1. Introduction

Water Resources Management is the an integrating concept for a number of water sub-sectors sub-sectors such as hydropower, water supply and sanitation, irrigation and drainage, and environmental environment (Gasinov and Yenilmez [7]).

The water resources management includes (Jairaj and Vedula [10]):

- The quantitative and qualitative exploration of water resources;;
- Water needs an requiring inventory records;;
- Measurement and matching of the water resources and water needs (demands) in a special system;; and
- Decision support depending with light of on the results.

Up to now, fuzzy set theory has been applied to broad fields. Fuzzy set theory introduced by Zadeh [28] make creates a model has to be that is set up using approximately known data which is approximately known. Fuzzy numerical data can be represented by means of fuzzy subsets of the real line, known as fuzzy numbers). For the fuzzy set theory development, we may referee refer to the papers of Kaufmann, [12], and Dubois and Prade [3]., they They extended the use application of algebraic operations of real numbers to fuzzy numbers by the use a fuzzifaction using a fuzzy principle. Fuzzy linear constraints with fuzzy numbers were studied by Dubois and Prade [3]. Lu et al. [16] introduced the definition of an inexact rough interval fuzzy linear programming method and investigated for generating the allocation of generated water allocation to agricultural irrigation system. In real- world the real-world problems, uncertainties may be estimated as intervals.,. Shaocheng [20] studied two kinds of linear programmings with fuzzy numbers called: interval numbers and fuzzy number linear programming, respectively. Tanaka et al. [22] have formulated and proposed a method for solving fuzzy coefficients linear programming with fuzzy coefficients.– Wang and Huang [25] developed an interactive two- stage two-stage stochastic fuzzy programming for managing water resources. They proposed an interactive resolution method within an inexact two- stage

two-stage stochastic programming. A ~~two- stage~~ two-stage optimization framework for planning reservoir operations ~~is~~ was proposed by Wang and Adams [23], where hydrologic uncertainty and ~~seasonally of~~ seasonal reservoir inflows ~~has been~~ were modeled as in a periodic Markov process. Through ~~a two- stage~~ a two-stage dynamic programming approach, ~~a long- term~~ long-term hydrothermal scheduling of multi-reservoir systems ~~has been~~ was examined by Ferrero et al. [5]. Bellman and Zadeh [1] introduced the concept of a maximizing ~~decision~~ decision-making problem. Zhao et al. [29] introduced ~~the~~ a complete solution set for ~~the~~ fuzzy linear programming problems using linear and nonlinear membership functions. For water resources management, Huang and Loucks [9] proposed ~~an~~ inexact ~~two- stage~~ two-stage stochastic programming. An interactive fuzzy resolution method for solving linear programming problems with fuzzy parameters ~~is~~ was proposed by Jimenez et al. [11]. For enhancing water resources management ~~developing~~, a number of optimization techniques ~~have been~~were developed (Slowinski [21], Wu et al. [26], Jairaj and Vedula [10], and Maqsood et al. [17]). A model for obtaining an optimal ~~multi- period~~ multi-period operation within a multi-reservoir system ~~is~~ was developed by Eiger and Shamir [4]. Xu et al. [27] investigated and applied an inexact ~~two- stage~~ two-stage fuzzy gradient ~~chance- constrained~~ chance-constrained programming method to the water resources management in ~~the~~ Heshui River Basin, Jiangxi Province. To quantify the economic ~~trade- offs~~ trade-offs when reducing groundwater abstraction to a sustainable level, Martinsen et al. [18] applied a multi-objective ~~multi- temporal~~ multi-temporal deterministic hydro economic optimization approach for this purpose. Fu et al. [6] proposed ~~a two- level a~~ a two-level symmetric ~~Nash- Harany leader- follower~~ Nash-Harany leader-follower game model to resolve the conflict that arises when different water users compete for a limited water supply. Khalifa [14] studied the water allocation problem using the ~~two- stage~~ two-stage fuzzy random programming. An ~~interval- valued~~ interval-valued fuzzy linear programming method ~~were~~ for modeling parameters with high vagueness ~~were~~was represented by ~~(~~Wang et al. [24], Goralczany [8], and Cai et al. [2]~~)~~. Khalifa and Al-Shabi [15] developed an approach for optimizing the water resources management problem based on the weighting method.

This paper aims to introduce and solve the problem of water resources management as ~~a two- stage~~ two-stage stochastic fuzzy linear programming. The problem is considered

by incorporating fuzzy numbers. A solution method for solving the problem with fuzziness in relations is suggested to demonstrate its applicability.

The remainder of the paper is organized as follows~~:~~ . Some preliminaries ~~needed in the sake of the paper~~ are given in ~~section2~~ Section 2. In ~~section~~ Section 3, a water resources management problem introduced by Huang and Loucks [9] and ~~-~~Wang and Huang [25] is introduced~~;~~ ~~and~~ hence, the problem is investigated in a fuzzy environment. Characterization of $\alpha -$ fuzzy optimal solution of the problem is ~~deduced~~ presented in ~~section4~~ Section 4. A solution method for solving the problem is proposed in ~~section5~~ Section 5.~~-~~ In ~~section~~ Section 6, a numerical example is given for illustration purposes. ~~Finally~~Finally, some concluding remarks are reported in ~~section~~ Section 7.