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For information

Legislative Council
Panel on Environmental Affairs

Supplementary Information on
208DS – Outlying Islands sewerage, stage 1 phase 1 part 1
Ngong Ping sewerage, sewage treatment and disposal

Purpose

This paper provides supplementary information on the detailed cost breakdown of the Ngong Ping Sewage Treatment Plant (STP), and a cost comparison between adopting the Sequencing Batch Reactor[1] (SBR) technology and the Biological Aerated Filters[2] (BAF) technology in treating sewage as requested by Members during the discussion on **208DS** – "Outlying Islands sewerage, stage 1 phase 1 part 1, Ngong Ping sewerage, sewage treatment and disposal" on 10 April 2003. In view of Members' interest on the effluent reuse opportunities raised at the meeting, additional information is also included in this paper.

Detailed cost breakdown of the Ngong Ping STP

2. The detailed cost breakdown of the Ngong Ping STP is as follows –

		$ million (in Sept 2002 prices)
A.	Treatment Facilities	90
	(a) Inlet pumping stations and inlet works (screens and grease separators)	25

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[1] Sequencing Batch Reactor is a kind of biological treatment process which utilises suspended growth of microorganisms to remove organic pollutants and nutrients from wastewater. It has the benefit of small in size and high flexibility to handle high fluctuating sewage flows.

[2] Biological Aerated Filter is a new kind of biological treatment process which utilises microorganisms that attach on a granular media, for removing of organic pollutants and nutrients from wastewater. It is even smaller in size as compared with Sequencing Batch Reactor but the experience of its operation in warmer climate like Hong Kong is limited.

	(b) SBR tanks	33	
	(c) Dual media granular filter and UV disinfection system	13	
	(d) Sludge digestion, dewatering and storage facilities	19	
B.	Earthwork		31
	(a) Site formation	10	
	(b) Excavation for underground structures	21	
C.	Emergency storage tank		25
D.	Landscaping works and miscellaneous		7
	Total		153

Comparison of SBR and BAF

3. A comparison of the SBR and the BAF treatment technologies is as follows –

Estimated Unit Capital Cost

	SBR (HK$/m³)	**BAF (HK$/m³)**	**Difference in %**
Inlet pumping stations and inlet works (screens and grease separators)	8,300	8,300	0
SBR tanks and BAF facilities	10,900	14,200[3]	30%
Dual media granular filter and UV disinfection system	4,500	4,500	0

[3] The capital cost estimates of the BAF facilities are derived having regard to overseas experience. The cost of using BAF facilities are 30% higher than that of using SBR tanks due to the need to build additional tanks and to cater for backwash. Due to our lack of experience in building BAF facilities suitable for meeting local requirements, the actual costs may vary from the figures quoted.

Sludge digestion, dewatering and storage facilities	6,300	6,000[4]	-5%
Total[5]	30,000	33,000	10%

Estimated Unit Operational Cost

	SBR (HK$/m³)	**BAF (HK$/m³)**	**Difference in %**
Staff Cost	1.4	1.4	0%
Materials and Chemicals	1.2	1.4[6]	17%
Energy	0.7	0.8[7]	14%
Buildings and Civil Maintenance (by independent contractors)	1.5	1.7[8]	13%
Miscellaneous (laboratory testing, laboratory equipment, workshop services)	1.2	1.2	0%
Total	6	6.5	8%

4. The higher capital and operational costs for the BAF systems are mainly due to the additional costs associated with building and operating the additional tanks and backwash facilities.

Justification for adopting the SBR in Ngong Ping STP

5. We have selected the SBR treatment technology for the Ngong Ping STP. Apart from the cost consideration, we have also taken into account the following factors in arriving at the conclusion that the SBR treatment technology is more suitable for the Ngong Ping STP –

(a) To provide tertiary treatment for the Ngong Ping sewage, we need the biological treatment process. Technically, there are only two

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4 The lower cost is due to the better sludge characteristics in terms of sludge processing.

5 The total cost does not include items B, C and D under paragraph 2 above as these items are only specific to the Ngong Ping STP due to its unique location.

6 The higher cost is due to the additional polymer/lime required for sedimentation and filter media for BAF.

7 The higher cost is due to the additional energy consumption for air blowing/scrapping in the additional sedimentation tanks/equalisation tanks.

8 The higher cost is due to the additional sedimentation tanks and equalisation tanks required for BAF.

generic types of biological treatment, namely the suspended growth activated sludge process (e.g., SBR) and the attached growth biological reactor (e.g., BAF).

(b) Of the various activated sludge processes, SBR is more suitable for the Ngong Ping STP situation because it does not require a continuous operation mode, and hence can have greater flexibility to cope with the very high fluctuation in sewage flows at Ngong Ping between weekdays and holidays.

(c) Although there are successful BAF installations overseas, we need more time to evaluate the performance of BAF technology under Hong Kong's conditions. However, the programme of the Ngong Ping STP is very tight as the STP has to be completed before the commissioning of the Tung Chung Cable Car Project in August 2005. Hence, we consider it prudent not to adopt the BAF or other less proven technology in the case of Ngong Ping STP.

(d) The chief merit of BAF treatment technology in comparison to SBR is space-saving. However, space availability is not a critical factor for the Ngong Ping STP as the whole STP is on Government land and no land resumption is required.

Effluent Reuse Opportunities

6. Various effluent reuse opportunities have been duly considered, namely for washing cable car, uses by cooling towers etc. The idea of cable car washing has been dropped because the MTRCL has indicated that its car washing operation will very likely be conducted at the Tung Chung Terminal, not at Ngong Ping. Moreover, it should also be noted that although the quality of the effluent after tertiary treatment is high, it still needs additional treatment to bring it up to standard for reuse options with non-direct body contact, e.g. flushing and irrigation in a controlled manner. Should the treated effluent be used for purposes with possible body contact, even higher additional treatment will be required to meet the stringent standard to protect the public health. The additional cost involved will be far too expensive to be justified for this particular project. The additional works required to support the currently proposed reuse options, i.e. flushing and landscape irrigation, will only cost $4.1 million, the funding of which has been approved under another PWP project under the Water Supplies Department, namely, **9323WF** by Finance Committee on 21 February 2003.

Environment, Transport and Works Bureau
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