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Water resources in Hong Kong

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Hong Kong has been enjoying an uninterrupted water supply since 1982. This can be attributable to a three-pillar water supply structure featuring rainwater collected from local catchments, imported Dongjiang water and seawater for toilet flushing.

Hong Kong has relied heavily on Dongjiang water. Yet Dongjiang also serves a major source of water supply for other cities in Guangdong. The planned development of the Pearl River Delta as a world-class industrial base should increase the water demand in Dongjiang-reliant cities in the years ahead.

While the recently signed new water supply arrangement guarantees Hong Kong a stable supply of Dongjiang water during 2015-2017, there is no assurance that Dongjiang will always be able to provide a constant water supply for Hong Kong. To prepare for such a possibility and serve as a responsible user of Dongjiang, it is prudent for Hong Kong to conserve water and review and explore the various options for sources of water supply.

Hong Kong's water tariff was frozen in 1995, but the water production cost has more than doubled since then. The Water Supplies Department has been financing the deficits with increased government funding. Indeed, the size of government funding can be reduced by measures such as reduction of spillage from small reservoirs and active control of water leakage.

The subject of water resources falls within the policy areas of the Panel on Development.

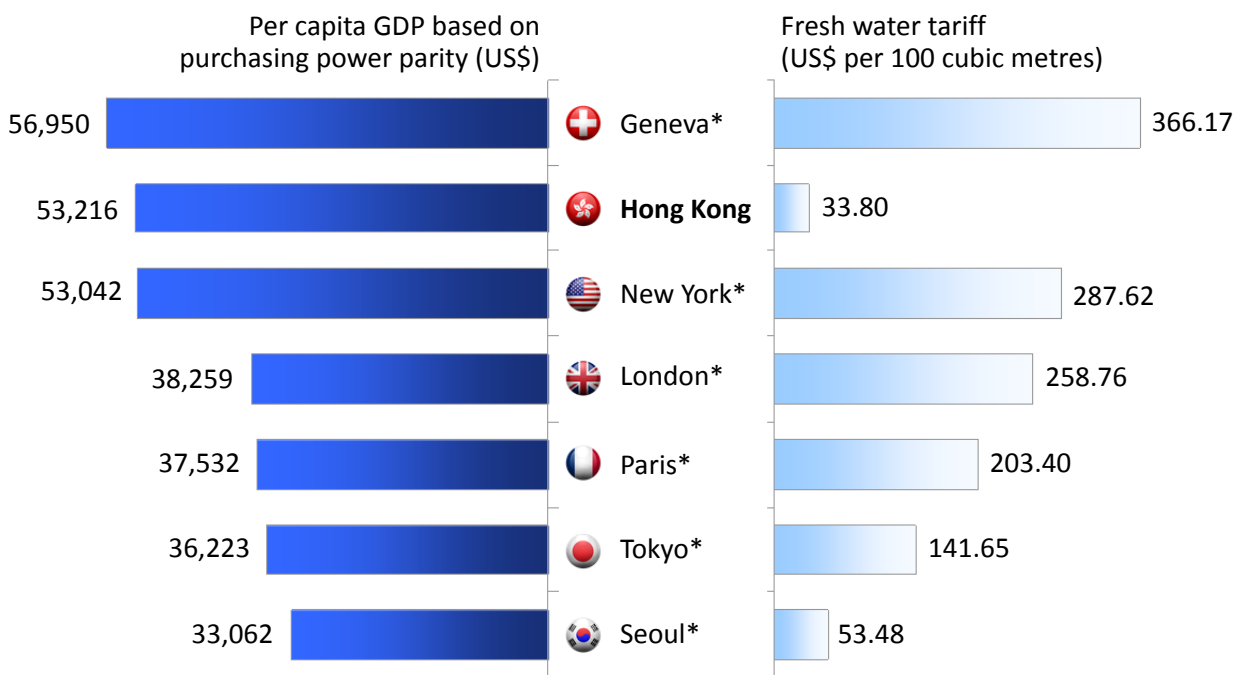
1. Introduction

1.1 Fresh water is a scarce natural resource. This is particularly true for Hong Kong, as it has no natural lakes or substantial groundwater resources and rainfall is the only local source of raw water (i.e. water not yet treated). As such, Hong Kong has put in place a water supply structure consisting of rainwater collected from local catchments (i.e. local yield), water imported from Dongjiang in Guangdong, and seawater used for toilet flushing. This three-pillar structure has enabled Hong Kong to enjoy a 24-hour uninterrupted water supply for more than three decades.¹

1.2 Hong Kong also enjoys a fairly low water tariff. Seawater for toilet flushing is supplied free of charge. Meanwhile, fresh water supply is charged on a subsidized scheme, and the water tariff has been much less than that in cities of comparable or lower per capita Gross Domestic Product ("GDP") (**Figure 1**).

¹ The last water rationing was in May 1982 when fresh water supply was available on a 16-hour basis for 24 days during the month.

Figure 1 – Per capita GDP and fresh water tariff in selected global cities, 2013



Note: (*) Per capita GDP is country-wide figure whereas fresh water tariff is city-specific figure.
Sources: International Water Association and World Bank.

2. Water consumption in Hong Kong

2.1 Low water tariff, coupled with a stable supply, has led to Hong Kong being one of the highest per capita water users in the world. According to a study conducted by the International Water Association in 2014, Hong Kong's domestic per capita water consumption stood at 209 litres/day in 2012. The figure was higher than that in many other global cities like Singapore (152 litres) and London (163 litres)².

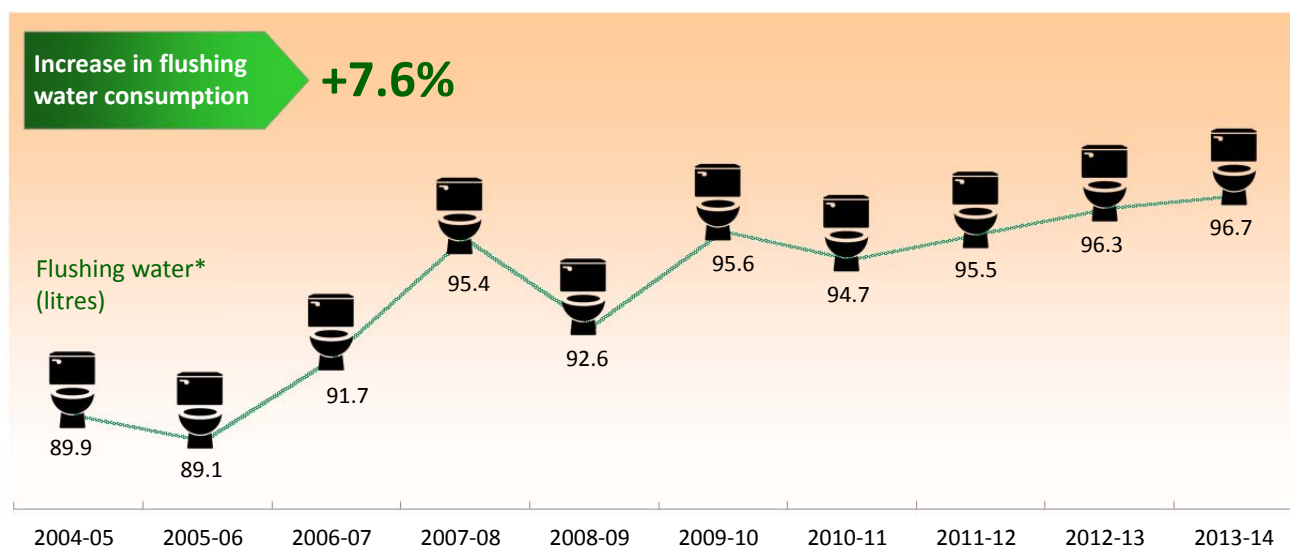
Flushing water

2.2 Hong Kong is the world's first city to systematically utilize seawater for toilet flushing and conserve fresh water for other purposes. The Water Supplies Department ("WSD") started installing a separate network to carry seawater in the 1950s, and has since then extended the network which currently covers about 80% of the total population. In 2014, the use of seawater for toilet flushing saved about 22% of fresh water consumption or 742 530 cubic metres ("cu m") of potable water a day.

² See International Water Association (2014) and Data.gov.sg (2015).

2.3 At present, about 20% of the total population are still using fresh water for toilet flushing. When fresh water used for toilet flushing is accounted for, Hong Kong's daily per capita flushing water consumption has been on the generally rising trend in recent years. According to WSD, it increased from 89.9 litres in 2004-2005 to 96.7 litres in 2013-2014, representing an increase of 7.6% over the period (Figure 2).

Figure 2 – Daily per capita flushing water consumption, 2004-2005 to 2013-2014



Note: (*) including both fresh water and seawater used for toilet flushing.

Source: Water Supplies Department.

2.4 The increase in daily per capita flushing water consumption can be attributable to, among other things, free supply of seawater for toilet flushing. While users are not charged for seawater flushing, seawater is by no means a free resource in Hong Kong. The supply of seawater for toilet flushing requires the construction of a separate network of seawater mains, pumping stations and service reservoirs. The fixed asset cost of the seawater flushing infrastructure amounted to HK\$6.5 billion as at end-March 2014. Due to the high salinity of the seawater, seawater mains are susceptible to corrosion. According to the Government, the service life of seawater mains is comparatively shorter than that of fresh water mains³.

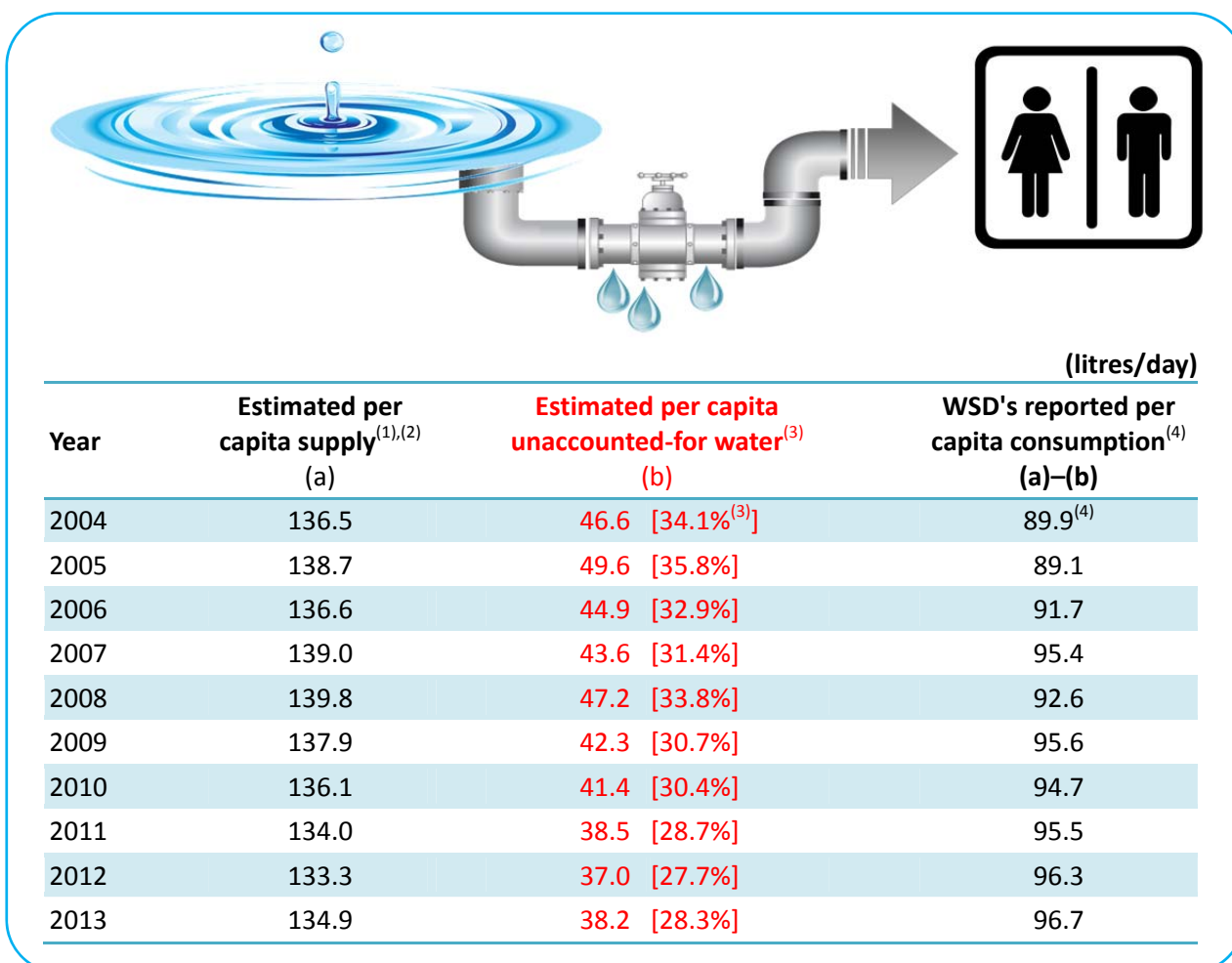
2.5 There are also other costs incurred in seawater flushing. The seawater is firstly screened by strainers to remove solid particles. It is then disinfected with chlorine or hypochlorite before being pumped to service reservoirs and for distribution to users. According to WSD, the unit cost of seawater supplied to

³ In the case of pipe materials used in older days such as cast iron and asbestos cement, the service life of seawater mains could be as short as 20 years. See Environment, Transport and Works Bureau (2006).

users for toilet flushing amounted to HK\$3.4/cu m in 2013-2014. Yet users may not be aware of the volume used and the costs so incurred as they are not reflected in the water bill. This gives users little incentive to reduce unnecessary use of toilet flushing water.

2.6 Apart from the "hidden" cost of seawater flushing, another area of note is the amount of "unaccounted-for" flushing water possibly stemming from factors such as water mains leakage and unauthorized water consumption. The estimated amount of per capita unaccounted-for water ranged between 37.0 litres and 49.6 litres per day during 2004-2013 (Figure 3). The figure suggests the need for WSD to reduce the amount of unaccounted-for water, thereby saving the expenditure spent on the supply of seawater and fresh water for toilet flushing.

Figure 3 – Daily per capita flushing water supply and consumption, 2004-2013



Notes: (1) estimation based on the sum of the total amount of seawater (recorded by WSD's pumping stations) and fresh water (including unaccounted-for water) supplied for toilet flushing.

(2) calendar year figure.

(3) estimated per capita unaccounted-for water as a percentage of estimated per capita supply.

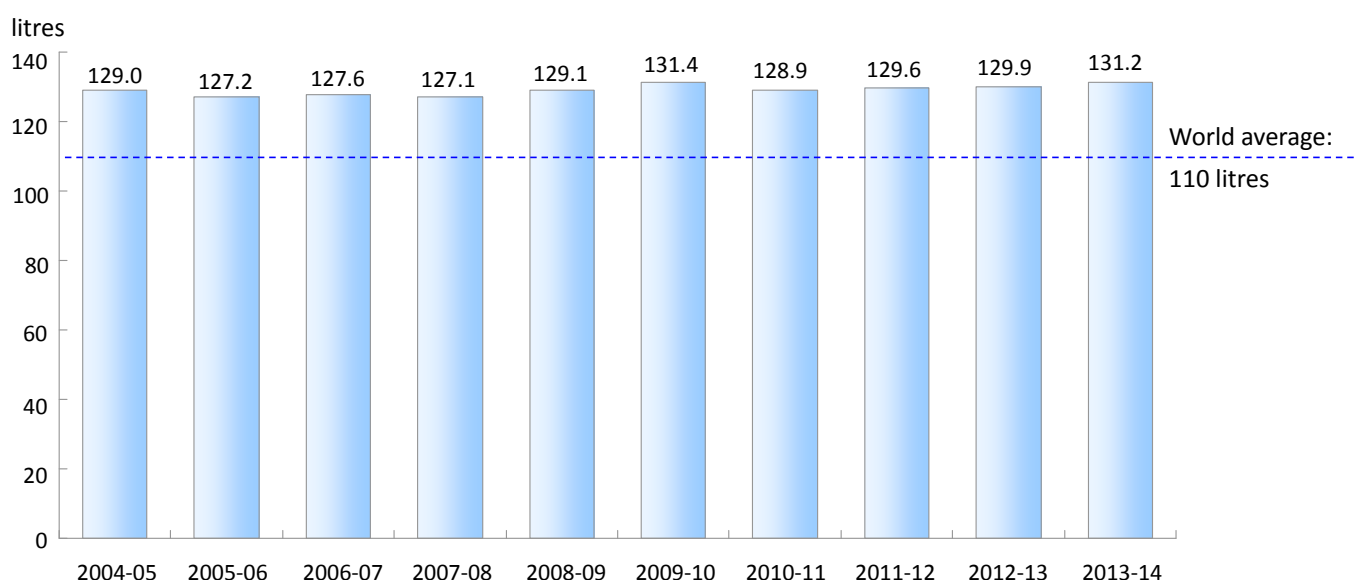
(4) financial year figures.

Source: Water Supplies Department.

Fresh water

2.7 Hong Kong's per capita domestic fresh water consumption remained at around 130 litres/day between 2004-2005 and 2013-2014⁴. This was 18% higher than the world average of 110 litres, and notwithstanding the implementation of various water conservation initiatives under the Total Water Management ("TWM") Strategy promulgated by WSD in 2008 (Figure 4)⁵. As a long-term strategy for the period up to 2030, the TWM Strategy aims at achieving an optimal balance between water demand and supply to support sustainable development in Hong Kong. It focuses on containing the growth of water demand through conservation initiatives such as water efficiency labelling scheme ("WELS") and use of water saving devices⁶.

Figure 4 – Daily per capita domestic fresh water consumption, 2004-2005 to 2013-2014



Source: Water Supplies Department.

Water efficiency labelling scheme

2.8 In Hong Kong, WELS is a voluntary water conservation initiative covering showers, water taps, washing machines, urinal equipment and flow controllers. However, overseas places such as Australia and Singapore require mandatory participation in WELS and cover toilet flushing cisterns as well. In addition, some state governments in Australia have put in place a rebate scheme to promote the purchase and installation of water efficient appliances⁷.

⁴ The figure excludes the amount of fresh water used for toilet flushing.

⁵ See Audit Commission (2015).

⁶ Other water demand management initiatives include active control of water leakage, enhancing public education on water conservation, and extending the use of seawater for toilet flushing.

⁷ For example, the Victorian government has made available a rebate of AUS\$100 (HK\$620) for the purchase and installation of a water efficient dual-flash cistern between 1 July 2012 and 30 June 2015.

Use of water saving devices

2.9 The TWM Strategy also focuses on promoting the use of water saving devices such as taps that limit flow, low-flow showerheads, dual-flush cisterns, flow control valves and flow restrictors. These devices use less water than conventional plumber fixtures or appliances. In April 2009, the Government issued a technical circular on Green Government Building requiring all new government buildings to use water saving devices. Recently, WSD has completed its first phase of retrofitting new plumbing fixtures and water saving devices in government buildings and schools. According to the Audit Commission, water consumption of government buildings and schools has instead increased after installing water saving devices. As explained by WSD, the increase in water consumption was due to "operation needs, maintenance and improvement works".⁸

2.10 Unlike Hong Kong, Singapore requires all new domestic premises and existing domestic premises undergoing renovation to install (a) dual-flush cisterns and (b) water fittings and products that are labelled with at least one or more ticks under WELS^{9,10}. Amid the implementation of the above compulsory measures in 2009, Singapore's daily per capita domestic water consumption reduced by about 3.2% between 2008 and 2014.

3. Water supply in Hong Kong

3.1 As a coastal city, Hong Kong has an unlimited supply of seawater from the ocean that is not affected by the acute climate changes¹¹. For fresh water supply, generally about 20%-30% is sourced from local yield and the remaining 70%-80% from Dongjiang (**Figure 5**).

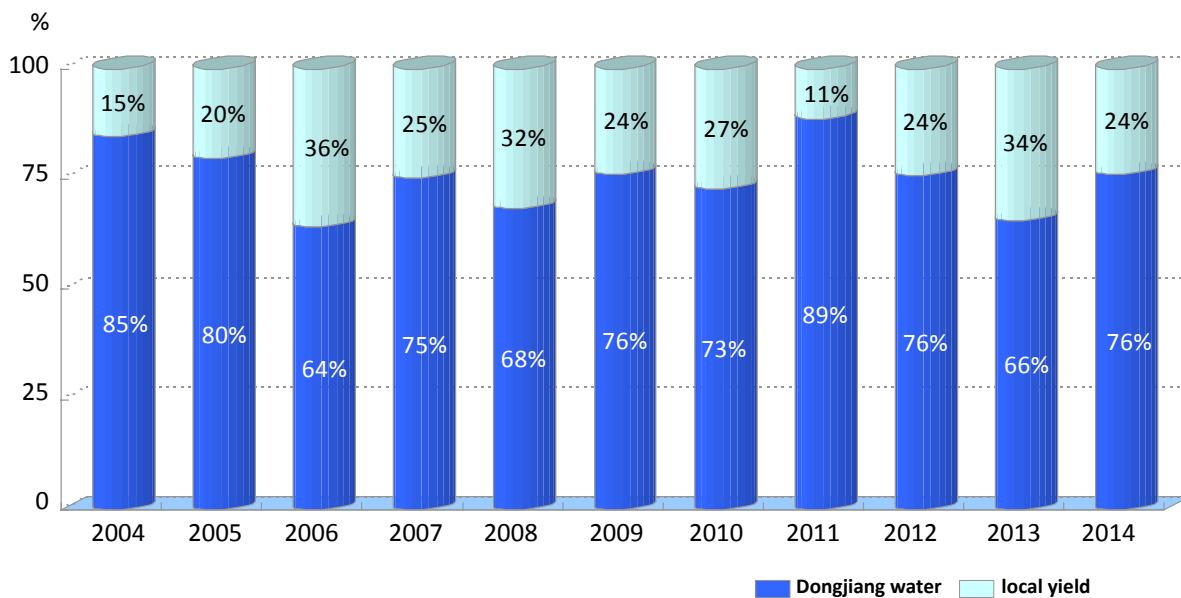
⁸ See Audit Commission (2015).

⁹ Singapore's WELS is a grading system of 0/1/2/3 ticks to reflect the water efficiency level of a product. The more ticks a product has, the more efficient it is.

¹⁰ The requirement to install water fittings and products that are labelled with at least one or more ticks under WELS also applies to non-domestic premises.

¹¹ For some areas that are far from seashore, the costs for installation and operation of seawater supply systems are prohibitively high. In those areas, WSD has started planning for or completed the infrastructure works to supply reclaimed water for non-potable uses (including irrigation and toilet flushing).

Figure 5 – Sources of fresh water supply in Hong Kong, 2004-2014



Source: Water Supplies Department.

Local yield

3.2 The natural fresh water resources in Hong Kong mainly come from rainfall. Rainfall is erratic and unevenly distributed between years in Hong Kong, but it is the lowest-cost water supply. According to WSD, the unit cost of fresh water produced from locally collected rainfall amounted to about HK\$4.0/cu m in 2013-2014.

Dongjiang water

3.3 Since 1960, Hong Kong has entered into a number of water supply agreements with Guangdong to meet its water demand. This included the 1965 agreement that formally started the importation of raw water from Dongjiang. During the early years, Hong Kong sourced about 20%-30% of its total water supply from Dongjiang. The percentage share has increased progressively since then and reached about 70%-80% in recent years. While securing a stable fresh water supply for Hong Kong, Dongjiang water incurs a higher production cost than rainwater. In 2013-2014, the unit cost of fresh water produced from Dongjiang water amounted to HK\$8.6/cu m, of which HK\$4.6 was the cost of raw water and HK\$4.0 the processing cost.

3.4 Since 2006, the "package deal lump sum" approach has been adopted to allow the flexibility in adjusting the amount of Dongjiang water piped to Hong Kong on a monthly basis. Under the approach, an annual lump sum payment is made to Guangdong in exchange for a reliable supply of Dongjiang water up to the annual supply ceiling specified in the water supply agreement. Yet the actual draw-down is determined by WSD each month after taking into account local reservoir and rainfall conditions. This flexibility aims to achieve a better control of the storage level in Hong Kong and minimize water overflow¹².

3.5 A new three-year water supply agreement was signed in May 2015 under which Guangdong provides a maximum of 820 million cu m of raw water to Hong Kong annually. The agreement also allows Hong Kong the flexibility to raise the annual supply ceiling to 1 100 million cu m. This ultimate annual supply ceiling was first set out in the water supply agreement signed in 1989, as well as in the "Water Resources Distribution Plan in the Dongjiang River Basin of Guangdong Province" 《廣東省東江流域水資源分配方案》 ("the Distribution Plan") promulgated by the Guangdong authorities in 2008. The Distribution Plan sets out the maximum amount of water Hong Kong and seven Guangdong cities can draw from Dongjiang (**Table 1**).

Table 1 – Water Resources Distribution Plan in Dongjiang River Basin

(million cu m)

	Allocated annual quantity		Reliance on Dongjiang
	under normal yield	under drought	
Hong Kong	1 100	1 100	~ 70%-80%
Dongguan	2 095	1 944	~ 90%
Shenzhen	1 663	1 608	~ 70%-80%
Heyuan	1 763	1 706	~ 90%
Huizhou	2 533	2 405	~ 70%
Shaoguan	122	113	as a supplementary source of water supply only.
Meizhou	26	22	
Guangzhou	1 362	1 285	
Total	10 664	10 183	-

Sources: Water Supplies Department, 廣東省人民政府辦公廳, 東莞市水務局, 深圳市水務局, 惠州市水務局 and 河源網.

¹² For example, Hong Kong imports less water from Dongjiang when its reservoirs are full, or more in times of drought. However, Hong Kong is still required to pay for the annual fixed quantity of Dongjiang water specified in the water supply agreement, no matter how much is actually supplied.

3.6 During 2006-2013, the annual flow of Dongjiang averaged at 25.4 billion cu m, which was 23% lower than the long-term annual average of 33.1 billion cu m during 1956-2005¹³. In addition, Dongjiang has been under increasing strain as it supports as many as 40 million people in Hong Kong and the seven cities in Guangdong. Looking ahead, Dongjiang is expected to be subject to a bigger challenge under a long-term development plan up to 2020 as promulgated by the National Development and Reform Committee in early 2009¹⁴. The plan focuses on, among other things, the development of the Pearl River Delta as a world-class industrial base for advanced manufacturing industries. This will inevitably add further pressure to water demand in the Dongjiang-reliant cities. Reflecting this, Dongguan, Shenzhen and Huizhou are forecast to exceed their allocated quantities of Dongjiang water under the Distribution Plan by 20%, 56% and 18% respectively in 2020.¹⁵

3.7 Notwithstanding the above, Hong Kong is guaranteed a stable supply of Dongjiang water during 2015-2017 under the new water supply agreement signed in May 2015. Yet there is no assurance that Dongjiang will always be able to provide a constant water supply for Hong Kong should extreme climate conditions in the Mainland lead to greater competition for Dongjiang water among the various cities of Guangdong. To prepare for this possibility and serve as a responsible user of Dongjiang, it is prudent for Hong Kong to conserve water and review and explore the various options for sources of water supply.

3.8 The Government has recently planned to build a desalination plant using advanced reverse osmosis technology in Tseung Kwan O¹⁶. The desalination plant is scheduled for completion in 2020 with an annual capacity to provide 50 million cu m of fresh water or 5% of the total fresh water supply, expandable to 100 million cu m or 10% in the future. The growing global popularity of the reverse osmosis technology has helped lower the cost of the desalination process. Yet the technology is still energy-intensive, which keeps the estimated cost of desalinated water at a high of HK\$12-\$13/cu m in 2013 (**Figure 6**).¹⁷

¹³ See 廣東省水利廳 (2015).

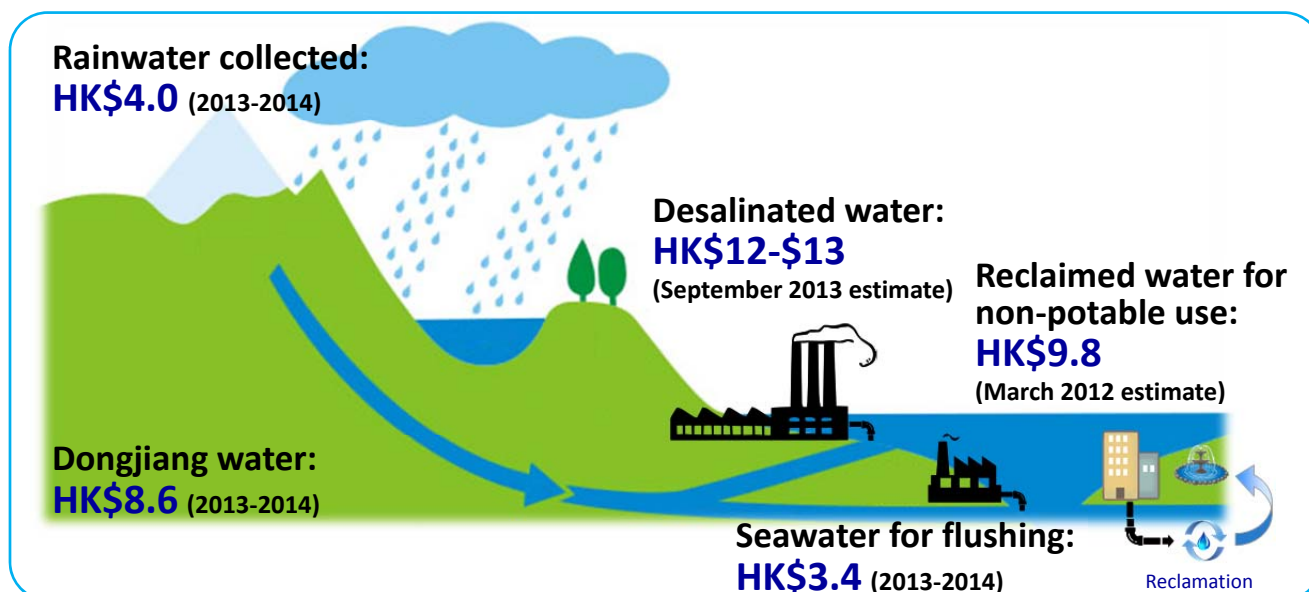
¹⁴ The plan, entitled *The Outline of the Plan for the Reform and Development of the Pearl River Delta for 2008-2020*, governs the long-term development of the Pearl River Delta.

¹⁵ See 東莞市水務局, 深圳市水務局 and 惠州市水務局 (2015).

¹⁶ According to the estimate made by WSD in January 2015, the estimated cost of the desalination plant project was HK\$9.3 billion. See Audit Commission (2015).

¹⁷ Based on the email reply from WSD dated 20 May 2015.

Figure 6 – Production cost of water supply in Hong Kong (per cu m)*



Note: (*) Figures provided by the Water Supplies Department.

4. Water tariff structure

4.1 Hong Kong's water tariff is among the lowest in the world. Seawater flushing is free and the use of fresh water for toilet flushing will be billed only if it is in excess of 30 cu m for a four-month period¹⁸. For fresh water supply, domestic users are charged through a subsidized four-tiered system and they only need to pay water tariff every four months.¹⁹

4.2 The fresh water pricing scheme was last reviewed in February 1995. At that time, the first tier provided up to 12 cu m of fresh water free and the second tier was subsidized by government rates. Only when the domestic customer reached the third tier of pricing did the water tariff reflect the actual production cost. For the fourth tier, it was charged at a punitive rate roughly 40% above the third tier rate (Table 2).

Table 2 – Hong Kong's fresh water pricing scheme adopted in February 1995

Category	Water pricing (HK\$ per cu m)
Domestic use	
First tier (first 12 cu m)	Free
Second tier (next 31 cu m)	4.16 (subsidized rate)
Third tier (next 19 cu m)	6.45 (cost recovery rate)
Fourth tier (for the remainder)	9.05 (punitive rate)

Source: Water Supplies Department.

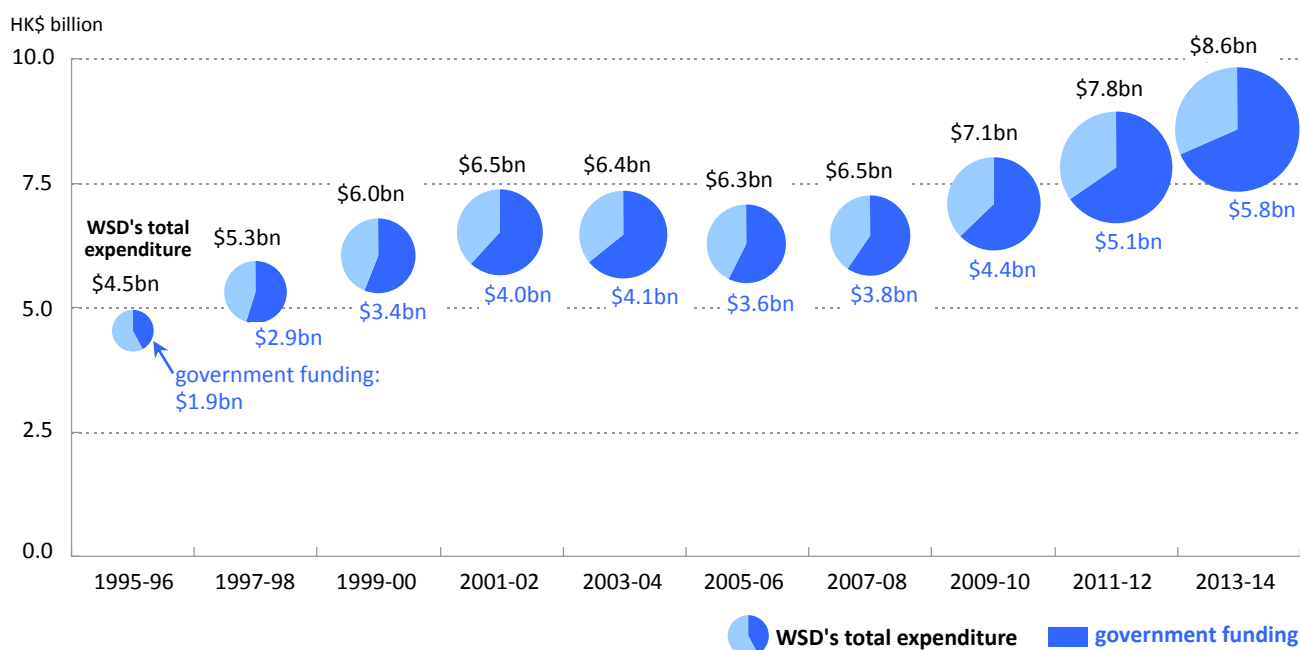
¹⁸ Any consumption of fresh water for toilet flushing above the level of 30 cu m per flat is charged at HK\$4.58/cu m. For metering of the quantity of fresh water used, there is only one meter installed in each building to record the total consumption of all flats in the same building.

¹⁹ Non-domestic users are charged at a flat rate per cu m of water consumed.

4.3 The basic principle of the four-tiered system was to provide a progressively increasing price structure to discourage unnecessary use of water. Costs recovered from excessive use subsidized the lower tiers. This design is similar to that of the "optimal" water pricing system advocated by the European Union²⁰, which is based on, among other things, volumetric or increasing block rates.

4.4 After the review in February 1995, the water tariff of different tiers has remained unchanged for 20 years. While the water tariff was frozen in 1995, the price of Dongjiang raw water more than doubled from HK\$2.2/cu m in 1995 to HK\$4.6/cu m in 2013. The processing cost of fresh water supply also increased progressively during the period²¹. As a result, the water tariff collected has only been able to cover part of the production costs of water supply, with the shortfall being financed by government funding (Figure 7).

Figure 7 – Financing of Water Supplies Department's total expenditure by government funding, 1995-1996 to 2013-2014*



Note: (*) only figures of selected years are shown for clarity of information.

Source: Water Supplies Department.

5. Government expenditure on water supply

5.1 WSD's total expenditure increased by HK\$4.1 billion from HK\$4.5 billion in 1995-1996 to HK\$8.6 billion in 2013-2014. This compares with the increase of HK\$114 million in the water tariff collected and other income (e.g. interest from deposit) received by WSD. The resulting shortfall was largely met by the increase in government funding amounting to HK\$3.9 billion over the period (Figure 7).

²⁰ See European Environment Agency (2013).

²¹ Indicative of this trend, WSD's operating and administration expenses increased from 978 million in 1994-1995 to 1 750 million in 2013-2014.

5.2 Government funding is likely to increase further under the new water supply agreement for the period from 2015 to 2017. During the period, the unit cost of raw water imported from Dongjiang will be increased from HK\$4.8/cu m in 2014 to HK\$5.1/cu m in 2015, HK\$5.5/cu m in 2016, and HK\$5.8/cu m in 2017. Assuming the processing cost of Dongjiang water remaining at the 2013-2014 level of HK\$4.0/cu m, even the highest-charge fourth tier tariff (currently at HK\$9.05/cu m) cannot cover the total unit cost of Dongjiang water during 2015-2017.

5.3 Reduction in water consumption may reduce the draw-down of Dongjiang water, and hence save the operating cost of pumping water from Dongjiang and treating the water before use²². Yet Hong Kong is still required to pay for the fixed quantity of 820 million cu m of Dongjiang water each year regardless of how much is actually supplied from Guangdong. This payment represents a fixed cost to WSD and would not be affected by the reduction in water consumption. Indeed, any reduction in water consumption will mean a loss of the tariff revenue that WSD could receive to cover part of the fixed cost of Dongjiang water²³. In other words, reduction in water consumption can conserve the scarce natural resource of water but it may not reduce WSD's expenditure.

5.4 Nevertheless, the Government can still resort to other measures to reduce WSD's expenditure, given the current water pricing scheme remaining unchanged. These include reduction in the spillage of locally collected rainwater from reservoirs during heavy and continuous rainfall, and active control of water leakage to avoid wastage of treated fresh water. The above two measures will not affect the water tariff collected by WSD, but it can reduce the draw-down of Dongjiang water, thereby saving the operating cost of pumping the water from Dongjiang. Apart from the pumping cost, active control of water leakage also helps avoid the wastage of money expended on the treatment of raw water.

Reduction of reservoir spillage

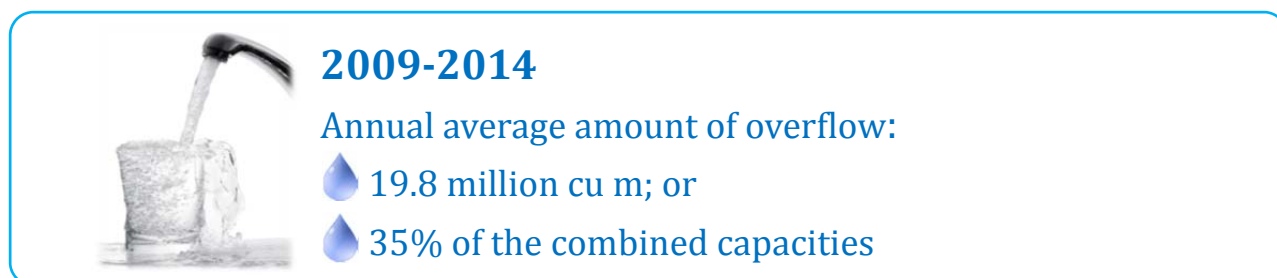
5.5 In Hong Kong, some small reservoirs overflow during periods of heavy and continuous rainfall. The amount of overflow averaged at 19.8 million cu m per year between 2009 and 2014, which accounted for about 35% of the combined capacities of the overflowing small reservoirs (**Figure 8**). The overflow reached a high of 40 million cu m or 71% of the combined capacities in 2013, when Hong Kong

²² The pumping of water consumes a large amount of electricity. In 2013-2014, WSD consumed 652 million kWh of electricity that cost it a total of HK\$611 million.

²³ At present, the respective water tariffs for the second, third and fourth tiers of domestic users are more than enough to recover the per unit processing cost of Dongjiang water. The residuals help recoup part of the fixed cost of Dongjiang water by HK\$0.16, HK\$2.45 and HK\$5.05 respectively.

recorded the highest rainfall of 2 847 millimetres during the period. To mitigate the overflow problem, WSD planned as early as in 2004 to implement the Inter-Reservoirs Transfer Scheme. However, WSD has yet to seek funding for carrying out the related construction works.

Figure 8 – Spillage from the small reservoirs, 2009-2014



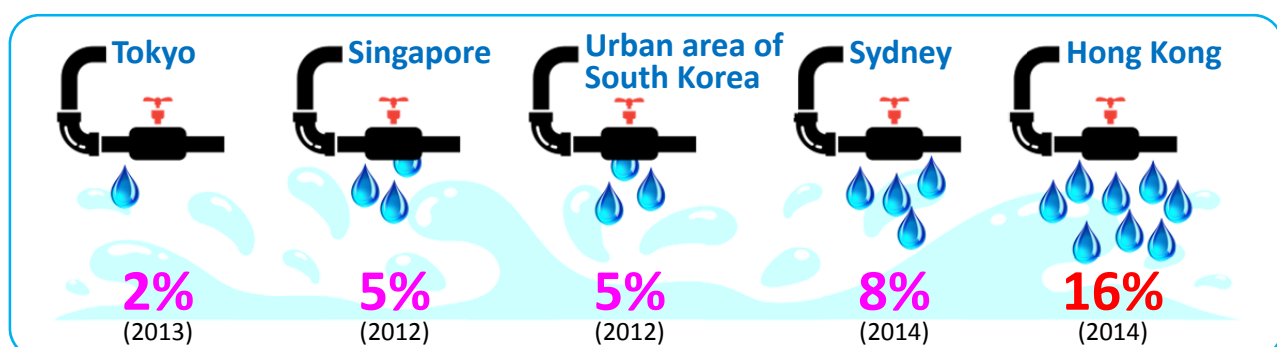
Source: Water Supplies Department.

Active control of water leakage

5.6 Hong Kong has over 8 000 km of water mains, many of which are more than 30 years old. The Government has implemented a territory-wide Replacement and Rehabilitation programme to replace and rehabilitate about 3 000 km of aged water mains for completion by 2015. This initiative has helped reduce the water leakage rate from more than 20% in the mid-2000s to 16% in 2014.

5.7 While Hong Kong has made notable progress in the control of water leakage, its leakage rate still paled in comparison with that in Tokyo (2%), Singapore (5%), the urban area of South Korea (5%), and Sydney (8%) (**Figure 9**). More importantly, fresh water loss due to the leakage in government mains totalled 157 million cu m in 2013, which is more than the planned annual capacity of the desalination plant at Tseung Kwan O.

Figure 9 – Water leakage rates in Hong Kong and selected places



Sources: Bureau of Waterworks of Japan, Korea Water and Wastewater Works Association, Organisation for Economic Co-operation and Development, Sydney Water and Water Supplies Department.

6. Observations

6.1 Today, Hong Kong enjoys a stable fresh water supply and its water tariff has been among the lowest in the world. Yet it would be prudent not to take water supply for granted, and there are several areas which warrant special attention:

- (a) Hong Kong's daily per capita flushing water consumption increased by 7.6% between 2004-2005 and 2013-2014. The increase can be attributable to, among other things, free supply of seawater for toilet flushing. Yet seawater is by no means a free resource in Hong Kong, as it must be extracted, disinfected, distributed, and treated before use. Users may not be aware of the volume used and the costs so incurred as they are not reflected in the water bill. This gives users little incentive to reduce unnecessary use of toilet flushing water.

Apart from the "hidden" cost of seawater flushing, another issue of note is the amount of "unaccounted-for" flushing water possibly stemming from factors such as water mains leakage and unauthorized water consumption. There is a need for WSD to reduce the amount of unaccounted-for water, thereby saving the expenditure on the supply of seawater and fresh water for toilet flushing;

- (b) Hong Kong's per capita domestic fresh water consumption remained at around 130 litres/day between 2004-2005 and 2013-2014. This was 18% higher than the world average of 110 litres, and notwithstanding the implementation of WELS and use of water saving devices by WSD in recent years.

In Hong Kong, WELS and use of water saving devices are voluntary water conservation schemes. In contrast, Singapore and Australia have made the participation in WELS mandatory. Singapore also requires all new domestic premises and existing domestic premises undergoing renovation to install new water saving devices;

- (c) as a major tributary of the Pearl River, Dongjiang has been under increasing strain as it supports as many as 40 million people in Hong Kong and the seven cities in Guangdong. Dongjiang will be subject to a bigger challenge as the planned development of the Pearl River Delta as a world-class industrial base should further boost the water demand in Dongjiang-reliant cities in the years ahead.

Hong Kong is guaranteed a stable supply of Dongjiang water during 2015-2017 under the recently signed new water supply agreement. Yet there is no assurance that Dongjiang will always be able to keep up a constant water supply for Hong Kong, particularly in times of extreme climate conditions. To prepare for such a possibility and serve as a responsible user of Dongjiang, it is prudent for Hong Kong to conserve water and explore alternative sources of water supply such as desalinated water;

- (d) Hong Kong's water tariff was frozen in 1995, but the water production cost has more than doubled since then. The shortfall has been financed by government funding. Adoption of water conservation measures by users is unlikely to reduce WSD's total expenditure given the current water pricing scheme remaining unchanged and under the existing "package deal lump sum" approach. The approach requires Hong Kong to pay for the fixed quantity of 820 cu m of Dongjiang water each year regardless of how much is actually supplied from Guangdong; and
- (e) the Government can, nevertheless, resort to other measures, such as reduction of spillage from small reservoirs and active control of water leakage, to avoid water wastage and thereby reduce WSD's expenditure.
 - (i) *reduction of reservoir spillage*: WSD planned as early as in 2004 to implement the Inter-Reservoirs Transfer Scheme to avoid the waste from reservoir spillage. However, WSD has yet to seek funding for carrying out the related construction works; and
 - (ii) *active control of water leakage*: Hong Kong has implemented a territory-wide programme to replace about 3 000 km of aged water mains. The programme lowered the water leakage rate from more than 20% in the mid-2000s to 16% in 2014. However, the rate still paled in comparison with that in Tokyo, Singapore, urban area of South Korea, and Sydney. More importantly, fresh water loss amounted to 157 million cu m in 2013, which is more than the planned annual capacity of the desalination plant in Tseung Kwan O.

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