

NATIONAL WATER-QUALITY ASSESSMENT PROGRAM: EFFECT OF RESTRICTED PHOSPHATE DETERGENT USE AND MANDATED UPGRADES AT TWO WASTEWATER-TREATMENT FACILITIES ON WATER QUALITY, METROPOLITAN ATLANTA, GEORGIA, 1988-93

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ABSTRACT

Historic effluent discharge and water-quality data analyses from six wastewater-treatment facilities (WWTF) in Metropolitan Atlanta indicated that the phosphorus load discharged to the Chattahoochee River decreased by about 83 percent during the period 1988-93 because of legislated restrictions on the use of phosphate detergents and improved efficiencies of phosphorus removal within WWTF. The U.S. Geological Survey recently compiled influent data for two Cobb County WWTF. These data, when compared to effluent data, are used as an example of percent phosphorus removal attributed to the legislated restrictions and improved efficiencies within the WWTF. Even though the volume of water treated by the two WWTF increased because of population growth, phosphorus concentrations and loads discharged from the WWTF decreased by 91-94 percent. About 55 percent of the decrease in phosphorus concentration, and 31-33 percent of the phosphorus load occurred in the influent and was attributed to the legislated restrictions on use of phosphate detergents. The remaining decrease in phosphorus concentrations and loads occurred in the WWTF and was attributed to improved efficiencies in treatment processes.

INTRODUCTION

The U.S. Geological Survey (USGS) National Water-Quality Assessment (NAWQA) Program has compiled and evaluated existing water-quality data for the Apalachicola-Chattahoochee-Flint (ACF) River basin. As a part of the analysis of these retrospective data, the USGS evaluated discharge and phosphorus-concentration data, and estimated phosphorus loads for the six largest wastewater-treatment facilities (WWTF) in Metropolitan Atlanta. The results of that analysis indicated that during the period 1988-93, the phosphorus load discharged to the Chattahoochee River from these six Metropolitan Atlanta WWTF decreased by about 83 percent because of legislated restrictions on the use of phosphate detergents and improved efficiencies of phosphorus removal within the WWTF (Wangness and others, 1994).

In February 1989, the Georgia Environmental Protection Division (GAEPD) issued an Administrative Order requiring all major WWTF discharges (larger than 1 million gallon per day (Mgal/d)) between Lake Sidney Lanier (upstream of Atlanta) and West Point Reservoir (downstream of Atlanta) to reduce the average concentration of phosphorus in effluent to 0.75 milligrams per liter (mg/L) or less. Nine municipal and one industrial WWTF were in compliance as of 1993 (David Kamps, Georgia Environmental Protection Division, oral commun., 1994). The three remaining WWTF in this reach of the Chattahoochee River are owned by the city of Atlanta,

which negotiated a delay in meeting the 0.75 mg/L standard until July 4, 1996, followed by a more restrictive limit of 0.64 mg/L average phosphorus concentration to be met by February 1997. As a companion effort to the GAEPD restrictions the Georgia General Assembly passed two legislative measures to reduce phosphorus contributions from household laundry detergents. On March 30, 1989, the Georgia Water Quality Control Act—Low Phosphorus Household Laundry Detergents Bill (H.B. 719)—was enacted. This legislation gave local governments the authority to mandate the sale of household laundry detergents containing less than 0.5 percent phosphorus by weight. In 1990, additional amendments were made to the Georgia Water Quality Control Act (S.B. 696), effective January 1, 1991, which mandated that all household laundry detergents sold or used in Georgia have less than 0.5 percent phosphorus by weight, and all household or commercial dishwasher detergents contain less than 8.7 percent phosphorus by weight. The amendments, however, exempted detergents used in many agricultural, commercial, industrial, and health-care facilities.

The data base that has been compiled by USGS for the ACF River basin includes monthly mean-daily discharge and phosphorus-concentration data for effluent from WWTF. USGS recently compiled similar, but more limited, data for WWTF influent. The purpose of this paper is to present an estimate of the reduction in phosphorus concentrations and loads from the legislated restrictions and, by difference, estimate the reduction from improved efficiencies of phosphorus removal within the WWTF.

DATA COLLECTION AND ANALYSIS

Mean-daily effluent discharge and phosphorus-concentration data were obtained from Discharge Monitoring Reports filed monthly with the GAEPD. Influent phosphorus-concentration and supplemental effluent data were obtained directly from each WWTF in an attempt to compile as complete a database as possible. Effluent data for WWTF were more readily available than influent data. For the purposes of this paper, the volume of influent is assumed to be the same as the discharge value reported for the effluent. Complete records of mean-daily influent and effluent phosphorus concentration data for the period 1988-93 were only available for R.L. Sutton and South Cobb WWTF's in Cobb County.

Annual mean-daily wastewater discharges and annual average discharge-weighted influent and effluent phosphorus concentrations were computed from the monthly data for the two WWTF in Cobb County to determine the percent phosphorus removal attributed to legislated restrictions (influent data) and improved efficiencies within WWTF

(difference between influent and effluent data) during the period 1988-93. The total reduction in phosphorus concentrations and loads, in percent, was calculated using influent data for 1988 and effluent data for 1993. The percent reduction in concentrations and loads that is attributed to legislated restrictions on phosphate detergents was calculated using influent data for 1988 and influent data for 1993. The percent reduction in concentrations and loads that is attributed to increased efficiencies of phosphorus removal within WWTF was calculated as the difference between 100 percent and the percent reduction attributed to legislated restrictions.

RESULTS

Metropolitan Atlanta's population increased by about 43 percent (from about 1,845,000 to 2,635,000) during the period 1980-93 (Atlanta Regional Commission, written commun., 1994). Much of the wastewater originating in Metropolitan Atlanta is discharged to the Chattahoochee River. From 1988 to 1993, the mean-daily volume of wastewater entering the two WWTF increased by 47 percent at the R.L. Sutton and by 12 percent at the South Cobb WWTF (fig. 1).

Annual mean-daily concentrations of phosphorus in treated effluent discharged from the R.L. Sutton and South Cobb WWTF decreased by 94 percent during the period 1988-93 (fig. 2). Annual mean-daily concentrations of phosphorus in plant influent decreased by 55 percent in the R.L. Sutton WWTF and by 35 percent in the South Cobb WWTF. When influent data for 1988 and 1992 are compared for the South Cobb WWTF, the annual mean-daily concentration of phosphorus decreased by 55 percent. This indicates that about 55 percent of the total reduction in annual mean-daily phosphorus concentrations from these two plants was the direct result of legislated restrictions on the use of phosphate detergents, and the remaining reduction of 45 percent was the result of improved efficiencies of phosphorus removal within the WWTF.

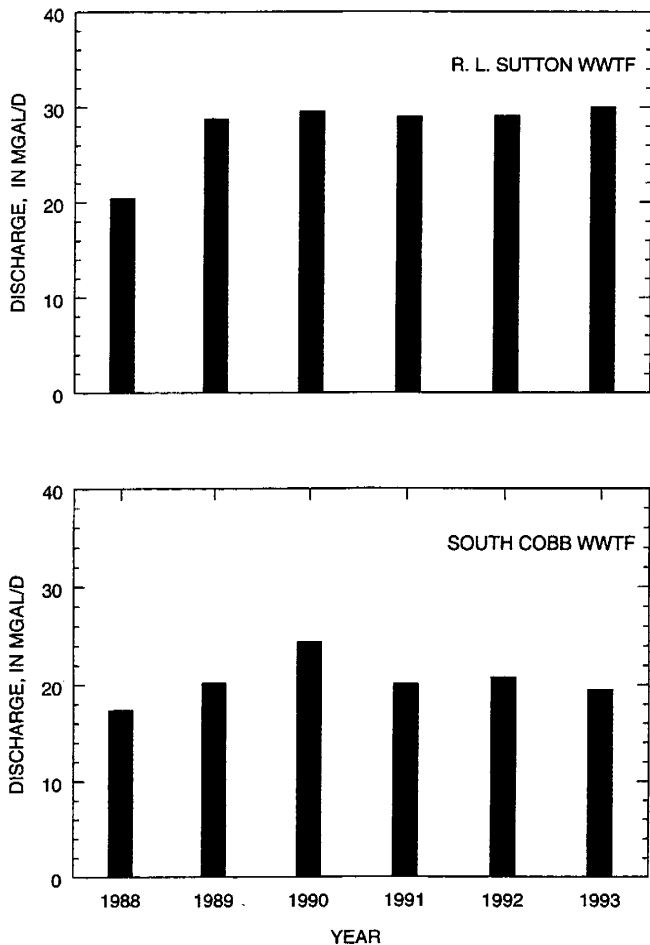


Figure 1. Annual mean-daily influent and effluent discharges at WWTF's, 1988-93.

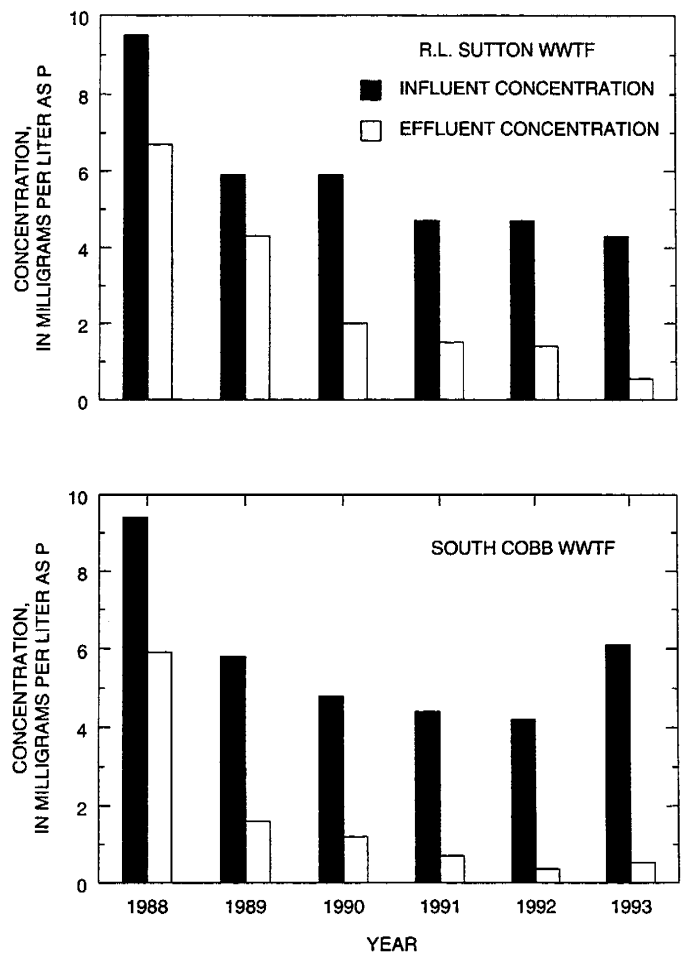


Figure 2. Annual mean-daily influent and effluent phosphorus concentrations at WWTF's, 1988-93.

Annual phosphorus loads in treated effluent discharged from both WWTF's also decreased during the period 1988-93 (comparison of 1988 phosphorus loads in influent with 1993 phosphorus loads in effluent) even though the discharge increased (fig. 3). The annual phosphorus load from the R.L. Sutton WWTF decreased by 91 percent, and the load from the South Cobb WWTF decreased by 94 percent. Annual phosphorus loads in plant influent decreased by 33 percent in the R.L. Sutton WWTF and by 31 percent in the South Cobb WWTF. These decreases in phosphorus loads are attributed to the decrease in phosphorus concentration following legislated restrictions on the use of phosphate detergents, and the remaining reductions (67 and 69 percent for S.L. Sutton and South Cobb WWTF, respectively) were the result of improved efficiencies of phosphorus removal within the WWTF.

LITERATURE CITED

Wangness, D.J., Frick, E.A., Buell, G.R., and DeVivo, J.C., 1994, Effect of the Restricted Use of Phosphate Detergent and Upgraded Wastewater Treatment Facilities on Water Quality in the Chattahoochee River near Atlanta, Georgia: U.S. Geological Survey Open-File Report 94-99, 4 p.

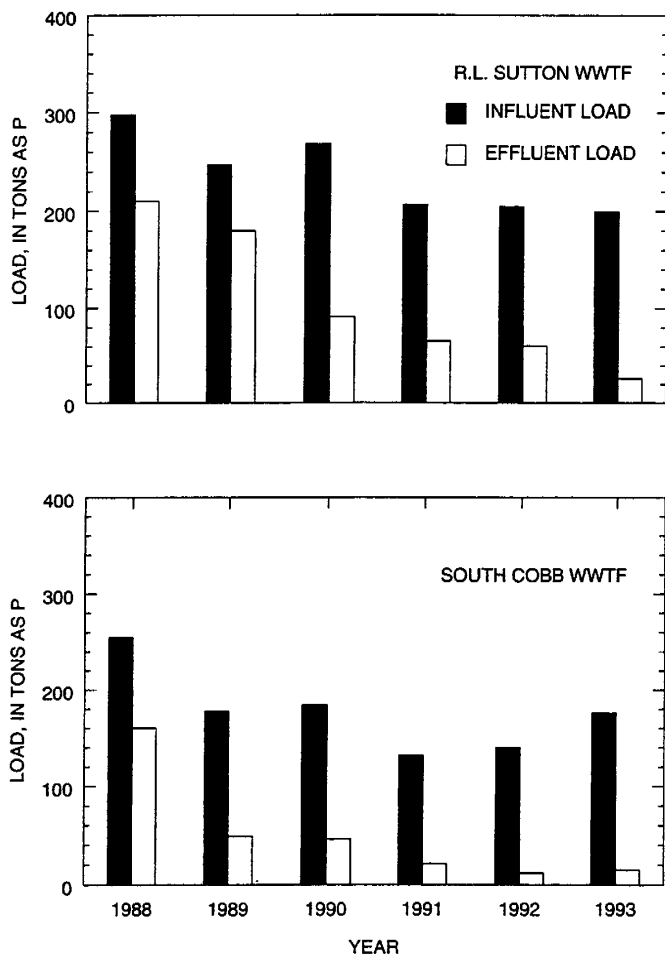


Figure 3. Annual influent and effluent phosphorus loads at WWTF's, 1988-93.