Data Collection Worksheet for RUSLE2 and Iowa Phosphorous Index

The Iowa Phosphorus Index (P-Index) is a risk assessment tool for assessing the potential of phosphorus delivery from fields to surface waters and is used in nutrient management and conservation planning tools for the USDA-NRCS.

According to Iowa Department of Natural Resources (IDNR) regulatory requirements, the Iowa Phosphorus Index has to be calculated for each individual management unit to establish its risk for the purpose of manure management plans. If an entire field is being managed as one unit, only one calculation is needed. On the other hand, if the same field is split into several units based on conservation practices, soil types, or crop rotations, the P-Index has to be calculated for each individual unit or calculate for the worse case scenario.

This worksheet provides guidelines for calculating the Iowa P-Index and for record keeping. Calculations for the Iowa P-Index require an estimation of sheet and rill erosion. A computer program, RUSLE2 (Revised Universal Soil Loss Equation 2), is to be used to make this estimation. This program was developed by the Agricultural Research Service (ARS) division of USDA and is being used by all Natural Resource Conservation Service (NRCS) service centers for soil conservation planning. RUSLE2 estimates average annual soil erosion as sheet and rill erosion in tons per acre per year for a given unit. This soil loss estimation is then used in calculation of the Iowa P-Index.

This document consists of two parts: Part 1: Collecting Information needed for RUSLE2 Simple SCI Template,

Part 2: Collecting Information needed for the Iowa Phosphorus Index.

IOWA STATE UNIVERSITY
Extension and Outreach

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Part 1: Collecting Information Needed for RUSLE2 Soil Loss (Sheet and Rill Erosion) Estimation

Step 1: Provide Producer / Land Owner Information

Unit/Field ID: _____ Legal Description: _____

County: _____ _____

Unit/Field Size (Area in Acres): _____ _____

Step 2: Determine Dominant Critical Area or Most Erosive Soil Type

Most erosive soil type in this unit/field is:* _____

Number of acres of the most erosive soil type as specified above: _____

Percent of field area covered by this soil type:** _____

Method used to calculate area (Check One):

_____ Field measurements _____ Approved USDA-NRCS Conservation Plans

_____ GPS/GIS Software _____ Estimated Value from county Soil Survey or eFOTG

_____ Planimeter with soil type maps _____ Other Specify: _____

* The letter found in the soil map unit refers to a slope class. Slope classes can be different from county to county. Soil map units with no letter designation or an "A" slope are generally 0-2% slope, a "B" slope is generally 2-5% slope. As the letters go higher, the slope class increases. For example. 138D2 has a steeper slope than 138B2. The number after the letter indicates the erosion phase. The higher the number, the more erosion has occurred on the site. If the soil map unit does not have a number listed after the letter, little to no erosion has taken place. Soil mapping symbols for different soil types can be obtained from county soil survey books available at the county USDA-NRCS office. If the slope class and erosion phase are same between soil map units, for example 138C2 and 120C2, the soil map unit with the larger area is the dominant soil type.

**If this soil type occupies less than 10% of the unit/ field size as noted in Step 1, choose the next most erosive soil type. Also, when calculating this percentage use the entire unit/field size, not just the area of RUSLE2 slope.

Step 3a: Determine Slope Length

Slopes for RUSLE2 are to be measured perpendicular to the contour line starting at the origin of overland flow near the top of the hill-slope and terminate at either the point of significant deposition where the slope flattens significantly, or at the point where flow concentrates in a larger channel, ephemeral gully, and/ or classical gully.

Length of RUSLE2 Slope: _____ Feet

The RUSLE2 Slope length determination for use in Iowa has been established as using the default values by soil map Unit (SMU) from eFOTG. Several methods of slope length determination, such as tape measure, GPS/GIS Software, measuring wheel, range finder, etc. can be used. Use of any such methods requires training to correctly determine the slope length.

Step 3b: Determine Slope Grade

Slope is always measured perpendicular to the contour or directly up and down the slope in the direction that gravity forces the water to run.

Grade of RUSLE2 Slope: _____ Percent

Percent RUSLE2 Slope grade determination for use in Iowa has been established as using the default values by soil map Unit (SMU) from eFOTG. Several methods of slope grade determination, such as hand level, Clinometer, Abney Level, Transit & Range Pole, GPS/GIS Software, etc. can be used. Use of any such methods requires training to correctly determine the percent slope grade.

Table 1: Specify applicable operations for the associated crop along with appropriate date of operation for each year as specified in Step 4. Make additional copies for use for multi-year crop rotations.

Crop to be Grown:	Estimated Yield: (Refer to Step 4(c) 1 for estimating yields)	Year:
Estimated Date of Operation	Operation (include equipment specifications i.e. depth, spacing)	Residue Addition (pounds per acre)
	After Harvest (baling, grazing, cover crop)	
	Fall Fertilizer (anhydrous, manure, other)	
	Fall Tillage (chisel point types, disk)	
	Manure Application (Method of application)	
	Spring Tillage (disk, field cultivate, rotary hoe, sprayer)	
	Plant (Drill, planter w/single/double disk opener, row width)	
	Row Cultivation	
	Harvest (grain, silage, etc.)	
	Other	
	Other	
Notes		

Table 2: Conservation Practices as applicable to Management Unit of Field.	
	Specification (Include as applicable conservation practice location, width, vegetation, rotation, number, etc.)
Practice 1	
Practice 2	
Practice 3	
Practice 4	
Other	

Step 4a (1): Determine Base Management
RUSLE2 needs information on crop rotation to give credit for crops grown and residue cover. Specify which crops will be grown in a full rotation on this field for example a two-year corn-bean rotation, a three-year corn-corn-bean rotation. Use Table 1 to specify crops and yields. Make copies of Table 1 to use for each year in the crop rotation.

Step 4a (2): Field Operations Sequence Determination
Specify applicable operations in Table 1 for the associated crop along with appropriate date of operation for each year in the crop rotation schedule. These operations affect the amount of residue cover/ live plants on the surface and thus affect erosion. Estimated dates of such operations are important, as RUSLE2 calculates how much soil cover (residue or live plants) is available during different times of year. Operations can include harvesting, fall tillage, spring field cultivation, planting, no-till drilling, or manure application Again, you may have to make copies of Table 1 for multi-year crop rotations.

Step 4b: Describe Management Sequence
Include one complete crop rotation sequence that will be implemented in the field regardless of the length of the rotation. RUSLE2 software best handles multi-year crop rotations by identifying each individual year or crop as "a single-year crop." The program then adds the years together to form a crop rotation. This provides an average soil loss over the full crop rotation time period. In case the crop rotation is altered or changed, a revised RUSLE2 calculuation will have to be determined.

Step 4c (1): Determine Yield
Estimate the crop yields for each of the crop rotation years as identified in Step 4a (1). Use only the crop yield estimate for the most erosive soil type as identified in Step 2 for use in Step 4a (1). Estimated crop yield values for different soil types must be obtained from County Soil Survey books or eFTOG.

Step 4c (2):Add External Residue
This step refers to any operation that is conducted on the field/unit and results in addition of residue cover on the soil surface or adding organic matter such as manure. Make sure to include any such operation in Table 1 as a part of the operation sequence. Some operations that can result in additional residue include compost surface application, mowing down of weeds, adding mulch, or adding heavy bedded surface-applied manure.

Step 4c (3): Describe Irrigation
This step refers to any liquid application through sprinkler or rotating gun irrigation systems. Include these operations and application rates in gallons per acre or inches of water applied in Table 1. In case manure is applied through irrigation, include solids concentration (from manure analysis) to take credit for residue addition.

Step 5a: Describe Contouring
This step determines if the crop rows have a grade to them and whether the rows are on the contour or off the contour. The row grade is the percent of slope along the length of the row. For example, absolute row grade of 1 percent means the contouring is actually on a 1 percent grade across the RUSLE2 slope; or example rows are not on a perfect contour. If the rows do not have any grade across the RUSLE2 slope, then the rows are "On Contour." If not contouring, rows are considered as "up-and-down the hill" in the RUSLE2 software.

Absolute row grade can be measured by estimating the grade of the row across the RUSLE2 slope. Any of the methods specified in Step 3b can be used to determine this row grade.
Absolute Row Grade:_____ Percent
Method Used (specify):_____

Step 5b: Describe Strips and Barriers
Strips and barriers can reduce the sediment movement within the field. These strips and barriers must exist on the RUSLE2 slope to be eligible for use in this step. An example will be a field-edge buffer that exists along the stream. This buffer should not be considered in this step if it does not exist on the RUSLE2 Slope. Credit for such a buffer should be considered in Iowa Phosphorus Index.

Conservation practices that can be included in this step are silt fences, straw bale barriers, strip cropping, and vegetative barriers (grass hedges). Include details of each practice in the Table 2. If there is a practice that exists in your field and is not specified previously, make sure to include it as well. Indicate the location of practice, width of the practice along the RUSLE2 slope, vegetation type, and the number of these practices (for example; two contour buffer strips, one 30-foot wide alfalfa buffer in the middle of RUSLE2 Slope, and one 45-foot cool season grass buffer not at

the bottom of the RUSLE2 Slope). If possible, outline the practices on a map to indicate location. When specifying strip cropping, include rotation of crops. For example, you can specify a strip cropping practice as 2-Strip rotation 0-1. This means that there are two strips on "RUSLE2 Slope" and the "0-1" means the first and second crop in the rotation are next to each other (this would be a two year rotation). A similar example will be 2-Strip rotation 0-2. Here "0-2" means that the first and third crops in the rotation are in strips next to each other (this would be a four-year rotation like corn-oats-hay-hay where corn and first year hay are adjacent or oats and second year hay are adjacent to each other).

Step 5c: Describe Diversions, Terraces and Sediment Basins

Diversions, Terraces and Sediment Basins act as sediment traps within the field. Conservation practices that can be included in this step are flow diversions, level terraces, parallel tile outlet terrace, and sediment basin. Include details of each of these practices in the Table 2. If there is a practice that exists in your field and is not specified previously, make sure to specify it as well. If possible, outline the practices on a map to specify location.

Step 5d: Describe Sub-surface Drainage

Subsurface drainage refers to the entire field. If the field is patterned tile, you can take credit for subsurface drainage. If the field has a few tile lines running up the waterways, do not take credit for subsurface drainage. Is there sub-surface drainage in the field/unit? Check one.

_____Yes _____ No

Part 2: Information Needed for the Phosphorous Index Calculation.

Step 6: Ephemeral Gully Erosion and Classical Gully Erosion

Ephemeral gullies are areas of erosion in the field where flow begins to concentrate and cuts into the soil surface. These areas can generally be leveled out each year with common tillage practices such as disking.

Classical gullies are areas of erosion in the field where substantially large cuts into the soil surface have been formed. These areas can not be leveled out with common tillage practices such as disking. Provide the following information:

1) Is this field / unit affected by gully erosion? Check One:

_____Yes _____ No

2) What is the estimated soil loss from ephemeral gully erosion? Tons per year _____

3) What is the estimated soil loss from classical gully erosion? Tons per year

4) What is the source of ephemeral gully soil loss information?
NRCS Field Office and/or Field Calculation

Field calculation for both ephemeral and classical gully erosion can be performed by making actual field measurements or by remote sensing (measured from maps) of certain dimensions of these gullies. Then, a calculation using a formula can be performed to estimate gully soil erosion. This formula and dimensions for measurements are available from your local NRCS office.

Step 7: Describe Sediment Traps

Do any of the following conservation practices exist within the field? Check any that apply.
Grade Stabilization Full Flow_____
Level Terraces_____
Water & Sediment Control Basins_____
Ponds and Grade Stabilization_____
Tile Inlet Terraces_____

Step 8: Describe Sediment Delivery

This information helps to determine how much sediment will actually reach the receiving water based on location of the field and the distance of the field to the receiving waters. Answer the following questions:

Step 8a: Iowa Landform Determination

What is the location of the field? For example, which land form does the field exists in? Refer to Map1 on page 7. Check only one that applies.

_____ Loess Hills
_____ Northwest Iowa Plains, Southern Iowa Drift Plain, Paleozoic Plateau
_____ Iowan Surface
_____ Missouri Alluvial Plains, Des Moines Lobe, Mississippi Alluvial Plains

Step 8b: Runoff Travel Distance
What is the straight line distance, in feet, to the nearest perennial or intermittent stream in the direction of water flow?
From the center of the field: _____ feet

Step 9: Filter Factor
Provide answers to the following questions

1) Does a filter strip exist between the end of the RUSLE2 slope and field boundary?

_____ Yes _____No

2) Has this filter strip been established per NRCS Conservation Practice Standard 393 - Filter Strip?
_____Yes _____No

3) Is there any concentrated flow taking place within the filter strip?
_____ Yes _____No

4) What is the width of this filter strip?
_____feet

Step 10: Describe Enrichment Factor (Residue Management Effect)
Check the one option below that applies. Consider the time period for which the P-Index is being calculated to determine which option to check. For time periods longer than one year, the field or management unit must stay with that practice for all years under consideration. You may cross check information provided in Table 1. Generally, for a field that is farmed as no-till and has manure injected on it, manure injection is considered as a tillage operation. As such, option of tillage should be selected in this step.

No-till _____ Tillage_____
Perennial forage and grass_____

Step 11: Indicate Phosphorus Test Factor
According to current IDNR rules, one sample for every ten acres is required. Every sample must be a composite of at least ten cores and each core should be six inches deep, representing top six inches of the soil profile. Samples must be averaged for the entire field or unit for which the P-Index is being calculated. Samples analyzed by different methods can not be averaged together.

_____Number of samples
_____Method of analysis (Bray-1P or Olsen-P or Mehlich-3 or Mehlich-3 ICP)
_____Average concentration in parts per million (ppm)

Note: NRCS requires the sample analysis only from the dominant critical area to be used when calculating the P-Index.

Step 12: Describe Rate Factor
This step takes into consideration amount of phosphorus applied from all sources since the last soil test information used in Step 10. Provide this number below. Do not include any planned or future applications in case you are making an immediate determination of P-Index. In case you are using P-Index calculation for planning purposes, include future applications for the planning period under consideration.

_____pounds/acre as P_2O_5

Method in which phosphorus is applied. Check one.
_____Injected or incorporated with 24-hours
_____Incorporated within one week
_____Surface application with no incorporation
_____Surface application on frozen or snow-covered or saturated ground or floodplain
_____No phosphorus application

Step 13: Indicate Sub-surface Flow Factor
This step takes into consideration any sub-surface flow of water and any movement of phosphorus with sub-surface flow. Answer the following questions.

1. Is tile drainage present in the field / unit? Check only one.

Yes_____No_____Unknown_____

If you checked yes, skip the rest of questions in this step. If you checked no, go to question number 4 and skip questions 2 and 3. If you checked unknown, go to question number 2.

2. Is the field row-cropped? Yes_____No____

If you checked no, skip question number 3 and go to question number 4. If you checked yes, go to question number 3.

3. Does the field have poorly drained soils?
Yes_____No_____

4. Does the field have good drainage?
Yes_____No_____

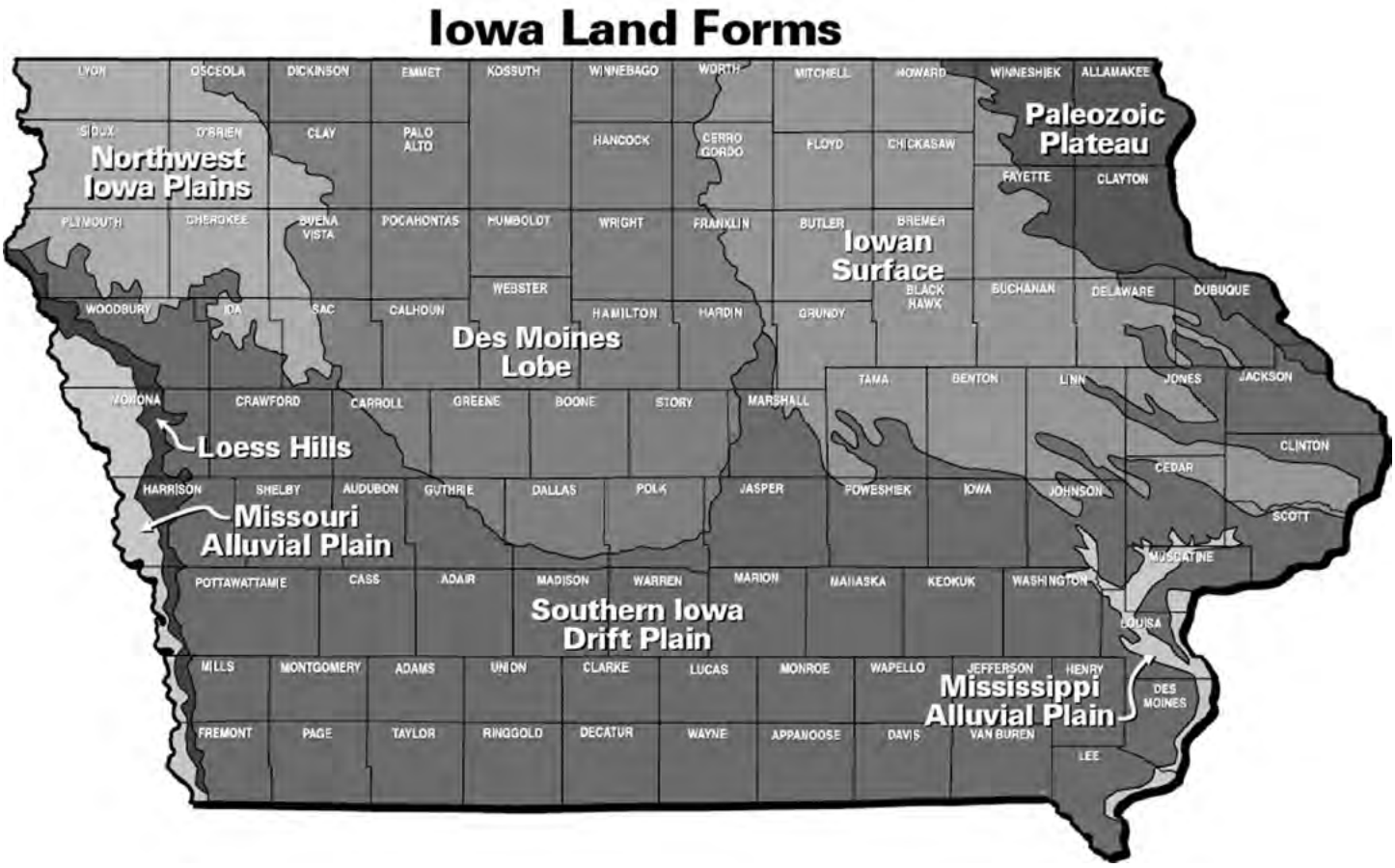
If you checked yes, go to question number 5. If you checked no, skip question number 5.

5. Does the field have highly permeable soils?
Yes_____No_____

More information about RUSLE2 is available online at: http://www.ia.nrcs.usda.gov/technical/RUSLE2.html

More information about the Iowa Phosphorus Index is available online at: http://www.ia.nrcs.usda.gov/technical/Phosphorous/phosphorousstandard.html

Map 1: Iowa Land Forms Map for Use in Iowa Phosphorus Index



Prepared by Kapil Arora, Agricultural Engineering Field Specialist
Reviewed by Barbara Stewart, State Agronomist, USDA – NRCS, Angela Rieck-Hinz, Extension Program Specialist, Department of Agronomy, and Jeremy Klatt, Nutrient Specialist, Iowa Department of Natural Resources.
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This is an information gathering tool only. It is recommended that users of this document should make sure they have the most recent version available due to changing regulatory requirements. Calculation of RUSLE2 Erosion Rate and Iowa Phosphorus Index should be done with assistance from NRCS service centers or Iowa State University Extension Staff or Service Providers who are trained in interpreting and using the information gathered in this document.

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	Other	
Notes		

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