

ITEM FOR PUBLIC WORKS SUBCOMMITTEE OF FINANCE COMMITTEE

HEAD 704 - DRAINAGE

Environmental Protection – Sewerage and sewage treatment

352DS - Harbour Area Treatment Scheme, stage 2A – construction of advance disinfection facilities at Stonecutters Island sewage treatment works

Members are invited to recommend to Finance Committee the upgrading of **352DS** to Category A at an estimated cost of \$109.9 million in money-of-the-day prices for the construction of the advance disinfection facilities at Stonecutters Island Sewage Treatment Works.

PROBLEM

The water quality in respect of bacterial level on the western side of Victoria Harbour and at the Tsuen Wan beaches is unsatisfactory. At present, seven Tsuen Wan beaches are closed. One of the reasons is that the treated effluent from Stonecutters Island Sewage Treatment Works (SCISTW) is not disinfected before discharge.

PROPOSAL

2. The Director of Drainage Services, with the support of the Secretary for the Environment, proposes to upgrade **352DS** to Category A at an estimated cost of \$109.9 million in money-of-the-day (MOD) prices for the construction of the advance disinfection facilities at SCISTW.

PROJECT SCOPE AND NATURE

3. The scope of **352DS** comprises –

/(a)

- (a) construction of four sodium hypochlorite storage tanks;
- (b) construction of two sodium bisulphite storage tanks;
and
- (c) provision of ancillary works including chemical delivery, dosing and control systems.

_____ A site plan showing the proposed works is at Enclosure 1.

4. We plan to start the above construction works in April 2008 for completion in October 2009.

JUSTIFICATION

5. To tackle the water quality problem in respect of the bacteria levels on the western side of Victoria Harbour and at the Tsuen Wan beaches, the Government plans to implement further improvement works, including the provision of disinfection facilities at SCISTW under stage 2 of the Harbour Area Treatment Scheme (HATS), as well as the local sewerage programmes in the area. As requested by the Public Accounts Committee when deliberating on the Director of Audit's Report No. 42 in 2004, part of the disinfection facilities is proposed to be advanced so as to reduce *E. coli* levels in the western harbour water and facilitate the early re-opening of the closed Tsuen Wan beaches.

6. In July 2005, we commissioned an environmental impact assessment (EIA) study for the provision of disinfection facilities at the SCISTW, including the part to be advanced as proposed under this project. The EIA study confirmed the need for disinfection in order to reinstate the water quality at the Tsuen Wan beaches.

7. Under the EIA Study, we have examined various disinfection technologies that are available for water and wastewater disinfection, including some emerging technologies, and have carried out a careful evaluation exercise to select the most appropriate disinfection technology for HATS. Local and international disinfection practices were also reviewed. The study concluded that chlorination by the use of sodium hypochlorite solution was the preferred disinfection technology for HATS. This is the only viable option that will allow the early commissioning of disinfection facilities and re-opening of the Tsuen Wan beaches given the time, land, and planning constraints.

8. We now propose to implement the advance disinfection facilities at the SCISTW under **352DS**. In parallel, we are progressing with the local sewerage programmes for the unsewered areas which are also causing pollution at the Tsuen Wan beaches. The works under **352DS** and these sewerage programmes will facilitate the re-opening of the closed Tsuen Wan beaches as soon as possible. We are also proceeding with the necessary planning and design work to enable timely implementation of HATS stage 2A. The other main components of HATS stage 2A include a deep sewage tunnel network connecting the northern and western shores of Hong Kong Island to the SCISTW, expansion and upgrading works for the SCISTW together with the installation of the remaining disinfection facilities, and the upgrading of the associated preliminary treatment works. Upon completion of HATS stage 2A and the other sewerage improvement projects in the area, the water quality in Victoria Harbour and at the Tsuen Wan beaches will be further improved.

FINANCIAL IMPLICATIONS

9. We estimate the capital cost of the proposed works to be \$109.9 million in MOD prices (see paragraph 10 below), made up as follows –

	\$ million	
(a) Advance disinfection facilities	87.7	
(b) Environmental mitigation measures	0.3	
(c) Consultants' fees for	10.3	
(i) contract administration	1.0	
(ii) site supervision	9.3	
(d) Contingencies	9.8	

Sub-total	108.1	(in September 2007 prices)
(e) Provision for price adjustment	1.8	

Total	109.9	(in MOD prices)

/A

A breakdown of the estimates for the consultants' fees by man-months is at Enclosure 2.

10. Subject to approval, we will phase the expenditure as follows –

Year	\$ million (Sept 2007)	Price adjustment factor	\$ million (MOD)
2008 – 2009	33.3	1.00750	33.5
2009 – 2010	54.6	1.01758	55.6
2010 – 2011	16.6	1.02775	17.1
2011 – 2012	3.6	1.03803	3.7
	108.1		109.9

11. We have derived the MOD estimate on the basis of the Government's latest forecast of the trend rate of change in the prices of public sector building and construction output for the period from 2008 to 2012. We will implement the civil, electrical and mechanical works under a single lump sum contract.

12. We estimate the annual recurrent expenditure arising from the proposed works to be about \$88 million.

13. Based on the current level of expenditure on operation and day-to-day maintenance of sewerage facilities, the proposed works will lead to an increase in the recurrent cost of providing sewage services by about 5%. This has been taken into account in determining the future sewage charges.

PUBLIC CONSULTATION

Consultation with District Councils

14. We consulted the Planning and Environmental Hygiene Committee of the Kwai Tsing District Council on 21 August 2007, the Environmental and Health

/Affairs

Affairs Committee of the Tsuen Wan District Council on 6 September 2007, and the Sham Shui Po District Council on 6 September 2007 and 28 September 2007. Members of the Planning and Environmental Hygiene Committee of the Kwai Tsing District Council raised no objection to the proposed works and requested the Government to conduct environmental monitoring work when the disinfection facilities are in operation. The Environmental and Health Affairs Committee of the Tsuen Wan District Council indicated support for the proposal and urged early implementation to facilitate re-opening of the Tsuen Wan beaches. The Sham Shui Po District Council members were supportive of the proposal. At the same time, they requested and we undertook to take early action to cover the sedimentation tanks at SCISTW for odour mitigation.

Consultation with Advisory Council on the Environment

15. On 15 October 2007, the Advisory Council on the Environment (ACE) endorsed the EIA report for the advance disinfection facilities, with conditions. The conditions, accepted by the Administration, stipulate, *inter alia*, that there should be more frequent monitoring of key pollutant parameters in the effluent and in the receiving waters; that there should be appropriate automated systems put in place to control the dosage of the disinfection chemicals; and that the monitoring results should be placed on a publicly-accessible website and reported to the ACE EIA Sub-committee on a quarterly basis.

Consultation with the Legislative Council Panel on Environmental Affairs

16. We consulted the Legislative Council Panel on Environmental Affairs on 26 November 2007 on the proposed works. Members raised no objection to our plan to submit the funding proposal to the Public Works Subcommittee. Nevertheless, some Members requested the Administration to provide supplementary information on a number of topics. The required materials were circulated to Members on 10 December 2007 and are included at Enclosure 3.

ENVIRONMENTAL IMPLICATIONS

17. The project is a designated project under the Environmental Impact Assessment Ordinance (EIAO) and an environmental permit is required for its construction and operation. In November 2007, the EIA report for the project together with the enhanced monitoring, control and reporting arrangements described in paragraph 15 above were approved under the EIAO. The EIA report concluded that the environmental impact of the project could be controlled to within the criteria under the EIAO and the Technical Memorandum on the EIA Process. We will implement the measures recommended in the approved EIA report.

18. For short term impacts during construction, we will control noise, dust and site runoff to levels within established standards and guidelines through the implementation of mitigation measures and good construction practices. We will also conduct a comprehensive environmental monitoring and audit programme during the construction stage to ensure compliance with the environmental permit requirements. We have included in paragraph 9(b) above a sum of \$0.3 million (in September 2007 prices) in the overall project estimate for implementing the environmental mitigation measures during this stage.

19. We have considered in the planning and design stages how to reduce the generation of construction waste. For example, excavation for structures will be minimised as far as practicable. In addition, in order to minimise the disposal of inert construction waste to public fill reception facilities, we will require the contractor to reuse inert construction waste including excavated soil for backfilling on site or in other suitable construction sites as far as possible. To further minimise the generation of construction waste we will encourage the contractor to maximise the use of recycled or recyclable inert construction waste, as well as the use of non-timber formwork.

20. We will also require the contractor to submit for approval a plan setting out the waste management measures, which will include appropriate mitigation means to avoid, reduce, reuse and recycle inert construction waste. We will ensure that the day-to-day operations on site comply with the approved plan. We will require the contractor to separate the inert portion from non-inert construction waste on site for disposal at appropriate facilities. We will control the disposal of inert construction waste and non-inert construction waste to public fill reception facilities and landfills respectively through a trip-ticket system.

21. We estimate that the project will generate in total about 9 120 tonnes of construction waste. Of these, we will reuse about 520 tonnes (6%) of inert construction waste on site and deliver 8 300 tonnes (91%) of inert construction waste to public fill reception facilities¹ for subsequent reuse. In addition, we will dispose of 300 tonnes (3 %) of non-inert construction waste at landfills. The total cost of accommodating construction waste at public fill reception facilities and landfill sites is estimated to be \$0.3 million for this project (based on a unit cost of \$27/tonne for disposal at public fill reception facilities and \$125/tonne² at landfills).

/This

¹ Public fill reception facilities are specified in Schedule 4 of the Waste Disposal (Charges for Disposal of Construction Waste) Regulation. Disposal of inert construction waste in public fill reception facilities requires a licence issued by the Director of Civil Engineering and Development.

² This estimate has taken into account the cost for developing, operating and restoring the landfills after they are filled and the aftercare required. It does not include the land opportunity cost for existing landfill sites (which is estimated at \$90/m³), nor the cost to provide new landfills, (which is likely to be more expensive) when the existing ones are filled.

This estimated cost of \$0.3 million for waste disposal has been included in the cost for advance disinfection facilities in paragraph 9(a) above.

HERITAGE IMPLICATIONS

22. This project will not affect any heritage site, i.e. all declared monuments, graded historic buildings and sites of archaeological interest.

LAND ACQUISITION

23. The project does not require any land resumption.

BACKGROUND INFORMATION

24. On 25 May 2001, the Finance Committee approved \$73.6 million for upgrading **5227DS** to Category A to carry out a series of trials and studies to evaluate and select a final configuration for the remaining stages of HATS based on the options recommended by the International Review Panel. The trials and studies were completed in June 2004. They confirmed that the recommended options were environmentally acceptable and technically feasible. Among the options, the centralised treatment at SCISTW was the preferred one in terms of cost, environmental and engineering aspects. It comprises –

- (a) Stage 2A – the proposed additional facilities, including the upgrading of existing preliminary treatment works (PTWs) in the Harbour area catchment on the northern and western sides of Hong Kong Island, the construction of about 20 kilometres of deep tunnels to convey sewage from the above PTWs to Stonecutters Island, and the upgrading of the existing SCISTW to provide chemical treatment and disinfection for an ultimate flow of 2.5 million m³/day; and
- (b) Stage 2B – the proposed biological treatment facility at a site adjacent to the existing SCISTW.

25. In 2005, we included two items under block allocation **Subhead 4100DX** “Drainage works, studies and investigations for items in Category D of the Public Works Programme” at a total estimated cost of \$14.03 million for engaging consultants to undertake the site investigations, surveys and an environmental impact assessment for the proposed disinfection facilities at SCISTW, including the advance facilities under **352DS**. The Category D items were completed in 2007.

26. In December 2005, we upgraded **238DS** “Harbour Area Treatment Scheme stage 2A – environmental impact assessment, investigations, tunnel conveyance system design” to Category A at an estimated cost of \$166.5 million (in MOD prices), for carrying out the environmental impact assessment study, site investigations, and preliminary planning and design of the sewage conveyance system for HATS stage 2A. The works under **238DS** commenced in January 2006 for completion in November 2009.

27. In July 2007, we upgraded **351DS** “Harbour Area Treatment Scheme, stage 2A – planning and design of the upgrading works of Stonecutters Island sewage treatment works and the preliminary treatment works” to Category A at an estimated cost of \$105.6 million in MOD prices, for the planning and design of the upgrading works of Stonecutters Island Sewage Treatment Works and the preliminary treatment works of HATS stage 2A. The works under **351DS** commenced in August 2007 for completion in August 2010.

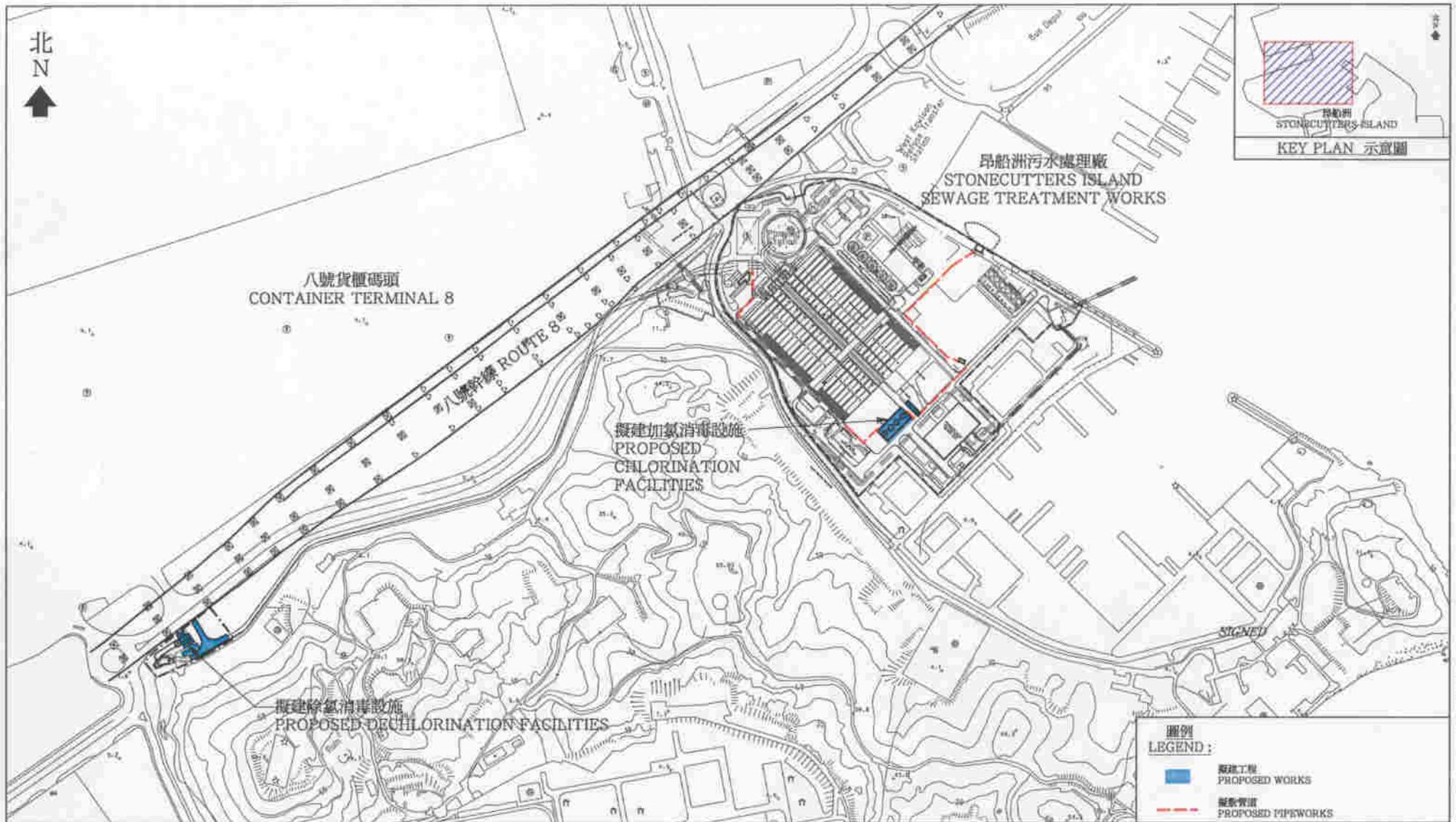
28. Of the 274 trees within the project boundary, 262 trees will be preserved, and the remaining 12 trees affected by the proposed works will be transplanted within the project site. All trees to be transplanted are not important trees³.

29. We estimate that the proposed project will create about 86 jobs (70 for labourers and 16 for professional/technical staff) providing a total employment of 1 403 man-months.

Environment Bureau
December 2007

³ “Important trees” refer to trees in the Register of Old and Valuable Trees, or any other trees that meet one or more of the following criteria –

- (a) trees over 100 years old;
- (b) trees of cultural, historical or memorable significance e.g. Fung Shui trees, trees as landmark of monastery or heritage monument, and trees in memory of important persons or event;
- (c) trees of precious or rare species;
- (d) trees of outstanding form (taking account of overall tree sizes, shape and any special features) e.g. trees with curtain like aerial roots, trees growing in unusual habitat; or
- (e) trees with trunk diameter equal or exceeding 1.0 m (measured at 1.3 m above ground level), or with height/canopy spread equal or exceeding 25 m.



圖則名稱 drawing title

工務計劃項目第352DS號
 「淨化海港計劃」第二期甲—在昂船洲污水處理廠建造前期消毒設施
 PWP ITEM No. 352DS
 HARBOUR AREA TREATMENT SCHEME, STAGE 2A - CONSTRUCTION OF ADVANCE
 DISINFECTION FACILITIES AT STONECUTTERS ISLAND SEWAGE TREATMENT WORKS

繪製 drawn	ORIGINAL SIGNED	H.K. LAI	日期 date	04-10-2007
核對 checked	ORIGINAL SIGNED	C.Y. LAI	日期 date	13-11-2007
批核 approved	ORIGINAL SIGNED	K.M. HO	日期 date	13-11-2007
部門 office	淨化海港計劃部 HARBOUR AREA TREATMENT SCHEME DIVISION			

圖則編號 drawing no.	比例 scale
DSS/2007/009	1:5000 FOR A3
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352DS – Harbour Area Treatment Scheme, stage 2A – construction of advance disinfection facilities at Stonecutters Island sewage treatment works

Breakdown of estimates for consultants’ fees

Consultants' staff costs		Estimated man-months	Average MPS* salary point	Multiplier (Note 1)	Estimated fee (\$ million)
(a)	Contract administration	7	38	1.6	0.6
	(Note 2)	13	14	1.6	0.4
(b)	Site supervision by resident site staff of the consultants	37	38	1.6	3.4
	(Note 2)	196	14	1.6	5.9
Total consultants’ staff costs					<hr/> 10.3 <hr/>

* MPS = Master Pay Scale

Notes

1. A multiplier factor of 1.6 is applied to the average MPS salary point to arrive at the full staff costs, including the consultants' overheads and profit, for staff employed in the consultants’ offices. MPS points 38 and 14 are used as the average MPS salary points for professionals and technical staff respectively. (As at 1 April 2007, MPS Point 38 = \$56,945 per month and MPS Point 14 = \$18,840 per month.)
2. We will only know the actual man-months and actual costs after the completion of the construction works.

352DS – Harbour Area Treatment Scheme, stage 2A – construction of advance disinfection facilities at Stonecutters Island sewage treatment works

**Supplementary information
to Panel on Environmental Affairs**

INTRODUCTION

In considering the paper on the above project on 26 November 2007, the Legislative Council Panel on Environmental Affairs requested the Administration to provide the following –

- (a) The timeframes within which the advance disinfection facilities at SCISTW and the local sewerage programmes for the unsewered areas in the Tsuen Wan area are expected to be completed.
- (b) The information on technologies, such as nanotechnology, which the Administration has considered before deciding on the use of chlorination/dechlorination for disinfection under HATS. In addition, the effectiveness and cost differences of these technologies.
- (c) The breakdown of the project cost of \$110 million, the recurrent cost and the daily amount of chlorine to be used. To also advise whether there is a mechanism under which the chlorination/dechlorination process can be stopped and the latest progress of HATS stage 2B.
- (d) An undertaking that the Administration will closely monitor the marine ecology before and after the application of chlorination/dechlorination process.
- (e) The Administration's plan on treatment of sludge.

THE ADMINISTRATION'S RESPONSE

Completion dates of the advance disinfection facilities at SCISTW and local sewerage programmes in the Tsuen Wan unsewered areas

2. The relevant projects which will improve the water quality at the Tsuen Wan beaches, and their current target completion dates, are as shown in the following table.

/Project

Project	Target completion date
Advance disinfection facilities at Stonecutters Island Sewage Treatment Works (352DS)	October 2009
Ting Kau sewerage stage 2 (52DS)	December 2009
Sham Tseng sewerage stage 3 (126DS)	December 2009

Disinfection technologies considered and relative costs

3. Before deciding on the use of chlorination/dechlorination for disinfection under HATS, we have conducted a detailed study of other disinfection technologies that are available for water and wastewater disinfection, including some emerging technologies. They included UV radiation and 10 other disinfection technologies listed below:

- Peroxone (Peroxide/Ozone)
- Ozonation
- Chlorine dioxide
- Potassium permanganate
- Chloramines
- Peracetic acid
- Bromine chloride
- Combined disinfectants
- Microfiltration
- Potassium ferrate

4. While some of the 10 disinfection processes listed above appear to be effective for sewage effluents on a laboratory scale, most of them have seldom been adopted for plant-scale use, even in small to medium-sized sewage treatment plants, due to one or more of the following reasons: high capital and operation costs, large footprint requirements, and being unproven in full scale applications. The lack of the large-scale application of these alternative technologies in effluent disinfection made them unattractive options for further consideration for HATS.

5. We short-listed UV radiation and chlorination/dechlorination for more detailed assessment. The factors examined included reliability and whether the technologies were proven in mega-scale application, flexibility in operation and design, footprint requirement and land availability, implementation programme, and cost effectiveness. We finally selected chlorination/dechlorination for HATS.

6. Regarding the detailed cost comparison, the chlorination/dechlorination option has been assessed to have a cost advantage of about 45% over the UV radiation option. This translates to a cost saving of about \$600 million based upon a 15-year life-cycle cost comparison.

7. Regarding nanotechnologies, we are aware that there are research programmes being conducted in universities and other research institutions. However, the applications are still at the research and early development stage and as far as we know have never been used for scaled-up sewage treatment even in any small to medium-sized sewage treatment plants. They are therefore not sufficiently developed to be considered for application to HATS.

Cost breakdown

Capital cost

8. The capital cost breakdown for the project is given in the following table.

	\$ million	
(a) Advance disinfection facilities	87.7	
(b) Environmental mitigation measures	0.3	
(c) Consultants' fees for	10.3	
(i) contract administration	1.0	
(ii) site supervision	9.3	
(d) Contingencies	9.8	
	Sub-total	108.1 (in September 2007 prices)
(e) Provision for price adjustment	1.8	
	Total	109.9 (in MOD prices)

Recurrent cost

9. The estimated annual recurrent cost breakdown for the project is as follows –

/Light

	\$ million
Light and Power	1
Chemical	82
Maintenance	1
Environmental Monitoring	4
Total	88

Daily chlorine consumption and associated cost

10. At the anticipated chlorine dosage rate of 11 to 15 mg/L, the daily consumption of sodium hypochlorite solution for disinfecting the chemically-enhanced primary treatment effluent from the Stonecutters Island Sewage Treatment Works is estimated to be about 19.7 tonnes of chlorine equivalent.

11. The additional operating cost for providing disinfection to the CEPT effluent from SCISTW using sodium hypochlorite and sodium bisulphite solutions would be about \$0.15/m³ of sewage treated.

Monitoring of marine ecology and the chlorination/ dechlorination process

12. We will carry out a comprehensive control and monitoring programme which includes a rigorous operating process to monitor and control the chemical dosages and the total residual chlorine (TRC) content in the effluent after dechlorination. A baseline monitoring programme and compliance monitoring programme will also be conducted before and after commissioning of the advance disinfection facilities respectively.

13. To monitor the possible marine ecological risk resulting from the project, we will conduct environmental monitoring for pre- and post-commissioning phases which will include a Whole Effluent Toxicity Test on five species on a quarterly basis, and sediment quality monitoring and surveys of the sea-bed ecology at eight monitoring stations on a half-yearly basis.

14. All the monitoring results will be reported to the EIA Subcommittee of ACE on a quarterly basis and uploaded to a designated website for public inspection.

15. Should exceedance of discharge limits be identified during the monitoring, or should toxicity in the receiving environment be found to be greater than that predicted under the EIA, we will carry out an immediate investigation as to the cause and take the necessary measures to rectify the problem.

Progress of HATS Stage 2B Preparatory Work

16. The main elements of the preparatory work for HATS stage 2B are the continued monitoring of the trends in the planning parameters for HATS and the commissioning of work to firm up on the co-use to be pursued at the identified site for the biological sewage treatment works. For the land co-use study, we have commenced the selection of consultants with a view to completing the statutory planning procedures for amending the zoning plan by 2010. For the planning parameters we have stepped up monitoring of the water quality trends through targeted field surveys. We continue to carry out annual updates on the key parameters concerning population growth and sewage flow forecasts.

Plan for Treatment of Sludge

17. The present practice of disposing of dewatered sewage sludge by landfilling is not sustainable. The Administration therefore proposes to build a dedicated Sludge Treatment Facility (STF) with a capacity of 2 000 tonnes per day to handle dewatered sewage sludge from the SCISTW and other regional sewage treatment works. We propose to adopt incineration technology for the STF, which will be equipped with advanced pollution abatement and emission control facilities to ensure full compliance with stringent international environmental standards.
