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Project Costs: **K&A \$375,000**

Project Completion: **1997-Water Quality Study; Oct. 1999-Design Phase;**
2002-Construction Phase; 2007 Post-monitoring

In March of 1996, the City of Kalamazoo authorized a study of Woods Lake with the focus of improving water quality conditions. This water body is unique in that it does not have natural streams flowing into or out of the lake. The lake does, however, have a decades-long history of receiving stormwater runoff from over 200 acres of land surrounding the lake through six different storm drains. This has created numerous water quality problems including nuisance weed growths, diminished water clarity, bacterial contamination, sedimentation and accumulation of pollutants from roadway runoff.

To address these concerns, KIESER & ASSOCIATES (K&A) was retained by the City of Kalamazoo to complete the Woods Lake study. The essential components of this study included:

- An assessment of current conditions in and surrounding Woods Lake.
- Measurement of specific pollutant levels in stormwater, lake water and sediments.
- Identifying options and developing strategies for: 1) a plan to stop continued degradation of the lake, and; 2) methods to reverse degraded conditions of the lake.

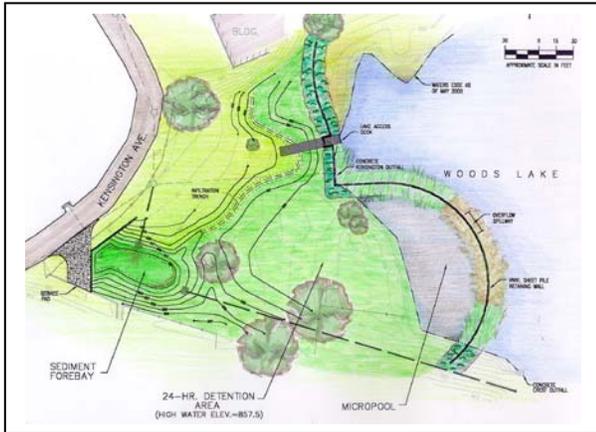
The goal was to identify cost-effective options to improve and sustain the quality and character of Woods Lake. K&A initiated five areas of study to complete project objectives through analysis of water quality conditions and an evaluation of engineering alternatives. Associated tasks included:

- A. Woods Lake Watershed Characterization/Water Quality Sampling
- B. Engineering Evaluation for Stormwater Design/Treatment Alternatives
- C. Watershed Pollutant Loading Analyses
- D. Best Management Practices/Public Outreach Program
- E. Restoration Alternatives

Products of the initial one-year study effort included some of the following:

- Bathymetric map of Woods Lake
- Pollutant loading estimates
- Sediment thickness survey
- Long-term water quality management goals and objectives
- Surficial sediment survey
- Identification of baseline water quality
- Updated drainage basin characterization
- Stormwater and road maintenance practices
- Best Management Practices needed
- Engineering analysis of stormwater treatment
- Citizen outreach
- Weed treatment options
- Citizen's educational brochure
- Preliminary dredging feasibility analysis

WATER QUALITY ANALYSIS OF WOODS LAKE, KALAMAZOO, MI



Since the submittal of the 1997 Woods Lake Water Quality Study Report, K&A, along with their engineering team member, URS Corporation, initiated implementation of several key lake restoration elements. The first of these included the creative development of a stormwater detention/wetland treatment system for nearly two-thirds of the lake's drainage area. Constrained by a very limited site area, system design included detailed meteorological and hydraulic analyses to determine optimal sizing of the treatment facility. Such efforts resulted in a treatment system one-third the size of that prescribed for a 5-year design storm yet capable of still treating nearly 98% of all storms. Treatment specifically focuses on phosphorus and sediment removal from stormwater while maintaining the hydraulic balance to sustain adequate lake levels. Other design

elements include property enhancements into a more usable park with educational features, and boardwalk access for fishing and other recreational activities.



Construction of this unique treatment facility began in July of 2002. Construction costs for this system were \$290,213 including re-routing of storm sewers. This new facility was completed in the Spring of 2003.

Based on subsequent stormwater treatment performance monitoring by K&A in 2007, data indicate the Kensington stormwater treatment system BMPs are achieving approximately 81% removal of TP and 81% removal of TSS loads that would otherwise discharge into Woods Lake. Overall, the system's treatment efficiency for phosphorus is at or above the originally targeted removal efficiency. Sediment removal efficiency is within the original estimated operating range.