A SUSTAINABLE WATER RESOURCES MANAGEMENT PLAN FOR A BIG CREEK

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REFERENCE: Proceedings of the 2003 Georgia Water Resources Conference, held April 23-24, 2003, at the University of Georgia. Kathryn J. Hatcher, editor, Institute of Ecology, The University of Georgia, Athens, Georgia.

Abstract. Fulton County, Georgia is developing comprehensive water resources management plans for its watersheds based on water reclamation facility (WRF) service areas, including Big Creek, Camp Creek, Deep Creek, Johns Creek, Little River, and Sandy Springs. The Water Resources Management Plans (WRMPs) are required by the County's National Pollutant Discharge Elimination System (NPDES) permit for the Camp Creek WRF expansion and the County's stormwater NPDES permit. Camp Dresser & McKee Inc. (CDM) prepared the Big Creek WRMP.

The management plans are addressing water quality (chemistry), habitat protection, water supply protection, flooding, and erosion to develop a sustainable water resources plan. The plans will include solutions to existing problems and fair and equitable development criteria to avoid problems from occurring in the future. CDM has also contributed to the Volume 1 Executive Summary and Volume 2 Methodology. These volumes contain summaries of the public information and involvement, data collection, infrastructure inventory, watershed characterization, hydraulic modeling, water quality modeling, and WRMP efforts.

This paper presents an overview of the program goals, constraints, data evaluations, computer analysis tools, and recommended management plan components for a sustainable stream.

INTRODUCTION

Fulton County, Georgia is coordinating regulatory initiatives and comprehensive water resources management goals to achieve sustainable water resources and fair and equitable growth. The plans include solutions to existing problems and fair and equitable development criteria to avoid problems from occurring in the future.

The CDM project team assisted Fulton County in developing this sustainable water resources program to protect public health and the environment for Big Creek. CDM worked with CH2M Hill, Brown and Caldwell, Ogden Environmental (now AMEC), and Parsons Engineering and Science, who have developed WRMPs for the other service areas.

The Big Creek WRF Service Area is approximately 70 square miles (43,000 acres) within the boundaries of Fulton County and includes the cities of Roswell and Alpharetta. Another 50 square miles of upstream tributary area lie in Forsyth County, Cherokee County, and the City of Cumming. Therefore, intergovernmental coordination is essential toward watershed-wide success. Big Creek is one of the largest service areas in the County, and it contains the raw water intake for the City of Roswell water treatment plant. It contains drinking water, fishing, and recreational designated uses. The Big Creek service area is being rapidly developed, and it is experiencing flooding, stream bank erosion, and water quality problems in several tributaries. Five streams in the study area are on the State of Georgia 303d list for partial or non-attainment of water quality for fecal coliform bacteria, including Big Creek, Hog Wallow Creek, Willeo Creek, Ball Mill Creek, and Foe Killer Creek. In addition, a variety of water quantity problems and issues were identified as part of the Watershed Initiative Network (WIN) of public workshops, which included stakeholders from across the communities. These included flooding of roads and buildings, erosion and sedimentation, and maintenance (Figure 1).

GOALS, OBJECTIVES, AND MANDATES

The County's goal is to develop and implement sustainable water resources management plan for Big Creek, and the other four service areas, complete with data and modeling tools necessary for managing point and non-point sources of pollution, erosion, and flooding hazards. The projects include:

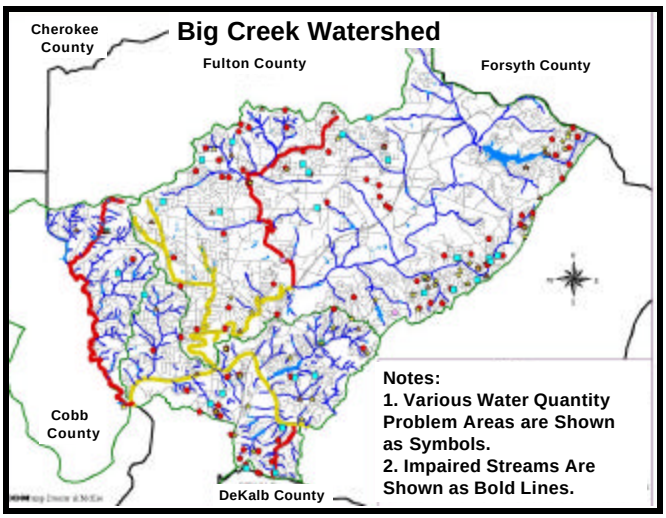

Figure 1. Big Creek watershed.

- Water quantity, water quality (chemistry), and biological assessment and characterization of streams;
- Identifying causes of water quality and biological impairment, flooding, and erosion;
- Developing implementable and flexible flood, erosion, and non-point source pollution management strategies; and
- Public involvement and education.

METHODOLOGIES

The CDM Team established 13 monitoring stations in the Big Creek Watershed to measure and evaluate water quality, habitat, benthic macroinvertebrates, and fish scores. These data were compared to reference stream data in relatively undeveloped watersheds as evaluated by all five watershed teams. The monitoring network included three stream gages for stage, velocity, and estimates of stream flow. This was coupled with monthly water quality data at the City of Roswell raw water intake from the 1970s through the present and EPD data gathered in 1995 to establish a baseline for aquatic integrity (stream and biotic health) and hydrologic, hydraulic, and water quality model calibration-verification.

CDM applied the United States (US) Environmental Protection Agency (EPA) Storm Water Management Model (SWMM) RUNOFF and EXTRAN modules for the hydrologic and hydraulic evaluations of the 2-, 5-, 10-, 25-, 50-, and 100-year 24-hour design storms. Hydrologic units averaged 50 acres for these models. The US EPA Hydrologic Simulation Program FORTRAN (HSPF) model was applied for continuous water quality simulations for the 1995 calibration year and for the 5-year time period from 1985 to 1989 because this included wet, dry, and average years in the historical record. These hydrologic units for the water quality model averaged 5 to 10 square miles in size. The Better Assessment and Science In Natural Systems (BASINS) graphical user interface was used to support HSPF.

Baselines for aquatic integrity and environmental health were established based on guidelines by GA EPD, EPA, and the National Academy of Sciences. The evaluations focused on fecal coliform bacteria, TSS, and Total Phosphorous (TP) to meet County aquatic integrity goals (recreational human contact along with benthic macroinvertebrate, fish, and habitat scores) and avoid eutrophication of downstream reservoirs.

CDM found that over 40,000 septic tanks had been permitted in the County since the 1940s, and developed a GIS database that address-matched nearly 28,000 of these. It was determined that septic tanks likely remained along streams that had higher fecal coliform levels due to difficulty and/or cost of sewer connection, and that many citizens were not aware that they may still have septic tanks from the WIN public meetings. CDM also used an antibiotic resistance analysis (ARA) to identify human versus animal and different types of animal sources to assist the County in its wastewater management program being performed by others. It was determined that animal contributions were significant in several tributaries and that human sources were evident during dry weather in several tributaries.

RESULTS

The results of monitoring data and modelling have indicated increases in several water quality parameters (fecal coliform, TSS, TP, TN, and metals), declines in fish and habitat, and increases in flow and erosion. Hydrologic changes and construction erosion/encroachment from development are the dominant causes of declines in fish/habitat and increases in erosion, flow, and TSS. Figure 2 shows an example TSS problem, and Figure 3 shows an example of one of the more severe erosion problems. Management plan components were developed to address each one of these issues, along with criteria for new and redevelopment to avoid future problems.

Figure 2. Watershed characterization – fecal coliform, erosion, nutrients, and sediments are increasing.

Figure 3. Severe erosion.

BIG CREEK WATER RESOURCES MANAGEMENT PLAN

The most effective methods to address the flooding, erosion, and water quality problems in Big Creek are by a combination of increased county operation and maintenance of storm water and wastewater infrastructure, retrofit facilities, and improved development criteria. The County and the watershed teams have identified three categories of actions during the course of this program based on priorities:

- Public health and safety
- Regulatory requirements
- Quality of life

Public health and safety were determined by the County to be of highest priority, closely followed by regulatory requirements. The following screening criteria were applied in plan options:

- Technically feasible and reliable – Flooding problems will be improved to level-of-service (LOS) guidelines to the "maximum extent practicable" (MEP), erosion will be managed by controlling hydrology (release rates) and in-stream velocities, and cost-effective water quality control is provided based on "knee of the curve" or diminishing return analyses performed by CDM (Figure 4). Conveyance solutions are gravity-driven.
- Socially and politically acceptable - The alternatives include public input on flooding, erosion, and water quality concerns from a series of public meetings with the WIN and other stakeholders to discuss potential solutions. The alternatives are likely to be permittable because they control or reduce nonpoint source pollutant loads to the streams to the MEP, maintain or lower flood stages and velocities, and do not adversely impact healthy wetlands.
- Environmentally acceptable - The recommendations have been formulated to be consistent with water quality requirements and goals; to minimize wetland impacts; to conserve freshwater where possible; and to protect fish, wildlife, and habitat. No ponds or BMPs were sited in healthy wetlands.
- Economically viable - The recommendations include detention sizing requirements for retrofit and for development based on "knee of the curve" analyses that consider diminishing returns.
- Financially feasible - The projects will need to be implemented in phases commensurate with the funding available. Therefore, solutions were geared toward a phased approach.
- Implementable - This plan must be implementable to meet the needs of the citizens. The screening criteria consider the constraints to implementability. Therefore, only implementable components have been considered in detailed plan formation

The plan has developed fair and equitable criteria to protect area streams for water supply, fishing, and recreation (Figure 5).

The recommended WRMP includes structural solutions to be built, and ordinances and standards to be regulated. The components will be phased based on priorities, and the County is working to build public-

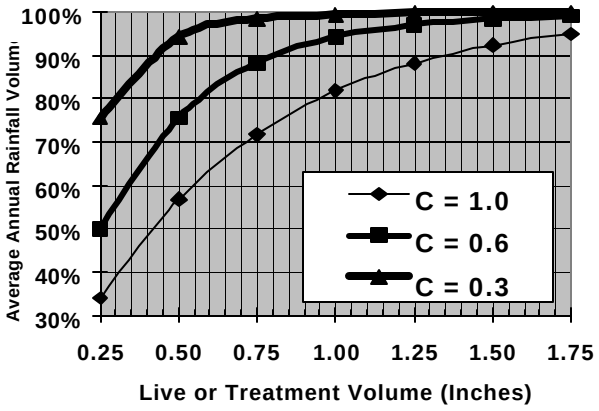

Figure 4. Fulton County – average annual volume capture versus detention volume.

private partnerships such that new infrastructure and retrofits can be coordinated to maximize benefits. The recommended WRMP components for a sustainable stream include:

- Public information and neighborhood projects (cleanups, check dams, bank stabilization, control illegal dumping);
- Erosion and sediment control (stronger enforcement with less variances);
- Wastewater management (correct sanitary sewer overflows and leaking sewers; septic tank maintenance, rehabilitation and replacement);
- New development controls including: detention for hydrologic control and treatment, landscape swales, floodplain protection, and stream buffers. The coordination of 100-year floodplain protection, coupled with stream buffers and control of natural hydrology, are crucial for maintaining sustainable streams;
- Stream restoration in more than 12 miles of critical reaches;
- Modify 270 existing lakes/ponds to improve treatment and attenuate hydrology;
- Fourteen culvert and bridge upgrades to reduce flooding;
- Pipe retrofits to treat runoff;
- Land acquisition of strategic environmental parcels;
- Regional wet detention ponds;
- Purchase low-lying homes; and

The estimated conceptual cost for this Big Creek WRMP is approximately $186,000,000, which will be phased in over a 20-year period.

Figure 5. Healthy stream example.

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