

Lysimeters Never Lie!

Better Analysis Helps Superintendents Meet Environmental Demands

By Mike Bohmenstingl, Director of Golf Maintenance, The Pines at Grand View Lodge,
and Craig Paskvan, Independent Soil Consultant

Minnesota's new environmental protection law (state law S.F. 1555) imposes strict new limits on phosphorus use in fertilizers. Golf course superintendents, who have always tried to be good stewards of the environment, now face even more rigorous requirements in the use of fertilizers on the links. Moreover, the stakes for golf club investors have been raised, for in some instances environmental tests can dictate whether a golf course can use fertilizer at all.

The three main fertilizer nutrients -- nitrogen, phosphorus and potassium -- of course, occur naturally in soils. Fertilizer use raises the level of these nutrients in the soil, which can result in these chemicals leaching through ground water. Nitrogen is often cited for polluting underground water systems, phosphorus is the lead nutrient associated with algae

"Environmental tests can dictate whether a golf course can use fertilizer at all."

blooms in surface waters and potassium affects the pH level and dissolved salt levels. When this occurs, it is the fertilizer that is most often blamed for nutrient runoff.

The superintendent's job is made more difficult because to satisfy the more stringent requirements the law impose, there is no easy way to determine how much phosphorus or nitrogen in the runoff is coming from fertilizer applications, and how much may be naturally occurring.

The case of The Preserve Golf Club near Pequot Lakes, Minnesota, illustrates just how important meeting the requirement of the new law can be. Operating with a conditional use permit, the course was under close scrutiny. It would not be able to fertilize at all, had it been unable to

prove that its fertilizer programs were not increasing the level of nutrients beyond the naturally occurring levels in the soil, and therefore, were not contributing to chemical effluent in water run-off into adjacent wetlands and lakes. Had these levels been elevated, the fertility practices of the golf course would have been in jeopardy.

The 240-acre site for The Preserve Golf Club includes 40 acres of wetlands, and lies entirely within the Cullen Lakes watershed. Thus, any surface water runoff from the club flows easterly and southeasterly toward Upper Cullen Lake through many acres of wetlands. The proximity of a golf club that potentially could use large quantities of fertilizer was of great concern to The Preserve's neighbors and nearby lakeshore residents.

During planning stages for the course construction in the early 1990s, concerns were raised to the Crow Wing County Planning and Zoning Board. The board required course developers to create and implement an environmental responsibility plan (ERP) before they would issue a conditional use permit and allow construction to begin.

Concerned neighbors, members of the Cullen Lakes Association, owners that had a financial interest in The Preserve and local authorities established an environmental advisory board to monitor compliance with the plan. With recommendations from the Minnesota Pollution Control Agency, the board would help to establish guidelines for the environmental responsibility plan and the conditional use permit.

The Advisory Board was most concerned with the protection of surrounding wetland areas from construction damage and phosphorus loading. Many board members worried that the use of fertilizers and pesticides on the golf course would pollute groundwater and increase algae blooms in local lakes.

The environmental advisory board along with a local water testing lab set up

a plan to measure chemical levels in the course and neighboring areas. Initial testing required the installation of monitoring wells and piezometers (an instrument to measure underground water flow). Water from seven neighboring wells was sampled to establish water quality baselines.

When course construction began, silt fences and earthen berms were built near

"(The analysis) shows that there is more to the phosphorus issue than just not applying fertilizer."

wetland areas, as were water retention ponds to filter any runoff that might occur. As part of the conditional use permit and the ERP, The Preserve was required to install twelve lysimeters and three wetland-monitoring pipes on the property.

The lysimeters were to be used to measure leachates (nutrients captured in the soil solution) moving through the soil profile. They were to be installed on four holes of the course; one located under the green, one under the fairway, and one in an undisturbed forest site. The idea was that The Preserve should manage its turf areas in such a way as to duplicate what was being found in the undisturbed forest areas on the course.

The lysimeters consisted of a large funnel covered with landscape fabric, buried twelve inches under the soil surface, with an attached tube running to a collection bottle located in a nearby pit. The Preserve was required to test these samples every six weeks or after a one-inch

(Continued on Page 11)

Better Analysis –

(Continued from Page 9)

rainfall event for total phosphorus, total nitrogen, total organic carbon, and conductivity.

Along with the lysimeters, testing was also required for three wetland-monitoring sites on the property and one site off the property near a beaver dam, where water flows from the wetlands into Upper Cullen Lake. Monitoring pipes were installed in these locations. Testing of the two irrigation wells and clubhouse well is required.

Because the soils in Crow Wing County are naturally high in phosphorus, the conditional use permit required The Preserve to conduct annual soil tests as well. Phosphorus is not to be applied to the golf course unless the soil test shows it to be deficient.

From 1996, when the course opened, until 2000, a local firm performed the required water testing. The firm submitted its annual report to the Crow Wing County Planning and Zoning Board and the Environmental Advisory Board. This report included test results and application records of pesticide, fertilizer, and irrigation usage as well as a summary and analysis drawn up by the owner of the testing firm.

Despite the extensive testing described above, Mike Bohnestingl, former course superintendent of The Preserve, was unable to find useful information in the data. The leachates were posted as total nitrogen, total phosphorus and total potassium. There was no way of determining from this data whether the leachates were naturally occurring or were coming from the fertilizer program. Thus, the testing program offered no direction. The whole point of the testing procedures was to use the data to better manage the fertility of the golf course while minimizing nutrient loading into nearby water-



A clubhouse view of The Preserve Golf Club

ways. In the meantime, opponents of the golf course believed the leachates were coming from fertilizers.

For the years 2000 and 2001, therefore, The Preserve decided to change testing firms in an attempt to learn more from the data collected. The course called in Craig Paskvan of Akeley, Minnesota, an independent soils consultant specializing in golf course fertility management.

Craig was asked to develop the data and break it down to answer the question: Where were the leachates coming from? Craig determined that the existing methodology and placement of measuring devices should yield the data required. But better analysis of the data seemed to be needed.

The first requirement was to break down the data on the main macronutrients – nitrogen, phosphorus, and potassium. A better data breakdown would allow the determination of where the nutrients as measured in the lysimeters


were coming from. By breaking down the macronutrients into their elemental forms, one could determine how much of the leachates found in the lysimeters came from organic or inorganic sources. Having a handle on those numbers would provide an important insight as to how the fertility program was working.

A second concern involved the interpretation and report of the results. Because of a possible conflict of interest, Craig felt it important to bring in a reputable analyst and report writer (Craig was also in charge of the fertility testing at The Preserve). With Michael's approval, Craig turned to Dr. Lam Ho. Formerly the Director of the Environmental and Industrial Division at Brookside Labs, Inc., Dr. Ho had recently started his own environmental consulting business. Dr. Ho was eminently well qualified to compile the data and do the write-up.


When the 2001 season got underway, Michael, for quality control reasons, was in charge of pulling the samples, filling out the chain of custody papers and sending them to the lab. Water samples were preserved at the time of collection as recommended by the U.S. Environmental Protection Agency and shipped to Brookside Laboratories, Inc.

Brookside Labs sent the results of its analyses to both Dr. Ho and Craig Paskvan. Dr. Ho and Craig discussed the results; then Craig reviewed them with Michael and reviewed any concerns or possible discrepancies in the results.

(Continued on Page 12)



**Duinick
Bros. Inc.**



GOLF

New Construction • Renovation
Restoration • Laser Leveling Tees
Drainage • Green Construction

800-328-8949
www.dbigolf.com
P.O. Box 208, Prinsburg, MN 56281



Better Analysis—

(Continued from Page 11)

Michael also compiled all the irrigation, fertilizer, pesticide and rainfall records for the year. This information, along with a topographical map of the golf course was sent to Dr. Ho for use in his report. Monitoring of the lysimeters took place every six weeks between May 1 and October 10, or after every rainfall in which

"Dr. Ho concluded that the fertility program... did not increase the levels of nutrients in the lysimeters beyond the baseline concentration ranges."

the amount of precipitation exceeded one inch during a twenty-four hour period.

Conclusions

After looking at all the data and work that was done at The Preserve for the 2001 growing year, Dr. Ho concluded that the fertility program in place at the golf course did not increase the levels of nutrients in the lysimeters beyond the baseline concentration ranges. The baseline concentration levels are those levels measured when no fertilizer had been applied. He found that nitrogen leachates levels were more organic in origin than inorganic.

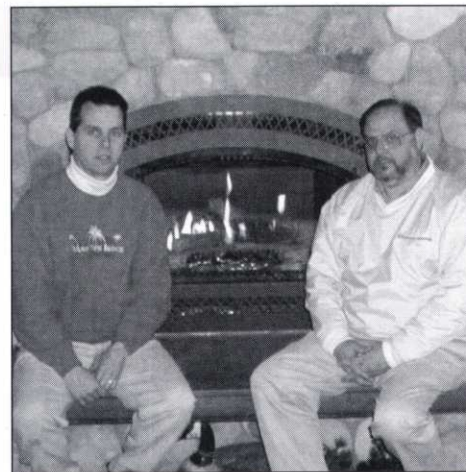
Phosphorus levels in the lysimeters were found to be in the range between normal and high to very high, even when no phosphorus fertilizer was applied. It appeared as if high phosphorus levels are normal in the soil at the Preserve; in fact, lowering the phosphorus in the leachate or lysimeters to a lower level may be difficult to do. Applying phosphorus fertilizers did not raise the level of phosphorus in the lysimeters; however, Dr. Ho recommended lowering the application rate of phosphorus when possible.

So what does this new information mean to Michael? For the first time, he has the ability to look at the data from the lysimeters and know that his fertility program is not contributing to any degradation of the environment. Second, it gives him knowledge of nutrient levels and possible nutrient problems in areas that he needs to be aware of. Third, he knows that even though there may be high levels of phosphorus in the leachates from time to time, those levels are reached due to the high levels of phosphorus naturally occurring in his soils. Michael also knows that

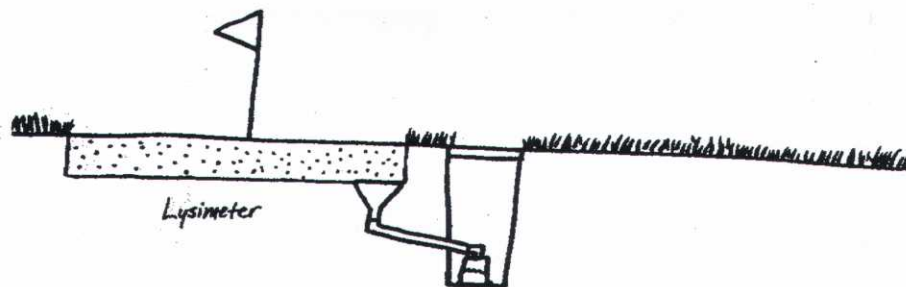
very little nitrogen is escaping into the lysimeters. That part of this fertility plan is working very well for him.

As a result of this new information, Michael and Craig have a new goal of trying to harness the naturally occurring high phosphorus levels to grow grass.

Why is the story of The Preserve important to golf course superintendents? It shows that there is more to the phosphorus issue than just not applying fertilizer. Organic matter and a soil's ability to give up nutrients need to be looked at before coming to any kind of conclusion that affects meeting the requirements of the new law or your ability to make judgments for your course. Also, better analysis of data showed that The Preserve was the not the "bad guy" with a poorly



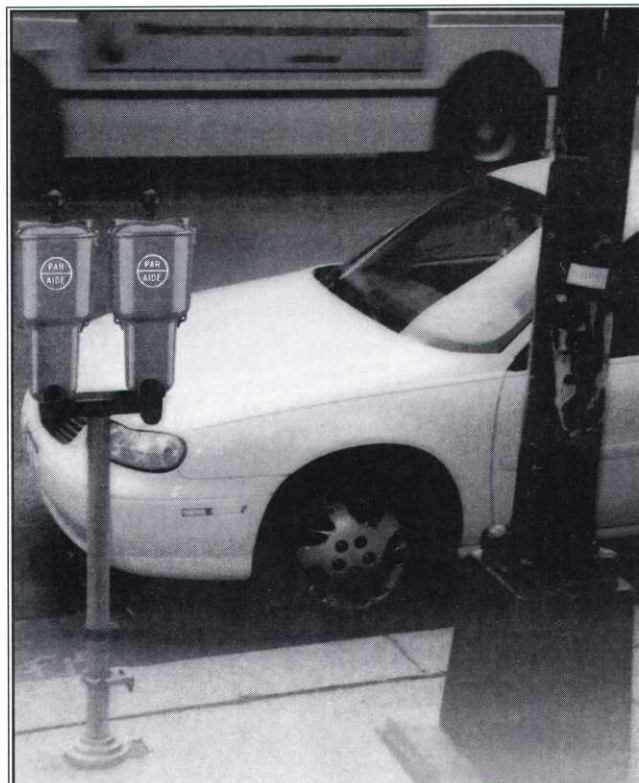
Superintendent Mike Bohmenstingl with consultant Craig Paskvan.



thought out fertilizer policy, but was in fact a good steward of the soil.

As a result of the environmental concerns at The Preserve, three additional golf courses constructed in Crow Wing County since 1996 have been subjected to similar constraints and testing protocols. Data collected at these sites and properly broken down help the superintendents better manage their fertility programs, thereby minimizing any adverse effects on the environment. Concerned residents are being shown that golf courses can indeed be operated in harmony with the natural settings they are built in.

The complete scientific data and analysis, including all graphs and tables of the testing done at The Preserve Golf Club, are available at www.paskvanconsulting.com.



Without you, who knows where we'd be.

Thanks for placing our products where they belong. On your golf course. 1-888-893-2433

