

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

Information is needed concerning the effect that golf course construction has on the movement of sediment and nutrients into surface waters during the construction process. To achieve the stated objectives, 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. Surface water runoff amounts were studied so that mass transport of nutrient and sediment could be analyzed.

Construction of Colbert Hills Golf Course started in July, 1998, and completed in May, 2000. Beginning in early 1998 and running into year 2002, this water quality monitoring program enabled us to study the impacts of construction and operation of the golf course on surface water quality. Up to date, more than 750 water samples have been collected and tested.

We divided the data set into three subsets, namely pre-construction (native conditions), during construction, and during operation. Significant impacts were seen during construction and operation. In samples of surface water leaving course during construction, the average nitrogen concentration was 4.52 mg/L with a minimum of 0.70 mg/L and maximum of 33.00 mg/L. The average phosphorus concentration was 1.12 mg/L with a minimum of 0.04 mg/L and maximum of 8.36 mg/L. This was mainly due to the destruction of native land covers that

caused heavy soil erosion. During operation, average nitrogen concentration was 2.61 mg/L and phosphorus was 1.12 mg/L compared with 1.18 mg/L and 0.55 mg/L under native conditions, respectively.

Using preliminary stream flow relationships, we were able to determine the surface water runoff amounts and the mass amounts of nutrient transported offsite. The determined rates of nutrient transport for native conditions were similar with those in the adjacent Konza Prairie Research Area.

The rate of nutrient transport during construction was 3 to 4 times of that under native conditions, which was consistent with the estimation of sediment yields. More data needs to be collected before we can have a comfortable conclusion, however, since 2000 was a very dry year.

We also studied the sediment yields using AGNPS 98, a non-point source pollution model. Modeling results indicated a sediment yield of 2.4 tons/ha/yr under native conditions. During construction, however, sediment yield was 4.7 tons/ha/yr at the upstream site (about 2 times the pre-construction amount) and 9.15 tons/ha/yr at the downstream site (about 4 times the pre-construction amount). The great amount of sediment at the downstream site was mainly due to the larger area of disturbance. Sediment yields are expected to return to pre-construction levels during operation.

We are pleased with the progress we have made on our project. 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.



The Colbert Hills Golf Course was carved out of tallgrass prairie near Kansas State University. Water quality of the new golf course will be compared with the natural tallgrass prairie.

We will need more measurements before we can develop satisfactory rating curves. We will also explore the relationships between sediment concentration and nutrients concentration, and between fertilizer application and nutrients concentrations.

Summary Points

- Compared to native conditions, both nitrogen phosphorus concentrations increased in surface waters during construction and operation.
- During construction, there was a four-fold increase in sedimentation during construction compared to pre-construction sedimentation rates.
- Sediment yield is expected to return to preconstruction level during regular golf course operation.