Intervention Strategies to Improve Water Quality on Country Club Bayou

Hui Zhu, Jeff Davis, Theodore G. Cleveland

Department of Civil and Environmental Engineering

University of Houston

Abstract

Country Club Bayou, formerly Slaughterhouse Ditch, is located in southeast Houston. The bayou drains from east to west connecting to Brays Bayou. The upper portion of the bayou is conveyed in a concrete channel. The lower portion of the bayou from the Hughes Street Railroad Bridge to the confluence is open channel.

Figure 1 is a portion of a USGS map of the study area based on field survey data from 1915. The map shows the bayou branching upstream of Evergreen Cemetery, with both branches depicted as open ditch. The map suggests that in 1915 most of the bayou was open ditch. Figure 2 is a portion of a recent USGS map of the same area (different scale). Between 1922 and the late l930's the bayou west of Evergreen Cemetery was covered over as part of a WPA project, and in 1948 the portion from Evergreen Cemetery to Hughes Street (the Hughes Tool Complex) was covered.

Pollution of the bayou has been problematic for at least a dozen years. Suspected high organic loading in the covered portion of the bayou contributes to low dissolved oxygen values, a septic odor, and black color. At times the water at Hughes Street Bridge has not meet state water quality standards for a non-designated stream.

The purpose of this research is to locate possible areas of pollution and evaluate possible intervention strategies to mitigate the effects of pollution. The investigation uses field monitoring of selected water quality parameters, computer simulation of water quality, and computer simulation of selected intervention strategies to develop approaches to improve the water quality.

Analysis of water quality data at Hughes Street Bridge indicate that the dissolved oxygen, sulfate, sulfide, CBOD, and Fecal Coliform have statistically meaningful differences when segregated by the descriptive variable "odor." The remaining water quality parameters did not appear to exhibit differences between odor and no-odor conditions.

Hypothesis testing of the DO data in an upstream vs. downstream stratification indicates that in the odor episodes all the upstream values are statistically different from the Hughes Street values. The data support a hypothesis that there is little difference in dissolved oxygen values upstream of Evergreen Cemetery, but between Evergreen and Hughes Street the dissolved oxygen value decreases by a factor of two. This result indicates that the oxygen demand in this segment of the system is higher than in the other areas of the covered portion.

The conceptual model divides the bayou into two portions, the covered and uncovered portion This distinction is selected because in the QUAL2E computer program the re-aeration coefficient and the light intensity function are applied globally, and different values cannot be applied in different

parts of the model. However this division allows these two sections to be considered independently, with the output of the covered portion serving as input to the uncovered portion. Figure 3 illustrates the network of computational elements and reaches for the covered portion of Country Club Bayou.

Several remediation strategies were modeled to improve the water quality of the covered portion of the river in odor condition. The water quality of covered portion can be improved with 30% recycle of the bayou water at saturation. Locating the point source near the upstream end is recommended. Re-aeration enhancement might be a feasible strategy to improve water quality of covered portion in the odor condition, assuming, the effect of the re-aeration coefficient was correctly estimated. Figure 4 is a typical simulation output.

If you have any questions, please contact **Dr. C.Vipulanandan**