NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

NUTRIENT MANAGEMENT

(Ac.)

CODE 590

DEFINITION

Managing the amount, source, placement, form and timing of the application of plant nutrients and soil amendments.

PURPOSE

- To budget and supply nutrients for plant production.
- To properly utilize manure or organic by-products as a plant nutrient source.
- To minimize agricultural nonpoint source pollution of surface and ground water resources.
- To protect air quality by reducing nitrogen emissions (ammonia and NO_x compounds) and the formation of atmospheric particulates.
- To maintain or improve the physical, chemical and biological condition of soil.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all lands where plant nutrients and soil amendments are applied.

CRITERIA

General Criteria Applicable to All Purposes

Plans for nutrient management shall comply with all applicable Federal, state, and local laws and regulations.

Plans for nutrient management shall be developed in accordance with policy requirements of the NRCS General Manual Title 450, Part 401.03 (Technical Guides, Policy and Responsibilities) and Title 190, Part 402 (Ecological Sciences, Nutrient Management, Policy); technical requirements of the NRCS Field Office Technical Guide (FOTG); procedures contained in the National Planning Procedures Handbook (NPPH), and the NRCS National Agronomy Manual (NAM) Section 503.

Persons who review or approve plans for nutrient management shall be certified through the Alaska Certified Specialist in Nutrient Management Program. Contact the NRCS state agronomist for more information.

Plans for nutrient management that are elements of a more comprehensive conservation plan shall recognize other requirements of the conservation plan and be compatible with its other requirements.

A nutrient budget for nitrogen, phosphorus, and potassium shall be developed that considers all potential sources of nutrients including, but not limited to animal manure and organic by-products, waste water, commercial fertilizer, crop residues, legume credits, and irrigation water.

Realistic yield goals shall be established based on soil productivity information, historical yield data, climatic conditions, level of management and/or local research on similar soil, cropping systems, and soil and manure/organic by-products tests. For new crops or varieties, industry yield recommendations may be used until documented yield information is available.

Plans for nutrient management shall specify the source, amount, timing and method of

application of nutrients on each field to achieve realistic production goals, while minimizing movement of nutrients and other potential contaminants to surface and/or ground waters.

Erosion, runoff, and water management controls shall be installed, as needed, on fields that receive nutrients.

Areas contained within established minimum application setbacks (e.g., sinkholes, wells, gullies, ditches, surface inlets or rapidly permeable soil areas) shall not receive direct application of nutrients.

Soil and Tissue Sampling and Laboratory Analyses (Testing)

Nutrient planning shall be based on current soil test results developed in accordance with University of Alaska Fairbanks guidance or industry practice if recognized by the University. Current soil tests are those that are no older than three years for perennial crops and one year for annual crops or any crop where manure or bio-solids are applied.

If a current soil test is not available, one will be completed within 12 months of developing a nutrient management plan. The most current soil test will be used to review and revise the nutrient management plan.

On perennial crops such as pasture or hayland soil tests will be required annually for three years and then every third year thereafter unless there is a major change in the crop rotation or operation.

On annually tilled crops, intensively managed pasture or hayland and fields where manure or bio-solids are applied annual soil tests are required.

Soil samples shall be collected and prepared according to the University of Alaska Fairbanks Cooperative Extension Service guidance or according to standard industry practice. Soil test analyses shall be performed by laboratories that are accepted in one or more of the following programs:

- State Certified Programs,
- The North American Proficiency Testing Program (Soil Science Society of America),

Soil testing shall include analysis for any nutrients for which specific information is needed to develop the nutrient plan. Request analyses pertinent to monitoring or amending the annual nutrient budget, e.g. pH, electrical conductivity (EC), soil organic matter, plant available nitrogen, extractable phosphorus and potassium. (Laboratories should use a 2N KCl extractable nitrate and ammonium nitrogen; and Mehlich 3 extractable phosphorus and potassium as these are the tests that Alaska fertilizer recommendations are based upon.

Plant Tissue Testing

Tissue sampling and testing, where used, shall be done in accordance with University of Alaska standards and recommendations.

Manure Testing

Manure and organic by-product nutrient application rates shall be based on nutrient analyses procedures recommended the University of Alaska or industry standard. At a minimum, manure analyses shall identify nutrient and specific ion concentrations, percent moisture, and percent organic matter. Salt concentration shall be monitored so that manure applications do not cause plant damage or negatively impact soil quality.

Nutrient Application Rates

Soil amendments are generally not practical in Alaska for adjusting soil pH due to high costs. The crop or variety shall be chosen based on pH range for optimum availability and utilization of nutrients. (See table 2 in the specification for pH adaptation of individual crops.)

Where amending soil to adjust pH is feasible planners should use table 3 in the specification to determine the lime application rate. Additional information can be found in Alaska Agronomy Technical Note 15-Liming Alaska Soils.

Recommended nutrient application rates shall be based on University of Alaska recommendations (and/or industry practice when recognized by the University) that consider current soil test results, realistic yield goals and management capabilities. If the University does not provide specific

recommendations, application shall be based on realistic yield goals and associated plant nutrient uptake rates.

The planned rates of nutrient application, as documented in the nutrient budget, shall be determined based on the following guidance:

- Nitrogen Application **-** Planned nitrogen application rates shall match the recommended rates as closely as possible, except when manure or organic by-products are a source of nutrients. When manure or organic by-products are a source of nutrients, see “Additional Criteria” below.
- Phosphorus Application **-** Planned phosphorus application rates shall match the recommended rates as closely as possible, except when manure or organic by-products are sources of nutrients. When manure or organic by-products are a source of nutrients, see “Additional Criteria” below.
- Potassium Application - Potassium shall not be applied in situations in which excess (greater than soil test potassium recommendation) causes unacceptable nutrient imbalances in crops or forages. When forage quality is an issue associated with excess potassium application, state standards shall be used to set forage quality guidelines.
- Other Plant Nutrients - The planned rates of application of other nutrients shall be consistent with Land Grant University guidance or industry practice if recognized by the Land Grant University in the state.
- Starter Fertilizers - Starter fertilizers containing nitrogen, phosphorus and potassium may be applied in accordance with University of Alaska recommendations, or industry practice if recognized by the University. When starter fertilizers are used, they shall be included in the nutrient budget.

Nutrient Application Timing.

Timing and method of nutrient application shall correspond as closely as possible with plant nutrient uptake characteristics, while considering cropping system limitations, weather and climatic conditions, and field accessibility.

Nutrient Application Methods.

Application methods to reduce the risk of nutrient transport to surface and ground water, or into the atmosphere shall be employed. To minimize nutrient losses:

- Apply nutrient materials uniformly to application area(s).
- Nutrients shall not be applied to frozen, snow-covered or saturated soil if the potential risk for runoff to surface waters exists.
- Nutrients shall be applied considering the plant growth habits, irrigation practices, and other conditions so as to maximize availability to the plant and minimize the risk of runoff, leaching, and volatilization losses.
- Nutrient applications associated with irrigation systems shall be applied in accordance with the requirements of Irrigation Water Management (Code 449).

Conservation Management Unit (CMU) Risk Assessment.

In areas with identified or designated nutrient related water quality impairment, a CMU specific risk assessment of the potential for nutrient transport from the area shall be completed.

States that utilize a threshold prescreening procedure to trigger CMU risk assessment shall follow approved procedures as recommended by the respective state or Land Grant University.

Use an appropriate nutrient risk assessment tool for the nutrient in question (e.g., leaching index, phosphorus index) or other state recognized assessment tool.

Additional Criteria Applicable to Manure and Organic By-Products Applied as a Plant Nutrient Source

When animal manures or organic by-products are applied, a risk assessment of the potential

for nutrient transport from the CMU shall be completed to adjust the amount, placement, form and timing of application of nutrient sources, as recommended by the state of Alaska or University of Alaska.

Nutrient values of manure and organic by-products (excluding sewage sludge or biosolids) shall be determined prior to land application based on laboratory analysis, acceptable "book values" recognized by the NRCS and/or the University of Alaska, or historic records for the operation, if they accurately estimate the nutrient content of the material. Field sampling of stored manure tends to be highly variable. Large numbers of samples are necessary for accurate estimates of nutrient content. Consult an NRCS agronomist or a Cooperative Extension Service specialist before designing a sampling scheme. Book values recognized by NRCS may be found in the Agricultural Waste Management Field Handbook, Chapter 4 - Agricultural Waste Characteristics. A summary table of this information is available in table 5 of the specification.

Manure and Organic By-Product Nutrient Application Rates.

Field Risk Assessment
When animal manures or other organic byproducts are applied, a field-specific assessment of the potential for phosphorus transport from the field shall be completed. This assessment will be done using the Alaska Phosphorus Index. In such cases, plans shall include:

- a record of the assessment rating for each field or sub-field, and

- information about conservation practices and management activities that can reduce the potential for phosphorus movement from the site.

When such assessments are done, the results of the assessment and recommendations shall be discussed with the producer during the development of the plan.

Phosphorus Index (PI) Rating

The Alaska Phosphorus Index will be used to evaluate the potential for phosphorus movement from the site. (See Agronomy Technical Note # 14) If the PI rating is Low or Medium, manure application rates will be based on nitrogen. If the PI rating is High or Very High, manure application rates will be either based on phosphorus or crop removal as outlined in table 1 below.

Table 1.

Phosphorus Index Rating	Phosphorus Application
Low Risk	Nitrogen Based
Medium Risk	Nitrogen Based
High Risk	Phosphorus Based soil test recommendation
Very High Risk	Phosphorus Based crop removal

Nutrient Application Rates

The planned rates of nitrogen and phosphorus application recorded in the plan shall be determined based on the following guidance.

When the PI rating is Low or Medium, refer to the **Nutrient Application Rates** under **General Criteria** above.

When the PI rating is High or Very High:

- **Nitrogen Application -** When the plan is being implemented on a phosphorus standard, manure or other organic byproducts shall be applied at rates consistent with the phosphorus standard. In such situations, an additional nitrogen application, from non-organic sources, may be required to supply the recommended amounts of nitrogen.

  Manure or other organic by-products may be applied on legumes at rates equal to the estimated removal of nitrogen in harvested plant biomass.

- **Phosphorus Application** - When manure or other organic by-products are used, the planned rates of phosphorus application shall be based on the Phosphorus Index Rating.

A single application of phosphorus applied as manure may be made at a rate equal to the recommended phosphorus application or estimated phosphorus removal in harvested plant biomass for up to three years of the crop rotation or crop sequence. When such

applications are made, the application rate shall:

- not exceed the recommended nitrogen application rate during the year of application, or
- not exceed the estimated nitrogen removal in harvested plant biomass during the year of application when there is no recommended nitrogen application.
- not be made on sites considered vulnerable to off-site phosphorus transport unless appropriate conservation practices, best management practices, or management activities are used to reduce the vulnerability.

The application rate (in/hr) for material applied through irrigation shall not exceed the soil intake/infiltration rate. The total application shall not exceed the field capacity of the soil.

When sewage sludge is applied, the accumulation of potential pollutants (including, but not limited to, arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, and zinc) in the soil shall be monitored in accordance with the US Code, Reference 40 CFR, Parts 403 and 503, and/or any applicable state and local laws or regulations.

Additional Criteria to Minimize Agricultural Non-point Source Pollution of Surface and Ground Water Resources

In areas with an identified or designated nutrient-related water quality impairment, (such as the ADEC 303(d) Impaired Waterbodies
List), an assessment shall be completed of the potential for nitrogen and/or phosphorus transport from the field. The Leaching Index (LI) and/or Phosphorus Index (PI), or other recognized assessment tools, may be used to make these assessments. The results of these assessments and recommendations shall be discussed with the producer and included in the nutrient management plan.

Plans developed to minimize agricultural nonpoint source pollution of surface or ground water resources shall include practices and/or management activities that can reduce the risk of nitrogen or phosphorus movement from the field.

Additional Criteria to Improve the Physical, Chemical, and Biological Condition of the Soil.

Nutrients shall be applied in such a manner as not to degrade the soil's structure, chemical properties, or biological condition. Use of nutrient sources with high salt content will be minimized unless provisions are used to leach salts below the crop root zone.

Nutrients shall not be applied to flooded or saturated soils when the potential for soil compaction and creation of ruts is high.

Additional Criteria to Protect Air Quality by Reducing Nitrogen and/or Particulate Emissions to the Atmosphere

In areas with an identified or designated nutrient management related air quality concern, any component(s) of nutrient management (i.e., amount, source, placement, form, timing of application) identified by risk assessment tools as a potential source of atmospheric pollutants shall be adjusted, as necessary, to minimize the loss(es).

When tillage can be performed, surface applications of manure and fertilizer nitrogen formulations that are subject to volatilization on the soil surface (e.g., urea) shall be incorporated into the soil within 24 hours after application.

When manure or organic by-products are applied to grassland, hayland, pasture or minimum-till areas the rate, form and timing of application(s) shall be managed to minimize volatilization losses.

When liquid forms of manure are applied with irrigation equipment, operators will select weather conditions during application that will minimize volatilization losses.

Operators will handle and apply poultry litter or other dry types of animal manures when the potential for wind-driven loss is low and there is less potential for transport of particulates into the atmosphere.

Weather and climatic conditions during manure or organic by-product application(s) shall be recorded and maintained in accordance with the operation and maintenance section of this standard.

CONSIDERATIONS

Consider induced deficiencies of nutrients due to excessive levels of other nutrients. Consider additional practices such as Conservation Cover (327), Grassed Waterway (412), Contour Buffer Strips (332), Filter Strips (393), Irrigation Water Management (449), Riparian Forest Buffer (391A), Conservation Crop Rotation (328), Cover and Green Manure (340), and Residue Management (329A, 329B, or 329C, and 344) to improve soil nutrient and water storage, infiltration, aeration, tilth, diversity of soil organisms and to protect or improve water quality.

Consider cover crops whenever possible to utilize and recycle residual nitrogen. Consider application methods and timing that reduce the risk of nutrients being transported to ground and surface waters, or into the atmosphere. Suggestions include:

- split applications of nitrogen to provide nutrients at the times of maximum crop utilization,
- avoiding winter nutrient application for spring seeded crops,
- band applications of phosphorus near the seed row,
- applying nutrient materials uniformly to application areas or as prescribed by precision agricultural techniques, and/or immediate incorporation of land applied manures or organic by-products,
- delaying field application of animal manures or other organic by-products if precipitation capable of producing runoff and erosion is forecast within 24 hours of the time of the planned application.

Consider minimum application setback distances from environmentally sensitive areas, such as surface water, shallow water table, sinkholes, thermokarsts, wells, gullies, ditches, surface inlets or rapidly permeable soil areas.

Consider the potential problems from odors associated with the land application of animal manures, especially when applied near or upwind of residences.

Consider nitrogen volatilization losses associated with the land application of animal manures. Volatilization losses can become significant, if manure is not immediately incorporated into the soil after application.

Consider the potential to affect National Register listed or eligible cultural resources.

Consider annual reviews to determine if changes in the nutrient budget are desirable (or needed) for the next planned crop.

On sites on which there are special environmental concerns, consider other sampling techniques. (For example: Soil profile sampling for nitrogen, Pre-Sidedress Nitrogen Test (PSNT), Pre-Plant Soil Nitrate Test (PPSN) or soil surface sampling for phosphorus accumulation or pH changes.)

Consider ways to modify the chemistry of animal manure, including modification of the animal's diet to reduce the manure nutrient content, to enhance the producer's ability to manage manure effectively.

PLANS AND SPECIFICATIONS

Plans and specifications shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose(s), using nutrients to achieve production goals and to prevent or minimize water quality impairment.

The following components shall be included in the nutrient management plan:

- aerial photograph or map and a soil map of the site,
- current and/or planned plant production sequence or crop rotation,

- results of soil, plant, water, manure or organic by-product sample analyses, realistic yield goals for the crops in the rotation,
- quantification of all nutrient sources,
- recommended nutrient rates, timing, form, and method of application and incorporation,
- location of designated sensitive areas or resources and the associated, nutrient management restriction,
- guidance for implementation, operation, maintenance, recordkeeping, and
- complete nutrient budget for nitrogen, phosphorus, and potassium for the rotation or crop sequence.

If increases in soil phosphorus levels are expected, plans shall document:

- the soil phosphorus levels at which it may be desirable to convert to phosphorus based implementation,
- the relationship between soil phosphorus levels and potential for phosphorus transport from the field, and
- the potential for soil phosphorus drawdown from the production and harvesting of crops.

When applicable, plans shall include other practices or management activities as determined by specific regulation, program requirements, or producer goals.

In addition to the requirements described above, plans for nutrient management shall also include:

- discussion about the relationship between nitrogen and phosphorus transport and water quality impairment. The discussion about nitrogen should include information about nitrogen leaching into shallow ground water and potential health impacts. The discussion about phosphorus should include information about phosphorus accumulation in the soil, the increased potential for phosphorus transport in soluble form, and the types of water quality impairment that could result from phosphorus movement into surface water bodies,
- discussion about how the plan is intended to prevent the nutrients (nitrogen and phosphorus) supplied for production purposes from contributing to water quality impairment,
- a statement that the plan was developed based on the requirements of the current standard and any applicable Federal, state, or local regulations or policies and that changes in any of these requirements may necessitate a revision of the plan.

OPERATION AND MAINTENANCE

The owner/client is responsible for safe operation and maintenance of this practice including all equipment. Operation and maintenance addresses the following:

- periodic plan review to determine if adjustments or modifications to the plan are needed. As a minimum, plans will be reviewed and revised with each soil test cycle,
- protection of fertilizer and organic byproduct storage facilities from weather and accidental leakage or spillage,
- calibration of application equipment to ensure uniform distribution of material at planned rates,
- documentation of the actual rate at which nutrients were applied. When the actual rates used differ from or exceed the recommended and planned rates, records will indicate the reasons for the differences.
- maintaining records to document plan implementation. As applicable, records include:
    - soil test results and recommendations for nutrient application,
    - quantities, analyses and sources of nutrients applied,

- dates and method of nutrient applications,
- crops planted, planting and harvest dates, yields, and crop residues removed,
- results of water, plant, and organic byproduct analyses, and
- dates of review and person performing the review, and recommendations that resulted from the review.

Records should be maintained for five years; or for a period longer than five years if required by other Federal, state, or local ordinances, or program or contract requirements.

Workers should be protected from and avoid unnecessary contact with chemical fertilizers and organic by-products. Protection should include the use of protective clothing when working with plant nutrients. Extra caution must be taken when handling ammonia sources of nutrients, or when dealing with organic wastes stored in unventilated enclosures.

The disposal of material generated by the cleaning of nutrient application equipment should be accomplished properly. Excess material should be collected and stored or field applied in an appropriate manner. Excess material should not be applied on areas of high potential risk for runoff and leaching.

The disposal or recycling of nutrient containers should be done according to state and local guidelines or regulations.