DEVELOPMENT OF A STORM WATER MASTER PLAN FOR THE UPPER YELLOW RIVER AND SWEETWATER CREEK WATERSHEDS IN GWINNETT COUNTY, GEORGIA

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Abstract. Gwinnett County is currently completing a Storm Water Master Plan in Sweetwater Creek and Upper Yellow River as a part of implementing recommendations of their county-wide watershed assessment. The Master Planning process has focused on the watersheds within the county with the greatest amount of growth and development and largest degree of stream degradation as determined by the watershed assessment. The project goals are to 1) identify existing conditions of streams and stormwater BMPs, 2) make recommendations for stream restoration and stormwater BMP projects, and 3) prepare a capital improvement program list that includes costs and benefits of the recommended projects. This paper presents methodology to rapidly assess existing stream and BMP conditions and evaluation criteria used to recommend the most effective capital improvement projects.

INTRODUCTION

Gwinnett County, similar to much of the metro Atlanta area, is undergoing rapid urban growth. Unfortunately, a common consequence of growth is degradation of the water resources necessary to maintain environmental quality, quality of life, and economic growth. In forested watersheds, most rainfall infiltrates forest soils and is delivered to a stream hours, days, or even months after a slow transit through the shallow groundwater system. Urbanization changes the fundamental hydrological processes of a watershed causing rapid runoff from impervious areas that is delivered to streams within minutes by well-defined, constructed drainage networks. Consequently, peak streamflows dramatically increase, and the greater erosivity of these flows erode and enlarge stream channels, with the additional sediment load carried downstream. Excessive sedimentation contributes to water quality impairment by degrading physical habitat for biological communities, thereby causing streams not to meet their designated uses.

Gwinnett County Department of Public Utilities (DPU) is working to develop a list of projects to address water quality and stream habitat improvements. The projects will include new and retrofit structural BMPs to address altered hydrology caused by urban development as well as stream restoration to improve aquatic ecosystem integrity. The results of this project will prioritize sub-watersheds and focus on the areas with the greatest need and/or ability to make an improvement to existing conditions. An innovative GIS based modeling effort will be used to determine benefits such as hydrology improvement and nutrient reduction. Other evaluation criteria are also considered such as cost and permitting issues.

Development of a watershed CIP to mitigate degraded water quality conditions is a sequential, four-step process. The first step is to assess and inventory watershed conditions, including stream conditions and existing structural BMPs. The assessment process leads to the identification of problem areas (Step 2) with significant stream degradation and are lacking adequate measures (BMPs) to prevent such degradation. In a third step, conceptual solutions (projects) are developed to mitigate the degraded conditions. These solutions may include new BMPs or the retrofitting of existing BMPs to reduce the discharge of the "channel-forming" floods and the "water quality" peak flows to more natural hydrologic conditions. Alternatively, or in conjunction with flow-reduction BMPs, stream stabilization and restoration may be undertaken to directly reduce the potential for channel sediment being input into streamflow. The

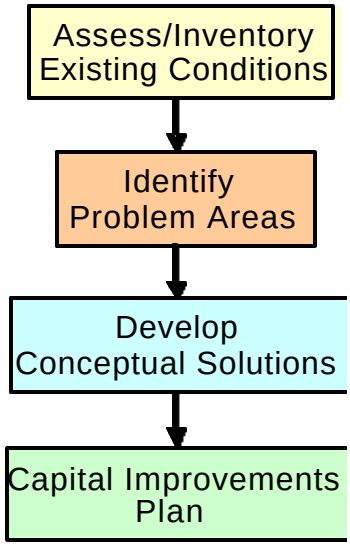

Figure 1. Four steps to developing a storm water CIP.

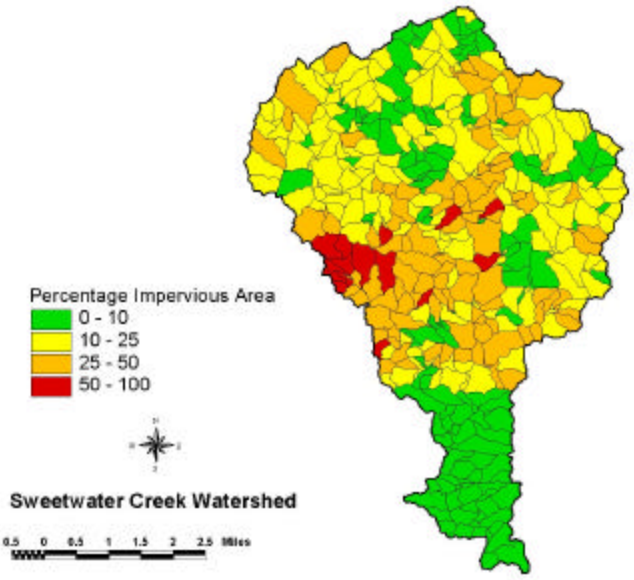

Figure 2. Percent impervious surface by sub-basin in Sweetwater Creek.

final step consists of selecting the best mix of BMPs and stream projects to meet water quality performance targets in the most cost-effective manner. These projects are the ones that will be incorporated into the CIP. This paper will focus on the methods used to develop the stormwater master plan.

METHODS

Inventory Existing Conditions

Three steps were taken to assess and inventory existing conditions. First, an extensive GIS system was created for the basin using existing data from Gwinnett county including streams, land cover, and impervious areas. From this data, GIS coverages were created such as percent impervious area that was used to prioritize stream and BMP inventory and evaluation steps. Figure 2 illustrates percent impervious area by sub-basin for Sweetwater Creek.

Next all streams in the study area were evaluated through detailed stream walks to determine sub-watersheds with the highest degree of stream degradation. Criteria such as bank erosion, sedimentation, habitat, and buffers were used to rank stream condition. In addition, information on maintenance needs were collected and submitted to the county.

Existing BMPs were located using aerial photography (see figure 3). More than 600 BMPs were located in the Sweetwater Creek and Upper Yellow River watersheds. Field crews verified the location, size and type of inlet and outlet structures, surrounding land use, and maintenance issues. Field crews also identified additional BMPs not located through aerial photography such as grass swales and man-made wetlands.

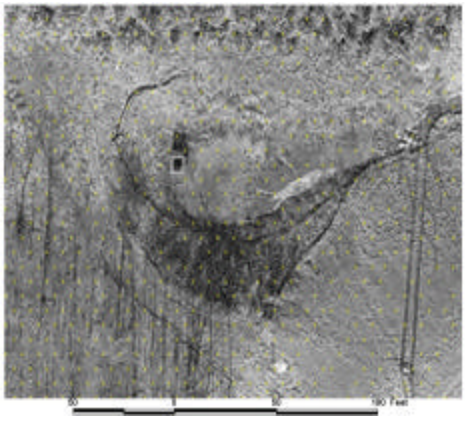

Figure 3. More than 600 BMPs were located using aerial photography in the Sweetwater and Upper Yellow River basins.

Identify Problem Areas

Sub-basins with impervious surface over 10 percent and stream reaches identified as degraded were overlaid to produce a map of problem areas. These areas were then targeted for more intense screening to identify the source of the problems, i.e. excessive hydrology from overland flow or in-stream conditions leading to degradation.

Develop Conceptual Solutions

Building off the steps above, potential new BMP sites will be identified using GIS methods and during field investigations. The approach generally consists of the following steps:

- Identify subwatersheds and stream segments where peak flows are increased due to urbanization
- Determine existing peak flows for each priority sub-watershed and segment using a GIS-based flow accumulation model
- Prioritize stream segments where channel degradation is due to upstream peak flow increases
- Use a GIS-based model to simulate potential BMP effects upon flow reductions and TSS.

Next, in coordination with the BMP projects, a list of evaluation criteria for potential stream restoration projects will be developed. Using the evaluation criteria, a matrix of candidate projects will be developed, including the type of restoration for each of the projects and planning level costs for each project. Potential projects will consider feasibility and project implementation issues. Project will be prioritized based on the benefits of the project (e.g. effectiveness at removing TSS, habitat improvements, flow reduction, etc.) and the feasibility of completing the project given the levels of service that are determined by Gwinnett County.

Capital Improvements Plan

A list of conceptual solutions, i.e., potential capital improvements projects will be developed and ranked based on the evaluation criteria. Projects and combinations of projects will be used to develop a prioritized CIP that will provide the most cost effective means for Gwinnett County to achieve its water quality goals for the Sweetwater Creek and the Upper Yellow River watersheds.

CONCLUSIONS

Gwinnett County is taking active steps to achieve water quality goals by developing a list of projects to address storm water runoff in developed areas. Both water quality and hydrologic issues are addressed. The methodology presented is useful for other developed cities and counties to prioritize projects that will ultimately help protect local streams.