Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

NUTRIENT MANAGEMENT

CODE 590

(ac)

DEFINITION

Manage rate, source, placement, and timing of plant nutrients and soil amendments while reducing environmental impacts.

PURPOSE

This practice is used to accomplish one or more of the following purposes:

- Improve plant health and productivity
- Reduce excess nutrients in surface and ground water
- Reduce emissions of objectionable odors
- Reduce emissions of particulate matter (PM) and PM precursors
- Reduce emissions of greenhouse gases (GHG)
- Reduce emissions of ozone precursors
- Reduce the risk of potential pathogens from manure, biosolids, or compost application from reaching surface and ground water
- Improve or maintain soil organic matter

CONDITIONS WHERE PRACTICE APPLIES

All fields where plant nutrients and soil amendments are applied. Does not apply to one-time nutrient applications at establishment of permanent vegetation.

CRITERIA

General Criteria Applicable to All Purposes

Develop a nutrient management plan for nitrogen (N), phosphorus (P), and potassium (K), which accounts for all known measurable sources and removal of these nutrients. Nutrient Management Plan content shall be consistent with applicable requirements and guidance found in *PA Code Title 25, Chapter 83, subchapter D, Sections 83.201 to 83.491* (Act 38 Regulations), the *Pennsylvania Nutrient Management Program Technical Manual* (Act 38 Technical Manual), the *Penn State Agronomy Guide* and other technical references cited.

Sources of nutrients include, but are not limited to, commercial fertilizers (including starter and in-furrow starter/pop-up fertilizer), animal manures, legume fixation credits, green manures, plant or crop residues, compost, organic by-products, food processing by-products, municipal and industrial biosolids, wastewater, organic materials, estimated plant available soil nutrients, and irrigation water.

When irrigating, apply irrigation water in a manner that reduces the risk of nutrient loss to surface and ground water.

Follow all applicable Pennsylvania requirements and regulations when applying nutrients near areas prone to contamination, such as designated water quality sensitive areas, (e.g., lakes, ponds, rivers and streams, sinkholes, wellheads, classic gullies, ditches, or surface inlets) that run unmitigated to surface or groundwater.

Soil and tissue testing and analysis
Base the nutrient management plan on current soil test results in accordance with Penn State Extension guidance, or industry practice when recognized by Penn State Extension. Use soil tests no older than 2 years when developing new nutrient management plans. Use tissue testing and or Presidedress Soil Nitrate Testing, when applicable, for monitoring or adjusting the nutrient management plan in accordance with Penn State Extension guidance, or industry practice when recognized by Penn State Extension. Variable rate nutrient applications are permitted provided methods meet the Plans and Specifications requirements of this standard.

For nutrient management plan revisions and maintenance, take soil tests on an interval recommended by Penn State Extension or as required by Pennsylvania and Federal rules and regulations.

Collect, prepare, store, and ship all soil and tissue samples following Penn State Extension guidance or industry practice. The test analyses must include pertinent information for monitoring or amending the annual nutrient plan. Follow Penn State Extension guidelines regarding required analyses and test interpretations.

For soil test analyses, use laboratories successfully meeting the requirements and performance standards of the North American Proficiency Testing Program under the auspices of the Soil Science Society of America and NRCS or use an alternative NRCS- or State-approved certification program that considers laboratory performance and proficiency to assure accuracy of soil test results. Alternative certification programs must have solid stakeholder support (e.g., PA Department of Agriculture, Penn State Extension, PA Department of Environmental Protection, NRCS State staff, growers, and others) and be State or regional in scope.

Maintain soil pH within ranges which enhance the adequate level for plant or crop nutrient availability and utilization. Refer to Penn State Extensiondocumentation for guidance.

Manure, organic by-product, and biosolids testing and analysis
Collect, prepare, store, and ship all manure, organic by-products, and biosolids following Penn State Extension guidance or industry practice when recognized by Penn State Extension. In the absence of such guidance, test at least annually, or more frequently if needed to account for operational changes (e.g., feed management, animal type, manure handling strategy, etc.) impacting manure nutrient concentrations. If no operational changes occur and operations can document a stable level of nutrient concentrations for the preceding 3 consecutive years, manure may be tested less frequently, unless Federal, State, or local regulations require more frequent testing. Follow Penn State Extension guidelines regarding required analyses and test interpretations. Analyze, as a minimum, total N, ammonium N, total P or P_2O_5, total K or K_2O, and percent solids.

When planning for new or modified livestock operations, and manure tests are not available yet, use the output and analyses from similar operations in the geographical area if they accurately estimate nutrient output from the proposed operation or use “book values” recognized by the NRCS (e.g., NRCS Agricultural Waste Management Field Handbook) and the Penn State Agronomy Guide.

For manure analyses, use laboratories successfully meeting the requirements and performance standards of the Manure Testing Laboratory Certification program under the auspices of the Minnesota Department of Agriculture or other NRCS-approved program that considers laboratory performance and proficiency to assure accurate manure test results.

For nutrient management plans developed as a component of a comprehensive nutrient management plan for an animal feeding operation (AFO) follow policy in NRCS directive General Manual (GM) 190,

Part 405, “Comprehensive Nutrient Management Plans.” These plans must include documentation of all nutrient imports, exports, and on-farm transfers.

Nutrient loss risk assessments
On all fields, nitrogen leaching risk shall be lessened utilizing management techniques described in the plan. Adequate treatment to address nitrogen leaching risk shall be consistent with criteria and guidance in this standard, *Act 38 Regulations*, the *Act 38 Technical Manual*, current Pennsylvania Nutrient Management Program guidance, the *Penn State Agronomy Guide,* and other relevant Penn State Extension publications.

Use current NRCS-approved phosphorus and soil erosion risk assessment tools to assess the site-specific risk of nutrient and soil loss.

Phosphorus risk assessment by means of the current version of the *Pennsylvania Phosphorus Index* (P Index) shall be used on all fields in accordance with Penn State Extension guidance and where any of the following conditions are met—

- P application rate exceeds Penn State Agronomy Guide fertility rate guidelines for the planned crop(s).
- The planned area is within a P-impaired watershed.
- The site-specific conditions equating to low risk of P loss have not been determined by the NRCS in cooperation with the PA Department of Environmental Protection.

Any fields excluded from a P risk assessment must have a documented agronomic need for P, based on soil test P and Penn State Agronomy Guide nutrient recommendations.

For fields receiving manure, where P risk assessment ratings equate to—

- LOW and MEDIUM rating.—Manure can be applied at rates to supply P at greater than crop requirement not to exceed the N requirement for the succeeding crop.
- HIGH rating.—Manure can be applied at rates not to exceed crop P removal rate.
- VERY HIGH rating.—No phosphorus can be applied. Conservation measures to minimize soil erosion, phosphorus loss and adverse impacts to water quality must be planned and implemented. Proper operation and maintenance of conservation practices and continuous best management practices to protect water resources are critical.

The 4Rs of nutrient stewardship
Manage nutrients based on the 4Rs of nutrient stewardship—apply the right nutrient source at the right rate at the right time in the right place—to improve nutrient use efficiency by the crop and to reduce nutrient losses to surface and groundwater and to the atmosphere.

Nutrient source
Choose nutrient sources compatible with application timing, tillage and planting system, soil properties, crop, crop rotation, soil organic content, and local climate to minimize risk to the environment.

Determine nutrient values of all nutrient sources (e.g. commercial fertilizers, manure, organic by-products, biosolids) prior to land application.

Determine nutrient contribution of cover crops, previous crop residues, and soil organic matter.

For operations following USDA’s National Organic Program, apply and manage nutrient sources according to program regulations.

For enhanced efficiency fertilizer (EEF) products, use products defined by the Association of American Plant Food Control Officials as EEF and recommended for use by Penn State Extension.

In areas where salinity is a concern, select nutrient sources that limit the buildup of soil salts. When manures are applied, and soil salinity is a concern, monitor salt concentrations to prevent potential plant or crop damage and reduced soil quality.

Apply manure or organic by-products on legumes at rates no greater than Penn State Agronomy Guide estimated N removal rates in harvested plant biomass, not to exceed P risk assessment limitations.

For any single application of nutrients applied as liquid (e.g., liquid manure, nutrients in irrigation water, fertigation)—

- Do not exceed the soil's infiltration rate or water holding capacity.
- Apply so that nutrients move no deeper than the current crop rooting depth.
- Avoid runoff or loss to subsurface tile drains.

Nutrient rate

Plan nutrient application rates for N, P, and K not to exceed Penn State Extension recommendations or industry practices when recognized by Penn State Extension. Lower-than-recommended nutrient application rates are permissible if the client's objectives are met.

At a minimum, determine the rate based on crop/cropping sequence, current soil test results, and P Index risk assessment. Use realistic expected crop yield goals.

For new crops or varieties where Penn State Extension guidance is unavailable, industry-demonstrated yield and nutrient uptake information may be used.

Realistic expected crop yield goals must be established based on historical yield data, soil productivity, local climate, nutrient test results, management level, and local research results considering comparable production conditions. When actual yield records are available during the development of the initial plan, it is recommended that the expected crop yields be based on these records. At the time of the plan review, revise yield goals for the updated plan based on yield records. For new crops or varieties, industry demonstrated yield and nutrient utilization information may be used until Penn State Extension information is available.

For the development of the initial plan where actual yield records are not available, realistic expected crop yield goals are determined by the operator and the planner and approved by NRCS. These yields should be consistent with soil capability, climate, operator management capability, as well as soil productivity guidance contained in the *Penn State Agronomy Guide.*

Nutrient application timing and placement

Consider the nutrient source, management and production system limitations, soil properties, weather conditions, drainage system, soil biology, and nutrient risk assessment to develop optimal timing of nutrients. For N, time the application as closely as practical with plant and crop uptake. For P, time planned surface application when runoff potential is low. Time the application of all nutrients to minimize potential for soil compaction.

For crop rotations or multiple crops grown in one year, do not apply additional P if it was already added in an amount sufficient to supply all crop nutrient needs.

To avoid salt damage, follow Penn State Agronomy Guide recommendations for the timing, placement, and rate of applied N and K in starter fertilizer or follow industry practice recognized by Penn State Extension.

Do not surface apply nutrients when there is a risk of runoff, including when—

- Soils are frozen.
- Soils are snow-covered.
- The top 2 inches of soil are saturated.

Exceptions for the above criteria can be made for surface-applied nutrients when conditions specified by *Act 38 Regulations* and the *Act 38 Technical Manual* are met and adequate conservation measures are installed to prevent the offsite delivery of nutrients. The following site and management factors must be considered: Climate, weather, soil conditions, slope, organic residue and living covers, amount and source of nutrients to be applied, areas of oconcentrated flow, and adequate setback distances to protect local water quality. The Pennsylvania Winter Application Matrix must be completed and documented in the plan for any operation with the possibility of winter application.

Additional Criteria to Minimize Agricultural Nonpoint Source Pollution of Surface and Groundwater

Nutrient management plans must identify and address resource concerns to meet quality criteria for water quality (sediment, nitrogen, phosphorus) and soil quantity (tolerable erosion). Practices and management techniques to address these concerns must be compatible and consistent with the operation's planned conservation system.

Planners shall assess and document soil erosion and sedimentation risk using approved tools, technologies, and procedures. Estimates of soil loss from sheet-and-rill erosion shall be evaluated utilizing soil loss prediction technology and supported field inspection as needed; evaluation to determine presence of gullies and sedimentation impacts on water quality will be determined by onsite inspection.

Manage nutrient placement, timing, source, and rate to avoid nutrient and sediment loading to stormwater runoff. To minimize risk of transport of nutrients, plan and implement coordinated conservation practices that avoid losses, and control or trap nutrients before they can leave the field. Implementation of additional conservation practices or suites of practices (including but not limited to residue and tillage management, conservation crop rotation, cover crop, and buffer practices) are required where needed. Runoff pathways between field and water resources shall be treated, as needed, to control and trap sediment and nutrients. Existing Critical Runoff Problem Areas, as defined by *Act 38 Regulations*, shall be identified during the field visit, documented in the plan and eliminated when the plan is implemented.

Nutrients shall be managed to minimize soil nitrate leaching losses to groundwater. The following leaching reduction strategies and technologies shall be considered in the planning process:

Corn fertilization considerations

- Treat pre-plant and early post plant broadcast applied nitrogen fertilizer with a nitrification inhibitor (does not apply to in-row starter fertilizer)
- Split apply nitrogen fertilizer application applying majority as sidedress
- Sidedress applications to corn after corn has reached the four true-leaf stage
- Under normal conditions, apply no more than 50 lbs/acre actual N as starter fertilizer (in-row plus broadcast)
- When manure is applied between previous crop harvest and corn planting time, apply no more than 20 lbs/acre N as in-row starter and zero N broadcasted. Assess need for sidedress N based on Chlorophyll Meter (at 6 true-leaf stage) or Presidedress Soil Nitrate Test (at 12-inch tall)
- Evaluate nitrogen management program performance using the Corn Stalk Nitrate Test and adjust management according that data

Fall/winter considerations

- Do not fall incorporate sod/forage crops with tillage. Sod/forage crops may be terminated with herbicides when soil temperature at 4- inch depth is approaching 45^{o}F
- Add winter crops and winter hardy cover crops to crop rotation whenever possible and especially

when fall/winter manure application is planned

- Always plant a winter hardy cover crop as soon as possible after corn silage harvest to allow establishment and vigorous growth when fall manure application is planned
- Manure may be applied in fall where there is a growing crop (perennial crops, winter grain, hardy cover crops). Applications should generally not exceed the greater of 50 lbs/acre of first year available N or 50% of the expected N requirement of next year's crop
- For legume crops, limit annual manure application to no more than 150 lbs of available N/acre.

Nutrients must be applied with the right placement, in the right amount, at the right time, and from the right source to minimize nutrient losses to surface and groundwater. The following nutrient use efficiency strategies or technologies must be considered:

- "Enhanced Efficiency (EE)" fertilizer products decrease losses to the environment as compared to a "reference soluble" product. EE products include:
  - "Slow Release" fertilizers with coatings or occlusions that slow nutrient release,
  - "Stabilized" fertilizers amended with an additive that reduces the rate of transformation of fertilizer compounds
- Cover crops
- Injection and low disturbance incorporation techniques
- Reduced rate and split application
- In-season soil and leaf analyses based decision
  - In-season Pre-Sidedress Soil Nitrate Test or Chlorophyll Meter Test, and late season Corn Stalk Nitrate Test to guide management
- Other technologies recommended by Penn State Extension that improve nutrient use efficiency and minimize surface or groundwater resource concerns.

Apply conservation practices to avoid nutrient loss and control and trap nutrients before they can leave the field(s) by surface, leaching, or subsurface drainage (e.g., tile, karst) when there is a significant risk of transport of nutrients.

Additional Criteria to Reduce the Risk of Potential Pathogens From Manure, Biosolids, or Compost Application From Reaching Surface and Groundwater

When applicable, follow proper biosecurity measures as provided in NRCS directives GM-130, Part 403, Subpart H, "Biosecurity Preparedness and Response" and 130-GM PA Amendment No. 3, Subpart H, "Biosecurity Procedures and Guidelines."

Follow all applicable Federal, Tribal, State, and local laws and policies concerning the application of manure, biosolids, or compost in the production of fresh, edible crops.

Apply manure, biosolids, or compost with minimal soil disturbance or by injection into the soil unless it is being applied to an actively growing crop, a minimum of 30 percent residue exists, or there is a living cover that has a fibrous root system with 75 percent or more cover. Do not surface apply manure if a storm event is forecast within 24 hours.

Additional Criteria to Reduce Emissions of Objectionable Odors, PM and PM Precursors, and GHG and Ozone Precursors

To address air quality concerns caused by odor, N, sulfur, and particulate emissions; adjust the source, timing, amount, and placement of nutrients to reduce the negative impact of these emissions on the environment and human health.

Do not surface apply solid nutrient sources, including commercial fertilizers, manure, or organic by-products of similar dryness/density when there is a high probability that wind will blow the material and emissions offsite. Do not surface apply liquid nutrient sources when there is a high probability that wind will blow the liquid droplets applied from sprinklers or other applicable methods offsite.

Reduce the potential for volatilization by applying sources subject to volatilization during cooler, higher humidity conditions or by placement that minimizes vulnerability to volatilization.

Additional Criteria to Improve or Maintain Organic Matter

Design the plant or crop management systems so the soil conditioning index (SCI) organic matter subfactor is positive.

Apply manure, compost, or other organic nutrient sources at a rate and with minimal disturbance that will improve soil organic matter without exceeding acceptable risk of N or P loss.

For low residue plant or cropping systems, apply adequate nutrients to optimize plant or crop residue production to maintain or increase soil organic matter.

CONSIDERATIONS

General Considerations

Consider development of nutrient management plans by conservation management unit (CMU). A CMU is a field, group of fields, or other land units of the same land use and having similar treatment needs and planned management. A CMU is a grouping by the planner to simplify planning activities and facilitate development of conservation management systems. A CMU has definitive boundaries such as fencing, drainage, vegetation, topography, or soil lines.

Develop site-specific yield maps using a yield monitoring system, multispectral imagery or other methods. Use the data to further delineate low- and high-yield areas, or zones, and make the necessary management changes. Use variable rate nutrient application based on site-specific factor variability. See NRCS directive Agronomy Technical Note (TN) 190, AGR.3, “Precision Nutrient Management Planning.”

Use the adaptive nutrient management learning process to improve nutrient use efficiency on farms as outlined in NRCS’ national nutrient policy in GM-190, Part 402, “Nutrient Management.” Consider using an adaptive approach to adjust nutrient rate, timing, form, and placement as soil biologic functions and soil organic matter changes over time. See NRCS directive Agronomy Technical Note (TN) 190, AGR.7, “Adaptive Nutrient Management Process.”

When developing new nutrient management plans, consider using soil test information no older than 1 year rather than 2 years.

Develop a whole farm nutrient budget (nutrient mass balance), including all imported and exported nutrients. Imports may include feed, fertilizer, animals and bedding, while exports may include crop removal, animal products, animal sales, manure, and compost.

Modify animal feed diets to reduce the nutrient content of manure following guidance contained in Conservation Practice Standard (CPS) Feed Management (Code 592).

Provide a nutrient analysis of all nutrient source exports (manure or other materials).

Excessive levels of some nutrients can cause induced deficiencies of other nutrients, (e.g., high soil test P levels can result in zinc deficiency in corn).

Use soil tests, plant tissue analyses, and field observations to check for secondary plant nutrient deficiencies or toxicity that may impact plant growth or availability of the primary nutrients.

Do not apply K in situations where an excess (greater than soil test K recommendation) causes nutrient imbalances in crops or forages.

Use bioreactors and multistage drainage strategies to mitigate nutrient loss pathways, as applicable.

Use legume crops and cover crops to provide N through biological fixation. Cover crops with a carbon to nitrogen ratio below 20:1 can release a large amount of soluble N after being plowed or tilled into the soil when an actively growing crop is not present to take up nutrients, leading to increased risks of nitrate movement and nitrous oxide emissions. The nitrous oxide emissions often occur in high soil moisture conditions, such as when a legume cover crop is plowed down in fall or early spring. To avoid these losses, use grass-legume or grass-legume-forbs mixtures with a more balanced carbon to nitrogen ratio.

Use winter hardy grass cover crops to take up excess N after the cash crop growing season and promote contribution of the nitrogen to next plant or crop.

Use conservation practices that slow runoff, reduce erosion, and increase infiltration (e.g., filter strip, contour farming, or contour buffer strips).

Use application methods, timing, technologies or strategies to reduce the risk of nutrient movement or loss, such as—

- Split nutrient applications.
- Banded applications.
- Injection of nutrients below the soil surface.
- Incorporate surface-applied nutrient sources when precipitation capable of producing runoff or erosion is forecast within the time of a planned application.
- High-efficiency irrigation systems and technology.
- Enhanced efficiency fertilizers
    - Slow or controlled release fertilizers
    - Nitrification inhibitors
    - Urease inhibitors.
- Drainage water management.
- Tissue testing, chlorophyll meters, or real-time sensors.
- Pathogen management considerations.

When a recycled product (e.g., compost) is to be used as a nutrient source on food crops or as food for humans or animals, make sure that pathogen levels have been reduced to acceptable levels (reference the Food and Drug Administration's Food Safety Modernization Act). www.fda.gov/FSMA When the recycled product has come from another farming operation, implement biosecurity measures and evaluate the risk of pathogen transfer that could cause plant or animal diseases.

Use manure treatment systems that reduce pathogen content from manure.

Implementing a soil health management system that reduces tillage or other soil disturbance, includes a diverse rotation of crops and cover crops, keeps roots growing throughout the year, and keeps the soils covered to reduce nutrient losses, and improves—

- Nutrient use efficiency, rooting depth, and availability of nutrients.
- Soil organic matter levels.
- Availability of nutrients from organic sources.
- Aggregate stability and soil structure.
- Infiltration, drainage, and aeration of the soil profile.

- Soil biological activity.
- Water use efficiency and available moisture.

Use targeted or prescribed livestock grazing to enhance nutrient cycling and improve soil nutrient cycling functions.

Elevated soil test P levels may lead to reduced mycorrhizal fungal associations and immobilize some micronutrients, such as iron, zinc, and copper.

Apply manure, compost, or other nutrient sources with minimal soil disturbance and at a rate that will improve soil organic matter without exceeding acceptable risk of N or P loss.

PLANS AND SPECIFICATIONS

The format of the plan shall follow the current 590 template as found in the Pennsylvania Nutrient Management Program website under “Planning Tools.” In the nutrient management plan, document—

- Aerial site photograph(s), imagery, topography, or site map(s).
- Soil survey map of the site.
- Soil information including: soil type, surface texture, drainage class, permeability, available water capacity, depth to water table, restrictive features, and flooding and ponding frequency.
- Location of designated sensitive areas and the associated nutrient application restrictions and setbacks.
- Results of approved risk assessment tools for P and erosion losses.
- Documentation establishing the application site presents a low/medium risk for P transport to local water if P is applied in excess of crop requirement.
- Current and planned plant production sequence or crop rotation.
- All available test results (e.g. soil, water, compost, manure, organic by-product, and plant tissue sample analyses) upon which the nutrient budget and management plan are based.
- When soil P levels are increasing above an agronomic level, include a discussion of the risk associated with P accumulation and a proposed P draw-down strategy.
- Realistic yield goals for the crops (where applicable for developing the nutrient management plan).
- Nutrient recommendations for N, P, and K for the entire plant production sequence or crop rotation.
- Listing, quantification, application method and timing for all nutrient sources (including all enhanced efficiency fertilizer products) that are planned for use and documentation of all nutrient imports, exports, and onsite transfers.
- Guidance for implementation, operation and maintenance, and recordkeeping.

For variable rate nutrient management plans, also include—

- Geo-referenced field boundary and data collected that was processed and analyzed as a GIS layer or layers to generate nutrient or soil amendment recommendations per management zone. Must include site-specific yield maps using soils data, current soil test results, and a yield monitoring system with GPS receiver to correlate field location with yield.
- Nutrient recommendation guidance and recommendation equations used to convert the GIS base data layer or layers to a nutrient source material recommendation GIS layer or layers.
- After implementation, provide application records per management zone or as applied map within individual field boundaries (or electronic records) documenting source, timing, method, and rate of all nutrient or soil amendment applications.

If increases in soil P levels are expected above an agronomic level (i.e., when N-based rates are used), document—

- Soil P levels at which it is desirable to convert to P-based planning.
- A long-term strategy and proposed implementation timeline for soil test P drawdown from the production and harvesting of crops.
- Management activities or techniques used to reduce the potential for P transport and loss.
- For AFOs, a quantification of manure produced in excess of crop nutrient requirements.

OPERATION AND MAINTENANCE

Review or revise plans periodically to determine if adjustments or modifications are needed. At a minimum, review and revise plans as needed with each soil test cycle, changes in manure management, volume or analysis, plants and crops, or plant and crop management.

Monitor fields receiving animal manures and biosolids for the accumulation of heavy metals and P in accordance with Penn State Extension guidance and Pennsylvania law.

For animal feeding operation, significant changes in animal numbers, management, and feed management will necessitate additional manure analyses to establish a revised average nutrient content.

Calibrate application equipment to ensure accurate distribution of material at planned rates. For products too dangerous to calibrate, follow Penn State Extension or equipment manufacturer guidance on proper equipment design, plumbing, and maintenance.

Document the nutrient application rate. When the applied rate differs from the planned rate, provide appropriate documentation to explain the difference.

Protect workers from and avoid unnecessary contact with nutrient sources. Take extra caution when handling anhydrous ammonia or when managing organic wastes stored in unventilated tanks, impoundments, or other enclosures.

Use material generated from cleaning nutrient application equipment in an environmentally safe manner. Collect, store, or field apply excess material in an appropriate manner.

Recycle or dispose of nutrient containers in compliance with State and local guidelines or regulations.

Maintain records for at least 5 years to document plan implementation and maintenance. Records must include—

- All test results (soil, water, compost, manure, organic by-product, and plant tissue sample analyses) upon which the nutrient management plan is based.
- Listing and quantification of all nutrient sources (including all enhanced efficiency fertilizer products) applied and documentation of all nutrient imports, exports and onsite transfers.
- Date(s), method(s), and location(s) of all nutrient applications.
- Weather conditions and soil moisture at the time of application, elapsed time from manure application to rainfall or irrigation event(s).
- Plants and crops planted, planting and harvest dates, yields, nutrient analyses of harvested biomass, and plant or crop residues removed.
- Dates of plan review, name of reviewer, and recommended adjustments resulting from the review.

For variable rate nutrient management plans, also include—

- Maps identifying the variable application location, source, timing, amount, and placement of all plant and crop nutrients applied.
- GPS-based yield maps for crops where yields can be digitally collected.

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