Practice Specification
Nutrient Management (Code 590)

SCOPE

1. The work shall consist of designing an annual nutrient management plan for the timing, form, method, rate, and location (including application setbacks) of nutrient application used to supply nutrients to plants while minimizing environmental losses due to runoff, erosion, leaching, denitrification, volatilization or other losses.
2. Each nutrient management plan must include a nutrient budget for each field and include maps (aerial site photograph or USGS map, soils map and topography map). Sensitive areas (i.e. surface water, sandy soils) and setbacks shall be indicated on the maps.
3. Use soil samples and manure nutrient analysis (as applicable) when making nutrient management decisions.
4. Complete nitrogen (N) leaching risk assessment (for all fields) and phosphorus (P) index risk assessments (for fields where manure, compost, organic by-products or municipal biosolids is applied) for each field in the nutrient management plan.
5. Identify low risk fields for surface application of nutrients on frozen and snow-covered-soils. When necessary to apply nutrients on frozen or snow-covered soils use application guidelines in Section 11.
6. Develop and maintain a nutrient management recordkeeping system as defined in section 13 of this document.

DEFINING SOIL SAMPLING AND NUTRIENT BUDGET AREAS. *Additional sampling guidelines can be found in University of Nebraska (UNL) NebGuide G1740 "Guidelines for Soil Sampling".*

1. Soil samples for nutrient analysis should always be taken from fields with similar soils and managements and should never represent an area greater than 40 acres. Areas of the field for which any of the following are different should be sampled separately.
   a. Soil texture, slope or landscape position that affect yield potential or nutrient availability (i.e. soil organic matter, soil texture, bottomland versus upland),
   b. Previous crop (i.e. soybeans or other legume that provide a nitrogen credit),
   c. Manure history (i.e. manure applied to only a portion of a field),
   d. Fertilizer history (i.e. higher rate of nitrogen applied in one area versus another in previous year),
   e. Dryland vs. irrigated,
   f. Irrigation water management practices that may have leached nitrate differently (i.e. upper, middle and lower end of a gravity irrigated field), and
   g. Other significant differences in site conditions, or management history.
2. One nutrient budget can be developed for multiple fields or sampling areas if soil test values are similar, and the following are the same:
   a. Crop planted (i.e. corn, wheat, sorghum, etc.),
   b. Irrigation method,
   c. Realistic yield goals, and
   d. Nitrogen credits (i.e. previous legume crop, manure history, etc.).
3. Additional requirements if site specific nutrient management is utilized are as follows:
   a. Soil samples will be taken using either grid sampling and/or management zones (directed) sampling. *Additional information on soil sampling for site specific nutrient management can be found in University of Nebraska Extension Circular EC-154 "Soil Sampling for Precision Agriculture".*

i. Grid Sampling
    1. When using grid sampling a sampling density of at least one sample per 2.5 acres is required. A sampling density of one sample per acre is recommended for fields with more apparent variability;
    2. Grid sampling is typically used for surface samples and all nutrients other than nitrogen.

ii. Management Zone (directed) Sampling
    1. When using directed sampling, each management zone shall be no larger than 20 acres in size;
    2. Spatial tools such as soil maps, aerial photos, yield maps, and other maps of soil variability such as maps from previous grid sampling efforts can be used to direct where samples are taken to determine if they have different fertilizer needs;
    3. In addition, if parts of the field had different preceding crops, different fertilizer/manure history, eroded areas, or old farmsteads they should be sampled separately;
    4. Ideally each management zone should have similar site and soil conditions (i.e. soil texture, soil color, organic matter, slope, drainage, etc.);
    5. Soil samples for nitrogen management generally use directed sampling rather than grid sampling because it is more practical.

iii. A combination of grid and directed sampling may be utilized. For example, surface grid samples may be utilized for amendments/nutrients other than nitrogen and directed management zone sampling used for nitrogen management.

b. In order to utilize site specific nutrient management a variable rate fertilizer applicator equipped with GPS guidance technology must be available to apply recommended nutrients and the management zones must be identified with GPS coordinates.

DETERMINING REALISTIC YIELD GOALS

1. Realistic yield goals shall be clearly documented for each field and established using the best available records and information. Realistic yield goals must be attainable yields and should be based on expected yields as follows:
    a. The average of the previous five years' yields using actual records such as scale tickets, yield monitors, certified crop insurance yield documentation, or Farm Service Agency (FSA) certified yields plus 5%. Do not include yields from years when a significant crop loss occurred from hail, drought, wind or other natural disasters.
    b. If actual yields are not available, use five-year county average yields from FSA or National Agricultural Statistics Service plus 5%.
2. For new crops, industry-demonstrated yields, and nutrient utilization information may be used until University of Nebraska information is available.

SOIL SAMPLING AND ANALYSIS REQUIREMENTS

1. Soil tests for phosphorus, potassium, pH and organic matter, when used for developing a new nutrient management plan, must be no older than 2 years. For nutrient management plan revisions and monitoring changes in soil test levels of phosphorus, potassium, pH and organic matter, take soil tests at intervals recommended by UNL.
2. Use appropriate soil test methods (refer to appropriate University of Nebraska NebGuides and/or Extension Circulars).
3. Soil samples must be collected prior to application of fertilizer and/or manure.

4. Surface Soil Sampling and Analysis:
    a. Surface soil samples must be collected at 0-8” for most nutrients (University of Nebraska guidelines). Refer to University of Nebraska (UNL) NebGuide G1740 “Guidelines for Soil Sampling” for the number of samples, methods of sampling, etc. required for surface soil sampling.
        i. For fields that must complete Phosphorus Index Risk Assessments, soil samples for soil test phosphorus (STP) levels should be collected at depths of 0-2” or 0-8”.
            1. It is preferred that soil samples are collected at depths of 0-2” if:
                1. tillage is conservation tillage or no-till, including perennial grass or forage;
                2. manure and/or phosphorus fertilizer is predominantly surface applied; and
                3. STP is greater than 25 ppm Bray1-P.
            2. If the above conditions are met and soil samples are collected at depths of 0-8”, the Phosphorus-Index will estimate the STP concentration the 0-2” depth based on soil texture and the type of phosphorus test used. (See Extension Circular EC195 “The Nebraska Phosphorus Index (2012): Background and Users Guide).
    b. Surface soil samples must be analyzed for pH, organic matter, phosphorus and potassium.
    c. Where salts or excess sodium are a concern, samples should be analyzed for electrical conductivity (EC), exchangeable sodium percentage (ESP), and ion concentrations of sodium, calcium, and magnesium.
    d. Surface soil test for other nutrients may be done as necessary if nutrient deficiencies are suspected.
    e. Surface soil samples must be collected at the same point in the crop rotation and during the same time of the year in subsequent years to determine trends.
5. Sampling for Nitrates:
    a. Nitrate-N soil tests, when required, must be taken following harvest of the previous crop and prior to applying nitrogen fertilizer or manure for the planned crop.
    b. Nitrate samples are not required for the following two situations:
        i. When the only source of nitrogen is a starter fertilizer and less than 25 pounds of total nitrogen will be applied.
        ii. Following soybeans unless organic amendments (manure or compost) were applied within the previous two years or soybean yields were low due to hail, drought or insect damage.
    c. Nitrate-N values (in ppm) shall be listed for each depth sampled. If soil test values are given in pounds per acre, divide by 0.3 times the sampling depth. For example, if the soil test value is 32 lbs/ac and the sampling depth was 0-8”, divide 32 by 0.3 x 8 or 2.4. So, 32 lbs/ac would equal 13 ppm.
    d. Refer to NebGuide G1740 for the timing, number of samples, methods of sampling, depth of samples, etc. required for deep nitrate sampling. Additional guidelines are as follows:
        i. At a minimum, nitrate samples should be taken from a depth of 0-24 inches. Split samples for nitrate (0-8 inches and 8-24 inches) are acceptable if surface samples are required in addition to the nitrate samples.
        ii. University of Nebraska nitrogen recommendations for corn and sorghum are based on a 48-inch sampling depth and on a 36-inch depth for most other crops. When depth of sampling is less than this, an appropriate estimated value of nitrate-N can be used below the sampling depth. When soil test results for nitrate-N are not available use a default value of 3 ppm for medium and fine textured soils and 1.5 ppm for sandy soils to calculate the N recommendation. For additional information see University of Nebraska Extension Circular EC117 “Fertilizer Suggestions for Corn”.
        iii. Timing of soil nitrate sampling:
            1. For spring planted crops on medium and fine textured soils, samples can be taken in

the fall after the harvest of the previous crop or in the spring before any nitrogen fertilizer application;

2. For fall planted crops on medium and fine textured soils, samples can be taken during the early fall prior to planting, or after emergence of the crop providing no nitrogen was applied prior to planting the crop;
3. Samples on coarse textured (sandy) soils must be taken in the same season that the crop is planted (i.e. spring for corn, fall for winter wheat), or after emergence of the crop unless manure or fertilizer is fall applied in which case soil samples must be take prior to nutrient application.

iv. Soil test analyses must be performed by laboratories successfully meeting the requirements and performance standards of the North American Proficiency Testing Program-Performance Assessment Program (NAPT-PAP) under the auspices of the Soil Science Society of America (SSSA) and NRCS, or other NRCS-approved program that considers laboratory performance and proficiency to assure accuracy of soil test results.

SUPPLEMENTAL TESTS FOR NITROGEN MANAGEMENT (optional tests)

1. Corn Stalk Nitrate Test (CSNT). *Additional information can be found in the Iowa State University (ISU) Extension publication, CROP 3154 "Use of the End-of-Season Corn Stalk Nitrate Test in Iowa Corn Production:"*
   a. The concentration of nitrate in the stalk at the end of the growing season reflects all factors that influenced nitrogen availability and nitrogen needs during the growing season. This test is used to determine if the crop had adequate nitrogen at the end of the growing season and enables the producer to evaluate their current fertility program and adjust accordingly.
   b. Sampling Procedures:
      i. Stalks should be sampled 1-3 weeks after black layer has formed on about 80% of the kernels of most ears.
      ii. Each sample will consist of 15 8-inch stalk segments taken from 6 inches above the soil surface from each Nutrient Budget Area as described in Section 2 "Defining Soil Sampling and Nutrient Budget Areas."
      iii. Samples should be placed in paper bags and sent to the laboratory for analysis as soon as possible after collection.
   c. Corn Stalk Nitrate Test Interpretation Categories:
      i. Low (< 250 ppm)may or may not indicate deficient N depending on specific conditions. For example, in years with high grain yield and active grain fill late in the season CSNT values can be near zero. However, for fields or areas within a field that consistently test in the **Low** category fertilization rates could probably be increased.
      ii. Sufficient (250-2000 ppm)category indicates high probability that nitrogen availability was adequate for the conditions during the growing season.
      iii. High (> 2000 ppm)category indicates high probability that nitrogen availability was greater than if fertilizer nitrogen had been applied at rates that maximize profits for producers. If rates are high across multiple years, then rate reductions would be appropriate with minimal risk of yield loss.
   d. When interpreting the results of the test, considerations must be given to weather conditions that occurred during the growing season, where:
      i. Drought conditions can result in elevated nitrates in the lower stalk. This can be due to nitrate uptake late in the season in combination with much reduced grain fill or missing ears.
      ii. With extremely wet conditions, stalk nitrate concentrations may be unusually low due to excess rainfall and nitrogen losses and/or high grain yield.

2. Late-Spring Soil Nitrate Test (LSNT). *Additional information can be found in the ISU Extension publication CROP 3140 "Use of the Late-Spring Soil Nitrate Test in Iowa Corn Production."*
    a. The LSNT is an in-season soil nitrate test for corn production used to determine soil nitrogen availability prior to side-dress applications.
    b. The LSNT is recommended for fields to which manure has been regularly applied because it accounts for mineralized nitrogen from the manure as well as some of the variability associated with manure application.
    c. Sampling Procedures:
        i. Soil samples for the LSNT should be taken to a depth of 12 inches when the corn is 6 to 12 inches tall.
        ii. Collect 16-24 cores from each Nutrient Budget Area as described in Section 2 "Defining Soil Sampling and Nutrient Budget Areas." Detailed information on sampling procedures is included in CROP 3140.
    d. Interpreting LSNT Results:
        i. The LSNT, as a calibrated soil test, has a critical value above which there is little expectation of crop response to applied nitrogen. For normal conditions, that value is 25 ppm nitrate-N. The recommended application rate is determined by subtracting the measured soil nitrates from 25 ppm (critical level) and multiplying the difference by 8. For example, with a soil test of 18 ppm nitrate-N, the nitrogen recommendation would be: 25-18 =7 x 8= 56 lbs. nitrogen/acre.
        ii. If rainfall is more than 20% above normal between April 1 and the time of sampling, ISU recommends reducing the critical value by 3-5 ppm to 20-22 ppm.
        iii. Manured fields and fields with first- or second-year corn after alfalfa tend to mineralize more nitrogen after the time of LSNT sampling than do other soils. Therefore, the LSNT critical levels above are not correct. Refer to the Table 1 in ISU Extension Publication CROP 3140 for recommended application rates.

MANURE, COMPOST, ORGANIC BY-PRODUCTS, AND BIOSOLIDS SAMPLING AND LABORATORY ANALYSIS (TESTING). ***Additional sampling and testing guidelines can be found in University of Nebraska (UNL) NebGuides G1450 "Sampling Manures for Nutrient Analysis" and G1780 "Manure Testing: What to Request?".***

1. Nutrient values of manure, compost, organic by-products and biosolids must be determined prior to land application.
    a. For existing operations, if manure is tested before the application event, the nutrient test results can be used to determine application rates for the manure and commercial fertilizers.
        i. When manure sampling prior to application is not practical due to agitation limitations, feeding operations that have consistent feeding and manure management history can determine application rates based on 5-year average results of past manure analyses.
        ii. If no prior test results are available, use "book values" recognized by the NRCS, University of Nebraska, or 5-year average results of past manure analyses from a similar operation in the same geographic area (as approved by NRCS) for determining application rates and sample the manure during the application event. Upon receipt of the manure nutrient test analysis results, the actual manure nutrient application rates can be re-calculated and the subsequent commercial fertilizer application rates can be adjusted.
    b. When planning for new or modified livestock operations "book values" are acceptable.
2. Manure shall be sampled annually in accordance with University of Nebraska guidelines. Each type of livestock waste (e.g. beef, swine, dairy, poultry, etc. and solids, litter, slurry, wastewater, runoff, etc.) and each type manure storage structure (e.g. pens, debris basin, stockpile, compost pile, holding pond, storage structure, deep pits and lagoons, etc.) should be sampled and analyzed.

Sampling procedures include:

a. Solid and Semi-Solid Manure:
    i. Collecting samples from open lots and manure piles is acceptable.
        1. Collect 20 or more samples from open lots, avoiding feed and watering areas. Place samples in a 5-gallon bucket, mix thoroughly and sub-sample.
        2. For manure piles, use an auger or soil probe to collect samples from 6 inches below the surface targeting the center of the pile. Collect 15 or more samples (30 is optimum) from stacks into a 5-gallon bucket. Mix samples thoroughly and collect a sub-sample to be sent to the laboratory.
    ii. Collecting samples during loading or application is preferable.
        1. Hand-grab samples from at least 10 spreader loads to form a composite sample, or
    iii. Sample manure during application by spreading a plastic sheet or tarp at least 4 foot by 4 foot in the path of applicator.
b. Liquid and Slurry Manure:
    i. Remember, NEVER ENTER CONFINED MANURE STORAGE DEEP PITS WITHOUT APPROPRIATE SAFETY EQIPMENT.
    ii. Sampling during pumping, loading, or after loading of liquid and slurry manure is preferred. Collect a sample in a clean container from the pump during loading or when pumping to an irrigation system or an umbilical cord applicator. Samples can be taken from the unloading part of a tank spreader immediately after loading. Take samples from several loads or at several pumping intervals to ensure a representative sample.
    iii. If sampling from the storage facility is the only option, development of a sampling tool made with PVC pipe should be considered. If a storage structure is sampled without agitation, it is important to obtain samples from various depths due to stratification of nutrients. Collect at least 20 sub-samples in order to obtain a good estimate of manure nitrogen content.
    iv. Liquid manure applied through sprinkler irrigation systems can also be collected during application. Place collection pans or buckets at eight or more points throughout the application area to collect the manure.

3. Label the sample container for identification, including your name and address, sample identification, date of sampling, manure type and sample location. Use University of Nebraska guidance for storage and delivery/shipping. Keep samples chilled (refrigerated) and if shipped by package, insulate container in layers of newspaper or add cold packs. Avoid weekend delays in shipping by sending early in week.
4. Manure nutrient analysis should be completed in accordance with University of Nebraska guidelines. Manure testing shall be done by laboratories successfully meeting the requirements and performance standards of the Manure Testing Laboratory Certification program (MTLCP) under the auspices of the Minnesota Department of Agriculture, or State recognized program that considers laboratory performance and proficiency to assure accurate manure test results.
    a. Manure and wastewater samples must be analyzed annually for the following:
        i. Total Nitrogen,
        ii. Total Ammonium-N,
        iii. Total Phosphorus,
        iv. Total Potassium, and
        v. Percent moisture or dry mater concentrations or content.
    b. Manure and wastewater sample reports should include the above nutrients plus Total Organic-N.

NITROGEN RECOMMENDATIONS

1. Follow University of Nebraska recommendations per Extension Circular EC155 “Nutrient Management for Agronomic Crops in Nebraska”, current University of Nebraska NebGuides or software.
2. Appropriate nitrogen credits must be accounted for as follows:
   a. Soil Test Residual:
      i. The amount of residual soil nitrogen is based on the average nitrate-N in the root zone in parts per million (ppm) to a depth of 2-4 feet depending on the crop to be grown according to University of Nebraska guidelines.
   b. Soil Organic Matter:
      i. Nitrogen credit for organic matter is based on the percent organic matter from a surface soil test and can be calculated for corn using the algorithm in EC155 or in University of Nebraska Extension Circular EC117 “Nutrient Management Suggestions for Corn.” For corn grown for grain the soil organic matter nitrogen credit = (0.14 x Expected Yield x % Organic Matter). The maximum organic matter used in the calculation is 3%.
      ii. Nitrogen credit from organic matter for other crops will be based on current University of Nebraska software, NebGuides or Extension Circular(s) for a given crop as appropriate.
   c. Irrigation Water Nitrate:
      i. If the field is irrigated and located in an area where ground water nitrate concentrations of 10 ppm or greater have been documented, analyze irrigation water for nitrate content during the irrigation season.
      ii. In subsequent growing seasons when nitrogen will be applied, credit nitrogen in irrigation water when the nitrate concentration is 10 ppm or greater based on a nitrate test from the previous irrigation season.
      iii. Nitrogen is credited based on normal seasonal irrigation rates during the growing season (prior to milk stage for grain crops), or as follows: 6² (east), 9² (central), 12² (west), or 15² (Panhandle).
      iv. Pounds of nitrogen/acre credited = [(inches pumped X ppm nitrate-N X 2.7) ¸ 12].
   d. Legume Nitrogen:
      i. Recommended legume nitrogen credits for selected crops can be found in University of Nebraska Extension Circular EC155 as well as other crop specific University of Nebraska Extension Circulars and NebGuides.
   e. Manure or other organic amendments:
      i. Manure application over the past three years will be credited per University of Nebraska recommendations (NebGuide G1335 “Determining Crop Available Nutrients from Manure”).
   f. Maximum applied rates of N fertilizers will match University of Nebraska recommendations as closely as possible. Applied N rates will not exceed the University of Nebraska recommendation by more than 10% not to exceed 10 lbs/ac.

MANAGEMENT ADJUSTMENTS FOR NITROGEN APPLICATION

1. Complete a Nitrogen Leaching Risk Assessment for each field in the nutrient budget using Table 1. Adjust management (e.g. timing of application, method, use of a nitrification inhibitor, and/or formulation of manure/fertilizer applied) in order to avoid excessive nitrogen leaching losses. Note: For Nitrogen Leaching Risk Assessment purposes do not include starter fertilizers or manure that is high in organic nitrogen, such as swine slurry or chicken litter, which is surface applied on medium or fine textured soils and not incorporated within 72 hours.

Table 1. Nitrate Leaching Potential of Inorganic Nitrogen Sources*

	Soil Texture		
	Coarse	Medium	Fine
Timing of Application	Sand, loamy sand and sandy loam	Silt, silt loam and loam	Clay, silty clay loam, silty clay, clay loam, sandy clay loam and sandy clay
Fall Application	High	Medium-Low	Low
Spring Application, Pre-plant	High-Medium	Medium-Low	Low
Side-dress or Split Application	Medium-Low	Low	Low

*Leaching Potential for inorganic sources of nitrogen are based on soil texture and timing of application.

2. Where Nitrogen Leaching Risk Assessment results equate to:
   a. High Risk, adjust nitrogen application timing and/or methods as follows:
      i. Commercial nitrogen fertilizer or manure high in inorganic nitrogen, such as swine slurry or chicken litter, shall not be fall applied when growing spring-planted crops;
      ii. Commercial nitrogen fertilizer or manure high in inorganic nitrogen, such as swine slurry or chicken litter, shall be split applied when growing fall-planted crops, such as wheat or rye, with no more than 50% of the nitrogen applied in the fall;
      iii. Organic sources of nitrogen such as feedlot manure may be applied in the fall when soil temperatures are 50 degrees Fahrenheit or less;
      iv. Liquid manure may be applied through irrigation systems during crop growth season.
   b. Medium and Low Risk, adjust nitrogen application timing as follows:
      i. Commercial nitrogen fertilizer or manure that is high in *crop available* inorganic nitrogen, such as swine slurry or chicken litter, may be applied in the fall for growing spring planted crops when:
         1. Soil temperatures are 50 degrees Fahrenheit or less; or
         2. A cover crop, such as wheat or rye, is established.
      ii. Manure that is high in crop available inorganic nitrogen, such as swine slurry or chicken litter, may be applied in the summer for growing spring planted crop when:
         1. Manure application rates are based on phosphorus uptake rates for the planned spring crop, or
         2. A cover crop, such as wheat or rye, is established.
   c. For site specific nutrient management, a variable rate fertilizer applicator equipped with GPS guidance technology will be used to apply nitrogen at recommended rates.

PHOSPHORUS RECOMMENDATIONS

1. Phosphorus application rates will be based from one of the following:
   a. University of Nebraska recommendations when soil test levels are less than 25 ppm using the Bray-1 P soil test. The following factors can be used to convert results from other soil tests to a Bray-1 P equivalent:
      i. For Mehlich II: Bray-1 equivalent = 0.9 x Mehlich II.
      ii. For Mehlich III: Bray-1 equivalent = 0.85 x Mehlich III.
      iii. For the Olsen (Sodium bicarbonate) test: Bray-1 equivalent = 1.5 x Olsen P.
   b. Rates equal to or less than the estimated crop removal of phosphorus in harvested biomass. Crop removal estimates for common crops can be found in Table 2. Additional crop removal estimates can be found Chapter 6 of the USDA Agricultural Waste Management Field Handbook or the Crop Nutrient Tool in the USDA Plants Database.

Table 2: Phosphorus removal estimates for common crops.

Crop	Yield Units	P-Removal (lbs P_2O_5)
Corn	bu	0.34 lbs/bu
Soybean	bu	0.85 lbs/bu
Sugarbeets	tons	1.7 lbs/ton
Dry Edible Beans	lbs	0.01 lbs/lb
Wheat	bu	0.53 lbs/bu
Corn silage	tons	3.3 lbs/ton
Sunflower	lbs	0.013 lbs/lb
Proso Millet	bu	0.39 lbs/bu
Potato	cwt	0.14 lbs/cwt
Grain Sorghum	bu	0.41 lbs/bu
Sorghum Silage	tons	2.9 lbs/ton
Oats	bu	0.26 lbs/bu
Popcorn	cwt	0.68 lbs/cwt
Alfalfa (hay)	tons	10.0 lbs/ton

   c. Phosphorus applications in excess of crop removal are allowed when Bray P-1 soil test values are less than 25 ppm and the objective is to increase soil test values over a 4 to 6-year period or when manure, compost, organic by-products, or biosolids are the primary source of phosphorus. A Phosphorus Risk Assessment must be completed for each field or management unit using the Nebraska Phosphorus-Index (NE P-Index). *For additional information on the NE P-Index, see the University of Nebraska Extension Circular EC195.*
2. When the result of the phosphorus risk assessment using the Nebraska P-Index is:
   a. **LOW** – phosphorus may be applied at rates greater than crop removal for the planned crop (or crops in the rotation). If manure, compost, organic by-products, or biosolids are the primary source of phosphorus, the total available manure nitrogen shall not exceed:
      i. University of Nebraska recommended rates for non-legume crops.
      ii. Nitrogen removal in harvested biomass for legume crops.
   b. **MEDIUM** – Phosphorus application rates greater than crop removal are allowed when adequate conservation practices are in place, such as filter strips or riparian buffers, or state required 100-foot setbacks along streams and water bodies are followed. If manure, compost, organic by-products, or biosolids are the primary source of phosphorus, the total available manure nitrogen shall not exceed:

i. University of Nebraska recommended rates for non-legume crops.

ii. Nitrogen removal in harvested biomass for legume crops.

c. HIGH – additionalphosphorus may be applied at rates not to exceed crop removal for the planned crop (or crops in the rotation).

i. If manure, compost, organic by-products, or biosolids are the primary source of phosphorus, the total available manure nitrogen shall not exceed:

1. University of Nebraska recommended nitrogen application rates during the year of application for non-legume crops.
2. Nitrogen removal in harvested plant biomass during the year of application for legume crops.

ii. A strategy to reduce the NE P-Index rating to medium within five years must be implemented. The strategy should include:

1. Completed site assessment for nutrients and soil loss to determine which practices can reduce the P-Index rating to medium within five years,
2. Change of practices to lower soil phosphorus and/or to reduce erosion and runoff sufficiently through management and/or added structures,
3. Alternative crop rotations that may uptake more phosphorus than the normal rotation.

d. VERY HIGH – no phosphorus application allowed until risk rating is lowered.

i. Implement soil phosphorus drawdown and erosion/runoff reduction strategy in developing a plan to reduce Phosphorus-Index rating to a medium within five to ten years, dependent on Phosphorus-Index numerical score.

Table 3. NE Phosphorus Index Score and Risk Ratings

NE P-Index Score	Risk Rating	Application Rates
0-2	Low	N-Based
2-5	Medium	N-Based
5-15	High	P-Based plus strategy to lower risk to medium in 5 years
>15	Very High	No P application until score is lowered and strategy to lower risk to medium in 5-10 years.

SURFACE APPLICATION OF MANURE TO SOILS WHEN THE TOP 2 INCHES OF SOIL ARE SATURATED FROM RAINFALL OR SNOW MELT

1. Under normal operating conditions for livestock wastewater structures, liquids shall not be applied to saturated soils,
2. During chronic wet periods and 25-year, 24-hour storm events outlined in the Department of Environment and Energy's Title 130, Livestock Waste Control, a discharge of effluent is not permitted unless the livestock operation has met National Pollutant Discharge Elimination System (NPDES) permit and/or State permit requirements. Discharges may include the application of wastewater onto saturated soils. **State regulations must be followed**.

SURFACE APPLICATION OF NUTRIENTS TO FROZEN AND/OR SNOW-COVERED SOILS

1. Definitions:
   a. Frozen soil is defined as impenetrable due to frozen soil moisture but not does not include soil that is frozen to a depth of two inches or less; and
   b. Snow-covered soil is defined as ground covered by one inch or more of snow or one-half inch of ice.
   c. Management units are fields sub-units based on slope, soil type, etc.
2. Nutrient Management Plans and Comprehensive Nutrient Management Plans should identify lower risk fields or management units for spreading and stacking/stockpiling manure on frozen or snow-coved soils based on the following:
   a. Low phosphorus delivery potential based on Phosphorus-Index rating score of 3.0 or less,
   b. Manure application rates are not more than those listed in the Phosphorus-Index Summary developed for the field,
   c. Slope of 12% or less,
   d. Greater than 30% ground cover by plants or crop residues,
   e. Existing land treatment conservation practices (e.g. buffers, field borders, filter strips) are in average condition and maintained,
   f. Management practices (i.e. no-till, mulch-till, contour farming, etc.) are appropriate for low erosion and runoff,
   g. State required setbacks from surface water (e.g. bed and bank streams, wetlands, lakes, etc.) are respected, and
   h. No manure is applied within 100 feet of drainage tile inlets that outlet directly into surface water.
3. Surface application of manure is restricted on frozen ground (where frozen ground conditions apply) and/or snow-covered soils (where snow-covered ground conditions apply); except when the field conditions above in bullet 2. a. thru h. are met and the application event complies with all applicable Federal, State and local laws and regulations.
4. Surface application of commercial fertilizer is restricted on frozen ground (where frozen ground conditions apply) and/or snow-covered soils (where snow-covered ground conditions apply); except when the field conditions above in bullet 2. c. thru g. are met and the application event complies with all applicable Federal, State and local laws and regulations and applicable setbacks.
5. Consider the following guidelines during winter application of manure:
   a. Apply to level or gently sloping fields or fields without channelized flow,
   b. Apply to fields or management units farthest from surface water, conduits to ground water and areas of concentrated flow,
   c. When possible, apply to the driest fields or management units, and
   d. Minimize manure application to grass waterways.
6. Consider delaying or rescheduling manure application events if large amounts of rain are forecast (with the probability of creating runoff).

APPLICATION OF OTHER PLANT NUTRIENTS AND SOIL AMENDMENTS

1. All other plant nutrients and soil amendments (lime) other than nitrogen and phosphorus can be applied according to University of Nebraska recommendations.
2. For site specific nutrient management, a variable rate fertilizer applicator equipped with GPS guidance technology will be used to apply nutrients and soil amendments at the recommended rates.

APPLICATION EQUIPMENT CALIBRATION

1. Calibrate nutrient application equipment annually. Like calibration of any commercial fertilizer spreader, annual calibration of manure application equipment is a key component to efficient nutrient use.
   a. Calibrate manure spreaders pivots used to apply manure and effluent in accordance with University of Nebraska Manure Applicator Calibration Guide.
      i. Manure Applicator Calibration Kits are available at many UNL Extension offices across the state. Find a kit near you.
   b. Calibrate irrigation pumps used for chemigation or fertigation.
   c. If manure is custom hauled and/or applied (by a professional manure applicator, etc.), retain copies of:
      i. current equipment maintenance logs,
      ii. documented calibration events, and
      iii. manure analysis reports if the manure applicator submits a manure sample to laboratory for analysis.
   d. Other important documents to obtain from a professional manure applicator include, but are not limited to:
      i. current liability insurance policy and
      ii. business certifications and/or employee training certificates (for manure application) as available (certification for a business and/or their employees is voluntary in Nebraska).

RECORDKEEPING

1. Records will be kept for a minimum of five years for each nutrient budget field or combined fields if applicable.
2. At a minimum the following records will be kept for each nutrient budget field or combined fields if applicable:
   a. Copies of applicable test results such as: soil tests, manure tests, irrigation water tests, LSNT tests, cornstalk nitrate tests, or other applicable test results.
   b. Maps showing the location of each field or management zone for which a nutrient budget was developed. Maps must include legal description.
   c. Nutrient budget calculations including crop rotation, realistic yield goal, nitrogen credits and planned nutrient application rates for nitrogen and phosphorus.
   d. Actual application location, timing, method, and rate (lbs./acre, gals/acre, tons/acre, etc.) for each nutrient and nutrient source applied, the total amount of nutrients applied per acre from all sources, and whether or not a nitrification inhibitor was used.
      i. If manure is exported, document:
         1. name and address of individual the manure was exported,
         2. type of manure and source (e.g. beef solids – stockpile; wastewater – swine storage pond, etc.),
         3. date and quantities exported, and
         4. indication that a copy of the manure nutrient analysis was provided to recipient.
      ii. If manure is imported and applied, document:
         1. type of manure and source (e.g. beef solids – stockpile, wastewater – swine storage pond, etc.),
         2. name and address of individual from which the manure was imported from,

3. date and quantities imported, and
4. copy of the manure nutrient analysis.

iii. If manure is applied, weather conditions and soil moisture 24-hours prior to application, at the time of application, and 24-hours after application.

e. Crop type(s) and actual yield(s) in bushels/ac, tons/acre or other appropriate measurement unit and any crop residue removed.

f. Unusual weather conditions affecting yields, e.g. drought, hail, heavy rain events, flooding, etc.

g. Calibration date(s) of application equipment. If using a professional manure applicator, obtain copies of application equipment calibration documentation with date of calibration. See section 13 of this document.

h. Dates of plan review, name of reviewer and any changes made as result of review.

3. Crop type(s) and actual yield(s) in bushels/ac, tons/acre or other appropriate measurement unit and any crop residue removed.
   a. Unusual weather conditions affecting yields, e.g. drought, hail, heavy rain events, flooding, etc.
   b. Calibration date(s) of application equipment. If using a professional manure applicator, obtain copies of application equipment calibration documentation with date of calibration. See section 13 of this document.
   c. Dates of plan review, name of reviewer and any changes made as result of review.
4. Additional record keeping requirements for site specific nutrient management based on grid or directed management zone soil sampling will document the following in addition to records listed above.
   a. Maps showing the locations of the grid or management zones and the associated soil test values;
   b. Variable rate documentation of the amount of each nutrient applied in each grid or management zone, such as computer-generated GIS maps from variable rate application equipment.

FEDERAL, TRIBAL, STATE, OR LOCAL REGULATIONS/RESTRICTIONS

1. Follow federal, tribal, state, or local requirements when procedures are more restrictive than outlined in this document. This may include, but is not limited to, soil sampling procedures including soil sampling depths; soil and/or manure nutrient testing requirements; nutrient application form and/or timing restrictions; record keeping, etc. Examples include, but not limited to the following:
   a. Nebraska Department of Environmental Quality (NDEQ)
      i. Nutrient management plans for permitted livestock waste control structures.
      ii. Chemigation permitting and chemigation safety equipment for fertilizer and livestock waste.
   b. Natural Resource Districts
      i. Nitrogen management for ground water protection,
      ii. Chemigation safety equipment for fertilizer and livestock waste.

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17. Specific Site Requirements