

## A GIS-based SINTACS model for assessing intrinsic groundwater vulnerability of the Alton Kopri basin, Kirkuk governorate northeast of Iraq.

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**Abstract.** The Alton Kopri Basin is an important and significant water basin in Kirkuk governorate where most of the area demand like drinking, agricultural, grazing, and industrial are depending on it. the basin consist of two main aquifers the upper aquifer formed by Quaternary deposits and the lower confined aquifer formed by Muqdadyi and Bai Hassan formations, the hydrological conditions for the lower aquifer changed laterally from confined to semi-confined down to unconfined from the center of the basin to northeast of the area. Flow direction from northeast to northwest coincident with topographic elevation trend. The annual groundwater recharge estimated by chloride mass balance method is (124 mm). It is important to assess the potential of ground water for pollution. For this purpose intrinsic vulnerability was assessed using SINTACS model with the aid of geographic information system (GIS) techniques. The final results show that two zones moderate and high vulnerability classes dominant the study area in the case of normal scenario occupied area are 423 km<sup>2</sup> and 649 km<sup>2</sup> respectively, the relevant scenarios represents with two categories, moderate category occupy 491 km<sup>2</sup> and high category occupy 549 km<sup>2</sup>. Three zones low, moderate, and high characterizes the nitrate scenario with 77 km<sup>2</sup>, 523 km<sup>2</sup> and 440 km<sup>2</sup> respectively, the SINTACS is the most subjective because of the wide range of the rating of some parameters. The high vulnerability zone exists in the most part of the basin center, where the unconfined upper aquifers exist. Accordingly, the impact of aquifer media, soil texture, and vadose zone is the most effective parameters in SINTACS model.

**Keywords:** Iraq, Kirkuk, Alton Kopri, Groundwater, Vulnerability, SINTACS.

### Introduction

The Alton Kopri Basin is an important and significant water basin in Kirkuk governorate. It supplies drinking water for over 95% of the rural population and over 50% of the urban population in this region. Protection of the groundwater in the Alton Kopri Basin has become a significant concern. Generally, the groundwater resources assessment is a key for integrated water resources management. Correct and detailed assessment of groundwater water resources is of great importance to plan, design, realize and manage any water resources development project. The results of the assessment are the basis for any decision making process, since they can lead to large investments and serious consequences on the environment (Al Mallah & Al Qurnawi 2018). Groundwater resources assessment



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