NEBRASKA DEPARTMENT OF ENVIRONMENTAL QUALITY

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FIELD PHOSPHORUS RISK ASSESSMENT

PROCEDURES FOR MAKING AN ASSESSMENT

Site characteristics/factors impacting phosphorus (P) loss have been placed in categories and assigned a weight factor based on relative impact on P movement from the site. Instructions are provided for each category, and only categories that apply to the manure application site are to be used. Each category's weight factor is multiplied by its risk value to get a weighted risk factor for each category. All categories are rated and the overall risk rating for the site is the sum of all values (refer to Table 3).

PHOSPHORUS LOSS CATEGORIES AND WEIGHT FACTOR IN PARENTHESIS

(Refer to individual category instructions).

- Soil Erosion (1.5)
- Furrow Irrigation Erosion (1.5)
- Sprinkler Erosion/Runoff (0.5)
- Runoff class (based on slope and soils) (1.5)
- Soil test (surface) Bray P1 or Olson Soil P test (1.0)
- Commercial P fertilizer application rate (0.5)
- Commercial P fertilizer application method (0.5)
- Manure/organic P application rate (1.0)
- Manure/organic P application method (1.0)
- Distance to concentrated surface water flow (1.0)

RISK RATINGS FOR EACH CATEGORY AS FOLLOWS:

- 0 = None (Not applicable = NA)
- 1 = Low
- 2 = Medium
- 4 = High
- 8 = Very High

CATEGORY INSTRUCTIONS

Individual sections from Table 3 are included at the beginning of instructions for each category to assist in determining the weighted risk factor for each category. After reviewing instructions for each category, up to three sites can be rated for Phosphorus loss risk utilizing Table 3.

Soil Erosion Category

Site Category	None (0)	Low (1)	Medium (2)	High (4)	Very High (8)	Risk Value (0, 1, 2,4, 8)	Weight Factor	Weighted Risk Factor
Soil Erosion	N/A	<5 tons/ac/yr	5-8 tons/ac/yr	9-12 tons/ac/yr	>12 tons/ac/yr		X 1.5	

Soil erosion is the movement of soil from the site due to runoff. This category is given in (ton/ac/yr). Soil erosion can be predicted using the Revised Universal Soil Loss Equation found in the Natural Resources Conservation Service (NRCS) Field Office Tech Guide. Erosion estimates are based on rainfall intensity, soil characteristics, percent and length of slope, crop rotation, tillage system (no-till, mulch till, etc.), and other practices such as terraces and contouring. If erosion estimates from NRCS are available use them. If not, use Table 1 to estimate annual water erosion.

Table 1. SOIL EROSION CATEGORIES (CROPLAND ONLY)

*BMP Category	None/NA	Low	Medium	High	Very High
**With BMPs	Non-sandy soils on 0-3% slope, sandy soils 0-5% slope	Non-sandy soils on 3-5% slope, sandy soils 5-8% slope	Non-sandy soils on 5-8% slope, sandy soils >15% slope	Non-sandy soils on of 8-15% slope	
Without BMPs		Non-sandy soils on 0-3% slope, sandy soils on 3-8% slope	Non-sandy soils on 3-5% slope, sandy soils 8-15% slope	Non-sandy soils on 5-8% slope, sandy soils on >15% slope	Non-sandy soils on >8% slope
Regardless of BMPs	Sandy soils on 0-5% slope				Non-sandy soils on >15% slope

* BMP – Best Management Practices

** "With BMPs" means all crops are no-till planted, or the site/field is terraced with 20% or more ground cover at planting, or greater than 50% of the crop rotation is perennial grasses and/or legumes, or a combination of these practices. Sandy soils are coarse textured soils that include fine and very fine sandy loam, loamy fine sand, loam and very fine sand textures, and non-sandy soils include silt, silt loam, silty clay, clay and clay loam textured soils.

Furrow Irrigation Erosion Category

Site Category	None (0)	Low (1)	Medium (2)	High (4)	Very High (8)	Risk Value (0, 1, 2, 4, 8)	Weight Factor	Weighted Risk Factor
Furrow Irrigation Erosion	N/A	Tailwater recovery, very erodible soils and QS<6, or other soils with QS <10	QS >10 for erosion resistant soils	QS >10 for erodible soils	QS >6 for very erodible soils		X 1.5	

QS is an erosion factor based on furrow slope (S) and flow rate (Q) as noted below.
Sediment-borne P and other nutrients are lost due to erosive flows within the furrow. Q equals furrow flow rate (in gallons per minute "gpm"), soil texture (categories listed below), and S equals furrow slope in feet of drop per 100 feet of furrow. Tailwater recovery means that irrigation runoff is captured in a tailwater recovery pit and is re-used for irrigation. Furrow flow rate and slope are accounted for as follows:

QS Value	=	Furrow Flow Rate (Q in gpm)	X	Furrow Slope (S = feet of drop per 100 feet or percent slope)		
Example		20 gpm	X	0.5	=	10

Soils are broken down into three surface texture categories, based on susceptibility to erosion due to furrow irrigation. Refer to the County Soil Survey Manual if you don't know the soil texture.

Very Erodible Soils: Soils with silt, fine and very fine sandy loam, loamy fine sand, loam and very fine sand textures.

Erodible Soils: Silt loam soils.

Erosion-Resistant Soils: Soils with silty clay, clay, and clay loam textures.

Sprinkler Irrigation Erosion Category

Site Category	None (0)	Low (1)	Medium (2)	High (4)	Very High (8)	Risk Value (0, 1, 2, 4, 8)	Weight Factor	Weighted Risk Factor
Sprinkler Erosion	All sites 0-3% slope, all sandy sites or site evaluation indicates little or no runoff, or large spray on silts 3-8%	Medium spray on silty soils 3-15% slopes, large sprays on silty soils 8-15% slope, low spray on silt soils 3-8%, large spray on clay soils 3-15% slopes	Medium spray on clay soils 3-8% slopes, large spray clay soils >15% slope, medium spray on silt soils >15% slope	Medium spray on clay soils >8% slope, low spray on clay soils 3-8%, low spray on silty soils >15% slope	Low spray on clay soils >8% slope		X 0.5	

This category rates the potential for erosion due to irrigation runoff from sprinklers. Spray type, soil texture and percent of slope impact erosion due to sprinkler irrigation runoff. When a comprehensive evaluation of irrigation runoff potential indicates little or no runoff will occur, this category is not applicable (NA) and is given a rating of "None" or 0.

Spray Type

- Large spray = nozzle wetted diameter is >50 feet
- Medium spray = nozzle wetted diameter is 20-50 feet
- Low spray = nozzle wetted diameter is <20 feet

Slope

- Percent of slope on the application site being evaluated

Texture

- Sandy textured (fine and very fine sandy loam, loamy fine sand, loam and very find sand)
- Silt (silt, silt loam, loam)
- Clay (silty clay, silty clay loam, clay, and clay loam textures).

Runoff Class Category

Site Category	None (0)	Low (1)	Medium (2)	High (4)	Very High (8)	Risk Value (0,1, 2, 4, 8)	Weight Factor	Weighted Risk Factor
Runoff Class	Negligible	Very Low or Low	Medium	High	Very High		X 1.5	

The runoff class of a site is based on the least permeable soil layer in the top three feet. Permeability classes for specific soils can be found in the soil series description in your County Soil Survey Manual. Slope and soil permeability class must be determined, then runoff class can be determined **(Refer to Table 2 below)**.

Table 2. RUNOFF CLASS

Slope %	Soil Permeability Class				
	Very Rapid (>20.00 in/hr)	Moderately Rapid (6.00-20 in/hr)and Rapid (2.00-6.00 in/hr)	Moderate (0.60-2.00 in/hr) and Moderately Slow (0.20-0.60 in/hr)	Slow (0.06-0.20 in/hr)	Very Slow (<0.06 in/hr)
	Runoff Class*				
Depressions	Negligible	Negligible	Negligible	Negligible	Negligible
0-1%	Negligible	Negligible	Negligible	Low	Low
1-5%	Negligible	Very Low	Low	Medium	High
5-10%	Very Low	Low	Medium	High	Very High
10-20%	Very Low	Low	Medium	High	Very High
>20%	Low	Medium	High	Very High	Very High

Soil Phosphorus Tests Category *(Use only one soil test category)*

Site Category	None (0)	Low (1)	Medium (2)	High (4)	Very High (8)	Risk Value (0, 1, 2, 4, 8)	Weight Factor	Weighted Risk Factor
Bray P1 Soil P Test	---	<30 ppm	30-60 ppm	60-120 ppm	>120 ppm		X 1.0	
Olson Soil P Test	---	<20 ppm	20-40 ppm	40-80 ppm	>80 ppm		X 1.0	

Bray P1 soil tests are typically used on soils with a pH of 7.0 or less, while Olson (sodium bicarbonate) soil tests are utilized on soils with a pH greater than 7.0 and contain calcium carbonate. Phosphorus soil tests should be taken from the top 2-3" for continuous no-till cropland, hay land and pastures, and from the top 8" or less for tilled cropland.

Commercial Phosphorus Fertilizer Application Method Category

Site Category	None (0)	Low (1)	Medium (2)	High (4)	Very High (8)	Risk Value (0, 1, 2, 4, 8)	Weight Factor	Weighted Risk Factor
Commercial P fertilizer Application Method	None Applied	Placed with planter or injected deeper than 2 inches	Incorporated < 3 months prior to planting or surface applied during the growing season	Incorporated >3 months before crop or surface applied <3 months before crop	Surface applied >3 months before crop		X 0.5	

The manner in which Phosphorus fertilizer is applied to the soil and the time that fertilizer is exposed on the soil surface impacts the potential Phosphorus loss. Incorporation implies that fertilizer Phosphorus is incorporated into the soil a minimum of two inches. The categories of increasing severity, LOW to VERY HIGH, depict the longer surface exposure time between fertilizer application, incorporation, and crop utilization.

Commercial Phosphorus Fertilizer Application Rate Category

Site Category	None (0)	Low (1)	Medium (2)	High (4)	Very High (8)	Risk Value (0, 1, 2, 4, 8)	Weight Factor	Weighted Risk Factor
Commercial P Fertilizer Application Rate	None Applied	<30 P_2O_5 lbs/ac	31-90 P_2O_5 lbs/ac	91-150 P_2O_5 lbs/ac	>150 P_2O_5 lbs/ac		X 0.5	

Commercial Phosphorus Fertilizer Application Rate is the amount, in pounds per acre (lbs/ac), of phosphate fertilizer (P_2O_5) that is applied. This does not include phosphorus from organic sources (manure).

Manure/Organic Phosphorus Source Application Method Category

Site Category	None (0)	Low (1)	Medium (2)	High (4)	Very High (8)	Risk Value (0, 1, 2, 4, 8)	Weight Factor	Weighted Risk Factor
Organic P Source Application Method	None Applied	Injected deeper than 2 inches	Incorporated < 3 months prior to planting or surface applied during the growing season	Incorporated >3 months before crop or surface applied < 3 months before planting	Surface applied to pasture or >3 months before crop		X 1.0	

The manner in which manure is applied to the soil and the time it is exposed on the soil surface impacts potential Phosphorus loss. Incorporation implies that manure is incorporated into the soil a minimum of two inches. The categories of increasing severity, LOW to VERY HIGH, depict the longer surface exposure time between manure application, incorporation, and crop utilization.

Manure/Organic Phosphorus Source Application Rate Category

Site Category	None (0)	Low (1)	Medium (2)	High (4)	Very High (8)	Risk Value (0, 1, 2, 4, 8)	Weight Factor	Weighted Risk Factor
Organic P application Rate	None Applied	<30 P_2O_5 lbs/ac	31-90 P_2O_5 lbs/ac	91-150 P_2O_5 lbs/ac	>150 P_2O_5 lbs/ac		X 1.0	

The organic Phosphorus source application rate is the amount, in pounds per acre (lbs/ac), of phosphate (P_2O_5) contained in manure, litter, or process wastewater that is applied. The amount of phosphate applied is based on tons/acre or gallons/acre applied and nutrient content can be estimated from manure, litter, and process wastewater tests or book values.

Distance to Concentrated Surface Water Flow Category

Site Category	None (0)	Low (1)	Medium (2)	High (4)	Very High (8)	Risk Value (0, 1, 2, 4, 8)	Weight Factor	Weighted Risk Factor
Distance to concentrated surface water flow	Runoff and sediment cannot exit the site.	>200 feet, or functioning grassed waterways, or tile outlet terraces or sediment basins in concentrated surface water flow areas or functioning grassed filter strips that are at least 100 feet wide	100-200 feet or function-ing grass filter strips that are at least 35 feet wide	<100 feet	0 feet or applications directly into concentrated surface water flow areas that occur within the application site		X 1.0	

This category is an estimate of distance between the application site, and the point where runoff water concentrates, which includes natural and made conveyances within the application site that direct runoff into intermittent or perennial streams, lakes or other water bodies. Use zero for distance, if manure, litter, process wastewater, or fertilizer Phosphorus is applied directly in concentrated flow areas that direct runoff directly into intermittent or perennial streams, lakes or other water bodies. If concentrated flow areas do not deliver runoff directly into a stream or other water body (concentrated flow spreads prior to entering the stream or other water body), use the distance from where runoff exits the application site to the point where it enters a stream or other water body. Installation of grassed waterways, tile outlet terraces, or sediment basins within concentrated flow areas that occur within the application site will reduce the risk of sediment-Phosphorus loss due to concentrated water flow. Application setbacks from concentrated flow areas will reduce the risk of total Phosphorus loss due to sheet flow. Grass filter strips are effective at reducing risk of sediment-Phosphorus from sheet flow but do not effectively reduce the risk of loss of sediment-Phosphorus in concentrated runoff.

COMPLETING RISK RATINGS

Each category-weighting factor in Table 3 is multiplied by the site risk rating to get a weighted value. All categories are rated (according to individual category instructions), and the overall risk rating is the sum of all values. After individual manure application sites/fields are rated (up to three sites), record the sites in the appropriate vulnerability-rating category in **Table 4**.

Table 3. PHOSPHORUS INDEX FOR ASSESSING VULNERABILITY OF THE SITE

Site Category	None (0)	Low (1)	Medium (2)	High (4)	Very High (8)	Risk Value (0, 1, 2, 4, 8)	Weight Factor	Weighted Risk Factor
Manure application Site/Field	----	----	----	----	----		----	
Soil Erosion	N/A	<5 tons/ac/yr	5-8 tons/ac/yr	9-12 tons/ac/yr	>12 tons/ac/yr		X 1.5	
Furrow Irrigation Erosion	N/A	Tailwater recovery, QS <6 very erodible soils, or QS <10 other soils	QS >10 for erosion resistant soils	QS >10 for erodible soils	QS >6 for very erodible soils		X 1.5	
Sprinkler Erosion	All sites 0-3% slope, all sandy sites or site evaluation indicates little or no runoff, or large spray on silts 3-8%	Medium spray on silty soils 3-15% slopes, large sprays on silty soils 8-15% slope, low spray on silt soils 3-8%, large spray on clay soils 3-15% slopes	Medium spray on clay soils 3-8% slopes, large spray clay soils >15% slope, medium spray on silt soils >15% slope	Medium spray on clay soils >8 slope, low spray on clay soils 3-8% , low spray on silty soils >15% slope	Low spray on clay soils >8% slope		X 0.5	
Runoff Class	Negligible	Very Low or Low	Medium	High	Very High		X 1.5	
Bray P1 Soil P Test Olson Soil P Test	---	<30 ppm Bray <20 ppm Olson	30-60 ppm Bray 20-40 ppm Olson	60-120 ppm Bray 40-80 ppm Olson	>120 ppm Bray >80 ppm Olson		X 1.0	
Commercial P fertilizer Application Method	None Applied	Placed with planter or injected deeper than 2 inches	Incorporated < 3 months prior to planting or surface applied during the growing season	Incorporated >3 months before crop or surface applied <3 months before crop	Surface applied >3 months before crop		X 0.5	
Commercial P fertilizer Application Rate	None Applied	<30 P_2O_5 lbs/ac	31-90 P_2O_5 lbs/ac	91-150 P_2O_5 lbs/ac	>150 P_2O_5 lbs/ac		X 0.5	
Organic P Source Application Method	None Applied	Injected Deeper Than 2 inches	Incorporated < 3 months prior to planting or surface applied during the growing season	Incorporated >3 months before crop or surface applied <3 months before planting	Surface applied to pasture or >3 months before crop		X 1.0	
Organic P application Rate	None Applied	<30 P_2O_5 lbs/ac	31-90 P_2O_5 lbs/ac	91-150 P_2O_5 lbs/ac	>150 P_2O_5 lbs/ac		X 1.0	

Table 3. PHOSPHORUS INDEX FOR ASSESSING VULNERABILITY OF THE SITE

Site Category	None (0)	Low (1)	Medium (2)	High (4)	Very High (8)	Risk Value (0, 1, 2, 4, 8)	Weight Factor	Weighted Risk Factor
Distance to concentrated surface water flow	Runoff and sediment can not exit the site	>200 feet or functioning grassed waterways, or tile outlet terraces or sediment basins in concentrated surface water flow areas, or functioning grassed filter strips that are at least 100 feet wide	100-200 feet or functioning grass filter strips that are at least 35 feet wide that filter runoff from the field	<100 feet	0 feet (occurs on-site)		X 1.0	
Site/Field Total	----	----	----	----	----		----	

INTERPRETING RESULTS OF SITE VULNERABILITY RATINGS

After multiplying the weighting factor by the risk factor for each site category and totaling all values in Table 3, record the manure application sites in the appropriate vulnerability-rating category in Table 4.

Table 4. SITE/FIELD VULNERABILITY TO PHOSPHORUS LOSS

Total of Weighted Values	Site Vulnerability	Site/Field Number(s)
<14	LOW	
14 - 27.5	MEDIUM	
28 - 55.5	HIGH	
>55.5	VERY HIGH	

- **LOW** – This site has a LOW potential for Phosphorus movement from the site.
- **MEDIUM** – This site has a MEDIUM potential for Phosphorus movement from the site. There is a greater probability for an adverse impact to surface water resources than from a LOW rated site
- **HIGH** – This site has a HIGH potential for Phosphorus movement from the site. There is a higher probability of an adverse impact to surface water than MEDIUM sites unless remedial action is taken.
- **VERY HIGH** – This site has a VERY HIGH potential for Phosphorus movement from the site. There is a very high probability for an adverse impact to surface water.