立法會
Legislative Council

LC Paper No. CB(1)439/16-17(07)

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Panel on Development

Meeting on 24 January 2017

Updated background brief on the proposed construction of a desalination plant at Tseung Kwan O

Purpose

This paper provides background information on the proposed construction of a desalination plant at Tseung Kwan O and summarizes the views and concerns expressed by Members on the subject at the meetings of the Legislative Council and its committees since the 2011-2012 legislative session.

Background

2. At present, about 20% to 30% of Hong Kong's fresh water supply is collected from rainfall and the remaining 70% to 80% is imported from Dongjiang ("DJ") to make up the shortfall. As Hong Kong has to compete with other cities in the Guangdong Province ("GD") for the scarce fresh water resources of DJ and climate change will bring about more frequent extremely dry weather, the Administration has implemented various water demand and supply management measures under the Total Water Management Strategy promulgated in 2008 to minimize the risk of water shortage. On water demand management, the Administration has been promoting water conservation through public education, encouraging the use of water saving devices, increasing the use of seawater for flushing and reducing water main bursts and leaks. On water supply management, the Administration has been

exploring new water resources which are insensitive to climate change,[1] such as seawater desalination.[2]

3. A pilot study completed in 2007 confirmed the technical feasibility of desalination using reverse osmosis[3] under local conditions to produce potable water complying with the World Health Organization guidelines for drinking water quality.

Proposed construction of a desalination plant at Tseung Kwan O

4. In June 2012, the Finance Committee ("FC") approved funding for conducting a planning and investigation study on a proposed desalination plant in Tseung Kwan O and the associated fresh water transfer facilities at an estimated cost of $34.3 million. The study, completed in 2015, confirmed the technical feasibility of the proposed desalination plant project and provided a preliminary design of the plant.[4]

5. According to the Administration,[5] a 10-hectare site at Tsueng Kwan O Area 137 has been reserved for the construction of a desalination plant. The output capacity of the plant will amount to 135 Mld at its first stage with provisions for future expansion to an ultimate capacity of 270 Mld, accounting for 5% (10% if expanded) of the total fresh water consumption in Hong Kong. The location of the proposed desalination plant is shown in **Appendix I**.

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1 Apart from seawater desalination, the Water Supplies Department ("WSD") has been developing other new water sources, such as reclaimed water, grey water reuse and rainwater harvesting.

2 The concept of seawater desalination is not new to Hong Kong. In 1975, a multi-stage flash desalination plant with an output capacity of 182 million litres per day ("Mld") was commissioned at Lok On Pai, Tuen Mun. Owing to high operation cost, the Lok On Pai desalination plant was decommissioned in 1981. Source: Desalination Plant at Tseung Kwan O — Feasibility Study, a WSD-commissioned study released in December 2013

3 Unlike the energy intensive multi-stage flash distillation process used in the Lok On Pai desalination plant, reverse osmosis is a mature and preferred technology dominating the market due to its reliability and progressive reduction in cost as the technology advances. Source: Desalination Plant at Tseung Kwan O — Feasibility Study

4 Source: The Administration's paper submitted to the Sai Kung District Council on "Progress of the Proposed Tseung Kwan O Desalination Plant Project" on 5 July 2016

5 Sources: LC Paper No. CB(1)650/14-15(05) and Information Note on "Water Resources in Hong Kong" provided by the Administration

6. In 2015, the Administration proposed conducting an investigation study review, design and site investigation works for the first stage of the proposed desalination plant. FC approved the relevant funding at an estimated cost of $154.5 million in June 2015. The works are scheduled for completion in the second half of 2017.

7. Meanwhile, the Water Supplies Department is carrying out detailed design for the water mains linking the proposed desalination plant and the existing fresh water service reservoirs. The Administration expects that, if all the works proceed smoothly, the mainlaying works can commence in 2017, whereas the plant construction can start in 2018 for commissioning of the first stage of the plant by 2020-2021 the earliest.[6]

Major views and concerns expressed by Members

8. In addition to expressing views on the aforesaid study and works at meetings of the Panel on Development ("DEV Panel"), the Public Works Subcommittee and FC between 2012 and 2015, Members have raised questions on the proposed seawater desalination plant at various meetings of DEV Panel, FC and the Legislative Council. The major views expressed by Members on the subject are summarized in the ensuing paragraphs.

Desalination cost

9. Members have sought information about the unit costs of drinking water produced from various sources and the estimated construction cost of the proposed desalination plant. The Administration advised that in the 2014-2015 financial year, the unit costs were $4.2 and $9.1 per cubic metre respectively for drinking water produced from local catchment and DJ water. As for seawater desalination at the proposed desalination plant at Tseung Kwan O, the Administration estimated that the cost would be about $12.6 per cubic metre at 2013-2014 price level, which did not take into account land premium. Of the $12.6, the capital cost of the desalination plant alone amounted to $4.6, whereas energy cost was estimated to be $3.6, and treatment, distribution and customer service costs amounted to $4.4. The Administration considered that, with the continuous advancement in technology, the cost of seawater desalination would be reduced over time. As regards the estimated construction cost of the first stage of the proposed desalination plant, the preliminary figure was about $9 billion, covering the

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[6] Source: The Administration's paper submitted to the Sai Kung District Council on "Progress of the Proposed Tseung Kwan O Desalination Plant Project" on 5 July 2016

construction cost of some common facilities for the first and second stages (e.g. the administration building). The estimated construction cost for the second stage was not yet available.

10. Some Members queried why the anticipated unit cost of seawater desalination in Hong Kong was higher than that in Singapore. The Administration advised that the unit cost of desalinated water in Singapore was reported to be around US$0.5. However, the components of the cost were unknown. In Hong Kong, the unit cost of desalinated water, estimated to be HK$12.6, covered energy, treatment, distribution and customer service costs as well as capital depreciation.

Need and cost-effectiveness

11. Given that the supply of DJ water was guaranteed and the anticipated water demand would not significantly increase in the future, some Members queried about the need for developing a desalination plant and whether it would be cost-effective to do so. These Members urged the Administration to consider other water management initiatives (such as promoting water conservation and increasing the capacity of local reservoirs) instead.

12. Meanwhile, some other Members supported the proposal of constructing a desalination plant. They considered that the proposal would increase the bargaining power of the Administration when negotiating the water supply agreement with the GD authorities. Moreover, with an anticipated increase in the purchase price of DJ water and a declining desalination cost alongside technological advancement, the price difference between DJ water and desalinated seawater would be narrowed down in the coming years.

13. The Administration advised that, to better prepare for the challenges arising from low local rainfall in recent years and the keen competition for DJ water in GD that might affect the supply of DJ water to Hong Kong, it had to explore water sources other than DJ water, such as seawater desalination, which would be unaffected by climate change. In addition, with the advancement of desalination technology, desalination cost had reduced from $30 per cubic metre some 20 years before to the present level of $12-$13 per cubic metre. As such, the Administration considered it the right time to develop a desalination plant. The development would also enable Hong Kong to master desalination technology and nurture local talents to operate the desalination facilities.

Target proportion of fresh water supply produced from seawater desalination

14. Considering the pace of development of seawater desalination in Hong Kong too slow, some Members urged the Administration to plan ahead for the further development of seawater desalination and increase the target proportion of fresh water supply produced from seawater desalination. Some Members asked if the Administration would formulate a policy to achieve long-term water self-sufficiency, or a water supply strategy setting out the respective proportions of fresh water to be produced from various sources.

15. The Administration considered it necessary to cope with the climate change by setting a target of producing 5% to 10% of fresh water in Hong Kong from seawater desalination. In deciding whether to further expand the proposed desalination plant or set a target proportion of fresh water supply produced from seawater desalination, the Administration would take into account various factors, such as fresh water demand, advancement in desalination technology and production cost. The Administration considered it an unrealistic goal for Hong Kong to achieve water self-sufficiency given that DJ water currently provided about 70% to 80% of Hong Kong's fresh water supply, and the estimated unit cost of seawater desalination would be considerably higher than that of DJ water.

16. On the proportions of various water supply sources after the commissioning of the proposed desalination plant, the Administration advised that up to 10% would come from desalination, 25% from reclaimed water, grey water and seawater (used for flushing), 50% or so from DJ water, with the remaining being local catchment water.

Environmental impact

17. In response to Members' enquiry about the disposal of brine produced at the proposed desalination plant after the reverse osmosis process, the Administration advised that similar to the practice adopted in overseas desalination plants using reverse osmosis technology, the brine would be discharged to the sea via the diffusers on the outfall and the brine would not cause adverse impact on the surrounding marine environment.

Visit of the Panel on Development to Singapore in 2016 to study its experience in developing water sources and safeguarding the quality of drinking water

18. A delegation of DEV Panel undertook an overseas duty visit to Singapore from 20 to 23 March 2016 to study the country's experience in

developing water resources and safeguarding the quality of drinking water. One of the delegation's interest areas was Singapore's experience in developing seawater desalination. An extract from the report on the duty visit[7] regarding the observations of the delegation on seawater desalination in Singapore is in **Appendix II**.

Latest development

19. At the meeting of DEV Panel to be held on 24 January 2017, the Administration will seek the Panel's support for part-upgrading PWP Item No. 357WF to Category A for the laying of dedicated fresh water mains for conveying the fresh water produced at the proposed desalination plant at Tseung Kwan O to the existing fresh water service reservoirs. The Administration will also brief the Panel on the progress of the design and construction of the first stage of the proposed desalination plant.

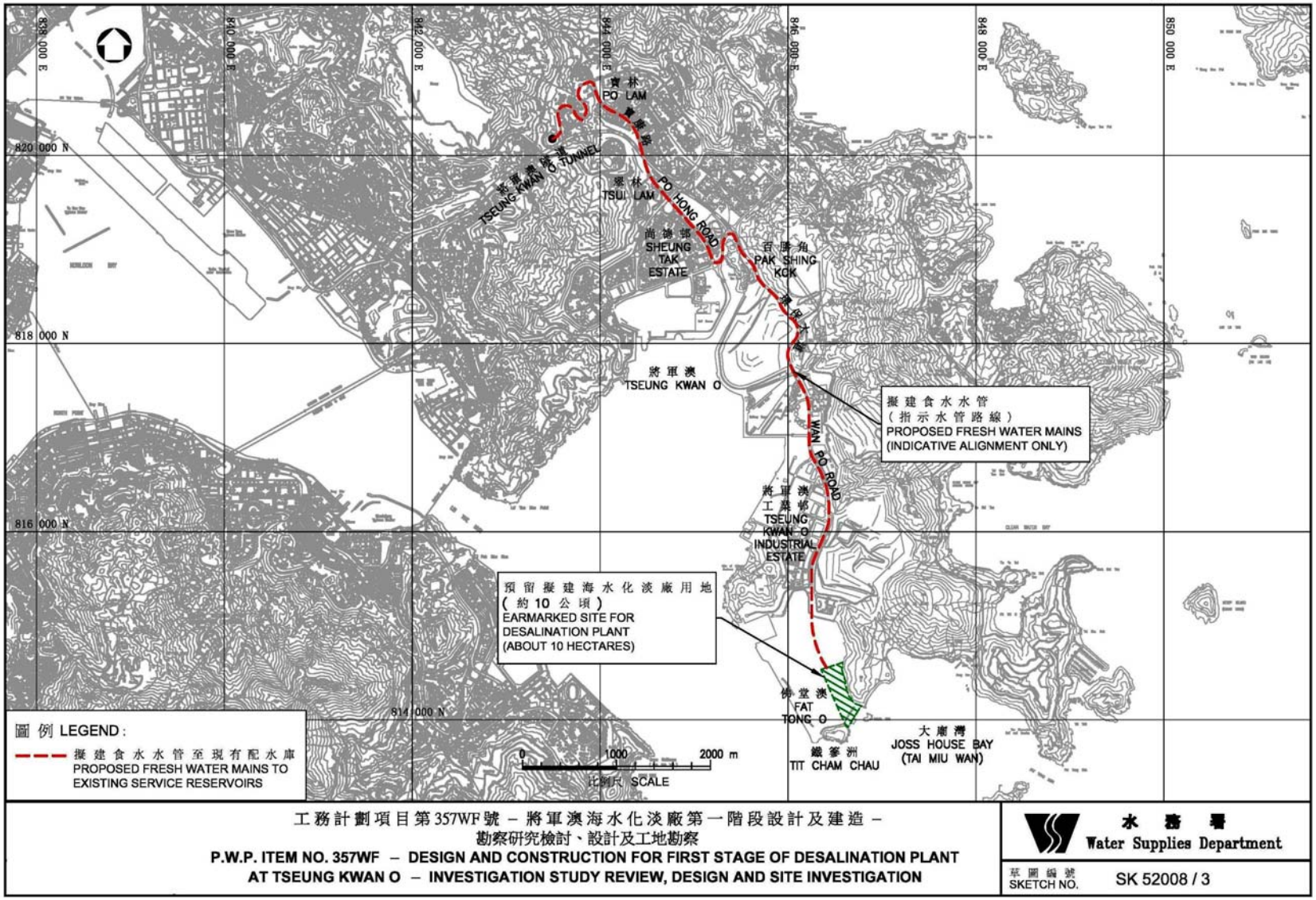
Relevant papers

20. A list of relevant papers with their hyperlinks is in **Appendix III**.

Council Business Division 1
Legislative Council Secretariat
17 January 2017

[7] Source: LC Paper No. CB(1)996/15-16

擬議將軍澳海水化淡廠位置圖
Location plan of the proposed desalination plant at Tseung Kwan O



資料來源：立法會CB(1)650/14-15(05)號文件
Source: LC Paper No. CB(1)650/14-15(05)

Extract from
Report on the Duty Visit to Singapore
to Study its Experience in Developing Water Resources and
Safeguarding the Quality of Drinking Water
from 20 to 23 March 2016
regarding the observations of the delegation
on seawater desalination in Singapore

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Seawater desalination

4.1.15 On the development of seawater desalination in Hong Kong, some delegation members consider that, while Singapore and Hong Kong face the same problem of insufficient local yield and have to rely on imported water, the situations between the two cities are quite different: in Singapore, for the sake of survival, the government has to develop seawater desalination at whatever the cost is to achieve water self-sufficiency. Whereas in Hong Kong, the supply of the Dongjiang ("DJ") water is guaranteed and the price is reasonable, rendering it unworthy for Hong Kong to spend huge sums of money to develop seawater desalination. These members consider that DJ water will remain an important water source for Hong Kong and its role will not be substituted by the development of seawater desalination.

4.1.16 Other members are of the view that, to cope with future uncertainties and in consideration of the great demand of other cities in the Guangdong Province for DJ water, there is a need for Hong Kong to develop seawater desalination as a water source to complement the existing sources. Noting that the cost of production of desalinated water as estimated by the Water Supplies Department ("WSD") is on the high side, i.e. \$12.6/m^3 (at 2013-2014 price level),[21] members urge WSD to look into ways to reduce the production cost.

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21 As reported in paragraphs 2.2.14 and 3.5.5 (of the report), the cost of importing DJ water in 2014-2015 was HK\$9.1/m^3, and the price of desalinated water produced in Tuaspring, Singapore, sold by Hyflux Ltd to the Public Utilities Board was S\$0.45/m^3 (about HK\$2.79/m^3) in 2013. The costs given by WSD (for DJ water and desalinated water) includes water distribution and customer service costs. As for the price of desalinated water in Singapore, little information is available about the components.

4.1.17 The delegation notes that the Tuaspring Desalination Plant is equipped with an on-site power plant to provide electricity supply for seawater desalination, and excess power generated by the power plant is sold to the national power grid. The combination of the desalination plant and the power plant helps create synergies between the two operations and lower the desalination cost.

4.1.18 As Hong Kong is going to develop a desalination plant in Tseung Kwan O, some delegation members suggest that the Government of the Hong Kong Special Administrative Region should draw reference from Tuaspring and consider the installation of power generation facilities inside the proposed desalination plant to reduce the desalination cost. However, having regard to the prevailing electricity supply arrangements in Hong Kong, delegation members consider that Tuaspring's arrangement of selling the excess power generated from the power plant at the desalination plant to the power grid may not be applicable to Hong Kong.

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Source: LC Paper No. CB(1)996/15-16

Appendix III

Proposed construction of a desalination plant at Tseung Kwan O

List of relevant papers

Council/Committee	Date of meeting	Paper
Panel on Development	25 October 2011	Administration's paper on "Management of Water Resources" [LC Paper No. CB(1)137/11-12(03)] Minutes of meeting [LC Paper No. CB(1)600/11-12]
Council meeting	9 November 2011	Hansard — written question (No. 9) on "Water Supplies in Hong Kong" (p. 1759-1763)
Panel on Development	17 April 2012	Administration's paper on "345WF — Planning and Investigation Study of Desalination Plant at Tseung Kwan O" [LC Paper No. CB(1)1514/11-12(03)] Administration's supplementary information paper [LC Paper No. CB(1)1855/11-12(01)] Minutes of special meeting [LC Paper No. CB(1)2565/11-12]
Public Works Subcommittee	16 May 2012	Administration's paper on "Head 709 — Waterworks 345WF — Planning and Investigation Study of Desalination Plant at Tseung Kwan O" [LC Paper No. PWSC(2012-13)18] Minutes of meeting [LC Paper No. PWSC72/11-12]

Council/Committee	Date of meeting	Paper
Finance Committee	8 June 2012	Administration's paper on "Recommendations of the Public Works Subcommittee made on 16 May 2012" [LC Paper No. FCR(2012-13)36] Minutes of meeting at 4:30 pm [LC Paper No. FC186/11-12]
Council meeting	27 February 2013	Hansard — written question (No. 20) on "Water Supply for Hong Kong" (p. 7381-7386)
Panel on Development	26 March 2013	Administration's follow-up paper on "Quality of Dongjiang Water and Water Quality Monitoring by the Water Supplies Department" [LC Paper No. CB(1)858/12-13(01)] Minutes of meeting [LC Paper No. CB(1)1334/12-13]
Finance Committee special meeting	10 April 2013	Report on the Examination of the Estimates of Expenditure 2013-2014 (Paragraphs 8.11-8.16 of Chapter VIII)
Council meeting	22 May 2013	Hansard — oral question (No. 6) on "Water Supply for Hong Kong" (p. 12021-12032) and written question (No. 14) on "Cost for Production of Potable Water by Desalination" (p. 12058-12061)
Finance Committee special meeting	2 April 2014	Report on the Examination of the Estimates of Expenditure 2014-2015 (Paragraphs 9.15-9.28 of Chapter IX)

Council/Committee	Date of meeting	Paper
Panel on Development	28 October 2014	Administration's paper on "Supply of Dongjiang Water" [LC Paper No. CB(1)89/14-15(07)] Minutes of meeting [LC Paper No. CB(1)347/14-15]
Council meeting	12 November 2014	Hansard — oral question (No. 4) on "Water Supply for Hong Kong" (p. 1899-1911)
Panel on Development	24 March 2015	Administration's paper on "357WF — Design and Construction for First Stage of Desalination Plant at Tseung Kwan O — Investigation Study Review, Design and Site Investigation" [LC Paper No. CB(1)650/14-15(05)] Administration's follow-up paper [LC Paper No. CB(1)758/14-15(01)] Minutes of meeting [LC Paper No. CB(1)985/14-15]
Finance Committee special meeting	1 April 2015	Report on the Examination of the Estimates of Expenditure 2015-2016 (Paragraphs 15.23-15.30 of Chapter XV)
Public Works Subcommittee	9 June 2015	Administration's paper on "Head 709 — Waterworks 357WF — Design and Construction for First Stage of Desalination Plant at Tseung Kwan O" [LC Paper No. PWSC(2015-16)18] Minutes of meeting [LC Paper No. PWSC245/14-15]

Council/Committee	Date of meeting	Paper
Finance Committee	26 June 2015	Administration's paper on "Recommendations of the Public Works Subcommittee made on 3 and 9 June 2015" [LC Paper No. FCR(2015-16)14] Minutes of meeting at 3:01 pm [LC Paper No. FC70/15-16]
Finance Committee special meeting	7 April 2016	Report on the Examination of the Estimates of Expenditure 2016-2017 (Paragraphs 16.23-16.31 of Chapter XVI)
House Committee	3 June 2016	Report on the Duty Visit to Singapore to Study its Experience in Developing Water Resources and Safeguarding the Quality of Drinking Water [LC Paper No. CB(1)996/15-16]