UNIVERSITI TEKNOLOGI MARA

LAND USE/LAND COVER FORECASTING OF FUTURE DEVELOPMENT AND ITS IMPACT ON HYDROLOGICAL RESPONSE IN MONSOONAL CATCHMENT AREA OF KELANTAN, MALAYSIA

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Tekonologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledge as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

Land use/land cover (LU/LC) change is related to the human need and demand such as residential, industrial, and commercial. As urban land development increase, the condition of the land surface may vary. Varies in land surface will assign negative impact to surrounding nature, such as flood occurrence in term of runoff. Therefore, this research attempts to study the cause and effect between LULC and runoff changes based on simulated future scenario analysis using geospatial-hydrological modelling approaches. The objectives of this study are i) to analyse suitability factors for future urban land development with the aid of the GIS planning support system software (i.e. Arc GIS 9.3 and What-if? 2.0), ii) to produce map of suitability and allocation areas for future land use development of Kelantan sub-basins (2020s, 2030s, 2040s and 2050s) and, iii) to simulate and quantify hydrologic responses changes of event-based rainfall due to simulated future land use changes (2020s, 2030s, 2040s,2050s) through hydrological modelling (i.e. HEC-HMS).The first analysis performed was to define the suitable area to be developed based on the selected factors which are slope, river, urban buffer, road network and demography data (i.e. population and employment information). Those factors were used in presenting the suitability of land area to be developed as low, moderate and high development scenario. Referring to the simulation of the future land development projection analysis through What-if? Software, the projected land use area such as forest, agriculture and built-up area are changing from the baseline years of 2010. Each sub-basin (i.e. Nenggiri, Galas, Pergau, Lebir, Kuala Krai and Guillemard Bridge) show the increase in built-up land development from a baseline 2010. Meanwhile, the forest and agriculture land area show the decrease value for every sub-basin area either for low, moderate or high development scenario. The Lebir sub-basin shows the highest increased in the projected built-up land in the year of 2050 with 69.70% based on the high development scenario. Meanwhile, the Nenggiri sub-basin stated the lowest projected built-up land area of 0.98% based on the high development scenario. Subsequently, the result obtained in the second objectives was used in the final analysis of the impact projection land use land cover in the future flooding. The result reveals that the high development scenario contributes to the predicted changes in peak discharge is increasing at downstream area. The Lebir sub-basin recorded increasing of flood occurrence at 36.39%, meanwhile, for the runoff is recorded to increase by 41.45%. Meanwhile, the low land development scenario predicted changes in peak discharge is increasing at upstream area. The Pergau sub-basin recorded the increasing rate of peak discharge at 19.53% and for runoff volume recorded increasing value at 20.73%. Therefore, this study provides an indicator of what will occur in the future if such projected land use land cover development using geospatial analysis were taken place. Thus, concrete the evidence that changes in land use land cover have brought the negative impact to the flood occurrence. This study is benefited in the decision making process, particularly for the urban planner as well as water resources manager in relation to reduce flood impact in the future.

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CHAPTER ONE
INTRODUCTION

1.1 RESEARCH BACKGROUND

Land use/land cover (LU/LC) classes differentiate vital information on natural landscape and human activities on the Earth's surface (Ikiel et al., 2012). LU/LC is an abstract concept, which categorize as agricultural, industrial, residential, recreational and other activities. Specifically, it is defined as characteristic of the arrangements, activities and inputs people undertake in a certain land cover type to produce, change or maintain it (Erickson, 2010). It also includes near-surface water, which usually used to satisfy multiple objectives or purposes.

LU/LC is one of the natural components helps in balancing the earth's ecosystem. Every single thing on the land (i.e. trees, grass, root trees) assists the hydrology cycle by supporting the process of evaporation, infiltration and transpiration through vegetation plant and soil. However, since year by years, increasing population in line with human demands has brought modifying issue of land become crucial nowadays. Modifying an existing structure of the soil component of land area from non-impervious to become impervious surface brought negative disaster such as flood to living things.

Flood is one of the occurrence disasters that could harm human and living things. It is an environmental venture that can occur almost everywhere around the world and denoted as an overflowing of water onto land that is typically dries (Junk, 1997; Mays, 2001 and NOAA, 2012). Floods anguish all features of life and might have miserable economic development in highly flood flat areas. Such in Thailand, flood events in 2011 have leaded a quarter of the country covered in water with many farms and rice were damaged and also destruct automotive industry and supply chain according to the Vice President of APAC, Automotive & Transportation, Vivek Vaidya and the Research Manager, Vijay Rao (APAC, 2011). While in Malaysia, floods also initiated by torrential monsoon rains in Malaysia has strained 14000 people to flee from their residential and search for sanctuary (AEDT (Australian