

Effect of Inflow and Infiltration in Sewerage System of Residential Area, Kuantan, Pahang

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Abstract: Inflow and infiltration is a phenomenon in sewerage systems that can have negative effects on the environment and human health if not treated properly. Collaboration has been made between Universiti Malaysia Pahang (UMP) and Indah Water Konsortium Sdn. Bhd. (IWK) where the purpose is to evaluate the amount of inflow and infiltration happening in sewerage systems of residential areas in Kuantan. For this part of the study, one sewer pipeline (MH92a–MH92b) was selected at the residential area of Bandar Putra, having a population equivalent of 1694. The method used in this research was the Flowrate method to tabulate data. ISCO 2150 and 4250 Area Velocity Flowmeters were used to measure flow rate data in the sewer pipeline, whereas ISCO 674 Rain Gauge was used to collect rainfall intensity data. Calibration of all the equipment was done at the Hydrology and Hydraulic Laboratory in UMP. The data was collected for 41 days with each measurement separated by an interval of five minutes. The result shows that the average percentage Infiltration Rate of Q_{peak} and Q_{ave} in this residential catchment were 10.3% and 26.5% which is higher than the value mentioned in Hammer and Hammer (2012). Inflow and infiltration is a real concern, so more study is required to determine whether revision of the infiltration rate recommended in the Malaysian Standard is needed.

Keywords: Inflow, Infiltration, Rainfall, Sewerage system

Introduction

Integrated urban sewerage system allows for high density of population and imperviousness associated with urbanization. Its role is to transfer wastewater to natural waters through urbanization (Kaushal and Belt 2012). Functional efficiency of sewer systems includes conveyance of wastewater from urban and industrial areas to sewerage treatment plants without inflow and infiltration (Rehan 2014). Inflow and infiltration is a phenomenon in sewerage systems that brings negative effects to the environment, human health and the sewerage system itself (Beheshti et al. 2015). According to EPA (2014), inflow is defined as sources of water that enters the sewerage system from manhole covers, area drain and roof leaders, whereas infiltration is defined as water from the subsurface that enter into sewerage system through defective pipes and loose joints.

Malaysia is a tropical country and the separate sanitary sewer system is commonly applied which only transport sanitary wastewater to sewerage treatment plant. The allowable infiltration rate should be incorporated into the sewerage system design. Based on Malaysian Sewerage Industry Guideline (MSIG) Volume III, maximum allowable infiltration rate is stated as $0.05\text{m}^3/\text{mm}/\text{km}/\text{day}$ (SPAN 2009). Besides that, according to Hammer and Hammer, the maximum allowable infiltration rate of peak hourly sanitary flow and average flow is 3% to 5% and 10%, respectively. The purpose of this research is to evaluate the amount of inflow infiltration happening in the sewerage system of Bandar Putra, Kuantan by comparing to allowable infiltration rate of peak hourly sanitary flow and average flow mentioned in Hammer and Hammer (2012).

According to previous studies in Norway, it was demonstrated that extraneous sources entering into sewer systems would overload the capacity of the sewer pipeline and increase the cost of maintenance required (Beheshti et al. 2015). Another case study was done in Columbus where 116 private houses were investigated. The result showed that 68% of the sewer pipeline was tested and inflow and infiltration occurred in the residential area (Pawlowski et al. 2014). A report investigating quantification of inflow from surface water and infiltration from groundwater was done by Karpf and Krebs (2011). The method used was inflow infiltration modeling combined in a quasi linear model.