

Publication

Kereyu D. D., Oonge Z. I. and Ndiba P. K. (2014). Application of GIS to Water Quality Management for the City of Nairobi Water Supply. *ICASTOR Journal of Engineering*, 7 (1), 5 – 23.

ICASTOR Journal of Engineering
Vol. 7, No. 1 (2014) 5 – 23

Application of GIS to Water Quality Management for the City of Nairobi Water Supply

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ABSTRACT

Water quality management with the aid of geographical information system (GIS) is a recent technology driven development that seeks to establish relationships between geographically referenced parameters to assist in decision-making. Although the City of Nairobi collects water quality data routinely it does not carry out comprehensive analyses and interpretations mainly because of a lack of data manipulation and analyzing tool. This study applied GIS statistical functions "Analyzing Patterns" and "Mapping Clusters" to year 2008 to 2011 water quality data of the 549,500 m³/d capacity City of Nairobi water supply. The analyses revealed regional variability for some water quality indicators and random distribution for others. Irrespective of variability, water quality indicators for surface water sources are within the WHO guidelines except for occasional or seasonal elevated turbidity and concentrations of iron, manganese, nitrates and lead. Hardness and alkalinity are below 25 mg/L as CaCO₃, indicating soft water with limited buffering capacity. Kikuyu Springs and Ruiru Reservoir exhibited greater concentrations of chlorides, dissolved solids and conductivity than the other surface water sources, which may be associated with impacts of urbanization on their catchment areas. Fluoride concentrations above WHO guideline limit of 1.5 mg/L are observed for boreholes and distribution systems in the central, eastern and southern part of the City and attributed to fluoride rich geological formations. The findings do not favour the current injection of borehole water into distribution system to supplement the main sources of water supply. Free residual chlorine (FRC) low and high values outside the WHO guideline range 0.2 to 0.5 mg/L observed in the eastern and western parts of the City, respectively, may assist in establishing appropriate of disinfection dosage for the distribution zones. The study demonstrated that observations of spatial variability of water quality parameters and their interpretations could assist managerial decision-making on control and improvement measures.

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Papers for our PC
17/2/14

