

# *Comparing Nutrient Losses Via Runoff from a New Golf Course and the Golf Course Site's Previous Native Condition*

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## Objectives:

1. Compare nutrient loading via surface water runoff from a new golf course versus the site's previous native prairie condition.
2. Investigate the new golf course's impact on surface water quality during construction and during golf course operations.

**Start Date:** 1998

**Project Duration:** 5 years

**Total Funding:** \$118,155

Kansas State University, in cooperation with Jim Colbert, PGA TOUR, GCSAA, and various alumni, have built a 27-hole championship golf course, Colbert Hills Golf Course, near Manhattan, Kansas. The golf course was built on land that has a prairie-woodland mix that is typical of the Flint Hills Region.

We have set up four monitoring stations on Little Kitten Creek (the major stream) and its tributaries to collect water samples, measure runoff discharges, and collect precipitation data. Water samples were tested for total nitrogen, total phosphorus, and sediment concentrations. We divided the data set into three subsets, pre-construction (native conditions), during construction, and during operation.

Data analysis showed that golf course construction has the greatest impacts on surface water quality with average concentrations of 3.94 mg/L, 0.93 mg/L, and 2,955 mg/L for total N (TN), total P (TP), and sediment (TSS) respectively, compared with 1.18 mg/L, 0.39 mg/L, and 477 mg/L for the pre-construction period.

During operation, sediment content was brought down significantly to an average of 397 mg/L, lower than that of the native prairie condition, due to turfgrass. The average concentrations of TN and TP were 2.38 mg/L and 0.67 mg/L, much lower than those in the construction period, but still about twice as much as those in the native prairie condition.

Further analysis shows that there are direct connections between fertilizer application and concentration of TN and TP in

	<b>Native</b> 4/98-7/98	<b>Construction</b> 8/98-4/00	<b>Early Operation</b> 5/00-5/01
No. of samples	28	138	87
<b>Total N</b> (ppm)	Mean 0.30 Maximum 4.80	3.94 0.00 13.40	2.38 0.05 13.98
<b>Total P</b> (ppm)	Mean 0.00 Maximum 1.70	0.93 0.00 8.36	0.67 0.01 2.65
<b>TSS</b> (ppm)	Mean Median Maximum 477 203 2496	2955 1121 38412	397 140 4698

*Total nitrogen (N), total phosphorus (P), and sediment (TSS) concentrations in major inflow and outflow at three different phases: native conditions, during construction, and during golf course operation.*

streams. There are cases that indicate the amount and timing of fertilizer application are to be blamed (i.e., when fertilizers are applied over a large area and significant rainfall comes shortly after application). However, only a few samples have TN great than 10 mg/L, a drinking water standard. We therefore believe that golf course operation, as a whole, does not pose immediate threat to the aquatic system.

The rate of nutrient transport during construction was three to four times that under native conditions which was consistent with the estimation of sediment yields. Particulate nitrogen and phosphorus absorbed by sediment particles and brought down to streams in runoff events are the major source of nutrient in streams in these periods. During golf course operation, fertilizer application is another source of nutrients in streams.

We will continue to collect surface water samples in order to have a better understanding of the impacts of golf course

operation on surface water quality.

## Summary Points

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