

# UPGRADING AND OPERATION OF SAN WAI SEWAGE TREATMENT WORKS

## Executive Summary

1. The San Wai Sewage Treatment Works (SWSTW) in Yuen Long was commissioned in 1993. It was designed for providing preliminary treatment to serve part of the Yuen Long, Tin Shui Wai and Hung Shui Kiu areas in the Northwest New Territories. In 2015, to cope with the projected increase in sewage flow demand due to planned new developments in the catchment area of SWSTW and to enhance the environmental performance of SWSTW, the capacity and treatment level of SWSTW needed to be upgraded. The Drainage Services Department (DSD) is responsible for the design and construction of the upgrading works, and operation of the upgraded SWSTW. The Environment and Ecology Bureau is responsible for policy matters on environmental protection and for overseeing the operations of DSD on the provision of sewerage and sewage treatment services.

2. DSD adopted a design-build-operate (DBO) arrangement for implementing the upgrading works of SWSTW and operation of the upgraded SWSTW. In April 2016, the Finance Committee of the Legislative Council approved the upgrading works of SWSTW at an approved project estimate (APE) of \$2,572.3 million. In January 2008, DSD awarded a consultancy agreement (Consultancy X) to a consultant (Consultant X) for the investigation, design and construction of the upgrading works of SWSTW. In May 2016, DSD awarded a DBO contract (Contract A) to a contractor (Contractor A) for the design and construction of the upgrading works of SWSTW, and subsequent operation of the upgraded SWSTW. The design and construction of the upgrading works of SWSTW commenced in May 2016 and were substantially completed on 5 March 2021. As of October 2023, \$1,924.7 million (75%) of APE had been incurred. The operation of the upgraded SWSTW commenced on 6 March 2021. Contractor A would operate the plant for 10 years and DSD has an option to extend the operation period for a further 5 years. The total operation payment to Contractor A since commissioning of the upgraded SWSTW and up to October 2023 was about \$163 million. The Audit Commission (Audit) has recently conducted a review to examine DSD's work in managing the upgrading works of SWSTW and operation of the upgraded SWSTW.

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### Upgrading works of San Wai Sewage Treatment Works

3. *Scope for improvement in ascertaining conditions of existing drainage system involving interfacing works.* According to Contract A, a complete stormwater drainage system shall be provided for the upgraded SWSTW. Contractor A's original design was to connect the proposed drainage system of the upgraded SWSTW to the external downstream public drainage system via an existing step channel (Channel A). After Contractor A took possession of the site in May 2017, Channel A was found to have been modified and buried below a local access road. As Channel A was found seriously deteriorated and collapsed, in April 2020, Consultant X issued an Employer's Change (EC — later valued at \$5.4 million) to instruct Contractor A to design and construct alternative stormwater drainage pipes and manholes to convey the stormwater flow. In Audit's view, there is scope for improvement in ascertaining conditions of existing drainage system involving interfacing works (paras. 2.6 to 2.8 and 2.10).

4. *Need to critically assess the choice of fill materials.* According to Consultant X, as the upgrading works of SWSTW comprise considerable quantity of backfilling works, the choice of fill materials would have a significant bearing on the potential extension of time due to inclement weather and its effects. As of October 2019, extensions of time of about 90 days had been granted to Contractor A due to inclement weather. In order to minimise risk of further works delay due to inclement weather, Consultant X issued an EC (later valued at \$2.7 million) in October 2019 to instruct Contractor A to adopt a mixed fill material for specific areas. In Audit's view, in implementing works projects involving considerable quantity of backfilling works, there is merit for DSD to critically assess the choice of fill materials (paras. 2.17 to 2.19).

5. *Recurring leakage and ponding problems.* According to Contract A, Contractor A shall be responsible for the rectification of defects in the works at its own cost in construction and operation stages. According to Consultant X, from July 2021 to February 2022, some leakage and ponding problems at various parts of the upgraded SWSTW were found. According to DSD, as of March 2022, Contractor A had rectified such leakage and ponding problems. In September 2022, Consultant X indicated that leakage and ponding problems were found at various parts of the upgraded SWSTW, and requested Contractor A to rectify them under Contract A as soon as possible. According to DSD: (a) these problems were of different nature, extent and locations at the buildings in comparing to those occurred

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before March 2022, and had all been rectified by Contractor A as of mid-March 2024; and (b) it requested Consultant X to conduct an investigation to ascertain the reasons for the recurring leakage and ponding problems at various buildings of the upgraded SWSTW. In Audit's view, DSD needs to take measures to ensure the early completion of the investigation and take further measures as needed to address the matter (paras. 2.22 to 2.25).

6. *Need to ensure that contractors timely submit the full set of required documents for finalisation of contract accounts.* Audit noted that Contractor A only provided the supporting documentation for the final accounts in full in January 2024 (i.e. a delay of about 1 year as compared with the required timeframe under Contract A), which resulted in knock-on delay on the finalisation of accounts of the design and construction portions of Contract A (paras. 2.29 to 2.31).

### **Monitoring of operation of upgraded San Wai Sewage Treatment Works**

7. *Non-compliances with some Key Performance Indicators (KPIs).* According to Contract A, there is a set of 14 KPIs (covering effluent quality requirements, environmental monitoring, and contract administration and reporting) for measuring the performance of Contractor A in operating the upgraded SWSTW. The monthly payment to Contractor A for operation of the upgraded SWSTW is adjusted to reflect the level of performance achieved, which is assessed by calculating the total demerit points based on monitoring results on KPIs in the same reporting month. Since the commissioning of the upgraded SWSTW in March 2021 and up to October 2023, DSD had deducted a total of \$78,822 from operation payments to Contractor A on 11 non-compliances involving 3 KPIs related to contract administration and reporting (i.e. monthly reporting, consistent minor breaches and data integrity). In Audit's view, the payment deductions relating to non-compliances with three KPIs on various occasions indicate scope for improvement in Contractor A's performance (paras. 3.4, 3.5, 3.7 and 3.8).

8. *Inconsistent contract provisions related to demerit point mechanism.* Audit noted that there were inconsistencies between provisions of Contract A related to the demerit point mechanism. For example, while a contract provision provides that the total maximum number of demerit points attributable to the non-compliances with KPIs identified for each reporting month is 5,000 points, another contract

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provision specifies that the maximum number of demerit points for calculating the monthly operation payment adjustment is 4,000 points (para. 3.9).

9. ***Need to timely issue under-performance notices (UPNs) for all under-performance events.*** According to Contract A, in case an under-performance event (i.e. Contractor A fails to comply with any of the general obligations under the contract) is identified, a UPN is issued to Contractor A. For under-performance events happened between March 2021 and October 2023, Audit noted that, as of January 2024, UPNs had not been issued to Contractor A for 16 under-performance events. DSD informed Audit in March 2024 that: (a) UPNs were issued to Contractor A for all these 16 under-performance events in February 2024; and (b) the issue of UPNs would result in assignment of additional demerit points to Contractor A for the related reporting months and potential deduction of \$93,637 from the operation payments made to Contractor A. In Audit's view, DSD needs to take prompt actions to adjust the operation payments to Contractor A (paras. 3.7, 3.12 to 3.14 and 3.16).

10. ***Contamination of effluent samples.*** According to Consultant X and Contractor A, from March 2021 to October 2023, abnormally high 5-day biochemical oxygen demand concentration was found in the effluent samples collected at the upgraded SWSTW in 4 occasions due to contamination of sampling bottles, automatic sampler components and sampling tools. According to DSD, to prevent recurrence of the incidents, follow-up actions had been implemented. In Audit's view, DSD needs to keep under review the effectiveness of the new measures for collecting and handling effluent samples at the upgraded SWSTW (paras. 3.18 and 3.19).

11. ***Need to ensure the timely submission of reporting materials containing the required information.*** According to Contract A, Contractor A is required to submit to the Supervising Officer (responsible for supervising Contractor A's operation of the upgraded SWSTW) reporting materials containing the required information. For the operation plans/reports relating to the period from March 2021 to October 2023, Audit noted that: (a) the operation plans for the second year and third year of operation were submitted late by Contractor A, with delays of 27 and 165 days respectively; and (b) some cases with non-compliance with contract requirements (e.g. total suspended solids concentration in centrate) were omitted in the monthly operation reports by Contractor A (paras. 1.11, 3.25 and 3.26).

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12. ***Scope for making better use of Computerised Maintenance Management System (CMM System) for monitoring maintenance works of facilities.*** According to Contract A, CMM System maintains the inspection and maintenance schedule and maintenance records of the facilities at the upgraded SWSTW. Audit noted that, as of January 2024: (a) there was no readily available information from CMM System showing whether the works orders had been completed as scheduled; and (b) some management reports (e.g. management information on whether preventive maintenance works had been performed as scheduled) could not be generated from CMM System for monitoring purpose (paras. 3.34 and 3.35).

### Other related issues

13. ***Scope for enhancing construction site safety.*** According to DSD, during the design and construction phase from May 2016 to March 2021, 5 non-fatal reportable accidents (i.e. accident resulting in an injury with incapacity for more than 3 days) happened at the construction site of Contract A. For some of these reportable accidents, there were late reporting of accidents, and late submission of preliminary accident reports and injury report forms by Contractor A to Consultant X. Apart from these reportable accidents, there were other incidents related to construction site safety during the testing and commissioning stage (e.g. leakage of hazardous gas) (paras. 4.5 and 4.6).

14. ***Scope for enhancing storage and handling of ferric chloride solution.*** According to DSD, ferric chloride solution is used as a coagulant to facilitate the settlement of suspended solids and stored in the storage tanks at the upgraded SWSTW. The Dangerous Goods Ordinance (Cap. 295) and its subsidiary legislation have been amended and came into effect on 31 March 2022 with a grace period of 24 months (i.e. up to 30 March 2024). Under the new legislation, among others, ferric chloride solution (not classified as dangerous goods before the enactment of the new legislation) has been classified as Class 8 dangerous goods and approvals for the storage and use of ferric chloride solution are required to be obtained from the Fire Services Department. Audit noted that, as of January 2024, the application for the storage and use of ferric chloride solution at the upgraded SWSTW had yet to be submitted to the Fire Services Department. In January 2024, DSD issued a letter to Contractor A and stating that it was the obligation of Contractor A to submit, on behalf of DSD, the documentation required for the approvals on the matter, and Contractor A was required to meet various milestones for monitoring the progress of

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implementing measures in meeting the statutory requirements before the expiry of the grace period (paras. 4.9 to 4.11).

15. ***Scope for improving project cost estimation.*** APE of \$2,572.3 million covered the design and construction portions of the upgrading works of SWSTW. However, as of October 2023, the total expenditure under the project vote was \$1,924.7 million (i.e. \$647.6 million (25%) less than APE of \$2,572.3 million). According to DSD, the significant variance was mainly due to lower-than-estimated tender outturn price for Contract A, and the actual adjustment for price fluctuation and contingency sums for unforeseen works lower than their estimated amounts. In Audit's view, in implementing works projects, DSD needs to take measures to ensure that project costs are estimated as accurately as possible (paras. 4.16 to 4.18).

16. ***Need to keep under review DBO contract arrangement.*** The upgrading of SWSTW was DSD's second sewage treatment works project adopting DBO contract arrangement. According to DSD, it was still in the pilot stage in respect of adopting DBO contract arrangement for selected sewage treatment facilities projects, and the actual achievement of cost saving of adopting DBO contract arrangement would be reviewed upon completion of the operation phase of Contract A. In Audit's view, DSD needs to keep under review the DBO contract arrangement of sewage treatment works (paras. 4.21, 4.23 and 4.24).

### Audit recommendations

17. **Audit recommendations are made in the respective sections of this Audit Report. Only the key ones are highlighted in this Executive Summary. Audit has *recommended* that the Director of Drainage Services should:**

#### *Upgrading works of SWSTW*

- (a) **in implementing works projects involving works interfacing with existing drainage system, take measures to ascertain the conditions of existing drainage system as comprehensively as possible (para. 2.20(a));**
- (b) **in implementing works projects involving considerable quantity of backfilling works, critically assess the choice of fill materials (para. 2.20(c));**

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- (c) **take measures to ensure the early completion of the investigation relating to the reasons for the recurring leakage and ponding problems at various buildings of the upgraded SWSTW and take further measures as needed to address the matter (para. 2.33(a));**
- (d) **in implementing works projects, strengthen measures to ensure that DSD contractors timely submit the full set of required documents for finalisation of contract accounts (para. 2.33(b)(ii));**

### *Monitoring of operation of upgraded SWSTW*

- (e) **continue to closely monitor the performance of the contractor in operating the upgraded SWSTW (including compliances with KPIs) (para. 3.28(a));**
- (f) **review the contract provisions related to the demerit point mechanism of the upgraded SWSTW contract and take measures to address the matter (para. 3.28(b));**
- (g) **regarding the 16 under-performance events with UPNs issued to Contractor A in February 2024, take prompt actions to adjust the operation payments to Contractor A (para. 3.28(c));**
- (h) **strengthen measures to ensure the timely issuing of UPNs for all under-performance events and adjustment of operation payments to Contractor A as needed (para. 3.28(d));**
- (i) **keep under review the effectiveness of the new measures for collecting and handling effluent samples at the upgraded SWSTW (para. 3.28(f));**
- (j) **strengthen measures to ensure the timely submission of reporting materials containing all required information by the contractor of the upgraded SWSTW (para. 3.28(h));**
- (k) **make better use of CMM System for monitoring maintenance works of facilities at the upgraded SWSTW (para. 3.37(b));**

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### *Other related issues*

- (l) **in implementing works projects:**
  - (i) **make continued efforts to enhance construction site safety (para. 4.13(a)(i));**
  - (ii) **take measures to ensure that DSD contractors timely report all accidents (including submission of related reports) at construction sites in accordance with related requirements (para. 4.13(a)(ii)); and**
  - (iii) **take measures to ensure that project costs are estimated as accurately as possible (para. 4.27(a));**
- (m) **take measures to ensure that the relevant approvals for the storage and use of dangerous goods (particularly ferric chloride solution) at the upgraded SWSTW are timely obtained from the relevant authorities (para. 4.13(b)(ii)); and**
- (n) **keep under review the DBO contract arrangement of sewage treatment works (para. 4.27(b)(ii)).**

### **Response from the Government**

18. The Director of Drainage Services agrees with the audit recommendations.