

Operational Aspects of Water Demand Management

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1. Introduction

The economic growth of Malaysia has increased tremendously since achieving independence. Couple with this economic growth is an ever-increasing demand for treated water supply. In 1990, treated water production was about 4,753 MLD, and in 2008, it had almost tripled to 12,468 MLD and projected to reach 24,485 MLD by the year 2020. Figure 1 shows the projected domestic and industrial water demand for peninsular Malaysia up to 2050 based on the National Water Resource Study carried out by Economic Planning Unit, Prime Minister's Dept. Figure 2 shows the capital investment required for the development of water resource projects from year 2000-2050 as extracted from the report. The Ministry of Natural Resources and Environment is currently carrying out a study to review the national water demand which will includes Sabah & Sarawak.

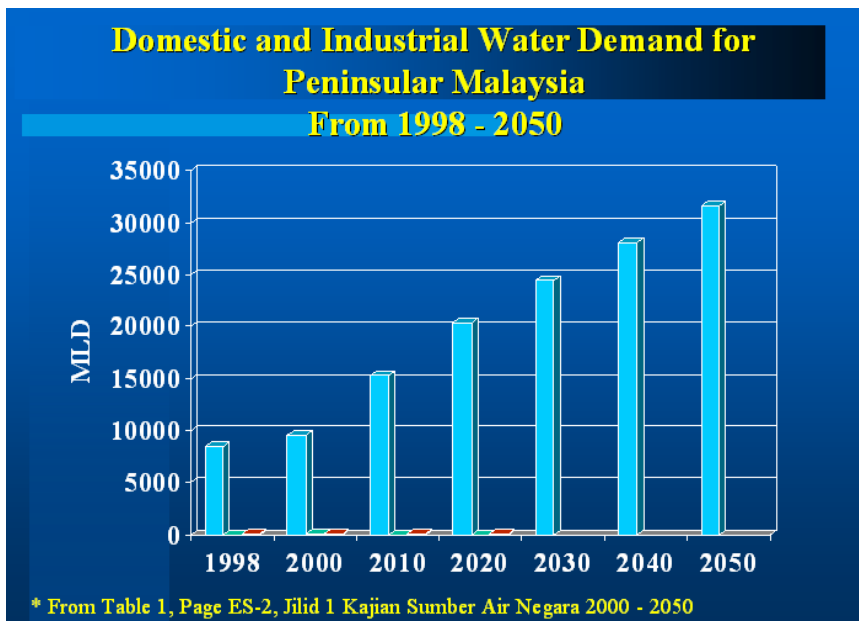


Figure 1 – Domestic and Industrial Water Demand for Peninsular Malaysia
1998 - 2050

CAPITAL INVESTMENT

PERIOD	RM (Million)
2000 - 2010	22,180.10
2011 - 2020	15,214.70
2021 - 2030	6,821.60
2031 - 2040	6,371.10
2041 - 2050	1,220.80
TOTAL	51,908.30

Figure 2 – Capital Investment for Water Resources Development

2.0 Meeting Water Demand

In the past, the Government of Malaysia in its development budget has always allocated huge capital investment for the development of water supply projects. The trend will continue but while focusing in development projects to increase water demand; emphasis has to be on slowing the rate of increase in water demand.

The predominant approach towards meeting increasing water demand has been towards supply augmentation schemes. However, the cost of developing new sources or expanding existing sources is getting costly as the cheaper and easily accessible water resources already developed. Continuous development of water resources/supply projects devoid of water demand management will lead to overusing resources, overcapitalization, resource wastage, pollution problems, adverse environmental impact, temporary and not cost-effective solutions and may also lead to social/political issues.

As the cost of development and construction of new water supply project becomes more costly, the state water authorities/operators have to look seriously into water demand management. To limit the continuous rising water demand, several measures been introduced such as compulsory water metering, increasing water tariff, efficient use of water for appliances, and implementing a holistic non-revenue water control program aiming for an efficient distribution network management, operation and maintenance.

The above measures aimed at reducing water wastage and losses. To the water authorities, water losses could be physical and non-physical. Physical water loss occurs along water mains, treatment plants, overflows from tanks/reservoir and leakage from the distribution system.

3.0 Definition of Water Demand Management

Water Demand Management (WDM) can be defined as the combination of management, financial, economic, engineering and other practices applied towards meeting consumer demand while at the same time optimizing service levels and the amount of water required from the treatment plants. There is a pressing need to manage water demand efficiently as available water resources for development is becoming less available, too costly to develop or too polluted for human consumption. It is widely accepted that to ensure a sufficient supply to consumer, supply must always meet demand. The quality of water delivered to consumers will affect water demand especially when using recycled water for usage such as toilet flushing, gardening etc. By using recycled water of much lower quality than portable water, there will be reduction in demand for portable water.

4.0 Water Demand Management Strategies

From the operational aspects, David B.Brooks, Director of Research, Friends of the Earth Canada in International Journal of Water Resources stated that a comprehensive definition of WDM must reflect both the series of steps that brings

water from source to use and the time and space dimensions of water use. Among the things WDM need to accomplish are:

1. Reduce the quantity or quality of water required to accomplish a specific task.
2. Adjust the nature of the task or the way it is undertaken so that it can be accomplished with less water or with lower quality water;
3. Reduce the loss in quantity or quality of water as it flows from source through use to disposal;
4. Shift the timing of use from peak to off-peak periods;

To accomplish the above, below strategies are required.

4.1 Reduce the quantity or quality of water required to accomplish a specific task.

For each task executed, different amount of water is used, depending on the process involve. For example, a Muslim performs ablution in order to say his prayers (sholat) five times a day. The volume of water used varies from one person to person. The average usage would be 3 – 4 liters of water per ablution but during the Hajj Pilgrimage, ones could manage with only one liter of water or less. To perform ablution ones does not need high quality river complying with water drinking standards. This also applies to task such as watering of plants, car washing, toilet flushing etc. A bad habit, which promotes water wastage, has to stopped/changed. Figure 3 shows some of the water saving tips.

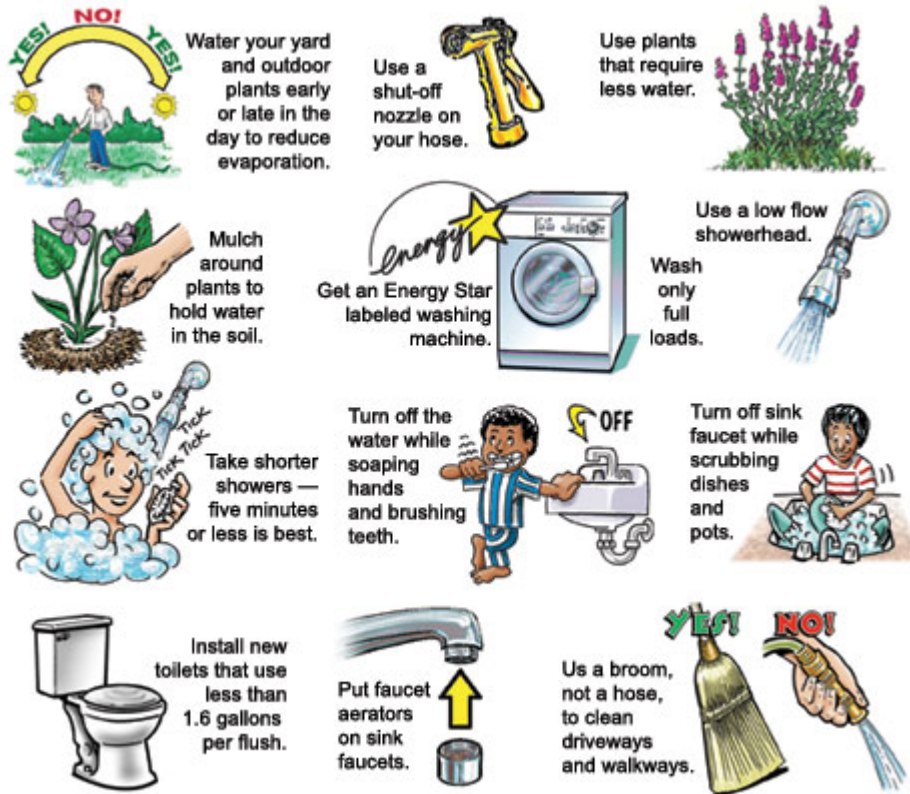


Figure 3 – Water saving Tips

In Government complexes or office buildings, installing additional plumbing system for rain harvesting or recycled water will help to reduce water demand.

Discouraging excessive use of water by introducing tariff control policy will help to reduce water demand. Penalizing heavy users whose consumption falls within tariff band of high consumption by paying higher water bills will discourage wastage.

Adopting the above strategies will help to reduce the per capita demand for water but success of such strategy may need awareness campaign and educating the public on water usage.

4.2 Adjusting the nature of the task or the way it is undertaken so that it can be accomplished with less water or with lower quality water

When performing a task, a consumer may let the tap runs continuously, which will be wastage or he/she may opt to open the tap intermittently for short period as need arises. Changing the way we have always been doing things, which promotes wastage will help in reducing water demand.

4.3 Reducing the loss in quantity as it flows from source to usage

Such strategies may involve implementing Non-Revenue Water (NRW) Control Program, reducing and controlling both physical (real), non-physical (apparent) water losses and unbilled authorized consumption. The NRW component of importance to WDM is physical loss. Physical losses arise from reservoirs/tanks overflows, main burst and leaks. Implementing NRW Control Program such as intensive leakage control (district metering zone), pipe replacement and pressure control will reduce these losses. The rate of pipe water leakage increases proportionally with pressure and by reducing and controlling high water pressure to low acceptable pressure, the rate/magnitude of water losses will be reduced. Figure 4 shows the definition of NRW as adopted by the International Water Association (IWA).

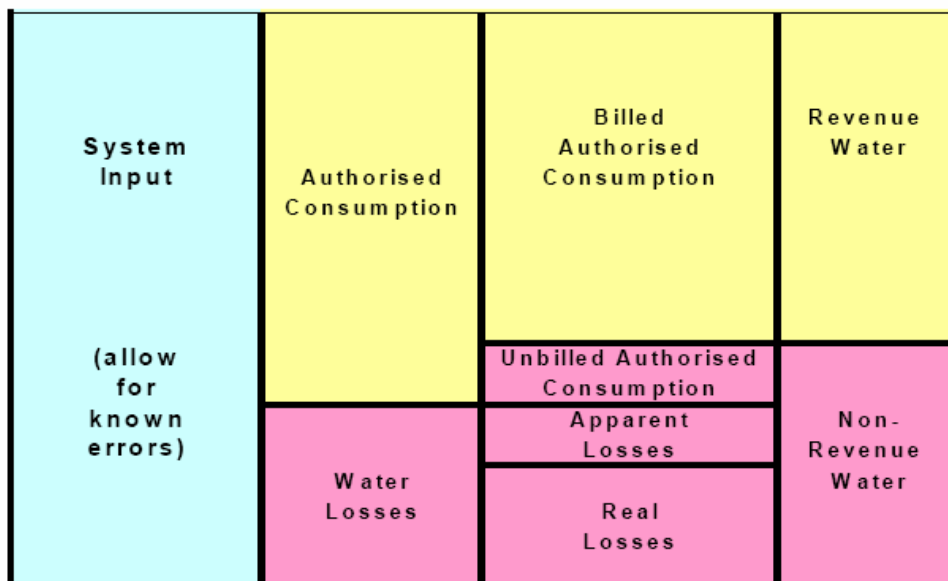


Figure 4 – Definition of Non-Revenue Water (NRW) from IWA

In 1987, the National NRW was 43 % and since the 6th Malaysian Plan (1991-1995), the Malaysian Government without fail has always allocated budget for the Water Authorities to embark on Non-Revenue Water Control Program. The 2008 NRW level is 37 % and targeted to achieve 35 % at the end of 2010. In order to sustain the achieved NRW level, execution of NRW control program must be continuous. If the NRW programme is inactive, the achieved NRW level will increase, making previous effort futile. Lack of commitment and resources by the operators are among reasons for failure of NRW program.

Fracture on a 3 inch spun iron main

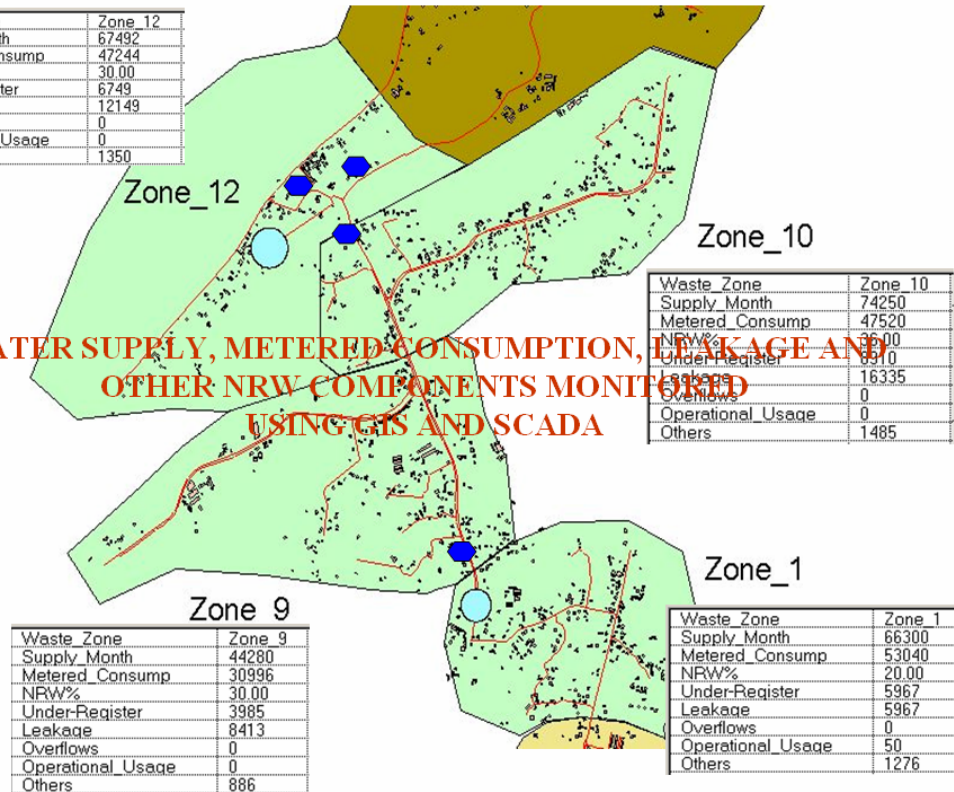


Note the small cavern produced by the leak, this may cause problems under foundations or roads

This leak flow has been logged as being 5 cubic meters per hour

Waste_Zone	Zone_12
Supply_Month	67492
Metered_Consump	47244
NRW%	30.00
Under-Register	6749
Leakage	12149
Overflows	0
Operational_Usage	0
Others	1350

WATER SUPPLY, METERED CONSUMPTION, LEAKAGE AND OTHER NRW COMPONENTS MONITORED USING GIS AND SCADA



Waste_Zone	Zone_10
Supply_Month	74250
Metered_Consump	47520
NRW%	30.00
Under-Register	6749
Leakage	16335
Overflows	0
Operational_Usage	0
Others	1485

Waste_Zone	Zone_9
Supply_Month	44280
Metered_Consump	30996
NRW%	30.00
Under-Register	3985
Leakage	8413
Overflows	0
Operational_Usage	0
Others	886

Waste_Zone	Zone_1
Supply_Month	66300
Metered_Consump	53040
NRW%	20.00
Under-Register	5967
Leakage	5967
Overflows	0
Operational_Usage	50
Others	1276

MONITORING CONTINUOUSLY LEAKAGE LEVEL

Weekly_Supply_&_Leakage(m3)							
Waste_Zone	Conn.	Supply_Week1	Leak_1st_Week(m3)	Leak_2nd_Week	Leak_3rd_Week	Leak_4th_Week	Leak_5th_Week
Zone_8	1250	21000	2100	2100	2100	2800	3500
Zone_7	789	8521	1193	1193	1193	1491	1988
Zone_6	990	9491	2183	2183	2183	2911	3347
Zone_5	1200	12417	2856	2856	2856	3570	3570
Zone_4	970	10815	1630	1630	1630	2173	2173
Zone_3	1000	15960	1596	1596	1596	2660	3724
Zone_2	660	9702	582	582	582	970	1455
Zone_1	850	15470	1392	1392	1392	2321	2321
Zone_9	760	10332	1963	1963	1963	2727	3272
Zone_10	1100	17325	3812	3812	3812	4574	6098
Zone_11	700	9261	1389	1389	1389	1760	1852
Zone_12	890	15748	2835	2835	2835	3402	3402

LEAKAGE CAN BE MONITORED DAILY, WEEKLY, MONTHLY, YEARLY

MONITORING UNITS CAN BE CUBIC METERS, LITRES/CONN/DAY LITRES/KM/DAY OR PERCENTAGE OF SUPPLY

4.4 Shifting the timing of use from peak to off-peak periods

During peak demand, demand may increase to double or triple during festive seasons. Existing water supply resources and facilities will be able to meet demand most of the time if during peak period; some of the major demands are shift to off-peak period.

Table 1. Demand Management Implementation Strategies and Programs

Strategy	Implementation Program
Public Education	<ul style="list-style-type: none"> Primary and secondary school programs Promotional campaigns and events Mass media advertising campaigns Dissemination of information through personal contacts Outreach programs to educate water users and help them install conservation hardware Xeriscape garden demonstration
Water Management Programs	<ul style="list-style-type: none"> Meter testing and replacement program Leak detection and repair program Distribution system audit program Tax incentives, subsidies, and rebates for adoption of conservation measures Social conservation incentives and disincentives program
Government Regulation	<ul style="list-style-type: none"> National water management laws and policies Water rights and priorities of use statutes Government enforced performance criteria and standards Local conservation codes and ordinances Water use restrictions and bans during emergencies
Economic Incentives	<ul style="list-style-type: none"> Water pricing and rate-making policies Tradable water rights Regional water markets and water banks Subsidies and rebates to water users Cross-subsidization of agricultural conservation Tax credits and incentives Penalties for excessive use (quotas) Privatization of water supply sector

Source: Dziegielewski and Baumann (1992), Dziegielewski et al (1993a)

5.0 Conclusion

Freshwater is finite and should be treated as a commodity. To successfully implement Water Demand Management, needs political will and strong government support in terms of policies and resources. Implementing new water development schemes is not the absolute solution to overcome water shortage. To encourage water savings, avoiding elements of subsidy and implementing proper pricing of water tariffs, will deter wastage of water. For a Non-Revenue Water program to be successful, appropriate strategy, methodology, adequate resources, commitment and concerted efforts within the water agency is of utmost importance.

References:

1. National Water Resources Study 2000-2050
2. Losses from water supply systems: Standard Terminology and Performance Measures – IWA the blue pages
3. Strategies for Managing Water Demand, Benedykt Dziegielewski, Southern Illinois University Carbondale
4. Water Demand Definition from Operational Aspects, David B. Brooks, Director of Research, Friends of the Earth Canada in International Journal of Water Resources
5. Allan Lambert, Leakage and Pressure Management Seminar, Victorian Water Association 6th October 2004
6. Labuan GIS & NRW Control Program