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March 9, 2011

Mac Hatcher
Stormwater and Environmental Planning Section
Department of Land Development Services
2800 North Horseshoe Drive
Naples, FL 34104

Dear Mac,
I am providing a scientific assessment of the COLLIER COUNTY FLORIDA-FRIENDLY USE OF FERTILIZER ON URBAN LANDSCAPES draft ordinance based on the best available science from the University of Florida – IFAS (UF-IFAS) and other national universities and current recommendations from the Center for Landscape Conservation and Ecology and the Florida Friendly Landscaping™ program at the UF- IFAS. This draft ordinance incorporates a number of scientifically-based practices based on information in the FDEP State Model Ordinance and the UF-IFAS Florida Friendly Landscaping™ program. Requirements in this draft ordinance that are contrary to existing science or where science is not available to support the proposed requirement will be identified and explained. In the cases where science does not support the recommendation in the ordinance, it is possible that more damage will be done to the environment and to impair water quality if enacted rather than delaying these specific recommendations until scientific knowledge is available.

A thorough review of scientific literature related to urban water quality is now available. The updated report from the University of Florida – IFAS, "Urban Water Quality and Fertilizer Ordinances: Avoiding Unintended Consequences," is available online at http://edis.ifas.ufl.edu/ss496. The report is a literature review of more than 100 scientific papers published nationally in the past 40 years. Together, these papers provide a clear picture of the relationships among water quality and landscape fertilization, leaching and runoff.

Two books published in 2008 provide additional details on maintaining urban water quality and the relationship to landscape and turfgrass management:
Water Quality and Quantity Issues for Turfgrasses in Urban Landscapes. Beard, J. B. and M. P. Kenna (eds). Council for Agricultural Science and Technology (CAST) Special Publication 27. Ames, IA. 2008.
The Fate of Nutrients and Pesticides in the Urban Environment, Vol. 997. Nett, M. T., Carroll, M. J., Horgan, B. P., and Petrovic, A. M. (eds). American Chemical Society, Washington, D.C. 2008.

**UF-IFAS Scientific Assessment of the COLLIER COUNTY FLORIDA-FRIENDLY USE OF FERTILIZER ON URBAN LANDSCAPES draft ordinance (March 2011):**

SECTION FIVE: TIMING OF FERTILIZER APPLICATION

No applicator shall apply fertilizers containing nitrogen and/or phosphorus to turf and/or landscape plants during the Prohibited Application Period, or to saturated soils.

Scientific data show that turfgrass fertilized during the active summer growing season reduces runoff and leaching and has a positive impact on the environment (Petrovic and Easton, 2005). In fact, trufgrass that was not fertilized during the summer months had greater runoff due to the poor quality of the turfgrass. Numerous published, peer-reviewed studies confirm that turf grass is healthiest and absorbs the most fertilizer nutrients during the active growing months of summer. Research also shows that nutrient leaching and run-off are greatest during other times of the year. Properly fertilized and maintained turfgrass has a lower impact on groundwater N levels than other land uses (Raciti et al. 2008).

Turfgrass was fertilized with zero, low, and high P (and a zero control) fertilization programs throughout the year (Bierman et al., 2010). . The researchers measured runoff volume and P loads moving off the research site plots. Where N and K were supplied (better growth), P in the runoff increased as the P rate increased. **P runoff from the unfertilized plots (no N and K and lower growth) was greater than from fertilized turf.** The researchers attributed the increased P runoff to poorer growth of the turfgrass in the unfertilized plots. P runoff was greater when P was applied in the fall, when plant growth slows and plants enter dormancy. These researchers concluded that P should not be applied in the fall or when soils already are high in P content, and that P runoff was reduced in healthy, fertilized (N and K) turf.

UF/IFAS research shows that leaching was negligible during the summer months from St.Augustinegrass grown with a commercial fertilizer containing 62% soluble/38% controlled-release N at a 1.0 lb N/1000 sq. ft. rate (Erickson, et. al. 2008). New research at UF-IFAS has shown that leaching from turfgrass is greater in the spring and fall than in the summer. In a Florida DEP-funded project more nitrogen is lost from fertilizer applications made during the time of year when the turfgrass is not growing as actively as it is in the summer (Trenholm et. al. 2011). The following are some preliminary results from the multi-year, multi-site study:

1. As St Augustinegrass matured after the first year, NO3–N leaching was minimal, even at very excessive application rates. No significant correlation with N rate and NO3-N leaching was found.
2. Zoysiagrass was more prone to leaching at high N rates.
   a. Less N is needed for zoysiagrass health and quality than for St. Augustinegrass
   b.Greater disease pressure leads to less viable turf and more NO3-N leaching.
3. There was a tendency for greatest NO3-N leaching in spring and fall, not in summer.
4. All cultural practices, including fertilization and irrigation are important to reduce nutrient movement from turfgrass.
5. Even at high rates imposed in this study, NO3-N leaching did not exceed 1.3% of the applied N in St Augustinegrass.

6. Turfgrass quality and health were adequate with the current UF-IFAS fertilizer recommendations.

Other studies have shown that over 75% of fertilizer applied to turfgrass can be accounted for in turfgrass clippings, verdure, thatch, soil, roots, and leachate with the remainder being lost through volatilization and denitrification which results in release of nitrogen into the atmosphere (Frank, 2006). Research results have clearly shown that healthy and well-managed turfgrass can actually slow runoff and trap pollutants (Beard and Green, 1994; Schueler and Swann, 2000c; USEPA, 1992). Studies have shown the positive nutrient characteristics of turfgrass compared to bare ground or poor quality turfgrass as a result of improper or lack of fertilization, insect or disease problems or poor irrigation practices (Gross et. al. 1990 ). They concluded that very low concentrations of NO3-N were found below the rootzone of turf. Sediment and attached nutrient losses from established turfgrass were low due to the thick, densely matted nature of turfgrass and the hydraulic resistance provided by the erect turf stand. They conclude that properly managed and judiciously fertilized turf is not a significant source of nutrients or sediment in surface or groundwater.

Healthy turfgrass, properly fertilized and watered to optimize growth, is effective in absorbing nutrients and reducing nutrient runoff . Easton and Petrovic (2004) have shown that doubling the amount of turfgrass shoots in a lawn reduces the amount of runoff by 67% and increased infiltration by 65%. And, on sites with moderate to low potential for runoff, high maintenance lawns had about half the amount of phosphorous runoff compared to unfertilized low maintenance lawns and wooded sites (Easton and Petrovic 2004).

Turgeon (2008) showed that warm-season turfgrasses are most active, thus absorbing the most nutrients, during the summertime temperatures, due to low photorespiration rates which allow for higher net photosynthesis and more shoot and root growth. Fertilizer applied to turfgrass during the summertime is used by turfgrasses and landscape plants to produce healthy shoots and roots responsible for the absorption and assimilation (conversion of nutrients into carbohydrates, proteins and amino acids through photosynthesis).

In some cases, Iron may be used to enhance the green color of turfgrass but it will not serve as a substitute for nitrogen deficiency (Trenholm et al., 2010). While both Fe and N deficiencies result in yellowing of turfgrass, they are distinctly different deficiencies in plants. Applying iron will not cure yellowing of turfgrass due to an N deficiency and iron fertilizer is not a substitute for N fertilizer. Foliar iron fertilizers such as Fe sulfate or chelated Fe solutions will help cure Fe deficiencies, and N fertilizers applied according to BMPs will cure N deficiencies.

Kussow (2008) has shown that nitrogen runoff was increased 25% when turfgrass was not fertilized for 2 years compared to properly fertilized turfgrass. Fry et al. (2004) showed that regular fertilizer nitrogen applications during the summer months are necessary to maintain turfgrass stand density which has been shown to reduce runoff and leaching (Easton and Petrovic, 2004).

After a thorough review of the scientific literature, we are unable to find any peer reviewed scientific publications demonstrating high levels of runoff or leaching during periods of active turfgrass growth provided the proper fertilizer rate and watering practices from UF-IFAS are used. **Research clearly demonstrates that the most important time to fertilize warm-**

**season turfgrass with the least amount of leaching and runoff is during the summer months when the roots and plants are actively growing and can absorb the nutrients.**

Scientific studies demonstrate:

1. Healthy turfgrass absorbs the majority of nutrients when applied at recommended rates, thus minimizing leaching and runoff from landscape surfaces.
2. Absorption of applied nutrients is greatest during periods of active plant growth.
3. Leaching and runoff are greatest during Fall, Winter and early Spring.
4. Irrigation at levels recommended by UF-IFAS supports the growth of turfgrass leaves and roots which subsequently reduces leaching and runoff since the roots absorb applied nutrients. Overwatering or under-watering prevents root growth and reduces the nutrient absorption effectiveness.
5. Proper fertilization is needed to maintain a strong, expansive root mass to absorb nutrients, especially during periods of active growth. Leaching and runoff increase as fertilizer rates are increased above the rates recommended by UF-IFAS and established in the FDACS fertilizer rule.

## SECTION SIX: FERTILIZER FREE ZONES

Fertilizer shall not be applied within ten (10) feet of any pond, stream, watercourse, lake, canal, or wetland as defined by the Florida Department of Environmental Protection (Chapter 62-340, Florida Administrative Code) or from the top of a seawall. If more stringent Collier County Code regulations apply, this provision does not relieve the requirement to adhere to the more stringent regulations. Newly planted turf and/or landscape plants may be fertilized in this Zone only for a sixty (60) day period beginning 30 days after planting if need to allow the plants to become well established. Caution shall be used to prevent direct deposition of nutrients into the water.

These recommendations are consistent with FDEP Chapter 62-340 Model Landscape Draft Ordinance. Also, the recommendation is in compliance with the UF-IFAS Florida Friendly Landscaping recommendations (Florida Yards and Neighborhoods Handbook, 2009, page 45). The UF-IFAS recommendations in this edition of the Florida Yards and Neighborhoods Handbook supersede all previous Florida Yards and Neighborhoods recommendations.

Care should be used in turfgrass and plant selection in the fertilizer free zone. Turfgrass and plant selection should slow the flow of water from the landscaped area to the water. Studies have shown that runoff was reduced by dense turf (Easton and Petrovic, 2002; Gross et al., 1990; 1991). Erosion in urban landscapes can be a serious problem resulting in loss of topsoil and the associated nutrients. Reducing the velocity of runoff water with dense, healthy turfgrass will increase infiltration and result in groundwater recharge (Blanco-Canqui et al., 2004; 2006; Easton and Petrovic, 2004). Healthy turfgrass captured runoff that contained nutrients and displaced soil from a 10% slope. Capturing the runoff allowed time for nutrient uptake by the turfgrass, reducing the N concentration in the runoff to the concentration in the

rain water (Erickson et al., 2001). Bare-soil areas are most prone to soil erosion that carries nutrients with the displaced soil.

## SECTION SEVEN: LOW MAINTENACE ZONES

A voluntary ten (10) foot low maintenance zone is strongly recommended, but not mandated, from any pond, stream, water course, lake, wetland or from the top of a seawall. A swale/berm system is recommended for installation at the landward edge of this low maintenance zone to capture and filter runoff. If more stringent Collier County Code regulations apply, this provision does not relieve the requirement to adhere to the more stringent regulations. No mowed or cut vegetative material may be deposited or left remaining in this zone or deposited in the water. Care should be taken to prevent the over-spray of aquatic weed products in this zone.

As noted, these recommendations are consistent with FDEP Chapter 62-340 Model Landscape Draft Ordinance. Also, the recommendation is in compliance with the UF-IFAS Florida Friendly Landscaping™ recommendations (Florida Yards and Neighborhoods Handbook, 2009, page 45). The UF-IFAS recommendations in this edition of the Florida Yards and Neighborhoods Handbook supersede all previous Florida Yards and Neighborhoods recommendations.

## SECTION EIGHT: FERTILIZER CONTENT AND APPLICATION RATES

(a) Fertilizers Applied to Turf and/or Landscape Plants within Collier County shall contain no less than fifty percent (50%) Slow Release Nitrogen per Guaranteed Analysis Label.

(b) Fertilizers should be applied to Turf and/or Landscape Plants at the lowest rate necessary. No more than four (4) lbs. of nitrogen per 1000 $ft^2$ shall be applied to any Turf/landscape area in any calendar year.

(c) Fertilizer containing nitrogen or phosphorus shall not be applied before seeding or sodding a site, and shall not be applied for the first 30 days after seeding or sodding, except when hydro-seeding for temporary or permanent erosion control in an emergency situation (wildfire, etc.), or in accordance with the Stormwater Pollution Prevention Plan for that site.

(d) Nitrogen or phosphorus fertilizer shall not be applied to turf or landscape plants except as provided in (a) above for turf, or in UF/IFAS recommendations for landscape

plants, vegetable gardens, and fruit trees and shrubs, unless a soil or tissue deficiency has been verified by an approved test.

Fertilizers can be supplied in soluble (fast) or slow- or controlled-release forms. Controlled-release fertilizers have been shown to be effective for producing healthy turfgrass (Sartain, 1981; 2008; Petrovic, 1990) and reducing the potential for nutrient losses (Saha et al., 2007; Snyder et al., 1984) from lawn grasses. Similarly, research also shows that properly managed soluble N sources can result in low leaching losses. This result was observed by Sartain (2008) and Quiroga-Garza et al. (2001). The latter authors found that highly insoluble N sources reduced N leaching losses but had negative impacts on turf growth and health. These authors, however, pointed out that a trade-off between turf color and N leaching may be important, i. e., lighter green turf color is associated with reduced N leaching losses, which may be an important consideration in the turfgrass system. They determined that proper N fertilization and irrigation practices, even with soluble N sources, can avoid risks of N leaching losses.

At the present time, research shows that total soluble nitrogenous fertilizers may leach from turfgrasses when applied at high rates (higher than recommended by UF-IFAS and included in the FDACS fertilizer rule). Based on available scientific results, it is most reasonable to limit application to 0.7 pounds of soluble nitrogen fertilizer per application (30% slow release) as stated in the FDACS Fertilizer Rule. The UF-IFAS Florida Friendly Landscaping™ program recommends the use of 30% SRN fertilizer (at the 1 pound application rate) until scientific documentation demonstrates the effectiveness of higher levels of SRN on turfgrass and the ultimate fate (leaching and runoff) with these fertilizers over multiple years (Florida Yards and Neighborhoods Handbook, 2009). In other words, **there is no multi-year documentation that use of fertilizers containing 50% slow release will reduce leaching or runoff from turfgrass while maintaining healthy turfgrass at fertilizer rates allowed by state law (FDACS Fertilizer Rule 5E-1.003(2), 2007).** As shown above, soluble fertilizer applied at recommended rates had low leaching rates.

## SECTION NINE: APPLICATION PRACTICES

(a) Spreader deflector shields are required when fertilizing via rotary (broadcast) spreaders. Deflectors must be positioned such that fertilizer granules are deflected away from all impervious surfaces, fertilizer-free zones and water bodies, including wetlands.

(b) Fertilizer shall not be applied, spilled, or otherwise deposited on any impervious surfaces.

(c) Any fertilizer applied, spilled, or deposited, either intentionally or accidentally, on any impervious surface shall be immediately and completely removed to the greatest extent practicable.

(d) Fertilizer released on an impervious surface must be immediately contained and either legally applied to turf or any other legal site, or returned to the original or other appropriate container.

(e)In no case shall fertilizer be washed, swept, or blown off impervious surfaces into stormwater drains, ditches, conveyances, or water bodies.

These practices are supported scientifically and are included the UF-IFAS Florida Friendly Landscaping recommendations (Florida Yards and Neighborhoods Handbook, 2009).

## SECTION TEN: MANAGEMENT OF GRASS CLIPPINGS AND VEGETABLE MATTER

In no case shall grass clippings, vegetative material, and/or vegetative debris be washed, swept, or blown off into stormwater drains, ditches, conveyances, water bodies, wetlands, or sidewalks or roadways. Any material that is accidentally so deposited shall be immediately removed to the maximum extent practicable.

Proper disposal of yard waste is critical to maintaining water quality. Nationally, yard trimmings comprised 12 percent of the total tonnage of municipal solid waste generated in 2000, second only to paper products (USEPA, 2005). Studies show there is considerable potential nutrient load from plant debris in the urban environment that can add significant amounts of nutrients to the storm water. Plant debris should be removed from impervious surfaces (street sweeping, blowing) or mulched and put back into the lawn with mulching mowers as soon as possible because water (rain) can easily and rapidly extract nutrients from the leaf debris (Strymchuck et al., 2004). For this reason, the UF-IFAS Florida Friendly Landscaping program and Florida Yards and Neighborhoods promotes the recycling of yard waste as one of the nine landscaping principles (Florida Yards and Neighborhoods Handbook, 2009).

## SECTION TWELVE: TRAINING

(a)All commercial and institutional applicators of fertilizer within the (un)incorporated area of Collier County shall abide by and successfully complete the six-hour training program in the “Florida-friendly Best Management Practices for Protection of Water Resources by the Green Industries” offered by the Florida Department of Environmental Protection through the University of Florida Extension “Florida-Friendly Landscapes” program, or an approved equivalent.

(b) Private, non-commercial applicators are encouraged to follow the recommendations of the University of Florida IFAS Florida Yards and Neighborhoods program when applying fertilizers.

UF-IFAS through the Center for Landscape Conservation and Ecology and the Florida Friendly Landscaping™ program are offering GIBMP training (a six-hour training program) to all professional applicators statewide. An on-line version of the training

program is available also. The training program has been approved by FDEP and individuals completing the course and passing an exam receive a Certificate of Completion.

References:


Beard, J.B. and R.L. Green. 1994. The Role of Turfgrasses in Environmental Protection and their Benefits to Humans. Journal of Environmental Quality 23:452-460.

Bierman, P. M., B. P. Horgan, C. J. Rosen, A. B. Hollman, and P. H. Pagliari. 2010. Phosphorus runoff from turfgrass as affected by phosphorus fertilization and clipping management. J. Environ. Qual. 39:282–292.

Blanco-Canqui, H., C. J. Gantzer, S. H. Andersen, 2006. Performance of grass barriers and filter stips under interrill and concentrated flow. J. Environ. Qual. 35:1969–1974.

Blanco-Canqui, H., C. J. Gantzer, S. H. Andersen, and E. E. Alberts. 2004. Grass barriers for reduced concentrated flow induced soil and nutrient loss. Soil Sci. Soc. Amer. J. 68:1963–1972.

Easton, Z. M. and A. M. Petrovic. 2004. Fertilizer Source Effect on Ground and Surface Water Quality in Drainage from Turfgrass. J. Environ. Qual. 33: 645 – 655.

Erickson, J. E., J. L. Cisar, J. C. Volin, and G. H. Snyder. 2001. Comparison of nitrogen runoff and leaching between newly established St. Augustinegrass turf and an alternative residential landscape Crop Sci. 41: 1889-1895.

Erickson, J. E., J. L. Cisar, G. H. Snyder, D. 2008. Does a mixed-species landscape reduce inorganic-nitrogen leaching compared to a conventional St. Augustinegrass lawn? Crop Science, Vol. 48:1-9.

Erickson, J. E., D M. Park, J. L. Cisar, G. H. Snyder, A. L. Wright. 2010. Effects of Sod Type, and fertilization on Nitrate-Nitrogen Leaching and Orthophosphate-Phosphorous Leaching from Newly Established St. Augustinegrass Sod. Crop Science: 50:1030 – 1036

Florida Department of Agriculture and Consumer Services. 2007. Rule 5E-1.003(2). Labeling requirement for urban turf fertilizers. http://www.flaes.org/pdf/ Urbun_Turf_Fertilizers_Rule.pdf.

Florida Yards and Neighborhoods Handbook. 2009. University of Florida – IFAS Extension. Gainesville, FL. (Recommendations in this edition supersede all previous recommendations).

Frank, K. M., K.W. O'Reilly, J.R. Krum and R.N. Calhoun. 2006. The Fate of Nitrogen Applied to a Kentucky Bluegrass Turf. Crop Science. 46: 209 – 215.

Fry, J. and B. Huang. 2004. Applied Turfgrass Science and Physiology. Wiley: Hoboken, New Jersey. p. 223.

Gross, C.M., J.S. Angle, R.L. Hill and M.S. Welterlen. 1990. Nutrient and Sediment Losses from Turfgrass. J. Environ. Qual. 19: 663 – 668.

Guillard K. and K. L. Kopp. 2004. Nitrogen Fertilizer Form and Associated Nitrate Leaching from Cool-Season Lawn Turf. J. Environ. Qual. 33:1822–1827.

Kussow, W. R. 2008. Management Practices Affecting Nitrogen and Soluble Phosphorous Losses from an Upper Midwest Lawn. In: The Fate of Nutrients and Pesticides in the Urban Environment Vol. 997. M. T. Nett, M. J. Carroll, B. P. Horgan, and A. M. Petrovic (eds.) American Chemical Society, Washington, D.C. 2008.

Moss, J.Q., G.E. Bell, D.L. Martin and M.E. Payton. 2007. Nutrient Runoff from Bermudagrass Golf Course Fairways Following Aerification. J. Applied Turfgrass Science. Online.

Pearl, H., V. Paul and J. M. O'Neil. 2010 . Coastal algae impact the coasts of Florida. University of Maryland Center for Environmental Studies, Cambridge MD.

Petrovic, A. M., and Z. M. Easton. 2005. The role of turfgrass management in the water quality of urban environments. Int'l. Turfgrass Soc. Res. Jour. 10: 55–69.

Protecting Water Quality from Urban Runoff. 2003. U. S. Environmental Protection Agency Publication 841-F-03-003. Washington, DC

Raciti, S. M., P. M. Groffman, and T. J. Fahey. 2008. Nitrogen retention in urban lawns and forests. Ecological Applications. 18: 1615–1626.

Schueler, T., and C. Swann. 2000c. Urban Pesticides: From the Lawn to the Stream. Watershed Protection Techniques 2(1):247–253.

Strynchuk, Justin, John Royal and Gordon England. 2004. Grass and Leaf Decomposition and Nutrient Release Study under Wet Conditions. Proceedings of the Joint Conference on Water Resource Engineering and Water Resources Planning and Management 2000. 431 pg. American Society of Civil Engineers. Reston, VA USA.

Trenholm, L. E., J. K. Kruse and J. B. Unruh. 2010. The Fertilizer Toolbox. UF-IFAS EDIS publication 1174.

Trenholm, L. E., J. B. Unruh and J. B. Sartain. 2011. Nitrate leaching and turf quality in established 'Floratam' St. Augustinegrass and 'Empire' Zoysiagrass. Crop Science: (Accepted for Publication)

Turgeon, A. J. 2008. Turfgrass Management, 8th ed. Pearson Education, Inc. Upper Saddle River, N.J.

U.S. Environmental Protection Agency (USEPA). 1992. Healthy Lawn, Healthy Environment: Caring for Your Lawn in an Environmentally Friendly Way. 700-K-92-005. Office of Prevention, Pesticides and Toxic Substances.

U.S. Environmetal Protection Agency (USEPA). 2005. National Management Measures to Control Nonpoint Source Pollution from Urban Areas. EPA-841-B-05-004.

U.S. Environmental Protection Agency (USEPA). 2010. Pet Waste Management. Public Education and Outreach on Stormwater Impacts. http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=4&minmeasure=1

Zarbock, H., A. Janicki, D. Wade, S. Janicki and R. Pribble. 1996. Model-Based Estimates of Total Nitrogen Loading to Tampa Bay. Technical Report 05-96. Tampa Bay Estuary Program, Tampa, FL.

Sincerely,

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Director, Center for Landscape Conservation and Ecology