Hydrologic and Water Quality Impact Assessment from an Intensively Managed Watershed-scale Turfgrass System

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Objectives:

1. To assess the hydrologic and surface water quality impact from a high-end golf course.

Start Date: 2003
Project Duration: three years
Total Funding: $70,861

The primary objective of this effort is to assess the hydrologic and surface water quality impact from a high-end golf course. Specifically, a sub-area of the Northland Country Club golf course in Duluth, MN will be monitored for nutrients (nitrate and phosphorus) and pesticides (2,4-D and chlorothalonil). The assessment will include surface and subsurface sites.

The study represents a unique turf assessment program that will allow quantification of the water quality loadings of turf environments. The findings and data from this study will be used by turf educators, model developers, researchers, consultants, managers, USGA staff, and agronomists to learn, study, develop, and implement new technologies and promote the benefits of turf for an improved sound environment associated with turf systems.

This project consists of a watershed-scale surface water quality (nitrate, phosphate, chlorothalonil, and 2,4-D) assessment. The monitoring program is designed to capture the hydrologic and environmental response of a watershed-scale turf system from cultural, chemical, and mechanical processes. The study site is a private golf course in Duluth, MN. The site is a near ideal hydrologic and water quality research area, as the study site has only one inflow location and one outflow location. NCC has several sub-watersheds or drainage areas with unnamed streams draining into Lake Superior.

The study area is located along a stream on the northeastern part of the NCC golf course. This area forms a discrete drainage area composed of 6 complete holes, three partial holes and unmanaged areas of mixed northern hardwoods and bedrock outcroppings. The drainage stream enters a natural pond (hole 11) located at the top of the small watershed. This stream then bisects the proposed study area. Therefore, water quality enhancement or degradation between the inflow and outflow point is contributed by the course.

Two ISCO 6712 automatic collection systems were installed at the site in when sampling began.

The contributing area of the course is approximately 110 acres. The inflow to the course originates from a low-density housing and forested area comprised of approximately 237 acres. This configuration will allow a relative contribution from the turf system to be studied. The surface monitoring stations and flumes are located where the stream enters the course and where the stream exits the study area.

The study area ranges in elevation from 1050 feet at the top of the sub-basin to 930 at the bottom of the basin. Eventually all surface drainage on the golf course migrates toward Lake Superior. Temporary flooding occurs occasionally along the narrow stream terraces during large scale rain events (2.5 - 4 inches).

The annual sampling period will vary due to climate but generally occurs between April 15 and November 10. Two ISCO 6712 automatic collection systems were installed at the site in April of 2003 when sampling began. Hydrologic samples (discharge) are recorded on a 10-minute time interval, while water quality samples are being collected based on a flow proportional sampling scheme using H-flumes and ISCO 6712 automated collection systems. The flow proportional scheme allows both base flow and storm event sampling.

Samples are being collected at the upstream and downstream locations so that quantification from the golf course can be determined and compared to the upland low density housing and forested area. In the early spring of 2004, two ISCO 6712 automated samplers were installed on two different subsurface drain lines located in the primary study area.

Summary Points

- Instrumentation to measure the flow entering and exiting the course was installed in late 2002.
- Hydrologic and water quality data have been collected during the playing season at the inlet and outlet since April, 2003.
- Instrumentation to measure quantity and quality of subsurface drainage on the course was established in April, 2004.
- Varying degrees of nutrients and pesticides exiting the course and in the subsurface drains have been detected.