*Water is a precious natural resource. The Government has formulated the Total Water Management Strategy for ensuring sustainable use of water resources. We appeal for the support and active participation of all in the community for the successful implementation of the measures in the Strategy to prepare us for possible acute climate changes or low rainfall. It is of paramount importance to engage our young generation, so that the effort will be well sustained.*

*Mr. MA Lee Tak, JP*
*Director of Water Supplies*

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twm

# Total Water Management in Hong Kong

## Towards Sustainable Use of Water Resources

The Government of the Hong Kong Special Administrative Region
Development Bureau

水務署
Water Supplies Department

*Thanks to the full support and co-operation of the Guangdong authorities in the supply of Dongjiang water and decades of efforts in building up our local supply system, people of Hong Kong are spared the distress and inconvenience of water rationing. But there is no room for complacency. In aspiring for sustainable development and meeting needs of the Pearl River Delta region, we have a duty to ensure reliable water supply for our future generations and for our neighbours. For this, the HKSAR Government has devised a Total Water Management Strategy for Hong Kong. We will press ahead with its implementation.*

*Mrs. LAM CHENG Yuet Ngor, Carrie, JP*
*Secretary for Development*

1.0 Total Water Management

2.0 What the Government Will Do

3.0 What You Can Do

4.0 Towards Sustainable Use of Water Resources

# Fresh Water is Precious

Fresh water is a precious natural resource. Supply of clean and safe drinking water is a problem in many parts of the world. Every society shares the global responsibility to promote sustainable use of fresh water resources on the Earth.



1.0

## Total Water Management

### *Water... A Global Challenge Now and in Future*

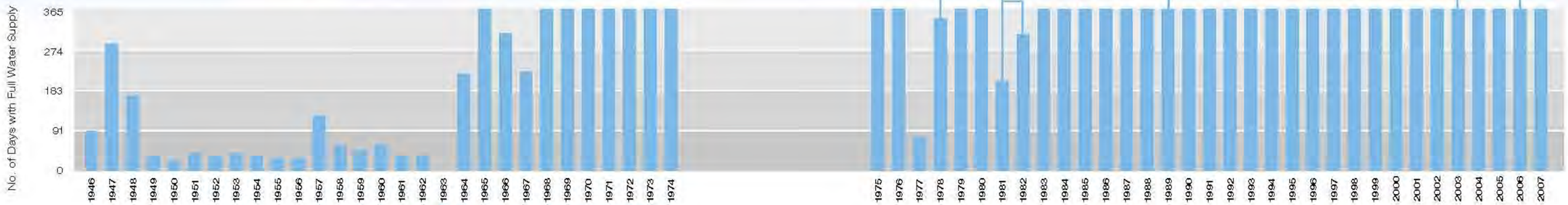
*Less than 1% of all the water resources on the Earth is readily accessible for human uses and its geographical distribution is uneven. In 2002, the World Health Organization estimated that 1.1 billion people in the world lacked access to clean water supply, nearly two-thirds of them in Asia. The United Nations Environment Programme forecast in 2000 that if current trends of water consumption continue, two-thirds of the world population will live in areas with moderate to high water stress by 2025. Climate changes due to global warming will make the situation worse.*

# 1.1

# From Water Rationing to Reliable Water Supply

In Hong Kong, maintaining reliable water supply is also a challenge. Water shortage used to be a serious problem before the early 1980s. This was because of geographical constraints of water supply (including unreliable rainfall pattern) and continuous increase in demand for safe drinking fresh water due to rapid growth of population. Water rationing was imposed from time to time in the history of water supply. People's livelihood was severely affected. The cost on our economy was tremendous.

## History of Water Supply in Hong Kong (1946-2007)



**1957**
Use of seawater for toilet flushing in Shek Kip Mei and Lei Cheng Uk Estate

**1960**
Water Supply Agreement with Guangdong
Supply from Shenzhen Reservoir

**1963**
Completion of Shek Pik Reservoir
24.5 mcm capacity

**1968**
Completion of Plover Cove Scheme and Extension in 1973
230 mcm capacity

**1959**
Completion of Tai Lam Chung Reservoir
20.5 mcm capacity

**June 1963 - May 1964**
Severe Water Rationing
4 hours of supply every 4 days

**1965**
Completion of Lower Shing Mun Reservoir
4.3 mcm capacity

**1965**
Water Supply Agreement with Guangdong
68.2 mcm/year of Dongjiang water supply

**1979**
Completion of High Island Scheme
281 mcm capacity

**1989**
Water Supply Agreement with Guangdong
Maximum 1,100 mcm/year of Dongjiang water supply

**2006**
Water Supply Agreement with Guangdong
Flexible supply of Dongjiang water

**1981-1982**
Last water rationing in Hong Kong

**2003**
Commissioning of 83km dedicated aqueduct for delivery of Dongjiang water

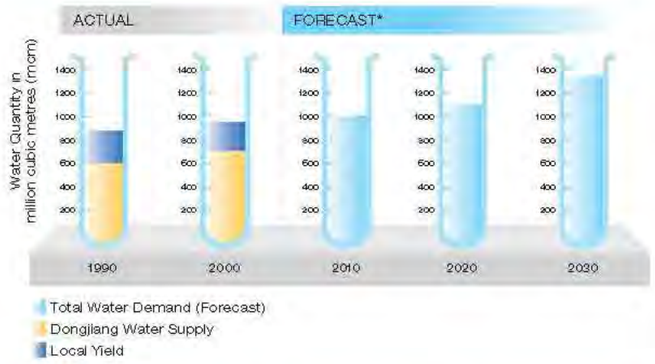
mcm = million cubic metres

To resolve the problem, the Government adopted three important water management measures:

- Construction of new reservoirs, for example, the large-scale Plover Cove Scheme and High Island Scheme
- Use of seawater for toilet flushing
- Negotiation with Guangdong to increase import of Dongjiang water into Hong Kong through the Dongshen Water Supply Scheme

Today, Hong Kong enjoys a reliable supply of fresh water. In 2007, the total fresh water demand was 951 million cubic metres (mcm). About 20%-30% of our water supply is surface water collected from local water gathering grounds (also known as "local yield"). The local yield can provide a reliable supply of 210 mcm per year in a one-in-one-hundred year drought. The average annual local yield is 295 mcm. About 70% to 80% of our fresh water supply is imported from Dongjiang at a long distance of over 80 km. The agreed maximum quantity of Dongjiang water for Hong Kong is 1,100 mcm per year. According to the latest forecast, our water demand should be met by the current arrangement of water supply up to 2030.

Water Demand and Supply of Hong Kong (1990 – 2030)




Reservoirs and Water Gathering Grounds in Hong Kong

***Water Demand Forecast in Hong Kong***

*The Government is now carrying out the "Replacement and Rehabilitation Programme" on water mains. This programme, which will end in 2015, will reduce the water demand in Hong Kong. On the basis of no additional water demand management measures after 2015 and a reference population of 8.4 million, the Government forecasts that the fresh water demand will grow to 1,315 mcm in Hong Kong by 2030.*



1.2

# Total Water Management (TWM) in Hong Kong

TWM is a modern concept for managing water resources in all aspects. TWM seeks to achieve an optimal balance between water demand and water supply in order to ensure sustainable use of water resources. The Government's TWM strategy aims to manage the demand and supply in an integrated, multi-sectoral and sustainable manner.

## *Why TWM?*

Even though our forecast water demand will be met by current water supply arrangement, TWM is required :

To better prepare Hong Kong for uncertainties such as acute climate changes and low rainfall.

To enhance Hong Kong's role as a good partner to other municipalities in the Pearl River Delta in promoting sustainable use of water in the light of rapid growth of water demand in the region.



## *TWM Study*

In the 2003 Policy Address, the Government pledged to implement a TWM programme. In October 2005, Water Supplies Department (WSD) commissioned a study to examine the fresh water demand and supply situations in Hong Kong and to evaluate all major options of water supply and demand management measures in terms of quantity of water saved or supplied, cost effectiveness, environmental impact and public acceptance. Based on the findings of the study, the current directions of water management are reaffirmed. Additional initiatives are proposed. The Legislative Council, relevant advisory committees, experts and stakeholders were consulted. Their views have been incorporated, where appropriate, into the TWM strategy.



1.3

# Partnership with the Public

The Government is committed to creating a partnership with the public to achieve sustainable use of water resources. With support from citizens, we aim to develop a new culture of using precious water resources wisely and in a sustainable manner in Hong Kong.

### *A Challenge for All People*

*Water shortage is often perceived as a problem for developing countries. In fact, this is a challenge worldwide. Fresh water supply in many parts of East Asia, where the overall water supply may appear abundant, is limited because of population growth, agricultural activities, pollution from sewage and industrial chemicals. Australians are struggling to resolve water shortage by water conservation, water reclamation, seawater desalination and installation of water saving devices in households.*

# 2.0 先節後增

# What the Government Will Do

The Government has formulated a TWM strategy for the period up to 2030. The strategy puts emphasis on containing growth of water demand through conservation. The Government will also strengthen water supply management. The key initiatives under the TWM strategy are as follows:

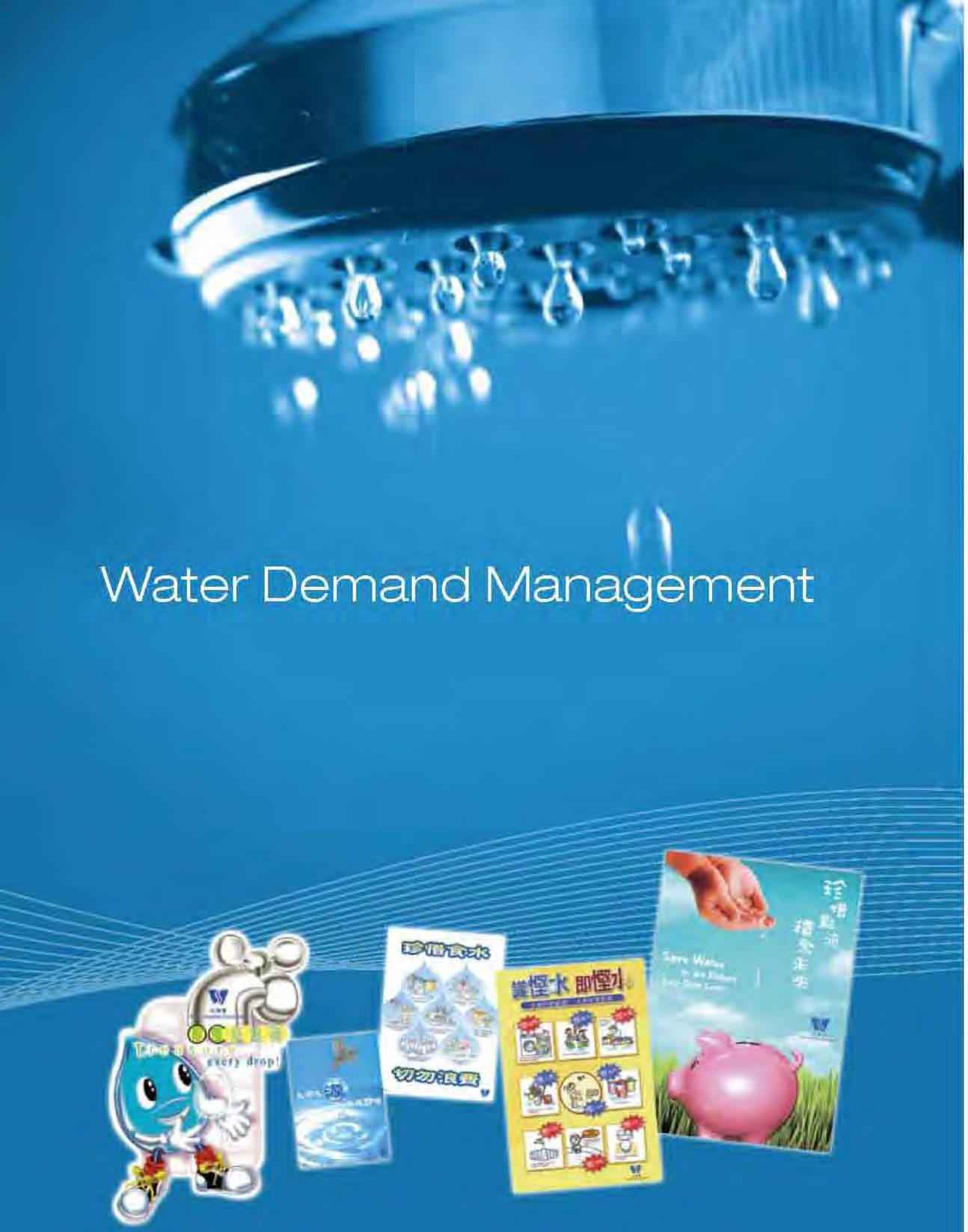
Water Demand Management

- To enhance public education on water conservation
- To promote use of water saving devices
- To enhance water leakage control through the programme to replace and rehabilitate aged water mains, and application of new technology to improve pressure management and detection of leakage
- To extend use of seawater for toilet flushing

Water Supply Management

- To strengthen protection of water resources
- To actively consider water reclamation (including reuse of grey water and rainwater harvesting)
- To develop the option of seawater desalination

Details of the TWM measures are explained below.




# Water Demand Management



2.1

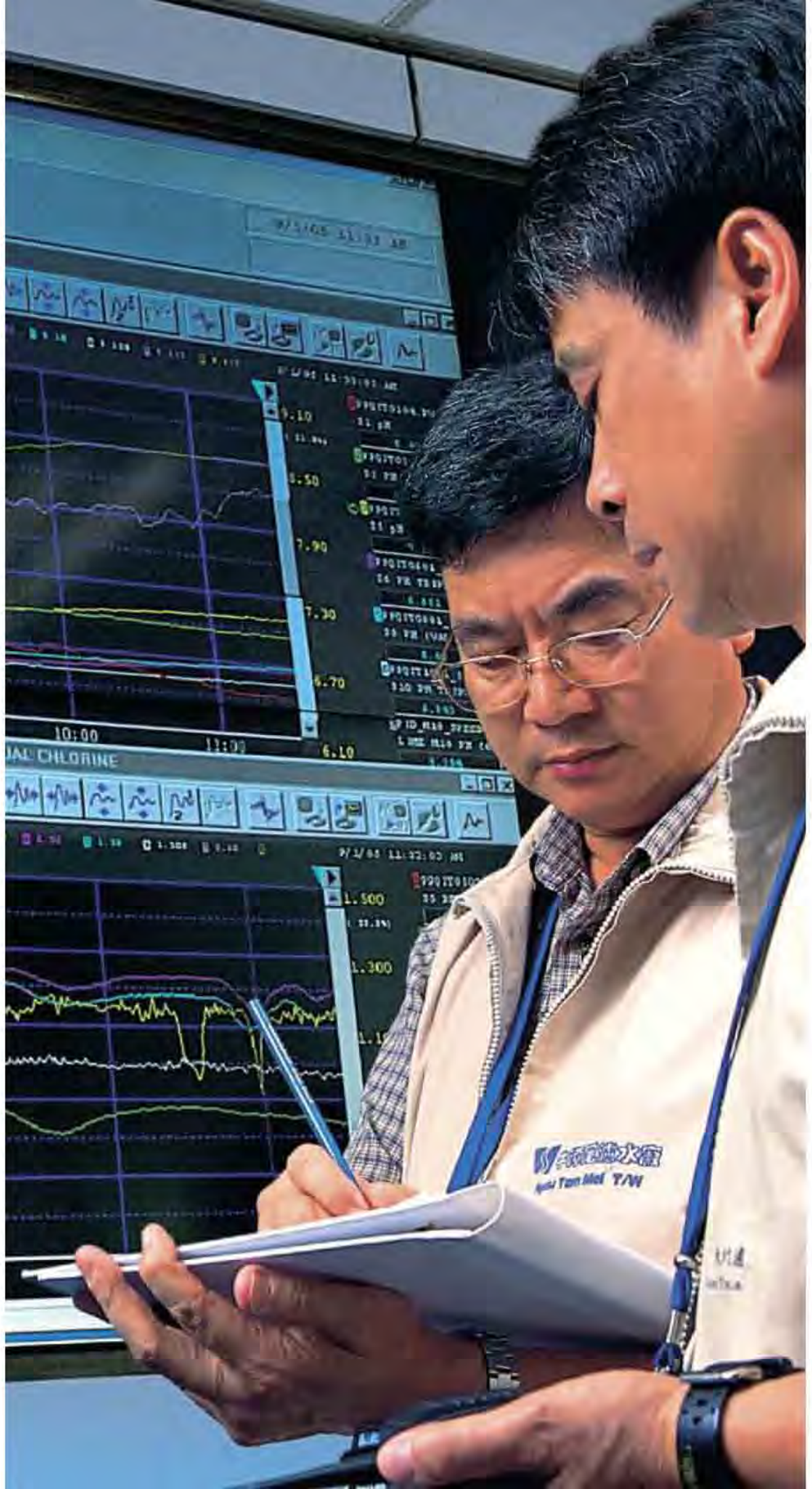
## Public Education on Water Conservation

The Government will regularly launch public education and publicity programmes to promote water conservation in all sectors, particularly targeting at the young people. Current measures (such as announcement-for-public-interest on TV and radio, leaflets, seminars and exhibitions) will be stepped up. New initiatives of public education programmes (such as television documentaries and websites) will be launched. The programmes will introduce to the public tips on water conservation as well as information about water scarcity around the world. For the young generation, the concept and knowledge on water conservation will be introduced to school programmes.

2.2

# Promote Water Saving Devices

Water saving devices use less water than conventional plumbing fixtures or appliances. Such devices include taps that limit flow, low-flow showerheads, dual-flush cisterns, flow control valves, and flow restrictors. Some dishwashers and washing machines also have high water efficiency. Overseas studies show that domestic indoor water demand can be reduced by 25% to 37% with the use of water saving devices.



Water Efficiency Labelling Scheme
WELS

## *Water Efficiency Labelling Scheme*

The Government will promote use of water saving devices. First, WSD will develop a voluntary "Water Efficiency Labelling Scheme" (WELS) to facilitate consumers to choose water saving devices. The concept is similar to the "Energy Efficiency Labelling Scheme" for electrical appliances. WELS will inform consumers of the level of water consumption and efficiency of plumbing fixtures and appliances used in bathrooms, toilets, kitchens and laundries. Implementation of WELS can take place by phases for different groups of products. The Government will consult relevant stakeholders such as manufacturers, distributors, retailers, and professionals when formulating the scheme. Publicity campaigns on WELS will be launched.

In addition, the Government will take a lead to install water-saving devices in its projects and buildings as far as practicable. If WELS is well received and market penetration of water saving devices reaches 40% by 2030, about 100 mcm of water can be saved annually from all the measures to promote water conservation.

### *Water Rating Labelling in Australia*

*Australia established a voluntary water efficiency labelling scheme in 1988. There are five ratings of water efficiency: moderate, good, high, very high and excellent. The scheme was well received and water consumption decreased. After 2005, the Australian Government made the scheme mandatory by phases.*

## 2.3

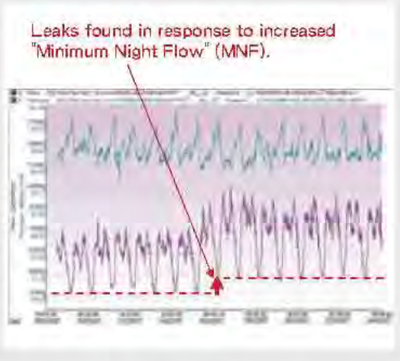
# Active Leakage Control

The Government aims to reduce water leakage to save about 85 mcm of water each year by 2030. A major factor of leakage is ageing of the 7,700 km network of water mains in Hong Kong (of which 6,150 km being fresh water mains). Parts of the network were constructed more than 30 years ago. Old water mains would leak or burst. The Government is investing heavily in a territory-wide "Replacement and Rehabilitation Programme" to replace and rehabilitate about 3,000 km of water mains (of which 2,500 km being freshwater mains) by 2015. The entire programme would cost $19.2 billion. WSD will commission a review to appraise the condition of the remaining water mains. Subject to the review findings, the Government may extend the "Replacement and Rehabilitation Programme" beyond 2015 to cover the remaining distribution network of water mains.

The Government will further reduce water leakage through implementing Comprehensive Pressure Management in all major water supply zones by phases, and enhancing leakage detection and monitoring by adopting new technologies.

### *Water Leakage Control Technologies*

*WSD applies new technologies to strengthen water leakage control.*




- *Comprehensive Pressure Management (CPM): This is to use the latest pressure management technologies (for example, installation of flow modulating pressure reducing valves and flow-meters) to optimise water mains pressure and reduce leakage. Since 2001, small-scale pilot schemes have been successfully conducted. New pilot schemes are being carried out in major supply zones such as North Point and Shau Kei Wan.*

- *Telemetric district metering: Each district metering area (DMA) is served by an electromagnetic flow-meter and a GSM (global system for mobile communication) data logger for transmitting the flow and pressure data to control centres via mobile phone networks. Early signs of leakage will be more easily detected for remedial actions.*



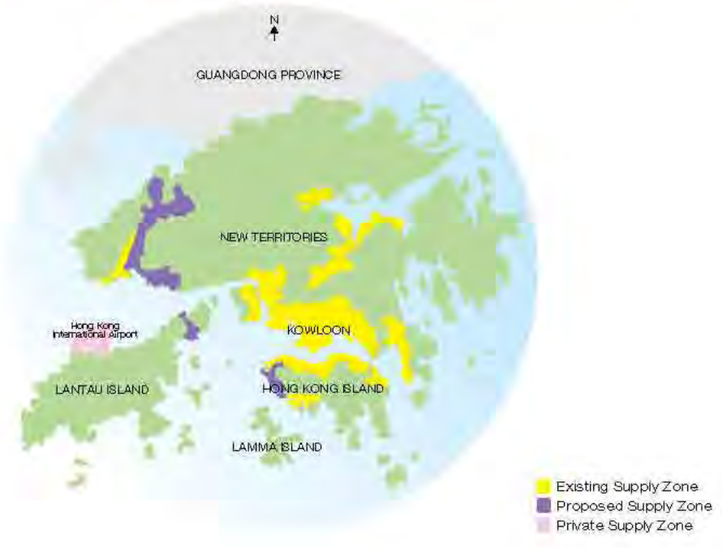


# Seawater Flushing

Seawater is already available for toilet flushing in metropolitan areas and most of the new towns, covering about 80% of population. WSD has been planning for extension of the use of seawater for toilet flushing whenever it is economically justified. Preparatory work is in progress for the supply to Disneyland, Pok Fu Lam, Tuen Mun East, Yuen Long and Tin Shui Wai.

### Portion of Supply by Seawater

### Existing Seawater Flushing Situation and Proposed Extensions



# Water Supply Management

## Protection of Water Resources

WSD plans to strengthen the current practice of protecting local water resources. First, a study is in progress to develop the water pollution risks and impacts assessment framework for protecting water resources from developments in water gathering grounds. Second, WSD will start a capital works project by 2011 to improve the existing catchwater system for safe and effective collection of surface water. In addition, the Government will continue close dialogue with the Guangdong Authorities to ensure the highest quality of imported water to Hong Kong.

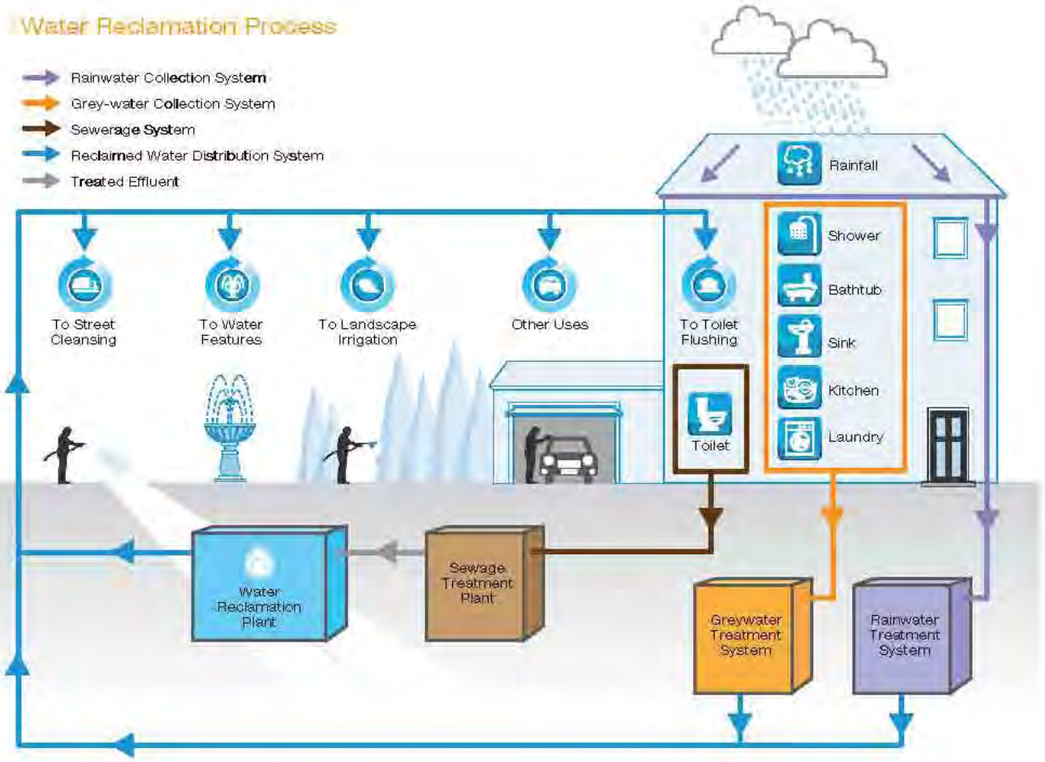
# 2.6

# Water Reclamation

Water reclamation is to use lower quality water to replace high quality water currently used for non-potable purposes such as toilet flushing and landscape irrigation. The Government is conducting pilot schemes. It is looking into a plan to provide reclaimed water from Shek Wu Hui Sewage Treatment Works for consumers in Sheung Shui and Fanling for toilet flushing and other non-potable uses. This plan will also bring forth positive impact on water quality at Deep Bay, which currently receives the discharge from the Treatment Works. The Government will consult the public and the districts concerned. The lead-time for the water reclamation scheme may take eight years. This initiative is estimated to save 21 mcm of water each year.

In addition, the Government will conduct trial schemes of reuse of grey water and rainwater harvesting for some new public projects. Grey water is collected from baths, wash-basins and kitchen sinks and can be treated for toilet flushing and irrigation. Rainwater can be harvested for similar purposes. The Government encourages private developers to adopt these forms of water reclamation.






### *Pilot Schemes of Water Reclamation in Hong Kong*

*The Government is conducting pilot schemes of water reclamation in Ngong Ping and Shek Wu Hui. The pilot schemes use reclaimed water for toilet flushing and gardening. The interim results of surveys under the two pilot schemes on public acceptance were favourable. Final review results will be available by the end of 2008.*

*In a new MTR property development in Tseung Kwan O, there is a plan to reuse grey water and collect rainwater for the purposes of irrigation, street cleaning and water features.*

### *NEWater in Singapore*

*In 2001, the Singaporean Government introduced NEWater, reclaimed water from the wastewater after advanced treatment and disinfection procedures. Most of the NEWater is supplied for non-potable uses such as certain manufacturing processes and air-conditioning cooling in commercial buildings. A small amount is introduced into reservoirs for further treatment into drinking water. Currently, there are four NEWater plants meeting 15% of daily water demand in Singapore. Construction of the fifth plant is underway. NEWater scheme has won international environmental protection awards.*

# 2.7

# New Water Resources

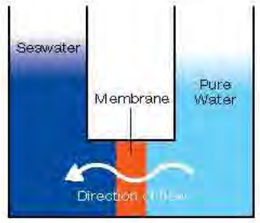
The TWM Study has looked into options of new water resources though there is no imminent need. The option of expanding water gathering grounds and reservoir storage is considered to be of very low priority for Hong Kong because of high costs and negative environmental impacts.

Seawater desalination by the reverse osmosis (RO) technology can produce the largest quantity of new water supply in Hong Kong. It is a proven technology around the world. In 2003, WSD began a pilot desalination plant study using RO technology in Tuen Mun and Ap Lei Chau. The pilot tests completed in 2007 have confirmed that RO desalination technology is viable for Hong Kong. The Government will develop the option of desalination.



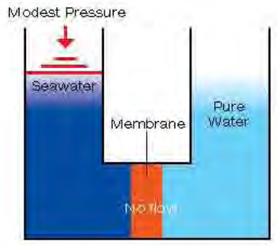
## Mechanism of Reverse Osmosis

### Normal Osmosis



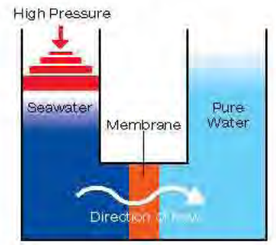

Under normal osmosis, water diffuses from less concentrated solution to more concentrated solution through a semi-permeable membrane to achieve osmotic equilibrium.

### At Osmotic Equilibrium




Modest pressure is applied to the seawater side so that fresh water cannot flow pass through the membrane.

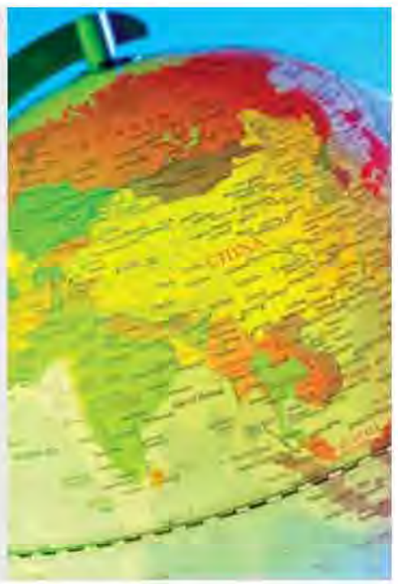
### Reverse Osmosis




Reverse osmosis is the process of forcing water from concentrated solution to less concentrated solution through a semi-permeable membrane under high pressure. The membrane allows fresh water to pass through while it retains salts and other impurities.

### *Desalination Around the World*

*Reverse Osmosis (RO) technology has been used in building desalination plants in a number of countries. In Singapore, Tuas Seawater Desalination Plant with a capacity of producing 10% of national demand (50 mcm per year) was opened in September 2005. Tuas is one of the most energy efficient desalination plants ever built. In Australia, Perth Seawater Desalination Plant, which provides 17% of Perth's water demand at full capacity, was opened in November 2006. It is the largest RO desalination facilities using renewable energy. The plant has won an international award for implementing affordable desalination scheme that minimizes environmental impact. In the Middle East, RO facilities with annual capacities of over 100 mcm have been completed in recent years.*



# 3.0

# What You Can Do

The Government's commitment alone is not enough for successful implementation of the TWM strategy. Everyone can contribute to achieving the goals of TWM. What you will do is of utmost importance to ensure sustainable use of water resources in Hong Kong.

# 3.1

# Conserve Every Drop of Water

Every drop of water is precious. Let us think before turning on our water taps.

A little change each day makes a big difference over time. You and your family can save a lot of water in every day life. For example, you can

Take short showers instead of bathing in bathtub everyday.

Do laundry with a full load.

Turn off the tap while brushing teeth, soaping hands and shaving.

Reuse water after washing fruits and vegetables for watering your plants.

Fix any dripping tap immediately.

Check for water leaks in your home regularly.

Avoid flushing unnecessarily.

*While dripping tap happens in your home, how much water will be lost per day?*

| | One drip per second | Drips breaking into stream | 1.5 mm stream | 3 mm stream | 6 mm stream |
|---|---|---|---|---|---|
| Wastage per day | 4 litres | 90 litres | 320 litres | 985 litres | 3,500 litres |

Information Source: UK Environment Agency, Website 2006



Examples on savings from a four-member household

| Water Saving Tips | Daily Water Saved Per Family (litres) |
|---|---|
| Cut each shower by 2 minutes | 96 |
| Turn off the tap while brushing teeth, soaping hands and shaving | 26 |
| Wash vegetables and fruits in a basin rather than under running water | 14 |
| Wash dishes in a filled basin rather than under running water | 28 |
| Wash clothes only with full loads on alternative days instead of washing with 1/2 loads daily | 20 |
| Take showers instead of baths (assume one bath by each member in a week) | 44 |
| TOTAL | **228** |

Average daily water consumption : 520 litres

Saving to be achieved from above examples : up to 228 litres (44% savings)

# 3.2

## Use Water Saving Devices

You can install water saving devices in your home. With WELS, it will be easy for you to choose such devices. If you use

SAVE
**50%**

Water-efficient washing machines, you can reduce water consumption by up to 50%.

SAVE
**30%**

Low-flow showerheads, you may save as much as 30% of water.

SAVE
**45%-55%**

Taps with flow restrictors, 45% to 55% water consumption can be reduced.

SAVE
**60%**

Water-efficient dishwashers, you may save up to 60% of water.



## Spread the Message

Another important contribution everyone can make is to spread the message of water conservation to your family and friends, in particular children. Long-term success of water conservation is dependent on efforts from all citizens, and a next generation that cares about precious water resources.

# 4.0

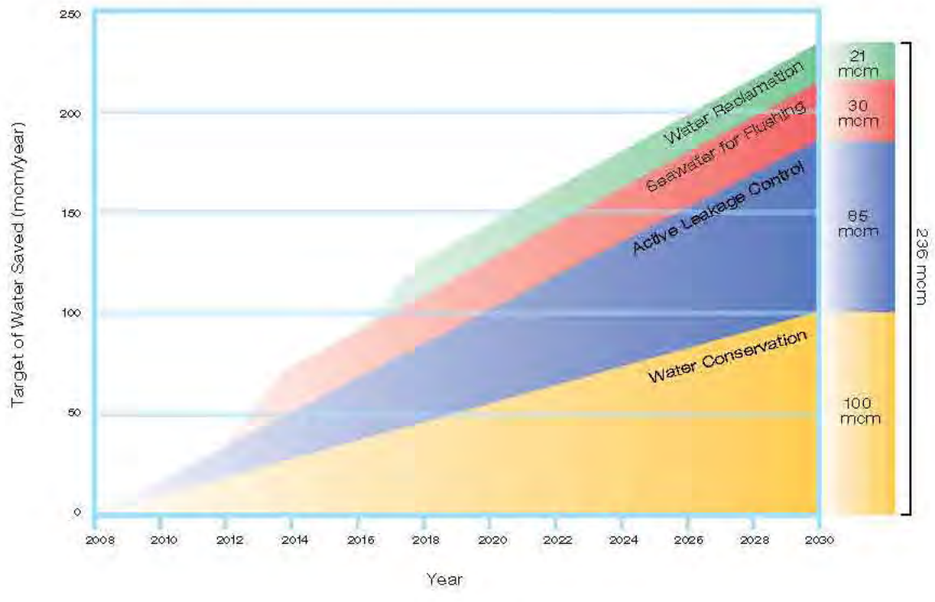
# Towards Sustainable Use of Water Resources

# 4.1

## Commitment to Successful TWM

The Government is committed to successful implementation of the long-term TWM strategy in an integrated, multi-sectoral and sustainable manner. To achieve this goal will require support from every citizen.

Cumulative Savings of TWM Measures




mcm = million cubic metres



# 4.2

## Future Review and Continuous Monitoring

The TWM strategy will form the foundation for future reviews and continuous monitoring of water management in Hong Kong. WSD produces annual forecasts of water demand and supply; and will monitor other critical data such as population and economic growth, social and economic activities so as to identify any change of circumstances. The Government will continue to initiate new measures to meet challenges, and to optimise utilization and development of water resources.

# 4.3

## A Sustainable Lifestyle for All

Sustainable use of water resources for our future is our common goal. Hong Kong needs a new attitude, a new lifestyle that gives high priority to caring the environment and preserving precious water resources on our Earth.

A sustainable lifestyle is the lifestyle of the 21st century for a better future for all.