For discussion
On 19 March 2001

Legislative Council
Panel on Environmental Affairs

Trials and Studies in Relation to The Way Forward for the Harbour Area Treatment scheme

Purpose

This paper seeks Members' views on the Administration's proposal to invite Public Works Subcommittee to recommend to Finance Committee to upgrade to Category A of the Public Works Programme a new item for undertaking trials and studies for the further development of the Harbour Area Treatment Scheme.

Background

2. To improve the water quality of the harbour, we initiated the Harbour Area Treatment Scheme (HATS) (formerly known as the "Strategic Sewage Disposal Scheme" (SSDS)) in the late eighties for the collection and treatment of sewage from the main urban areas on both sides of Victoria Harbour. Implementation was divided into four stages. To bring about early improvement to harbour water quality, the first stage was designed to convey sewage from the most densely populated and industrialized areas to a sewage treatment works at Stonecutters Island for chemically enhanced primary treatment (CEPT)[1] before discharge into the western harbour via an interim outfall. We expect to commission the first stage collection systems around the end of 2001.

3. On full commissioning, stage I will treat about 70% of the sewage from the harbour area. It will reduce the biochemical oxygen demand load on the

[1] CEPT is the treatment technology being used in the Stonecutters Island Sewage Treatment Works (SCISTW) which was constructed under Stage I of HATS and has been in operation since May 1997. The CEPT process in SCISTW is able to achieve 90% of the effluent quality standards of conventional biological treatment plant.

harbour by about 50%, and the suspended solid load by about 55%. It is expected to reduce *E.coli* load by about 30%. However, to meet fully the objectives of cleaning up the harbour and improving neighbouring water bodies, further works are needed to collect and treat sewage from Hong Kong Island and to upgrade overall treatment and discharge arrangements.

4. Between 1996 and 2000, an environmental impact assessment (EIA) was conducted to assess the preferred treatment level and discharge location for the subsequent stages of the scheme. A study concluded that the CEPT-effluent from Stonecutters Island should undergo a further disinfection process and then be discharged to a location east of Lamma Island. This configuration, termed the "1999 scheme" is shown at **Enclosure 1**. Were it to proceed now, we estimate that the 1999 scheme would be completed by 2011.

5. The public concerns raised by the delays in Stage I of the project, coupled with continued criticism of the preferred treatment level, reliance on large treatment plants and discharge arrangements for subsequent stages, led to the conclusion in 1999 that further stages of the HATS should not be implemented until Stage I had been completed and greater public understanding and consensus had been established on the way forward. In his 1999 Policy Address, the Chief Executive announced that the Government would carry out another review of the scheme. In April 2000, we invited an international review panel (the IRP) of local and overseas experts to carry out the review.

6. In its final report released on 30 November 2000, the IRP recommended that before final decisions on further stages were made, consideration should be given to upgrading the treatment level to tertiary standard, and EIA work undertaken to establish whether effluent treated to this standard could be discharged into the harbour area, doing away with a long oceanic outfall. To achieve this, four alternative treatment and discharge options were proposed, all involving the use of Biological Aerated Filter (BAF)[2] technology for treatment, deep tunnels for the sewage transfer system, and short outfalls for disposal. As illustrated in **Enclosure 2**, these options differ in the degree of centralization and the proposed outfall locations. A summary of the IRP's recommendations and the Administration's responses and decisions on the way forward is set out in a Brief for the Legislative Council issued on 1 March 2001.

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[2] This is an advanced treatment process characterized by compact size.

The Proposal

7. The Government proposes to carry out environmental and engineering feasibility studies, to develop a contractual framework for option implementation, and to test out BAF technology and, if necessary, other compact sewage compact technologies. These trials and studies are necessary for ascertaining whether the compact technologies and the four options are viable, and for addressing the question as to whether there is any capacity constraint in Stage I. Specifically, the studies and trials are -

Compact sewage treatment technologies trials

To test the feasibility and effectiveness of compact technologies, particularly BAF, in treating saline sewage, and to assess the reliability and operational risk, land requirements, sludge production rates and the capital and recurrent costs of such technologies.

Environmental feasibility study

To carry out water quality modeling and related assessments in respect of the IRP options and any other treatment and discharge options; to evaluate the potential impacts of the options on the receiving water environment and their effectiveness in achieving the water quality objectives and meeting other relevant agreed criteria. The effectiveness of the options for meeting long term demands for treatment capacity for the whole HATS catchment area will also be examined.

Engineering feasibility study

To identify specific potential sites to accommodate the various facilities under the different options, to provide updated estimates in respect of capital and recurrent costs for various options and to propose a list of feasible options and provide support for a community consultation exercise.

Feasibility study for contractual framework

To review possible contractual arrangements, including "Design, Build, Operate" (DBO), and develop a framework that would help expedite the delivery of the project and identify the most appropriate means in operating the projects.

A brief on the detailed scope and significance of the above studies and trials is set out at **Enclosure 3**.

Justification

8. In proposing the four options, the IRP recognized that there were several uncertainties that needed to be addressed. It therefore recommended that a number of studies and trials be carried out before a final configuration for the subsequent stages of the HATS is selected. The trials and studies need to address the following important issues -

(a) Due to the generally high saline content of Hong Kong's sewage, there is a need to test the effectiveness of the BAF technology in terms of organics removal, nitrification, and denitrification with local sewage. We will invite manufacturers to offer pilot plants to test out BAF technology or other compact treatment technologies that have been well-proven for large-scale application. The trial data will be used for assessing not only the effectiveness of the technology and the relevant recurrent costs, but also the size of the sites where the new treatment facilities may need to be located.

(b) The IRP indicated that CEPT plus BAF should be the preferred treatment technology, with discharges made into the harbour at various possible locations. But, they drew no conclusions as to the precise effluent quality needed to meet current environmental requirements, or the long term acceptability of discharging effluent into the harbour. We therefore need to carry out a detailed water quality assessment to address these issues. Because previous studies have not focused in detail on the harbour area as a long-term discharge location, we need to compile a considerable amount of new information and undertake environmental feasibility studies and surveys.

(c) The IRP recommended that we should consider new treatment facilities located within or close to certain residential areas e.g. Sandy Bay and North Point. These facilities are expected to occupy significant space even if they employ BAF technology. We need to assess the land,

engineering and other constraints relating to the sites where such facilities might be accommodated, as well as the economic implications of such a semi-distributed system. A major part of the engineering feasibility study can only be conducted after the results from the BAF trials described above become available.

(d) Since a long lead-time is required for infrastructure projects like the HATS facilities, the IRP recommended that the Administration consider the DBO approach which may help to speed up the process. We will examine various kinds of contractual arrangements, including the DBO method, with a view to identifying the most appropriate framework for subsequent development in terms of speeding up the delivery time, controlling risk, and maximizing cost-effectiveness.

(e) The Stage I system was designed in 1993. Since then, there has been a substantial increase in the anticipated sewage flow in the Stage I catchment areas due to committed and proposed residential and commercial development in the catchment areas. This may create capacity constraint problems in the Stage I system in the medium to long term. To overcome this potential constraint, the 1999 scheme suggested that the Stage I flow from the eastern Hong Kong catchments of Chai Wan and Shau Kei Wan should be transferred to the future collection tunnel on the North Shore of Hong Kong Island system. However, the IRP considered that capacity constraints will not exist in the foreseeable future, and recommended that we carry out a flow assessment study to reassess whether there are indeed likely to be any such constraints. If the IRP's suggestion is right, the proposed deep tunnel between Shau Kei Wan and North Point will not be necessary.

(f) The IRP also recommended a study be conducted to reassess the capacity of the Stonecutters Island Sewage Treatment Works (SCISTW). The study's findings, together with information from other studies such as the flow assessment and the trials on compact technologies recommended by the IRP, will enable assessment to be made as to whether all the sewage from the harbour area can be treated at SCISTW.

(g) With more detailed information available from the studies and trials, we will also update the financial implications of the various options and work out the likely implementation programmes.

9. We need to engage professional services to assist with the studies outlined in paragraph 8(a) to (d). Prior to the release of the IRP report, the Environmental Protection Department had already identified the need to develop a hydraulic assessment tool to assess the performance of the HATS Stage I system to tie in with its commissioning. A small-scale study was therefore commissioned for this purpose and the tool will enable us to conduct a flow reassessment study as required by the IRP (subparagraph 8(e)). We do not need additional funding for conducting the flow reassessment study. Reassessment of SCISTW's capacity (subparagraph 8(f)) will be undertaken by the Drainage Services Department using existing resources.

10. The studies and trials will provide the information needed to undertake a full analysis of the options and enable us, if necessary, to identify potential alternatives in case any modification of the IPR options is required. Apart from this, the information obtained will help to determine whether the compact technologies investigated may have a wider application in Hong Kong.

11. Without these studies and trials, it will not be possible to establish the technical and economic viability of the IRP options. We will not be able to provide the public with accurate information on their costs and timetables, the associated risk, the likely benefit and the impact on the marine environment. Without such information, we foresee difficulty in building public consensus on the way forward for improving the water quality in the harbour.

Timetable

12. The trials and studies are expected to take about two years between November 2001 and October 2003. A detailed timetable for the proposed studies and trials as follows -

(a) Trials of compact sewage treatment technologies: Nov 2001 – June 2002
(b) Flow reassessment study: Nov 2001 - Oct 2002

(c) SCISTW capacity reassessment study: Jan 2002 – March 2002
(d) Environmental feasibility/engineering studies: Nov 2001 – Oct 2003
(e) Feasibility study for contractual framework: Mar 2002 – Mar 2003

13. The timetable above represents the shortest reasonable time frame for the following reasons:

(a) To obtain reliable results, trials of compact sewage treatment technologies must be carried out with sewage fully representative of SCISTW effluent under full load. Such a full load will not be available until the Stage I collection systems have commissioned around the end of this year. The operation then has to be tested under various environmental conditions.

(b) Similarly the flow reassessment and the SCISTW capacity reassessment studies can only be completed after the full commissioning of the Stage I. The flow reassessment study in particular requires analysis of data covering all seasonal conditions.

(c) The environmental feasibility study will take 18 months from Nov 2001 to May 2003. Phase 1 of this study will take a year because a two-season marine survey will need to be conducted. Phase 2, which involves a detailed assessment on water quality and ecology, can only be conducted after the completion of phase 1.

(d) Six months is the minimum time required for the engineering feasibility studies and evaluation of options, but this work can only be done when the results of the other studies are available because those other studies will determine the limiting factors concerning plant size and operational conditions. Such information is crucial to determining the feasibility of installing treatment capacity at the IRP's indicative locations.

Financial Implications

14. We estimate the capital cost of the studies and trials to be $74.33 million in money-of-the-day (MOD), made up as follows –

			$ million	
A.	Trials on compact sewage treatment technologies		14	
B.	Studies			
(a)	Professional Services		41.75	
	(i) Environmental feasibility study	17.5		
	(ii) Engineering feasibility study	11.85		
	(iii) Feasibility study for contractual framework	8.0		
	(iv) Others – general project management for the above three studies	4.4		
(b)	Field survey (for the environmental feasibility study only)		9.3	
(c)	Laboratory testing and analysis (for the environmental feasibility study only)		1.7	
C.	Contingencies		4.7	
		Subtotal	71.45	(in Sept 2001 prices)
	Inflation allowance		2.88	
		Total	74.33	(in MOD)

A detailed breakdown of the costs of the studies and trials is given at **Enclosure 4**.

Public Consultation

15. The report of the IRP on the review of the HATS was released to the public on 30 November 2000. The IRP presented its report to the Government, the Advisory Council on the Environment (ACE), the Legislative Council Panel on Environmental Affairs (EA Panel) and the public on 30 November 2000 and 1

December 2000. The Administration presented its responses to the IRP report review and our decision on the way forward on 1 March 2001.

16. To increase transparency and monitor the progress of the trials and studies, a Monitoring Group chaired by the Secretary for the Environment and Food is being set up. The three local members of the IRP are being invited to join the group, together with four representatives nominated by the ACE and some other members of the public. The Director of Environmental Protection and the Director of Drainage Services will also be members.

17. On 1 March 2001, a publication entitled "A Clean Harbour for Hong Kong" was issued to promote public awareness of measures needed to clean up the harbour, the IPR options, and the Government's responses and proposed way forward. Views from the public are welcome. We will conduct further public information and consultation programmes as the studies and trials progress to build up consensus in the community on the most appropriate way to improve our harbour water quality.

Environmental Implications

18. The proposed studies and trials themselves will not have any environmental implications.

19. While the Stage I of the HATS will bring substantial relief to the harbour later this year, we will not be able to meet all the water quality objectives as the remaining 30% of the sewage flow (from the area from North Point through Central and round to Aberdeen) will still be entering the harbour without proper treatment. Deterioration will resume as the population grows and development on both sides of the harbour continues.

20. It is therefore important that we proceed as soon as possible with the proposed studies and trials so as to establish the feasibilities of the options identified by the IRP. This will help to inform and guide decisions on the way forward with a view to further improving water quality at the harbour and safeguarding public health and the marine environment. The results of the proposed studies and trials will be incorporated into the statutory EIA and other project feasibility studies that will be needed for the preferred option as and

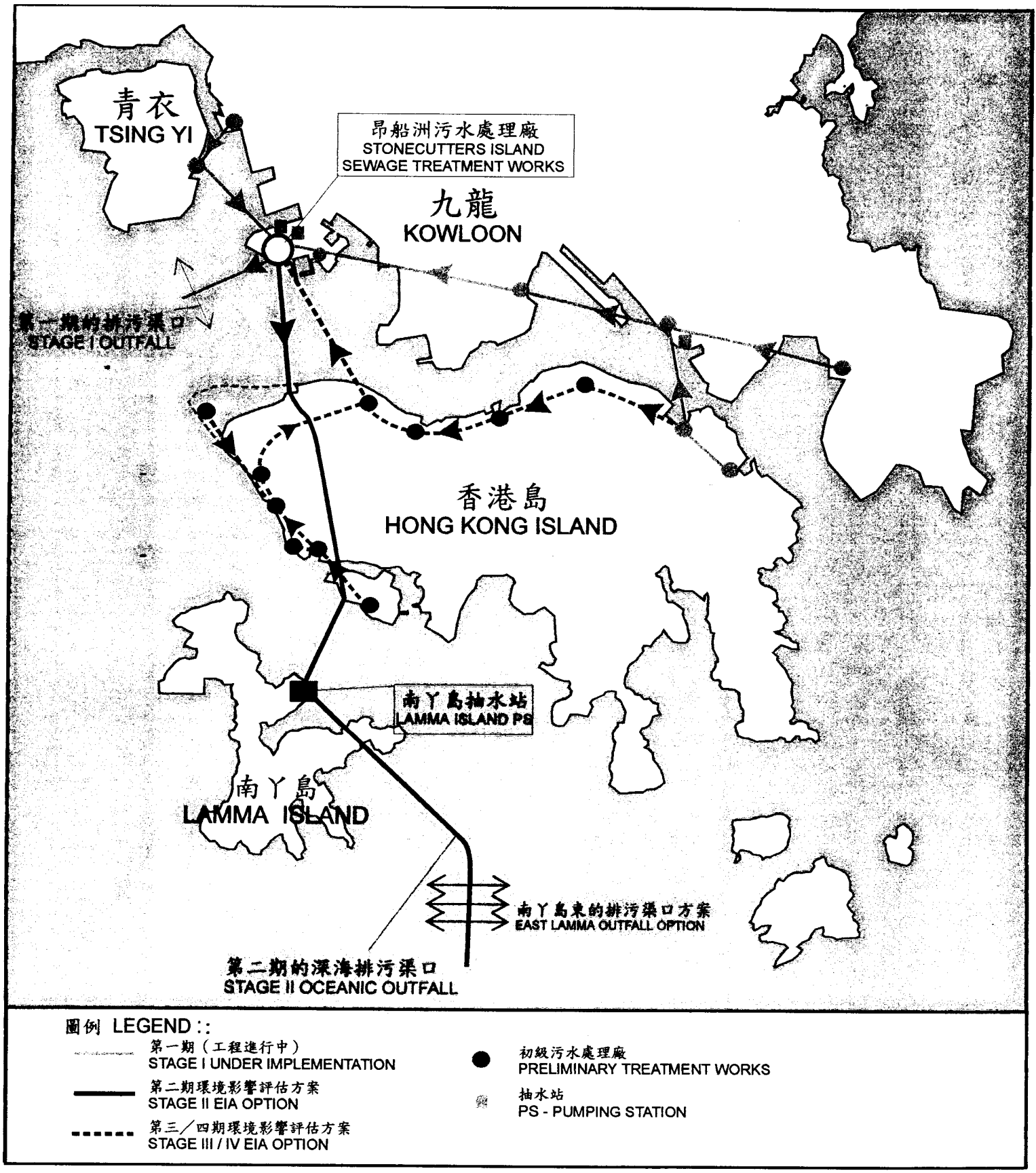
when it has been selected.

Conclusion

21. Members are invited to support our proposal to seek the Public Works Subcommittee's agreement to recommend to the Finance Committee to approve funding for the concerned studies and trials.

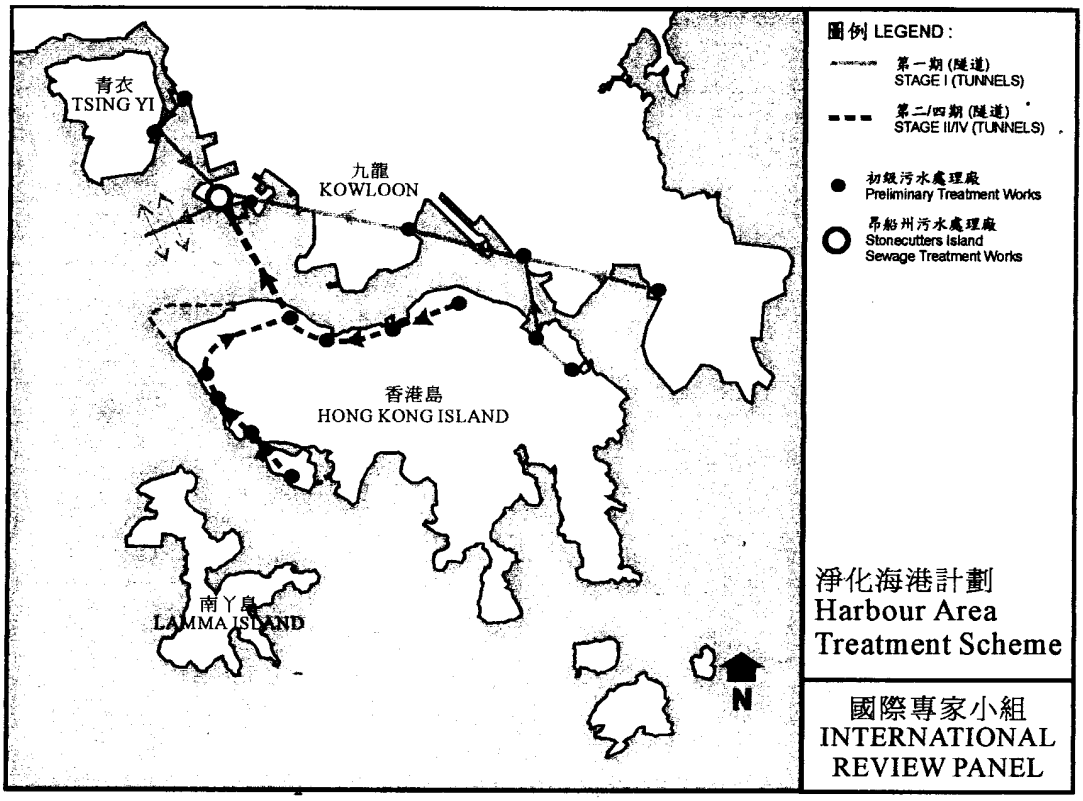
Environment and Food Bureau
March 2001

一九九九年環境影響評估建議的淨化海港計劃（一九九九年計劃）
The Harbour Area Treatment Scheme as recommended by the 1999 Environmental Impact Assessment (the 1999 Scheme)

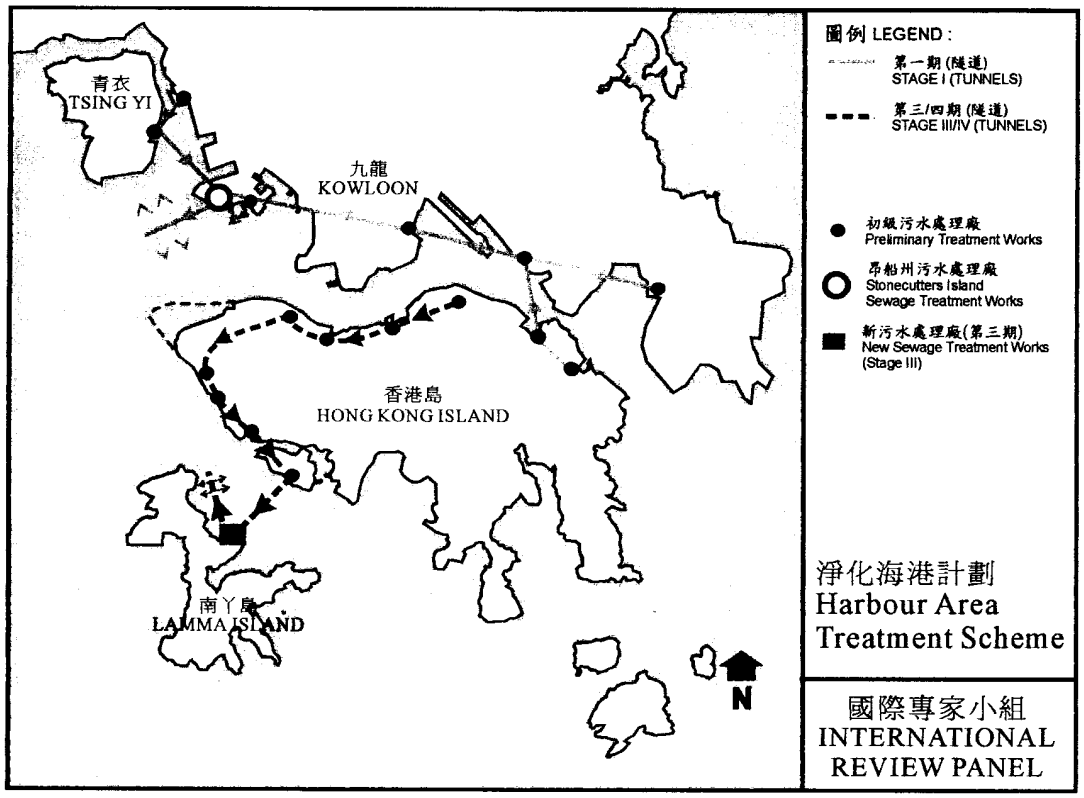


國際專家小組於二零零零年十一月建議的四個方案的示意圖
Schematic Diagrams of the four options recommended by the International Review Panel in November 2000

The First Option 第一個方案[1]

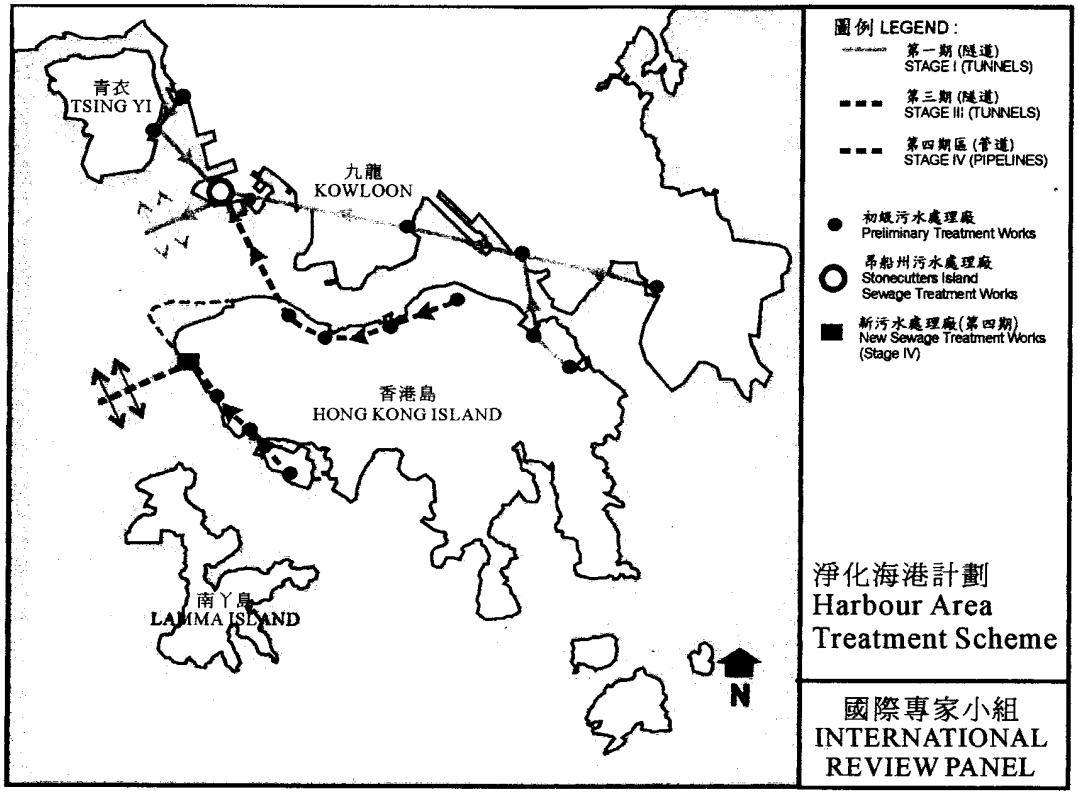


The Second Option 第二個方案

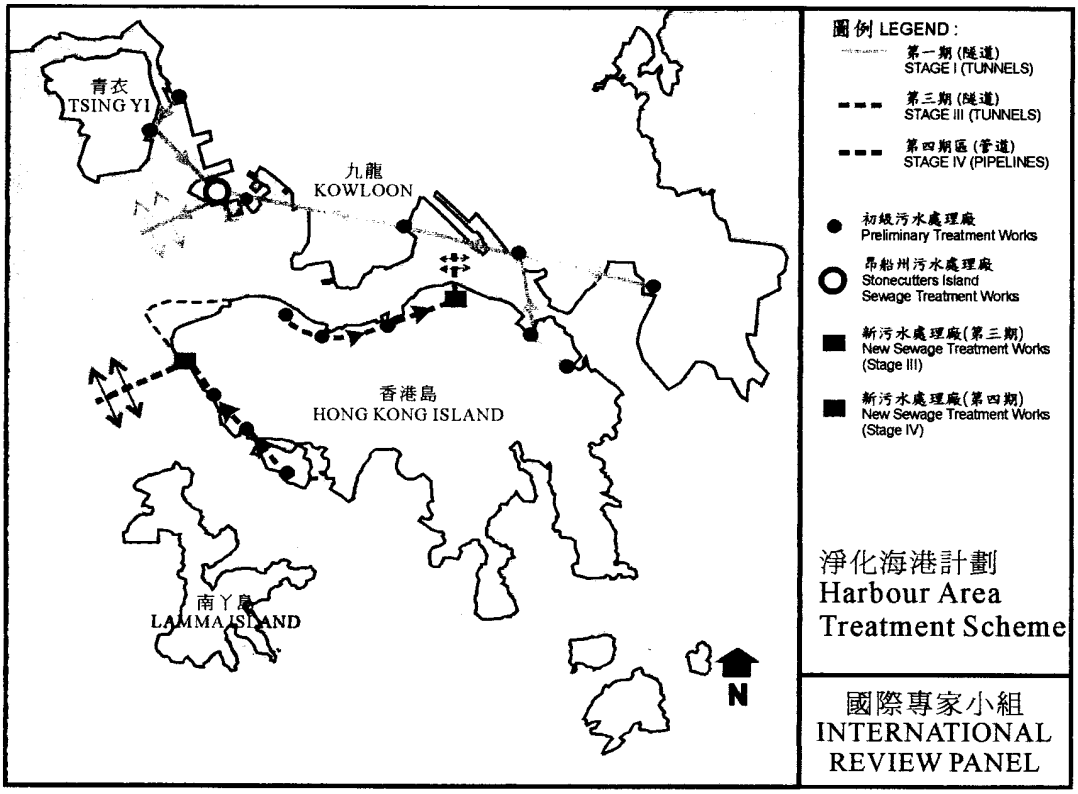


[1] 國際專家小組於二零零零年十一月的報告內分別把四個方案命名為5a至5d方案。
These four options are labelled option 5a to 5d respectively in the IRP report issued in Nov 2000.

The Third Option 第三個方案



The Fourth Option 第四個方案



Enclosure 3

Detailed scope and significance of the studies and trials to examine IRP's findings/recommendations

Trials or Studies	Detailed Scope	Significance
Trials		
Trials on Compact Sewage Treatment Technologies	To test the feasibility and effectiveness of compact technologies, particularly BAF, in treating saline sewage; to assess the reliability and operational risk, land requirements and sludge production, and capital and recurrent cost.	• There is uncertainty surrounding the effectiveness of BAF under local conditions. It is essential to be sure of the effectiveness of BAF in order to determine whether all the flows can be treated at Stonecutters Island; the same information is essential for determining the feasibility of those IRP options that involve treatment at other sites in the urban area as the area of land needed is a critical factor. • The recurrent cost of BAF depends on its efficiency and the extent of treatment required. We need to verify the recurrent cost implication as this will have significant bearing on long term financial requirements.
Studies		
Environmental feasibility	(a) To review existing information, undertake surveys, and carry out tests to characterize existing environmental conditions and the quantity, quality and toxicity of treated effluent.	• This will determine whether the receiving water environment (namely Western Harbour, West of Hong Kong Island (HKI), North East of Lamma Island, North Point) proposed by IRP could accommodate the treated

Trials or Studies	Detailed Scope	Significance
	(b) To review and propose appropriate ecological and water quality standards and criteria for impact assessment, based on existing information and the additional information obtained from the environmental surveys. (c) To assess any capacity constraint for the Kowloon and north-east Hong Kong Island (Stage I) elements of HATS, taking into account the latest population projections, the findings of the flow assessment study recommended by the IRP and the possible commissioning date of the remaining Hong Kong Island (Stage III/IV) elements of HATS, and to identify possible options to relieve any capacity constraint in Stage I. (d) To carry out water quality modeling and related assessments in respect of the IRP and any other treatment and discharge options found to be needed (e.g. to what extent nitrification and denitrification are required.) as a result of (c) above. (e) To undertake ecological impact and human health risk assessments for the various options. (f) To evaluate the potential impacts of the options on the receiving water environment, and their	effluent discharged. • If water quality modeling shows that BAF treated effluent could not be discharged in the vicinity of the Harbour (including western harbour, west of HKI and North Point), then a long outfall may have to be built. • Apart from the above options, this water quality assessment will allow us to decide whether the options identified to relieve any Stage I capacity constraint will be environmentally acceptable.

Trials or Studies	Detailed Scope	Significance
	effectiveness in achieving the water quality objectives and meeting other relevant agreed criteria.	
Engineering feasibility	(a) To identify specific potential sites to accommodate the various facilities under the different options, and taking into account land, engineering and other constraints, to prepare schematic designs for various options. (b) To provide updated estimates in respect of capital and recurrent costs for various options. (c) Taking into account other studies relating to the IRP review, to propose a list of feasible options and provide support for a community consultation exercise.	• This would form the basis of our further consultation with LegCo/ACE/the public. • These feasibility studies are necessary because even if all the IRP options are shown to be acceptable in terms of their environmental impact, we need to verify whether there are land or other engineering constraints that might pose problems to their implementation. • In addition, some indication of likely land-based impacts is necessary in order to allay the concerns of residents in any area selected as a potential treatment site. • To make any realistic assessment of the foregoing, we have to identify whether land is available or can be created; engineering feasibility cannot be assessed unless we have a reasonably firm site; firm sites cannot be selected until we are sure of the land and operational requirements of the BAF systems in the Hong Kong context. • Detailed and reliable cost information is needed as the costs of the IRP options have so far not been well defined and will depend crucially upon the treatment

Trials or Studies	Detailed Scope	Significance
		level found to be required and the particular configuration of treatment and disposal locations eventually adopted.
Feasibility study for contractual framework	• To review possible contractual arrangements, including "Design, Build, Operate" (DBO), and develop a framework that would help expedite the delivery of the project and identify the most appropriate means in operating the projects.	• To verify whether contractual arrangements like DBO will help reduce interface issues, and result in a more cost-effective design and speedier works delivery as suggested by the IRP. • If DBO could reduce recurrent cost, it will help reduce pressure on increasing sewage charges.

Enclosure 4

A detailed breakdown of the cost of the studies and trials to examine IRP's findings/recommendations

		$ million	
A.	Compact sewage treatment technologies trials		
	Setting up of pilot plants to test out different compact technologies in Hong Kong, particularly the BAF technology		14
B.	Studies		
(a)	Professional services		41.75
	Environmental feasibility study		
	(i) identification and establishment of ecological and water quality standards and criteria	0.3	
	(ii) effluent characterization, field survey and laboratory testing programme design and supervision, data analysis, and hypothesis testing	1.0	
	(iii) Stage I capacity constraint assessment and its impact (with consideration to findings of the flow assessment study) and identification of possible options to relieve any anticipated capacity shortfall	1.0	
	(iv) water quality modeling to simulate the impact of discharge on the receiving water bodies, including assessment of cumulative impacts	8.3	
	(v) ecological impact and risk assessment	6.9	

		$ million	
	Engineering feasibility study		
	(vi) development of schematic design, taking into account the land, engineering and other constraints, and other studies relating to the IRP options	6.5	
	(vii) review of financial implications	0.8	
	(viii) development of implementation programmes	1.0	
	(ix) options evaluations and comparisons, based on findings of these studies	2.2	
	(x) preparation work in relation to community consultation	1.35	
	Feasibility study for contractual framework		
	(xi) review of possible contractual arrangements, including DBO and identification of a suitable contractual framework	2.0	
	(xii) development of the contractual framework, including preparation of core contract documents, comprising Instructions to Tenderers, Form of Tender, Conditions of Contract, Specifications, etc	6.0	
	Others		
	(xiii) general project management (for the studies in items B(i) to (xii))	4.4	
(b)	Field survey (for the environmental feasibility study only)		9.3
	(i) water and sediment quality	1.3	

			$ million	
	(ii) hydrodynamics	4.0		
	(iii) ecology	4.0		
(c)	Laboratory testing and analysis (for the environmental feasibility study only)		1.7	
	(i) toxicity and bio-testing	0.6		
	(ii) water and sediment chemistry	1.1		
C.	Contingencies		4.7	
		Subtotal	71.45	(in Sept 2001 prices)
	Inflation allowance		2.88	
		Total	74.33	(in MOD)