

# Detention Properties of Subsurface Stormwater Modules Under Tropical Climate

C. H. J. Bong<sup>1\*</sup>, L. L. P. Lim<sup>2</sup>, C. K. Ng<sup>2</sup>, S. L. Chai<sup>3</sup>

<sup>1</sup>UNIMAS Water Centre, Faculty of Engineering  
Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, MALAYSIA

<sup>2</sup>Faculty of Engineering,  
Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, MALAYSIA

<sup>3</sup>Wenhong Plastic Industries Sdn Bhd, 93250 Kuching, Sarawak, MALAYSIA

\*Corresponding Author

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**Abstract:** Subsurface stormwater module is one of the components of a sustainable drainage system. However, the performance of subsurface stormwater module as on-site detention under tropical climate like Malaysia has not been extensively studied in the literature. The current study involves on-site installation of pilot scale subsurface stormwater modules exposed to tropical climate to simulate real conditions to evaluate the detention performance. Rainfall together with the changes in water level and volume of water detained in the installation were observed for six months between April 2021 to October 2021. The subsurface stormwater module used in the current study has a porosity of 94%. It was found that the subsurface stormwater module setup was able to detain between 35.2% to 95.6% of the rainfall volume generated from total rainfall between 11.1 mm to 56.8 mm. The findings can be used as design consideration for using subsurface stormwater module under tropical climate.

**Keywords:** Flash flood, on-site detention, stormwater management, sustainable drainage, urban

## 1. Introduction

Rapid development in urban areas alter the natural balance between runoff and natural absorption areas by replacing natural areas with greater amounts of impervious surface. This necessitates the development of new sustainable stormwater management strategies that can promote infiltration and reuse, quality enhancement and quantity reduction [1]. Stormwater modules have been applied as part of sustainable drainage and rainwater harvesting system. Stormwater modules are generally made of plastic material and placed underground to collect water, act as temporary pond before discharging the water into drainage system, thereby inhibits flooding due to excessive stormwater runoff. Stormwater modules are designed in different shape and patterns to increase lag time in the flow (attenuation), reduce the flow volume by enhancing groundwater recharge and provide storage [1]. The use of subsurface stormwater modules has been recommended in the Urban Stormwater Management Manual for Malaysia, 2<sup>nd</sup> Edition [2] if there is insufficient space for a swale, where the flow can be divided into surface and subsurface conduits. The subsurface stormwater modules can also trap water at the source where it can be retained in the modules. Hence, subsurface stormwater modules can be used to temporarily store floods (detention) or to convey flow (drainage).

The effectiveness of subsurface stormwater modules as storage system has been evaluated by Mohd Sidek et al. [3] where three different storage systems namely modules storage tank (without infiltration to surrounding soil), loose rock infiltration system and modules infiltration system have been compared. It was found that in terms of peak flow