

## CHAPTER FIVE

### NON REVENUE WATER

This chapter discusses the problem of Non Revenue Water (NRW). It will also unveil the causes of NRW, the various methods used to overcome this problem and the reasons for the urgent apprehension of this problem.

#### 5.1 Definition

Non revenue water (NRW) is the amount of water put into the systems that brings no revenue to the water supply authority concerned. It is defined as the difference between the amount of water supplied and the amount metered at consumer premises (Malaysia Water Industry Report 95/96).

$$\text{NRW} = \boxed{\begin{array}{cc} \text{QUANTITY} & \text{OF} \\ \text{WATER} & \text{LEAVING} \\ \text{TREATMENT PLANT} \end{array}} - \boxed{\begin{array}{cc} \text{QUANTITY OF WATER} \\ \text{BILLED} & \text{TO} \\ \text{CUSTOMERS} \end{array}}$$

The higher the NRW rate, the lesser amount of water is sold to consumers. This means a loss of revenue to the water authority.

#### 5.2 Benefits of Reduction and Control of NRW

A low NRW rate reduces wastage and losses. This would allow the increase of demand be met and reduce the capital work involved or least allow for deferment of such projects. With extra revenue generated it can be used to conserve available resources.

Realising the benefits of containing the NRW, the Federal Government has approved a total of RM470 million in the Seventh Malaysia Plan for

rehabilitation of water supply system. In addition, RM112.1 million has also been approved for the improvement of water supply to industrial areas, which is also aimed to reduce NRW. If the NRW can be reduced then the average tariff that would be needed to equal the LRMC supply could be lowered as more revenue is generated from the control of NRW.

Since NRW is part of the whole water distribution system, a reduction in the NRW means more water is made available to the consumers. In the event of a reduction in the production of water, the shortage will not be serious to warrant a crisis as what happened in 1998.

### **5.3 Current Scenario**

The NRW rate in Selangor is considered high. The average NRW from the period 1990 to 1998 is 38%. Table 5.1 shows the NRW for the respective years. This differs far from the long term objective of the Federal Government to achieve NRW at 25% by the year 2000 (Malaysia Water Industry, 95/96).

The high level of NRW constitutes a tremendous loss in water revenue. High priority has been given to tackle this problem beginning with the Sixth Malaysia Plan and continues into the Seventh Malaysia Plan.

**Table 5.1 NRW in Selangor from 1990- 1998**

| Year | NRW (%) |
|------|---------|
| 1990 | 46      |
| 1991 | 41      |
| 1992 | 40      |
| 1993 | 39      |
| 1994 | 39      |
| 1995 | 36      |
| 1996 | N/A     |
| 1997 | N/A     |
| 1998 | 38      |

Source: adapted from JBAS Annual Report 1995

As early as 1986, a study on NRW was conducted in several districts in Selangor. The districts covered were Petaling Jaya, Sabak Bernam and Kuala Selangor.

Over the years, more NRW monitoring areas were developed under the NRW Programs in Selangor. This is important to ensure that the NRW is under control. The number of NRW areas by districts in the year 1993 is shown in Table 5.2

**Table 5.2 NRW Areas by Districts in 1993**

| District            | Petaling | Sepang | Kelang | Hulu<br>Langat | Hulu<br>Selangor | Kuala<br>Lumpur |
|---------------------|----------|--------|--------|----------------|------------------|-----------------|
| No. of NRW<br>Areas | 52       | 10     | 4      | 2              | 4                | 3               |
| % of NRW            | 35       | 36     | 39     | 25             | 31               | 37              |

Source: JBAS Annual report 1993

All the districts except Hulu Langat have a rate of NRW higher than 25% desired by the Federal Government. The NRW at 35% and above are recorded in densely populated areas in Kuala Lumpur, Petaling, Kelang and Sepang.

## **5.4 Causes of NRW**

The causes of NRW can be categorised into:

- Physical loss.

This refers to pipe leakage. It is believed that 80% of reticulation pipes in Selangor are made of asbestos cement pipes and they are old. They are more than 25 years. In Japan the pipes are made of steel and ductile iron. This makes the NRW in Japan at the rate of 8% only.

- Water used but without revenue.

This refers to pilferage, meter under registration, system maintenance and fire fighting. Pilferage refers to illegal connection and water theft. Under registration meter is caused by old meter that is not functioning well. As it ages, it will read less than the actual quantity that passes through it. System maintenance refers to flushing of pipes after repairs of bursts, washing of reservoirs, periodic testing of hydrants and others.

## **5.5 Optimum Level of NRW**

JBAS hopes to achieve a desired level of NRW of 20%. Optimum level refers to level beyond which it is no more cost effective to spend money and efforts to further reduce the NRW (JKR, KL (Unpublished),1998).

### **5.5.1 Measures to achieve desired level of NRW**

To achieve the desired level of 20% the following measures are deemed important:

- Replace old pipes and leak detected. Repairs would be carried out at night at the earliest possible time.
- To reduce pilferage water to 5% by laying steel pipes in squatter areas and legalises the supplies.
- To keep meter under registration at 5%. This means meter above 5 years

old should to be replaced.

## 5.6 Comparison of NRW between Its Desired Level and Present Level

- Physical loss of water

If the desired level can be reduced from 16% to 8% (see Table 6.3) then it means 196.3 Mld of water can be saved. This further impacts on the construction of dams, treatment plants and transmission of water. This will help in the deferment or reduction in current and future project that is capital intensive.

- Monetary Values

To achieve and save the desired level of water (196.3 Mld), JBAS can purchase less water from the privatised treatment plants. This amounts to RM62,816 per day. If pilferage and meter under registration were reduced to 5%, it would mean an increase in revenue collection of RM135,722 per day. If NRW is reduced to 20% JBAS can generate extra cash of RM256,682 per day or RM93.69 million a year! So it is urgent and crucial that the NRW problem be tackled as soon as possible even though if it means a substantial costs is involved to achieve the target (from 38% to 20%). Table 5.3 shows the NRW in Selangor.

**Table 5.3 NRW in Selangor**

| NRW Component                          | Present Level      | Optimum Level      | Optimum Level Vs Present level |                      |                                 |
|--|--------------------|--------------------|--------------------------------|----------------------|---------------------------------|
|  |                    |                    | Dif # in Quantity              | Saving per day (RM)* | Increased revenue per day(RM)** |
| Physical loss<br>Pipe burst & leakages | 16%<br>(392.6Mld)  | 8%<br>(196.3 Mld)  | 196.3<br>Mld                   | 62,816<br>(a)        |                                 |
| Pilferage                              | 12%<br>(294.5 Mld) | 5%<br>(122.7 Mld)  | 171.8<br>Mld                   |                      | 135,722<br>(b)                  |
| Meter under registration               | 8%<br>(196.3 Mld)  | 5%<br>(122.7 Mld)  | 73.6<br>Mld                    |                      | 58,144<br>(c)                   |
| System Maintenance & Fire fighting     | 2%<br>(49.1 Mld)   | 2%<br>(49.1 Mld)   | 0                              |                      | 0                               |
| Total                                  | 38%<br>(932.5Mld)  | 20%<br>(490.8 Mld) | 441.7<br>Mld                   | (a)+(b)+<br>(c)      | =256,682<br>per day             |

Source: mimeo JKR, KL 1998

\* Based on average purchase price of bulk water @ 32 per cubic metre

\*\* Based on selling price of water @RM0.79 per cubic metre.

# Dif = Difference

**Table 5.4 Annual Consumption and Production - Comparison between Selangor Darul Ehsan and Penang (1992 – 1996)**

|                | SELANGOR                        |                                |                 | PENANG                          |                                |                 |
|----------------|---------------------------------|--------------------------------|-----------------|---------------------------------|--------------------------------|-----------------|
| Year           | Total Annual Consumption<br>(A) | Total Annual Production<br>(B) | % of<br>(A)/(B) | Total Annual Consumption<br>(C) | Total Annual Production<br>(D) | % of<br>(C)/(D) |
| 1992           | 354,585,505                     | 592,302,241                    | 59.9            | 147,424,089                     | 185,399,925                    | 79.5            |
| 1993           | 382,632,947                     | 643,236,260                    | 59.5            | 152,474,409                     | 188,699,890                    | 80.8            |
| 1994           | 411,525,170                     | 675,474,445                    | 60.9            | 159,598,549                     | 204,006,530                    | 78.2            |
| 1995           | 449,188,354                     | 701,464,300                    | 64.0            | 172,321,333                     | 220,434,450                    | 78.2            |
| 1996           | 511,878,238                     | 798,060,455                    | 64.1            | 184,540,571                     | 235,479,385                    | 78.4            |
| 5-year average |                                 |                                | 61.7            | 5-year average                  |                                | 79.0            |

Source: adapted from JKR, 1998, (Unpublished).

The table above shows that the water utilisation in Selangor Darul Ehsan is very much lower than in Penang. The percentage of water usage in Selangor in relation to the production is in the range of 59 to 64%, averaging 61.7%. In contrast, the Penang Water Board managed a better utilisation rate of 78% to 81%, averaging 79.0%. This is partly due to non revenue water usage which is substantially higher in Selangor Darul Ehsan. For the period 1992 to 1996, non revenue water in Selangor Darul Ehsan averages 39.4% compared to Penang, which has only 21.0%.