

**Nutrient Management Plan
for
Turf Establishment on Roadside Projects
Virginia Department of Transportation**

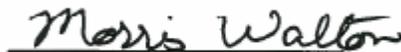
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Turf Establishment on Construction Project Nutrient Management Plan for VDOT

The Virginia Department of Transportation (VDOT) agrees to comply with all requirements set forth in the Nutrient Management Training and Certification Regulations, 4 VAC 50-85-10 *et seq.*, and to follow recommendations for fertilization application rates for long-term maintenance of healthy roadside vegetation in VDOT rights-of-way and facilities as described in the Virginia Nutrient Management Standards and Criteria, Revised July 2014 and the Urban Nutrient Management Handbook, May 2011. VDOT will implement the Department of Conservation and Recreation's approved Nutrient Management Plan.

1. Site Description & Sampling Information

This nutrient management plan was written to accommodate lime and fertility management for long-term maintenance of healthy roadside vegetation in VDOT rights-of-way and facilities.

Soil Types, Sampling and Fertilizer Application Requirements:

This nutrient management plan was written to accommodate lime and fertility management for existing turf type vegetation on roadsides and stormwater basins statewide or for the establishment of wildflower plots..

When dry fertilizer is used, it shall be applied uniformly to the seeding areas at the time of seeding. All slow release and slowly soluble fertilizer may be applied through a hydraulic seeder except for Sulfur Coated Urea (SCU). The method of application for all fertilizer products shall be approved by the Engineer prior to applying the fertilizer. When fertilizer is applied in liquid form or mixed with water, fertilizer shall provide the same value of nutrients per acre as specified for dry fertilizer. Fertilizer applied in liquid form shall be constantly agitated during application.

No Soil Tests Required:

Total construction project area to be fertilized:

Area to receive permanent seeding

The roadside areas that are to be seeded are mostly vegetated areas two or three years after the road construction project has been completed. The soil that will receive Roadside seeding consists of drastically disturbed cut/fill landscapes which are mapped by USDA-NRCS as either "Udorthents" or "made land" that has only received fertilization during construction. VDOT's experience is that these areas would produce soil test levels for Phosphorus in the L to M soil fertility range. In lieu of soil testing, VDOT has accepted Phosphorus reduction in the fertilization rate that would be specified for a H- to H+ soil test for Phosphorus. At no time will a fertilizer be applied Roadside vegetation maintenance with nutrients at a higher rate than indicated below, unless a soil test is taken.

Therefore, no Soil Test will be required for Roadside vegetation when the fertilizer is applied in accordance with the following:

Nitrogen (N)	30 lbs per acre
Phosphorus (P) P ₂ O ₅	30 lbs per acre
Potassium (K) K ₂ O	30 lbs per acre

This rate can be achieved by the application of 300 pounds per acre (6.9 pounds per 1,000 sq feet) of 10-10-10 (N-P-K) fertilizer.

Lime should be applied at 2 tons per acre when a soil test is not required. If the *Protocol for Determining Lime Requirement by On-Site Soil Testing with pH Indicator Strips* is completed, then liming rates can be reduced below 2 tons per acre. **See Attachment A. On-Site pH Testing 12-16-07.pdf** for the *Protocol for Determining Lime Requirement by On-Site Soil Testing with pH Indicator Strips*.

Area to receive temporary seeding:

No Soil Test will be required for construction projects that will require fertilization for the purpose of establishment of temporary vegetation, whether in a block or along a linear path. Fertilizer may be applied without a soil test at the following rate:

Nitrogen (N)	15 lbs per acre
Phosphorus (P) P ₂ O ₅	15 lbs per acre
Potassium (K) K ₂ O	15 lbs per acre

This rate can be achieved by the application of 150 pounds per acre (3.4 pounds per 1,000 sq feet) of 10-10-10 (N-P-K) fertilizer.

Lime should be applied at 1 ton per acre when a soil test is not required. If the *Protocol for Determining Lime Requirement by On-Site Soil Testing with pH Indicator Strips* is completed, then liming rates can be reduced below 1 ton per acre. **See Attachment A. On-Site pH Testing 12-16-07.pdf** for the *Protocol for Determining Lime Requirement by On-Site Soil Testing with pH Indicator Strips*.

Soil Test Requirements

If the vegetation has failed to be satisfactorily established after the Permanent Seeding and Overseeding operations, a soil test will be required prior to any additional nutrient application for the establishment of turf. A site assessment should be conducted by a qualified professional to determine the soil's physical problems and weather conditions that may have contributed to the failure to establish vegetation. Once the causes of the poor vegetation establishment have been determined and site-specific remedial action has been taken (e.g., low pH corrected by lime application), any vegetative re-establishment shall follow the specified fertilizer applications rates listed in the table 3.G below.

A soil sample shall be taken for each 20 acres of area where vegetation has failed to establish or one sample per mile for large linear projects.

Soil samples shall be analyzed for pH, phosphorus, and potassium by a laboratory approved by the Department of Conservation and Recreation (See Attachment B. DCR Laboratory List - March 2016.). Once sampled, soil test data for a given location may be used for all remaining years under this plan.

Soil Sampling Methods: Take 20 or more sub-samples from the upper 4 inches of soil, from different locations within each uniform sampling area, to make a composite sample. Take the sub-samples in a random manner (e.g., with a zigzag pattern) to minimize the variability that may be present in your sampling area. This allows you to obtain a reasonably representative soil sample. Soil samples must be analyzed for pH, phosphorus, and potassium.

The larger the area, the more sub-samples are needed. The more sub-samples you take, the more representative your sample will be of your landscape area. Since your 1/2 pound composite sample could represent up to 2 million pounds of soil, you can understand why proper sampling is so important.

When you have taken sufficient sub-samples from a uniform area, thoroughly mix the sub-sample slices or cores, breaking up clumps and removing all foreign matter such as roots, stalks, rocks, etc. (see <http://www.soiltest.vt.edu> or <http://www.soiltest.vt.edu/Files/sampling-instructions2.html>)

2. Nutrient & Lime Recommendations and Nutrient Application Worksheet

Appropriate soil sampling and analysis is essential for effective nutrient management planning. In order to maximize fertilizer effectiveness and uptake efficiency, soil pH must be adjusted to the optimal range of between 6.0 and 6.5 whenever fertilizers are applied.

Nutrient Recommendations:

Nitrogen Fertilizer:

At the time of Roadside Seeding no more than 0.7 pounds per 1,000 ft² of total nitrogen will be applied. The fertilizer used during Roadside Seeding should have no more than 0.7 pounds of WSN available per 1,000 ft² (as stated on the manufacturer's labeling).

An overseeding fertilizer application at the rate of 0.7 pounds per 1,000 ft² of total nitrogen can be applied 30 days after Permanent Seeding.

Phosphorus and Potassium Nutrient Needs (Established Turf)

Phosphorus and Potassium Fertilizers: Apply phosphorus (P₂O₅) and potassium (K₂O) as indicated as necessary by a soil test using Table 6.5 below, from the DCR *Urban Nutrient Management Handbook*.

Table 6.1. Phosphorus and potassium levels applied to turfgrass establishment on the basis of soil testing (Virginia Tech soil test levels).

Soil test level*	Phosphorus (P ₂ O ₅)		Potassium (K ₂ O)	
	(lb/1,000 sq ft)	(lb/Acre)	(lb/1,000 sq ft)	(lb/Acre)
Low	2.0-3.0	90-130	2.0-3.0	90-130
Medium	1.0-2.0	45-90	1.0-2.0	45-90
High	0.5-1.0	20-45	0.5-1.0	20-45
Very high	0	0	0	0

* For low soil test levels within a category (e.g., L-), use the higher end of the range of nutrient needs. For high soil test levels (e.g., L+), use the lower end of the range of nutrient needs.

Liming Recommendations:

The “lime requirement” for a soil is the amount of agricultural limestone needed to achieve a desired pH range for the plants that are grown. Soil pH determines only active acidity — the amount of H⁺ in the soil solution at that particular time — while the lime requirement determines the amount of exchangeable or reserve acidity held by soil clay and organic matter.

Most laboratories use soil pH in combination with “buffered” solutions to extract and measure the amount of reserve acidity, or “buffering capacity” in a soil. The measured amount of exchangeable/reserve acidity is then used to determine the proper amount of lime needed to bring about the desired increase in soil pH.

Phosphorus solubility and plant availability are controlled by complex soil chemical reactions, which are often pH-dependent. Plant availability of P is generally greatest in the pH range of 5.5 to 6.8. When soil pH falls below 5.8, P reacts with Fe and Al to produce insoluble iron and aluminum phosphates that are not readily available for plant uptake. At high pH values, phosphorus reacts with Ca to form calcium phosphates that are relatively insoluble and have low availability to plants.

For normal soil materials, liming recommendations will be based upon standard agronomic criteria to maintain soil pH between 6.0 and 6.5. Lime shall be applied at the rate specified for Roadside Seeding or Overseeding or on the soil test report. The agricultural lime shall be selected from the Approved Products List 6 AGRICULTURAL LIMING MATERIALS REGISTRATION group A Agricultural Liming Materials (Pulverized or Ground Limestone). When applying Agricultural pulverized or ground limestone from group A, no **Lime Rate Adjustment for CCE** is required. Agricultural limes can be applied as either a granular or pelletized product. If a product is selected from group B (Hydrated Lime) or group C (Industrial Co-Product – Substandard Liming Materials), then the **Lime Rate Adjustment for CCE** must be applied to adjust the tonnage of product that must be applied to equate to a ton of Agricultural lime from group A. Liming products listed in group D (Fast Acting Lime) or Group E (Soil Amendments) cannot be used as a replacement for a group A products.

Lime rates are based on **Table 3-1 Lime Recommendations for Virginia Crops (tons/acre)** **Target Soil pH** Lime Rates based on Va Tech Soil buffer pH, **Table 3-2 Lime Application Rate (tons/acre) to achieve desired pH based on SMP Buffer Test** and **Table 3-3 Lime Rate Adjustment for CCE** in the Virginia Nutrient Management Standards and Criteria, Revised July 2014, which can be found starting on page 7 of *Attachment B. DCR Laboratory List – March 2016* or use the Lime Tab on the VDOT Excel spreadsheet named *Construction Project Fertilizer and Lime Recommendations.xls*.

For sulfidic materials (see Orndorff and Daniels, 2002 for maps and definitions) or **any** soil sample with a water pH < 4.0, liming recommendations must be based on reactive potential acidity or acid-base-accounting analysis.

Citation: Orndorff, Z.W. and W.L. Daniels, 2002. Delineation and Management of Sulfidic Materials in Virginia Highway Corridors, Final Contract Report VTRC 03-CR3. Virginia Center for Transportation Innovation and Research (VCTIR), formally the Virginia Trans. Res. Council, Charlottesville, VA. <http://vtrc.virginiadot.org/PubDetails.aspx?PubNo=03-CR3>

3. Nutrient Management Guidelines

A. Season of Application of Fertilizers and Cautions

All fertilizer will be applied between March 15th and November 1st. Fertilization of grasses outside of this window may result in lost nutrients. In the Fredericksburg, Hampton Roads and Richmond Districts, fertilizers may be applied from March 1 to November 15. Cool season grasses should be fertilized between August 15th and November 15th to encourage good root development in the fall. Warm season grasses should be fertilized between June 1 and August 1. This will result in denser stands of grass the following year.

B. Impervious Surfaces

Do not apply fertilizers containing nitrogen or phosphorus to impervious surfaces (sidewalks, streets, etc.). DO NOT use urea as an ice melting substance in cold weather. **Remove any granular materials that land on impervious surfaces by sweeping and collecting, and either put the collected material back in the bag, or spread it onto the turf and/or use a leaf blower etc., to return the fertilizer back to the turfgrass canopy.**

C. Management to Improve Density of Turf without Use of Fertilizers

- (1) Returning Grass Clippings – Do not pick up clippings when mowing. This will allow the nutrients to recycle back to the soil.
- (2) Legumes, such as white clover, may be incorporated into the turf to provide long term N source for grasses. The pH of the soil should not be lower than 6.0 - 6.5, and the level of phosphorus should be consistent with a soil test level no higher than “M”.
- (3) Suggested Mowing Guidelines – cool season grasses should not be mowed lower than 4-6 inches and warm season grasses should not be mowed lower than 2-3 inches. Mowing the grasses below their minimum height (scalping) should never be allowed because this will shock the plant and can kill the vegetation.

- (4) Mower blades need to be kept sharp. This produces a cleaner cut which reduces the amount of brown leaf ends, stress and disease on the grass plants. The results are a healthier and stronger turfgrass that will need less pest control.

D. Environmentally Sensitive Areas

VDOT will recognize environmentally sensitive sites as defined in Section 1A of the Virginia Nutrient Management Standards and Criteria, revised July 2014, and limit N and P applications appropriately. Nutrient application set-backs, as set forth in Section 1B (e.g. 100 feet from wells or springs, 50 feet from surface water, 50 feet from sinkholes, 50 feet from naturally occurring limestone outcrops and 25 feet from all other naturally occurring rock outcrops), will be rigorously followed. However, this plan was developed such that the rate and timing of nutrient applications safeguards water quality, and the plan is appropriate for use in environmentally sensitive areas.

The use of fertilizers with slow-release nitrogen is greatly encouraged, especially where there is any reason to suspect there is a risk of environmental impacts.

E. Use of Iron

Foliar iron supplements may be used to stimulate a greening effect on the turfgrass during the summer months without additional applications of nitrogen. A rate of 1 to 1.5 pounds of iron per acre is appropriate.

F. Use of Organic Sources as Nutrients:

Application of organic sources of nutrients for management of Construction Project vegetation will be allowed only upon submission and approval of a site-specific Nutrient Management Plan.

G. Fertilizer Ratios Appropriate for VDOT Use

Nutrient management plans serve two primary purposes:

- (1) Ensuring that plants have optimum soil nutrient availability for good productivity and quality, and
- (2) Ensuring minimum movement of nitrogen and phosphorus from the specified area of application to surface and ground waters where they can potentially have a detrimental effect on water quality. Although NMPs cover more than nitrogen and phosphorus, only these two nutrients are considered a risk for impairing water quality. Other nutrients are essential for plant growth but do not cause water quality problems in the mid- Atlantic region.

Table 3.G below must be used to determine the best ratio of fertilizer for use in establishing vegetation.

Table 3.G Fertilizer Ratios Recommended for Roadside Projects

Virginia Tech "P"	Fertilizer Analysis (N-P-K)*	Pounds of fertilizer/A	Pounds of Nitrogen/A	Pounds of P ₂ O ₅ /A	Pounds of K ₂ O/A
L-, L and L+	10-20-20 and 0-46-0	300 and 85	30	100	60
M-, M and M+	10-20-20	300	30	60	60
H-, H and H+	10-10-10	300	30	30	30
VH	46-0-0	65	30	0	0

* Rate is dependent on Analysis of fertilizer used and corresponding N, P₂O₅ and K₂O needs. For example 225 Lb/acre of 20-20-20 N-P-K would yield the same nutrients per acre as 450 Lb/Acre of 10-10-10 N-P-K ratio fertilizer.

To determine the fertilizer to be used on a project, the phosphorus values are the controlling factor. When multiple soil samples are taken on a project, the phosphorus or "P" values must be analyzed to determine if one or more fertilizer chemicals should be specified. The areas to be fertilized on a Roadside project are predominately formerly drastically disturbed cut/fill landscapes. It will not be a common practice to specify more than one fertilizer ratio.

To develop the fertilizer recommendations for a project that requires more than one soil test during the concurrent engineering process or soil tests for topsoil, use the Fertilizer Tab on the Excel spreadsheet named *VDOT Construction Fertilizer and Lime Recommendations.xls*.

H. Equipment Calibration and Fertilizer Application Methods

After determining the source and form of nutrients that best fit the project, it is necessary to have an accurate assessment of the area planned for fertilization (size, surrounds, plant materials, etc.). Although this area should have been estimated to determine the number of soil samples required for the project it is important to check all calculations before the fertilizer and lime are purchased and applied. Square footage of areas can usually be calculated by assessing site characteristics for typical shapes and using some basic geometric formulas for the different shapes.

Application Methods

Hydroseeder

The fertilizer, lime seed and mulch should be added in accordance with the accepted protocol and the seeding completed by a trained operator.

Rotary or Drop Spreader

When a Rotary or Drop Spreader is used, two factors are important: the spread pattern and the calibration of the spreader.

The spread pattern with a rotary spreader will never be completely uniform because of the variability in spread due to wind, speed, equipment operation, and for some fertilizers, the different sizes and weights of particles. To manage the lack of spread uniformity, most textbooks suggest calibrating the spreader to deliver one-half the desired rate of product and apply the product in two passes at right angles to each other. Other published information suggests that similar (if not better) delivery results can be obtained by applying granular products at one-half application rates in a parallel delivery pattern.

For additional information on equipment calibration, please review Chapter 10. Equipment Calibration and Fertilizer Application Methods of the *Urban Nutrient Management Handbook*. The *Urban Nutrient Management Handbook* can be downloaded from the following site: http://pubs.ext.vt.edu/430/430-350/430-350_pdf.pdf

I. Reporting

All fertilizer applications applied in accordance with this Nutrient Management Plan must be reported by the Certified Fertilizer Applicator who supervised the project in accordance with Virginia Department of Agriculture and Consumer Services requirements.