Work in Progress - Service Learning Opportunity: A University and Community Partnership in Creek Restoration

Camilla M. Saviz, Ph.D.
Department of Civil Engineering, University of the Pacific
3601 Pacific Avenue, Stockton, CA 95211
csaviz@pacific.edu

Abstract - A service learning opportunity has been incorporated as part of a required upper-division course in Civil Engineering. A collaborative relationship was established between homeowners along Five-Mile Creek, an urban creek in Stockton, CA, and the University of the Pacific Civil Engineering Department. Like most surface waters in California, the creek serves multiple beneficial, and sometimes conflicting, uses. Consequently, it is affected heavily by human activities and experiences water quality problems. Creek analysis and restoration projects have been conducted as part of a Water Resources Engineering course and have provided students with opportunities to develop and apply field, analytical, and technical skills. Students examine and develop solutions for this 'real world' problem; communicate with homeowners; and research political, social, environmental, and regulatory issues. This pilot project serves to demonstrate that community involvement (or "Service Learning") projects can serve an important role in support of learning while providing mutually beneficial opportunities for students and for the community.

Index Terms - Service Learning, Creek Restoration, Community Partnerships, Project-Based Learning.

INTRODUCTION

Five Mile Creek, a storm runoff drainage channel located in Stockton, California, is a shallow 4.3 km channel bounded by residences, a high school, an orchard, a park, and a golf course. The creek experiences tidal effects as part of the Sacramento-San Joaquin Delta system and at its downstream confluence with the Delta, flow into and out of Five Mile Creek is constrained and controlled by a weir and pump system. Hydrodynamic problems in Five Mile Creek include low velocities that promote sediment deposition and algal growth. Elevated velocities and water depths during peak runoff periods have caused erosion of banks and flooding of some residents’ properties. Water quality problems include elevated nutrient and pesticide concentrations, low dissolved oxygen concentrations during warm months, and blooms of duckweed and water hyacinth that have covered and choked entire sections of the channel. These water quality problems have resulted from shallow channel depths and poor circulation; placement of flood-control levees and removal of riparian vegetation along several reaches; and addition of nutrients and pesticides including chlorpyrifos and diazinon with urban storm water and agricultural runoff.

Since the channel is not used for flood control, it receives low priority for clean-up and restoration funds from local agencies. However, the creek and its riparian corridor provide habitat for several avian and aquatic species while also providing recreational and educational opportunities for the public. Two years ago, several homeowners became interested in restoring the creek water quality, eradicating nuisance algae and odor problems that occur during warmer months, and alleviating erosion and sedimentation problems. These homeowners, organized under a group called 'Friends of Five Mile Creek', contacted the University of the Pacific for assistance.

IMPLEMENTING A SERVICE LEARNING PROJECT

The creek and its potential restoration provided excellent hands-on learning opportunities for Civil Engineering students enrolled in a Water Resources Engineering course, so a collaborative relationship was established between homeowners and the University of the Pacific Civil Engineering Department. Initial efforts have focused on identifying and quantifying environmental, hydrodynamic, and water quality problems, and developing alternative preliminary solutions. The project has been implemented as part of the course, taught each Spring semester, and is currently in its second year. The project includes the following elements:

- Field surveys - Students and local residents have conducted field surveys along the creek to measure cross sections, velocities, and water quality constituent concentrations.
- Information gathering and documentation - Students have interviewed residents, park and golf course groundskeepers, local government agency personnel, and others to obtain information about problems, pertinent historical and engineering information, management practices, economic considerations, regulations, etc. and documented their findings and observations.
• Analysis - Results of field surveys and information from communications with stakeholders were analyzed by student teams. Each team performed a preliminary mass balance on the system and identified and prioritized problems to be resolved.
• Synthesis - Based on knowledge about the system and material in the course, each team generated a preliminary proposal that included pertinent background information, identification of potential alternatives for solution of the highest-priority problems in the creek, and development of task lists identifying information and work needed to implement the solutions.
• Communication - In addition to the written proposal, each student team presents their proposal to the class in the form of a professional oral presentation, as would be done when bidding for a project. Students, representing 'clients', perform peer evaluations on each of their classmates' projects. At present, the written proposals have been compiled and given to Friends of Five Mile Creek on an informational only basis, but it is expected that during the next year, stakeholders will become more involved during each step of the process. It is expected that one or more of the proposed projects will eventually be implemented on a pilot test basis.

Students provide written documentation in support of each component described above. Calculations are presented and analysis must be explained in a written submittal. The course instructor provides feedback on each of these elements as well as on a written pre-proposal submitted before each team prepares their final proposal. Peer evaluation scores and comments are compiled and distributed to respective teams after the formal presentation.

LEARNING OPPORTUNITIES AND RELATION TO ABET CRITERIA

Community involvement or service learning projects are not often included as part of a course or curriculum, mainly due to limitations in instructors' time or interest, resources, or an inability to adapt projects to meet course objectives. However, when correctly administered, such opportunities can provide experiences that complement and reinforce classroom and laboratory learning while providing students with invaluable exposure to complexities that can be part of engineering practice. Such projects can also serve to demonstrate social and environmental impacts of engineering solutions.

Service learning opportunities of this type can be used towards achieving several of the required program outcomes defined by the Accreditation Board for Engineering and Technology for engineering programs in Criterion 3 [1]-[2], namely:

(3a) an ability to apply knowledge of mathematics, science, and engineering
(3c) an ability to design a system, component, or process to meet desired needs
(3e) an ability to identify, formulate, and solve engineering problems
(3g) an ability to communicate effectively
(3h) the broad education necessary to understand the impact of engineering solutions in a global and societal context

Five Mile Creek is small compared to most rivers and sloughs in the region. However, the variety of issues, stakeholders, and regulations provide a realistic, though scaled down, representation of different technical and non-technical issues that must be considered in engineering practice. Additionally, difficulties in identifying and quantifying the 'known' and 'unknown' parameters provided students with a valuable experience in defining elements of an open-ended problem. Finally, environmental impacts of engineering solutions are clearly apparent in many sections of the creek, for example, by sediment build-up downstream of a pump station discharge pipe, and erosion of homeowners' properties, among others. These types of field observations can serve to contextualize engineering education and to enhance students' appreciation of the need for a broad education.

SUMMARY

A service learning opportunity has been incorporated as part of a required upper-division course in Civil Engineering. The focus of the project, enhancement and restoration of water quality in a local creek, arose through collaboration with local community members. The project has been adapted to meet several course and curricular learning objectives, while also providing valuable technical assistance to the community. Such projects can promote mutually-beneficial partnerships between Universities and local communities. These 'real-life' projects also help to emphasize the importance of non-technical components involved in engineering practice such as regulations, economics, public interaction, and communication. After the initial start-up and problem identification period, it is expected that one or more of the proposed projects will be implemented on a pilot test basis and evaluated as part of the course.

REFERENCES