

Integration of Groundwater Vulnerability Assessment in Landfill Site Screening at the Local Level: Case Study in the Prestea Huni-Valley Municipality of Ghana

Edward A. A. Kwesi, Kwame Tenadu, John K. Annan, Matthew Homiah and Jonathan Annobil (Ghana)

Key words: Geoinformation/GI; Remote sensing; Spatial planning; Urban renewal; Landfill Site Screening; Multicriteria Decision Modelling; Constraint Mapping; Groundwater Vulnerability Assessment; Prestea Huni-Valley; Waste Management

SUMMARY

This paper presents the steps and results of a GIS-based site selection method that explicitly accounts for groundwater protection in the selection of landfill sites for municipal solid waste (MSW) management by integrating groundwater vulnerability assessment as a criteria in addition to meeting existing regulatory requirements and local conditions. This is especially important for urban mining areas in Ghana and other developing countries where there are rising urbanization, waste generation and disposal problems, environmental pollution and health hazards from mining operation and waste dumping at inappropriate locations. A case study approach is adopted with the Prestea Huni-Valley Municipal Area (PHMA) as the study area. Equipment used include a desktop computer, ArcGIS and Microsoft Office Software, Google earth, GPS receiver and field cameras. With the waste management needs of the study area and the regulatory requirement as bases, the necessary data sets were gathered and organised into a spatial database suitable for site selection analysis. The factors considered included proximity to rivers, roads, railways and settlements; land-cover type; slope; hydrogeology; and groundwater. The ArcGIS was vital for the preparation of the spatial database, processing models and the generation of criterion and output maps and other analytical steps and results. The analysis was done in a 2-stage constraint mapping fashion using tools and methods like buffering, overlays, raster-vector conversion, boolean algebra and “model-builder”. The initial constraint mapping produced a number of sites that met the regulatory requirements but these were reduced to a few suitable ones in the second stage where ground water vulnerability analysis was applied to exclude areas of high groundwater contamination risk from the candidate sites. The methods and final results which indicate both the prohibited and suitable sites are available to support improved waste disposal efforts in the study area. The paper recommends the method for use by waste management departments in PHMA and other similar areas and that groundwater vulnerability analysis should be included in the site selection process as demonstrated in this paper.

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FIG e-Working Week 2021

Smart Surveyors for Land and Water Management - Challenges in a New Reality

Virtually in the Netherlands, 21–25 June 2021