

## **CHAPTER TWO**

### **LITERATURE REVIEW**

A review of the literature relevant to this study is presented in this chapter. More specifically the chapter reviews the literature on the causes of the water crisis, the demand and supply of water, the pricing of water, the concept and definition of sustainability of water resources development and the management of water as a scarce resource.

#### **2.1 Causes of the Water Crisis**

Water rationing was imposed in Selangor Darul Ehsan and Kuala Lumpur from 27<sup>th</sup> March 1998 to the end of July 1998 in 322 areas. It is estimated that a total of 1,200,000 consumers were affected by the rationing.

According to a report by the JBAS the water crisis in Selangor was due to prolonged drought (Subramaniam, 1998). There was no rainfall in the catchment area from January to March 1998. Consequently this lowered the water level at the Langat and Semenyih Dam which supply water to the affected areas. Figure 2.1 and 2.2 show the water level and rainfall in the Sg. Langat and Semenyih Dams respectively for the period from 1<sup>st</sup> January 1998 to 18<sup>th</sup> July 1998. However from the graphs we may note that although the amount of rainfall began to rise from the end of April, the water level in the dams did not increase immediately. To avoid depletion of water resources, water rationing was resorted to. As a result of the prolonged drought and the low water levels in the dams, water production in Sg. Langat, Semenyih, Cheras and Ampang water treatment plants fell to their lowest level (Table 2.1).

Figure 2.1 Sg. Langat Dam Level 01 Jan 1998 - 20 July 1998

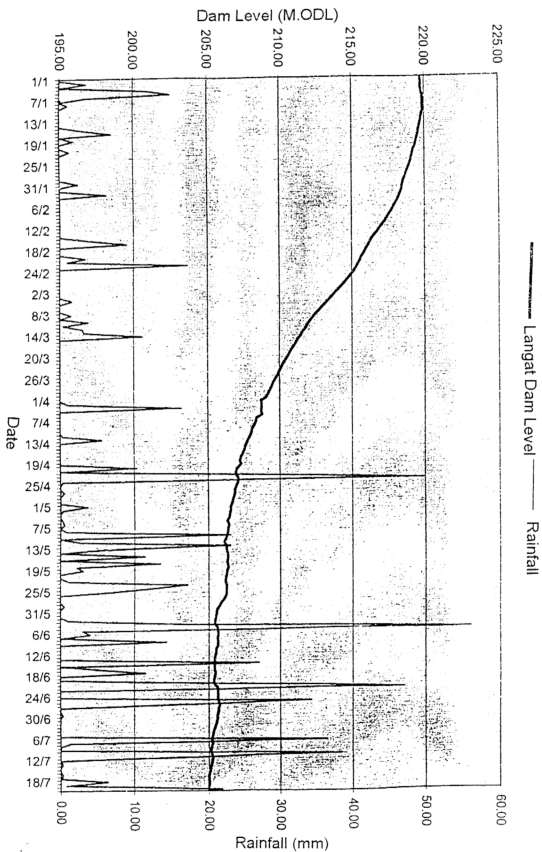
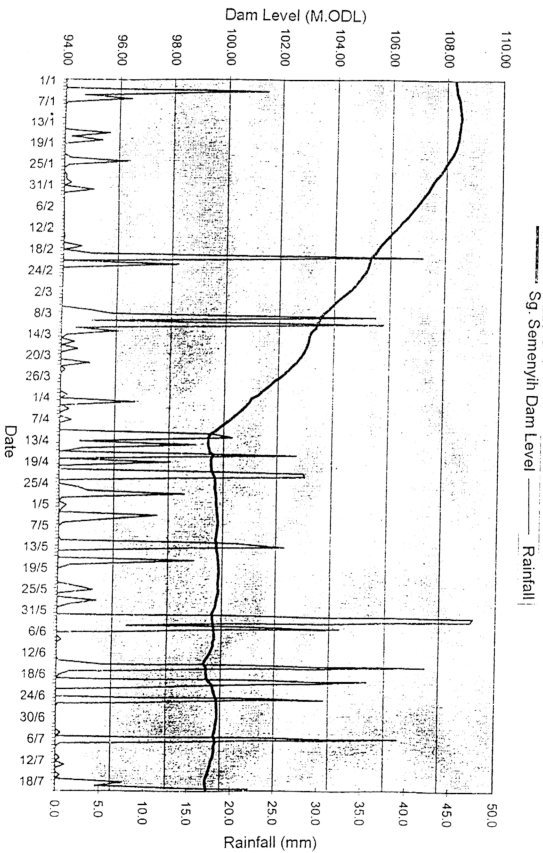


Figure 2.2 Semenyih Dam Level 01 Jan 1998 - 20 July 1998



**Table 2.1 Status of Water Production in Selangor (30 Mac 1998)**

Water Treatment Plant	Source of water	Operation capacity (Mld)		Reduction (%)
		Normal	Now	
Sg. Langat	Langat Dam	477	272	43
Ampang Intake	Ampang Dam	27	18	33
Cheras Mile 11	Sg. Langat	32	14	56
Sg. Semenyih	Semenyih Dam	613	545	11
Bkt Nanas	Klang Gate Dam	157	157	0
Sg. Selangor	Sg. Buloh Dam	954	954	0
Sg. Batu	Batu Dam	112	112	0
23 others	Rivers	181	181	0

Source: JKR, KL 1998.

## 2.2 Hydrometeorology

Although Malaysia receives abundant rainfall throughout the year, most of the water disappears as surface runoff, evaporation and transpiration. It was found that the consumption of water by households, industries and agriculture constitutes less than 2 percent of the annual runoff (Sivalingam, 1997(a), p.233).

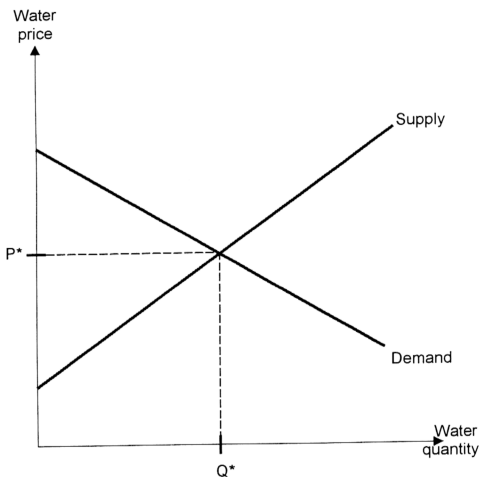
Rainfall in Malaysia is not evenly spread throughout the year and occurs mainly in the interior which are also the least densely populated areas. There is only one major catchment area in Semenyih, Selangor to meet the demand for water for the state of Selangor and the Federal Territory of Kuala Lumpur. Water must be captured and treated before distribution to all users. This over reliance on one catchment area may, according to some be a cause of the water crisis in Selangor (JBAS, 1998).

## 2.3 Demand and Supply

However, a contrary view is that water resources are not efficiently managed. This is because water rates are set below the marginal cost of supplying water and this leads to wastage. From an economic viewpoint, water is utilised efficiently only when the marginal cost of the last unit supplied is equal

to the marginal benefit of the use of that last unit. In the demand and supply graph drawn below, the consumer's marginal willingness to pay is the demand curve. The supply curve is the marginal costs of providing the water.

**Figure 2.3 Efficient Utilisation of Water Resource**



Source: Sivalingam, 1997(a), p. 238.

The efficient water utilisation level is  $Q^*$ , which is the intersection of the demand and supply curves. At this equilibrium level, the water rate is set at  $P^*$  which is the efficient water tariff and also the cost of each unit of water supplied which can be recovered by the water agency.

## 2.4. Pricing

It has been observed that water tariffs are usually set administratively rather than by setting water rates to equal the marginal cost of supplying the last unit of water. The existing water allocation mechanism in Malaysia is best described as authoritarian, and motivated more by political rather than economic considerations. Water rates are highly subsidised and as a result revenue collected is insufficient to re-invest in system improvements (Sivalingam, 1997(b), p.292). Subsidies may also lead to the inefficient use of water. The distribution of water may also not be even because of physical defects in the distribution systems.

If water tariffs do not cover costs then the sustainability of the system is dependent on the government's budget allocation. For example, a small budget allocation implies reduced expenditures on maintenance which will result in poor service quality. On the other hand a large budget allocation may subsidise the use of water and hence encourage wastage. With low rates, people do not have the incentive to save water. (Sivalingam, 1997(a)).

The correct pricing of water is important to ensure uninterrupted supplies of water. The water rates in Malaysia have traditionally been low (Sivalingam, 1995, p.14). In the 1970's and early 1980's most rates were that and set below the marginal cost of supplying water. In 1985, many states in Malaysia shifted to increasing block tariffs but this has not changed substantially due to probably, political pressure (Sivalingam, 1994).

Water supply development is capital-intensive as it requires the construction of reservoirs, treatment plants and distribution systems. Hence, the long-run marginal cost will be the relevant marginal cost for analysing the efficiency of water development (Sivalingam, 1997(a)).

This is an economist's approach to water pricing. It is based on future costs and market values. The other two approaches to pricing of water are (Sivalingam, 1995, p.5):

### 1. The Traditional Bureaucratic approach.

Under this approach, water prices are set arbitrary and are seldom based on accurate cost data as no attempt is made to collect or estimate such data. Water is heavily subsidised to the upper and middle classes of society. The poor are usually denied access to water and no effort is made to ascertain as to whether the poor are willing to pay the full cost of recovery; and

### 2. The Accountant's approach.

Water prices are based on historical data and book values. These book values do not reflect present or future market value. This means the cost of water capacity expansion remains stable into the future.

The Economist's approach is appropriate because the supply cost tends to rise over time and space. If the cost of capacity expansion is rising, then the cost of producing the next unit of water would be higher than the cost of producing the previous unit of water.

Water pricing is important to reflect the scarcity value of water and to ensure that it is allocated efficiently and to recover the money spent on developing water resources.

The objectives of water pricing are (Sivalingam, 1995, p.1):

- (i) to facilitate the efficient allocation of water resources;
- (ii) to ensure a fair and equitable distribution of water resources;
- (iii) to promote conservation of water and the environment;
- (iv) to recover the full costs of supply
- (v) to generate revenue by implementing a simple tariff structure

## **2.5 Non Revenue Water (NRW)**

Non revenue water (NRW) is the amount of water generated by treatment plants that brings no revenue because of faulty pipes distribution, pilferage and collection system. The NRW reduces the state's investment funds because the amount of treated water that could actually be sold is lesser and thus may affect the viability of developing new water projects (Sivalingam, 1997(a), p.260).

The non revenue water rate has continued to rise. A study by the Asian Development Bank (ADB, 1986, p.22) found that non revenue water was as high as 43 percent in 1987. Leakage and inefficient revenue collection were the main problems. A feasibility study of the Selangor system expansion assumes that non-revenue water rate is 20 – 30 percent (Sivalingam, 1997(a), p.260).

## **2.6 Sustainability**

For the water supply system to be sustainable, all the costs incurred in supplying water should be covered (WHO 1994, p.3). The Government of Malaysia has always advocated that the states should have self-financing water schemes (Sivalingam, 1994). Unfortunately this is not the case for the state of Selangor. A supply source is self-financing if the average tariff equals the long-run marginal cost. This is because if the price of water is sold at that level, the supply source will be able to meet the cost of producing the next unit of water.

It was noted that the water tariffs are often set below long-run marginal costs. (Sivalingam, 1995, pp. 12-13). Water tariffs have always been set low to ease the burden of the poor. It is also justified that an adequate supply of affordable treated water prevents the spread of water-borne diseases.



On the supply side, an incorrect pricing structure can have adverse consequences (Sivalingam, 1995, pp.13-14). The adverse consequences brought about by underpricing will lead to low revenues, which result in neglect on maintenance. The reduced expenditure on maintenance caused leakages and meter underregistration to worsen, which reduced revenues even more. This vicious cycle continues.

## **2.7 Managerial approach**

Water management is a state matter. In Selangor, the administration of water resources involves eight agencies which requires co-ordination in order to function effectively. Co-ordination of agencies and continuity of planning and management are currently not achieved in the water planning programs of many countries (Howe, 1995). There are issues which must be resolved in order to effectively design an institutional framework:

- i) co-ordinated management of surface water and groundwater;
- ii) co-ordinated management of water quantity and water quality -this is essential in rural areas in Malaysia where dry season occurs sometimes and far from water basins;
- iii) motivating greater economic and physical efficiencies in water use; and
- iv) the most important objectives of appropriate pricing and financing of water systems is the improvement of the economic efficiency of water use.

It is therefore important to study and analyse the current water management structure in Selangor and to achieve long term sustainability.