PHD SYNOPSIS

Title: DELINEATION OF GROUND WATER POTENTIAL ZONE USING GEOSPATIAL TECHNIQUES AND ANALYTICAL HIERARCHY PROCESS IN GEDABO CATCHMENT, ETHIOPIA

By

Eyoel Yigeltu

Dilla University, College of Engineering and Technology

School of Hydraulics and Water Resources Engineering

Department of Water Resources and Irrigation Engineering, Dilla, Ethiopia.

Mobile Numbers: 0935969090 P O Box 419 Dilla, SNNPR, Ethiopia Fax +251 (46) 331 2564

E-mail address: eyigeltu114@gmail.com

Eyuely@du.edu.et

ABBREVIATION

DEM	Digital Elevation Model
GIS	Geographic Information System
LU/LC	Land Use / Land Cover
NMA	National Meteorology Agency
RS	Remote Sensing
SRTM	Suttle Radar Topographic M

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1. INTRODUCTION

Water is the foremost essential and imperative asset for human life. It is reducing rapidly in rustic and urban regions since of use of water in agribusiness as well as in residential sectors. Ground water is picking up more consideration owing to the shortage of surface water and lack of precipitation. There's water scarcity in a few Dilla Town is one of these. Due to little and insufficient sum of new water people ordinarily take off their minimal lands desolate without any edit or vegetation. Endeavors are subsequently required to find surrogate source of water for financial help.

Ethiopia, being one of the foremost hydrologically favored nations in east Africa, is accepted to have a expansive ground water potential. Ponders appear wrong comes about of 2.5 BCM by WAPCOS, to 185 BCM by Alemayehu, in 2001 (Moges, 2012). Which can be taken as a sign of how much nitty gritty ponder and overview is required to appraise the countries resources with distant much better higher stronger improved a distant better accuracy. This uncertainty in estimation can have a ruining impact on the nations interest to utilize its water assets potential to the limit.

Satellite data is useful for determining the parameters that control groundwater life and movement (Pandiyan et.al., 2013). The ability to generate information spatially and temporarily, which is critical for accurate research, prediction, and verification, is one of the unique advantages of using remote sensing data for hydrological investigations and monitoring. As a result, remote sensing and geologic mapping are used.

Many studies have been carried out for searching the ground water potential zones in the topography of solid rock. Routine strategies were utilized to distinguish the potential ground water zones based on physical field overview. A part from customary strategies, unused innovations and methods are being connected utilizing adjacent inaccessible detecting and Geographical Data Framework for classifying the ground water potential zones. Ground water circumstance differs with the distinctive landscape, topographical, hydrological and geomorphological parameters. A number of analysts are using the application of farther detecting and GIS in this field. The inclusion of distinctive parameters allows the different results appropriately. Ground water potential zones can also be looked based on as it were the lineaments as well as another combined parameter (Lillesand et.al., 2000)

The viable improvement of the groundwater assets will have a significant effect on the advancement of the community business. In reality, producing groundwater potential outline contains a critical effect to improve feasible administration of groundwater resources within the think about range as well as within the nation. Hence, a point by point consider has been performed to distinguish the potential ranges of groundwater assets for superior utility. In like manner, this paper contributes by giving depicted groundwater potential zones through executing farther sensing techniques and GIS devices to have legitimate organization, administration, and feasible utilize of groundwater assets within the sub-basin. Seven determinant components, to be specific, Drainage density, lineaments, Slope, Soil, Lithology, LULC, Geomorphology, were accounted for within the study.

1.1 Aim and Objectives of the Study

The aim of this study to identify the ground water potential of the study using geospatial techniques and analytical hierarchy process.

Within this aim, the objectives will be identified as follows:

1. To develop thematic layers for groundwater potential zone development,
2. To identify and delineate suitable groundwater potential zones through the integration of different thematic layers,
3. To prepare spatial variability of groundwater zones,
4. To demonstrate the capabilities of remote sensing and GIS in groundwater mapping.

1.2 Research Questions

1. Are there any potential sites for Ground water in Gidabo river catchment?
2. Is it possible to use GIS and Remote Sensing for localization of potential sites for scale ground water potential?

1.3 Scope and Limitation of the Study

The research is limited to the GIS-based Ground water potential assessment for identification of the location of available ground water potential: on Gidabo River catchment South Nations Nationalities and Peoples, Ethiopia. Ground water potential assessment is dependent on the available Drainage density, lineaments, Slope, Soil, Lithology, LULC, Geomorphology. For this study, DEM downloaded from Earth Explorer has been used. For detail investigation and design purposes, surveying of an identified specific location must be carried out. In addition to this, the study will also be limited to address the ground quality and its suitability for different aspects such as drinking, agricultural and industrial activities.

1.4 Description of the Study Area

1.4.1 Location

Gidabo river catchment is the sub-catchment of Rift Valley river basin and situated between latitudes 6°10'N and 6°57'N and longitudes of 38°05'E and 38°38'E in Ethiopia. It covers a total land area of 3302 km^2. Gidabo River rises at an elevation of about 3,280m in the Soka Sonicha mountain ranges, southeast Ethiopian highlands, and flows to Abaya Lake, to North-westwards having 1124m.

A significant portion of the catchment is a collection of the permanent and intermittent streams arises from the highlands of Chuko, Aleta Wondo, Bursa and Dara districts from Sidama Zone, and Dilla town, Dila Zuria and Bule districts from Gedio Zone. Dilla town and Aleta Wondo town are the most popular towns in the catchment area of the river.

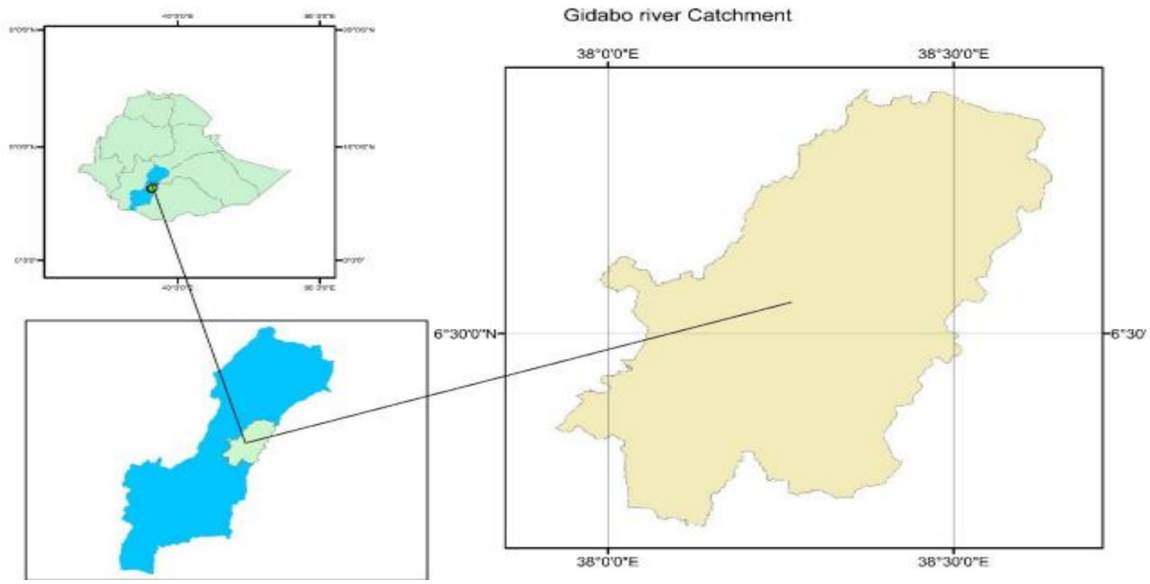


Figure 1.Location of the study area

1.4.2 Topography and Geology

The Gidabo river catchment being part of the Rift valley was formed by volcanic activities in the Rift valley during the period of Pliocene and Holocene. Accordingly, it is believed that ancient basement rocks lie-under the whole rift valley. The catchment is a sub-catchment of the Rift Valley river basin of Ethiopia, which is the main part of the Great East African Rift Valley, the geology of which is made up of volcanic rocks outpoured in the quaternary and tertiary period.

The formation mainly comprises acidic rocks in association with weathering derived soils overburden and lacustrine deposits of the flood plain. Some parts of the upper reach, all of the middle reach and the upper half of the lower land area, are characterized by trap series alkali basalts and trachyte of the tertiary period, generally known as Oligocene basalt flows. The remaining half of the lower reach, at the flat area around the lakes, is covered with quaternary period alluvium deposits (Ababu, 2005).

According to the study of WoldeGabriel et al., 1990 and Boccaletti et al., 1995, the southern part of the rift, which includes Gidabo River catchment, is dominantly covered with acidic rocks with silica-rich including much ash and pumice. Rhyolite, pyroclastic fall deposits and alkaline basalt are the primary volcanic units for rock formations in the study area. Their outcrops are notably exposed along the roads and stream cuts. This unit characterizes the slope in the eastern part of Abaya Lake. Lacustrine deposits encompass the marshy flood plain next to the lake.

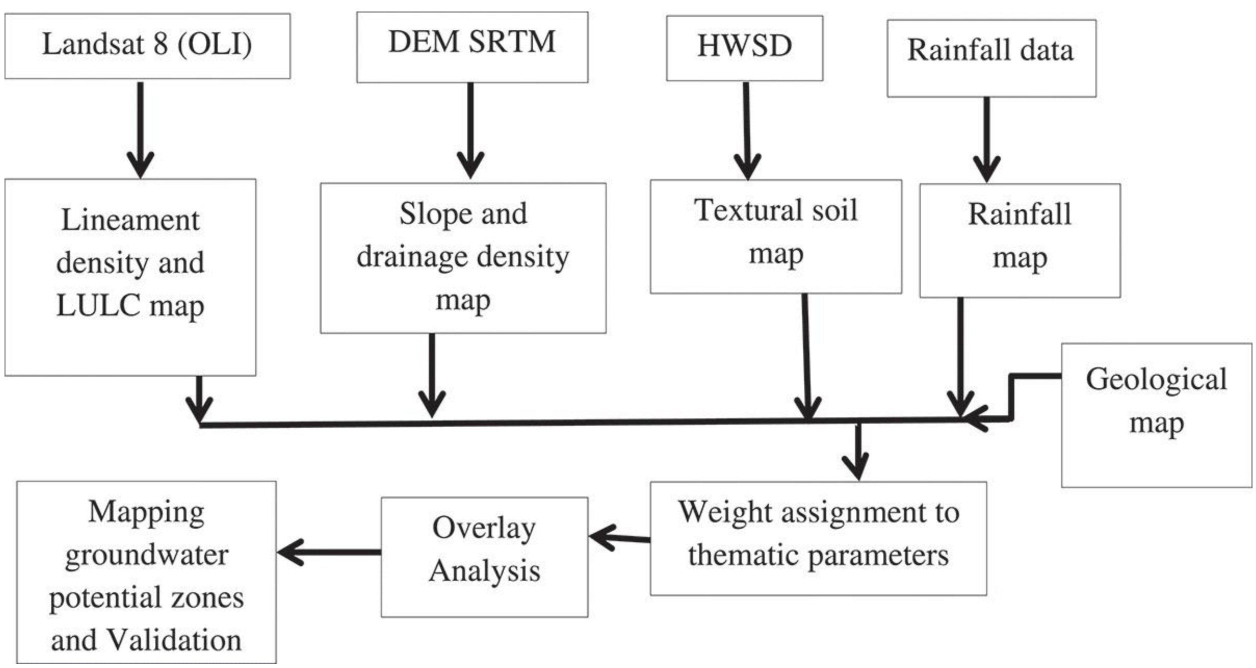
2. Methodology

In this Study, various types of data and software will be used in this analysis. Using the ArcGIS instrument, a digital elevation model (DEM) with a resolution of 30 meters will be obtained from the Shuttle Radar Topography Mission (SRTM). Filling sinks, flow direction, flow accumulation, and stream network extraction are all part of the drainage density creation process.

After that, a line density analysis tool swill be used to build the drainage density chart. The USGS website will be used to acquire a Landsat 8 Operational Land Imager (OLI) satellite image, which will be used to produce lineament density and LULC maps (USGS, 2019). PCI Geomatica's line module will be used to perform automatic lineament extraction. The daily rainfall data of and groundwater well data will be collected from the National Metrological Agency and Ethiopian Ministry of Water, Energy and Electricity, whereas geological data will be obtaine from the Ethiopian geological survey. A rainfall map will be develop using inverse distance weight methods. Soil map of the study area will be prepare using the Harmonized World Soil Database (HWSD).

Once the thematic maps will be developed the weight will assign to the parameters influencing groundwater occurrence and movement. Then, groundwater potential map will be develop using weighted index overlay analysis. The groundwater potential index will be calculate using a weighted linear combination method (Malczewski, 1999) In general, the study procedure adopt will be shown in the flowchart (Figure 2).

Figure 2. Conceptual framework adopted for the generation of groundwater potential map



$$GP_x = L_w L_r + Lc_w Lc_r + Ld_w Ld_r + Sg_w Sg_r + Dd_w Dd_r + R_w R_r + S_w S_r$$

where GP_x is the groundwater potential index [-]; L is the score of lithology [-]; D_d is the score of drainage density [-]; L_d is the score of lineament density [-]; S_g is the score of slope gradient [-]; L_C is the score of LULC [-], S is the score of soil [-], and where the subscripts w and r refer to the weight of a theme and the rate of individual features of a theme, respectively.

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