

## **ABSTRACT**

Communities around the Lake Kitangiri sub-basin rely primarily on groundwater as their main source of water for domestic use and various economic activities. Geographic Information Systems (GIS) and Remote Sensing (RS) play a crucial role in identifying suitable zones with high groundwater potential. In this study, groundwater potential zones were delineated using Geographic Information System (GIS) and Remote Sensing (RS) techniques combined with Multicriteria Decision Analysis (MCDA), i.e., Analytic Hierarchy Process (AHP). The assessment incorporated multiple thematic layers, including geology, geomorphology, slope, land use and land cover (LULC), lineament density, rainfall, drainage density, and soil type. GIS has been used to integrate and overlay thematic layers using a weighted overlay analysis tool, whereas the AHP method has been used to assign the weights, normalize, and rank thematic layers and their associated sub-themes based on their suitability, characteristics, or influence on Groundwater Potential Zones (GWPZs).

The output groundwater potential zone map is categorized into five suitable zones: extreme potential cover 1894.47 km<sup>2</sup> (3%), high potential 18188.84 km<sup>2</sup> (28.4%), moderate potential 39631.48 km<sup>2</sup> (61.9%), low potential 4296.96 km<sup>2</sup> (6.7%), and less potential 0.02 km<sup>2</sup> (0%), Hence, the study areas have been more suitable for groundwater potential zones as compared to the total area. The groundwater potential map was validated using the existing water source and well points. Thus, the delineated groundwater potential zone maps are reliable, and the resultant potentiality mapping has played a vital role in the sustainable development and management of the water resources in the study area.

**Keywords:** GIS; RS; Multicriteria Decision Analysis (MCDA); AHP, Groundwater Potential Zones (GWPZs).