Stormwater Runoff Water Quality Newsletter
Devoted to Urban/Rural Stormwater Runoff
Water Quality Management Issues
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This edition of the Newsletter presents information on the National Research Council's report on managing nutrient-related water quality problems in the Gulf of Mexico and in the Mississippi River watershed. It also presents further discussion of the US EPA's nutrient criteria for the state of Florida and the US EPA webcasts on Nutrient Management.

The National Academies Announce the Release of Report:
"Improving Water Quality in the Mississippi River Basin and Northern Gulf of Mexico: Strategies and Priorities"
http://dels.nas.edu/Report/Improving-Water-Quality-Mississippi/13029
According to the National Research Council, "*This report offers advice and priorities to the U.S. Environmental Protection Agency on improving water quality in the Mississippi River basin and Northern Gulf of Mexico—including how to better manage and monitor nutrients, especially nitrogen and phosphorus. Most nutrient pollution across the river basin comes from diffuse, hard-to-trace sources known as nonpoint sources—for example, the majority of nitrogen and phosphorus loadings come from agricultural landscapes and activities. Reaffirming a recommendation from a 2008 National Research Council report on Mississippi River water quality, this report proposes that the Environmental Protection Agency establish a numeric limit for the amount of nutrients in the waters of the northern Gulf. These "nutrient criteria" would provide an endpoint that the Environmental Protection Agency and the Mississippi River states can use to begin working upstream in setting water quality standards for nutrients and processes for improving water quality.*"

In addition the Environmental Protection Agency, Congress, the Administration, federal agencies, and states should collaborate better and provide stronger leadership, the report says. It recommends that the Environmental Protection Agency, its partner federal agencies, and Mississippi River basin states develop a more action-oriented, basinwide strategy to address nutrient-related water quality problems throughout the basin than has been used to date. Find all information related to this Report.

This report and the findings it contains are the products of an expert committee of the National Academies. The Academies convene committees of scientific leaders who serve pro bono to study specific questions and inform decision making. Committees review the available scientific evidence and reach consensus in an environment free of political, special-interest, and government influence; a rigorous peer review and other checks and balances ensure the integrity of these reports."

Key Finding
A basin wide action plan—developed by the Environmental Protection Agency, its partner federal agencies, and the Mississippi River States—would address nutrient-related water quality problems throughout the Mississippi River Basin and the Northern Gulf of Mexico. There have been some federal and state efforts to coordinate nutrient management and related water quality programs across the Mississippi River basin. To date, however, these interagency efforts have not produced a rigorous, action-oriented plan that includes clear performance measures, milestones, and deadlines, for reducing nutrient loadings.

A stronger and more coordinated commitment from the Environmental Protection Agency, its partner federal agencies, the Congress, the Administration, and the Mississippi River Basin States is needed to help develop long-term, adaptive and collaborative actions for effectively addressing water quality problems across the Mississippi River Basin and into the Northern Gulf of Mexico.

Establishing establish a numeric limit for the amount of nutrients in the waters of the northern Gulf would act as an endpoint for the Environmental Protection Agency and the Mississippi River States to set water quality standards for nutrients throughout the basin.

Support and advice from the Environmental Protection Agency could strengthen the activities of the Department of Agriculture Mississippi River Basin Healthy Watersheds Initiative. The Initiative is a four-year, $320 million program designed to promote improvements in water quality at 41 watersheds across the Mississippi River basin. "

An online PDF version of this report is available at
http://www.nap.edu/catalog.php?record_id=13029

Background information on the Gulf of Mexico excessive fertilization water quality issue of hypoxia and the impact of the Mississippi River watershed sources of nutrients for the Gulf are discussed in Newsletters NL -9-1/2, 9-10, 10-1, 12-5, 12-7/8, 13-3 available at, http://www.gfredlee.com/newsindex.htm.

Follow-up on US EPA's Development of Nutrient Criteria for Florida
Newsletter 13-3 [available at http://www.gfredlee.com/Newsletter/swnewsV13N3.pdf] provided information on the statistics-based approach that the US EPA proposed for developing nutrient criteria for the state of Florida, and on significant technical problems with that approach. As discussed, the fundamental problem with the proposed approach used for nutrient criteria is the fact they were not based on a cause-and-effect coupling between nutrient levels (or the numeric criteria) and nutrient-related water quality impacts. There is no reliable technical foundation for confidence that achieving the criteria will achieve desired water quality characteristics in a cost effective way, or that achieving the numeric criteria is necessary in order to effect the desired characteristics.

While the US EPA received a large number of comments pointing out various aspects of the technical unreliability of the then-proposed approach for developing numeric nutrient criteria for Florida, the Agency largely ignored those comments and promulgated numeric nutrient standards

for Florida as it had proposed. The Florida nutrient standards can be found in the "Federal Register": December 6, 2010 (Volume 75, Number 233) online at
[http://www.federalregister.gov/articles/2010/12/06/2010-29943/water-quality-standards-for-the-state-of-floridas-lakes-and-flowing-waters]. That Federal Register states,
"Water Quality Standards for the State of Florida's Lakes and Flowing Waters"
"*SUMMARY: The Environmental Protection Agency (EPA or Agency) is promulgating numeric water quality criteria for nitrogen/phosphorus pollution to protect aquatic life in lakes, flowing waters, and springs within the State of Florida. These criteria apply to Florida waters that are designated as Class I or Class III waters in order to implement the State's narrative nutrient provision at Subsection 62-302-530(47)(b), Florida Administrative Code (F.A.C.), which provides that '[i]n no case shall nutrient concentrations of a body of water be altered so as to cause an imbalance in natural populations of aquatic flora or fauna.'"*
"Action: Final Rule" "Dates: This final rule is effective March 6, 2012, except for 40 CFR 131.43(e), which is effective February 4, 2011.

Drs. G. F. Lee and Jones-Lee summarized significant technical problems with the US EPA then-proposed numeric water quality criteria with particular focus on agricultural runoff in:

> Lee, G. F., and Jones-Lee, A., "Unreliability of US EPA-Proposed Florida Numeric Nutrient Criteria/Standards," PowerPoint slides of Invited Presentation at Meeting of Association of American Plant Food Control Officials, Portland, Oregon, August 3 (2010). http://www.gfredlee.com/Nutrients/FloridaNutrientCriteria-sli.pdf

Many of the issues addressed are also applicable to regulating N and P compounds in urban stormwater runoff.

Newsletter 13-3 also presented information on the US EPA Science Advisory Board's (SAB) review of the US EPA's proposed approach for developing national nutrient water quality criteria based on statistical correlation approaches. The SAB found that the Agency's proposed approach was not technically valid and that it lacked reliable foundation in a cause-and-effect relationship between nutrients and water quality impacts necessary for meaningful criteria. Earl Cummings, a reader of the *Stormwater Runoff Water Quality Newsletter*, brought to our attention the following review of the unreliability of statistics-based relationships for quantitatively coupling cause and effect:

> Siegfried, T., "Odds Are, It's Wrong: Science Fails to Face the Shortcomings of Statistics," Science News, 177(7):26 March 27 (2010)
> http://www.sciencenews.org/view/feature/id/57091/title/Odds_Are,_Its_Wrong

That article states, "*For better or for worse, science has long been married to mathematics. Generally it has been for the better. Especially since the days of Galileo and Newton, math has nurtured science. Rigorous mathematical methods have secured science's fidelity to fact and conferred a timeless reliability to its findings.*

During the past century, though, a mutant form of math has deflected science's heart from the modes of calculation that had long served so faithfully. Science was seduced by statistics, the math rooted in the same principles that guarantee profits for Las Vegas casinos. Supposedly, the proper use of statistics makes relying on scientific results a safe bet. But in practice, widespread misuse of statistical methods makes science more like a crapshoot."

The Siegfried article provides several examples of the misuse of statistical approaches that are not based in established cause and effect. While not discussed by Siegfried, the US EPA's mechanical use of a statistical approach that lacked cause-and-effect coupling for developing numeric water quality criteria for Florida is another example of the misuse of statistics. As expected and justified several Florida groups have filed suit against the US EPA to have the court overturn those nutrient criteria. In January 2011 the Florida League of Cities and the Florida Stormwater Association filed a lawsuit against the US EPA on the US EPA-adopted nutrient criteria [http://www.florida-stormwater.org/]. A copy of the complaint filed in that litigation is available at: http://www.florida-stormwater.org/Files/Member%20Services/Advocacy/Regulatory/Complaint.pdf

In the 1960s while teaching and conducting research in the Water Chemistry Program at the University of Wisconsin- Madison Dr. G. F. Lee and his graduate students conducted a number of studies on the water quality impacts of nutrients in urban stormwater runoff. Of particular concern in those studies was the amount of total and algal-available N and P in the runoff. Reports of findings of those studies included the following:

Cowen, W. F., and Lee, G. F., "Phosphorus Availability in Particulate Materials Transported by Urban Runoff," Journ. Water Pollut. Control Fed. 48(3):580-591 (1976). http://www.gfredlee.com/Nutrients/AvailPParticulatesCowen.pdf

Cowen, W. F., Sirisinha, K., and Lee, G. F., "Nitrogen Availability in Urban Runoff," Journ. Water Pollut. Control Fed. 48(2):339-345 (1976). http://www.gfredlee.com/Nutrients/NAvailCowenSirisinha.pdf

Cowen, W. and Lee, G. F., "Leaves as a Source of Phosphorus," Environ. Sci. & Technol. 7:853-854 (1973). http://www.gfredlee.com/Nutrients/CowenLeavesP.pdf

Lee, G. F.; Jones, R. A. and Rast, W., "Availability of Phosphorus to Phytoplankton and its Implications for Phosphorus Management Strategies," IN: Phosphorus Management Strategies for Lakes, Ann Arbor Science Publishers, Inc., Ann Arbor, MI (1980). http://www.gfredlee.com/Nutrients/Avail-P.pdf

Lee, G. F., "Assessing Algal Available Phosphorus," Submitted for Inclusion in the Proceedings of US EPA Science Symposium: "Sources, Transport, and Fate of Nutrients in the Mississippi River and Atchafalaya River Basins," Minneapolis, MN, November 7-9 (2006). http://www.gfredlee.com/Nutrients/AvailPEPASymp06.pdf

Those studies found that in stormwater runoff, soluble ortho P and about 20% of the particulate P was available to support algal growth; particulate P was largely unavailable. While some of the so-called BMPs for control of phosphorus in urban stormwater runoff, such as detention basins, are effective in removing particulate phosphorus, they typically have limited effectiveness in removing soluble ortho P; the removal of particulate P from runoff is largely ineffective in controlling the algal-available P in the runoff. The US EPA position in Florida and elsewhere that total P in all sources needs to be controlled, ignores the literature that demonstrates that the primary focus of phosphorus control programs should be on soluble ortho phosphorus.

The ammonia and nitrate in urban stormwater runoff are available to support algal growth; only part of the organic nitrogen in such runoff is typically available to support algal growth.

The studies by Kluesener and Lee found that urban stormwater runoff typically contributes about 0.1 gP/m^2(watershed area drained)/yr and 0.5 $gN/m^2/yr$. The total P contributed by urban areas is about twice the amount in typical agriculture stormwater runoff because of the greater proportion of paved land in urban areas that does not permit infiltration of stormwater. These findings are discussed by:

> Kluesener, J. W., and Lee, G. F., "Nutrient Loading from a Separate Storm Sewer in Madison, Wisconsin," Journ. Water Pollut. Control Fed. 46(5):920-936 (1974). http://www.gfredlee.com/Nutrients/KluesenerLeeNutrLoad.pdf
>
> Rast, W., and Lee, G. F., "Nutrient Loading Estimates for Lakes," Journ. Environ. Engr. 109(2):502-518 (1983). http://www.gfredlee.com/Nutrients/NutrientLoadingEstRast.pdf

Urban stormwater runoff water quality managers face significant difficulties in controlling nitrogen and phosphorus in stormwater runoff especially during large runoff events. While during smaller runoff events it is possible to use commonly employed "BMP's" such as grassy-vegetated areas for reducing N and P in runoff, under high flow conditions when the greatest loads of N and P compounds occur conventionally designed vegetated areas become ineffective in removing N and P compounds from the runoff.

A number of the key issues in managing nutrients in urban stormwater runoff are discussed in:

> Lee, G. F. "Evaluating Nitrogen and Phosphorus Control in Nutrient TMDLs," Stormwater, 3:10-24, January/February (2002). http://www.stormh2o.com/January-february-2002/evaluating-nitrogen-phosphorus.aspx

Last summer, the Florida Farm Bureau published, "White Paper: EPA's Proposed Numeric Nutrient Criteria," which is available at [http://www.floridafarmbureau.org/numeric_nutrient_criteria].

That paper discusses some of the problems that the implementation of these criteria will cause agricultural interests in the state.

Based on our experience investigating water quality impacts of aquatic plant nutrients in agricultural runoff and the technical literature, the focus of P control in agricultural stormwater runoff should be soluble ortho P, and not total P. Large amounts of money could be spent by agricultural interests to implement P control practices that target total P (e.g., detention basins) in runoff from large storms, that will in fact have limited impact on eutrophication-related water quality in the receiving waters.

Similarly, control of N (nitrate and ammonia) in agricultural runoff and other sources should be limited to those watersheds that contribute to waterbodies in which N is demonstrated to be the major factor controlling excessive fertility. It has been demonstrated repeatedly that in freshwater waterbodies, control of P at its major sources, rather than N, is more effective in

controlling excessive fertility in receiving waters. This has been found to be the case even for waterbodies in which the P concentrations are well-above growth-rate-limiting concentrations. The implementation of the recently adopted US EPA N criteria for the state of Florida would be expected to cause Florida agricultural interests to spend large amounts of money for N control while achieving limited improvement in eutrophication-related water quality in receiving waters.

We have developed several papers/reports on nutrient control in agricultural runoff/discharges, including:

Lee, G. F. and Jones-Lee, A., "Assessing the Water Quality Impacts of Phosphorus in Runoff from Agricultural Lands: Expanded Discussion," Presented in part at American Chemical Society Agro Division Symposium, "Environmental Impact of Fertilizer Products in Soil, Air and Water," Chicago, IL, August (2001). (Published in part in Symposium Proceedings (Lee and Jones-Lee, 2004)
[http://www.gfredlee.com/Nutrients/P_Runoff_Ag_ACS.pdf])
(http://www.gfredlee.com/ ag_p-1_012002.pdf)
http://www.gfredlee.com/Nutrients/ag_p-1_012002.pdf

Lee, G. F., and Jones-Lee, A., "Assessing the Water Quality Significance of N & P Compound Concentrations in Agricultural Runoff," Invited Paper Presented at Agrochemical Division, American Chemical Society National Meeting, San Francisco, CA, September (2006). http://www.gfredlee.com/Nutrients/N-PRunoffACS.pdf

Lee, G. F., and Jones-Lee, A., "Assessing Water Quality Significance of N & P Compound Concentrations in Agricultural Runoff," PowerPoint Slides for Invited Paper Presented at Agrochemical Division, American Chemical Society National Meeting, San Francisco, CA, September (2006).
http://www.gfredlee.com/Nutrients/N-PSlidesACS.pdf

Lee, G. F. and Jones-Lee, A., "Nutrient TMDLs and BMPs," PowerPoint slide presentation to the UC Agricultural Extension farm advisors and researchers, Woodland, CA (2005). http://www.gfredlee.com/Nutrients/FarmAdvisorsWoodland.pdf

Lee, G. F., and Jones-Lee, A., "Application of Vollenweider OECD Modeling: Limiting Nutrient Issues," Report of G. Fred Lee & Associates, El Macero, CA, February (2009).
http://www.gfredlee.com/Nutrients/LimitingNutrientIssues.pdf

Rast, W., Jones, A., and Lee, G. F., "Predictive Capability of US OECD Phosphorus Loading-Eutrophication Response Models," Journ. Water Pollut. Control Fed. 55(7):990-1003 (1983). http://www.gfredlee.com/Nutrients/PredictiveCapabilityOECD.pdf

vanNieuwenhuyse, E., "Response of Summer Chlorophyll Concentration to Reduced Total Phosphorus Concentration in the Rhine River (Netherlands) and the Sacramento–San Joaquin Delta (California, USA)," Can. J. Fish. Aquatic, Sci. 64(11):1529-1542 (2007).
[http://www.ingentaconnect.com/content/nrc/cjfas/2007/00000064/00000011/art00006]

Guidance on managing excessive fertilization of waterbodies is provided in:

Jones-Lee, A., and Lee, G. F., "Eutrophication (Excessive Fertilization)," Water Encyclopedia: Surface and Agricultural Water, Wiley, Hoboken, NJ pp 107-114 (2005). http://www.gfredlee.com/Nutrients/WileyEutrophication.pdf

Lee, G. F. and Jones-Lee, A., "Developing Nutrient Criteria/TMDLs to Manage Excessive Fertilization of Waterbodies," Proceedings Water Environment Federation, TMDL 2002 Conference, Phoenix, AZ, November (2002). http://www.gfredlee.com/Nutrients/WEFN-Criteria.pdf

and in our Stormwater Newsletters, 1-2, 1-3, , 4-3/4, 5-1, 6-1, 6-2, 7-6/7, 9-1/2, 9-8, 9-10, 10-1, 10-2, 10-4, 10-5, 10-6, 10-7, 10-13, 11-2, 11-5, 11-9, 12-3, 12-5, 12-6, 12-7/8, 13-3 available at, http://www.gfredlee.com/newsindex.htm and in papers and reports on our website, www.gfredlee.com in the Excessive Fertilization section at http://www.gfredlee.com/pexfert2.htm

Florida, like many other areas, experiences significant water quality problems due to the discharge of excessive amounts of nutrients especially phosphorus. It is important that the vast knowledge on how nitrogen and phosphorus impact excessive growths of aquatic plants in waterbodies be applied in the development of regulatory programs. The effective regulation of N and P discharges for the control of excessive fertilization of waterbodies must be based on technically sound and quantitative assessment of the cause-and-effect coupling between available nutrient load and water quality.

Questions on our writings on these issues should be submitted to G. Fred Lee at gfredlee@aol.com.

US EPA Webcasts on Nutrient Water Quality Issues

The US EPA Watershed Academy has held a series of webcasts on nutrient impact and management issues. The January 26, 2011 two-hour webcast was devoted to, "*Nitrogen and Phosphorus Pollution and Harmful Algal Blooms in Lakes.* As described in the webcast announcement, "*This webcast highlighted an emerging issue of nutrient enrichment leading to harmful algal blooms in lakes. The webcast explained the connection between nutrients and harmful algal blooms such as blue green algal blooms. These algal blooms are causing loss of recreational uses including fishing, swimming and in some cases are resulting in increasing costs for drinking water treatment. The webcast will provide an overview of the issue and will present case studies on Grand Lake St. Mary's in Ohio and Lake Waco in Texas. This Webcast is a first in a series of Watershed Academy Webcasts on the important issue of nutrients and their impact on water resources.*"

PowerPoint slides from that webcast are available at:
[http://water.epa.gov/learn/training/wacademy/upload/2011_1_26_slides.pdf].
Past Nutrient Management webcasts are available at:
[http://water.epa.gov/learn/training/wacademy/archives.cfm#nutrient].

US EPA National Lakes Assessment (NLA):
Reporting on the Condition of the Nation's Lakes

On January 5, 2010 US EPA aired a "Watershed Academy Webcast" on "the condition of the nation's lakes." According to the US EPA's announcement of the webcast (available at [http://water.epa.gov/learn/training/wacademy/upload/2010_01_05_flyer-2.pdf]) "*NLA provides unbiased estimates of the condition of natural and man-made freshwater lakes, ponds and reservoirs greater than 10 acres and at least one meter deep. Using a statistical survey design, 1,028 lakes were selected at random to represent the condition of the larger population of lakes across the lower 48 states. The NLA presents data on the extent of lakes that support healthy biological communities, selected stressors impacting lake quality, and information on recreational indicators of lake condition such as microcystin, an algal toxin which can harm humans, pets, and wildlife. The NLA also reports on lake trophic status and includes comparisons of current data to 1972 data on wastewater-impacted lakes*."

PowerPoint slides for that webcast are available at:
[http://water.epa.gov/learn/training/wacademy/upload/2010_01_05_slides-2.pdf]