Publications

TR-156

Effectiveness of Native Species Buffer Zones for Nonstructural Treatment of Urban Runoff

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- Full Text

A field study was conducted to determine the influences of vegetation composition, buffer width, and infiltration rate on the effectiveness of native vegetation buffer zones as nonstructural treatments of urban runoff with respect to increasing water quality. The field site was in Austin, Texas with runoff originating in a parking lot with a drainage area of approximately one hectare. The soil was a shallow, well-drained clay overlying limestone. Twelve constituents were measured; fecal streptococci, fecal coliforms, dissolved nitrate, total nitrate, dissolved total phosphorus, total phosphorus, dissolved

ammonia, total ammonia, dissolved total Kjeldahl nitrogen, total Kjeldahl nitrogen, total lead, and total suspended solids. Four different vegetation compositions were used as treatments; wooded areas, wooded areas cleared, native grasses mowed, and native grasses unmowed. The vegetation in the mowed and unmowed areas was primarily composed of Johnson grass (Sorghum halepense), Bermuda grass (Cynodon dactylon) and mixed legumes. The wooded area was dominated by common red cedar (Juniperus virginiana) with scattered live oak (Quercus virginiana) and Ashe juniper (Juniperus ashei). The ground cover was juniper litter and scattered Texas wintergrass (Stipa leucotricha).

Only total suspended solids, total lead, total Kjeldahl nitrogen, total nitrate, total phosphorus, dissolved nitrate, and dissolved total phosphorus were influenced at the 0.10 significance level by vegetation composition and buffer width. For pollutants affected by vegetation composition, the wooded areas had the highest mean concentrations of pollutants. The mowed and unmowed areas generally had the lowest concentrations of pollutants. For this application of buffer strips, it was found that as buffer width increased, the pollutant concentration also increased. Other researchers have reported decreasing pollutant concentrations. One explanation is that this is caused by excess transport capacity associated with the runoff entering the buffer strip. As the runoff moved though the buffer strip, pollutants were detached and transported through the buffer strip. If the buffer strip is sufficiently wide, an equilibrium between detachment and transport capacity may be reached and a decrease in pollutant concentration may be seen subsequently.

A physically-based model was developed to simulate sediment yield through the buffer strips studied. The model has a stochastic pollutant concentration input generator. Transport capacity is computed using the Yalin equation. Detachment and deposition are computed using a modified version of the

Universal Soil Loss Equation. The model was used to simulate this field study. The model did not simulate individual rainfall events well. The model predicted the long-term average results of this field study with concentrations increasing with buffer width. The coefficient of determination for observed concentrations compared to average predicted concentrations was 0.90.

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