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Conservation of underground water with the ecosystem approach to the development of the New towns in Bogor, Tangerang, Bekasi (Botabek) Region

Parino Rahardjo^{a*}, Djoko. M. Hartono^b, Emirhadi Suganda^c, Hadi Susilo Arifin^d

^aDoctoral Student of Environmental Science Study Program, University of Indonesia/Faculty of Urban & Regional Planning Department, Faculty of Engineering, University of Tarumanagara, Jakarta, Indonesia.

^bCivil Engineering Department, Faculty of Engineering, University of Indonesia

^cArchitecture Department, Faculty of Engineering University of Indonesia

^dLandscape Architecture Department, Faculty of Agriculture. Bogor Agricultural University

Abstract

The limited supply of clean water led to some residents in the city, as well as business and trade areas using underground water. Optimization of land used in the development of new towns and expanded impervious land surface, thus reducing infiltration capacity, resulting in an increased volume of runoff. The use of underground water and the reduced infiltration of rainwater resulted in a decrease in the underground water table. To maintain the underground water table and preventing land subsidence resulted from the use of underground water as raw material for clean water. The effort required is how doing underground water conservation. This paper discusses the development of new towns to assess the natural landscape as underground water conservation efforts on the development of the new town. The research method uses a quantitative approach to calculate the potential runoff using a soil conservation service, while to analyze the trend of changes in land cover using temporal spatial analysis, using descriptive analysis. The data used satellite imagery. The study found open green spaces, water bodies, and infrastructure in the form of green corridors can reduce runoff and maintain the underground water table.

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* Corresponding author. Tel.: +62 85214867188; fax: +0-000-000-0000 .
E-mail address: parinor19@gmail.com

1. Introduction

Development of new towns should be in accordance with the carrying capacity of the environment in which the city develops. "Carrying capacity is defined as the continuous load the maximum that can be imposed by humans on the environment (the Independent Commission on Population and Quality of Life, 2000). Carrying capacity of a good city is able to meet the need for clean water, clean air, food security, comfort, and safety. According to the Golani (1976) "New town is a settlement with economic independence. Ecosystem changes occurred in the area in which the city developed. In landscape ecology, urban structure consists of a matrix, is the dominant element in the form of a collection of buildings, the patch is a cluster of residential, commercial and business center, a forest park city / lake, while the corridors in the form of roads, rivers, and pedestrian paths. "From the perspective of ecology, urban development affects the structure of the patch, resulting in changes in the size, shape, interconnectivity, and the composition of the patch experienced. It also produces a variety of disorders due to physical changes in the configuration of urban structures. Changes in land cover in urban development affect biotic diversity, primary productivity, soil quality, runoff and sedimentation. Urban activities also affect the dynamics of populations, communities, ecosystems, microclimate, air quality, and produce the urban heat island (Alberti, 2005)." According to Forman & Godron (1986) and Turner (1989) " ecological landscape be defined in various ways, but in general is the study of the structure (pattern), and the process of change. Landscape structure (pattern) can be considered as the spatial relationship between the elements of the landscape, while the landscape function or process is, the interaction between the spatial elements, and changes in the landscape is a change in the structure and function that occur through time (Hobs, 1997). Soil impervious cover increases runoff, which in turn disrupt the hydrological cycle, because of the rain that falls to the earth cannot seep into the soil, so that the ground water is not getting supplies, when underground water is used for materials clean water, shortage of underground water occurs. "The water that fell to earth in the form of rain, will experience a variety of events, evaporates into the air in the clouds condenses and falls back to earth in the form of rain. Water will be maintained while the body of water (river, lake / reservoir), and in the soil. Rainwater that falls to the ground and called infiltration and supply of underground water, rain water while others will flow on the surface of the ground (runoff), through the flow of soil, water in lakes, rivers, and the sea would evaporate and return air, this process can be referred to as the hydrology (Arsyad, 2010)."

"Following the classification of water NEA United sub habitat, including natural and artificial water bodies such as rivers, underground water lakes, marshes, ponds, trenches, canals and reservoirs. The water bodies have ecosystem services (Losco et al., 2012)."

The needs of urban green open space have ecological function, as one of the underground water system and integrated water resources. Green open spaces such as corridors and urban environment in the city park have an active role to improve air and water quality (Rao, 1997). In addition to green open space at a store of groundwater, lakes and ponds have the same functionality as the storage of rain water for the needs of the city and as a place of recreation. "Lakes and Ponds, generally defined as a body of water, which has a dependency on rainfall (Meester et al. 2005). It covers water bodies man-made or natural, (Rodriguez, 2007, p. 819)."

Based on the description above can be understood, that the ground surface is not watertight allows infiltration of rainwater, because the soil has the ability to absorb rainwater. Infiltration capacity would be better if the soil surface is covered by vegetation. Extensive vegetation covers in the form of open green space will further increase the infiltration capacity so as to reduce the flow of surface water and maintain the underground water reserves. In addition to green open spaces, lakes and ponds are natural or artificial in new towns function that can reduce runoff, thereby reducing the threat of flooding in the new towns and the surrounding area which has a lower height. The lake, with a large capacity, such as the storage of rain water, can serve as raw material for clean water for the new towns. In addition, the lake has a function to lower the air temperature micro and recreation areas, wildlife habitat, are also useful to encourage the hydrological processes. The city can be considered as an ecosystem, because there is a reciprocal relationship between the abiotic, the building is and the built environment more, and with biotic, e.g. organisms, flora and fauna, including humans in it, the relationship as a system (Newman and Jennings 2008) and according to Alberti (2008) "in the urban ecosystem, the human is dominant with the complexity and activities that make it different from the natural ecosystem."

"Ecosystem urban consists of seven elements identified as: (1) trees along the road; (2) lawn & garden; (3) the urban forest; (4) of agricultural land; (5) wetlands (6) lake / sea, and (7) rivers (Poland and Sven 1999)." Of the seven elements of urban ecosystems, agricultural land cannot be applied to the development of new towns in the region Botabek, because the land area is limited and expensive. Urban ecosystems provide useful services to new

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