GEOSPATIAL ANALYSIS OF URBAN GROUNDWATER QUALITY BY UTILIZING GIS - A CASE STUDY IN GAMPAHA DISTRICT SRI LANKA

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Introduction

In Sri Lanka, the need for groundwater is always growing, particularly for irrigated agriculture, the industrial sector, and urban/rural water supplies. According to information from the National Water Supply and Drainage Board (NWSDB), Sri Lanka has 30,000 deep groundwater wells. Shallow karstic aquifers, lateritic aquifers, shallow regolith aquifers, deep confined aquifers, alluvial aquifers, and coastal sand aquifers are just a few of the six main types of aquifers that Sri Lanka has identified. In addition to these aquifers, many groundwater pockets can be found in Sri Lanka. Groundwater in Sri Lanka is about 8 km^3 (IGES Freshwater Management Project, 2007). Development and urbanization directly affect the groundwater quality and agricultural, commercial, residential, industrial, and municipal activities contribute to the deterioration of groundwater quality in urban areas. In urbanized areas due to the increase in population, temperature and garbage can be effective for the quality of groundwater and quality of drinking water. As a result of rapid urbanization, groundwater quality can be changed. Gampaha district is the most populous district in Sri Lanka and it is one of the important cities in our country facing significant urbanization and development.

Therefore, a comprehensive study of groundwater quality for the Gampaha district is significant. But there is still no comprehensive analysis of groundwater quality in the Gampaha district. Therefore, this investigation supports a comprehensive investigation of the quality of groundwater in the Gampaha district that can be used to further analysis. Hence, water resources in the Gampaha district can be used properly way and can get the real picture of the drinking water quality in the Gampaha district. The specific objectives of this study are to identify major factors that affect the groundwater quality in the Gampaha district and map the spatial distribution of those factors. According to these specific objectives the major objective of this study is to map the groundwater quality in the Gampaha district and assess suitability for drinking purposes using GIS.

Methodology

The type of research is quantitative and secondary data is used for carrying out the study. This study consists of a descriptive approach and by using GIS and

geostatistics techniques groundwater quality map was prepared. For the analysis, ArcMap 10.5 software was used.

Groundwater quality data was obtained from National Water Supply and Drainage Board (NWSDB) and the land administrative boundary of the Gampaha district was obtained from the survey department of Sri Lanka. There were more quality parameters defined by the world health organization such as the potential of Hydrogen (pH), Iron, Electrical Conductivity (EC), Hardness, Nitrate, Sulfate, and Chloride like that (World Health Organization 2004). EC, pH, Iron, Chloride, Sulfate, Hardness, and Nitrate are the identified parameters that impact the quality of groundwater in the Gampaha district according to NWSDB and WHO guidelines. WHO standards were used for the analysis of the quality of drinking water in the Gampaha district. Root Mean Square Error (RMSE) calculations were used for accuracy assessment and water quality index calculations were used for weights calculation of the parameters.

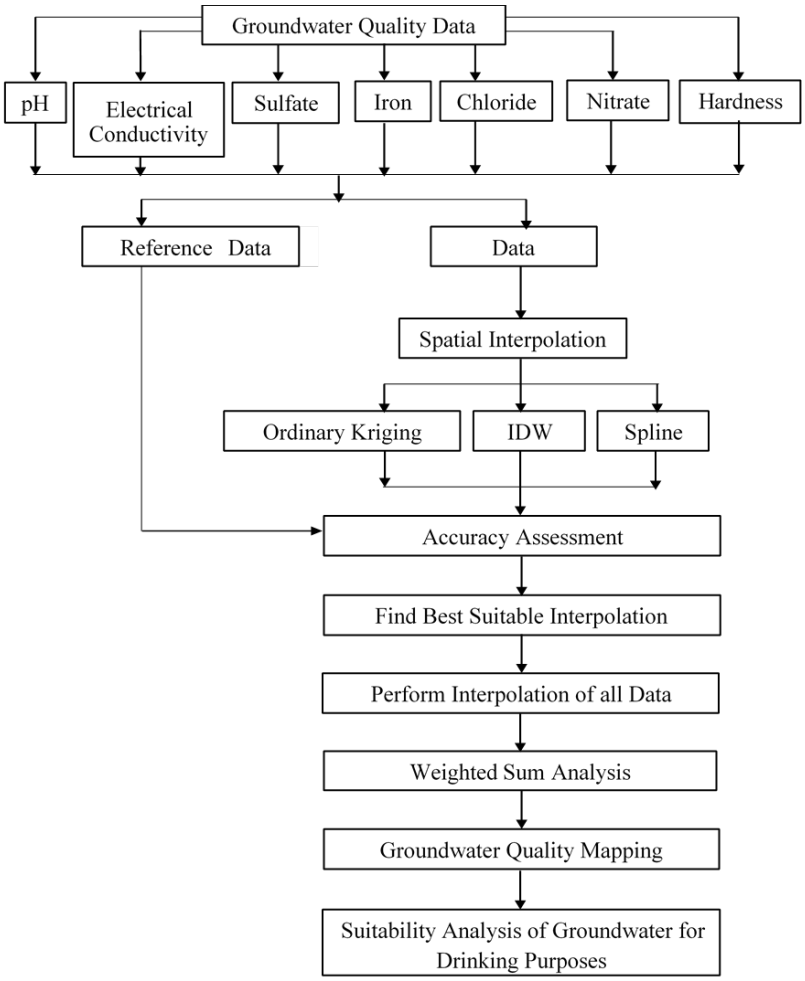

Figure 1: Experimental Design

Results and Discussion

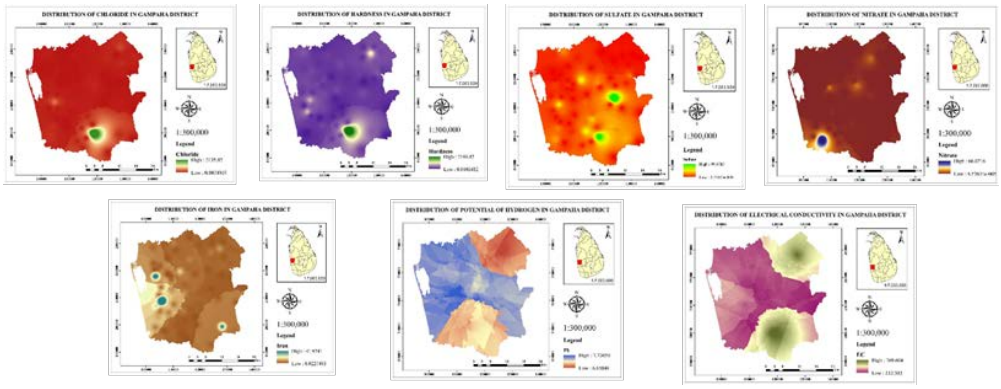

Figure 2: Spatial Distributions of Quality Parameters

Table 1. Area coverage of classified classes

Class	Area(km^2)	Percentage
Suitable	68.6175	5%
Moderate Suitable	892.78	65%
Highly Suitable	420.7425	30%

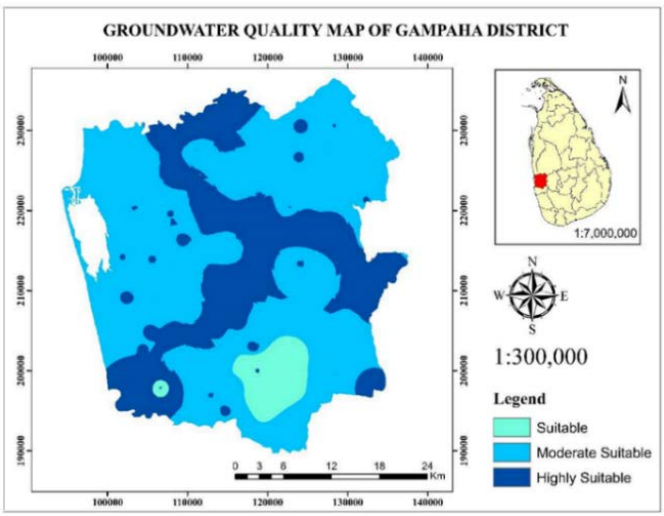

Figure 3: Groundwater Quality Map

According to the final output, the quality of groundwater was good in the Gampaha district and the water quality of the whole area in the district was appropriate for drinking purposes. Therefore, haven't polluted groundwater in the Gampaha district according to WHO guidelines. The result of the final groundwater quality map is categorized into three classes such as suitable, moderately suitable, and highly suitable using WHO guidelines for drinking water quality. Table 1 shows the area coverage of each class. As a result of the analysis, most of the areas were moderately suitable for drinking purposes a percentage of sixty-five. Thirty per cent of the area was highly suitable for drinking purposes and five per cent of the area was suitable for drinking purposes.

According to this study, the urbanization and development of the Gampaha district have not affected the quality of groundwater. Therefore, the Quality of groundwater has not changed due to industrial, agricultural, commercial, and residential activities. And also, all the groundwater in the whole area is suitable for drinking purposes. Therefore, all the people in the Gampaha district can be used groundwater for drinking, agriculture, and other purposes.

Conclusion

Groundwater quality mapping is significant for Sri Lanka because most of the people in the Gampaha district use groundwater for their work, especially for drinking purposes. Therefore, the quality of water is significant. The Gampaha district is one of the greatest urbanized and populous districts in the country. Therefore, the main objective of this study was to map the quality of groundwater in the Gampaha district using GIS and geostatistical techniques to generate a clear picture of the current context. GIS is the best tool for mapping, querying, and analysing.

This study shows all the people in the district still can use groundwater for drinking purposes. Hence should be avoided unnecessary use of water in tap lines and try to use groundwater for day-to-day life useful. From that can reduce purification expenditures and can use the natural resources in the country effectively. It may be helpful for the development of the country and economy.

References

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