For discussion **PWSC(2000-01)30**
on 24 May 2000

ITEM FOR PUBLIC WORKS SUBCOMMITTEE OF FINANCE COMMITTEE

HEAD 704 - DRAINAGE
Environmental Protection - Sewerage and sewage treatment
276DS - Sha Tin sewage treatment works stage 3 extension

Members are invited to recommend to Finance Committee the upgrading of **276DS** to Category A at an estimated cost of $2,425.0 million in money-of-the-day prices.

PROBLEM

The Sha Tin sewage treatment works (STSTW) has reached its design capacity and will not be able to cope with the forecast sewage flow from Sha Tin and Ma On Shan areas.

PROPOSAL

2. The Director of Drainage Services (DDS), with the support of the Secretary for the Environment and Food, proposes to upgrade **276DS** to Category A at an estimated cost of $2,425.0 million in money-of-the-day (MOD) prices for undertaking extension and modification work to STSTW.

PROJECT SCOPE AND NATURE

3. The scope of the project comprises -

(a) construction of inlet works including one aerated grit channel, two sets of de-gritting equipment, two flume channels and one fine screen;

(b) construction of ten primary sedimentation tanks and the associated sludge pumping stations;

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(c) construction of ten aeration tanks, one air blower house and the associated drainage pumping stations;

(d) construction of 20 final sedimentation tanks and associated sludge pumping stations;

(e) construction of ultra-violet disinfection facilities;

(f) construction of sludge treatment facilities including six digestion tanks, one boiler house, one sludge de-watering house and ancillary facilities, and an extension of the existing sludge thickening house;

(g) construction of a laboratory building[1] including the necessary equipment, office and associated stores;

(h) laying of pipelines;

(i) modification of 12 existing aeration tanks and 24 existing final sedimentation tanks;

(j) ancillary works including power supply system, control systems, building services installations, fire services installation, lifting appliances, cabling works, road works, process commissioning and site safety measures etc.; and

(k) interim measures such as temporary modification to the existing aeration tanks to improve the treatment process' performance.

A plan showing the proposed works is at Enclosure 1.

JUSTIFICATION

4. Due to rapid developments in Sha Tin and Ma On Shan areas in recent years, STSTW has reached its design capacity of 150 000 cubic metres (m^3) per day. Although the Drainage Services Department has been carrying out various interim measures such as the replacement of inlet screens, the balancing of flow at

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[1] The design and construction supervision of the laboratory building will be carried out by Architectural Services Department using in-house staff resources.

peak hours, installation and upgrading of sludge removal equipment to increase the sludge treatment capacity and the provision of foam removal equipment for the existing aeration tanks to enhance plant efficiency and, hence, effluent quality, the plant is still experiencing occasional difficulties in meeting the discharge standards, particularly during the winter months and peak flow periods. To completely resolve the capacity problem, it is necessary to carry out extension works to STSTW to increase its treatment capacity.

5. Moreover, the residential population in Sha Tin and Ma On Shan areas is anticipated to increase from the existing 630 000 to 830 000 by the year 2011. We forecast that the daily sewage flow from residential, commercial, industrial and other developments in these areas will increase to 340 000m^3 by 2011. The proposed extension works will increase the capacity of STSTW to 340 000m^3 per day to cater for additional sewage flows generated by these future developments.

6. We intend to start the construction of the proposed extension works in March 2001 for completion in mid 2008. In order to bring early relief to the current capacity problem during peak flow periods, we plan to commission phase 1 of the proposed extension works in 2004 so that the plant will be able to handle the anticipated amount of sewage generated by that time. We will also carry out interim measures, such as temporary modification work to the existing aeration tanks, to improve the performance of the plant prior to the commissioning of the phase 1 works in 2004.

7. At present, the discharged effluent is only required to comply with the existing standards for Biochemical Oxygen Demand (BOD), Total Nitrogen (TN), and Total Suspended Solids (TSS). In order to comply with new effluent standards for ammonia nitrogen and *E. Coli*, we will also upgrade the treatment process of STSTW to improve the ammonia nitrogen removal capacity of the plant and include a disinfection system to reduce the *E. Coli*. level in the effluent. Upon full commissioning of the extension works, it is expected that the discharged effluent will comply with all five stipulated standards, namely BOD, TSS, TN, ammonia nitrogen and *E. Coli* level, the details of which are shown in Enclosure 2.

8. We have adopted an advanced activated sludge process with nutrient removal in the design of the proposed extension works. The treatment process will thus be more flexible in responding to climatic conditions and in minimising the

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adverse effect of salt water flushing. Furthermore, by using compact rectangular treatment units, we will be able to achieve a substantial increase in the treatment capacity with the limited land available.

9. If we do not implement the proposed extension works, the quality of the effluent discharged by STSTW will deteriorate. The sub-standard effluent will pollute the receiving water bodies and their Water Quality Objectives will not be met. In addition, if the proposed extension works are not implemented, future development of the Sha Tin and Ma On Shan areas cannot proceed without leading to further deterioration in the effluent quality.

10. The Director of Drainage Services has deployed in-house staff to undertake the detailed design of the project. However, there is insufficient in-house site staff to supervise the proposed construction works and contract site staff will need to be employed. In addition, it is necessary to engage consultants to conduct the necessary environmental monitoring and auditing of the project due to inadequate in-house expertise.

FINANCIAL IMPLICATIONS

11. We estimate the capital cost of the proposed works to be $2,425.0 million in MOD prices (see paragraph 12 below), made up as follows -

			$ million
(a)	Inlet works		15.1
(b)	10 primary sedimentation tanks and associated sludge pumping stations		102.9
(c)	Aeration system		284.9
	(i) aeration tanks	265.7	
	(ii) air blower house	19.2	
(d)	20 final sedimentation tanks and associated sludge pumping stations		312.3

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		$ million		
(e)	Ultra-violet disinfection facilities		75.9	
(f)	Sludge treatment facilities		322.7	
	(i) sludge thickening system	92.2		
	(ii) sludge digestion and dewatering system	230.5		
(g)	Laboratory building		64.2	
(h)	Pipeworks		109.3	
(i)	Modification to 12 existing aeration tanks and 24 final sedimentation tanks		112.0	
(j)	Ancillary works		176.8	
(k)	Interim measures		45.4	
(l)	Environmental mitigation measures		56.4	
	(i) environmental mitigation works	33.8		
	(ii) consultants' costs	22.6		
(m)	Contract site staff		62.4	
(n)	Inspection of electrical and mechanical equipment overseas		0.5	
(o)	Contingencies		173.1	
	Sub-total		1,913.9	(in December 1999 prices)

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		$ million	
(p)	Provision for price adjustment	511.1	
	Total	2,425.0	(in MOD prices)

A breakdown of the estimates for consultants' costs is at Enclosure 3.

12. Subject to approval, we will phase the expenditure as follows -

Year	**$ million (Dec 1999)**	**Price adjustment factor**	**$ million (MOD)**
2001 - 2002	170.9	1.04500	178.6
2002 - 2003	222.9	1.10770	246.9
2003 - 2004	583.2	1.17416	684.8
2004 - 2005	233.6	1.24461	290.7
2005 - 2006	173.3	1.31929	228.6
2006 - 2007	203.5	1.39845	284.6
2007 – 2008	122.4	1.48235	181.4
2008 – 2009	112.2	1.57129	176.3
2009 – 2010	91.9	1.66557	153.1
	1,913.9		2,425.0

13. We have derived the MOD estimates on the basis of Government's latest forecast of trend labour and construction prices for the period 2001 to 2010. We will implement the works under five contracts: including two civil works contracts, two electrical and mechanical works contracts and one building works contract. The civil works contracts, comprising the construction of civil

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engineering structures of the treatment facilities, will be tendered as re-measurement contracts because the quantities of piling works may vary subject to the actual ground conditions. The electrical and mechanical contracts will involve the supply and installation of electrical and mechanical equipment for the treatment facilities. The laboratory building will be constructed under the building works contract. We will tender the electrical, mechanical and building works under standard lump-sum contracts because we can clearly define their scope. We will make provision for price adjustments as the construction period of these contracts will exceed 21 months.

14. The additional annually recurrent expenditure is estimated to be $88.4 million. The increase in recurrent costs is mainly due to an increase in consumables and maintenance works required for the operation and maintenance of the sewage treatment works, such as electricity, chemicals and sludge disposal. When STSTW is working at its design capacity, the recurrent cost per cubic metre of sewage treated will be $1.4 (at today's prices) after the extension is in operation, compared with the existing cost of $1.6 (assuming operation at design capacity).

15. Based on the current level of expenditure on operation and maintenance of sewerage facilities, the proposed works by itself would lead to an 8.0% increase in the recurrent expenditure on provision of sewage services. This will be taken into account in determining sewage charges.

PUBLIC CONSULTATION

16. On 2 March 2000, we consulted the Health and Environment Committee of the Sha Tin District Council on the proposed works. Members supported the proposed works. We also consulted the LegCo Panel on Environmental Affairs on 5 May 2000. Members supported in principle the implementation of the proposed works. Some Members requested additional information on the project, such as the effluent standards of the upgraded plant and the interim measures proposed, which is now set out in this paper.

ENVIRONMENTAL IMPLICATIONS

17. This project is a designated project under Schedule 2 of the Environmental Impact Assessment (EIA) Ordinance and an environmental permit is required for its implementation and operation. In November 1999, the EIA report for the project was approved. The report concluded that the environmental impact of the project can be controlled to within the criteria set out in the EIA Ordinance and the Technical Memorandum on the EIA Process. We will implement the

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measures as recommended in the report. Long-term environmental mitigation works comprise the implementation of an environmental monitoring and audit (EM&A) programme, addition of chemicals to reduce odour, and provision of landscape works to provide a natural and pleasant view in harmony with the surroundings. The EM&A programme covers both the construction and operation phases. During the construction phase, we will establish an environmental team and employ an independent environmental checker to audit and monitor the construction activities. During the operation phase, we will carry out odour and water quality monitoring work to verify the performance of the mitigation measures and the sewage treatment process respectively.

18. For impacts during construction, we will incorporate in the contracts standard pollution control measures such as water-spraying to reduce emission of fugitive dust, and the use of silenced construction plants to reduce noise generation so as to control construction impacts to within the established standards and guidelines. We estimate the cost of implementing the environmental mitigation measures to be $56.4 million in December 1999 prices. We have included this cost in the overall project estimate.

19. At the planning and design stages we considered ways of minimizing the generation of construction and demolition material (C&DM). We have adopted a module design approach such that the formwork can be reused repeatedly. We estimate that about 125 000 m^3 of public fill will be delivered to public filling facilities after allowing for reuse and about 25 000 m^3 of construction and demolition waste (C&DW) will be disposed of at landfills.

20. Under the terms of the contract, we will require the contractor to submit a waste management plan for approval. This will contain appropriate mitigation measures, including the allocation of an area for waste segregation. We will ensure the day-to-day operations on site comply with the approved waste management plan. We will reuse the public fill generated from the project either on site or in other construction sites as far as possible. We will require the contractors to implement necessary measures to minimize the generation of C&DM and to reuse and recycle C&DM.

21. We will require the contractors to separate public fill from C&DM waste for disposal at appropriate locations and to sort the C&DW by category on site to facilitate reuse in order to reduce the generation of such waste. The disposal, reuse and recycling of C&DM will be recorded for monitoring purposes. We will control the disposal of public fill and C&DW to designated public filling facilities and landfills respectively through a trip-ticket system.

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LAND ACQUISITION

22. The project does not require any land acquisition.

BACKGROUND INFORMATION

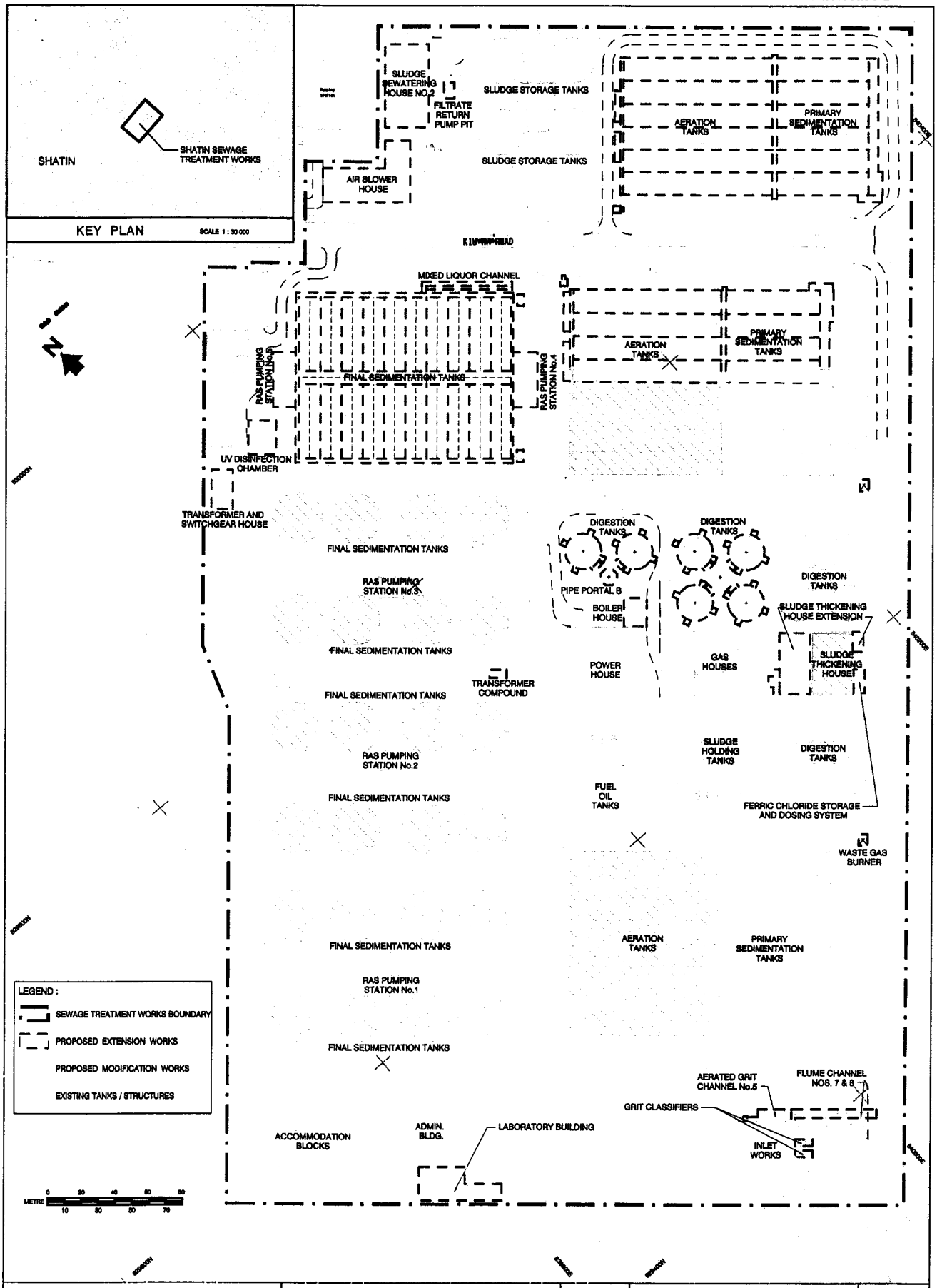
23. We upgraded **21DS** "Sha Tin New Town - interim and permanent sewage treatment works, stage 1" to Category A in 1974. The construction works started in 1976 and were completed in 1982. We upgraded **20DS** "Sha Tin New Town - permanent sewage treatment works, stage 2 - design and construction" to Category A in 1979. The construction works started in 1982 and were completed in 1988.

24. Owing to the rapid development of the Sha Tin and Ma On Shan areas, STSTW has reached its design capacity in handling the sewage flows from these areas. There have been difficulties in meeting the discharge licence standards during peak flow periods and cold winter months when low ambient temperatures lead to bacterial changes and have an adverse impact on the treatment process. To cope with the increasing sewage flow and the impact of salt water flushing introduced in 1996, we have been modifying operational techniques and carrying out minor modification works in STSTW to enhance its efficiency.

25. In April 1996, we upgraded **276DS** to Category B for STSTW stage 3 extension. We have substantially completed the detailed design and tender documents for the proposed works using in-house staff resources. We intend to start the proposed construction works in March 2001 for completion in mid 2008. To bring about an early enhancement to STSTW's capacity and to improve effluent standards, we will commission the expansion in phases progressively starting from 2004 and 2006 to cater for the planned developments coming on stream in the Sha Tin and Ma On Shan areas.

26. We estimate that the proposed works will create some 440 new jobs during the construction stage. These will comprise 80 professional or technical staff and 360 labourers, totalling 22 800 man months.

Environment and Food Bureau
May 2000



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	office SEWERAGE PROJECTS DIVISION			

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Enclosure 2 to PWSC(2000-01)30

276DS – Sha Tin sewage treatment works, stage 3 extension

Characteristics of Raw Sewage and Effluent Standards

Pollutant	**Characteristics of Raw Sewage**	**Current Effluent Standard**	**Effluent Standards upon the completion of stage 3 extension**
BOD	180 mg/l	20 mg/l	20 mg/l
TSS	220 mg/l	30 mg/l	30 mg/l
TN	42 mg/l	25 mg/l	20 mg/l
NH_3	26 mg/l	N/A	5 mg/l
E Coli	10^7 counts/100 ml	N/A	1,000 counts/100 ml

Legend

BOD - Biochemical Oxygen Demand;
TSS - Total Suspended Solids;
TN - Total Nitrogen;
NH_3 - Ammonia Nitrogen;
mg/l - milligrams per litre;
ml - millilitre; &
N/A - Not Applicable.

Enclosure 3 to PWSC(2000-01)30

276DS – Sha Tin sewage treatment works, stage 3 extension

Breakdown of estimates for consultants' costs

	Consultants' staff costs		**Estimated man months**	**Average MPS salary point**	**Multiplier factor**	**Estimated fee ($ million)**
(a)	Environmental checking during construction	Professional	31	40	2.4	4.7
		Technical	44	16	2.4	2.3
(b)	Odour monitoring & auditing	Professional	6	40	2.4	1.0
		Technical	60	16	2.4	3.0
(c)	Water monitoring & auditing	Professional	46	40	2.4	6.9
		Technical	13	16	2.4	0.7
			Total consultants' staff costs for environmental mitigation measures			18.6
	Out-of-pocket expenses					
(a)	Investigation works and other reimbursable expenses					4.0
			Total out-of pocket expenses			4.0
			Total consultants' costs			22.6

Notes

1. A multiplier factor of 2.4 is applied to the average MPS point to arrive at the full staff costs including the consultant's overheads and profit, as the staff will be employed in the consultant's offices. (At 1.4.99, MPS Pt. 40 = $62,780 p.m. and MPS Pt. 16 = $21,010 p.m.).

2. Out-of-pocket expenses are the actual costs incurred. The consultant is not entitled to any additional payment for overheads or profits in respect of these items.

3. The figures given above are based on estimates prepared by Director of Drainage Services and Director of Environmental Protection. We will only know the actual man months and actual fees when we have selected the consultant through the usual competitive lump sum fee bid system.

4. The consultants' staff costs include supervision of investigation works and environmental monitoring works. The costs of environmental monitoring works are included in the cost for environmental mitigation measures.