CHAPTER 1

INTRODUCTION

1.1 Background

A sewerage system is an infrastructure or system consisting of a pipes network and pumps to collect, treat and dispose of wastewater or sewage. It is one of the significant considerations for any industrial or residential construction projects since this system will be used often for various activities in everyday life. This research is focused on the residential areas sewerage system and is working together with Indah Water Konsortium (IWK) as well as Universiti Malaysia Pahang (UMP).

Sewerage system is very important. The elements in the sanitary sewer system include ditches, gravity pipelines, pump stations, screening chambers, manholes and other devices that are used to collect and transport the sewage to wastewater treatment plants. The sources of sewage include water that leaves the sink or shower, and toilet flushing from residential, industrial or commercial area. An effective sanitary sewerage system is essential for the health and safety of the citizen, which if not managed properly will cause pollution and environmental problem.

According to the USEPA (2014), base sanitary flow, rainfall derived infiltration and inflow and groundwater infiltration are the three main components of wastewater flow in a sewerage system. Inflow and infiltration have a large extent to influence the effectiveness of sanitary sewer system. Normally, every sewer line will have some inflow and infiltration.
A small amount of inflow and infiltration can be tolerated since it may not cause overflows or increase the cost to transport and treat the sewage. Based on Donohue & Associates (2012), infiltration occurs when the sewer lines are poorly designed and constructed as well as the existing sewer lines undergo deterioration and degradation of the material and joint. For inflow, it will occur when rainfall or storm water enters the sewerage system at points of direct connection of the system such as manhole covers, roof leaders, foundation drains, drains from driveway and other indirect connections to the storm sewer.

In Malaysia, sewerage systems are designed based on the Malaysian Standard Code of Practice MS1228:1991. Normally sewerage systems do indeed include an acceptable amount for inflow and infiltration. Due to a different geographical area, every sewerage system may experience a different amount of rainfall and infiltration. Therefore, suitable adjustment for special conditions of inflow and infiltration is needed to include in the MS1228:1991.

1.2 Problem Statement

In order to design a sewerage system, the designer will base on the population equivalent (PE) of that area to design a specific amount of capacity and include some allowance for inflow and infiltration. As stated in MS1228:1991, the maximum infiltration rate for a sewerage system is 50 litre/day/km/mm-dia. Meanwhile, Hammer & Hammer (2004) proposed that 46 litre/day/km/mm-dia is the maximum infiltration rate of a sewerage system. The sewerage system is considered adequate if the infiltration rate does not exceed 50 litre/day/km/mm-dia and 46 litre/day/km/mm-dia as stated in MS1228:1991 and Hammer & Hammer (2004) respectively. Once the infiltration rate of a sewerage system exceeds the designed amount, the system will overload and negative impacts will occur. The negative impacts will be discussed further in the literature review part. From the negative impacts stated, research is definitely required to study on the suitability of the current sewerage system to accommodate the amount of inflow and infiltration.
### 1.3 Objectives of Study

i. To measure the rate of inflow/infiltration of the sewerage system at Taman Lepar Hilir Saujana, Bandar Putra and Kota Sas.

ii. To compare the infiltration rate of the sewerage system at Taman Lepar Hilir Saujana, Bandar Putra and Kota Sas with Malaysia Standard MS1228:1991 and Hammer & Hammer (2004).

iii. To study the effects of rainfall on inflow and infiltration patterns in the sewerage system.

### 1.4 Scope of Work

In this research, Taman Lepar Hilir Saujana, Bandar Putra and Kota Sas were chosen to measure the inflow and infiltration pattern with population equivalent (PE) 1290, 4723 and 10000 respectively. A survey to analyse the population equivalent of Taman Lepar Hilir Saujana, Bandar Putra and Kota Sas was carried to check on the population given by IWK. Two manholes located near the sewerage treatment plant were selected at each site. For Taman Lepar Hilir Saujana, Manhole 84 (MH84) and Manhole 85 (MH85) were chosen to carry out this research; Manhole 92a (MH92a) and Manhole 92b (MH92b) were chosen at Bandar Putra; Manhole 219 (MH219) and Manhole 220 (MH220) were chosen at Kota Sas. In order to measure the inflow and infiltration pattern, area-velocity flow-meter and sensor was installed in both upstream and downstream manholes. Rain gauge that was used to measure the rainfall intensity was set-up at each site. 5 sets of data were required to increase the accuracy of the data collected. The average duration for each set of data is 2 weeks. From the data collected, graphs used to determine the relationship of flow rate with rainfall intensity was produced. Malaysia Standard Code of Practice MS1228:1991, Hammer & Hammer (2004) and Indah Water Konsortium Population Equivalent Table were used as a guide in this research.