GIS-based site selection for hazardous waste disposal facilities in Penang and Kedah

ABSTRACT

The GIS with an integration of multicriteria decision analysis (MCDA) has been widely applied in many areas to assist in siting facilities. The application of both has been demonstrated to produce sound decisions. This study is focused on site selection process to determine the location for hazardous waste disposal facility, with a case study on Penang and Kedah. A model was developed that incorporated criteria to be used for exclusionary areas and factor map. AHP method was used to assign weight for evaluation criteria which will be used as input in GIS analysis. There are ten constraint criteria: surface water (SW), environmentally sensitive lands (ESL), environmentally protected areas (EPA), areas with high groundwater pollution risk (HGPR), prohibitive geological conditions (PGC), topography (TOPO), land uses (LU), road networks and transportation (RNT), infrastructures and utilities (IU), and population and public places (PPP). The four factor maps were population and public places (PPP), topography (TOPO), road network and transportation (RNT), and geology (GEO). The model of site selection involved three phases: (1) generation of final constraint map, (2) generation of final factor map, and lastly (3) generation of final suitability map. The final suitability map has been classified into five discrete categories: (0) not suitable, (1) least suitable, (2) suitable, (3) moderately suitable, and (4) highly suitable. The model has generated about 95 % of study area to be excluded as potential sites. The remaining 5 % of land that was suitable for siting was further evaluated to identify their location. Those sites were in Putat, Padang Perahu, Jeram, Padang Lalang, Tebengau, Kangkong, Dulang, Singkir, Sok, Baling, Padang Meha, Bagan Sena, Sedim, Mahang, Sungai Batu, Kuala Selama, Karangan and Terap. The integration of GIS and MCDA has absolutely improved the site selection process, thus enhance decision making.

Keyword: Geographic information system; Site selection; Multicriteria decision analysis; Hazardous waste disposal facilities; Suitability index