AXIOS RIVER BASIN WATER QUALITY MANAGEMENT

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ABSTRACT. This paper presents a consistent methodology to analyze the water quality management of a river basin. Mathematical modelling techniques are used to establish the water quality characteristics of the study area and to assess the effects of alternative management strategies in a quantitative way.

The Axios river basin in Northern Greece is used as a target area to demonstrate the capabilities of the methodology and the computational framework. The study provides a thorough examination of the water use in the river basin, the associated water quality standards, external factors influencing the water quality and alternative measures. Finally, a quantitative comparison of management strategies is given.

Key words. Water quality management, Axios river basin, Greece.

1 Introduction

The management of a river basin focuses on the various functions of the river basin and on possible conflicts between them. For a number of functions, water quality is an important criterion, for example the public water supply, recreation, fishing and the presence of nature reserve areas.

This paper presents a consistent methodology to analyze the water quality management of a river basin. Computational techniques play a very important role in this approach. During the study a mathematical tool has been developed that supports the analysis. This tool consists of a set of mathematical models and data structures to describe the water quality in a river basin and to predict the effect of various measures. The computational framework may be applied to a general type of Mediterranean river basins. The methodology, including the mathematical tools, is applied to the Axios river basin in the Northern part of Greece, in order to demonstrate the capabilities of such an approach.

The complete results of the present study were reported by Argiropoulos e.a. [1991].
2 Methodology for the water quality management analysis

The three keywords in the analysis of water quality management are the water system, its functions and the management. During the analysis the following steps must be taken [Miser e.a., 1985]: 1. The establishment of the functions of the river basin, and the connected water quality standards. 2. The determination of the characteristics of the river basin with respect to water quality. 3. The definition of alternative measures by the water management authorities inside the study area and alternative scenarios concerning the external factors that influence the water quality. 4. The analysis of the impact on the water quality of the different alternatives that were selected. 5. The evaluation of the chosen alternatives with respect to their desirability.

The second step of the analysis requires an exact recording and description of the water quality status of the river basin by means of regular and incidental monitoring campaigns. During the second and fourth step of the analysis the use of mathematical models may prove to be valuable. For the Axios river basin, two reports have been written dealing with these topics [Argiropoulos, 1991 and Van Gils, 1991].

The further explanation of the methodology presented above will be given in the example concerning the Axios river basin. Before this, the water quality modelling techniques that were used to support the management analysis will be discussed briefly.

3 Water quality modelling

The water quality model must offer a sufficiently adequate description of the fate and behaviour of all relevant water quality constituents. For Greek inland waters, water quality problems may arise due to bacterial pollution, due to oxygen depletion as a result of the degradation of organic material, due to eutrophication and due to pollution with toxic compounds (heavy metals, PCB's, pesticides, etc.).

The core of the water quality model is a general purpose programme to solve the advection diffusion equation. In one dimension it reads [Postma, 1990]:

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\frac{\partial C}{\partial t} + \frac{\partial C}{\partial x} + \frac{1}{A} \frac{\partial}{\partial x} [ A D ] + S = 0
\] (1)