CHAPTER 1: INTRODUCTION

Water is a finite resource, essential for agriculture, industry and even human existence. Next to oxygen, fresh water is the most important substance for sustaining human life.

It has been unequivocally demonstrated that water of good quality is crucial to sustainable socio-economic development. Discharge of toxic chemicals, over-pumping of aquifers, long range atmospheric transport of pollutants and contamination of water bodies, are some of today's major causes of water quality degradation.

Urban population often grows faster than the rate at which basic services, such as, water and electricity can be installed. As the ring of the suburban neighbourhoods (including slums and squatter settlements) expands around the city core, there is a scramble to find new sources of water. Frequently new wells are drilled to tap aquifers. Without proper understanding of the underlying geology of the area, this haphazard development of groundwater supplies leads to a number of serious problems: contamination from industrial and domestic sources, sinking land or soil subsidence.

Groundwater may be adversely affected for decades once contaminants have found their way into the hydrogeological system. Surface water (from streams, rivers, lakes and reservoirs) is more easily polluted than groundwater, but can be cleaned up relatively quickly (IDRC, 1988).

The adulteration of the quality of the water in the river depends

basically on the source of contamination and the environmental conditions of the river basin. There are two sources of contamination: artificial contamination, which results from human activities such as making a living from exploiting the river and manufacturing work carried out in the river basin. There is also natural contamination due to the activities of nature. This includes flow volume and tides and by artificial elements such as water intake and storage.

The contaminated materials that flow into the river change the quality and quantity of the river depending on the conditions of the river basin. This is due to the physical, chemical and biological reactions that occur in the river basin. The action required to revert the quality of water to the original state is known as the self-cleaning action. However, if the quantities of the contaminated materials that flow into the river are substantial, this action will not be sufficient and the quality of the water will deteriorate.

Water, although an absolute necessity for life, can be a carrier for many diseases if it is heavily contaminated by pathogens. Contamination is usually due to human feces in the water supply, because of either poor sanitary habits or inadequate treatment of public water supplies. The majority of waterborne pathogens cannot multiply in water but many can survive in water and retain infectivity for long periods (Larry and Judy, 1996). Disease with etiologial agents thought to be trasmitted by water are Salmonellosis, Poliomyelitis, Giardiasis, Cholera, Shigellosis, Typhoid, etc.

In developing countries, waterborne diseases kill thousands everyday. Even when a source of drinking water is safe, polluted surroundings and lack

of hygiene may contaminate the water, causing disease to spread. It is important to observe high levels of personal, domestic and community hygiene to reduce the incidence, prevalence and severity of waterborne diseases.

There is abundant water in Malaysia as a whole. The annual rainfall over the Malaysian land mass amounts to 990 billion m^3, of which some $556m^3$ appears as surface runoff and about 64 billion m^3 recharges groundwater. The balance of about 360 billion m^3 returns to the atmosphere through evaporation and transpiration. The annual surface runoff and groundwater recharge, amounting to 630 billion m^3, makes up the water resources of Malaysia. The overall water demand is growing at about 4% annually and projected to be about 20 billion m^3 by the year 2020. The annual domestic and industrial water demand will grow to 5.8 billion m^3 and the irrigation demand to about 13.2 billion m^3 in 2020. The annual water demand in 1990 was 1.4%, and by the year 2020 will be about 3% of the water resource base (Abdullah and Jusoh, 1996).

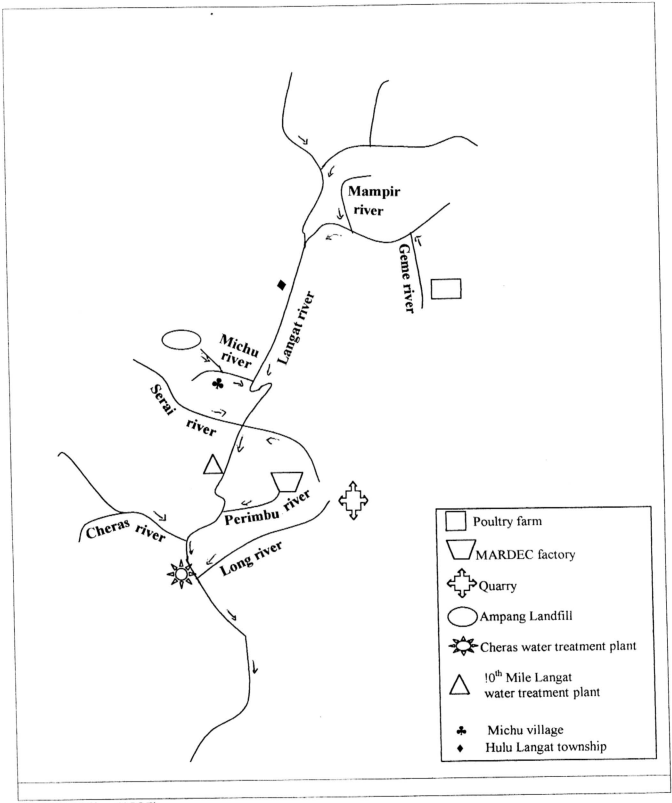
The river systems in Malaysia are an integral part of the water resources system. There are more than 50 river systems in Sabah and Sarawak. River systems as a whole, with or without impounding reservoirs, are estimated to contribute about 97% of the raw water supply source.

Rivers have on the receiving end for the last 20 years. This situation does not only occur in Malaysia but the world over. With the tremendous rate of development, institutions are grappling with the problem of finding out what the real situation is like, let alone controlling it. In view of this, the Department of Irrigation and Drainage launched the 'Love Our Rivers' campaign in 1993.

The first phase involved a campaign to create awareness among the general public on the present state of our rivers and the need for all quarters to cooperate to prevent further deterioration of the rivers. In the second phase, emphasis is given to the enforcement and technical capacity of the agencies entrusted with the job.

In 1998, 33 rivers (28%) were clean compared to 24 in 1997, 71 (59%) were recorded as slightly polluted and 16 (23%) polluted compared to 25 in 1997. The polluted rivers were Sungai Miri/Lutong , Sungai Balok, Sungai Merbok, Sungai Air Baloi , Sungai Buloh , Sungai Danga, Sungai Landas, Sungai Jimah, Sungai Jejawi, Sungai Kelang, Sungai Juru, Sungai Sengget, Sungai Tukang Batu, Sungai Sepang, Sungai Kempas and Sungai Pinang (DOE, 1998). Fourty three percent of rivers were polluted by ammoniacal nitrogen (NH -N) from livestock farming and domestic sewage; 34 % by suspended solid due to earthwork and land clearing activities and 21% by biological oxygen demand (BOD) due to discharges from agro-based and manufacturing industries. The corresponding figures in 1997 were 80% ammoniacal nitrogen, 31% suspended solid and 69% BOD. The improvement in ammoniac nitrogen and BOD pollution is substantiated by the fact that the number of polluted rivers had reduced from 25 in 1997 to 16 in 1998 (DOE, 1998).

The Sungai Langat is recorded as one of the most polluted river in our country (Figure1.1). Untreated domestic sewage has been identified as a major



Source : Elias (1997)

Figure 1.1: Sungai Langat's River Basin

cause of pollution of the Sungai Langat (Leong, 1998). The history of the pollution started in a developing area near Sungai Mampir. The existence of a duck-rearing farm at the Sungai Geme caused fecal pollution along Sungai Mampir and Sungai Langat.

During the months of October and September in 1998, several water shortage cases occurred in the Klang Valley and hundreds of thousands of consumers had to go without water for days. Due to the high level of diesel content in the water, the treatment plants at the Langat and Cheras areas had to be closed down for about six times in two months. The diesel was released from a quarry, which is located at Sungai Long. This river eventually joins the Sungai Langat, carrying along the diesel. In addition to the diesel contamination, there has also been ammonia pollution from the poultry farm along the Sungai Cheras and a rubber factory (Mardec) at Sungai Long.

The condition of the Sungai Langat became worse when the Sungai Michu was heavily polluted with leachate generated from the Ampang non-sanitary Landfill. The landfill, which has been operating for more than ten years and is now officially closed does not have a proper leachate collection system and therefore the leachate ends up contaminating the river as well as the groundwater. The rubbish dumped at this site has been transferred to the air Hitam landfill in Puchong. During the dry season, when the volume of the river water drops, the concentration of leachate increases (Yasin, 1997). Earlier, the river was extensively used by the surrounding residents for washing and cooking but now after the heavy contamination even the animals are reluctant to use the water.

The Selangor Government identified 71 factories operating illegally along the river and these factories store hundreds of diesel drums along the river (Yasin, 1997). Diesel is an organic compound that contains hydrocarbon and even at a very low concentration, the carbon molecules in the diesel is capable of reacting with chlorine to form tetrachloride, a carcinogenic compound.

New Straits Times on the 14th of July 1998 reported that three companies were caught by the Department of Environment for allegedly discharging untreated effluents into the Sungai Langat. They were Kajang Paper Mills Sdn. Bhd, Mauri Fermentation Sdn.Bhd. and J and Y Laundry Sdn. Bhd. All the three companies were charged under the Environmental Quality Act (EQA) 1974, which provides a maximum fine of RM 100,000 or 5 years jail or both. From January to July 1998, a total of 8 companies including the National Sewerage Management Concessionaire, Indah Water Consortium have been charged for water pollution by the department under section 25(1) of the EQA.

1.1 Research site

The area of the present study is located at 14th mile, Hulu Langat Road, Selangor. The landfill is 2 km from the Hulu Langat town, in Bukit Seputeh Forest Area. The waste is dumped on a steep slope facing a small valley where the Sungai Michu runs. Two important residential areas are Hulu Langat township and Michu and Gahal Villages, which are located within 2km from the research site.

The Ampang Jaya Municipal Council (MPAJ) was handling the collection and landfilling of domestic waste in the area of study. The management of the landfill was handed over to MPAJ by the Kajang Municipal Council (MPK) in 1992. The dump site has been receiving waste from Ampang and Hulu Langat areas since late 1980's. The waste is mainly generated from the developing areas, which includes housing areas, industrial areas, commercial centers etc. The total domestic and toxic waste generated by the MPAJ is approximately 287 tonnes/day in 1995 and expected to increase to 377 tonnes/day in the year 2000.

The site is a non sanitary landfill. It is 15 hectares in area. In January 1998, wastes dumped on the small hill, slid down, causing the wastes to fall into the villager's private properties. A month later, on the 22nd February 1998, due to the El Nino effect and severe dry weather, these wastes caught fire and it took two days for the authorities to put out the fire. After these two tragedies the Municipality decided to close the landfill to prevent further pollution. At present, all the waste generated in the Klang Valley goes to the Air Hitam landfill which covers an area of 59 hectares and a total capacity of receiving 10 000 m^3 waste. The Ampang non-sanitary landfill has now been turned into a vegetable farm (Plate 1).

The Ampang non sanitary was not equipped with proper leachate and gas collection systems. Therefore, the leachate ends up contaminating the Sungai Michu, posing odor and health hazards. Recently, a leachate collection pond and treatment plant have been set up. Underground pipes were installed to collect the leachate and channel them into the pond.

In this research, water samples obtained from the Michu and Langat rivers will be analyzed to monitor the level of pollution before and after the landfill closure.

1.2 Research Objectives

The aim of this research is to study leachate contamination in the rivers which is located adjacent to the Ampang non-sanitary landfill before and after the landfill was closed.

The objectives of this study are as follows;

- To characterize the leachate from the non sanitary landfill in Ampang by analyzing the physical, chemical and biological parameters
- To study the difference in the concentration of leachate which was collected before and after the landfill was closed
- To analyze the water samples collected from Sungai Michu and Sungai Langat which is located adjacent to the landfill to investigate the extent of leachate contamination
- To determine other sources of pollution in these rivers

Plate 1: Vegetables planted in the ex non-sanitary landfill

Plate 2: Remaining waste at the ex non-sanitary landfill