# *立法會*
# *Legislative Council*

LC Paper No. CB(1)825/17-18(05)

Ref: CB1/PL/DEV

**Panel on Development**

**Meeting on 24 April 2018**

**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 ("TKO"). It also summarizes the views and concerns expressed by Members of the Legislative Council ("LegCo") on the subject 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. With the increasing water demand arising from continuous population and economic growth and the unforeseen extreme weather brought about by climate change, the Administration considers that there is a need to develop a strategic alternative water resource by seawater desalination,[1] which is not susceptible to climate change.

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[1] 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 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

Construction of a desalination plant at Tseung Kwan O

3. In June 2012, the Finance Committee ("FC") approved funding for conducting a planning and investigation study on a proposed desalination plant in TKO and the associated fresh water transfer facilities at an estimated cost of $34.3 million in money-of-the-day ("MOD") prices. The study comprised detailed investigation of the feasibility and cost-effectiveness, preliminary design, formulation of the implementation strategy and programme, and impact assessments for the proposed desalination plant. It was completed in 2015.

4. According to the Administration, a 10-hectare site in TKO Area 137 has been reserved for the construction of a medium-sized desalination plant, and the aforesaid planning and investigation study has confirmed that TKO Area 137 is a suitable location for siting the proposed desalination plant in terms of the quality of nearby seawater. The use of the reverse osmosis technology[2] for the proposed desalination plant has also been proven technically feasible with an estimated unit water production cost at about $12 to $13 per cubic metres ("$m^3$") at 2016 price level. The layout plan showing the proposed works is shown in **Appendix I**.

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

6. In January 2017, the Administration briefed the Panel on Development ("DEV Panel") on the proposal to upgrade part of PWP Item No. 357WF, entitled "Design and construction for first stage of desalination plant at Tseung Kwan O", to Category A for the laying of a 10-kilometre water main to convey the fresh water produced at the proposed desalination plant to the TKO Fresh Water Primary Service Reservoir. The Administration planned to commence the proposed mainlaying works in the fourth quarter of 2017 for completion in the second quarter of 2022. FC approved the funding proposal at an estimated cost of $720.5 million (in MOD prices) in October 2017.

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[2] Reverses osmosis has become a mature technology and is used in most of overseas desalination plants in recent years. According to the International Desalination Association, there are over 17 000 desalination plants worldwide with a total water production capacity of more than 80 million $m^3$ per day and reverse osmosis accounts for approximately 60% of the installed capacity. The number of desalination plants using reverse osmosis technology is on the increase. Source: LC Paper No. FCR(2017-18)33A

According to the Administration, the remainder of PWP Item No. 357WF retained in Category B mainly comprised the site formation of the 10-hectare site in TKO Area 137, construction of the proposed desalination plant and associated works.

Visit of the Panel on Development to Singapore in 2016

7. A delegation of DEV Panel conducted 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 regarding the observations of the delegation on seawater desalination in Singapore is in **Appendix II**.

**Major views and concerns expressed by Members**

8. In addition to expressing views on issues related to seawater desalination at meetings of the DEV Panel and during the aforesaid duty visit, Members raised questions on the subject at meetings of LegCo, FC and the Public Works Subcommittee. The major views expressed by Members on the subject are summarized in the ensuing paragraphs.

Need for developing a desalination plant

9. 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. Yet, 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 Guangdong Province ("GD") authorities.

10. 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. In addition, with the advancement of the technology, the cost of seawater desalination had reduced from $30 per $m^3$ some 20 years ago to the present

level of $12 to $13 per $m^3$. 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.

Planning for the proposed desalination plant at Tseung Kwan O

11. Members enquired about the details of the first and second stages of the proposed desalination plant at TKO Area 137, including the project timetable, estimated water production capacity, and the percentage of the fresh water output against the total water consumption in Hong Kong. The Administration advised that the first stage of the proposed desalination plant would have a water production capacity of 135 000 $m^3$ per day, accounting for 5% of the total fresh water consumption in Hong Kong. The percentage would become 10% if the second stage was to be developed. The Administration then (in July 2017) advised that the construction of the first stage was expected to be completed around the end of 2021. The Administration would review on a continuous basis the future demand for fresh water in Hong Kong to decide the timing for commencing the works for the second stage of the desalination plant.

12. Some Members suggested that the Administration should consider developing the second stage of the proposed desalination plant in a cavern with a view to reducing land intake. The Administration explained that, when selecting a site for developing a desalination plant, it had taken into account various factors, i.e. seawater of consistently good quality should be available at the seawater intake; the discharge of brine into the sea would not cause adverse impact on the surrounding marine environment; and a fresh water supply network of wide coverage should be near the plant. The Administration undertook to take into consideration Members' suggestions when planning the second stage of the plant.

Desalination cost and technology

13. Members have sought information about the unit costs of drinking water produced from various sources. The Administration indicated that in the 2015-2016 financial year, the unit costs for drinking water produced from local catchment and DJ water were $4.3 and $9.5 per $m^3$ respectively, while the unit cost for seawater desalination at the proposed desalination plant at TKO would be about $12 to $13 per $m^3$.

14. Some Members queried why the anticipated unit cost of seawater desalination in Hong Kong was higher than that in Singapore.

The Administration advised that it might not be appropriate to compare the unit costs for production of desalinated seawater in Hong Kong and other cities, as the costs were affected by various factors. In Hong Kong, the unit cost of desalinated water covered capital investment, energy consumption, water treatment and distribution, and customer service. A more reasonable comparison, on the other hand, would be that on the energy consumption for production of each unit of desalinated seawater. The preliminary estimated energy consumption for the production of desalinated seawater at the proposed desalination plant at TKO was about 4.4 kilowatt-hours ("kWh")/$m^3$, which was comparable to that of the desalination plants in overseas cities (about 3.5 to 5 kWh/$m^3$).

15. Some Members enquired about the measures to reduce the cost of seawater desalination over time, and suggested that the Administration should consider adopting advance technology, such as making use of solar energy, to achieve reduction of cost. Some Members asked whether renewable energy would be generated from the disposal of the brine produced after the reverse osmosis process.

16. The Administration indicated that the proposed desalination plant at TKO Area 137 was adjacent to the Southeast New Territories landfill, which generated methane gas. The Administration had been discussing with the Hong Kong and China Gas Company Limited the feasibility of making use of the methane gas to provide electricity supply to the proposed desalination plant to reduce the energy cost. Furthermore, the two-stage development approach would enable the Administration to accumulate experience at the first stage and make use of new desalination technology to lower the production cost at the second stage. The Administration would study various options for optimizing the energy consumption of desalination, such as installing advanced energy recovery systems for greater energy efficiency.

Target proportion of fresh water supply produced from seawater desalination

17. Considering the slow pace of development of seawater desalination in Hong Kong, 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.

18. 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.

19. 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.

Traffic and environmental impacts

20. Some Members expressed concern about the impact of the mainlaying works on the traffic from TKO Area 137 to Po Lam, in particular along Wan Po Road and Po Hong Road. They also asked how the Administration would mitigate the environmental impact such as noise and dust nuisances associated with the construction works.

21. The Administration advised that to ensure that the works would not cause any significant impact on the traffic, it would adopt trenchless methods as needed for laying of the water main at busy road junctions and sections, in particular those along Wan Po Road. Also, the works contract would set out the recommended pollution control measures to be undertaken by the contractor. The Administration would require the contractor to implement those measures in order to minimize the environmental impact of the mainlaying works.

22. 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.

**Latest development**

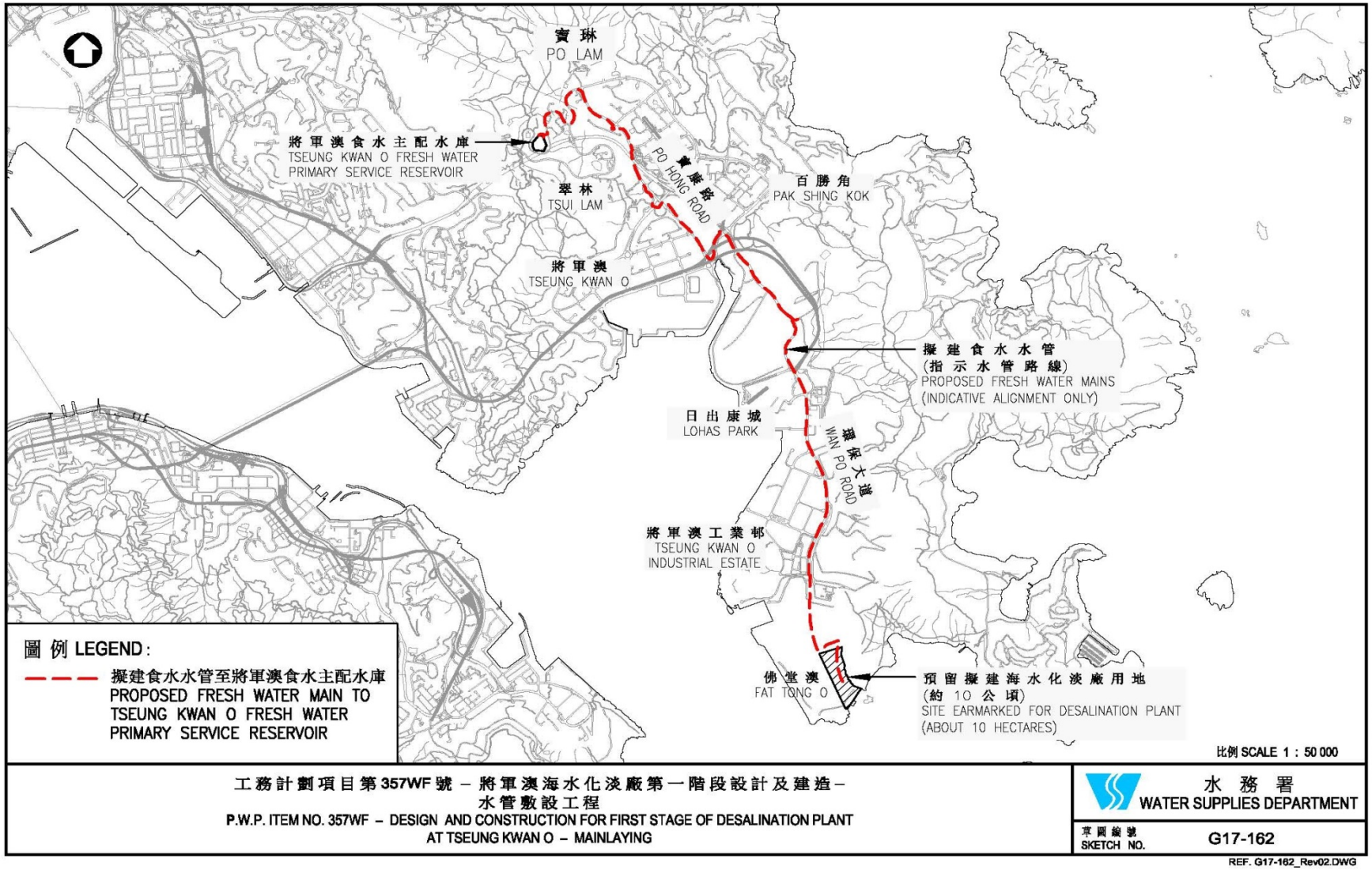
23. At the meeting of DEV Panel to be held on 24 April 2018, the Administration will seek the Panel's support for upgrading the remaining part of PWP Item No. 357WF to Category A for the construction of the proposed desalination plant at TKO Area 137.

**Relevant papers**

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

Council Business Division 1
Legislative Council Secretariat
20 April 2018

# 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FCR(2017-18)33A號文件
Source: LC Paper No. FCR(2017-18)33A

**Appendix II**

**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)]<br><br>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)]<br><br>Administration's supplementary information paper [LC Paper No. CB(1)1855/11-12(01)]<br><br>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]<br><br>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]<br><br>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)]<br><br>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)]<br><br>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)]<br><br>Administration's follow-up paper [LC Paper No. CB(1)758/14-15(01)]<br><br>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]<br><br>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]<br><br>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] |
| Panel on Development | 24 January 2017 | Administration's paper on "357WF—Design and construction for first stage of desalination plant at Tseung Kwan O—mainlaying" [LC Paper No. CB(1)439/16-17(06)]<br><br>Administration's follow-up paper [LC Paper No. CB(1)791/16-17(01)]<br><br>Minutes of meeting [LC Paper No. CB(1)700/16-17] |
| Finance Committee special meeting | 31 March 2017 | Report on the Examination of the Estimates of Expenditure 2017-2018 (Paragraphs 4.15-4.22 of Chapter IV) |

| Council/Committee | Date of meeting | Paper |
|---|---|---|
| Public Works Subcommittee | 4 July 2017 | 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(2017-2018)7]<br><br>Minutes of meeting [LC Paper No. PWSC269/16-17] |
| Finance Committee | 13 October 2017 | Administration's paper on "Recommendations of the Public Works Subcommittee made on 10 June and 4 July 2017" [LC Paper No. FCR(2017-18)33A] |