M	L	L
1.48	V	V	V	V	M	L	L
1.64	V	V	V	V	H	M	L
1.82	V	V	V	V	H	M	L
2.02	V	V	V	V	H	M	L
2.24	V	V	V	V	H	M	L
2.48	V	V	V	V	H	M	L
2.75	V	V	V	V	V	M	L
3.05	V	V	V	V	V	M	L
3.39	V	V	V	V	V	M	L
3.76	V	V	V	V	V	M	L
4.17	V	V	V	V	V	M	L
4.62	V	V	V	V	V	H	L
5.13	V	V	V	V	V	H	L
5.69	V	V	V	V	V	H	M
6.31	V	V	V	V	V	H	M
7.00	V	V	V	V	V	H	M
7.76	V	V	V	V	V	V	M
8.61	V	V	V	V	V	V	M
9.55	V	V	V	V	V	V	M
10.59	V	V	V	V	V	V	M
11.75	V	V	V	V	V	V	M
13.03	V	V	V	V	V	V	M
14.45	V	V	V	V	V	V	M
16.03	V	V	V	V	V	V	M
17.76	V	V	V	V	V	V	H

K is Light Red

Representative Land System

LS Factor	P	C	M	H G	A 1	A 2	Z
.10	M	M	M	M	L	L	L
.11	H	M	M	M	L	L	L
.12	H	M	M	M	L	L	L
.14	H	M	M	M	L	L	L
.15	H	M	M	M	L	L	L
.17	H	H	M	M	L	L	L
.19	V	H	M	M	L	L	L
.21	V	H	M	M	L	L	L
.23	V	H	H	M	L	L	L
.25	V	H	H	H	L	L	L
.28	V	V	H	H	L	L	L
.31	V	V	H	H	L	L	L
.35	V	V	H	H	L	L	L
.38	V	V	V	H	L	L	L
.43	V	V	V	V	L	L	L
.47	V	V	V	V	M	L	L
.52	V	V	V	V	M	L	L
.58	V	V	V	V	M	L	L
.65	V	V	V	V	M	L	L
.72	V	V	V	V	M	L	L
.79	V	V	V	V	M	L	L
.88	V	V	V	V	M	L	L
.98	V	V	V	V	M	L	L
1.08	V	V	V	V	M	L	L
1.20	V	V	V	V	M	L	L
1.33	V	V	V	V	H	M	L
1.48	V	V	V	V	H	M	L
1.64	V	V	V	V	H	M	L
1.82	V	V	V	V	H	M	L
2.02	V	V	V	V	H	M	L
2.24	V	V	V	V	V	M	L
2.48	V	V	V	V	V	M	L
2.75	V	V	V	V	V	M	L
3.05	V	V	V	V	V	M	L
3.39	V	V	V	V	V	M	L
3.76	V	V	V	V	V	H	L
4.17	V	V	V	V	V	H	L
4.62	V	V	V	V	V	H	M
5.13	V	V	V	V	V	H	M
5.69	V	V	V	V	V	H	M
6.31	V	V	V	V	V	V	M
7.00	V	V	V	V	V	V	M
7.76	V	V	V	V	V	V	M
8.61	V	V	V	V	V	V	M
9.55	V	V	V	V	V	V	M
10.59	V	V	V	V	V	V	M
11.75	V	V	V	V	V	V	M
13.03	V	V	V	V	V	V	M
14.45	V	V	V	V	V	V	H
16.03	V	V	V	V	V	V	H
17.76	V	V	V	V	V	V	H

USLE CATEGORY TABLE

R = 110

L = 0 to 1 Ton/Acre/Year (0 to 2 Tonnes/Hectare/Year)
M = >1 to 3 Tons/Acre/Year (>2 to <7 Tonnes/Hectare/Year)
H = >3 to 5 Tons/Acre/Year (7 to 11 Tonnes/Hectare/Year)
V = >5 Tons/Acre/Year (>11 Tonnes/Hecatre/Year)

K is Light Green

Representative Land System

LS Factor	P	C	M	HG	A1	A2	Z
.10	L	L	L	L	L	L	L
.11	L	L	L	L	L	L	L
.12	L	L	L	L	L	L	L
.14	L	L	L	L	L	L	L
.15	L	L	L	L	L	L	L
.17	M	L	L	L	L	L	L
.19	M	L	L	L	L	L	L
.21	M	L	L	L	L	L	L
.23	M	M	L	L	L	L	L
.25	M	M	L	L	L	L	L
.28	M	M	L	L	L	L	L
.31	M	M	M	L	L	L	L
.35	M	M	M	M	L	L	L
.38	M	M	M	M	L	L	L
.43	M	M	M	M	L	L	L
.47	H	M	M	M	L	L	L
.52	H	M	M	M	L	L	L
.58	H	M	M	M	L	L	L
.65	H	H	M	M	L	L	L
.72	H	H	M	M	L	L	L
.79	V	H	M	M	L	L	L
.88	V	H	H	M	L	L	L
.98	V	H	H	H	L	L	L
1.08	V	V	H	H	L	L	L
1.21	V	V	H	H	L	L	L
1.33	V	V	H	H	L	L	L
1.48	V	V	V	H	L	L	L
1.64	V	V	V	V	L	L	L
1.82	V	V	V	V	M	L	L
2.02	V	V	V	V	M	L	L
2.24	V	V	V	V	M	L	L
2.48	V	V	V	V	M	L	L
2.75	V	V	V	V	M	L	L
3.05	V	V	V	V	M	L	L
3.39	V	V	V	V	M	L	L
3.76	V	V	V	V	M	L	L
4.17	V	V	V	V	M	L	L
4.62	V	V	V	V	M	L	L
5.13	V	V	V	V	M	M	L
5.69	V	V	V	V	H	M	L
6.31	V	V	V	V	H	M	L
7.00	V	V	V	V	H	M	L
7.76	V	V	V	V	H	M	L
8.61	V	V	V	V	H	M	L
9.55	V	V	V	V	V	M	L
10.59	V	V	V	V	V	M	L
11.75	V	V	V	V	V	M	L
13.03	V	V	V	V	V	M	L
14.45	V	V	V	V	V	M	L
16.03	V	V	V	V	V	H	L
17.78	V	V	V	V	V	H	L

K is Blank

Representative Land System

LS Factor	P	C	M	HG	A1	A2	Z
.10	M	L	L	L	L	L	L
.11	M	L	L	L	L	L	L
.12	M	M	L	L	L	L	L
.14	M	M	L	L	L	L	L
.15	M	M	L	L	L	L	L
.17	M	M	M	L	L	L	L
.19	M	M	M	M	L	L	L
.21	M	M	M	M	L	L	L
.23	M	M	M	M	L	L	L
.25	H	M	M	M	L	L	L
.28	H	M	M	M	L	L	L
.31	H	M	M	M	L	L	L
.35	H	H	M	M	L	L	L
.38	H	H	M	M	L	L	L
.43	V	H	M	M	L	L	L
.47	V	H	H	M	L	L	L
.52	V	H	H	H	L	L	L
.58	V	V	H	H	L	L	L
.65	V	V	H	H	L	L	L
.72	V	V	H	H	L	L	L
.79	V	V	V	H	L	L	L
.88	V	V	V	V	L	L	L
.98	V	V	V	V	M	L	L
1.08	V	V	V	V	M	L	L
1.20	V	V	V	V	M	L	L
1.33	V	V	V	V	M	L	L
1.48	V	V	V	V	M	L	L
1.64	V	V	V	V	M	L	L
1.82	V	V	V	V	M	L	L
2.02	V	V	V	V	M	L	L
2.24	V	V	V	V	M	L	L
2.48	V	V	V	V	M	L	L
2.75	V	V	V	V	M	M	L
3.05	V	V	V	V	H	M	L
3.39	V	V	V	V	H	M	L
3.76	V	V	V	V	H	M	L
4.17	V	V	V	V	H	M	L
4.62	V	V	V	V	H	M	L
5.13	V	V	V	V	V	M	L
5.69	V	V	V	V	V	M	L
6.31	V	V	V	V	V	M	L
7.00	V	V	V	V	V	M	L
7.76	V	V	V	V	V	M	L
8.61	V	V	V	V	V	H	L
9.55	V	V	V	V	V	H	L
10.59	V	V	V	V	V	H	M
11.75	V	V	V	V	V	H	M
13.03	V	V	V	V	V	H	M
14.45	V	V	V	V	V	V	M
16.03	V	V	V	V	V	V	M
17.78	V	V	V	V	V	V	M

K is Light Blue

Representative Land System

LS Factor	P	C	M	HG	A1	A2	Z
.10	M	M	M	L	L	L	L
.11	M	M	M	L	L	L	L
.12	M	M	M	M	L	L	L
.14	M	M	M	M	L	L	L
.15	M	M	M	M	L	L	L
.17	H	M	M	M	L	L	L
.19	H	M	M	M	L	L	L
.21	H	M	M	M	L	L	L
.23	H	H	M	M	L	L	L
.25	H	H	M	M	L	L	L
.28	V	H	M	M	L	L	L
.31	V	H	H	M	L	L	L
.35	V	H	H	H	L	L	L
.38	V	V	H	H	L	L	L
.43	V	V	H	H	L	L	L
.47	V	V	H	H	L	L	L
.52	V	V	V	H	L	L	L
.58	V	V	V	V	L	L	L
.65	V	V	V	V	M	L	L
.72	V	V	V	V	M	L	L
.79	V	V	V	V	M	L	L
.88	V	V	V	V	M	L	L
.98	V	V	V	V	M	L	L
1.08	V	V	V	V	M	L	L
1.20	V	V	V	V	M	L	L
1.33	V	V	V	V	M	L	L
1.48	V	V	V	V	M	L	L
1.64	V	V	V	V	M	L	L
1.82	V	V	V	V	M	M	L
2.02	V	V	V	V	H	M	L
2.24	V	V	V	V	H	M	L
2.48	V	V	V	V	H	M	L
2.75	V	V	V	V	H	M	L
3.05	V	V	V	V	H	M	L
3.39	V	V	V	V	V	M	L
3.76	V	V	V	V	V	M	L
4.17	V	V	V	V	V	M	L
4.62	V	V	V	V	V	M	L
5.13	V	V	V	V	V	M	L
5.69	V	V	V	V	V	H	L
6.31	V	V	V	V	V	H	L
7.00	V	V	V	V	V	H	M
7.76	V	V	V	V	V	H	M
8.61	V	V	V	V	V	H	M
9.55	V	V	V	V	V	V	M
10.59	V	V	V	V	V	V	M
11.75	V	V	V	V	V	V	M
13.03	V	V	V	V	V	V	M
14.45	V	V	V	V	V	V	M
16.03	V	V	V	V	V	V	M
17.78	V	V	V	V	V	V	M

K is Light Yellow

Representative Land System

LS Factor	P	C	M	HG	A1	A2	Z
.10	M	M	M	M	L	L	L
.11	M	M	M	M	L	L	L
.12	H	M	M	M	L	L	L
.14	H	M	M	M	L	L	L
.15	H	M	M	M	L	L	L
.17	H	M	M	M	L	L	L
.19	H	H	M	M	L	L	L
.21	V	H	M	M	L	L	L
.23	V	H	M	M	L	L	L
.25	V	H	H	M	L	L	L
.28	V	H	H	H	L	L	L
.31	V	V	H	H	L	L	L
.35	V	V	H	H	L	L	L
.38	V	V	H	H	L	L	L
.43	V	V	V	H	L	L	L
.47	V	V	V	V	L	L	L
.52	V	V	V	V	M	L	L
.58	V	V	V	V	M	L	L
.65	V	V	V	V	M	L	L
.72	V	V	V	V	M	L	L
.79	V	V	V	V	M	L	L
.88	V	V	V	V	M	L	L
.98	V	V	V	V	M	L	L
1.08	V	V	V	V	M	L	L
1.20	V	V	V	V	M	L	L
1.33	V	V	V	V	M	L	L
1.48	V	V	V	V	H	M	L
1.64	V	V	V	V	H	M	L
1.82	V	V	V	V	H	M	L
2.02	V	V	V	V	H	M	L
2.24	V	V	V	V	H	M	L
2.48	V	V	V	V	V	M	L
2.75	V	V	V	V	V	M	L
3.05	V	V	V	V	V	M	L
3.39	V	V	V	V	V	M	L
3.76	V	V	V	V	V	M	L
4.17	V	V	V	V	V	H	L
4.62	V	V	V	V	V	H	L
5.13	V	V	V	V	V	H	M
5.69	V	V	V	V	V	H	M
6.31	V	V	V	V	V	H	M
7.00	V	V	V	V	V	V	M
7.76	V	V	V	V	V	V	M
8.61	V	V	V	V	V	V	M
9.55	V	V	V	V	V	V	M
10.59	V	V	V	V	V	V	M
11.75	V	V	V	V	V	V	M
13.03	V	V	V	V	V	V	M
14.45	V	V	V	V	V	V	M
16.03	V	V	V	V	V	V	H
17.78	V	V	V	V	V	V	H

K is Light Red

Representative Land System

LS Factor	P	C	M	HG	A1	A2	Z
.10	H	M	M	M	L	L	L
.11	H	M	M	M	L	L	L
.12	H	M	M	M	L	L	L
.14	H	M	M	M	L	L	L
.15	H	H	M	M	L	L	L
.17	V	H	M	M	L	L	L
.19	V	H	M	M	L	L	L
.21	V	H	H	M	L	L	L
.23	V	H	H	H	L	L	L
.25	V	V	H	H	L	L	L
.28	V	V	H	H	L	L	L
.31	V	V	H	H	L	L	L
.35	V	V	V	H	L	L	L
.38	V	V	V	V	L	L	L
.43	V	V	V	V	M	L	L
.47	V	V	V	V	M	L	L
.52	V	V	V	V	M	L	L
.58	V	V	V	V	M	L	L
.65	V	V	V	V	M	L	L
.72	V	V	V	V	M	L	L
.79	V	V	V	V	M	L	L
.88	V	V	V	V	M	L	L
.98	V	V	V	V	M	L	L
1.08	V	V	V	V	M	L	L
1.20	V	V	V	V	H	M	L
1.33	V	V	V	V	H	M	L
1.48	V	V	V	V	H	M	L
1.64	V	V	V	V	H	M	L
1.82	V	V	V	V	H	M	L
2.02	V	V	V	V	V	M	L
2.24	V	V	V	V	V	M	L
2.48	V	V	V	V	V	M	L
2.75	V	V	V	V	V	M	L
3.05	V	V	V	V	V	M	L
3.39	V	V	V	V	V	H	L
3.76	V	V	V	V	V	H	L
4.17	V	V	V	V	V	H	M
4.62	V	V	V	V	V	H	M
5.13	V	V	V	V	V	H	M
5.69	V	V	V	V	V	V	M
6.31	V	V	V	V	V	V	M
7.00	V	V	V	V	V	V	M
7.76	V	V	V	V	V	V	M
8.61	V	V	V	V	V	V	M
9.55	V	V	V	V	V	V	M
10.59	V	V	V	V	V	V	M
11.75	V	V	V	V	V	V	M
13.03	V	V	V	V	V	V	H
14.45	V	V	V	V	V	V	H
16.03	V	V	V	V	V	V	H
17.78	V	V	V	V	V	V	H

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