

Soil Risk Assessment Tool Handbook



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1.0 INTRODUCTION

During a storm event, a raindrop can detach soil particles from the ground, causing them to become suspended and transported by water. Vegetation can act as a barrier to this erosion, protecting the soil from the initial rainfall impact, as well as slowing down and filtering overland flow. During the construction process, however, this natural barrier is lost when the vegetation and topsoil are removed for site grading. This can produce a large pulse of sediment in the runoff leaving the site. This runoff then travels downstream and can have many impacts on the receiving water body. Increased sediment loads can change channel geometry, bury existing vegetation, decrease suitable fish habitat, and the nutrients adsorbed to sediment particles can affect water quality.

Construction projects in Ontario are complex and involve the implementation of erosion and sediment control (ESC) measures to mitigate soil erosion and nutrient buildup in receiving water courses. Sediment erosion and transport can be reduced through the development process by implementing best management practices (BMPs). BMPs are commonly divided into 2 categories, one category which covers the ground to prevent erosion from occurring and are referred to as erosion control BMPs (vegetation, surface roughening, compost blankets, etc.) and a second category which promotes the deposition of sediment already eroded and are referred to as sediment control BMPs (silt fence, check dams, sediment ponds, etc.).

The Soil Risk Assessment (SRA) Tool has been created to predict average annual soil loss from areas which have implemented a variety of ESC measures. The SRA tool can be used to assess the efficiency of ESCs on construction sites and to determine areas of high erosion risk. This document outlines the SRA Tool and the theory and equations behind its development.

2.0 UNIVERSAL SOIL LOSS EQUATION

The Site Risk Assessment (SRA) Tool is based on the Universal Soil Loss Equation (USLE) developed by Wischmeier and Smith (1978) and the Revised Universal Soil Loss Equation (RUSLE) developed by the US Department of Agriculture (USDA).

This method is an empirical tool used to predict the rate of erosion on a single slope. This is done by multiplying five “factors” that represent characteristics soil (K factor), site cover management (C), site support practices (P), site topography (LS factor), and rainfall (R factor) to determine the potential long-term average annual soil loss for the given conditions. This erosion model was created for use in selected cropping and managing systems, but is also applicable to the construction site environment.

The USLE is given by equation [1]:

$$Y = R \times K \times LS \times C \times P \quad [1]$$

Where:

- Y: Computed soil loss per unit area
- R: Rainfall factor. Accounts for the energy available to detach particles.
- K: Slope erodibility factor. The ability of raindrops and overland flow to detach and transport soil.
- LS: Slope length and gradient factor. A steeper and longer slope corresponds to a higher erosive potential.
- C: Cropping management factor. Accounts for vegetation or erosion control BMPs that reduce detachment and transport of soil.
- P: Support factor. Accounts for sediment control BMPs that may pool water and promote infiltration and settling of sediment laden water.

Soil losses computed with the USLE are best available estimates, and do not represent absolute values. The USLE will generally be most accurate for medium-textured soils, slope lengths of less than 400 feet, gradients of 3 to 18 percent, and consistent seeding and management systems represented in the USDA erosion studies . The accuracy of the predicted soil loss will depend on how accurate physical and management conditions on are described by the parameter values.

2.1 Factor Descriptions

The following sections describe each of the factors which are used within the USLE and correspondingly to determine the average annual soil loss within the SRA Tool.

2.1.1 R Factor

The R Factor within the RUSLE equation represents the variation in rainfall intensity and duration for a given location. Rainfall is the source of energy required to dislodge particles from the ground surface. Variation in the magnitude and length of this energy source will therefore impact the amount of sediment eroded. The Ontario Ministry of Agriculture, Food, and Rural Affairs (OMAFRA) have assigned many regions of Ontario an R Factor value based on collected rainfall data from nearby weather stations. This data has been incorporated into Table 1.

Table 1: R Factor Values for each City/Area within Ontario

City/Area	R Factor	Mean Annual Runoff (mm)	City/Area	R Factor	Mean Annual Runoff (mm)
Attawapiskat	90	340	Owen Sound	90	375
Barrie	90	300	Pickle Lake	90	290
Bearskin Lake	90	240	Red Lake	90	200
Brantford	90	260	South River	90	450
Clarington	90	275	St. Thomas	90	250
Cobalt	90	350	Timmins	90	350
Cochrane	90	375	Toronto	90	225
Dryden	90	225	Delhi	100	250
Englehart	90	360	Guelph	100	280
Iroquois Falls	90	375	Hamilton	100	275
Kapuskasing	90	360	London	100	325
Kenora	90	200	St. Catherines	100	260
Kingston	90	350	Chatham-Kent	110	200
Kirkland Lake	90	360	Essex	110	210
Midland	90	410	Kitchener	110	300
Moosone	90	380	Windsor	110	200
Niagara	90	280	City of Simcoe	120	250
Ogaki	90	355	Fergus/Orangeville	120	295
Oshawa	90	275	Prospect Hill	120	300
Ottawa	90	310	Glen Allen	130	400

Most areas have been given an R factor value of 90, however values up to 130 used. Table 1 lists R Factor values for many major cities and areas within Ontario. To determine an R value for a location not on this list, Figure 1 can be used. Simply find the location on the map, and divide by 17 to convert into the correct units used in the SRA Tool.

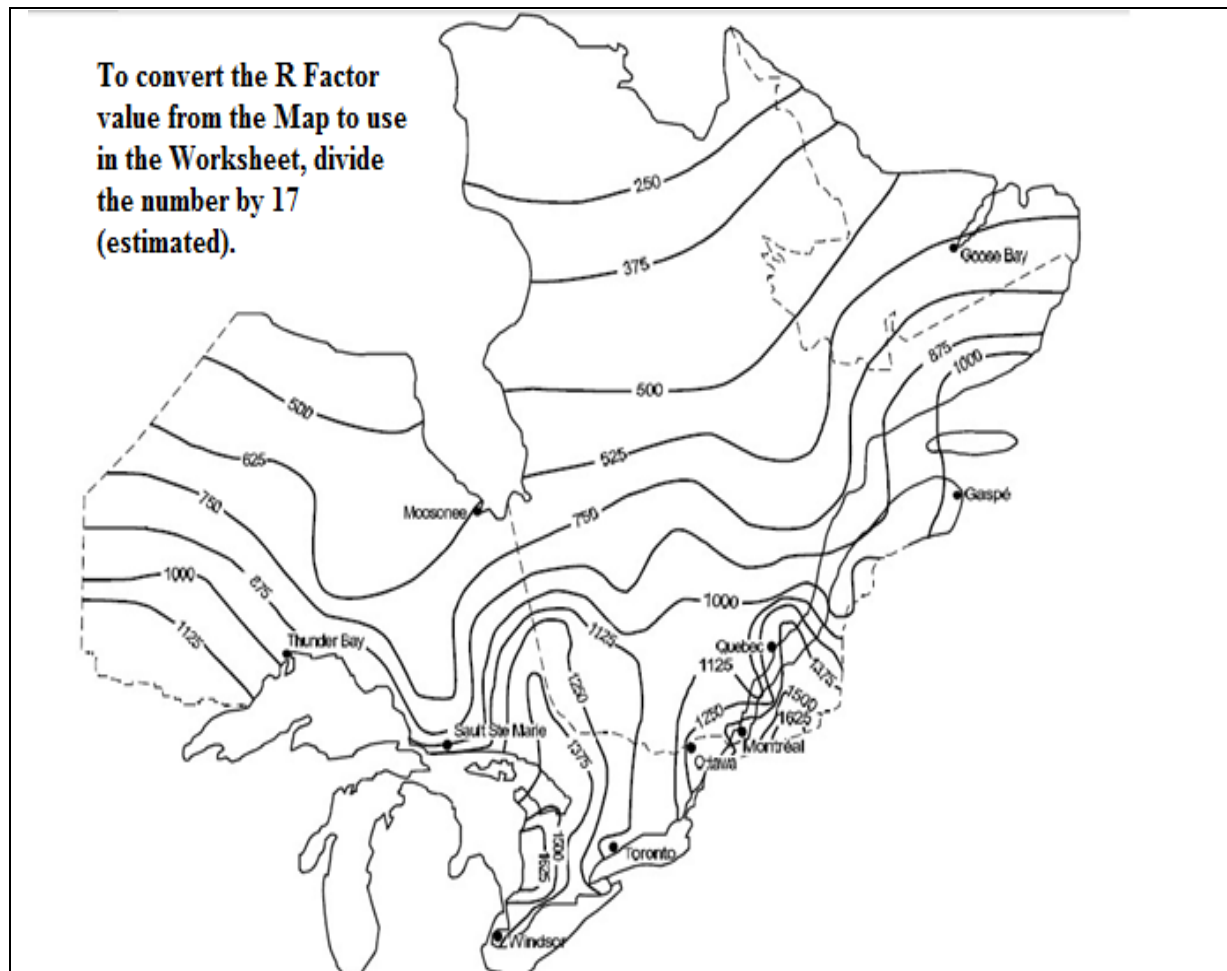


Figure 1: R Factor values for Ontario and Quebec (from MNR, 1984)

2.1.2 K Factor

The K factor is a measure of the soil erodibility and runoff potential and can range between 0.02 and 1.03 (Table 2), depending on the percent of organic matter (OM) present. The K Factor measures the ability of raindrops and overland flow to detach and transport soil particles and is given as the rate of soil eroded per unit area as measured on standard conditions. Standard conditions imply a 72.6 ft long plot with a 9% slope under uncultivated fallow land. The main contributing soil characteristic that governs K is the soil texture. Soils high in clay and sand are given low K values. Sandy soils promote high rates of infiltration and therefore do not allow much runoff for particle transport. Clayey soils on the other hand do allow runoff, but the chemical bonding between particles are not easily broken and detachment is still low. Silty soils have medium rates of infiltration and detachment and are therefore especially susceptible to erosion processes and have high K values. The amount of organic matter within the soil also influences the K Factor of the soil.

Table 2: K Factor values based on percent OM (OMAFRA, 2012)

Textural Class	K factor		
	Average OM	Less than 2% OM	More than 2% OM
Clay	0.49	0.54	0.47
Clay Loam	0.67	0.74	0.63
Coarse Sandy Loam	0.16	-	0.16
Fine Sand	0.18	0.20	0.13
Fine Sandy Loam	0.40	0.49	0.38
Heavy Clay	0.38	0.43	0.34
Loam	0.67	0.76	0.58
Loamy Fine Sand	0.25	0.34	0.20
Loamy Sand	0.09	0.11	0.09
Loamy Very Fine Sand	0.87	0.99	0.56
Sand	0.04	0.07	0.02
Sandy Clay Loam	0.45	-	0.45
Sandy Loam	0.29	0.31	0.27
Silt Loam	0.85	0.92	0.83
Silty Clay	0.58	0.61	0.58
Silty Clay Loam	0.72	0.79	0.67
Very Fine Sand	0.96	1.03	0.83
Very Fine Sandy Loam	0.79	0.92	0.74

2.1.3 LS Factor

The LS factor combines length and slope site characteristics into one variable using a standard equation. It is based on the belief that more erosion will occur on a steeper slope, and a longer slope will allow more opportunity for this erosion to occur. It is a unitless parameter relative to the standard conditions referenced above. A value of 1 signifies that the site in question does not vary in length and slope compared to the standard conditions. Values obtained for the LS factor can range from 0.06 to well over 100, depending on the site gradient and slope length. To calculate the LS Factor, Equation [2] is used:

$$LS = [0.065 + 0.0456(\text{slope}) + 0.006541(\text{slope})^2] \times \left(\frac{\text{Slope length}}{22.1}\right)^{NN} \quad [2]$$

Where:

Slope: slope steepness (%)
Slope length: length of slope (m)
NN: 0.2 if slope <1
0.3 if $1 \leq \text{slope} < 3$
0.4 if $3 \leq \text{slope} < 5$
0.5 if slope ≥ 5

2.1.4 C Factor (Erosion Control BMPs)

The C Factor accounts for vegetation or erosion control BMPs that reduce detachment and transport of soil particles over the landscape. This may include undisturbed native vegetation, straw and wood mulches, or surface netting. For the purpose of the SRA Tool, the C factor is determined using the efficiency value of the BMP, which is the percent that a particular practice can reduce the sediment yield. The C Factor for a given BMP is found by subtracting the efficiency (in fraction format) from 1 (Equation [3]). The efficiency can be adjusted based on things such as installation quality or age.

$$C_i = 1 - \text{Efficiency} \quad [3]$$

Where:

C: C Factor
i: Individual BMP

A variety of erosion control BMPs efficiency and C Factor values are given in Table 3. The net C Factor for an area is computed by considering C Factor of each BMP and the proportion of area that each of those BMPs cover within the watershed. To calculate the net C Factor, Equation [4] is used:

$$C_{net} = (\sum C_i \times A_i) \quad [4]$$

Where:

C_i: Individual BMP C Factor
A_i: Fraction of total area the BMP covers

Equation [4] gives the weighted average based on the proportion of land covered by the specific BMP.

Table 3: Efficiency and C Factor Values (2,3,5,6,8,9,10)

BMP erosion control / Land Uses	Efficiency	C Factor	BMP erosion control / Land Uses	Efficiency	C Factor
Chemical Stabilization	0.90	0.10	Completed Construction Area	0.99	0.01
Compost Blankets	0.95	0.05	Soil Stabilized by Vegetation	0.90	0.10
Hydroseeding - Hydromulching	0.90	0.10	Fruit Trees	0.90	0.10
Riprap Armouring	0.95	0.05	Grain Corn	0.60	0.40
Seeding	0.95	0.05	Grassland	0.97	0.03
Slope Texturing / Roughening	0.60	0.40	Hay and Pasture	0.98	0.02
Sodding	0.95	0.05	Orchard	0.84	0.16
Soil Retention	0.95	0.05	Planted Forest	0.62	0.38
Vegetated Buffer	0.74	0.26	Silage corn, beans & canola	0.90	0.10
Bare Soil (Exposed Soil)	0.00	1.00	Undisturbed Natural Vegetation	0.99	0.01

2.1.5 P Factor (Sediment Control BMPs)

The P factor accounts for any support practice that may pool water and promote infiltration and settling of sediment laden water. It is defined as the ratio of soil lost under a support practice to the soil lost through straight-row farming up and down the slope.

Support practices at a construction or agriculture site can include straw bales, rock check dams, silt fences, slope terracing, compost filters, or sediment basins. For the purpose of the SRA Tool and similar to the C Factor determination, the P factor is determined using the efficiency value of the BMP, which is the percent that a particular practice can reduce the sediment yield. The P Factor for a given BMP is found by subtracting the efficiency (in fraction format) from 1 (Equation [5]). The efficiency can be adjusted based on things such as installation quality or age.

$$P_i = 1 - \text{Efficiency} \quad [5]$$

Where:

- P: P Factor
- i: Individual BMP

A variety of erosion control BMPs efficiency and P Factor values are given in Table 4.

Table 4: Efficiency and P Factor Values (1,2,4)

BMP sediment control	Efficiency	P Factor
Compost Filter Berm	0.88	0.12
Check Dam	0.80	0.20
Compost Filter Socks	0.92	0.08
Drain Inlet Sediment Barrier	0.70	0.30
Fiber Rolls and Wattles	0.60	0.40
Rock Filter Berm	0.95	0.05
Sandbag Barrier	0.65	0.35
Sediment Pond	0.65	0.35
Sediment Traps	0.65	0.35
Silt Fence	0.75	0.25
Straw Bale Barrier	0.75	0.25

The net P Factor for an area is computed by considering the individual P Factor of each BMP and the proportion of runoff that flows into each of those BMPs within the watershed. To calculate the net P Factor, Equation [6] is used:

$$P_{net} = (\sum P_i \times A_i) \quad [6]$$

Where:

P_i: Individual BMP P Factor

A_i: Fraction of total area that flows into that BMP

Equation [6] gives the weighted average based on the proportion of runoff which flows into that the specific BMP.

3.0 TOOL LAYOUT

The SRA Tool is spreadsheet based tool and is therefore able to operate on most computer systems. The tool is broken down into tabs: disclaimer, soil loss, drainage areas, climate, soils, BMP inputs, risk, and BMP cost. The following sections describe each component briefly.

3.1 Disclaimer Tab

The first tab that is encountered when the SRA Tool is opened is the disclaimer. This section outlines that the information provided within the tool is licensed “as is” and the Information Provide excludes all representations, warranties, obligations, and liabilities, whether expressed of

implied, to the maximum extent permitted by law. Please note that the model has its own limitations, and the original document(s) should be followed. The Information Provider is not liable for any errors or omissions in the information, and will not under any circumstances be liable for any direct, indirect, special, incidental, consequential, or other loss, injury, or damage caused by its use or otherwise arising in connection with this information, even if specifically advised of the possibility of such loss, injury, or damage. Please refer to the original documentation or speak with an expert in this area before using the information for decision making purposes. The Disclaimer tab then states that by using the spreadsheet tool, you accept the terms and conditions outlined above.

In general, the Disclaimer Tab states that the SRA Tool should not be singularly relied upon when designing a sediment and erosion control plan. Every effort has been made to ensure the SRA Tool is able accurately estimate the relative amount of erosion that can potentially occur under the specified conditions, however it does not replace experience or actual on site conditions. The SRA Tool is based on information published by government agencies, academic institutions, and product testimonials. If a discrepancy is found between any of the original documents and the SRA Tool, the original document should be considered correct.

3.2 Soil Loss Tab

The Soil Loss tab is the home base for the SRA Tool (Figure 2). This tab is where all input data is summarized and where the final results are displayed. The red text indicates information that must be manually inputted by the user, while the black text indicates information that is automatically calculated from the input information. Only the red and yellow portions of the Soil Loss Tab require direct input of information.

Soil Loss Worksheet for Construction Sites in Ontario																	
City or Weather Station:		Toronto				User Input											
R. Factor:		90				RESULTS											
Parcel ID	Land Type	Area (ha)	Percent of Total Area (%)	Slope (%)	Slope Length (m)	NN	LS Factor	Soil Texture Class:	OM Content	K factor (t/ha)	Bare Soil Loss (t/ha/year)	Bare Soil Erosion Risk	C Factor	P Factor	Soil Loss with BMP (t/ha/year)	Soil Erosion Risk	
1	Exposed Soil	1.88	33.1	12.5	56	0.5	2.64	Clay Loam	Average OMC	0.67	159.1	Very High	0.97	0.04	6.1	Very Low	
2	Exposed Soil	1.2	21.1	12.5	40	0.5	2.23	Clay Loam	Average OMC	0.67	134.4	Very High	0.86	0.04	4.4	Very Low	
3	Exposed Soil	1.35	23.8	17.9	78	0.5	5.59	Clay Loam	Average OMC	0.67	337.3	Very High	0.98	0.15	49.6	Very High	
4	Exposed Soil	1.25	22.0	10.9	110	0.5	2.99	Clay Loam	Average OMC	0.67	180.2	Very High	0.94	0.08	13.7	Moderate	
5			0.0								0.0	Very Low	1.00	1.00	0.0	Very Low	
6			0.0								0.0	Very Low	1.00	1.00	0.0	Very Low	
Total		5.68	100	Mean Annual Sediment Yield of the Site (t/ha/year)								200.8	Very High			17.7	Moderate
Total Reduction:															91%		

Figure 2: Screenshot of the Soil Loss tab

Rainfall data is displayed at the top left corner and is indicated by the red background colour. This is the first step in using the SRA Tool. The nearest city or weather station can be selected from a drop-down list. Once a location is selected, a R Factor value is calculated for the given location. If no location is listed in the drop down menu that is satisfactory for the site location, the “other” option should be selected and the user can manually input a value from the Climate Tab.

The yellow portion of the Soil Loss Tab is known as the “existing conditions” of the site. This is where information regarding each unique land parcel can be input to generate the “risk” of soil erosion to occur on that parcel of land. The risk is based on the potential for water to detach and transport soil from bare land conditions. To complete the yellow portion of the Soil Loss Tab, the construction site should be sectioned into sub-drainage areas based on differences in the land use, slope, and soil texture. Each area should be assigned a Parcel ID, which should correspond to any ID assigned to it as per any sediment and erosion control plan already created, to reduce overlap. The SRA Tool comes with six Parcel ID rows built into the model. Any additional Parcel IDs that are required must be added by right clicking a row and then clicking the “insert” command. For each Parcel ID, the general land use can be selected from a drop-down menu under the “land type” column. The land type can be classified as pre-development, exposed soil, stabilized by vegetation, or paved surface. The area (in hectares), average slope (in percent), and slope length (in meters) should also be input in the existing conditions sections for each Parcel ID. These values are then used to automatically calculate the NN coefficient and LS Factor for each Parcel ID.

To complete the rest of the yellow existing conditions portion of the Soil Loss Tab, information regarding the soil texture class and organic matter content should then be entered. If you are not sure of these values, then the “Soil” Tab of the SRA Tool should be used, and will be covered in a few slides. The values input for the texture class and the organic matter percent are then used to determine the K Factor for each Parcel ID.

When completing the yellow portion of the Soil Loss Tab, you should try to avoid averaging input values based on more than one site condition in a specified area. For example, an area that has the same land use, slope, and organic matter content should be separated into two discrete areas with unique Parcel IDs if it contains two discrete areas of sand and clay. The sand and clay should not be averaged into silt, since they display much different physical properties that will affect their ability to be detached, transported, or deposited within the site.

Once all of information has been entered in the yellow section, the bare soil loss is calculated for each Parcel ID. The bare soil loss is then used to determine the risk associated with each land use based on the input site characteristics. If a Parcel has been classified as high risk, it should not be left exposed for long periods of time, and special care should be given to ensure proper BMPs

used. Parcels which are classified as low risk may not require a high level of BMPs on site during active site works.

The blue portion of the Soil Loss Tab is known as the “BMP impact” of the Parcel ID. This is where the C and P Factors for each Parcel ID are summarized for the user. Each Parcel ID should have a corresponding “BMP Tab” where the information is unit. The blue portion of the Soil Loss Tab is meant to only summarize the Factors, and the information should not be directly input in this Tab.

The green portion of the Soil Loss Tab is referred to as the “results” section. This column incorporates the existing conditions and the impact of on-site BMPs to determine the average annual soil loss. This is the theoretical amount of sediment that will be transported offsite into down gradient receiving waters and should be compared to the background value found in the red section. The average annual soil loss value is also compared to the total bare soil loss, and reduction percent is given.

3.3 Drainage Areas Tab

The “Drainage Area” Tab is where information regarding the watershed and each Parcel ID can be stored. This may include sediment and erosion control diagram, a completed site plan, a site inspection form, or any other documentation which helps to delineate the site boundaries. This Tab can be used as a visual display for the user while inputting data into the SRA Tool. Its use is not required for model tabulation; it is only a designated space for additional resources.

3.4 Climate Tab

The Climate Tab is where additional information regarding the R factor (red section of the Soil Loss Tab) can be found. If the location is not specifically mentioned within the City drop-down list within the Soil Loss Tab, you would have selected “other” in the drop down list.

The Climate Tab includes all of the necessary information to manually determine the R factor, as described in Part 2 of this presentation. As a refresher, R factor can be found by first locating the site on Figure 1 within the Climate Tab. The adjacent contour intervals should be extrapolated to determine the value which best suites the site location. The site value should then be converted to the correct units by dividing by 17. The resultant R Factor value can then be entered under the “R Factor” column within the “other” row. This value will then appear within the Soil Loss Tab and will be incorporated into the soil loss calculations.

3.5 Soils Tab

The Soil Tab is where additional information regarding the determination of the soil K Factor can be found. The percent of sand, silt, and clay can also be used to determine the textural class

of the soil using a textural triangle, if this is not already known (Figure 4). Similar to the Climate Tab, you can also enter your own K Factor using the “other” row of Table 1.

3.6 BMP Input Tab

The BMP Input Tabs are where information regarding the ground cover and presence of on-site BMPs are entered into the SRA Tool. Each Parcel ID should have its own BMP Input Tab for data regarding that specific sub drainage area. This Tab is separated into two distinct sections: The first section on the left is colour coded green, is intended to calculate the C Factor, and includes erosion control BMP (Figure 5). The second section on the right is colour coded blue, is intended to calculate the P Factor, and includes sediment control BMPs (Figure 6).

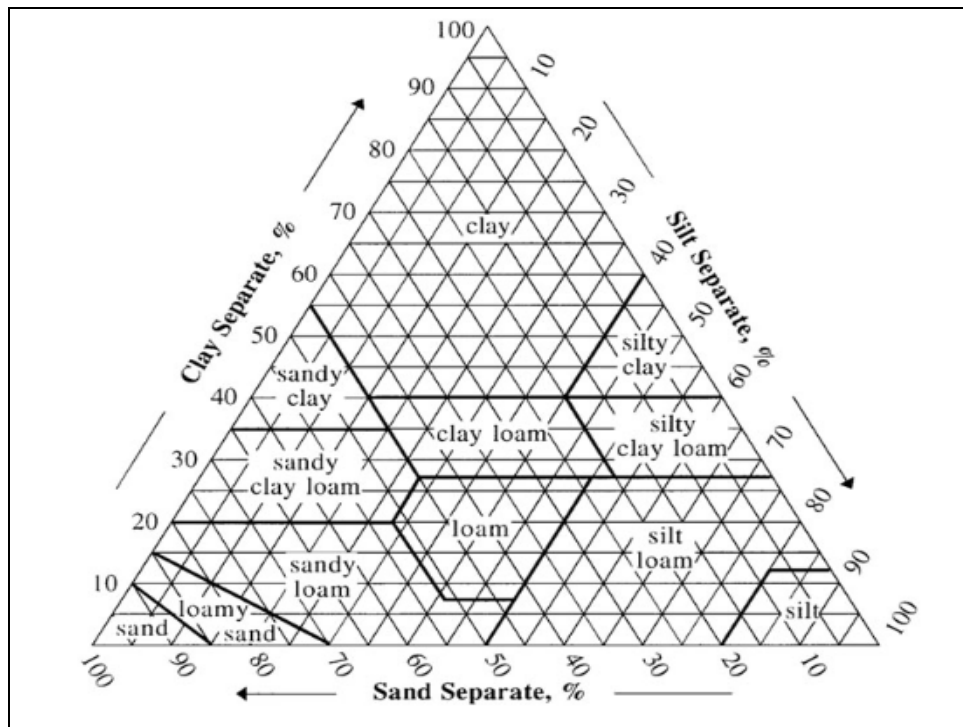


Figure 3: Soil textural triangle used to determine soil class.

To complete the C Factor section of this tab, the user should identify the portion of the Parcel ID that is covered with each land cover outlined in the left column. It should be noted that when you first open the tool, the default for each chart is 100 percent of the area covered in bare, exposed soil. Land cover may include BMPs such as compost blankets or mulch, or may be unaffected natural vegetation such as grassland, planted forest, or fruit trees. The “percent area protected” should therefore total 100 percent, since the type of land cover must be determined for the entire Parcel ID. If no BMP or vegetation is present, the “bare soil” should be selected for the remainder of the coverage area.

In addition to the type of land cover, the land use can be ranked from 0 to 1 based on the design quality, installation quality, and maintenance quality. A value of 1 represents maximum quality and cover efficiency. These three quality characteristics are largely geared toward installed BMPs, which can vary in their installation and design. Natural vegetation, can however be ranked based on its maintenance, such as if the vegetation has been impacted by past sediment deposition. Each of the three quality considerations are then multiplied with the maximum efficiency to determine the net efficiency, and resulting individual BMP C Factor. This value for each land cover is then used to determine the area-weighted average C Factor for the entire Parcel ID. This value is carried over to the Soil Loss Tab for use in the soil loss estimation.

C Factor								
Erosion Control BMP	Maximum Efficiency	Design Quality	Installation Quality	Maintenance Quality	Net Efficiency	Individual C Factor	Percent Area Protected (%)	Proportional C Factor
Chemical Stabilization	0.90	1.00	1.00	1.00	0.90	0.10	0	0.00
Compost Blankets	0.95	1.00	1.00	1.00	0.95	0.05	0	0.00
Hydroseeding-Hydromulching	0.90	1.00	1.00	1.00	0.90	0.10	25	0.03
Mulching (Table)	0.93	1.00	1.00	1.00	0.93	0.07	0	0.00
Riprap Armouring	0.95	1.00	1.00	1.00	0.95	0.05	30	0.02
Seeding	0.95	1.00	1.00	1.00	0.95	0.05	0	0.00
Slope Texturing / Roughening	0.60	1.00	1.00	1.00	0.60	0.40	0	0.00
Sodding	0.95	1.00	1.00	1.00	0.95	0.05	15	0.01
Soil Retention	0.95	1.00	1.00	1.00	0.95	0.05	0	0.00
Vegetated Buffer	0.74	1.00	1.00	1.00	0.74	0.26	0	0.00
Bare Soil (Exposed Soil)	0.00	1.00	1.00	1.00	0.00	1.00	30	0.30
Completed Construction Area	0.99	1.00	1.00	1.00	0.99	0.01	0	0.00
Disturbed Soil Stabilized by Vegetation	0.90	1.00	1.00	1.00	0.90	0.10	0	0.00
Fruit Trees	0.90	1.00	1.00	1.00	0.90	0.10	0	0.00
Grain Corn	0.60	1.00	1.00	1.00	0.60	0.40	0	0.00
Grassland	0.97	1.00	1.00	1.00	0.97	0.03	0	0.00
Hay and Pasture	0.98	1.00	1.00	1.00	0.98	0.02	0	0.00
Orchard	0.84	1.00	1.00	1.00	0.84	0.16	0	0.00
Planted Forest	0.62	1.00	1.00	1.00	0.62	0.38	0	0.00
Silage corn, beans & canola	0.50	1.00	1.00	1.00	0.50	0.50	0	0.00
Undisturbed Natural Vegetation	0.99	1.00	1.00	1.00	0.99	0.01	0	0.00
Area-Weighted C Factor								0.35

**cant have more than one surface cover per unit area eg. surface roughening with seeding

Figure 4: Screenshot of the C Factor section of the SRA Tool.

It should be noted that in some cases, more than one land cover may exist over the same area. The SRA Tool does not have a built in mechanism for dealing with this scenario. It is recommended that in these instances, the installation quality be increased to reflect the increase in land cover.

To complete the P Factor section of this Tab, the user should first identify whether the entire Parcel ID drains into the same type of sediment control BMPs. For example, if one section flows into a rock check dam before connecting to the main channel, than this section will have added

sediment control, which should be reflected in the P Factor. Sediment control BMPs may include check dams, sediment ponds, silt fence, or straw bale barriers.

If you believe there should sub catchments in the Parcel ID, the area should be entered in the smaller “Sub catchment ID” chart below the main blue P Factor chart. The total area in this smaller chart should equal the total are of the Parcel ID. If the user does not want to separate into multiple sub catchments, the total area should still be entered into “C1”.

The user should then identify if any of the listed BMPs are found within the designated area. Each sediment control BMP can be ranked based on design, installation, and maintenance quality similar to the C Factor section. The P Factor must also account for multiple levels of the same BMP within the same area, so the number of individual BMPs within the area must also be input. For example, the reduction efficiency of a second or third successive rock check dam will not be the same as the first rock check same due to initial reduction in sediment and the sediment particle size. To account for this variation, the geometric mean of the reduction factor is used to avoid over estimation. This is accounted for within the SRA Tool when the user inputs the number of BMPs in each sub catchment. The area weighted average P Factor is then calculated for the Parcel ID and carried over to the Soil Loss Tab for use in soil loss estimation. If no sediment control BMPs are present, the “number of BMPs in each sub section” should be left at 0.

P Factor										
Sediment Control BMP	Maximum Efficiency	Design Quality	Installation Quality	Maintenance Quality	Net Efficiency	Individual P Factor	Number of BMPs In Each Sub Catchment			
							C1	C2	C3	
Compost Filter Berm	0.88	1.00	1.00	1.00	0.88	0.12	0	0	0	
Check Dam	0.80	0.75	0.95	0.60	0.34	0.66	2	0	0	
Compost Filter Socks	0.92	1.00	1.00	1.00	0.92	0.08	0	0	0	
Drain Inlet Sediment Barrier	0.70	1.00	1.00	1.00	0.70	0.30	0	0	0	
Fiber Rolls and Wattles	0.60	1.00	1.00	1.00	0.60	0.40	0	0	0	
Rock Filter Berm	0.95	1.00	1.00	1.00	0.95	0.05	0	0	0	
Sandbag Barrier	0.65	1.00	1.00	1.00	0.65	0.35	0	0	0	
Sediment Pond	0.65	1.00	1.00	1.00	0.65	0.35	0	0	0	
Sediment Traps (Basins)	0.65	1.00	1.00	1.00	0.65	0.35	0	0	0	
Silt Fence	0.75	0.75	0.90	0.50	0.25	0.75	1	0	0	
Straw Bale Barrier	0.75	1.00	1.00	1.00	0.75	0.25	0	0	0	
None	----- NA -----					1.00	----- NA -----			
							0.32	1.00	1.00	
							Area Weighted P Factor			0.32

Sub Catchment ID	Area (ha)
C1	4.8
C2	0
C3	0
TOTAL	4.8

Total Area (ha):	4.8
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*Net efficiency for individual BMP must be consistent over entire P Factor calculation
 * Different subcatchments can be used to separate areas that have the same ground cover (C Factor) but have different sediment erosion BMPs (P Factors)
 * If there are no subcatchments in the Parcel ID, enter the entire area within "C1"

Figure 5: Screenshot of the P Factor section of the SRA Tool

3.7 Risk Tab

The Risk Tab contains information on how the soil risk of something is defined. Table 1 displays the five risk categories, based on the OMAFRA Fact Sheet No. 12-051. Risk can be very low (tolerable), low, moderate, high, or severe based on the potential soil loss estimated using the SRA Tool. These are the categories that are used in the Soil Risk Tab for each Parcel ID.

3.8 BMP Cost Tab

The BMP Cost Tab is where information regarding the cost of each individual BMP is stored for the user's reference. This Tab is not connected to the bare soil loss calculation, it is only supplemental knowledge. Cost is often a deciding factor for many erosion and sediment control designs. This Tab allows the user to select a BMP that can efficiently reduce sediment while minimizing the overall cost to implement.

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