CB(1) 2460/03-04(01)

Monitoring Group on Trials and Studies for the Harbour Area Treatment Scheme

1st Meeting at 9:30 a.m. on Saturday, 23 June 2001

Present:

Mrs Lily Yam	Secretary for the Environment and Food (Chairperson)
Dr Albert Koenig	
Prof Leonard K H Cheng	
Prof Rudolf S S Wu	
Dr Ho Kin-chung	Member of Advisory Council on the Environment
Ms Iris Tam	Member of Advisory Council on the Environment
Dr Ng Cho-nam	Member of Advisory Council on the Environment
Mr Chan Bing-woon	
Mrs Josephine Mak Chen Wen-ning	
Mr W S Chan	Deputy Secretary for Works (Works Policy)
Mr Robert Law, JP	Director of Environmental Protection
Mr John Collier, JP	Director of Drainage Services
Mr Raistlin Lau	Principal Assistant Secretary for the Environment and Food (B)1 (Secretary)

In attendance:

Mr Donald Tong	Deputy Secretary for the Environment and Food (B)
Mr Mike Stokoe	Deputy Director of Environmental Protection
Mr Benny Wong	Assistant Director of Environmental Protection
Dr Malcolm Broom	Principal Environmental Protection Officer, EPD
Mr S K Aggarwal	Assistant Director of Drainage Services
Mr W W Chui	Senior Engineer, Drainage Services Department
Mr Maurice Loo	Assistant Secretary for the Environment and Food (B)1A

Absent with apologies:

Prof Peter Hills	Member of Advisory Council on the Environment
Mr Jimmy Kwok Chun-wah	

Discussion **Action**

I. Opening

The Chairman welcomed all members to the first meeting of the Harbour Area Treatment Scheme (HATS) Monitoring Group (MG). She stated that the Government was committed to finding the most environmentally and cost effective way forward for the remaining stages of the Scheme. The MG would play a critical role in the process.

2. The Chairman asked members to treat the papers provided to them and discussions at the meetings in confidence to avoid any unnecessary confusion or needless speculation which might arise from premature release of information in a piecemeal and uncoordinated manner. She also requested members to declare any direct or indirect, potential or real interests they might have in connection with the work of the Environmental Protection Department (EPD), the Drainage Services Department (DSD) and HATS in particular.

3. The meeting then went through the terms of reference of the MG as set out in paragraph 19 of the Information Paper on HATS: Background and Way Forward [MG(2001)01]. It was agreed that the MG should be described as the "Monitoring Group on Trials and Studies for HATS".

4. The Chairman informed members that four members of the Environmental Affairs Panel (EAP) of the Legislative Council (LegCo) had visited Europe in April 2001 to study the sewage treatment facilities there, with particular reference to Biological Aerated Filters (BAF) plants. They had compiled a report of the visit and given a presentation to the Panel on 21 June. The EAP had yet to take a view on the report's recommendations. The Chairman said that LegCo had had reservations about previous proposals for HATS. EAP would need to be kept informed of key developments of HATS as the project progressed. Mr Rob Law supplemented that the public also had an enormous interest in the HATS and therefore it was very important to develop a consensus on the way forward in the community. However, as the options inevitably would come with different

price tags, the community must be made aware of them clearly and the consultation process should be as open and transparent as possible.

5. The Chairman said that in view of the complexity of the subject and the technical nature of the MG's discussion, a detailed briefing and a visit to the Stonecutters Island Sewage Treatment Works (SCISTW) should be arranged for the non-official members before the second meeting. Secretary/ EPD/ DSD

II. Agenda Item 1: HATS Background and Way Forward [MG(2001)01]

6. Mr Benny Wong gave a power-point presentation to take members through the history of HATS, the 1999 Scheme and the four options recommended by the International Review Panel (IRP) in 2000. He also briefly explained the scope and objectives of the trials and studies to be undertaken by Government as recommended by the IRP.

7. In response to Dr Ng Cho-nam's question about the general water quality of Victoria Harbour in the past 10 years, Mr Wong said that the dissolved oxygen (DO) level had been decreasing slowly whilst the bacteria level had shown a gradual upward trend over time. This indicated that there had been a general increase in organic pollution load. As for the other parameters, their levels tended to fluctuate from time to time without any obvious pattern.

8. In response to Mrs Josephine Mak, Mr Law briefly explained the different levels of sewage treatment. He said that the Chemically Enhanced Primary Treatment (CEPT) used at SCISTW was somewhere between primary and secondary treatment whereas BAF technology was a type of compact sewage treatment technology which could be used to further upgrade the CEPT process to the tertiary treatment level. As the effluent had been treated to a higher level, it would be acceptable to discharge the effluent through short outfalls in coastal waters.

9. In response to Dr Ho Kin-chung, Mr John Collier explained that the existing SCISTW was already treating some 25% of the Stage I sewage flows from Northwest Kowloon. He

added that the eastern sewage tunnels would be commissioned around November/December while the full commissioning of Stage I of the HATS would take place some time between early and mid January next year. He clarified that the preliminary treatment done at the preliminary treatment works (PTWs) could remove suspended solids larger than 6 mm in diameter in sewage.

10. Dr Ng asked whether the full commissioning of Stage I would result in any obvious improvement to the water quality of the Victoria Harbour, particularly in terms of parameters such as biochemical oxygen demand (BOD) and chemical oxygen demand (COD). He also asked whether any lack of improvement could be attributed to pollutants entering the Harbour from sources outside Hong Kong. Mr Law said that the original HATS were divided into four stages and therefore it was never intended that Stage I alone could solve the water pollution problem in the Harbour. Mr Wong supplemented that mathematical modeling results revealed that the central and eastern parts of the Harbour would show more significant improvement because the effluent from central and eastern Kowloon would be diverted to the SCISTW. As for the western part of the Harbour, there would still be improvement on some parameters upon the full commissioning of Stage I of HATS. However, with growing commercial activities and expanding population around Victoria Harbour, pollution in the Harbour would build up quickly again if further stages of the HATS were delayed. Turning to the impact of pollutants from the Pearl River, Mr Wong said that it would mainly affect the nitrogen level of the Harbour waters whereas the high bacteria level was more related to activities in Hong Kong. He explained that nitrogen in ammonia form was toxic to marine life whereas nitrogen in nitrate form might cause red tide. Dr Albert Koenig said that the 10-year monitoring data of EPD showed that most parameters measured inside the Victoria Harbour were worse than those measured outside the Harbour, which suggested that the pollution of the Harbour was a home-made problem. The water quality of the Harbour, if properly treated, could in theory be improved to the surrounding standard. Prof Rudolf Wu also commented that the Pearl River should only influence the furthest part to the west of the Harbour, as confirmed by the review of the EIA in the past.

11. The Chairman noted that the IRP had recommended that sewage tunnels under Stage III and IV of HATS, which were

common to all of the IRP options, should be constructed to save time. She asked Mr Collier to explain why it was not feasible to proceed as proposed. Mr Collier said construction of the common tunnels in the northern part of the HK Island could not proceed since the direction of the sewage flow had yet to be decided. Prof Leonard Cheng noted that upgrading of the PTWs would last 8 years and asked whether such works could go ahead first. Mr Collier answered that the upgrading could be completed within the construction time allowed for the deep sewage tunnels. Mr Wong supplemented that based on the findings of the Preliminary Project Feasibility Study for Stage III/IV, only the deep tunnel work was on the critical path.

III. Agenda Item 2: Trials and Studies in relation to the Way Forward for HATS [MG(2001)02]

12. The Chairman said that the LegCo Finance Committee had approved a total sum of $73.6 million (in money-of-the-day prices) for the trials and studies on HATS. She stressed that the MG was established to increase transparency and to monitor the progress of the trials and studies whose ultimate objective was to help shortlist the feasible options for public consultation in 2003. Mr Law encouraged members to put across their views on the trials and studies so that the MG could take all these into account in its deliberation on the way forward for the next stages of the HATS. The Chairman referred members to the tabled tentative programme for the trials and studies and asked if members were content about the overall suggested approach before focusing on the details of individual trials and studies.

13. In response to Dr Koenig's question, Mr Wong said HATS was only one of Government's sewerage projects. Government would continue to press ahead with non-HATS projects.

14. Dr Ho agreed with the plan for the trials and studies in general. He asked whether the land constraint would be duly considered in the trials and studies. The Chairman said that land issues would be examined in the context of the Environmental and Engineering Feasibility Studies (EEFS). Mr Law supplemented that the Government had set up a Technical Group internally and the Planning and Lands Bureau was also represented in the Group

to address land issues. The Technical Group would ensure the smooth and proper interface of the various trials and studies so that the options derived from the trials and studies would be practical and viable, apart from being environmentally and technically feasible.

15. Prof Wu observed that there was a great deal of inter-connection between the EEFS and the Compact Sewage Treatment Technology Trials (CSTTT). He considered that the study brief for the EEFS should include a cost-benefit analysis of all the options instead of simply assessing their financial implications. Mr Mike Stokoe assured members that the Technical Group chaired by him would ensure the proper coordination of all the trials and studies. He also affirmed that the EEFS would include a cost-benefit analysis of the IRP options. The Chairman drew members' attention to the fact that the EEFS actually comprised a series of comprehensive studies which would look into different aspects of the options. In response to Dr Koenig, she said that there was a lead department for every trial or study and the information could be found in the annexes to MG(2001)02.

16. The meeting then discussed these annexes.

Annex I: Compact Sewage Treatment Technology Trials

17. The meeting noted that DSD was the lead department for these trials. Dr Ho asked whether it was the IRP's recommendation that the trials should only be confined to BAF technology. He recognized that testing all viable technologies would not be possible but he noted that some LegCo Members had reservation about focusing exclusively on BAF technology. Prof Cheng stated that the IRP had come up with the recommendation to test BAF technology after very careful consideration. He explained that the IRP had in fact received and considered many alternative technologies and had ruled out those that were not well proven or did not have any track record for large-scale application. Dr Koenig pointed out that different technologies could be used to raise the level of treatment. However, BAF technology was recommended owing to its high treatment capacity on a relatively small footprint. It was also the only new and well-proven compact technology with large-scale application in the past 15 to 20 years.

18. The Chairman observed that while she had full confidence in the IRP's judgment and recommendation, it might be prudent not to exclude other compact technology. There was a possibility, no matter how remote that all three selected BAF trial plants proved to be not viable for Hong Kong. Furthermore LegCo had specifically asked that the trials should not be confined to BAF technology and Government had undertaken to include other compact sewage treatment technologies in the trials when seeking funding approval from the Finance Committee. Hence, it would not be advisable to confine the trials to the BAF technology. She then asked the former IRP members whether they had any strong objection to this approach. Prof Cheng said he could understand the political sensitivity. He remarked that the trials could cover other non-BAF compact technologies as long as the well-proven and large scale application criteria remained unchanged. Dr Koenig also shared this view. The meeting agreed that the invitation of submission of "Expression of Interest" (EOI) should be extended to cover other well-proven compact sewage treatment technologies with a track record of large-scale operations. DSD

19. Dr Ng noticed that only three BAF vendors would be selected ultimately. He asked if an independent consultant would be appointed to monitor the trials to be carried out by the BAF vendors given that the vendors would tend to produce favourable results in order to secure the contract for building the multi-billion dollar plant. Mr Collier said that DSD would monitor the performance of the vendors carefully. Dr Ng said the trial results might be undermined if vendors were allowed to conduct the effluent sampling collection and analysis themselves as currently proposed. Mr S K Aggarwal said that a senior chemist would oversee the sample collection/analysis work and a local laboratory accredited under the HK Laboratory Accreditation Scheme (HOKLAS) would be required to test the samples collected. After some discussion, it was agreed that DSD should appoint an independent checker to oversee the trials. DSD

20. With reference to item (f) of Appendix of Annex I, Prof Wu asked whether an independent laboratory would be engaged to test the effluent instead of entrusting the vendors with the work. After some discussion, it was agreed that only one laboratory would be used to carry out sampling/analysis work for

the three vendors and the appointment of this laboratory would be arranged by DSD. DSD

21. Prof Wu referred to Objective (c) in page 1 of Annex I. He said that since *E. Coli* was a key parameter the contract for the trials should include provisions for the testing of disinfection technologies such as ozonation and ultra-violet disinfection. Mr Collier said that BAF technology could not achieve a high degree of disinfection for sewage. Disinfection, if required, had to be provided by additional facilities and could be separately examined. Mr Aggarwal added that separate disinfection trials had indeed been carried out on CEPT/secondary-treated effluent by using ozonation and ultra-violet technologies. Dr Koenig commented that the results should be applicable to BAF-treated effluent.

22. Prof Wu noted that the land requirement was a critical factor. Mr Collier replied that the trials and studies were inter-related and the footprint requirement would be considered in the EEFS.

23. In response to Ms Iris Tam, Mr Collier said that the weightings proposed to be accorded to the financial and technical aspects of proposals submitted by the vendors were 20% and 80% respectively. He agreed that some vendors might deliberately tender a very low price in order to secure the service contracts as they would have their eye on the ultimate contract for building the BAF facilities. However, DSD would carefully examine the technical aspect of the proposals. Mr W S Chan said that under existing procedures, department heads would have to explain to the Engineering and Associated Consultant Selection Board or Central Tender Board whether the concerned consultants could realistically undertake the required work before accepting exceptionally low tenders. Drawing on his experience in housing projects, Mr Chan Bing-woon cautioned against accepting the lowest bids. He said that DSD could also consider adopting the two-envelope approach in the tender selection process so as to examine the technical proposal and price proposal separately. Mr Collier confirmed that this approach would be used for the trials. In light of comments received, the Chairman asked Mr Collier to re-examine whether the weighting for the price factor should be further lowered. Members noted that these proposed weightings were, however, subject to approval by the DSD

Public Works Tender Board.

24. In response to Dr Ho, Mr Law said that the BAF trials would help ascertain whether BAF technology could work in the environment of Hong Kong. However, whether the treated effluent would then be able to meet the water quality objectives (WQOs) for the Harbour and whether the existing WQOs should be revised were separate issues and the EEFS would look into these issues. Dr Ho referred the meeting to paragraph 4 of Annex I on the effluent standard and stressed that the standard should be carefully set so as not to compromise the WQOs. Mr Collier said the effluent standard shown in paragraph 4 was the highest attainable standard.

25. Dr Koenig referred the meeting to paragraph 5 of Annex I and asked whether each selected BAF vendor would be required to produce data on both the nitrification and denitrification performance of the technology. Mr Aggarwal replied in the affirmative. He agreed to specify this requirement explicitly in the finalized brief. In response to Dr Koenig's suggestion, Mr Aggarwal also confirmed that the flow proportional sampling methodology would be used. Since the amount of sludge generated from BAF would be relatively small, Dr Koenig asked why the vendor was specifically requested to provide the "approach of treating the BAF sludge" in item (c) of Appendix of Annex I. Mr Collier said the item was inserted to evaluate the experience of vendors in addressing the odour problem arising from sludge generated during the denitrification process of BAF. The meeting agreed that the wording should be refined to set out more clearly the requirement. DSD

26. Dr Koenig asked whether the trial period was limited to three months. Mr Aggarwal replied that the first phase trial would be done in the hot season and would last for three months. Subject to the tender prices, a second phase trial of three months would, if possible, be carried out in the cold season to better assess the viability of BAF technology. Mr Donald Tong informed the meeting that the submission to the Public Works Subcommittee only included the first phase trials. Dr Koenig pointed out that the nitrification and denitrification process would be affected by the cold season and he doubted whether a three-month trial in the hot season would be sufficient. In reply, Mr Aggarwal said that trials of BAF technology in the hot season

would be more crucial and the first phase trials would be carried out between March and June. In addition, the timing of the trials would tie in with the progress of the EEFS. The Chairman observed that June was not the hottest month of the year and asked whether the trial results would be compromised by the proposed time frame. Mr Stokoe said that the length of the trials would be constrained by the costs involved. DSD would try to prolong the trial period subject to funding availability. Prof Wu commented that the installation cost should be the major cost of the trials and the rest should be relatively inexpensive. In response to the Chairman, Mr Aggarwal said that DSD would still have to shoulder the costs of supervision and laboratory analysis even if the selected vendors were willing to prolong the trial period at their own cost. He estimated that each trial would cost about $4-5 million for a three-month period. However, he added that there would be provisions in the contract to specify the cost if Government decided to retain the pilot plant for conducting further testing. The Chairman asked DSD to look into the possibility of extending the trials to cover both hot and cold seasons and report to MG. DSD

27. In response to Ms Tam, Mr Collier said the criterion for a proven treatment capacity of 100,000 m^3/day as specified in item (h) of Appendix of Annex I would correspond to some of the largest BAF plants in the world. Although the future BAF facilities would need to handle 1.2 million m^3 of sewage per day from SCISTW, the proposed criterion of 100,000 m^3/day would be sufficient for demonstrating whether the technology could be applied in a large scale manner.

Annex II: Environmental and Engineering Feasibility Studies

28. The meeting noted that EPD was the lead department. The Chairman asked how the various studies could be integrated. Bearing in mind the EEFS would cut across various disciplines and it might be difficult for a consultant to be equally competent in these areas, she asked whether the consultancy should be broken down into several smaller assignments. Mr Stokoe said that EPD had indeed considered this option but decided to recommend a single consultancy as this approach was often adopted by EPD and works departments. Mr Law said that if the EEFS was split into several assignments, individual

consultants would tend to focus on their own assignment and might have little regard to the interface/coordination amongst various assignments, thereby undermining the quality of the final product. This fragmented approach would mean that Government would have to take up much of this coordination work which could have been avoided if the assignments came under one single consultancy. If a single consultancy was commissioned, the selected consultant would be driven by its own commercial interests to ensure the proper coordination of its subconsultants. Mr W S Chan agreed with Messrs Law and Stokoe and advised that the use of a single consultancy would be the better approach since interface problems between different consultancies could be avoided.

29. Prof Wu referred to paragraph 1.2(b) of Annex II and said that the objective therein seemed to overlap with one of the objectives of the trials. He said that the interface issue should be carefully addressed. He also reiterated that the cost-benefit analysis of the options should be clearly included in the study brief for the EEFS. Mr Wong clarified that the results of the trials would be fed into the EEFS so as to achieve the objective of characterizing the influents and effluents of the HATS system under paragraph 1.2(b) of Annex II. He confirmed that a cost-benefit analysis would be undertaken under the EEFS.

30. Prof Wu said that the water quality criteria for Victoria Harbour should be carefully considered. Mr Law replied that it was the intention to have the water quality criteria agreed by the MG in the first place. Mr Wong said that EPD would draw on its in-house experience and the consultant would separately provide its expert advice to take this matter forward in late 2001 and early 2002. Dr Ho suggested that the subject should be discussed at some public forums with the participation of academia as well. Mr Law advised that EPD was prepared to do so. He also clarified that academia had been consulted on the water quality criteria in the course of conducting the SSDS EIA but EPD had received very few response at that time.

31. Prof Cheng referred to paragraph 2.10 of Annex II and asked why the consultant would not be required to make submissions under the Environmental Impact Assessment Ordinance (EIAO). Mr Law answered that the EIAO was a statutory process and Government as the project proponent should

be responsible for the submission of the EIA. As the EIAO procedures were project specific, it would not be appropriate to make an EIAO submission at the stage when options were being considered. However, the findings of the EEFS would be drawn on extensively in a future EIAO submission of the preferred option.

32. Dr Ho noted that consultants who had been involved in the development of the concept/strategy of the former SSDS or the SSDS EIA would be excluded from the longlist. Mr Law confirmed that understanding and explained that it was necessary to do so in order to avoid any real or perceived conflict of interest and to build trust and consensus for the way forward. However, he remarked that the exclusion would only cover the principal consultants who had had major involvement in the SSDS in the past. Prof Wu said that the exclusion should also be applied to the sub-consultants who had had involvement in the SSDS, such as the subconsultant responsible for developing the water quality model. Mr Law said that the sub-consultants usually carried out specific tasks assigned by the main consultants and had no involvement in the development of the concept or strategy of SSDS. He added that there must be good justifications for excluding the consultants. The consultants were very mindful of their own reputation and would not hesitate to take Government to Court if they were excluded for no good reasons. Dr Ho suggested that consultants who had a close connection with the BAF vendors should also be excluded. In response, Mr Collier said that two of the BAF vendors were the largest water project companies in the world and Dr Ho's suggestion would be difficult to implement in practice. The Chairman said that the key was for the departments to devise a good system for declaration of interests. She also asked EPD and DSD to circulate the list of consultants being excluded to the MG for information. EPD/ DSD/ EPD/ DSD

33. Prof Wu referred to paragraph 2.6 and suggested including beaches as one of the sensitive receivers. Mr Wong agreed with the suggestion.

34. Ms Tam asked whether Government would conduct public consultation at different stages. The Chairman said that it was crucial for the community to reach a consensus before Government embarked on such a large-scale undertaking. The issue of public consultation could be discussed at the coming

meeting.

Annex III: Study on Procurement Options

35. The meeting noted that DSD was the lead department. Mr W S Chan suggested and Mr Collier agreed that "contractor design, build, operate and transfer" under paragraph 5(c) of Annex III should be replaced by "design, build, operate and transfer". The Chairman referred to paragraph 7(a) of Annex III and asked why there was a need to develop procurement options for each of the identified feasible development options and not consider this aspect after one option had been selected. Mr Collier said the arrangement was intended to save time and provide necessary input to the EEFS. Prof Cheng said the bulk of the cost of the study would go to developing the costs of individual components of the IRP options. He did not think that working out the cost of various IRP options would increase substantially the cost of the study as this would mainly involve combining individual cost factors. DSD

Annex IV: Stage I Flow Reassessment Study

36. The meeting noted that EPD was the lead department and the study was already in progress. Mr Wong confirmed that the cost of the Study was not included in the overall funding of $73.6 million approved by the LegCo. Dr Koenig asked whether the appointment of that particular consultant firm would constitute any conflict of interest. Mr Wong answered that the company would only be responsible for developing the hydraulic assessment model and EPD itself would do the analysis.

Annex V: Capacity Reassessment Study for the SCISTW

37. The meeting noted that DSD was the lead department. Dr Koenig asked and Mr Collier agreed to provide the report which gave rise to the preliminary figure of the maximum peak flow of 41 m^3/s stated in paragraph 3 of Annex V. Prof Wu suggested that DSD could consider using the same laboratory designated for the BAF trials to undertake the analysis DSD

set out in paragraph 4 of Annex V. Mr Collier said the department would prefer to do it separately. In any event, the cost of this Study was not included in the overall funding of $73.6 million approved by the LegCo.

IV. Agenda 4: AOB

38. Members did not raise any other issues for discussion.

V. Date of Next Meeting

39. The meeting noted the tabled tentative schedule of future meetings. The next meeting would be held on 13 September.

Environment and Food Bureau
September 2001

Monitoring Group on Trials and Studies for HATS

2nd Meeting at 2:30 p.m. on Thursday, 13 September 2001

Present:

Mrs Lily Yam	Secretary for the Environment and Food (Chairperson)
Dr Albert Koenig	
Prof Rudolf S S Wu	
Professor Peter Hills	Member of Advisory Council on the Environment
Ms Iris Tam	Member of Advisory Council on the Environment
Dr Ng Cho-nam	Member of Advisory Council on the Environment
Mr Chan Bing-woon	
Mrs Josephine Mak Chen Wen-ning	
Mr W S Chan	Deputy Secretary for Works (Works Policy)
Mr Robert Law, JP	Director of Environmental Protection
Mr John Collier, JP	Director of Drainage Services
Mr Raistlin Lau	Principal Assistant Secretary for the Environment and Food (B)1 (Secretary)

In attendance:

Mr Donald Tong	Deputy Secretary for the Environment and Food (B)
Mr Mike Stokoe	Deputy Director of Environmental Protection
Mr Benny Wong	Assistant Director of Environmental Protection
Dr Malcolm Broom	Principal Environmental Protection Officer, EPD
Mr S K Aggarwal	Assistant Director of Drainage Services
Mr W W Chui	Senior Engineer, Drainage Services Department
Mr Maurice Loo	Assistant Secretary for the Environment and Food (B)1A
Mr Simon Eldridge	Consultant (Agenda IV only)
Ms Cynthia Lockeyear	Consultant (Agenda IV only)

Absent with apologies:

Professor Leonard Cheng	
Dr Ho Kin-chung	Member of Advisory Council on the Environment
Mr Jimmy Kwok Chun-wah	

Discussion **Action**

I. Confirmation of the minutes of the 1st meeting

Members confirmed the draft minutes subject to amending "East Kowloon" in the first sentence of paragraph 9 of the draft minutes as "North West Kowloon".

II. Matters arising

2. The Chairman informed members that seven Members had taken part in a background briefing cum visit to the Stonecutters Island Sewage Treatment Works on 29 August. She suggested and Members agreed to discuss matters arising from the last meeting on trials and studies under Agenda III.

III. Progress Report on Trials and Studies for HATS - MG(2001)03

3. Mr Stokoe took members through the report. The Chairman referred members to paragraph 8 and highlighted that Montgomery Watson (MW), which had been debarred from undertaking any consultancies and studies to examine options recommended by the International Review Panel (IRP) in view of their significant past involvement in developing the strategy for the then Strategic Sewage Disposal Scheme (SSDS), had expressed interest in undertaking the compact sewage treatment technology trials. On behalf of Prof Cheng, the Secretary conveyed his concern about the Government's proposal for not debarring MW from bidding for the sewage treatment technology trial, particularly if only one firm would eventually be chosen to undertake the trial. Prof Cheng did not share the view that MW did not have potential conflict of interest in undertaking the trials because it had all along been advocating an alternative treatment strategy. The Secretary added that the funding should be able to support trials by at least two companies. Prof Wu said he shared Prof Cheng's concern. He opined that given the funding constraint, it might be advisable to debar MW and award the trial contracts to companies which had no involvement in setting the HATS strategy in the past.

4. As the discussion on MW was also related to the

procurement arrangements for the trials contracts, the Chairman invited Mr Collier to take Members through the supplementary note to MG(2001)03 on the trials. In response to Dr Koenig, Mr Collier said the main purpose of inviting expression of interest was to define the scope of the coming open tendering process. Based on the assessment criteria endorsed by Members at the last meeting, Drainage Services Department (DSD) had evaluated all the submissions received and then shortlisted 2 generic designs of Biological Aerated Filter (BAF) technology and two non-BAF technologies, namely Continuous Activated Sludge Process (CASP) and Submerged Aerated Filter technology plus denitrifying filter (SAF). DSD's plan was to invite open tenders based on the BAF technology and the two specific non-BAF technologies only (paragraph 3 of the supplementary note) and then to award the trial contracts in accordance with the proposed plan set out in paragraph 5 of the supplementary note.

5. Dr Koenig said that CASP could mean any type of activated sludge process and 90% of them could not be regarded as compact sewage treatment technology at all. On the other hand, plants based on SAF might need as much as ten times the space required by BAF plants. He had serious reservations in the CASP and SAF and had grave doubts in the Government's proposal for confining the trial on non-BAF technologies to these two specific technologies. Mr Aggarwal stressed that all the shortlisted technologies were backed up by submissions which met the two qualifying requirements, namely proven experience of a capacity greater than 100,000 m^3 per day and overall plant footprint of less than 2.3 hectares. Apart from sharing a similar footprint, the proposed plants based on CASP and SAF were also similar in height with those based on BAF. It was after the above objective evaluation that DSD decided to recommend both CASP and SAF in the technology shortlist for open tender invitation. Dr Koenig pointed out that DSD's conclusion on SAF appeared to contradict an article on SAF recently published in the journal of the Chartered Institute of Water and Environmental Management. He also observed that SAF seemed to be a patented technology and therefore the specific inclusion of SAF as one of the shortlisted technologies might give undue competitive edge to the patent holder. Dr Ng commented that the purpose of conducting trials was to remove uncertainties surrounding the viability of compact sewage treatment technologies in Hong Kong. He therefore considered that in addition to conducting trials on BAF,

the Government should also cover some well-proven non-BAF technologies in the trials. Mr Collier agreed that the main objective of the trials was to test whether the selected technologies would still work effectively in the local environment of Hong Kong, notwithstanding the fact that they might be proven to be effective elsewhere.

6. The Chairman said Government should not rule out other non-BAF technologies when inviting bids at this stage. However, it would carefully evaluate all tender submissions, particularly those using non-BAF technologies. We would not try out non-BAF technologies if it were found that they were all non-starters and could not meet the stringent requirements. Dr Koenig said he was not against testing other non-BAF technologies but considered that the Government should not confine the tender submissions on non-BAF technologies to only CASP and SAF. The tender documents should instead set out some general features which the non-BAF technologies should meet. Mr Aggarwal cautioned that DSD might receive many more submissions if the open tendering process was to extend to othernon-BAF technologies, and would need much more time to evaluate them. This might delay the trial programme. Prof Wu asked if it was still the intention of Government to test as many variations of BAF technology as possible. The Chairman said that Government would certainly not wish to misdirect our efforts to non-starter technologies.

7. Ms Tam suggested the first two trial contracts should go to tenders based on BAF technology. Subject to funding availability, the third contract could then go to a tender based on non-BAF technology. Mrs Mak observed that this would mean that there would not be a trial on non-BAF technology if funding could only allow two trials. Prof Hills asked if it was possible to secure more funding to ensure that three trial contracts could be conducted. The Chairman responded that the Legislative Council had specifically asked that trials should not be confined to BAF technology and Government had undertaken to include other well-proven compact sewage treatment technologies, if available, in the trials when seeking funding approval. As more funding would be required for extending the duration of each trial as agreed at the last meeting, there was a possibility that the number of trials might have to be reduced from three to two accordingly. Since a huge sum of $73.6 million had just be allocated for the trials and

studies, it would be politically difficult to seek additional funding from LegCo. Mr Collier supplemented that Members had also suggested giving the price factor as low a weighting as possible in tender evaluation. Therefore, it was even more difficult to ensure that the funds available could be used to support three trials.

8. After some more discussion on whether CASP and SAF should be specified as the only non-BAF technologies for open tender invitation, the Chairman concluded that the tenders should be open to all non-BAF technologies including CASP and SAF. However, only tenders which were in full compliance with the stringent criteria relevant to Hong Kong's situation should be considered. The meeting also endorsed the proposed procurement plan as set out in paragraph 5 of the supplementary note. Mr Aggarwal supplemented that DSD would need to seek approval of the Public Works Tender Board for the proposed plan.

9. Turning back to MW's expression of interest to take part in the trials, Mr Stokoe said Members agreed to debar MW from undertaking the Environmental and Engineering Feasibility Study (EEFS) and the Study on Procurement Options (SPO) because its significant past involvement in the development of SSDS might compromise their evaluation of the IRP options and recommendations. Given that the pilot plant trials would not involve any provision of advice and recommendations, it was unlikely that participation by MW, if selected, should result in any conflict of interest. Moreover, from a commercial perspective, since the downstream works for implementing the remaining stages of HATS would be much more substantial in dollar terms, he doubted whether MW would choose to sabotage the trial if selected. Mr Law supplemented that if MW were to be debarred from an open tendering process, special approval from Finance Bureau would need to be sought. He also informed Members that MW were close to seeking legal redress when it was debarred from undertaking the EEFS and SPO as their professional reputation was perceived to be at stake. Unless Government had a very strong ground to debar MW from the pilot plant trials, MW would not hesitate to challenge such a decision of Government. Dr Ng shared the view that it would be difficult to justify debarring MW from the pilot plant trials, but added that there was also the question of public perception if MW was not debarred. In response to the Chairman, Mr W S Chan said that legal advice would need to be sought on whether Government could debar a

company from taking part in an open tendering process on the basis of negative public perception. The meeting eventually agreed that MW, as well as Binhai and Pypun, should not be debarred from the pilot plant trials. In response to Dr Koenig, the Chairman asked DSD to copy the tender documents to Members as and when the tender invitations were released. DSD

IV. Proposed Publicity Plan for HATS - MG(2001)04

10. The consultants from Weber Shandwick Worldwide (WSW) joined the meeting. Dr Broom took Members through the paper. Mr Eldridge and Ms Lockeyear then gave a presentation on the scope of WSW's consultancy work, their proposed strategic plan on the publicity programme and the major findings of a survey it commissioned on public awareness on HATS. The presentation materials are at Annex.

11. Mrs Mak advised that schools could be an effective channel to help reach out the community. She suggested that education materials should be distributed to students to educate them on the importance of HATS and a clean harbour. Students would in turn take the message home to their parents. Consideration should also be given to exploring whether the school curriculum could be suitably adjusted so that the HATS messages could reach the students more effectively.

12. The Chairman said that it was not easy to present visually a story on sewage treatment in a way that could capture and maintain people's attention. Mrs Lockeyear said if an announcement of public interest was well executed, it should be able to draw public attention. It was also possible to present messages in graphics and develop a logo to offer the public a visible link to HATS.

13. The Chairman observed that whilst eight out of ten respondents did not consider themselves well informed in this regard, only four would like to be consulted on the way forward for HATS. She said it was too early to map out a specific consultation plan on the way forward but the survey findings did suggest that ways to enlist public views in the consultation process should be carefully considered. She also observed that the public generally did not have a good understanding of why sewage treatment was so expensive. In order to pave the way for

involving the public in the future, it might be necessary to tell them why their views were important and to bring up the question of who should pay for the subsequent phases of HATS at a later stage. However, she acknowledged that the question of who should pay could be very sensitive under the prevailing economic climate. Mrs Lockeyear said the majority of the people did not mind paying a little more according to the survey findings. However, she agreed that it would not be advisable to jump immediately to this sensitive question until people were able to appreciate what sort of environmental benefits they had been receiving and would receive in return.

14. Dr Ng said that the public would certainly be very impressed if they could be told that they could swim in the Harbour. Mr Law said the Harbour was intended to be used by marine traffic and to serve as a port. Swimming was clearly not anticipated as the appropriate beneficial use of the Harbour. Dr Ng said the fact that the Harbour was not suitable for swimming because of heavy marine traffic was not very well communicated to the public. Mr Law said that the water quality of the Harbour was not intended for swimming purpose anyway. Although it was technically possible to upgrade the water quality of the Harbour to enable safe swimming, the price tag would be very high. He further supplemented that the Harbour was in fact not as deep as the public expected and turbidity due to current movement and marine traffic was unavoidable.

15. Dr Wu said that it was necessary to build a consensus on the way forward. However, the public must be made aware of the cost and benefit associated with HATS. They should not expect that there would be free lunch. The Chairman said we might need a phased publicity programme with different themes for different stages. We might risk losing public support immediately if we highlighted the cost factor at the outset. Mr Law said the EEFS would examine the cost and benefit factors for the various options. Mr Chan Bing-woon said that the public tended to be more receptive if the cost angle could be communicated to them in a tactful manner. Mr Eldridge stressed that it was important to let the public know the importance of HATS before involving them to think about the financial implications.

16. Mrs Tam noted that pollution in the Harbour was widely considered less pressing than air pollution. She believed that the

reason for that was that the Harbour problem appeared to be too distant. She concurred that more should be done to let the public appreciate the problem visually. She suggested that the public should also be informed of how the water quality in Hong Kong was compared with the harbours of other major cities.

17. Dr Koenig said the publicity programme should also bring out the message that many of the leisure activities such as fishing and swimming could be done outside the Harbour following improvement of the water quality at the Harbour. Dr Ng suggested organizing a "Harbour Festival" annually which could comprise activities such as cross-harbour swimming to draw public attention on the Harbour and its importance to Hong Kong.

18. The Chairman observed that the WSW's consultancy would end in early May 2002 but the major publicity event, i.e. the official commissioning ceremony for HATS Stage I system, and the series of supporting publicity activities would be held next April. She thanked the consultants for their presentation and asked them to take into account views expressed by Members when planning and implementing the publicity programme.

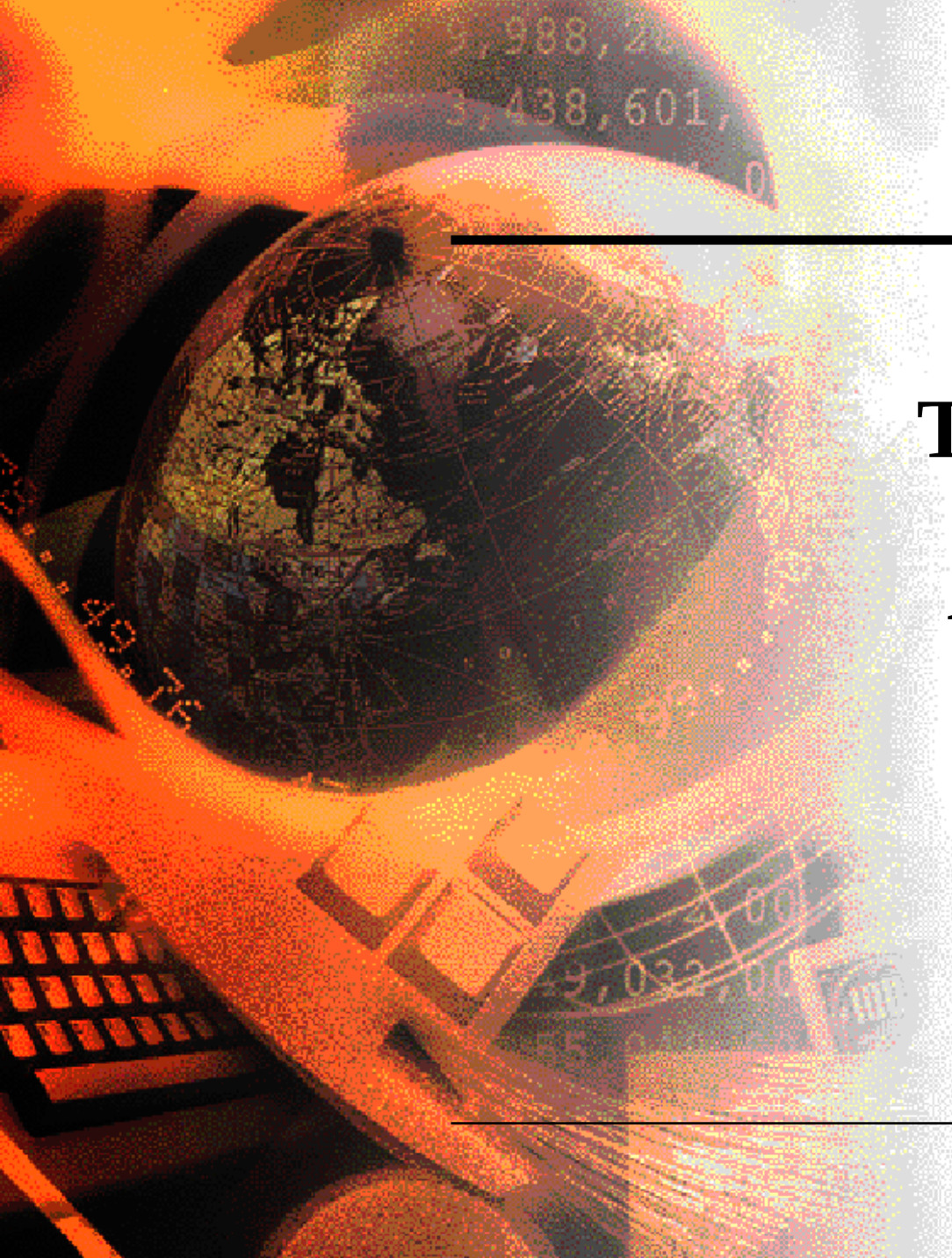
V. AOB

19. Members did not raise any other issues for discussion.

VI. Date of Next Meeting

20. The Chairman informed members that the next meeting was tentatively scheduled for 7 December 2001. However, since Prof Cheng would only return from his sabbatical leave on 15 December 2001, the secretariat would check with Members and find a most convenient date for all.

Environment and Food Bureau
September 2001



ORC INTERNATIONAL

Harbour Area Treatment Scheme (HATS) Public Awareness Study

A Pre Campaign Report Prepared for:

WEBER SHANDWICK WORLDWIDE

September 7, 2001

Table of Contents

Background and Research Objectives

- Weber Shandwick are undertaking a publicity program on behalf of the Environmental Protection Department of the Government of the Hong Kong SAR (EPD) to increase public awareness of the HATS scheme.
- In order to evaluate the effectiveness of the proposed publicity program, and assist in communications planning, Weber Shandwick has proposed assessing the public's awareness and understanding of the Harbour Area Treatment Scheme (HATS), both before and after the publicity program.
- Therefore a pre and post survey was recommended to assess the following objectives.
  - Gauge the effectiveness of the publicity program in achieving its communication objectives by measuring the public's understanding of, and support for the HATS before and following the publicity program.
  - Provide insights on the media used by different population groups which will be most appropriate to build community awareness.

Methodology

Approach

- A representative sample of 615 members of the public aged above 18 were drawn randomly for a 10 minute telephone interview. The Hong Kong telephone directory was used as our sampling frame as the penetration rate is 99%, 1% being silent numbers.
- Fieldwork was conducted from August 6th to 17th.

Sample Structure

- The following quotas were applied to ensure sufficient representation for that particular age group to allow statistically robust results. The percentage quotas are similar to those of the Hong Kong population (aged 18 and above) census.

Age Group	Female	Female %	Male	Male %
18-24	38	6%	40	7%
25-29	30	5%	24	4%
30-34	37	6%	32	5%
35-39	46	7%	38	6%
40-44	45	7%	35	6%
45-49	31	5%	30	5%
50-54	23	4%	25	4%
55-59	12	2%	15	2%
60 or above	59	10%	55	9%
Total	321	52%	294	48%

Methodology

- Further, all respondents were screened to ensure they have lived in Hong Kong for the past 12 months.

Analytical Notes

- This report serves as the first report phase of the HATS Public Awareness Study. A second wave of research will take place after stage one of the HATS Publicity campaign, presently scheduled for April / May 2002. Given that a number of publicity generating programs and activities would have taken place by then, a second wave of research would be appropriate to assess changes in the public's views and attitudes.

Executive Summary

Executive Summary

Awareness

- ***A lot of work needs to be done to increase the awareness levels of the extent of the environmental issues facing Victoria Harbour, the plan to improve its water quality, its progress and the benefits it brings to the people.***

- A minority of the population are aware of the critical levels of the water pollution in Victoria Harbour.
  - Only 22% were aware that most sewage is discharged almost untreated into the Victoria Harbour.
  - Even fewer people (18%) know that the natural capacity of the harbour waters to absorb the waste put into them has been exceeded.
- A minority of the population (12%) regard themselves to be knowledgeable about the government's initiatives to improve the water quality in Victoria Harbour. The majority have 'never heard of' / 'know the name only' of SDSS (67%) or HATS (73%).
- Only a minority of the population are aware of the investment levels required (30%), the progress of the plan (<30%) and its benefits (22%).
- Compared with other environmental issues facing Hong Kong, namely air, noise and waste pollution, the Victoria Harbour water pollution issue is ranked third (37%), way below Air (91%) and marginally below Waste (38%).

Executive Summary

Awareness

- ***Important foundations needed to obtain support and commitment from the public are in place, clearing the path for a potentially successful campaign.***

- Fundamental views and opinions instrumental to support for the campaign are in place. A majority of the general public does see the importance of the Victoria Harbour to Hong Kong and acknowledge the high pollution levels of the waters, a majority believing it to be either the same / worse than 3 years ago (71%).
- Furthermore, a majority (88%) do not accept the idea of discharging untreated sewage into the Victoria Harbour and support (67%) the government's plan to allocate funds, equal to half the cost of the Airport Railway, to improving the water quality in Victoria Harbour.
- 73% agree that the government is committed to protecting and restoring water quality in the Victoria Harbour.
- The public has empathy with the government and recognizes the need to keep the waters in Victoria Harbour clean and a majority of the population (64%) are willing to pay at least 'a little more' in sewage charges to achieve better water quality in the Victoria Harbour.
- The public (78%) also accepts the delay in implementing the next step in improving water quality until full feasibility studies have been undertaken.

Executive Summary

Target Audience

- ***The publicity campaign should make a concerted effort to reach the whole population, to reinforce the need to reduce the water pollution in Victoria Harbour. However, priority groups for the campaign are 18-29 and 30-44 age groups, given their role as educators of the next generation and key tax payers funding the project respectively.***

- *The 18-29 age group as one of the key audiences:*
  - The improvement of water quality in Victoria Harbour requires both the government clean up efforts and the public's conscientious commitment to prevention. The 18-29 age groups will be the generation who will be the future funders of the project. Also, it is important for them to educate their children of the right values namely, value of Victoria Harbour to Hong Kong and the need to maintain its cleanliness. If this generation is not well educated now, they will most likely not be able to inculcate these beliefs into their children, thus dampening efforts to control future pollution levels.
  - Currently, those in this age group do not have particularly strong commitment to improving the water quality of Victoria Harbour.
  - They acknowledge that the Victoria Harbour waters are polluted and tend to be less accepting of the statement that the government is 'committed to protecting and restoring the water quality in the Victoria Harbour.'
  - However, they have relatively lower awareness of the issues surrounding the Victoria Harbour and are less interested in being consulted on 'the way forward for the Victoria Harbour water quality improvement plans'.

Executive Summary

  - *This target group tends to prefer receiving information from the Internet over radio, after TV and Print media. The publicity campaign should also be made available on the Internet to facilitate reaching those who are more internet savvy.*
- *For more strategic reasons, we would consider those in the 30-44 age group also a key target audience.*
  - They are the main contributors of taxpayers money, the source of funds for the project. There is a need to be sensitive towards their views, seeking their 'buy in' to the project to ensure minimal disapproval.
  - *This target group can be reached primarily through TV and print media.*

Executive Summary

- ***To increase awareness levels among the less well informed, the publicity campaign must succeed in educating the less educated about the importance of the Victoria Harbour to Hong Kong, the seriousness of the water pollution in Victoria Harbour and the importance of keeping the harbour waters clean.***

- Those who are less educated tend to be less knowledgeable of the plans to clean up the Victoria Harbour. They also tend to give lower importance ratings to 'Importance of Victoria Harbour to Hong Kong' and the 'Importance of a **clean** Victoria Harbour.' and give less support towards 'the government's plans to allocate funds equal to half of the cost of the Airport Railway to improving Victor Harbour's water quality'. At the same time, there is higher resistance amongst this group to pay more sewage charges to improve the water quality in Victoria Harbour. They also tend to be less concerned about discharging untreated sewage into the Victoria Harbour.'

Executive Summary

Communication theme and imagery :

- ***The majority (78%) of the Hong Kong population is unaware that 'currently most sewage generated in Hong Kong is discharged almost untreated into the Victoria Harbour'. This is a powerful message and may serve as a call to action to Hong Kong.***

- Currently, the interest level for the program and the issue of Victoria Harbour water pollution is low, perhaps due to lack of awareness over the gravity of the issue.
- Aesthetic reasons, such as the harbour waters being 'smell free, less floating refuse, having clear water and healthy marine life' are more powerful imagery over functional reasons such as 'clean enough for recreational boating'.
- In communications about the Victoria Harbour water quality improvement plans, transparency is encouraged and full governmental support to the plan should be demonstrated.
- Sensitivity should be given to communicating about the required fund allocation for the project, equal to half of the cost of the Airport Railway. As the Victoria Harbour water pollution issue is seen as less critical (37%) than Air pollution (91%), there may be pockets of the population segment who believe that more funds should be allocated to the latter.

Executive Summary

Communication channels:

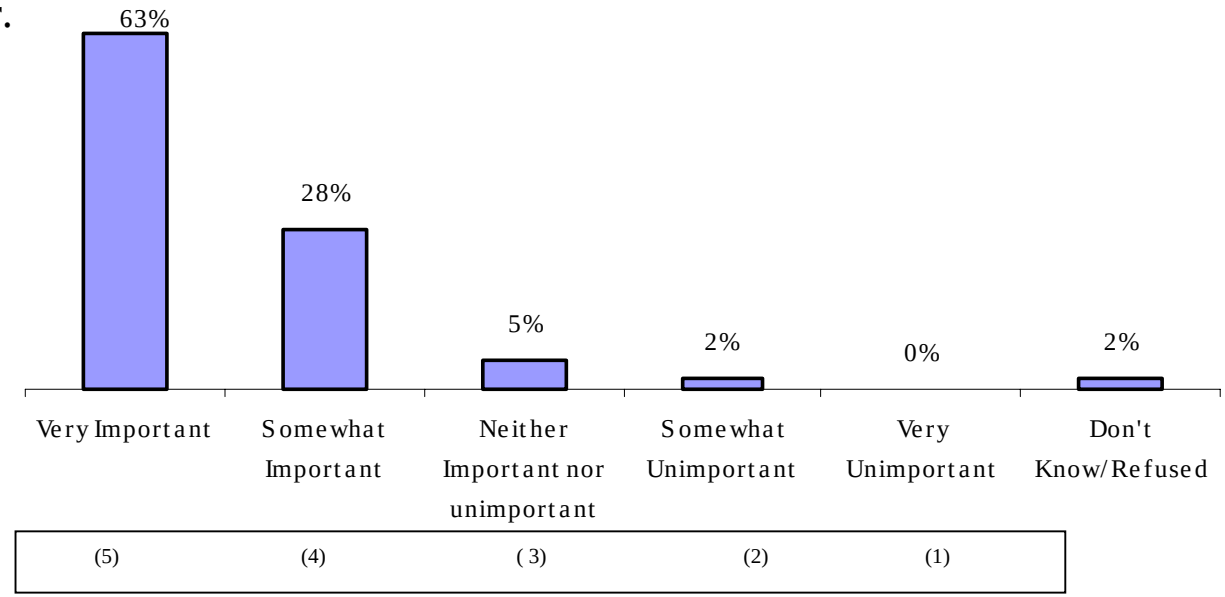
- ***A majority of the public can be reached using TV, print and radio. These are the main sources of information for them.***
  - Currently, the most often given reasons for being *uninformed* about the government's plan to clean up the Victoria Harbour center around lack of promotion (41%), and media coverage (22%). In contrast those who are *informed* mentioned that they have learnt about the plan through TV and print media.
  - Although the penetration rate of Internet in Hong Kong is high, Internet is not a frequently used information source for this topic. However, when the population was asked where they would like to receive their information from, it was mentioned fourth (7%) after television (38%), print media (31%) and radio (12%). The low ranking of the Internet as a current information source for issues surrounding the Victoria Harbour water quality may may be due to the lack of awareness of which Internet sites have information on this issue. To increase visibility on the Internet, it is recommended that more hyperlinks should be encouraged at more commonly used Hong Kong websites including popular government sites.

Key Findings

Importance of Victoria Harbour

The younger generation, less educated and those living in NT have to be educated to recognize the value that Victoria Harbour brings to Hong Kong, as this will affect their commitment level towards the campaign.

- A majority of the population thinks the Victoria Harbour is important for Hong Kong. Age, education level and residential district impact upon the population's view of the importance of Victoria Harbour.



Population segment who gave significantly *higher* importance ratings
- ≥ 30 yrs (≥ 4.58)
- Living on Hong Kong (4.71)
- Tertiary educated (4.75)
- Monthly household income ≥ $30K (4.58)

Mean 4.56

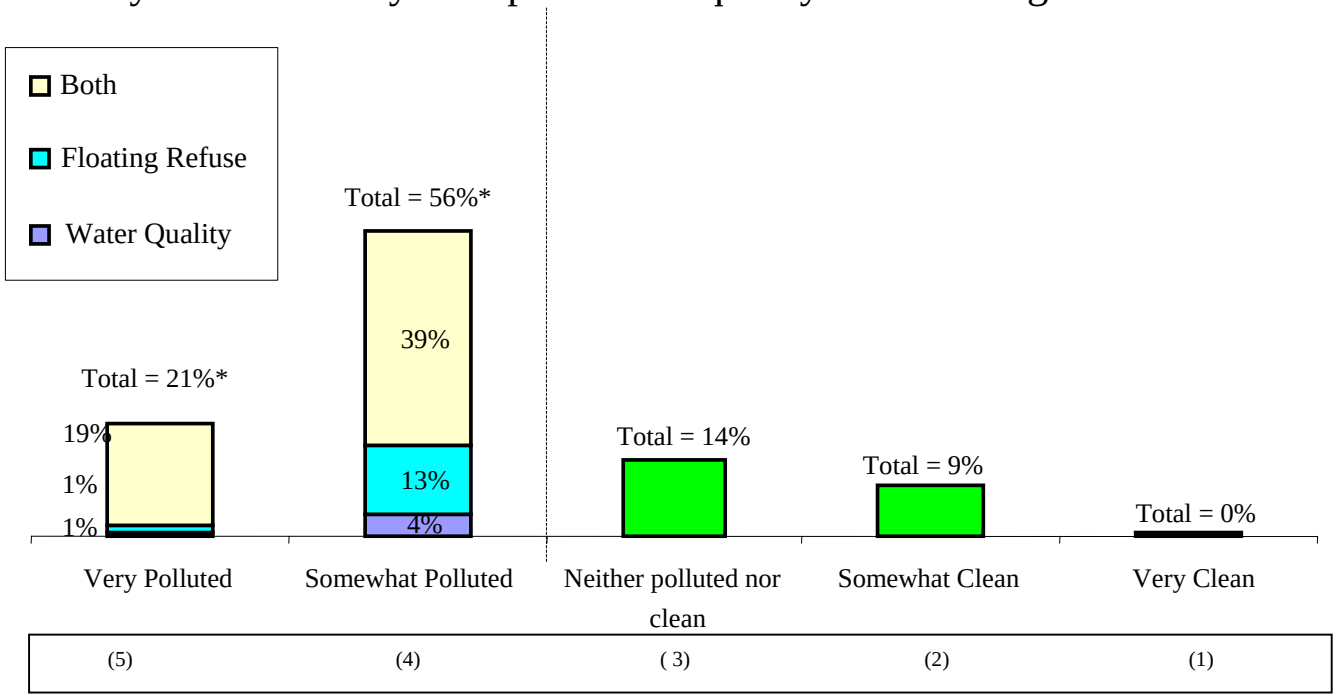
Population segment who gave significantly *lower* importance ratings
- 18-29 year (4.31)

Q1. Base: All respondents

General pollution levels in Victoria Harbour

Education level and monthly household income affects perception. The less educated with lower monthly household incomes tend to give lower pollution ratings and vice versa

- A majority of the population (77%) felt that the Victoria Harbour was polluted and that the pollution was mostly contributed by both poor water quality and floating refuse.



Mean 3.86

Population segment who gave significantly *higher* ratings
- 18-29 (3.91)
- Monthly household income ≥ $30K (3.93)
- Secondary/ Tertiary Educated (3.89)

Population segment who gave significantly *lower* ratings
- Primary/lower (3.80)
- Monthly household income < $15K (3.76)

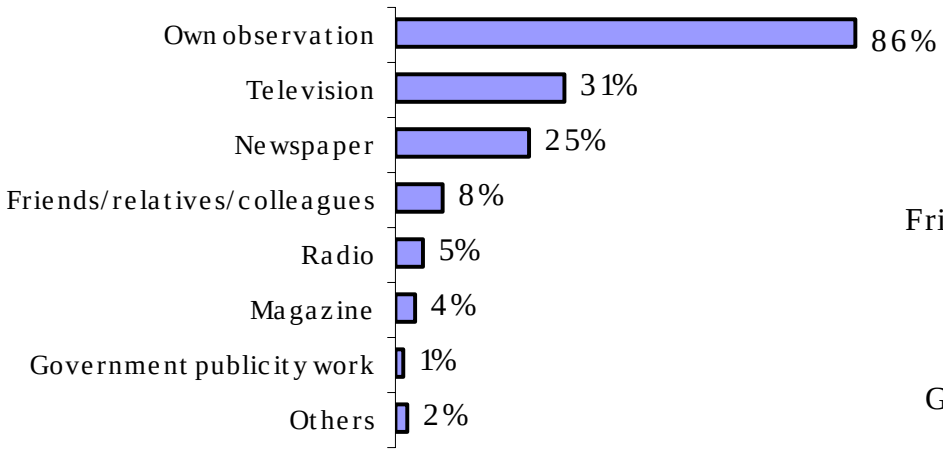
Q2, 2a. Base: All respondents

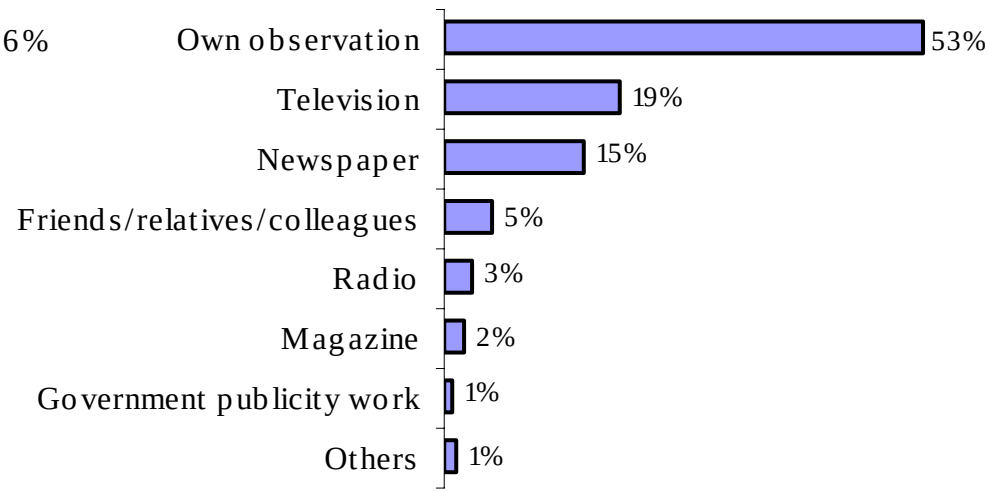
* Those answering 'very polluted' or 'polluted' in Q2 were then asked Q2a:'Is that with regard to water quality, floating refuse or both?').

Information sources for the general pollution levels in Victoria Harbour

'Seeing is believing'. Personal observation is the most powerful information source. Other major communication sources include TV and newspaper.

- A majority of the population drew their perceptions of the pollution level through their own observation (86%), television (31%) and newspapers (25%). Other information sources, though less impactful, were through their personal grapevine – friends/relatives/colleagues (8%), radio (5%) and magazines (4%).
- Compared to other age groups, those between 30 and 49 more often heard about the pollution in the Victoria Harbour from television and the newspapers.



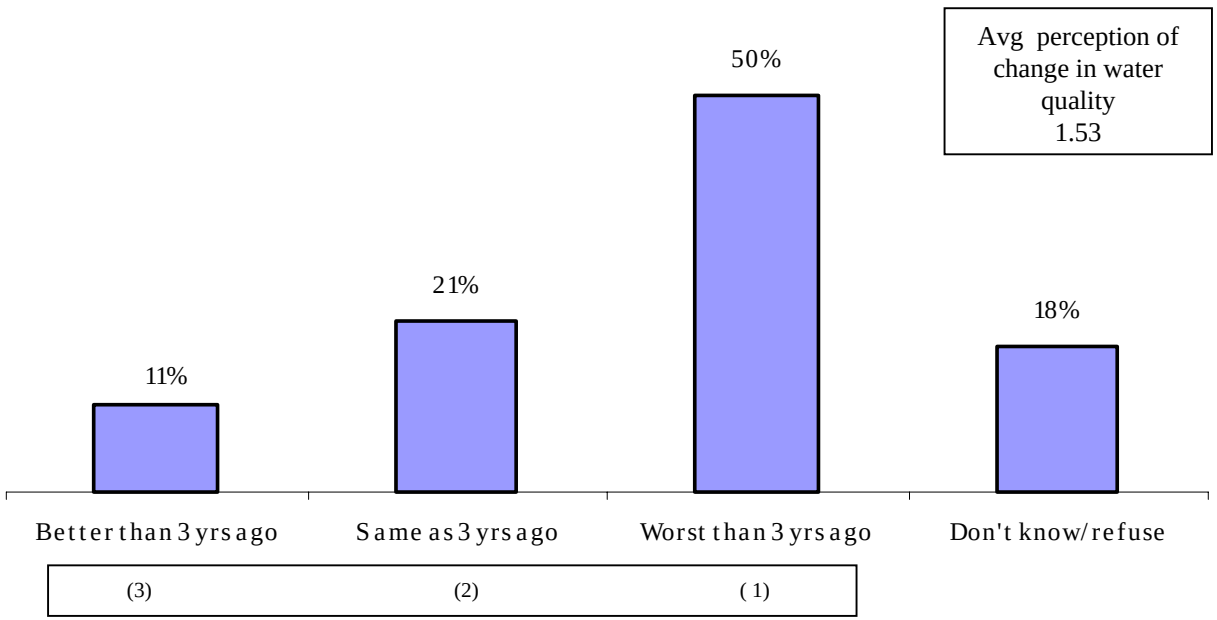


Q2b. Base: All respondents who felt the harbour was pollution = 448

Q2b. Base: Total No. of Mentions = 730

Water Quality of Victoria Harbour - Current condition versus three years ago

For every one person who thinks the water quality has improved, 5 others think it has deteriorated.

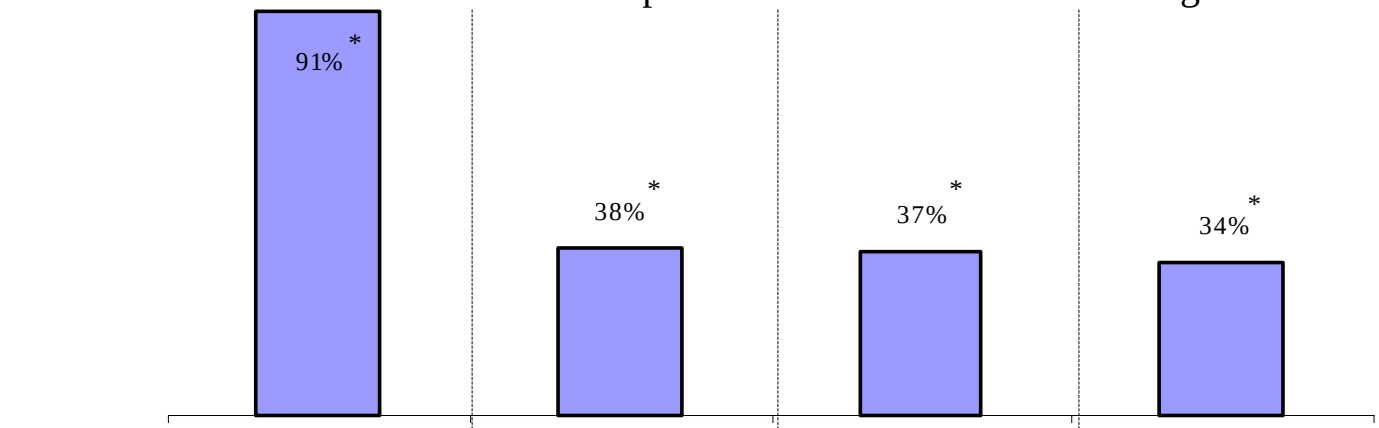


Q3. Base: All respondents

Importance of Environmental Issues facing Hong Kong

Emphasis should be given to the 18-29 age group as they are educators of the future generation.

- The current importance ratings for 'Victoria Harbour water pollution' needs to be increased. A large portion of those who need to be influenced are aged between 30-59. They have mostly given higher rankings to 'Air' pollution and their mean scores for Victoria Harbour water pollution are lower than the average of 2.87.



*Avg Importance scores:	(1.34)	(2.81)	(2.87)	(2.99)
Population segment which tend to give:				
Higher proportion of top 2 ranking	• *30-59*	• ***18-29*** • *Tertiary Educated* • *Monthly household income ≥ $15k*		•*Aged ≥ 60*
Lower proportion of top 2 ranking	• *18-29*	• *Aged ≥60* • *Monthly household income <$15K* • *Less educated*		• *18-29*

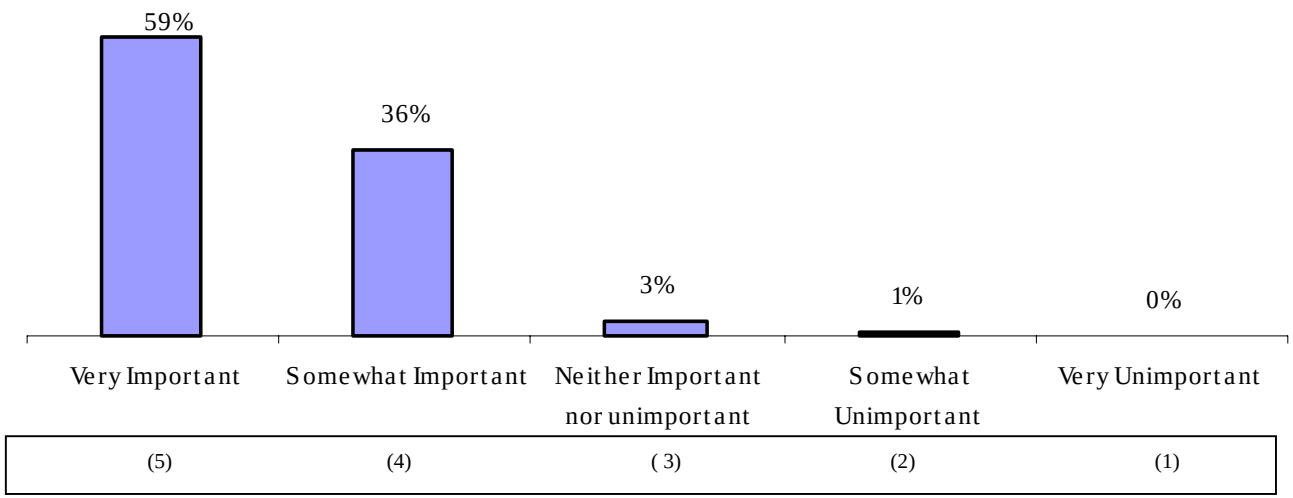
Q4. Base: All respondents

* Proportion with the top 2 ranks (Scale used:1-4 where 1= 'Most important' and 4 = 'least important').

Importance of a Clean Victoria Harbour

The HATS publicity campaign should be sensitive when communicating about the allocation of funds to HATS, as the population may feel that there are other more pressing environmental issues that warrant a greater allocation of funds. Insensitive communication may create negative sentiments.

- Although a majority of the population indicated that it is important to have a clean Victoria Harbour, they perceive this issue to be less pressing behind Air and Waste pollution (Clean Victoria Harbour ranks third with only a 1% gap behind Waste).
- Education and living district influences perception.



Mean
4.54

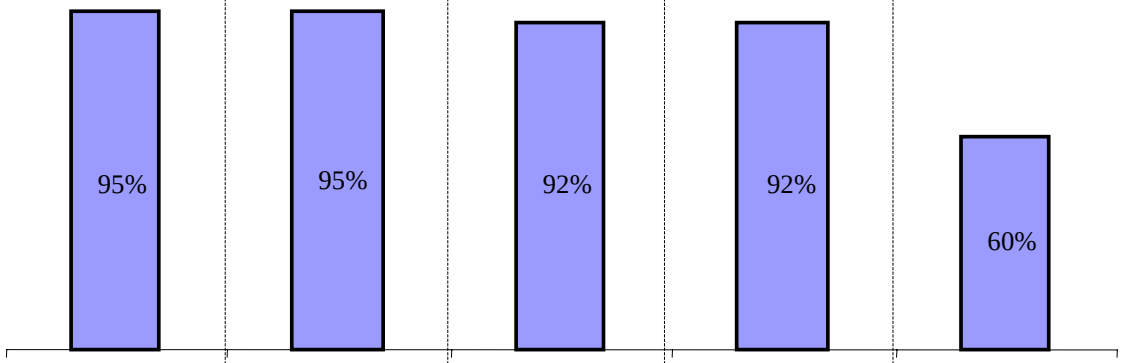
Population segment who gave significantly higher importance ratings
•Tertiary Education (4.61)
•Living in Hong Kong Island (4.7)

Population segment who gave significantly lower importance ratings
•Living in Kowloon (4.52) and NT (4.48)
•18-29 (4.37)

Q5. Base: All respondents

Importance ranking of issues related to the Victoria Harbour

Communication and imagery used for any HATS public communication should revolve around creating an aesthetically pleasant environment for the entire population as the key benefit over functional reasons (recreational boating). Among those aged 18-29 the proportion of people that gave a 'Very important' or 'Somewhat important' rating is lower than the rest of the population.



	Is smell-free	Has less floating refuse	Has clear water	Has healthy marine life	Is clean enough for recreational boating
**Avg Importance scores:*	*(4.67)*	*(4.58)*	*(4.46)*	*(4.49)*	*(3.67)*

Population segment which gave significantly:

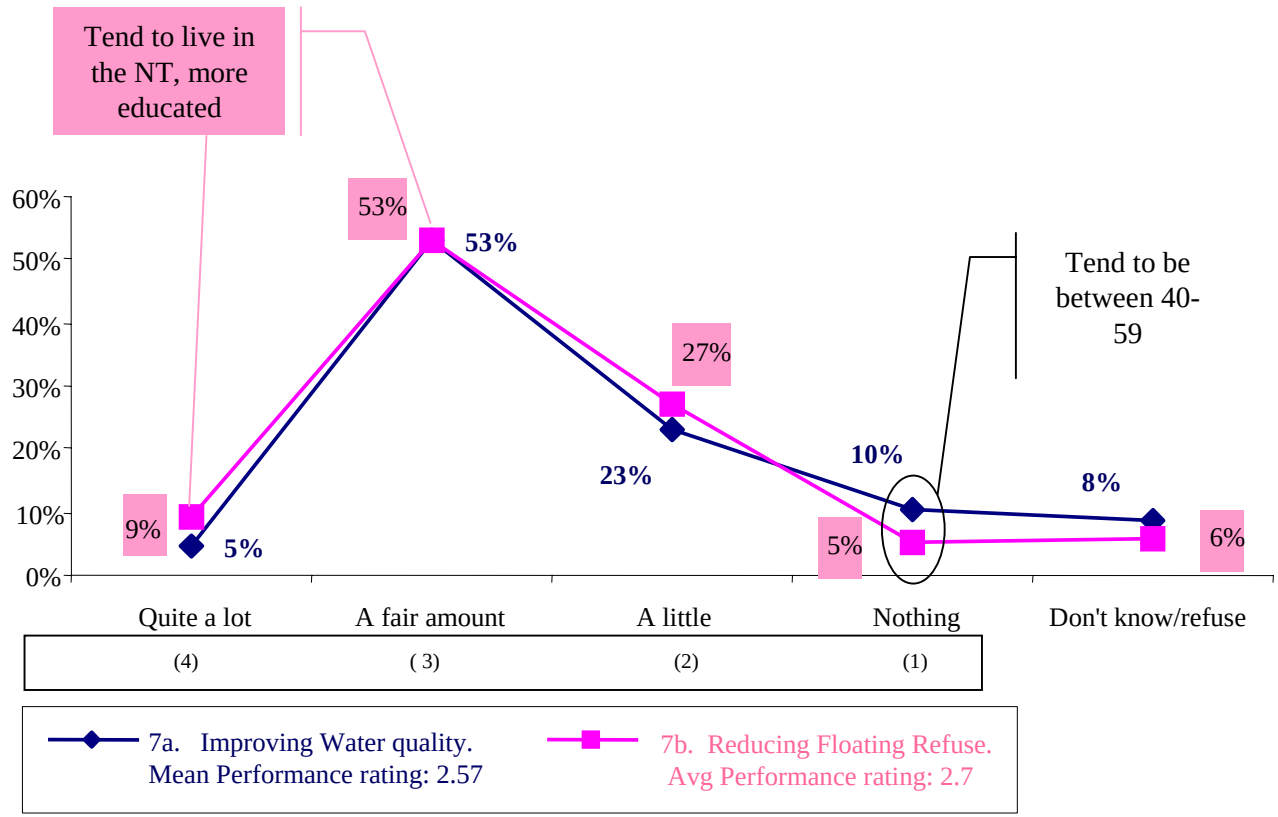
Higher proportion of top 2 scores	• *Tertiary Educated*	• *Secondary/ Tertiary educated*	• *Female, lower monthly household income*		• *Primary/Secondary educated, lower monthly household incomes*
Lower proportion of top 2 scores	• *18-29*		• *18-29*	• *18-29*	• *18-39* • *Monthly household incomes ≥ $15K* • *Tertiary Educated*

Q6. Base: All respondents

* Proportion of frequencies with the top 2 ranks (5 point scale used, where 5= 'Very important' and 1 = 'very unimportant').

Perceptions toward the government's current efforts to improve water quality and reduce floating refuse in the Victoria Harbour

A majority of the population feels that the government is putting 'a fair amount' of effort into improving the water quality and reducing floating refuse. The less educated tend to have 'lower/ no effort' ratings.

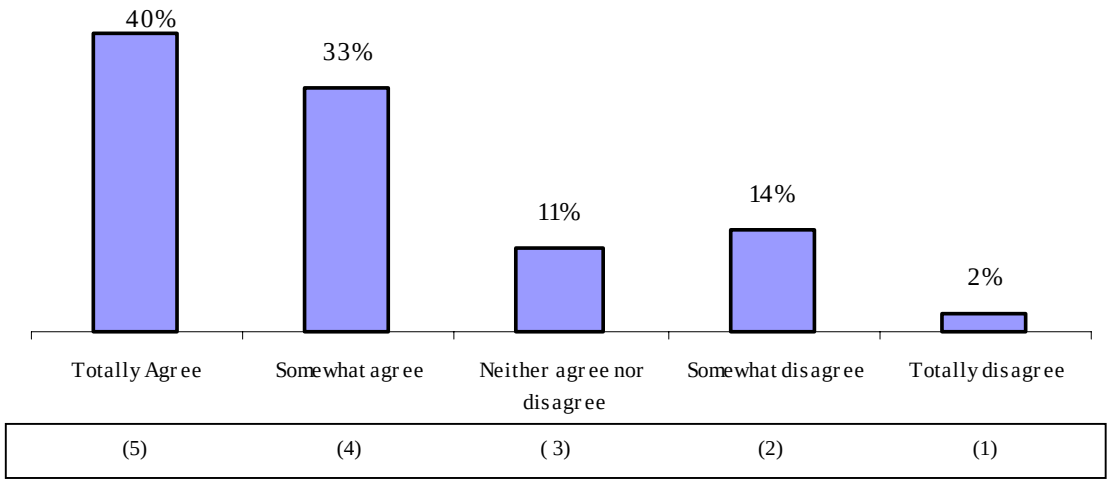


Q7a & b. Base: All respondents

Agreement levels with the statement 'The Government is Committed to Protecting and Restoring Water Quality in Victoria Harbour'

Pleasingly, 73% of the population do accept the Government's commitment to clean up Victoria Harbour.

- Age and education levels have an impact on perception.



Population segment who gave significantly higher ratings
- Primary educated (4.25)
- Lower household income (4.21)
- Aged between 30-39 (3.78)

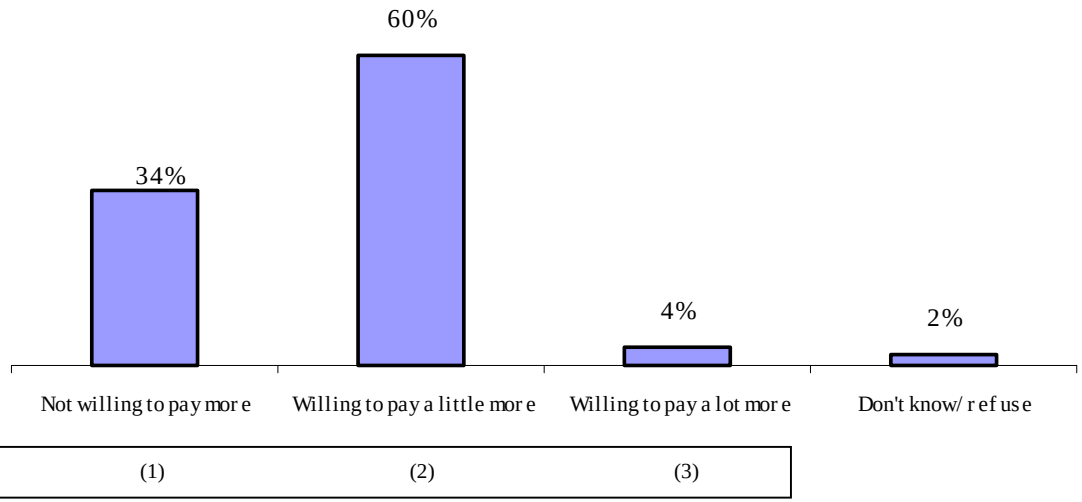
Mean
3.95

Population segment who gave significantly lower ratings
- Tertiary educated (3.72)
- Higher monthly household income (3.7)
- Aged18-29 (3.41)

Q8. Base: All respondents

Willingness to pay more sewage charges to achieve better water quality in the Victoria Harbour

There is resistance to pay more amongst those who are lesser educated with lower monthly household incomes.



Population segment who gave significantly higher ratings
•Primary educated (1.59)

Mean
1.69

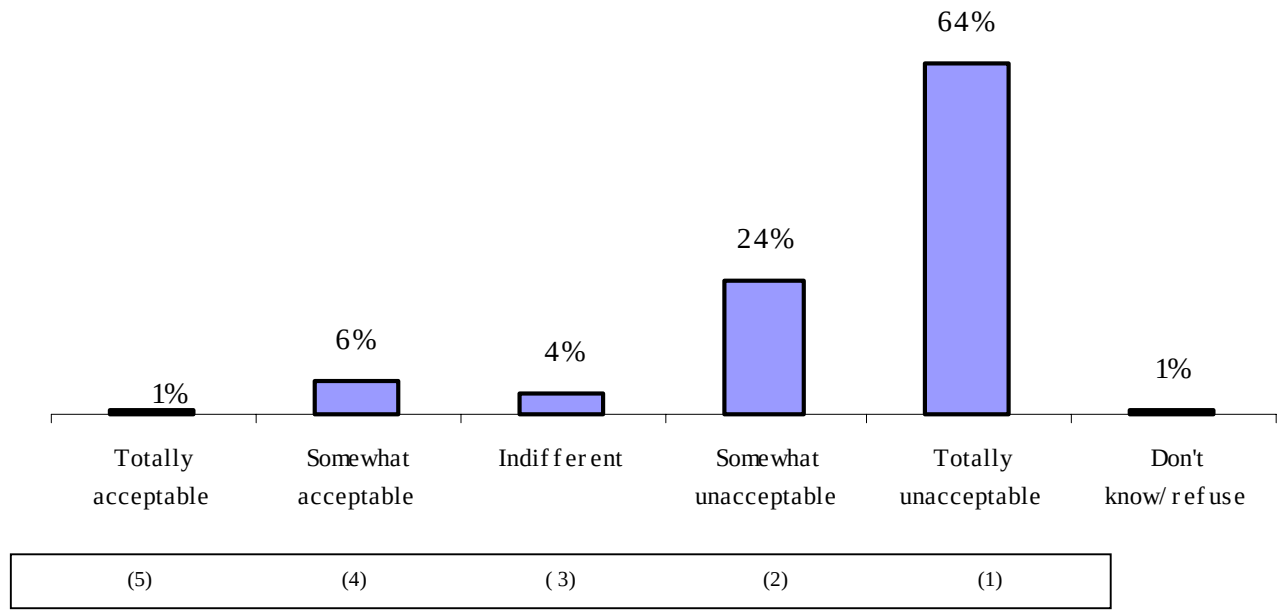
Population segment who gave significantly lower ratings
•Secondary (1.71)/
•Tertiary educated (1.77)

Q9. Base: All respondents

Acceptance of discharging untreated sewage into the Victoria Harbour

Not much corrective education is needed here, since the majority of the population is against the idea of discharging untreated sewage into the Victoria Harbour. However, constant value re-enforcement is still necessary.

- A majority of the population said that they were against the idea of discharging untreated sewage into the Victoria Harbour.
- The less educated tend to give fewer 'unacceptable' ratings.



Mean
1.55

Population segment who gave significantly lower ratings

•Mid (1.5) to high (1.34) monthly household incomes of $15K and above

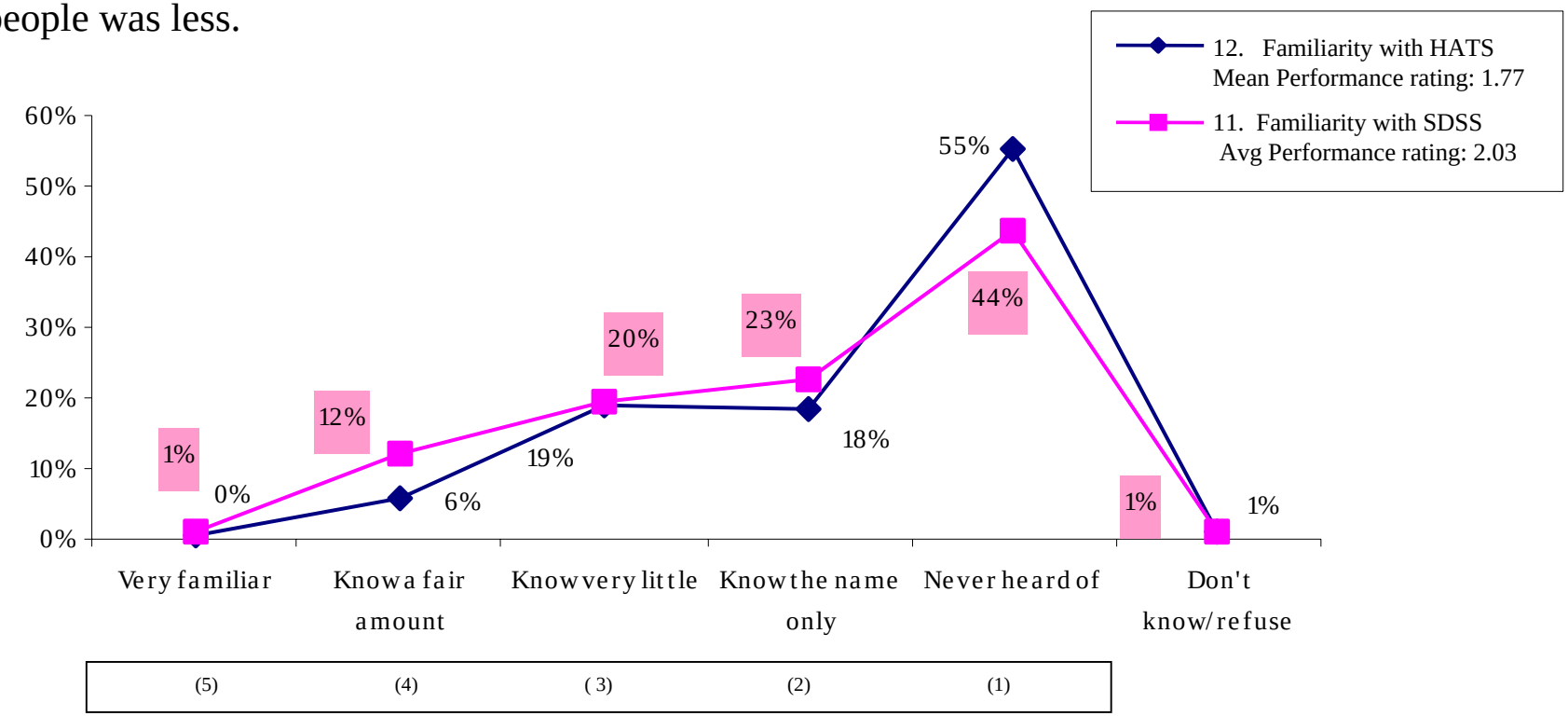
•Tertiary educated (1.39)

Q10. Base: All respondents

Familiarity with HATS and SDSS

An awareness campaign is required not only to inform the public of the name of the scheme, but also its objectives, milestone achievements and its future plans. The awareness level for HATS is on par/marginally lower than SDSS.

- Of all the respondents who gave 'Never heard of' ranking, the proportion of tertiary educated people was less.



Q11 & 12. Base: All respondents

Information Sources of HATS and SDSS

TV and print were the two most used sources for information. While current usage is very low, there is an opportunity to increase awareness using the Internet, given Hong Kong's high internet penetration. Proactive canvassing by the government to appear on TV forums on related environmental topics can help increase awareness

- Those aged 18-39 tend to receive more information from the television over newspapers.
- Those aged 40-59 tend to receive more information from the newspapers over television.

	SDSS (%)	HATS (%)
Television	39%	34%
Newspaper	35%	34%
Radio	9%	9%
Friends/relatives/colleagues	7%	11%
Magazine	3%	3%
Government publicity work	2%	1%
Internet	1%	1%
In the course of work	1%	1%
Others	1%	1%
Forgot/Don't know	2%	5%
Total	**100%**	**100%**

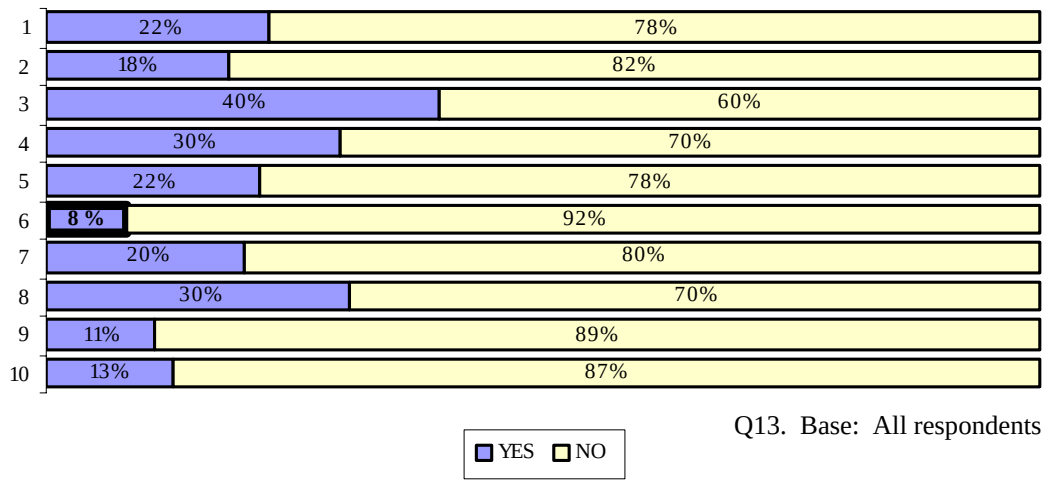
Q11a & 12a. Base: All information sources mentioned

Awareness of issues relating to Victoria Harbour water quality improvement plan

The general population have very low awareness levels of all the issues surrounding water quality in Victoria Harbour. The majority are not aware of the need to go beyond the current plan.

Statement:

1. Currently most sewage generated in Hong Kong is discharged almost untreated into the Victoria Harbour?
2. The natural capacity of the harbour waters to absorb the waste put into them has been exceeded?
3. A plan is being implemented to improve the water quality of the Victoria Harbour?
4. The first stage of the plan is a significant investment?
5. The first stage of the plan will bring significant benefits by reducing pollution loads on the harbour?
6. Even after full implementation of the first stage of the plan, 30% of the sewage discharged into the harbour still remains almost untreated?
7. Even after full implementation of the first stage of the plan the water quality in the Victoria Harbour will deteriorate in coming years without further action?
8. The HK Government invited an international review panel to re-examine proposals for further development of the sewage treatment system?
9. A series of studies and trials is needed to thoroughly test the way forward after the first stage of the plan?
10. The plan was originally called Strategic Sewage Disposal Scheme (SSDS) and now has been renamed as Harbour Area Treatment Scheme (HATS)?



Q13. Base: All respondents

Information Sources for Victoria Harbour water quality improvement plan

TV and print are the key information sources to be used for the publicity campaign. Selection of appropriate media, channels, programs and newspapers should be guided by target audience usage. The Internet as an information source is currently under utilized possibly due to lack of knowledge on which sites to obtain information from on the Internet .

Statement:

1. Currently most sewage generated in Hong Kong is discharged almost untreated into the Victoria Harbour?
2. The natural capacity of the harbour waters to absorb the waste put into them has been exceeded?
3. A plan is being implemented to improve the water quality of the Victoria Harbour?
4. The first stage of the plan is a significant investment?
5. The first stage of the plan will bring significant benefits by reducing pollution loads on the harbour?
6. Even after full implementation of the first stage of the plan, 30% of the sewage discharged into the harbour still remains almost untreated?
7. Even after full implementation of the first stage of the plan the water quality in the Victoria Harbour will deteriorate in coming years without further action?
8. The HK Government invited an international review panel to re-examine proposals for further development of the sewage treatment system?
9. A series of studies and trials is needed to thoroughly test the way forward after the first stage of the plan?
10. The plan was originally called Strategic Sewage Disposal Scheme (SSDS) and now has been renamed as Harbour Area Treatment Scheme (HATS)?

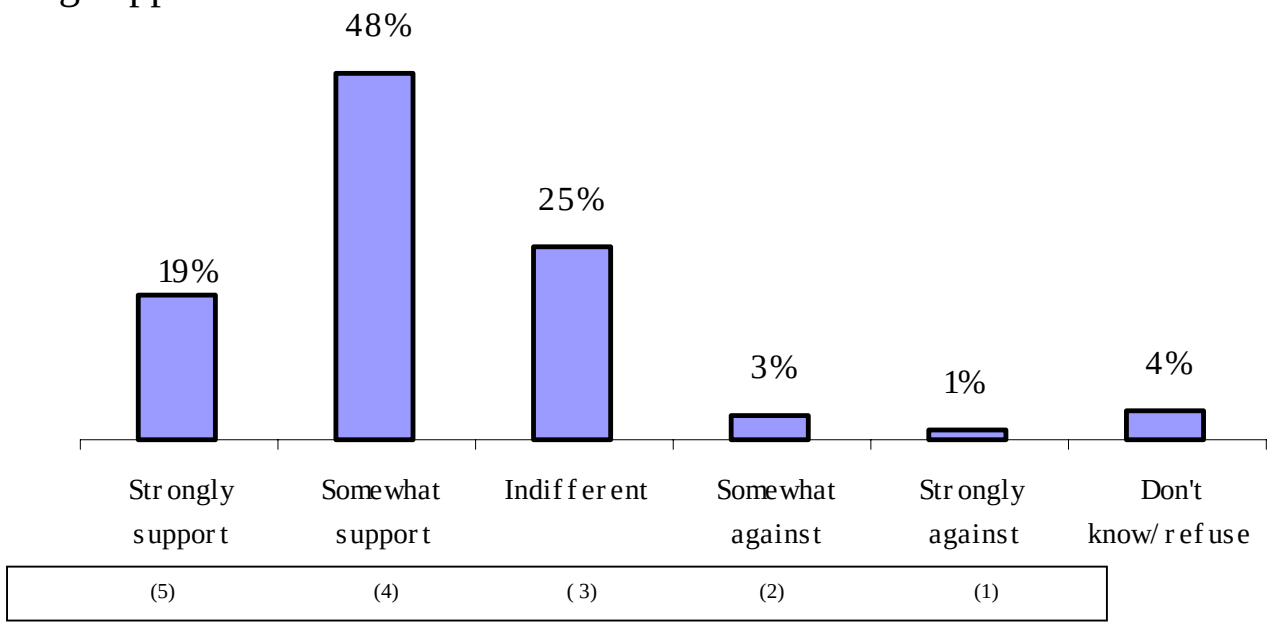
Statement:	1	2	3	4	5	6	7	8	9	10	Total
Television	35%	39%	53%	40%	40%	38%	41%	43%	43%	43%	**42%**
Newspaper	34%	33%	20%	37%	39%	35%	35%	38%	34%	33%	**33%**
Radio	10%	14%	9%	9%	10%	10%	6%	10%	9%	14%	**10%**
In the course of work	8%	7%	9%	6%	6%	6%	10%	4%	2%	3%	**6%**
Own observation	1%	5%	3%	2%	2%	5%	5%	3%	6%	3%	**3%**
Friends/relatives/ colleagues	2%	1%	5%	3%	2%	3%	2%	1%	2%	3%	**2%**
Internet	1%	0%	1%	1%	1%	3%	1%	0%	2%	2%	**1%**
From textbook	7%	0%	0%	0%	0%	0%	0%	0%	0%	0%	**1%**
Magazine	0%	1%	0%	1%	0%	0%	1%	0%	1%	0%	**1%**
Government publicity work	1%	0%	0%	0%	0%	0%	0%	0%	1%	0%	**0%**
Other books	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	**0%**
Seminars		0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Environmental Organizations	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Q13a. Base: All information sources mentioned

Support for the government's plan to allocate funds equal to half of the cost of the Airport Railway, to improving Victoria Harbour's water quality

There is a positive relationship between the importance of having a clean Victoria Harbour and support. Thus, to increase support ratings, the public have to be educated of the benefits and importance of having a clean Victoria Harbour.

- A majority of the population expressed support,though a significant proportion were 'indifferent' to the idea.
- Education level has an impact on the level of support. Those who were less educated were less likely to give strong support and vice versa.



Population segment who gave significantly higher ratings
•Secondary (3.84) /
•Tertiary Educated (3.92)

Mean
3.83

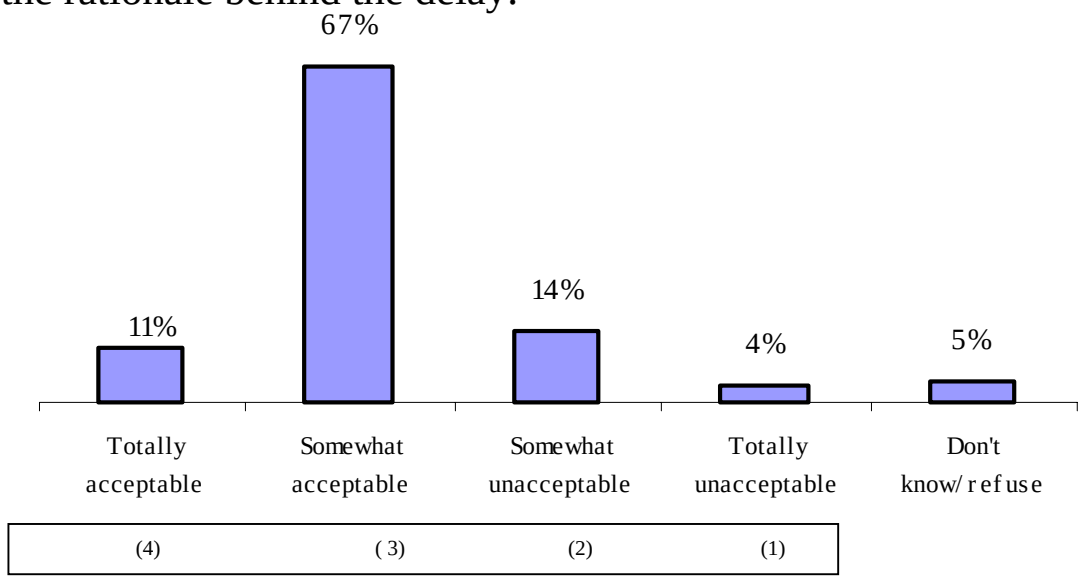
Population segment who gave significantly lower ratings
•Primary Educated (3.76)

Q14. Base: All respondents

Acceptance for a delay to the next step of improving the water quality in the Victoria Harbour until a full feasibility study has been undertaken

Care must be taken to communicate clearly on progress and keep the public informed of the rationale for the required timelines.

- A majority of the population expressed qualified acceptance. There were population segments which indicated that it is 'somewhat unacceptable' to stalling the development of the project. Those in this segment tended to be tertiary educated. Their objections may be caused by a lack of awareness towards the complexities involved, raising their doubts about the government's commitment towards the plan, thus misunderstanding the government's intentions without understanding the rationale behind the delay.



Population segment who gave significantly higher ratings
•18-29 (3)

Mean 2.89

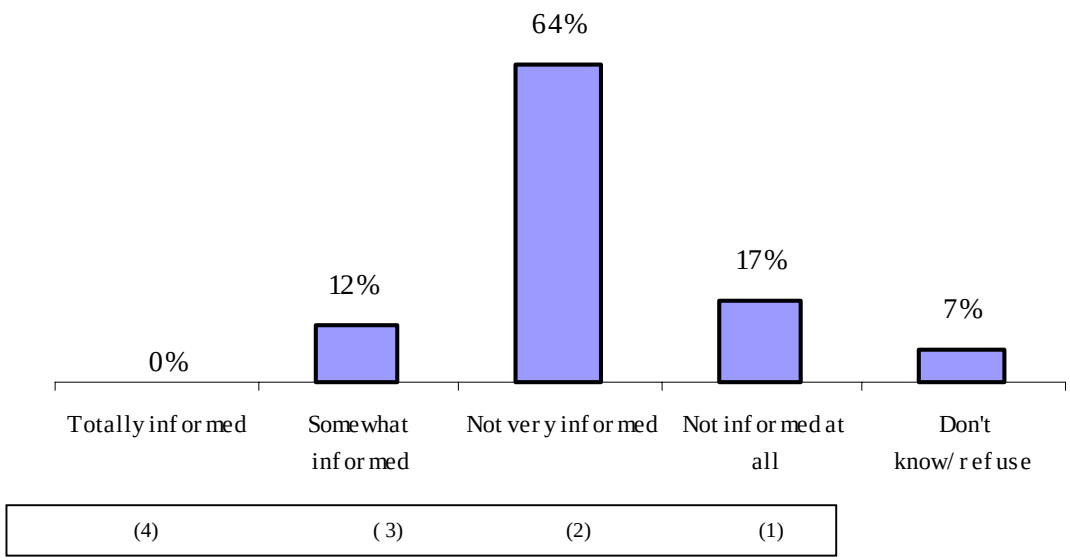
Population segment who gave significantly lower ratings
•Tertiary Educated (2.71)

Q15. Base: All respondents

Knowledge levels about the Hong Kong Government's plan to clean up the Victoria Harbour

The public recognizes that they are not well informed on the government's plans

- Overall, 81% of the population do not regard themselves as knowledgeable about the Hong Kong Government's plan to clean up the Victoria Harbour. Those with secondary / tertiary education tended to perceive themselves to be more informed.



Population segment who gave significantly higher ratings
•Secondary(2) /
•Tertiary Educated (2.03)

Mean
1.95

Population segment who gave significantly lower ratings
•Primary Educated (1.78)

Q16. Base: All respondents

Reasons for being informed/uninformed about the government's plan to clean up the Victoria Harbour

Again, print and TV seem to be the two key sources of information on the government's plan. A strong sense of government commitment will encourage public awareness and interest.

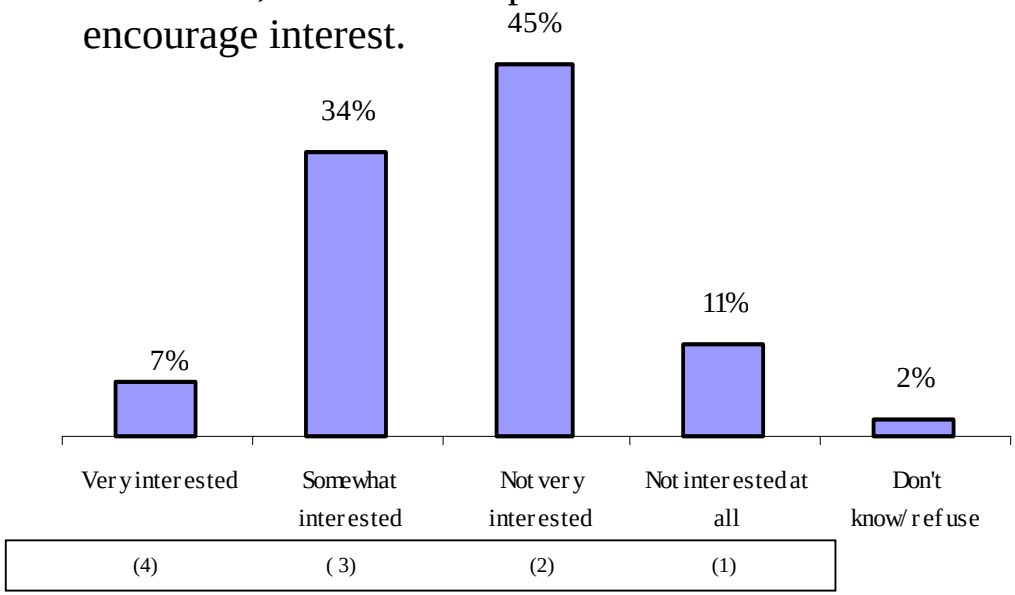
Informed	**%**	**Uninformed**	**%**
Newspaper published related information	36%	Lack of promotions	29%
TV	34%	Lack of coverage on media	22%
Observation, self interest/ grapevine discussion	8%	Not interested in topic	16%
News	7%	Lack of government promotion/education	12%
Information from the government	5%	Lack of awareness of plan	8%
Radio program	3%	Seldom read newspaper/watch TV	6%
In the course of work	3%	Plan lacks transparency	3%
Critics in some programs	2%	Not aware of way to access information	2%
School	2%	Literacy issues	2%
Internet	1%		
Total	**100%**	**Total**	**100%**
Base: All reasons mentioned	**116**	**Base: All reasons mentioned**	**631**

Q16a.

Interest in being consulted on 'the way forward' for the Victoria Harbour water quality improvement plans.

While 8 in 10 do not feel well informed, only 4 in 10 wish to be consulted in the future.

- Those who received secondary/tertiary education tended to be more interested in being consulted on the Hong Kong Government's development plans on this project.
- Those aged between 18-39 were more keen to use the Internet as their preferred communication over radio, after TV and print media. Website addresses should be made easily accessible to encourage interest.



Population segment who gave significantly higher ratings
•Secondary (2.38) /
•Tertiary Educated (2.53)

Mean 2.38

Population segment who gave significantly lower ratings
•Primary Educated (2.28)
•18-29 (2.29)

Preferred Channel	**%**
Television	38%
Print Media	31%
Radio	12%
Website/Internet	7%
Don't want any information	2%
Leaflet by government	2%
Public consultation process	2%
Poster at public place	1%
Others	2%
DK/Refuse	3%
Total	100%

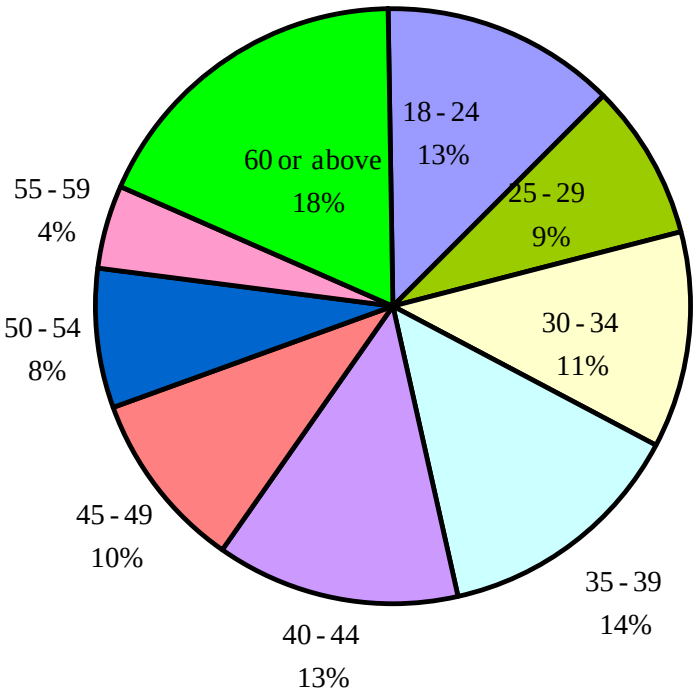
Q17. Base: All respondents

Q18. Base: All communication channels mentioned

Appendix 1: Demographics

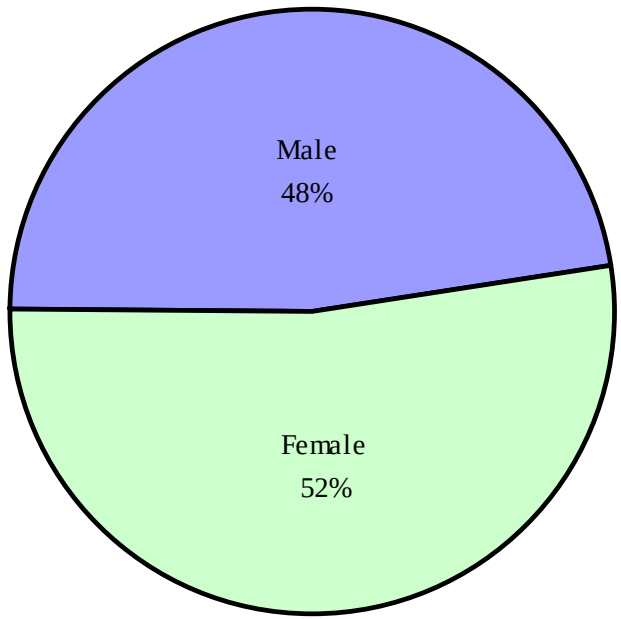
Demographics (1)

Age



Base: All respondents, N=615

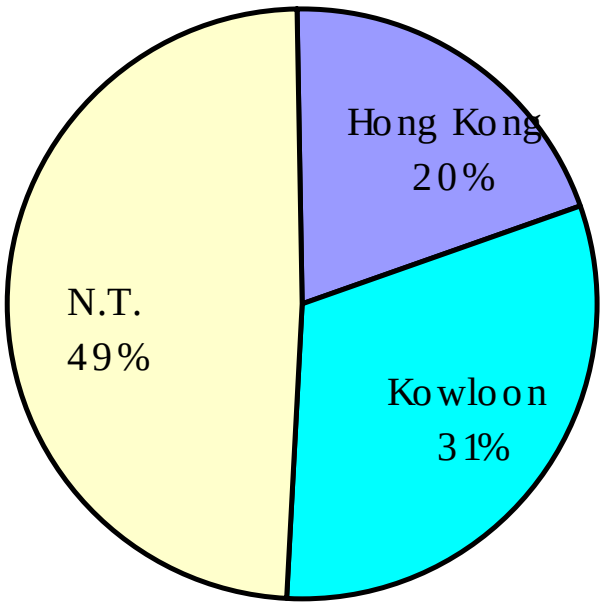
Gender



Base: All respondents, N=615

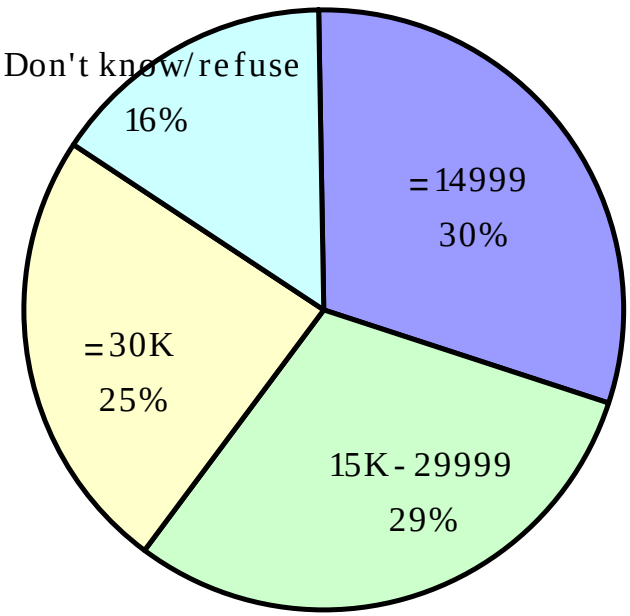
Demographics (2)

Living District



Base: All respondents, N=615

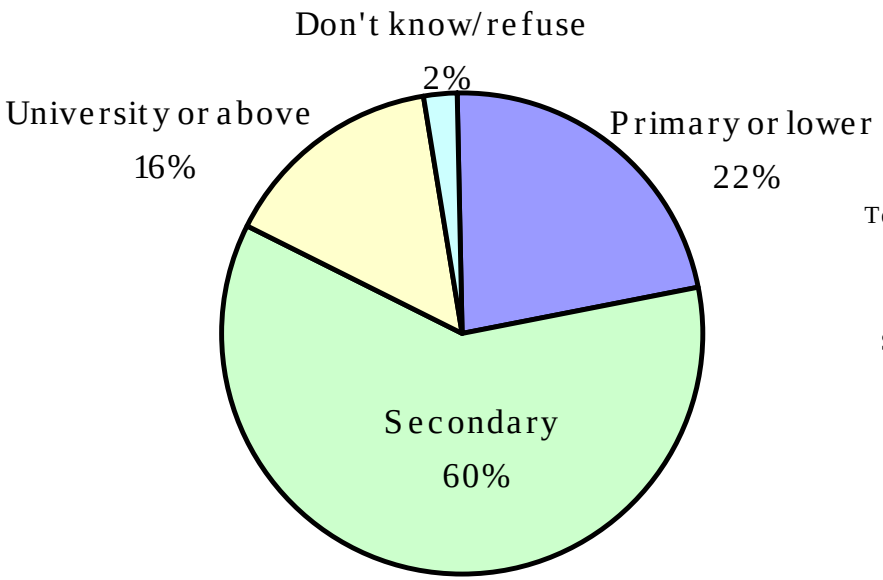
Monthly Household Income



Base: All respondents, N=615

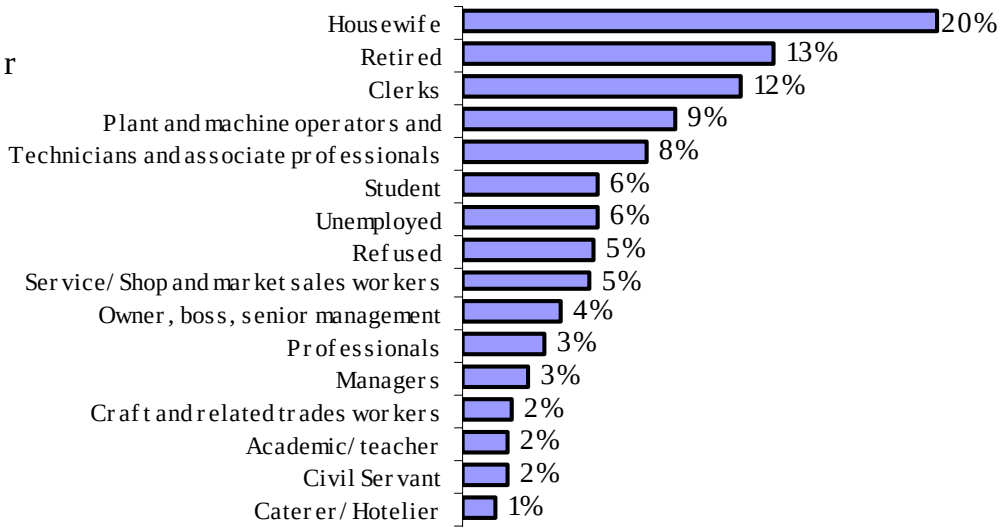
Demographics (3)

Education Level



Base: All respondents, N=615

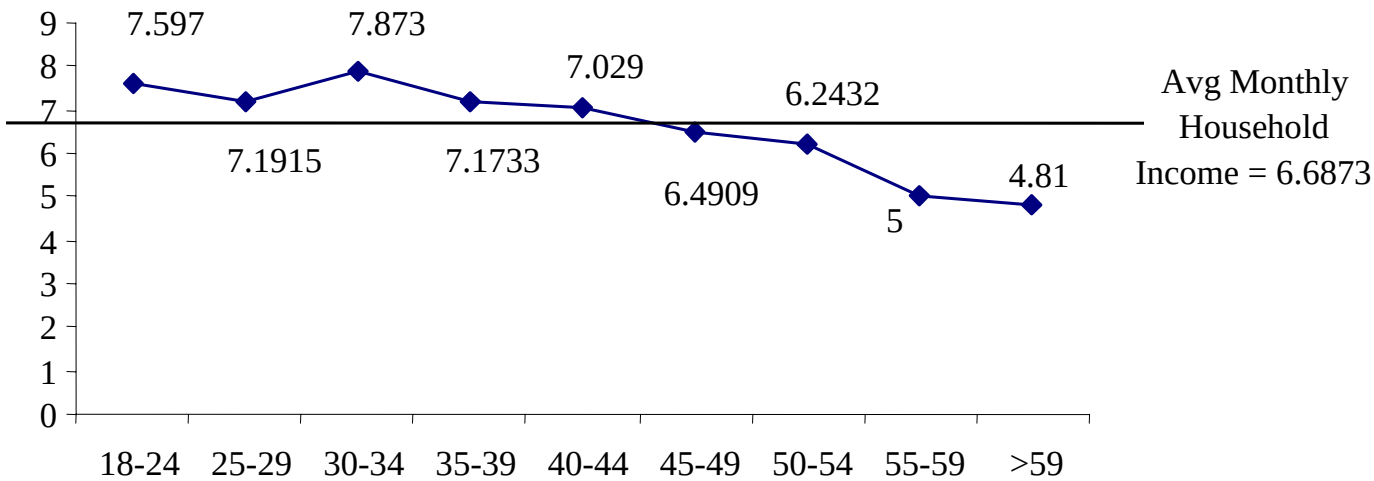
Occupation



Base: All respondents, N=615

Demographics (4)

Monthly Household income by Age group



Base: All respondents, N=615

Monitoring Group on Trials and Studies for HATS

3rd Meeting at 9:00 a.m. on Thursday, 21 February 2002

Present:

Mrs Lily Yam	Secretary for the Environment and Food (Chairperson)
Professor Leonard Cheng	
Dr Albert Koenig	
Prof Rudolf S S Wu	
Professor Peter Hills	Member of Advisory Council on the Environment
Ms Iris Tam	Member of Advisory Council on the Environment
Dr Ng Cho-nam	Member of Advisory Council on the Environment
Dr Ho Kin-chung	Member of Advisory Council on the Environment
Mr Chan Bing-woon	
Mr Jimmy Kwok Chun-wah	
Mrs Josephine Mak Chen Wen-ning	
Mr W S Chan	Deputy Secretary for Works (Works Policy)
Mr Robert Law, JP	Director of Environmental Protection
Mr John Collier, JP	Director of Drainage Services
Mr Raistlin Lau	Principal Assistant Secretary for the Environment and Food (B)1 (Secretary)

In attendance:

Mr Donald Tong	Deputy Secretary for the Environment and Food (B)
Mr Benny Wong	Assistant Director of Environmental Protection
Dr Malcolm Broom	Principal Environmental Protection Officer, EPD
Mr S K Aggarwal	Assistant Director of Drainage Services
Mr W W Chui	Senior Engineer, Drainage Services Department
Miss Christina Chong	Assistant Secretary for the Environment and Food (B)1A

Discussion **Action**

The Chairman welcomed Members, particularly Mr. Jimmy Kwok who was attending his first MG meeting.

I. Confirmation of the minutes of the 2nd meeting

2. The minutes of the 2nd meeting were confirmed without amendment.

II. Matters arising

Para. 9

3. The Chairman informed Members that the tender documents for the Compact Sewage Treatment Technology Pilot Plant Trials had been sent to them for reference.

IV. Water Quality Criteria for EEFS (Paper No. MG(2002)01)

4. The Chairman thanked Dr K C Ho, Dr Albert Koenig, Dr Ng Cho-nam, and Prof Rudolf Wu who had offered their expert views to assist EPD in refining the proposed water quality criteria (WQC) before the matter was discussed at that meeting. She added that she would welcome Members' advice on the consultation process which might need to be open to all stakeholders, including the community at large. While the public might not be interested in the technical details, they should not be denied an opportunity to comment as the WQC would be a critical factor in determining the acceptability of the various options under study. This approach would also help educate the public on the need to protect the water quality of the Harbour and pave the way for the public consultation on options towards the end of 2003 and for discussion on sewage charges.

5. Dr Malcolm Broom gave a PowerPoint presentation on the concept of beneficial uses in various water control zones in Hong Kong, the difference between Water Quality Objectives (WQO) and WQC, and the proposed WQC which, subject to refinement by the Environmental and Engineering Feasibility Studies (EEFS) consultant and comments received during the consultation, would be adopted as the benchmark for measuring the impact of treated effluents discharged under various options into the potential receiving water bodies. **(Annex)**

6. Dr Broom said that the standard proposed for the dissolved oxygen (DO) criterion for Victoria Harbour in the third bullet of

paragraph four in Annex I (i.e. 4mg/L as water column average to be met 90% of the time and 2 mg/L within the bottom 2m of the water column to be met 90% of the time) should be revised such that the 2 mg/L target was to be met as a minimum, at all times, throughout the water column, as agreed earlier between the four MG Members and EPD. Tables 2 and 3 of Annex 1 would also be amended accordingly.

WQC

7. In response to the Chairman's question, Dr Broom said that the WQC put forward in the paper were very similar to those proposed in the 2000 Environmental Impact Assessment (EIA) Report for the former Strategic Sewage Disposal Scheme (the 2000 Report), except that the DO criteria had been raised. Mr Robert Law supplemented that the proposed Total Inorganic Nitrogen (TIN) criteria would form a starting point for discussion with the scientific community but the EEFS consultant would also conduct an assessment of the risk associated with adopting these proposed criteria. If the risk was perceived to be substantial, the implications of adopting higher levels of nutrient removal, as a precautionary measure to mitigate the perceived risk, would be assessed. Prof Rudolf Wu added that compared with the prevailing WQC, the proposed DO criteria would be tightened while the TIN criterion in southern waters would be relaxed. He suggested that the nitrogen criterion should be tightened. (Post-meeting Note: The proposed nitrogen (or TIN) criterion for southern waters is that adopted in the 2000 Report, but it represented a relaxation compared with the prevailing TIN WQO for the area, which is 0.1 mg/L).

8. Mr Law said that there was a need to maintain a balance between technological capability and community aspirations. There was always a price tag for going beyond what would be scientifically justified. The cost of each option should be spelt out at some stage to facilitate a sensible discussion by the public. In response to the Chairman's question on when the options and the associated implications would be available, Dr Broom advised that the WQC could only be firmed up after the completion of the consultation exercise and the computer modeling work, probably in the autumn. Full cost implications would not be known until substantially later as the consultants would have to prepare designs for treatment works that would ensure that the agreed

WQC could be met.

9. The Chairman said that the community at large should be involved in the subject at an early stage so that lack of consensus in developing the former SSDS could be avoided. Prof Wu said that the beneficial uses of the Harbour might be a good starting point for involving the public. Mr Chan Bing-woon concurred that it was important to let the community know the cost of each option as the public would need to pay for their selected option ultimately.

10. Dr Koenig opined that it would be easier for the public to understand the need for setting WQC by bringing in the concept of "beneficial uses". He suggested that Government should prepare a diagram showing in layman's terms the beneficial uses of the waters in Hong Kong to be supplemented by the necessary technical information for public consumption. The Chairman said that the EEFS consultant should be asked to follow up on the above suggestion. EPD/EEFS consultant

11. Dr Ho Kin-chung suggested that the Government should allow more flexibility when setting beneficial uses, say by enabling the Harbour to be suitable for swimming during part of a year. Mr Law pointed out that Victoria Harbour was a busy port and as such its beneficial uses, on safety grounds alone, could not reasonably include recreational ones such as swimming. It would be difficult to set the WQOs for the Harbour in such a way that could guarantee safe swimming during a particular time of a year. As the water quality goals for the Harbour could not be set so as to ensure the water would be safe for recreational swimming on a routine basis, there would always be some risk attached to swimming in the Harbour. EPD could only ensure that such risk would not be ridiculously high. The Chairman said that the above explanation should be clearly given to the public during the consultation process. Dr Ho agreed that the risk involved should be clearly relayed to the public but he believed that it should be possible to allow some variations in beneficial uses of the Harbour between, say, dry and wet seasons. Mr Law noted that there was strong latent desire in the community for swimming in the Harbour and the public might regard it as an indicator to measure the success of HATS. He said that EPD would give further thoughts to how the aspiration of the community could be addressed by containing the risk to an acceptable level. EPD/EEFS Consultant

EPD

12. Prof Leonard Cheng said that even the scientific community might not be able to reach consensus on the appropriate WQOs or WQC to be adopted to allow certain beneficial uses. This should be where the cost factor kicks in. The public might not be very interested in the technical debate on the setting of the WQC, but they would probably be interested in the resource implications for achieving a particular level of improvement in water quality. He suggested that a suitable strategy should be developed to involve the public in the formulation of proposed WQC. The Chairman agreed and said that MG Members would be closely involved in various stages of the consultation exercise. EPD

13. Prof Wu commented that the proposed TIN criterion for the Mirs Bay Water Control Zone (MBWCZ) could be lowered from 0.3 mg/L to 0.15 mg/L as the TIN level of waters in that region had already achieved the more stringent standard. Dr Broom said that in considering the proposed initial criteria for the study, EPD had not focused on the TIN level for MBWCZ since it seemed extremely unlikely that discharges of effluent under any of the HATS options, being mainly on the western side of the Harbour, would have any material impact in that area. Moreover, there did not appear to be any evidence of a need to establish a more stringent criterion for the area for the purpose of preventing eutrophication. However, he said that EPD could ask the EEFS consultant to examine whether the existing criterion would present a problem. EPD

14. Prof Rudolf Wu said that a higher nutrient level would give rise to algal blooms more easily. Since the beneficial uses for MBWCZ were similar to the Southern Water Control Zone (SWCZ), he could not see good grounds for applying different TIN criteria in the two Zones.

15. Dr Koenig said that the TIN criterion of 0.2 mg/L for SWCZ was first introduced in the 2000 Report. Since the existing TIN WQO for the SWCZ was 0.1 mg/L, he wondered if the TIN criterion should be tightened to 0.1 mg/L accordingly. Dr Broom said that the background level of TIN in the western part of the SWCZ already exceeded 0.1 mg/L due to the influence of the outflow from the Pearl River Estuary. As there was little Hong Kong could do to bring the TIN level back below 0.1 mg/L, it

would not be practicable to set the criterion at 0.1 mg/L.

16. In response to the Chairman, Mr Law said that although there were reports suggesting that the Mainland had plans to upgrade its wastewater treatment so as to improve water quality, it was very difficult to get hold of the implementation details. It remained to be seen whether one single Mainland authority would emerge to coordinate the water quality issue as municipal governments in the Pearl River Delta Region were fairly autonomous. Mr Benny Wong also pointed out that sewer discharge was not the sole contributor of TIN as farms in the Mainland would also produce nitrogen pollutants which would find their way to various water bodies. He suggested that instead of discussing the absolute level of TIN, an alternative would be to look at that proportion of the concentration likely to be due to discharges from Hong Kong and consider the extent to which resources should be spent to reduce that proportion. Dr Broom said that the additional loading due to local activities in Hong Kong was probably very small. Prof Wu agreed that contribution from non-point sources should not be overlooked. He suggested that the EEFS consultant should be asked to review whether the TIN concentration in SWCZ and MBWCZ could be further reduced and if so, at what cost. The Chairman agreed. EPD/EEFS consultant

17. Dr Ng Cho-nam said that the public might query why there was inconsistency between WQC in different water control zones with the same beneficial uses. After further discussion, the meeting agreed that the nutrient criteria for the area of the Mirs Bay WCZ which was also marked as a fish spawning/nursery ground should be aligned with those for SWCZ.

18. In response to the Chairman's question on the parameters adopted by EPD in assessing the acceptability of the HATS options, Dr Broom said that these would be the WQC for the receiving water bodies.

19. Ms Iris Tam asked if the Harbour should also be designated as secondary-contact recreation area as she understood that there was a plan to build a water recreation centre in east Kowloon and she observed that there were occasional sailing activities in the Harbour at present. Mr Law said that Marine Department would not encourage water recreational activities such as sailing in the Harbour in light of the heavy marine traffic.

The water quality of the Harbour was also not suitable for such activities. Sailing had not been officially banned in the Harbour because there was not sufficient justification to take such drastic measures. Ms Tam suggested that Government should make its position clear to the public.

20. Dr Ng asked EPD to clarify the criteria to be applied at the intersection between the fish spawning ground and the Victoria Harbour Water Control Zone. Dr Broom said that the more stringent set of criteria would be applied in these overlapping areas to protect the more sensitive beneficial uses.

Consultation Process

21. In response to the Chairman's question, Mr Law said that it was necessary to agree on the WQC before the costs of the various options for the remaining stages of HATS could be worked out. Therefore, he considered that the scientific community should be invited to comment on the technical proposals first. This would then produce the necessary parameters to evaluate the options and to work out their associated cost implications. The general public would certainly be involved at a later stage when information on costs etc. became available.

22. Mrs Josephine Mak opined that the general public should be involved as soon as possible. She said that the present paper appeared to focus too much on the technical aspects and suggested that more emphasis should be put on the rationale behind the establishment of water control zones and the setting of different WQC for different zones during the public consultation. Mr Chan Bing-won suggested that the public should be involved at an appropriate stage to ensure there could be a consensus on the remaining stages of HATS. Mr Jimmy Kwok also concurred that the public should be engaged early during the deliberation on the WQC so as to avoid problems in future as the study advanced. Mr Law shared Members' views but remarked that it would not be possible to produce sufficient information, such as costs, for consulting the public until the scientific community had offered their views on the WQC, and until the assessment of compliance with the criteria, for each of the options, had been carried out.

23. Prof Peter Hills said that it would be difficult to win public

support for investing in the remaining stages of HATS given the current economic situation. He said that the Government should be very careful to avoid pitfalls that had been experienced in the implementation of the previous SSDS. It was also important to manage the public expectation during the interim period before Government implemented the remaining stages of HATS. Prof Leonard Cheng said that the Government should educate the public on the importance of HATS so as to enlist their support. Mr Ho Kin-chung said that the Government would need to continuously review the sewage charging policy and to impress upon the public why they had to pay for sewage services.

24. The Chairman suggested that the public should be educated on the general concepts of beneficial uses, WQOs, WQC, etc. They should also be told why Government had to implement the remaining stages of HATS, the implications of revising the WQC and other areas of concern. She commented that the PowerPoint presentation materials with suitable refinement should form a good basis for developing materials for public education in this subject. She suggested that the consultation process should be divided into two stages – the first stage to take place later this year should aim to solicit major stakeholders' views on the technical criteria, as well as to inform the public on the general background; while the second stage towards the end of 2003 should focus public attention on the options for the remaining stages of HATS, with price tags attached. The public document on WQC to be issued during the first stage consultation should be split into two parts, with the main text giving general background to enhance public understanding of the concepts involved, and a technical annex focusing on technical information on proposed WQC to solicit views from the academia and the related professionals.

25. Prof Peter Hills said that targets for each stage of consultation should be clearly defined. Moreover, it was important to find an effective way to monitor and collect the feedback received from the general public.

26. Mr Law supported the two-stage consultation approach and offered to provide regular updating to the public on HATS in between the two stages. The Chairman asked whether the new approach would have any implications for the original programme for the trials and studies. Dr Broom said that it might take more time if the public were involved earlier than originally envisaged

EPD/EEFS consultant

since the consultants would have to produce a layman's document for consultation purposes in addition to the technical document. The Chairman said that EPD and the EEFS consultant should refine the proposal in MG(2002)01 taking into account the discussions at the meeting.

27. Members agreed that consideration should be given to including the Advisory Council on Environment, the LegCo Panel Environmental Affairs, Lingnan University, and mariculturists associations in the list of consultees. The Chairman asked EPD to prepare a short paper on the revised consultation process which should include the targets to be achieved at different consultation stages. Mr Law said that the expanded scope of consultation and the need to monitor the feedback were likely to incur extra costs and EPD would assess the financial implications. EPD

IV. Progress Report on Trials and Studies for HATS - MG(2002)02

28. The Chairman said that since the meeting held last September, good progress had been made on the trials and studies. The Secretariat had also written to Members to update them on the latest progress from time to time.

29. The Chairman thanked Dr Albert Koenig for accepting the Government's invitation to offer expert advice on the technical submissions of the tenders received. She said that the contracts for the three pilot plant trials had been successfully awarded in January.

30. The meeting noted the progress of HATS studies and trials as set out in the paper. In response to Dr Koenig, Mr John Collier said that DSD had no intention to publicize widely the commissioning of the trials. However, he agreed with Dr Koenig that DSD could organize special visits for interested professionals and academia.

V. AOB

31. Members did not raise any other issues for discussion.

VI. Date of Next Meeting

32. The Chairman informed Members that the next meeting was tentatively scheduled for Friday, 7 June 2002. The Secretary would confirm this with Members nearer the time and would continue to update Members on major progress on the trials and studies before next meeting.

Environment and Food Bureau
June 2002

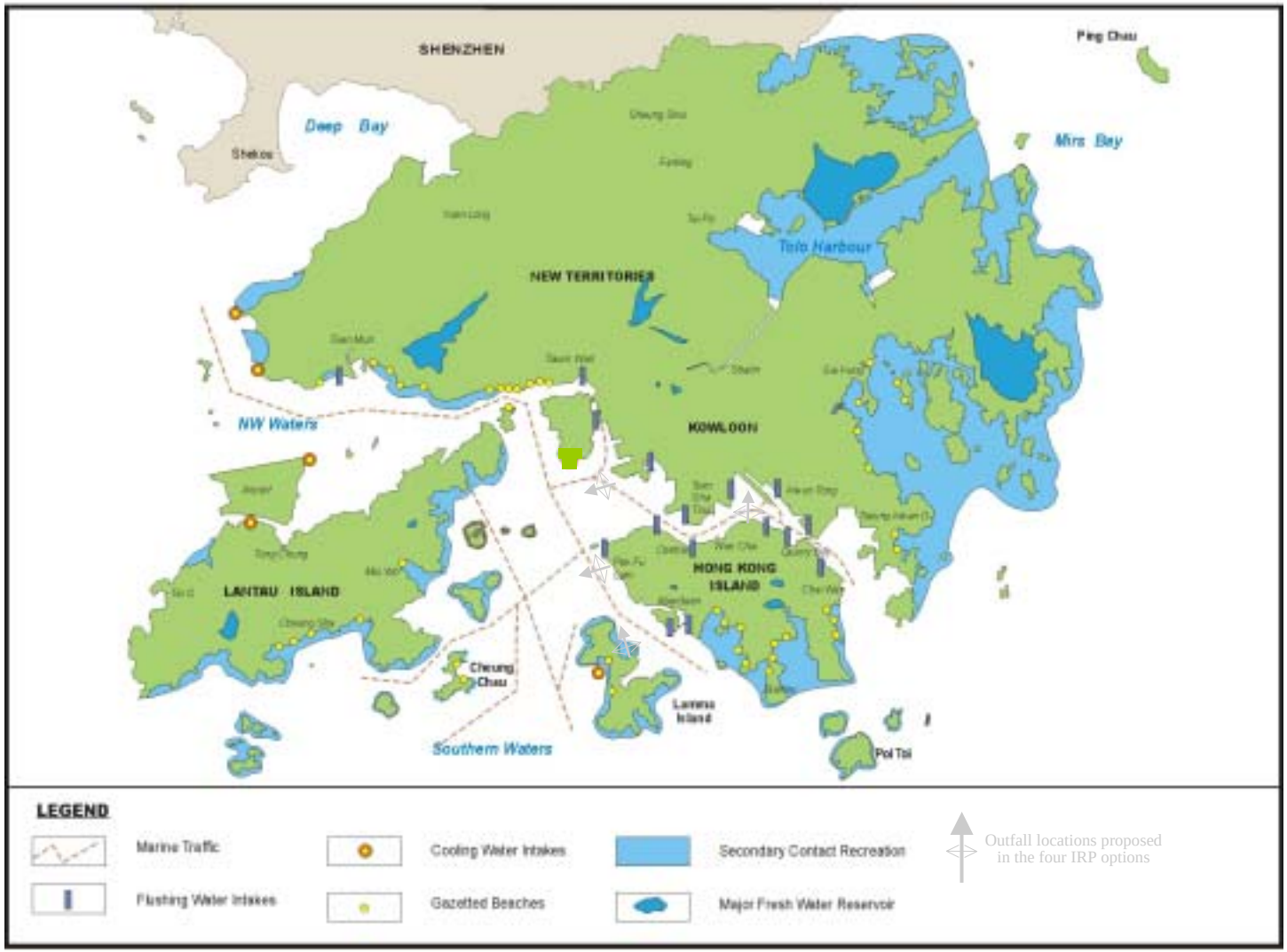
Environmental and Engineering Feasibility Study (EEFS) for HATS Water Quality Criteria

Environmental Protection Department

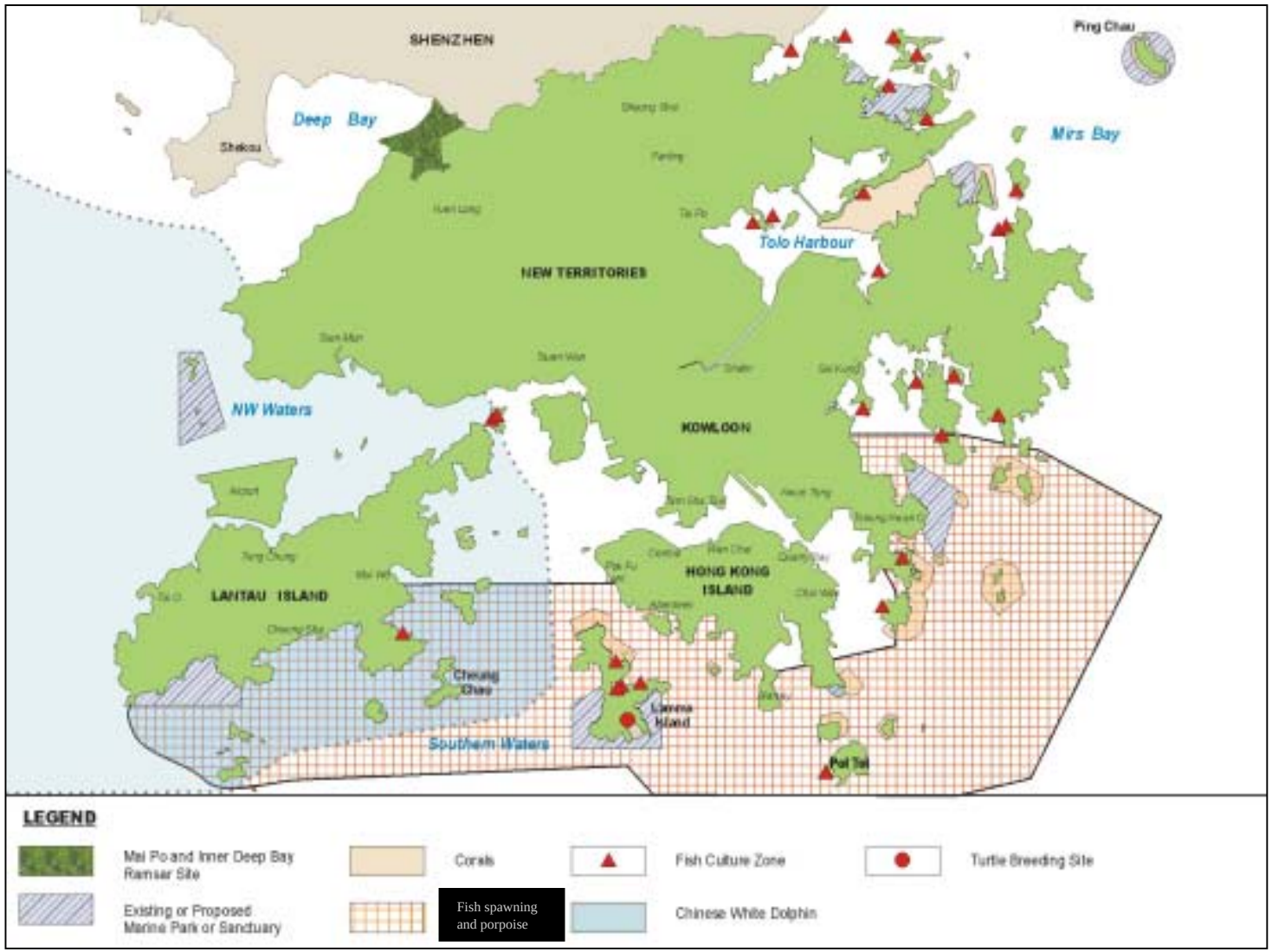
General Principles

- What are the desired uses or functions of our marine waters? How are they distributed?
- What water quality is needed to support those uses/functions?
- Establish water quality objectives (WQOs) which reflect the desired water quality.

Human Uses of Marine Waters



Natural Resources



Key Water Quality Requirements for Various Uses

Uses	Key Requirements
Maintain Aquatic Life	High DO, Low ammonia & Toxic Substances
Ecosystem Function	Low Nutrients & Sedimentation
Source of Food	Low Toxic Substances
Swimming & Recreation	Low Bacteria
Cooling Water	Low Fouling Organisms & Bacteria

Existing WQOs

To safeguard aquatic life :

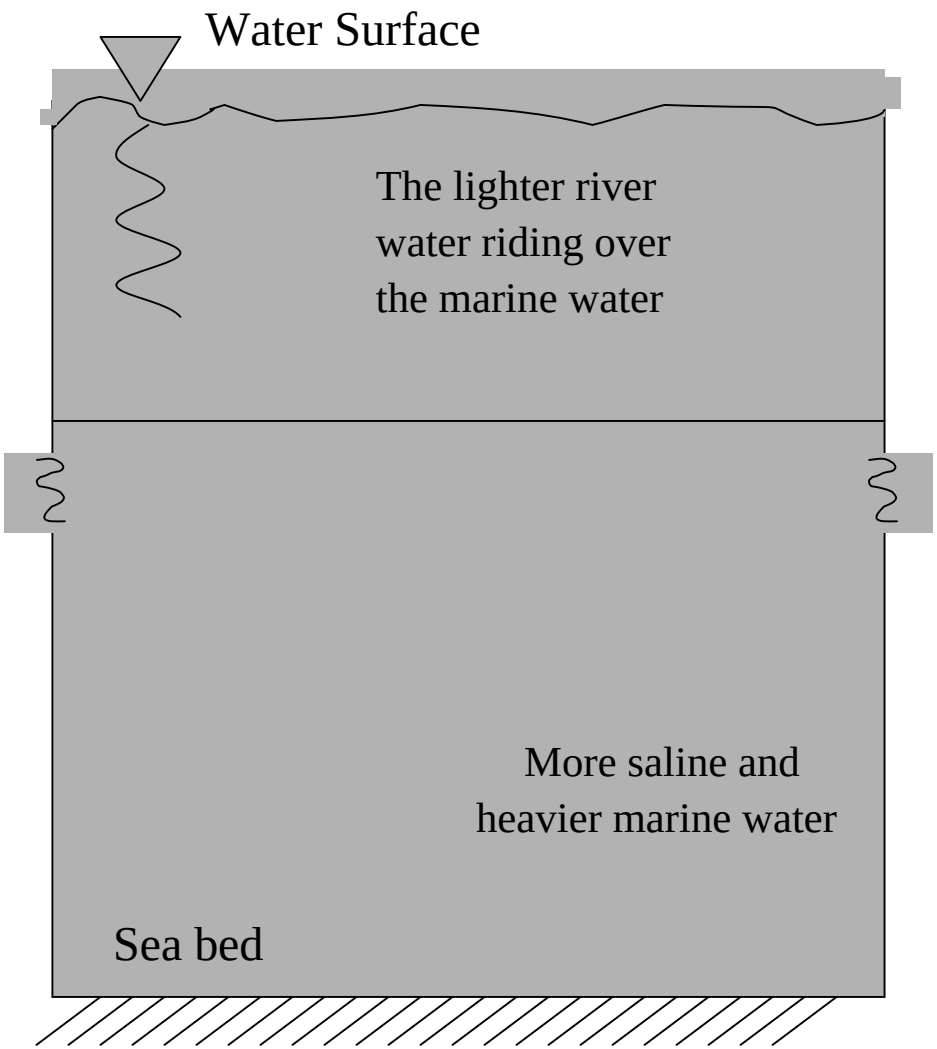
- average water column

  DO > 4 mg/l, 90% of time

- near sea bed,

  DO > 2 mg/l, 90% of time

Diagrammatic Illustration of Stratification Phenomenon in Marine Waters subject to Estuarine Influence



- Top layer is generally more oxygen-rich due to re-aeration from surface.
- Stratification discourages self-mixing and oxygen-exchange.

To protect ecosystem function :

- Total Inorganic Nitrogen

  < 0.1mg/l to < 0.7 mg/l

  (varies according to locations)

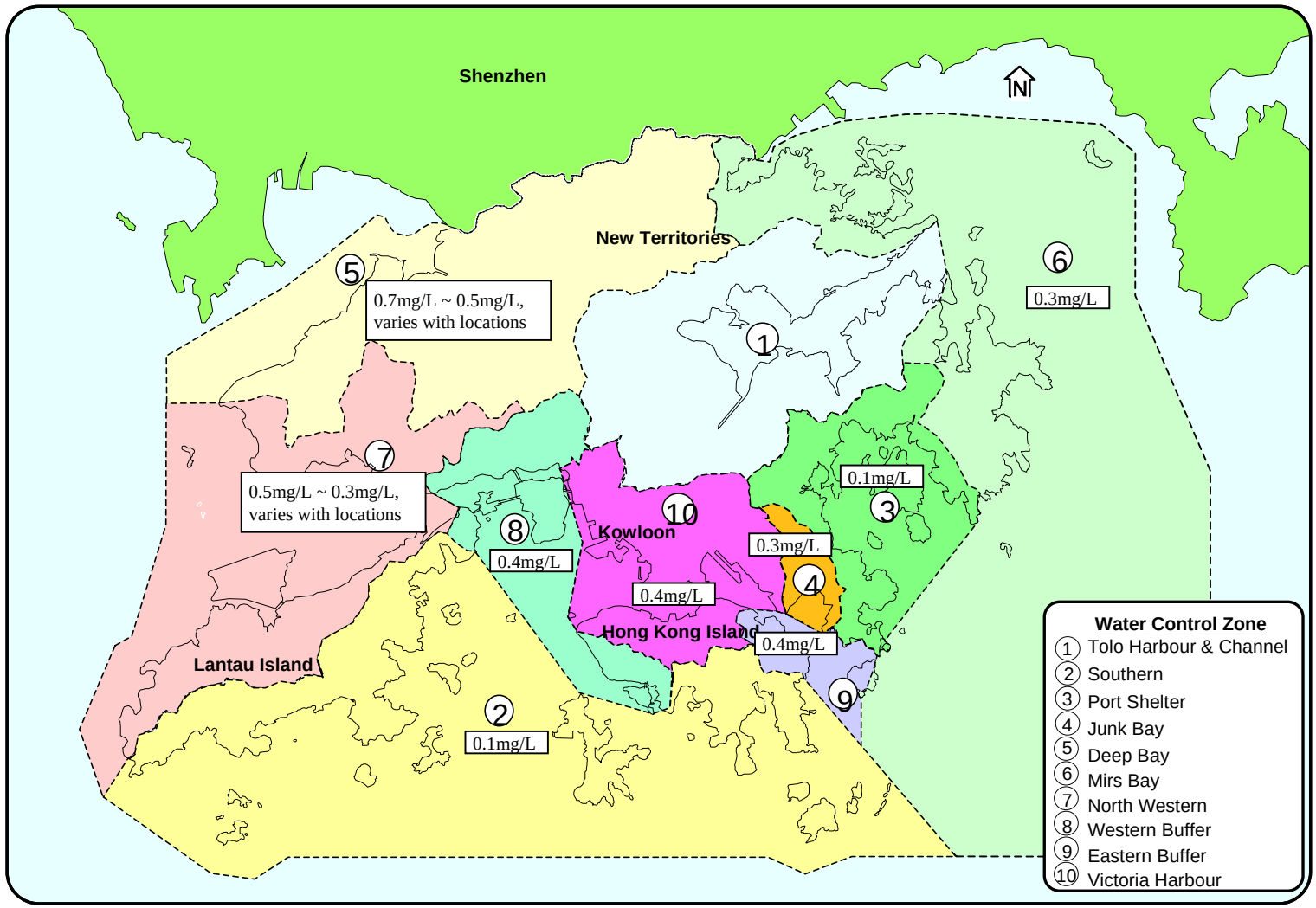
- ambient Suspended Solids not to rise by more than 30%

- no accumulation of solids at the sea bed

Eutrophication

A phenomenon observed when too much nutrient promotes excessive algal growth which disrupts normal oxygen balance.

Existing Total Inorganic Nitrogen WQO for different Water Control Zones in Hong Kong



To protect food supply :

- No discharge of toxic substances that will lead to accumulation in biota

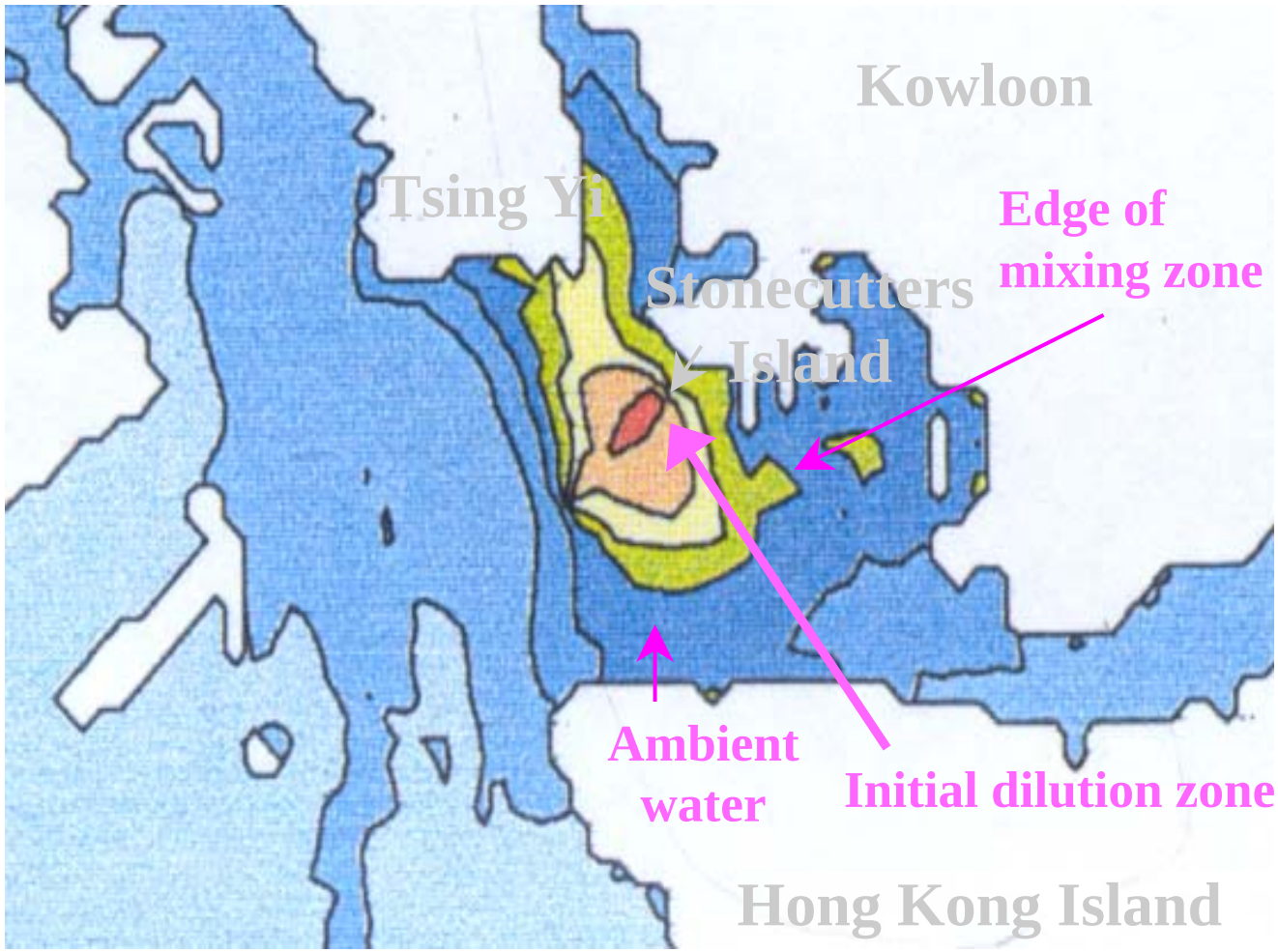
To protect swimmers :

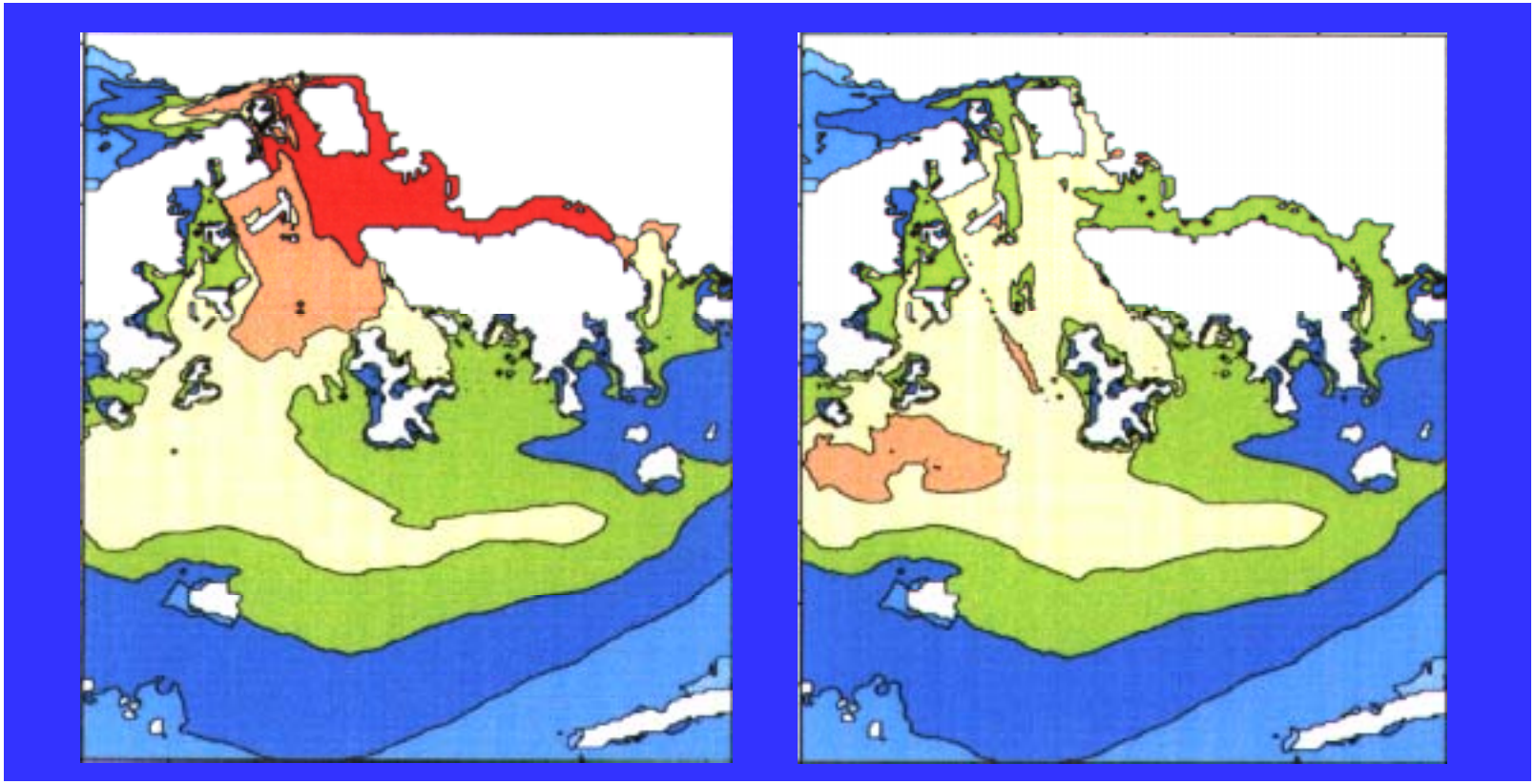
- Geometric mean *E.coli* less than 180 counts/100ml

Why do we need Water Quality Criteria (WQC) ?

- WQOs are long term goals for facilities planning and pollution control strategy development.
- WQC are for assessing project-specific impacts, e.g. impacts at the initial dilution zone and mixing zone of a discharge.

Diagrammatic Representation of Initial Dilution and Mixing Zone





Dissolved Oxygen (mg/l)
(wet season)

Typical Output of a Far-field Dispersion Model

How to decide which criteria should apply where?

- For toxic substances, the area in which the criteria are exceeded must be minimized => hence criteria should be met at the edge of the IDZ.

- For other substances, there is more flexibility, but the bottom line is that the criteria should be met at the point where relevant sensitive receivers are encountered.

Examples :

- Bacteria criteria must be met at
  - Beaches
  - Secondary contact recreation zones
  - Water intakes
- More stringent nutrient criteria must be met in areas more susceptible to eutrophification

In what way will the WQC guide us ?

- Through impact assessment, the following will be determined in terms of WQC compliance :
  - acceptability of each discharge
  - the related effluent standards
  - precise outfall locations
- Assessment results are guidance for subsequent engineering design of the facilities

Iterative process

While we have been able to propose criteria as a starting point, based on what we know about local conditions at different locations, the process of refining the criteria and their area of application will require input from the local scientific community.

With this input, we will be able to determine, through computer modeling, the combinations of outfall locations and levels of treatment that are needed to meet the relevant criteria in those areas where the local scientific consensus agrees they should be met.

What are the initial proposals for the WQC ?

- WQC to be based on BUs of the water bodies
- WQC for different specific needs proposed:
  - At edge of initial dilution zone
    - mainly WQC for conservative substances (e.g. toxic metals, etc.)
  - At edge of mixing zone - mainly WQC for non-conservative substances (e.g. nutrients and DO)
  - WQC for specific beneficial uses and zones
    - e.g. E.coli criteria for bathing beaches

What is the way forward ?

- EEFS consultant to review the initial proposal
- Consultation with the academic community, green groups, professional bodies and other stakeholders
- Refine general consensus
- Report findings to MG

Monitoring Group on Trials and Studies for HATS
4th Meeting at 2:30 p.m. on Monday, 28 October 2002

Present:

Mrs Rita Lau	Permanent Secretary for the Environment, Transport and Works (Chairman)
Professor Leonard Cheng	
Dr Albert Koenig	
Prof Rudolf S S Wu	
Ms Iris Tam	Member of Advisory Council on the Environment
Dr Ng Cho-nam	Member of Advisory Council on the Environment
Mr Chan Bing-woon	
Mr Jimmy Kwok Chun-wah	
Mrs Josephine Mak Chen Wen-ning	
Mr Robert Law, JP	Director of Environmental Protection
Mr Raymond Cheung, JP	Director of Drainage Services
Mr Raistlin Lau	Principal Assistant Secretary for the Environment, Transport and Works (E) 1(Secretary)

In attendance:

Mr Donald Tong	Deputy Secretary for the Environment, Transport and Works (E) 1
Mr Benny Wong	Assistant Director of Environmental Protection
Dr Malcolm Broom	Principal Environmental Protection Officer, EPD
Mr S K Aggarwal	Assistant Director of Drainage Services
Mr W W Chui	Chief Engineer, Drainage Services Department
Miss Christina Chong	Assistant Secretary for the Environment, Transport and Works (E) 1A
Mr John Gall	CDM (on agenda item 4 only)
Mr James Chan	CDM (on agenda item 4 only)
Dr Thomas Chung	Department of Health (on agenda item 5 only)

Absent with apologies

Professor Peter Hills	Member of Advisory Council on the Environment
Dr Ho Kin-chung	Member of Advisory Council on the Environment
Mr W S Chan	Deputy Secretary for the Environment, Transport and Works (Works Policy)

Discussion **Action**

The Chairman introduced herself to Members and welcomed them to join the first meeting chaired by her.

2. The Chairman suggested and the meeting agreed to swapping agenda item 4 with item 3 so as to advance the briefing by CDM - the Environmental and Engineering Feasibility Studies (EEFS) Consultant – on the Water Quality Criteria (WQC).

I. Confirmation of the minutes of the 3rd meeting

3. The revised minutes of the 3rd meeting sent to Members on 23 October 2002 were confirmed without further amendment.

II. Matters arising

Para. 10

4. The Secretary reported that the EEFS Consultant had prepared a covering consultation document setting out issues related to the Water Quality Objectives and WQC in layman's terms for public consumption. The document was also copied to Members in June prior to release.

Para 11

5. The Secretary reported that the risk relating to organizing swimming events in the Harbour would be further discussed under agenda item 6.

Para 12

6. The Secretary reported that the consultation process for the proposed WQC was completed and Members were closely involved throughout the consultation process.

Paras 13 and 16

7. The Secretary reported that after taking into account views expressed during the consultation period, the EEFS Consultant had not proposed any change to the criteria for Total Inorganic Nitrogen (TIN). He proposed that issues arising from the above decision be discussed under agenda item 4.

Para 26

8. The Secretary reported that the Environmental Protection Department (EPD) was about to start a round of general briefings for District Councils on HATS to update them on the achievement and progress made so far and to prepare them for the future consultation on the way forward for the remaining stages of HATS.

Para 27

9. The Secretary reported that ETWB and EPD were considering the overall consultation strategies and would present a paper to set out the recommendations of the Administration for discussion by the MG in due course. ETWB/ EPD

III. WQC for EEFS (Paper No. MG(2002)05)

10. The Chairman welcomed Messrs John Gall and James Chan of CDM. After brief introduction on the paper by Dr Malcolm Broom, Mr Gall gave a PowerPoint presentation to Members on the process and findings of the WQC consultation, and the finalized WQC (Presentation materials at Annex). In brief, the Consultant proposed to retain the previously proposed WQC except that the dissolved oxygen (DO) criteria to be applied in fish culture zones would be the same values as the existing Water Quality Objectives (WQO). The Consultant would also adopt a less mechanical approach in dealing with the WQC, by engaging its science team to assess all the evidence in arriving at a view on the likely impacts of different options.

11. Prof Leonard Cheng asked if the Consultant would consider recommending refinement of WQC or relocation of certain habitats from the Victoria Harbour if the assessment of the science team was that the WQC were not adequate to ensure the continued survival of those habitats. He also had doubt on why the DO criteria would not be able to support some existing fish culture zones if the fish could survive under worse conditions without the HATS. He asked whether the Consultant would recommend relocating the fish culture zones or amending the WQC if they also arrived at the same conclusion. Mr Gall responded that the WQC were set with regard to the general uses of the waters, instead of the specific requirements of individual habitats and operations. However, as the water quality of the Harbour would likely improve after the completion of the remaining stages of HATS, he expected that those habitats or fish culture zones which existed at the moment should be able to survive better in future. Mr Gall also cautioned that relocating a habitat was a very complicated process and overseas experience had so far indicated no guarantee for success. He would not recommend it as a general solution.

12. Prof Rodulf Wu welcomed the additional scientific assessment process. However, he commented that the ammonia criteria might be too stringent and thus might escalate the cost unnecessarily. He suggested that the science team should revisit the criteria later. Prof Wu also observed that the WQC for fish culture zones were more stringent compared with the background levels outside the zones, making the WQC in question very difficult to achieve in practice. He was concerned that this might pose great difficulties for implementing the remaining stages of HATS.

13. Mr Gall responded that the WQC were drawn up after extensive consultation with concerned parties such as green groups, professional bodies and the academia. He noted that the need to ensure appropriate protection for the fish culture zones had been raised by the Advisory Council on the Environment and that the Consultant felt it was appropriate, in this regard, to recommend adoption of the existing WQO. He observed that the general sentiment in comments received had in fact shown a preference for higher standards in Victoria Harbour even though the resources there might not be considered of high value.

14. Dr Albert Koenig commented that the proposed pH range of 6.5 to 8.5 for the edge of the initial dilution zone was skewed towards the low end given that the normal pH of sea-water was 8.1 and sometimes beyond 9. In response, Mr Gall said that the proposed pH range was widely adopted globally.

15. Prof Wu suggested that the testing conditions for acute toxicity should be set out more clearly. In particular, the kind and number of species used for testing should be stated clearly. Mr Gall agreed. CDM

16. Dr Ng Cho-nam enquired about the application of WQC in the initial dilution zone and the mixing zone and whether the size of the two zones could be demarcated clearly. Mr Gall explained that the size of the initial dilution zone would be quite specific as it was defined in terms of the predicted behaviour of the plume, which would normally fall within about 250m of the discharge point. As for the size of the mixing zone, it might vary depending on several factors such as the components of effluent, the background in the receiving water and the resources likely to be impacted. There would thus be an element of subjectivity in determining the permissible size of the mixing zone for any one component. This would be arrived at through an iterative process involving assessment by the Consultant's science team.

17. Dr Ng asked whether it was necessary to conduct new environmental impact assessment (EIA) given that new WQC had been drawn up. Dr Broom advised that the EEFS would only examine the feasibility of the options. No EIA would be required until there was a specific project proposal. Dr Ng said that he was under

the impression that it was a requirement under the EIA Ordinance to use WQO in EIA. Dr Broom clarified that there was no statutory requirement to use WQO for evaluation of a designated project although in practice this was usually the case. Mr Rob Law added that the guidance of the EIA Authority was that the WQO could be used but a project proponent would not be barred from applying standards higher than the WQO.

18. The meeting endorsed the finalized WQC and the inclusion of the scientific assessment process.

(The EEFS consultants left the meeting at this point.)

IV. Progress Report on Trials and Studies for HATS - MG(2002)04

19. The Chairman informed the meeting that good progress had been made on the trials and studies since the last MG meeting in February. The Secretariat had also provided Members with an interim progress report on the trials and studies in August. She pointed out that the paper MG(2002)04 aimed to report the latest progress of the trials and studies as well as to seek Members' views on two specific issues, namely whether the EEFS Consultant should prepare an additional set of layout design for the remaining stages of HATS; and whether the Compact Sewage Treatment Technology Trials should be extended for three more months.

20. Mr Wong took members through the paper. He reported that in general, all trials and studies were on schedule.

An additional set of layout design (Annex A to the paper)

21. In response to Dr Koenig, Mr Wong said that the first set of layout design would be based on the treatment level recommended by IRP, i.e nitrification while the second set of layout design would likely be based on nitrification plus denitrification and disinfection.

22. On Dr Ng's question regarding whether the layout design would take into account the effluent reuse possibility and Dr Koenig's suggestion of using the treated effluent for water-cooling and toilet flushing, Dr Broom said that the relatively high salinity of the incoming sewage could create technical problems for reuse of the treated effluent. The Chairman said that the Secretary for the Environment, Transport and Works attached great importance to water conservation and was keen on promoting effluent reuse. The Government was discussing with the Mass Transit Railways Corporation Limited on a pilot scheme of reusing the treated effluent from Ngong Ping Sewage Treatment Works at present. In the light of the experience gained from the pilot scheme, the

Government would be in a better position to explore further opportunities for effluent reuse in Hong Kong. Mr Law added that since the urban areas around the Harbour had been using sea-water for toilet flushing purpose, reuse of the treated effluent from Stonecutters Island for toilet flushing would help little in terms of fresh water conservation. Mr Raymond Cheung also pointed out that given the huge volume of effluent produced from HATS Stage I system, it would be difficult to reuse it in a gainful manner.

23. Prof Cheng supported the proposal of asking the EEFS Consultant to prepare an additional set of layout design in order to better assess the implications of different treatment levels. Mr Jimmy Kwok concurred that the additional expenditure of $1.5M for preparing an additional set of layout design would be well justified, as the information obtained would be useful in the future public consultation process. Mr Kwok also reminded that proper Chinese translation of consultation materials should be made available in consulting the DCs in future. Ms Tam also supported the proposal

EPD/ CDM

24. In response to Ms Tam and Dr Koenig, Mr Benny Wong advised that the estimated budget of $1.5M for the additional set of layout design was based on the latest quotation from the EEFS Consultant and it should cover changes due to larger site requirements.

25. Mrs Josephine Mak asked if further sets of design would be necessary to cover treatment options in between the basic and the highest levels. Prof Cheng said that treatment options in between would likely involve repackaging of various treatment processes only.

26. After discussion, the meeting agreed that the EEFS Consultant should be asked to prepare an additional set of layout design as proposed by EPD.

Extension of trial period for CSTTT

27. Mr Satish Aggarwal said that one Biological Aerated Filter (BAF) contractor had proposed three alternative configurations and the other BAF contractor had proposed two. Both BAF contractors had taken more time than expected to stabilize their processes but they had recently commenced the testing of their second configurations. If the trial period could be extended, then the two BAF contractors would be able to test their first configurations again in winter after completing the full testing of their second configurations. However, he pointed out that the EEFS Consultant would only rely on the data contained in the interim report to be issued in October 2002 for carrying out their studies. Further data gathered from the extended trials would be too late for the EEFS studies.

28. Prof Wu noted from the progress report that the Submerged Aerated Filter (SAF) pilot plant had experienced some problems with the media and the system had just been stabilized. He questioned whether there would be sufficient data for analyzing the feasibility of the SAF technology in Hong Kong if the trial period was not extended and whether SAF would be ruled out as a result. Mr Aggarwal responded that the SAF contractor had only proposed one configuration and it was already running on 70% of the design capacity. Therefore, the SAF contractor should have adequate time to complete the testing of its configuration in the remaining months. He added that the interim report on trials would be based on their findings up to August 2002.

29. Prof Cheng expressed concern over the comprehensiveness of the interim report if only findings up to August were included. He said that the biological process in hot and cold seasons might be very different and the interim report would not contain adequate information if it could only reflect the findings in the hot season. He pointed out that as the coldest month in Hong Kong was February, it would be of value to extend the project so that information on operability at that time could be obtained.

30. Mr Benny Wong said that it would be acceptable to take forward the EEFS based on the interim report. The general expectation of the public was that the Government should complete the trials and studies on HATS promptly, and it would be undesirable to hold up the EEFS to wait for completion of the whole trial. Morever, the BAF technology had been well-proven in Europe where cold season data were abundant. The data obtained from the local trials in the hot season plus cold season data obtained from overseas should provide sufficient reference for the EEFS Consultant to start working on the layout design. Finally, in finalizing their conclusions next summer the EEFS Consultant would still have time to take into account any new data that became available. Moreover, the future project proponent for the remaining stages of HATS would still have ample time to conduct detailed trials on the selected technology during the detailed design and planning stage.

31. Dr Koenig commented that even though February should be the coldest month in Hong Kong, the effect due to a further minor drop in temperature could be predicted and extrapolated in the absence of actual trials. In response to Prof Cheng, Mr Aggarwal confirmed that the trial period could be extended on a monthly basis up to a maximum of three months and the monthly cost for three plants would be around $600,000. However, the contractors would need to be promptly advised on whether the extension option would be exercised in order to plan for the deployment of their expatriate staff.

32. Dr Ng asked whether it was possible to extend individual trial contracts,

instead of all three of them. Dr Koenig commented that it would not be desirable to do so as it might give the wrong signal that the Government had already decided to pick a particular technology. Mr Kwok suggested that the least promising trial should not be extended. The Chairman said that it would not be appropriate to single out a particular trial for extension. In response to Dr Koenig, Mr Aggarwal said that nitrification was the process causing the complication and denitrification was a relatively straight forward process. He also clarified that the two BAF contractors were testing the second configuration of their pilot plants in September and they had already finished the testing of their first configuration in the hot season.

33. The Chairman said that since extension of trials involved additional expenditure, she would like to be satisfied that the extension was essential and that drawing reference from overseas experience would not be relevant. Mr Wong commented that the limitation of relying on overseas experience was that the local sewage was saline and of higher temperature. Dr Koenig commented that there were plenty data about the performance of the technologies in cold weather.

34. Prof Cheng advocated strongly that the trials should be extended to cover February. In conclusion, the Chairman said that taking Members' views and the explanation given, she would support extending the trials of all three plants for an extra month in order to capture the data for the month of February. She asked the Drainage Service Department (DSD) to explore if funds were available and to inform Members by way of a post-meeting note. (**Post-meeting note**: DSD has confirmed that it could absorb the expenses for the one-month extended trial and would make the necessary arrangement with the contractors accordingly.) DSD

35. Dr Ng suggested that the evaluation of the pilot plant trials should take into account the amount of resources used to monitor and manage the pilot plants, as it would serve as useful pointers in estimating the amount of resources required to manage a full-scale system. DSD

V. HATS Publicity – An annual cross-harbour swim as an achievable benefit of HATS - [MG (2002)06]

36. Dr Thomas Chung from the Department of Health joined the discussion. Dr Broom gave a brief introduction on the paper.

37. Mr Law said that he had been approached by the media and the public frequently on whether and when cross-harbour swimming could be allowed. This issue had clearly become the focus of attention when people discussed HATS. From the publicity perspective, the holding of a cross-harbour swimming event upon the completion of the subsequent stages of HATS might enable people to

visualize the benefits of HATS, thus securing their support. However, he stressed that the Harbour was not intended for regular swimming. Therefore, even after the completion of the remaining stages of HATS, swimming in the Harbour could still be subject to health risks posed by residual pollution loads due to non-point source pollution. It would not be possible to completely eliminate the risk of infection.

38. Prof Wu agreed with Mr Law and expressed concerns about the risks associated with cross-harbour swimming. He said that HATS would suffer a major PR disaster in case a few people got sick after swimming in the Harbour. Dr Ng remarked that the HATS system could suffer further damage should people get infected even after disinfection facilities were installed into the HATS. Dr Ng also pointed out that the problem of floating refuse should also be addressed although he understood that it was beyond the remit of HATS.

39. Dr Koenig said that if the E.coli level of 212 per 100 ml was the actual measurement, he saw no good reason to disallow cross-harbour swimming provided that participation was totally voluntary and the Government had taken all reasonable precautionary measures to publicize and minimize the risks involved. In response to Dr Ng, Mr Wong said that the E.coli level in the eastern Harbour was much lower than the level in Shing Mun River which was around 1,000-2,000 per 100 ml. In reply to Ms Tam, Mr Law said he would not advise the public to consume fish caught in the Harbour. The Chairman also remarked that the western Harbour was still receiving untreated sewage from the northern shore of Hong Kong Island and the fact spoke for itself.

40. Prof Cheng made reference to the E.coli removal efficiency of CEPT plus BAF without disinfection shown in Table 1 of the paper and asked if 95% was an estimate or actual figure. Mr Aggarwal said that the figure was an estimate. The testing carried out for a limited period during the pilot plant trials indicated that the E.coli removal efficiency of BAF could be above 99%. Dr Koenig concurred that the 95% figure was probably on the conservative side and the actual E.coli removal efficiency of BAF should be better. In light of the notable reduction in bacteria levels in the eastern Harbour, Prof Cheng opined that the Government might consider a more robust strategy in publicizing the achievement of HATS, by pointing out the fact that the water quality of the eastern Harbour was comparable to a "poor" graded beach.

41. Mr Law cautioned that while the Government could publicize the improvement, it should not make any explicit recommendation on cross-harbour swimming. Nevertheless, he anticipated that questions would still be thrown to the Government on whether the Harbour was suitable for swimming after the commissioning of all stages of HATS. His personal view was that the Harbour was still not suitable for regular swimming even by then.

42. The Chairman said that the question of cross-harbour swimming would bound to be raised when the Government reported progress of the trials and studies to LegCo Panel in November. A well-considered response would need to be formulated. She said that an annual cross-harbour swimming event would be appealing to the public as a tangible benefit of HATS. Under the present economic climate, securing funding support from LegCo for the remaining stages of HATS would not be an easy task and helping the public to visualize the benefits of HATS should form part of the strategy for building up our case. She hastened to add however that the Government had to disseminate truthful and honest information about the risk involved and should make it clear to any potential organizer. In any event, whether the swim could be organized would depend on whether the application would be able to meet with the requirements and approval of the relevant authorites. ETWB/ EPD

43. Prof Cheng said that the monitoring results of EPD on the bacteria levels were scientific data and there was no reason to object to their release. In response to Dr Koenig, the Chairman said that the monitoring results of EPD would probably be released to the EAP as part of the progress report on the trials and studies. Prof Wu said that the Government should have an obligation to ensure what it promoted would be acceptable from the public health angle and he suggested that the Government should not actively promote cross-harbour swimming as an ultimate goal for HATS. The meeting agreed that the aspiration of the community for cross-harbour swimming should be addressed in the future publicity strategy but the risk involved should be clearly set out as well. The meeting noted that the upcoming EAP meeting in November would be the first opportunity to collect public feedback on the proposition in the paper. ETWB/ EPD

44. Mrs Mak opined that the pamphlet on HATS was very useful as it provided a general background on HATS in layman terms and she suggested that the pamphlet should be widely distributed to schools and other relevant organizations. Ms Tam also commented that the model on HATS Stage I System displayed at the infrastructure exhibition in the City Hall was very impressive and it would be an appropriate venue to distribute the pamphlets. EPD

VI. AOB

45. Dr Koenig informed the meeting that he had earlier requested the Secretariat to look into whether the Independent Checker (IC) appointed by DSD for the pilot plant trials had had any collaboration with one of the trial contractors in his capacity as a staff member of the Hong Kong University of Science and Technology (HKUST) before; and if so, whether it would constitute any conflict of interest. Dr Koenig clarified that he did not have any doubt about the integrity of

the IC but he considered it important to set the record straight. Mr Aggarwal reported that DSD had investigated into the case and found no conflict of interest. He added that DSD had employed a number of staff to monitor the trials and appointed an Independent Laboratory to test the results of the trials. It was most unlikely that the IC would be able to influence the outcome of the pilot plant trials in any inappropriate manner.

46. The Secretary supplemented that the IC himself, the management of the trial contractor and the President and CEO of HKUST Research and Development Corporation had all written to DSD to confirm that the IC had never taken part in any research collaboration between HKUST and the parent companies of the trial contractor in question.

VII. Date of Next Meeting

47. The Chairman informed Members that the next meeting was tentatively scheduled for January 2003. The Secretary would confirm the exact date with Members nearer the time and would continue to update Members on major progress on the trials and studies before the next meeting. Secretary

Environment Branch
Environment, Transport and Works Bureau
November 2002

Environmental and Engineering Feasibility Assessment Studies in Relation to the Way Forward of the Harbour Area Treatment Scheme

Water Quality Criteria Briefing for

The HATS Monitoring Group

Agenda

- Process Followed
- Summary of Key Issues
- Questions and Discussions

Solicitation of Stakeholder Input

- Distribution of Briefing Document on June 1
- Call for Written Comments by July 27
- Special Briefing of Advisory Council on the Environment on June 17
- Viewsharing Workshop for All on June 22
- Follow-up Meetings Offered to All Who Provided Comments

Focus of Comments

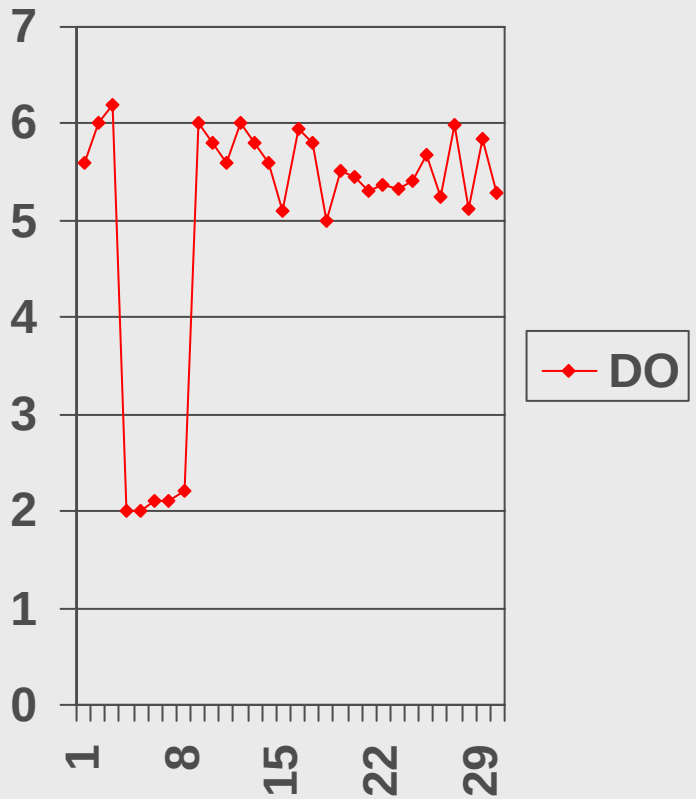
- Policy Matters – 12 comments
- Dissolved Oxygen – 20 Comments
- Nutrients – 16 Comments
- Pathogens – 8 Comments
- Miscellaneous- 29 Comments

Central Issues

- Application of the Criteria
- Dissolved Oxygen
- Nutrients
- Other Contaminants

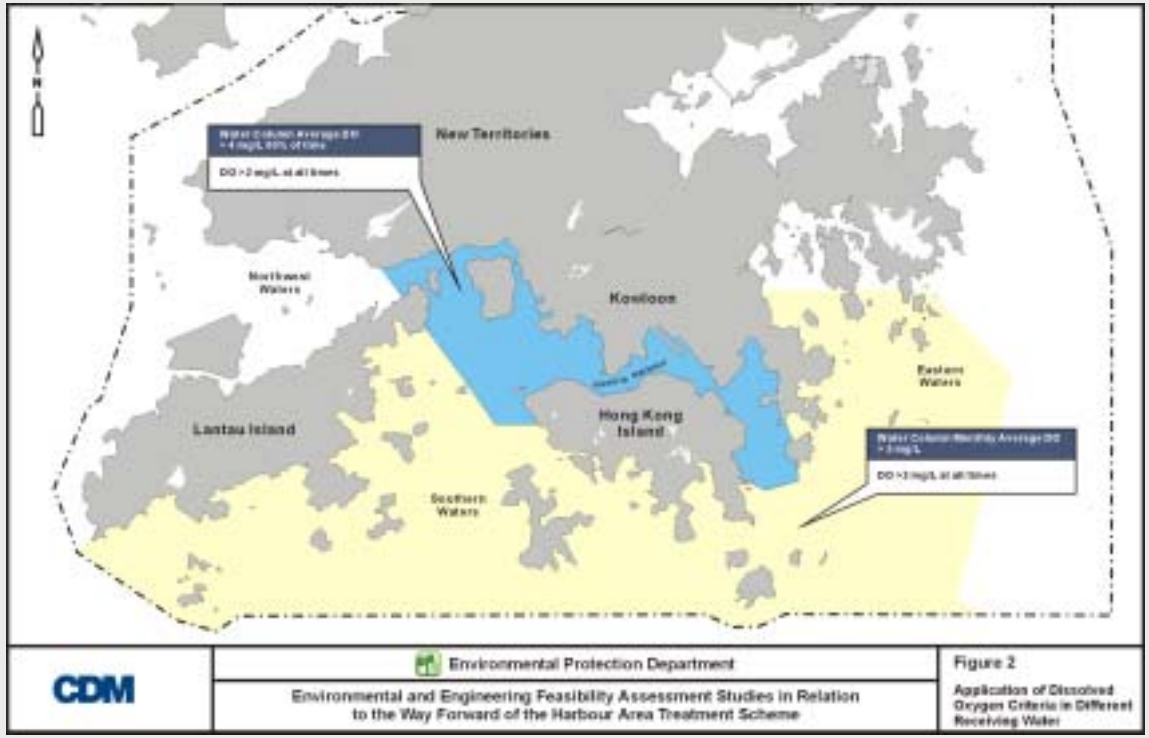
Application of the Criteria

- Concern that rote application of criteria could lead to technical compliance but damaging effects
- In response we note that the WQC are not the only measure of acceptability – a full assessment of HATS impacts by our science team is as important



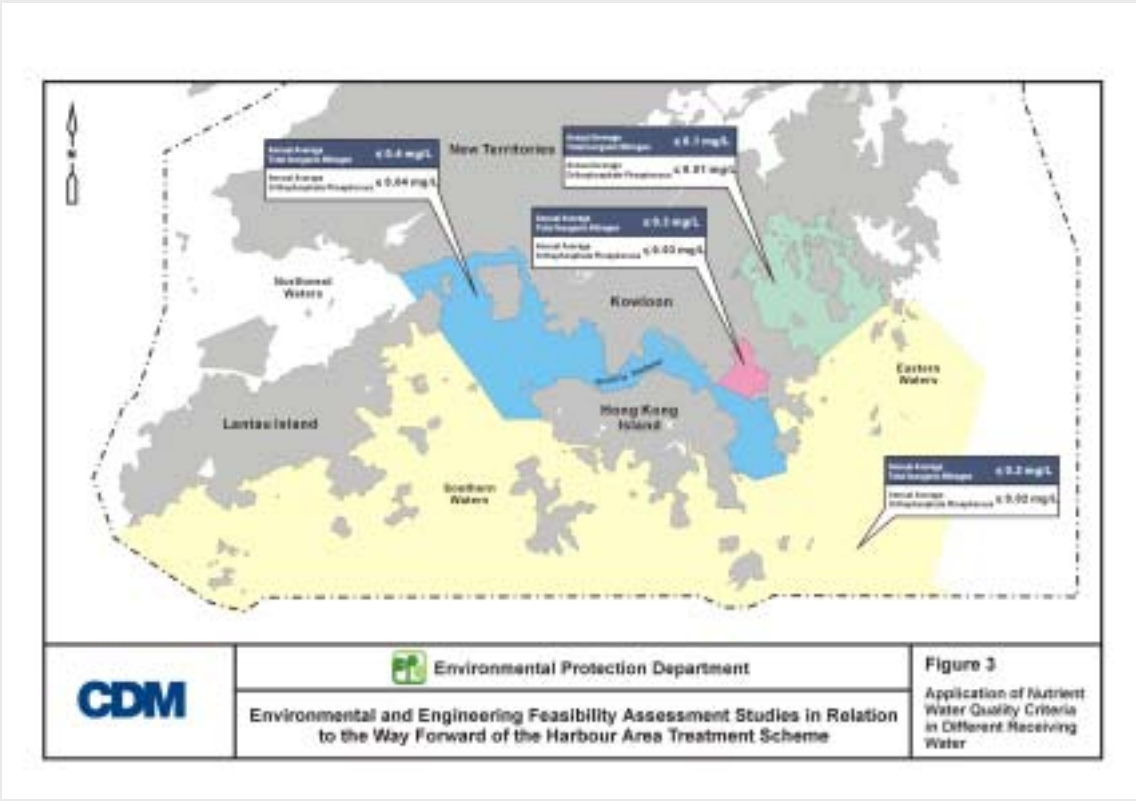
Dissolved Oxygen

- WQC for Fish Culture Zones should match WQO
- Victoria Harbour WQC for DO should be the same as elsewhere



Nutrients

- A general call for more stringent nutrient limits as a matter of policy
- Call for establishment of limits at levels appropriate to highly sensitive waters



Other Contaminants

- A general call for expansion of bathing related bacteriological WQC to encompass Victoria Harbour, not simply bathing beaches
  - Issue is one of policy related to harbour uses, more so than the development of WQC for the assessment of HATS options
  - Our study brief requires the evaluation of treatment with and without disinfection. Thus, information to support policy deliberations available through HATS studies

Summary of Changes

- **Modify WQC for Dissolved Oxygen for fish culture zones**
- **Emphasize assessment process as part of HATS evaluations in future deliberations**
- **In other respects, maintain the criteria as presented**

Monitoring Group on Trials and Studies for HATS
5th Meeting at 2:30 p.m. on Thursday, 3 July 2003

Present:

Mrs Rita Lau	Permanent Secretary for the Environment, Transport and Works (Chairman)
Prof Leonard Cheng	
Dr Albert Koenig	
Prof Rudolf S S Wu	
Ms Iris Tam	Member of Advisory Council on the Environment
Dr Ng Cho-nam	Member of Advisory Council on the Environment
Dr Ho Kin-chung	Member of Advisory Council on the Environment
Mr Chan Bing-woon	
Mr Jimmy Kwok Chun-wah	
Mrs Josephine Mak Chen Wen-ning	
Mr Robert Law	Director of Environmental Protection
Mr George Lai	Director of Drainage Services
Mr Raistlin Lau	Principal Assistant Secretary for the Environment, Transport and Works (E) 1(Secretary)

In attendance:

Ms Doris Cheung	Deputy Secretary for the Environment, Transport and Works (E) 1
Mr Benny Wong	Assistant Director of Environmental Protection
Mr. Peter Baldwin	Principal Environmental Protection Officer, EPD
Mr S K Aggarwal	Assistant Director of Drainage Services
Mr W W Chui	Chief Engineer, Drainage Services Department
Dr Samuel Chui	Assistant Secretary for the Environment, Transport and Works (E) 1A
Mr John Gall	CDM (on agenda item 4 only)
Mr James Chan	CDM (on agenda item 4 only)
Dr. K D Yin	CDM / Hong Kong University of Science and Technology (on agenda item 4 only)
Dr. Cynthia Yau	CDM / Hong Kong University of Science and Technology (on agenda item 4 only)
Prof Howard Huang	Independent Checker of Compact Sewage Treatment Technology Trials, Hong Kong University of Science and Technology (on agenda item 5 only)
Mr Henry Tam	Senior Engineer, DSD (on agenda item 5 only)

Absent with apologies

Professor Peter Hills	Member of Advisory Council on the Environment
Mr W S Chan	Deputy Secretary for the Environment, Transport and Works (Works Policy)

Discussion

1. The Chairman welcomed Members to the 5th MG Meeting. The Chairman explained that the 5th MG meeting had been postponed from 15 April 2003 to 3 July 2003 owing to a number of unexpected hiccups. First of all, the outbreak of SARS had put considerable strain on the Government. As a result, many departments, including both the Drainage Services Department (DSD) and the Environmental Protection Department (EPD), had to redeploy their resources to deal with SARS related issues at the expense of their normal activities in April and May. Separately, the Compact Sewage Treatment Technology Trials (CSTTT) and the Environmental and Engineering Feasibility Studies (EEFS) had also encountered specific problems of their own. For the CSTTT, it was DSD's original plan to present the preliminary key results of the trials to the MG in April. However, as the trials had been extended by one month to cover the winter month of February, the trial contractors could only finish their draft final reports by May. DSD then took a few weeks to go through the reports with the contractors with the help of the Independent Checker. As regards the EEFS, the Dutch and US specialists working for CDM were not able to travel to Hong Kong as planned when the travel advisories of the World Health Organization and US Center for Disease Control and Prevention were in force. Moreover, the compilation of the cost estimates and preparation of the schematic designs were also more complicated than CDM had originally envisaged. As a result of these interruptions, the EEFS was some two months behind schedule. The Chairman reassured Members that the Government was committed to keeping Members closely informed of the latest findings of the trials and studies and would press on with the remaining work now that the SARS saga had come to an end.

I. Confirmation of the minutes of the 4th meeting

2. The revised minutes of the 4th meeting sent to Members on 24 April 2003 were confirmed without further amendment.

II. Matters arising

3. **Para. 8 –** The Secretary reported that EPD had completed the first round of briefing for District Councils (DCs) in mid June. DSD also organized an open day at the Stonecutters Island Sewage Treatment Works on 1 & 2 March with around 8,300 people attended.

4. **Para. 9 –** The Secretary reported that EPD had received some useful feedback from the DCs regarding future consultation on the way forward for HATS. The Administration would take into account these suggestions in formulating the consultation strategies and would present the consultation plan to the MG for discussion in due course. **(Action: ETWB/EPD)**

5. **Para. 15 –** The Secretary suggested CDM be asked to give detailed response as appropriate when agenda item 4 was discussed.

6. **Para. 19 –** The Secretary reported that the executive summary of the interim report of the CSTTT (Paper MG(2002)08) was distributed to all MG Members on 19 December 2002.

7. **Para 34 –** The Secretary reported that the CSTTT was extended by one month to cover the coldest month - February.

8. **Para 35 –** The Secretary suggested DSD giving further details on the amount of resources required to monitor and manage the pilot plants when agenda item 5 was discussed.

9. **Para 42 and 43 –** The Secretary reported that the Legislative Council's Panel on Environmental Affairs (EAP) and the Advisory Council on the Environment (ACE) were briefed of the progress of the trials and studies in November and December respectively. The EAP did not raise any question concerning cross-harbour swimming. As for the ACE, the Council generally welcomed the idea of an annual cross-harbour swimming event but some members also stressed that it would be important to inform the public of the potential health risk clearly.

10. **Para 44** – The Secretary reported that the publicity materials on HATS were distributed as suggested by Members.

III. Progress Report on Trials and Studies for HATS – (Paper No. MG(2003)03)

11. The Chairman invited Mr. Benny Wong of EPD to report the progress of the trials and studies for HATS. Mr Wong took Members through the paper. Members did not raise any question but noted that there was a projected slippage in the programme of the EEFS by about two months.

IV. Water Quality Assessment for the Environmental and Engineering Feasibility Studies – (Paper No. MG(2003)04)

12. The Chairman welcomed Mr. John Gall, Mr. James Chan, Dr. K D Yin and Dr. Cynthia Yau of CDM/HKUST. Mr. John Gall gave a PowerPoint presentation to Members on the water quality modeling results and the initial findings of water quality assessments (Presentation materials at Annex A).

13. With reference to the initial findings presented by CDM, the Chairman invited Members to express views on CDM's assessment that Phosphorus (P) was the limiting nutrient and hence denitrification would not be necessary provided that effort was made to reduce the discharge of P. She also invited Members' views on CDM's preliminary recommendation of providing disinfection for the HATS discharge on a precautionary basis.

14. In response to Prof. Rudolf Wu's enquiry, Mr. Gall reported that the criteria used for options evaluation were those agreed at the 4th MG meeting and the modeling results indicated that specific criteria for the Zone of Initial Dilution were met for all the IRP Options tested. The specific ammonia criterion included the annual average unionized

ammonia of 0.021 mg/L, which could probably be met without full-nitrification. The total inorganic nitrogen (TIN) level in the Victoria Harbour was predicted to be around 0.2 – 0.4 mg/L depending on whether denitrification would be provided.

15. Prof. Wu asked CDM to substantiate its conclusion that P was the limiting nutrient. Dr. K C Ho also asked CDM to clarify its methodologies of conducting the analysis and whether the P-limiting conclusion was applicable to a harmful red tide only or to an algal bloom in general. Dr. Ho opined that since there were two key algae, namely diatom and dinoflagellate, which could cause red tides in Hong Kong but would compete with each other at different Nitrogen (N) and P ratios, CDM's analysis would be conceptually wrong if only chlorophyll-a analysis was conducted without bioassay analysis.

16. Dr. K.D.Yin responded that the study was based on the community approach with seawater collected from the concerned area for algal growth and bioassay analysis to simulate the natural condition. Other than N:P ratio, the study also investigated the effect of P-concentration, the dilution factor and the vertical water column mixing condition on the algal growth potential. Dr Yin stressed that their findings were in line with EPD's historical environmental monitoring data.

17. In view of Members' strong interest in continuing with the technical discussion on the P-limiting conclusion, the Chairman suggested EPD organize a separate forum for more in-depth technical exchange on the nutrients issue. Prof. Wu considered that it was crucial to clarify whether the water was N-limiting or P-limiting before considering whether denitrification was necessary. He further requested EPD to provide the details of CDM's analysis to Members before the technical meeting. Mr. Robert Law said that EPD and CDM did arrange a technical view-sharing workshop on 20-21 June 2003 to discuss the technical details relating to the water quality assessment and Members were invited to the workshop as well. It was unfortunate that interested Members were not able to attend the workshop ultimately. He welcomed the Chairman's suggestion of arranging another forum to go through the technical aspect of the assessments with interested Members and undertook to provide the details of CDM's analysis in advance. **(Action : EPD)**. That said, Mr. Law reminded Members that since the HATS discharge would mostly affect the western Harbour area instead of the eastern waters, historical events happened in the eastern waters might not be relevant in deliberating the conclusion drawn by CDM.

18. Dr. Albert Koenig asked CDM when the recommended effluent standards would become available. Mr. Gall responded that the initial water modeling results had indicated that most of the proposed water quality criteria could be complied by adopting the four IRP options. The results had also revealed that while nitrification would be necessary, full nitirification would unlikely be required to achieve the ammonia standard. As regards how these observations should be translated into specific effluent standards, it would be up to EPD as the relevant authority under the law to decide.

19. Mr. Law said EPD was rather relaxed about the setting of effluent standards as the imminent key issue should be to foster a general consensus on the level of treatment required under HATS, taking into account the environmental factors and cost implications. He opined that the setting of appropriate effluent standards should be consequential upon the formation of a general consensus in the community.

20. Prof. Leonard Cheng asked CDM whether the Dissolved Oxygen (DO) level and the nutrients levels in the ambient waters were influenced by the Pearl River flows or the oceanic currents and whether the modeling runs had taken into account future changes. Mr. Gall responded that the low DO level was attributable to both the Pearl River flows and the oceanic currents from the South China Sea. For nutrients, whilst N was mainly brought along by the Pearl River flows, P came from both the Pearl River flows and the oceanic currents. The model runs were conducted based on the treatment levels assumed under the IRP options for the sewage from the HATS catchments. For the Pearl River Delta, the modeling assumed a 35% increase in flow but its effect was offset by an increased investment in sewage treatment in PRD.

21. Mr. Ho advocated that denitrification should be pursued on a precautionary basis, regardless of whether N or P should be the limiting nutrient. He argued that the conclusion of CDM was based on the N- or P-limiting approach but he considered it important to take into account the overall nutrient levels and to follow the precautionary principle.

22. The Chairman stressed that all treatment options would have cost implications and it was always important to justify any recommendation on the remaining stages of HATS having regard to actual environmental needs substantiated by sound scientific arguments.

23. Dr. Koenig did not consider there was a need for denitrification. Mr. Jimmy Kwok commented that it was important to consider the cost implications. He considered that under the current economic outlook, it was unlikely that Hong Kong could afford the recurrent and capital costs for denitrification. Mr. Chan Bing-woon shared Mr. Kwok's view.

24. Ms. Iris Tam asked about the cost differential between P-removal and N-removal. Mr. Gall responded that CEPT was very effective in P-removal. By doubling the dose of the Iron(III) Chloride ($FeCl_3$) used in CEPT, he believed that the P-removal rate would increase from 60% to 80% with only a slight increase in sludge production. Unlike N-removal by means of denitrification which required a large number of additional treatment units, P-removal did not require major capital investment as the essential chemical dosing facilities were already there. Moreover, the recurrent cost of dosing $FeCl_3$ was also much lower than that of methanol.

25. Dr. Ng Cho-nam observed that even though both disinfection and denitrification could be argued as essential based on the precautionary principle, the public would likely attach different importance to them. Given the SARS episode, it would be difficult to persuade the public to go against the precautionary principle and do away with disinfection. However, it was less likely that the public would insist on providing denitrification in view of the huge cost involved and the lack of tangible benefits, particularly when the historical data on red tides in the Harbour area did not point to the need for denitrification. Dr. Ng therefore took the view that there was no strong justification to insist on denitrification, even though he supported the provision of disinfection on the ground of upholding the precautionary principle.

V. Final Results of the Compact Sewage Treatment Technology Trial (Paper No. MG(2003)05)

26. The Chairman reported that following the 4th Meeting on 28 October 2002, the Administration had reported the interim progress of the CSTTT to the EAP in November 2002. The views of the EAP were diverse and some Panel Members were highly skeptical of the cost and operability of the Biological Aerated Filters (BAF). They demanded that the Government should find out more about the application of BAF overseas. In view of such feedback, the Government had through its Economic and Trade Offices (ETO) overseas obtained reports on BAF compiled by other economies. The Dutch report and the New York City's report were what the ETOs had successfully obtained so far and the summaries were attached to Information Note MG(2003)06 for Members information.

27. The Chairman invited Prof. Howard Huang, the Independent Checker, to join the Meeting on this item. Mr. Satish Aggarwal gave a Powerpoint presentation to Members on the overall findings of the CSTTT (Presentation materials at Annex B). In overall terms, the two BAF technologies were able to treat the local sewage to the specified effluent standards but the Submerged Aerated Filter (SAF) technology failed to perform satisfactorily.

28. On the design of the treatment system, Mr. Aggarwal explained that it was possible, albeit difficult, to build BAF units of 3 to 4 layers at the remaining 2.3 hectares idle site of the Stonecutters Island Sewage Treatment Works (SCISTW) to provide nitrification to a sewage flow of 1.7 million m^3/day (i.e. the original HATS Stage 1 design capacity). However, one of the BAF contractors had already proposed to use part of the adjacent Government dockyard for providing the supporting facilities, such as the chemical storage and sludge handling facilities in pursuing the above design. Moreover, the land requirement for any disinfection had not yet been factored in. It was therefore very obvious that the remaining site of SCISTW would not be able to accommodate any flow higher than 1.7 million m^3/day, bearing in mind that the latest estimated Stage 1 ultimate flow was some 2.2 million m^3/day. Mr. Aggarwal, however, remarked that apart from the need for denitrification the ammonia effluent standard would also have a impact on the number of BAF units required, and hence the land requirement of the BAF plants.

29. Prof. Cheng said that the Government should not be bounded by inter-departmental rivalries when planning a major infrastructure project of the scale of the HATS. He stressed that if the feasibility of HATS options was dependent on the availability of adjacent land owned by another Government department, the Government should coordinate itself to make available the required land. Prof. Cheng also pointed out that the advocates of a decentralized treatment system should be reminded that the BAF system was indeed a distributive system as every BAF unit would work independently albeit located in the same plant. Finally, Prof Cheng stressed that BAF was a well proven technology of good potential for application in the remaining stages of HATS. He did not agree to the views held by some BAF critics that the Government should continue with the technology search to find a better technology as the search could last forever.

30. The Chairman agreed with Prof Cheng that the Government should not be bounded by red tape and departmental interests in the decision making process. However, she

pointed out that the contractors should be fully aware that they were required to operate under the constraints set out in the Study Brief prior to taking part in the trials. Therefore, it was not unreasonable for DSD to require the contractors to follow the requirements in the Study Brief as far as practical. That said, the Government always welcomed the contractors to share their actual findings and give their genuine views and assessments. She added that despite the views expressed by Prof Cheng on BAF being a proven technology that is most suitable for Hong Kong's land scarce situation, the Government would need to take into account all relevant factors before arriving at a decision.

31. Mr. Law added that CDM was asked to study whether the treatment system could fit into the 2.3 hectare site within SCISTW but the Government had not suggested that the IRP options should not be pursued if the outcome was negative. He opined that the debate over the choice of the best sewage treatment technology had gone on for years and nothing would happen if we were always looking for a better technology. He said that the key issue should be to forge a general consensus on the optimal treatment level required to meet our environmental standards in a cost-effective manner.

32. Dr. Koenig said that modular treatment units similar to the BAF design had been used in many water treatment plants (WTP). He was therefore curious to note the scepticism of some legislators over the BAF technology.

33. Prof. Huang pointed out that although the BAF system was able to treat the sewage to the specified effluent standards, the concerns over the operational problems were not invalid. During the trials, all the three contractors encountered numerous operational problems and their systems had to be shut down on many occasions. Moreover, the causes of such problems were often difficult to trace and the contractors had to resolve them by trial and error. He said that there was a fundamental difference between the BAF process and the treatment process used in a WTP, being that the organic content of the sewage to be treated by BAF was 100 – 200 times higher than that of the raw water. Therefore, unlike a WTP unit, which could maintain a uniform flow pattern easily, a BAF unit would often encounter clogging due to much faster and uneven bacterial growth. Once clogging was developed, the sewage would pass through the channels formed among the clogs and the operation of the concerned BAF unit would need to be suspended for maintenance. Prof Huang anticipated that the problems of uneven bacterial growth, clogging and channeling would magnify in a full-scale BAF unit.

34. Prof. Huang further advised that the lack of reliable online monitoring system would add to the operational problems. He explained that with some 200 – 300 BAF units operating simultaneously, the operator would have great difficulties in identifying the malfunctioning units if the online monitoring system was not reliable. These problems were not going to die down but would appear from time to time.

35. Mr. Aggarwal said that the ammonia sensor was the most unreliable part of the online monitoring system. The ammonia sensor worked very well in a WTP but it failed to function reliably in a BAF system during the CSTTT. As the contractors could not count on the ammonia sensor, they tended to increase the supply of oxygen to make sure that full nitrification was achieved. The very stringent ammonia effluent standard of 2 mg/L further exacerbated the problem caused by the reliability of the online system.

36. In response to the Chairman's question as to whether the problem caused by the online monitoring system could be resolved, Mr. Aggarwal responded that the online monitoring instruments were unable to give accurate readings. However, if the effluent standard was not very stringent, the operator would not need very accurate readings as long as the monitoring system could indicate the change in readings in a timely manner to prompt the operator to take necessary actions to resolve the problem. Moreover, although the reliability of the online monitoring system was a key operational problem at present, it was not impossible that more reliable on-line monitoring instruments might become available in future.

37. Prof. Huang added that it was unrealistic to expect a BAF system to be free of operational problems. He pointed out that a BAF system had to count on the activities of bacteria but the behavior of the latter was not fully predictable. As a result, even with the provision of stand-by BAF units, the operational problem of a BAF system could not be resolved completely. In fact, since the bacteria in the stand-by units were often starved for a long period, it would take time for the bacteria in these units to build up if such units were to be put into operation. Therefore, the stand-by units would hardly be able to start working immediately.

38. In view of the above discussion, the Chairman said that the Government must satisfy itself that these problems could be addressed satisfactorily before making any recommendation to the public.

39. Dr. Koenig considered that many of the aforesaid problems might appear to be very serious during the trials because the loading was constantly changing and the systems themselves were often stretched to their limits during the trials. He believed that most of the problems could be resolved during full-scale operation. He then asked whether similar online monitoring problems were encountered and resolved in other sewage treatment works run by DSD in Hong Kong, such as the Shek Wu Hui STW and Shatin STW.

40. Mr. Aggarwal responded that the successful operation of the activated sludge process is not so much dependant on continuous online monitoring and therefore there was no online ammonia monitoring instrument in Shatin STW and Taipo STW. However, DSD was currently testing the feasibility of installing online ammonia monitoring instrument at the Shek Wu Hui STW but the instruments supplied by the contractor were not able to provide reliable readings.

41. Prof. Huang added that since the activated sludge process involved a long sludge age and a long hydraulic retention time of up to 10 hours, online monitoring was much less important. However, as the hydraulic retention time for BAF was only 10 – 15 minutes and the valves for controlling air supply and backwash needed to be switched on and off within a very short timeframe, online monitoring / control became very critical. In fact, the New York City BAF Demonstration Project had revealed operational problems very similar to those experienced in the CSTTT.

42. Dr. Koenig noted that the Dutch report was only a desktop study conducted in 1995 while the US had little experience in operating BAF. He commented that a compact system would generally be more difficult to operate. Given that the BAF process would require 1/5 of the space required by the conventional activated sludge process, the

operational problems and higher operating cost would be inevitable trade-offs. The Chairman considered that it was important to help the general public understand the trade-offs in that case.

43. Prof. Wu opined that by adopting a good design and grouping the BAF units systematically, the operator should be able to identify the malfunctioning units readily. Moreover, he considered that there should be room for relaxing the ammonia standard from 2 to 5 mg/L. Finally, he observed that the initial results from CDM indicated that there should be room for tolerating some under-performance by the BAF system for a short period. This would give 1 – 2 days for the operators to identify and resolve the operational problems.

44. Mr. Wong agreed that there was room for relaxing the effluent standards. However, he doubted whether relaxing the ammonia standard would resolve all the problems to the extent that online monitoring would no longer be necessary. Prof. Huang responded that if the ammonia standard could be relaxed, a large part of the operational problems could be resolved.

45. Dr. Ng envisaged that the public would soon demand the Government to give its assessment on the reliability of the BAF system and whether the BAF system should be used in Hong Kong. Even though there were problems surrounding the BAF system, he did not see other better alternatives unless the Government would opt for a lower level of treatment. Mr. Law responded that the conventional secondary treatment process could be considered if additional land was available. So far, the Administration had reserved sufficient land at the Lamma Island.

46. The Chairman considered that the CSTTT had provided useful insights on the application of the BAF technologies in Hong Kong. She stressed that the Government would not recommend any proposal in which it did not have any confidence. Hence, it was necessary for the Government to have a clear understanding of the potential problems of a BAF system. On the question of relaxing the ammonia standard, she cautioned that it was important to avoid giving the wrong signal to the public that the Government was tampering with the effluent standards in order to suit the BAF systems.

47. Prof. Cheng commented that it was extremely unlikely that all the BAF units would run into problems at the same time. The large number of BAF units would effectively provide some buffer for some units to go wrong at one time. As there were many successful BAF plants overseas, he believed that a BAF system could also be successfully operated in Hong Kong.

48. Prof. Huang responded that although relaxing the ammonia standard could help address some of the operational problems, the operator would still need to rely heavily on the online monitoring and control system. Moreover, the problems would be much more complicated when the operator was controlling a large number of BAF units at one time as it was not easy to identify the problematic units under such circumstances. The actual operating costs could therefore turn out to be much higher than one could have expected. In fact, most of the overseas BAF plants were much smaller than what had been contemplated under the HATS and none of them were required to meet a stringent ammonia standard of 2 mg/L.

49. In response to Prof. Cheng, Mr. Law said that the purpose of a trial should be to find out the limits of a technology and therefore some very stringent standards should be set. This would allow the Administration to have more confidence in the technology should the standards be relaxed afterwards.

50. In view of the concerns over the various operational problems identified, Mr. Wong suggested that DSD should document the operational problems encountered in the CSTTT in the Final Report clearly. **(Action: DSD)**

51. In response to Mr Wong, Mr. Aggarwal confirmed that online monitoring would still be needed even when the ammonia standard was relaxed. He also stressed that despite the operational problems discussed, DSD considered that it was not impossible to operate a BAF system. However, it would take more effort for the operator to calibrate the online monitoring system and to maintain the control system. Subject to adequate training, DSD's staff should be able to operate a BAF system professionally.

52. Mr. Kwok said that based on his experience as a supplier of online monitoring instruments, it was extremely difficult for any ammonia sensor to give accurate readings at the ammonia level of 2 mg/L. Even if the ammonia level was increased to 5 mg/L, it was still very difficult to give reliable readings because the small tubes of the ammonia sensor could easily be clogged.

53. Prof. Wu considered that there should be plenty room for relaxing the ammonia standard if CDM's modeling results were correct. Therefore, he was confident that the BAF operator could be allowed adequate response time to detect and resolve the operational problems.

VI. AOB

54. There was no other issue raised.

VII. Date of Next Meeting

55. The Chairman informed Members that the next meeting was tentatively scheduled for mid September 2003. The Secretary would confirm the exact date with Members nearer the time and would continue to update Members on major progress on the trials and studies before the next meeting.

Environment Transport and Works Bureau
July 2003

Briefing On Water Quality Impacts Of HATS Options

HATS Monitoring Group

July 3, 2003

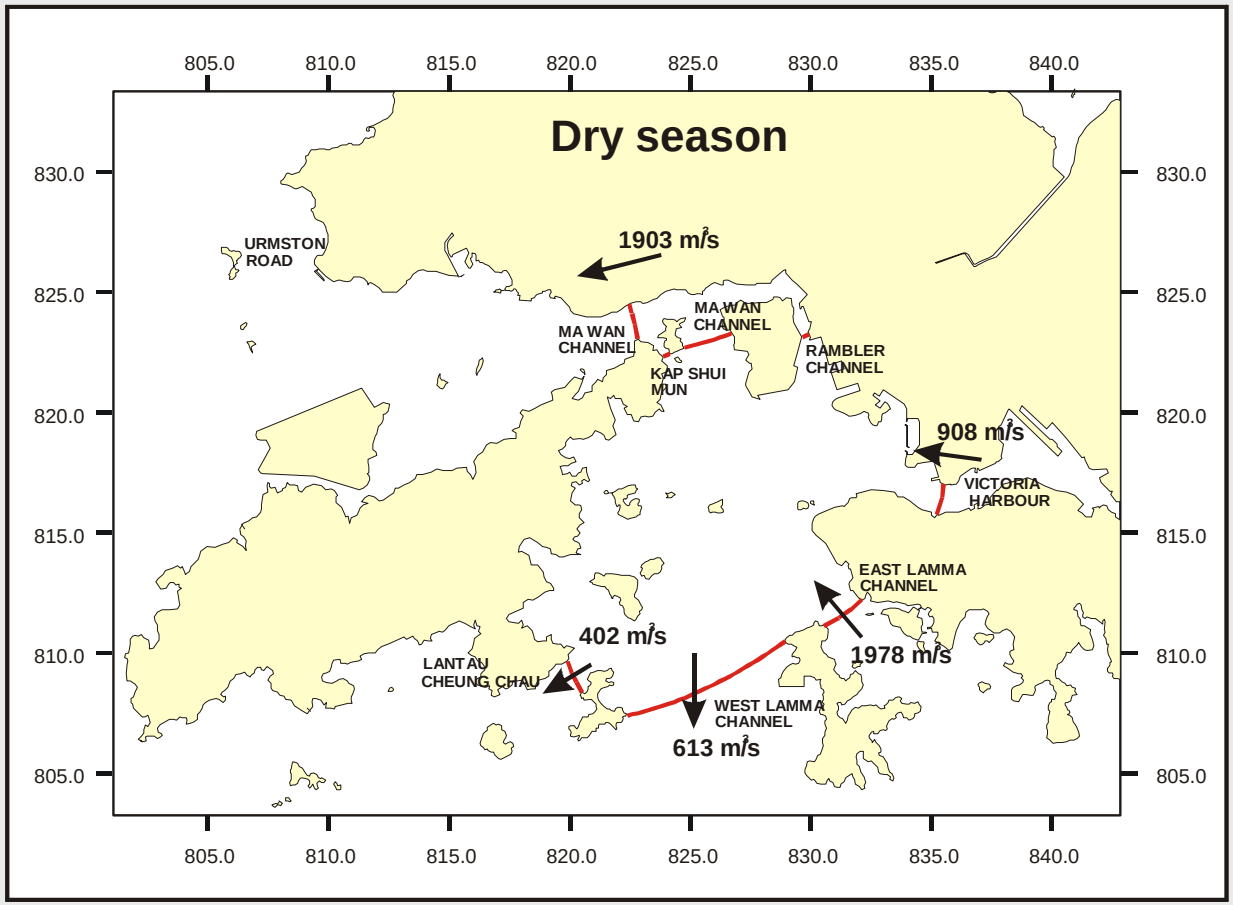
Agenda

- Discuss Large Scale Circulation
- Present General Conclusions With Respect To Water Quality Compliance Under IRP Treatment Scenarios
- Discuss Differences Between IRP Options

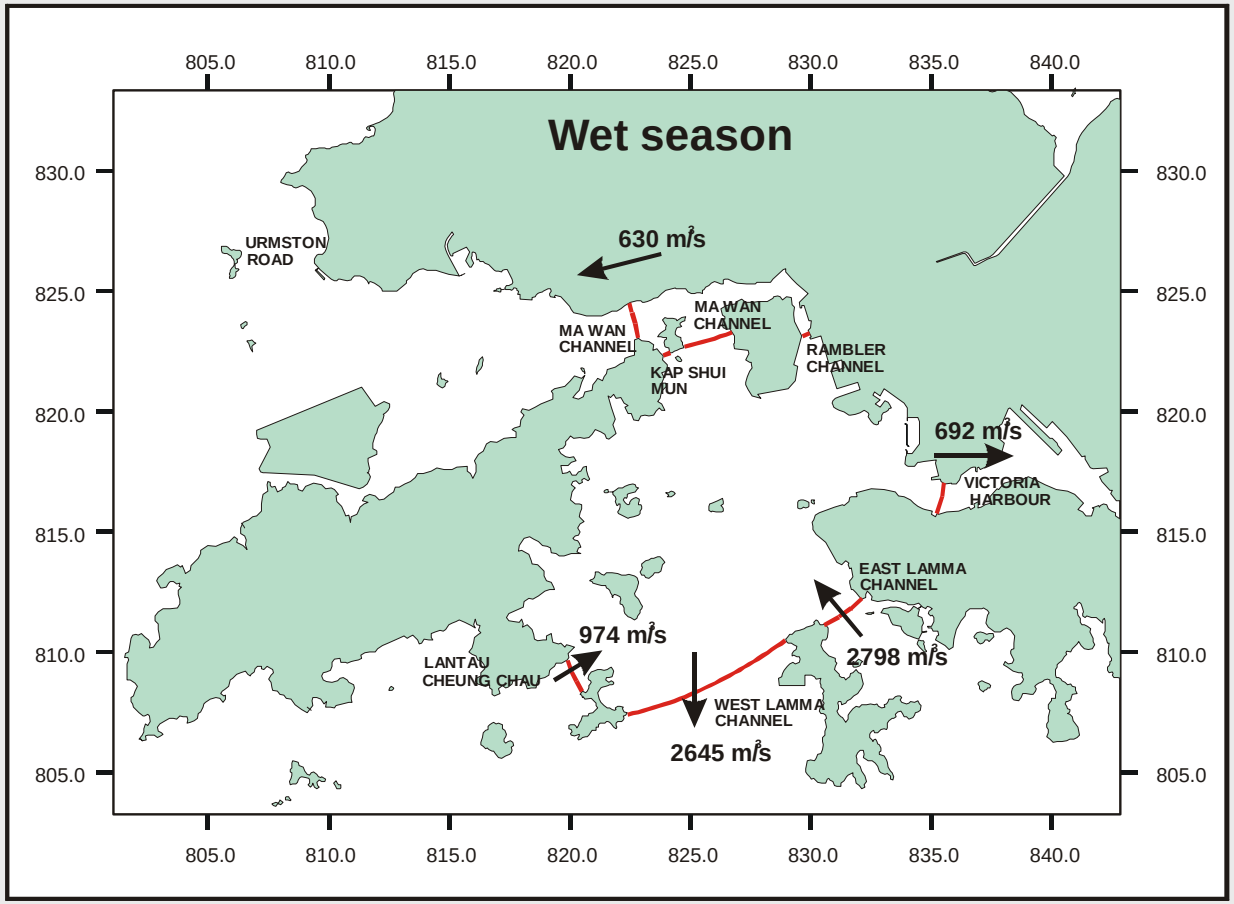
Circulation

- Impacts Fate And Transport Of HATS Pollutants
- Direction And Speed Both Important
- In Hong Kong Different Seasonal Patterns
- On-shore transport of offshore bottom water significantly influences water quality issues

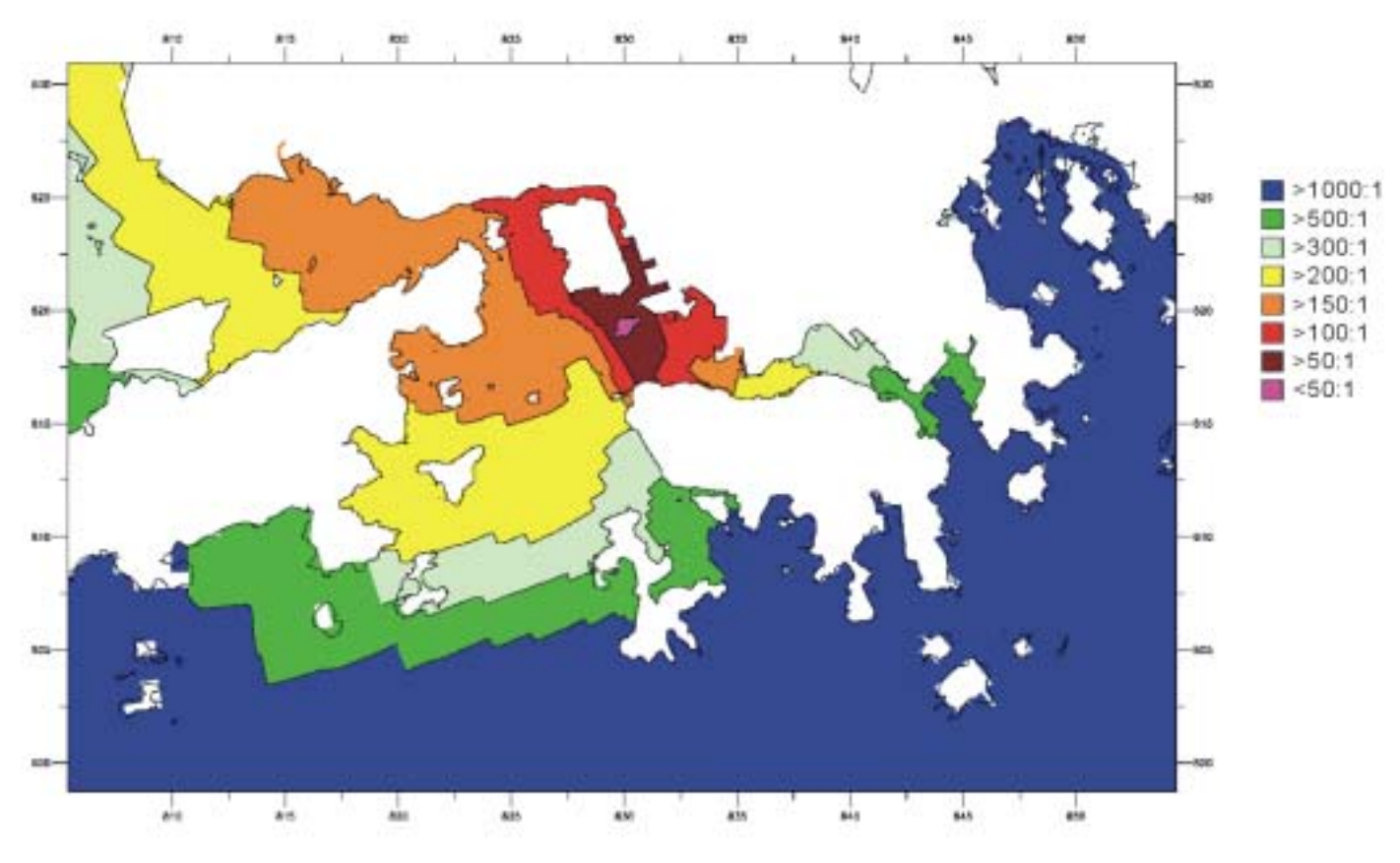
Residual Circulation Patterns



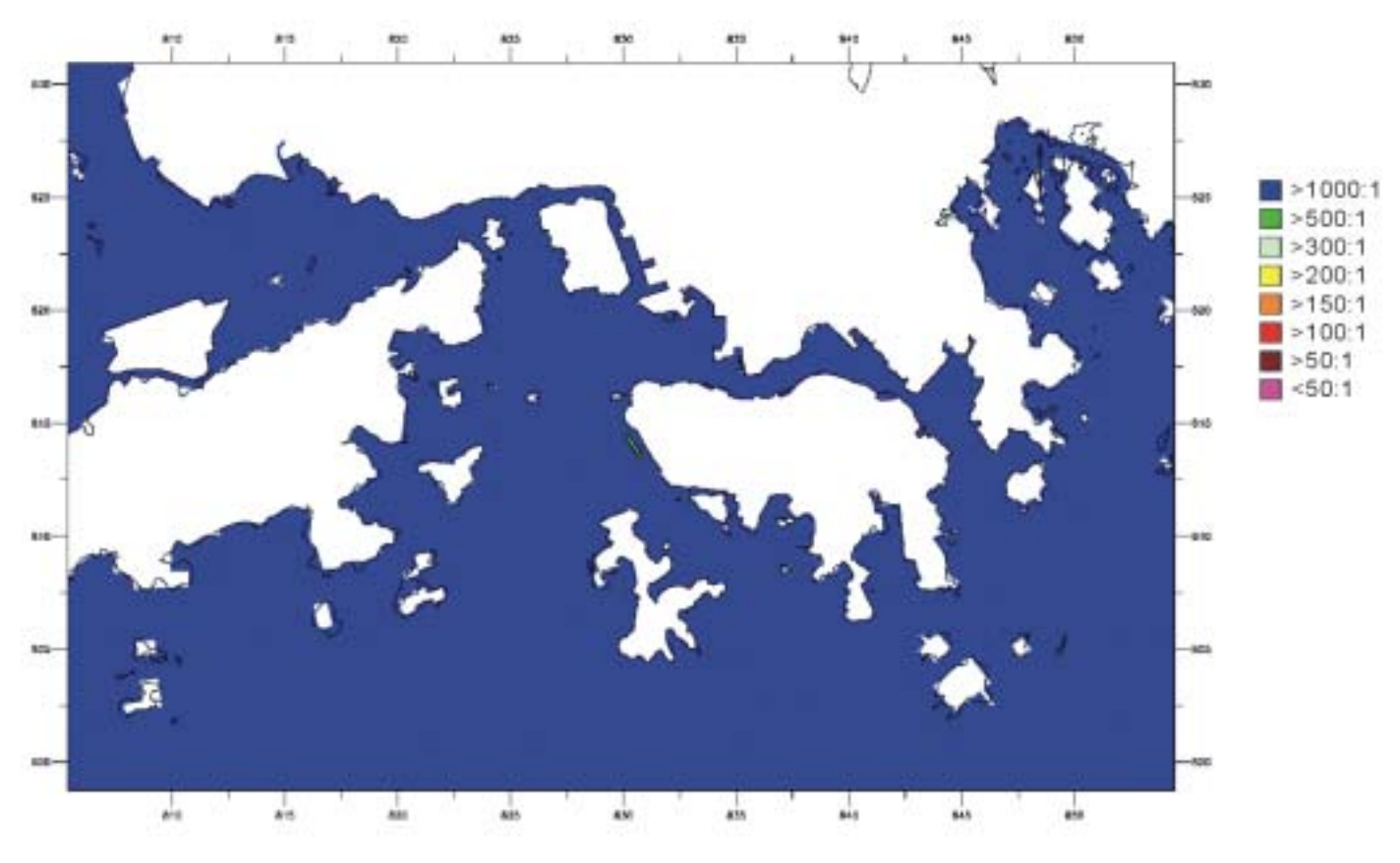
Residual Circulation Patterns



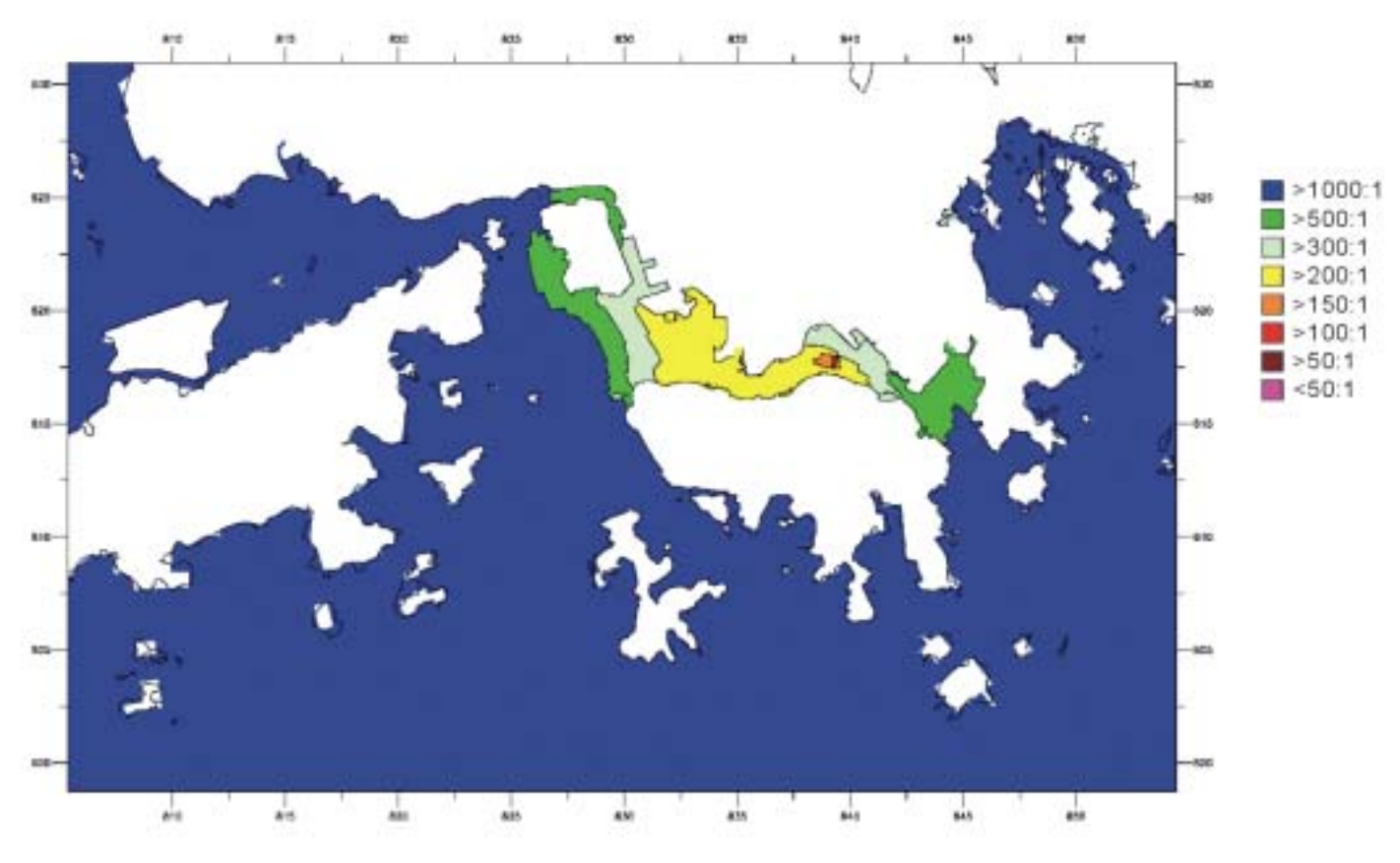
Stonecutters Island Average Dilution



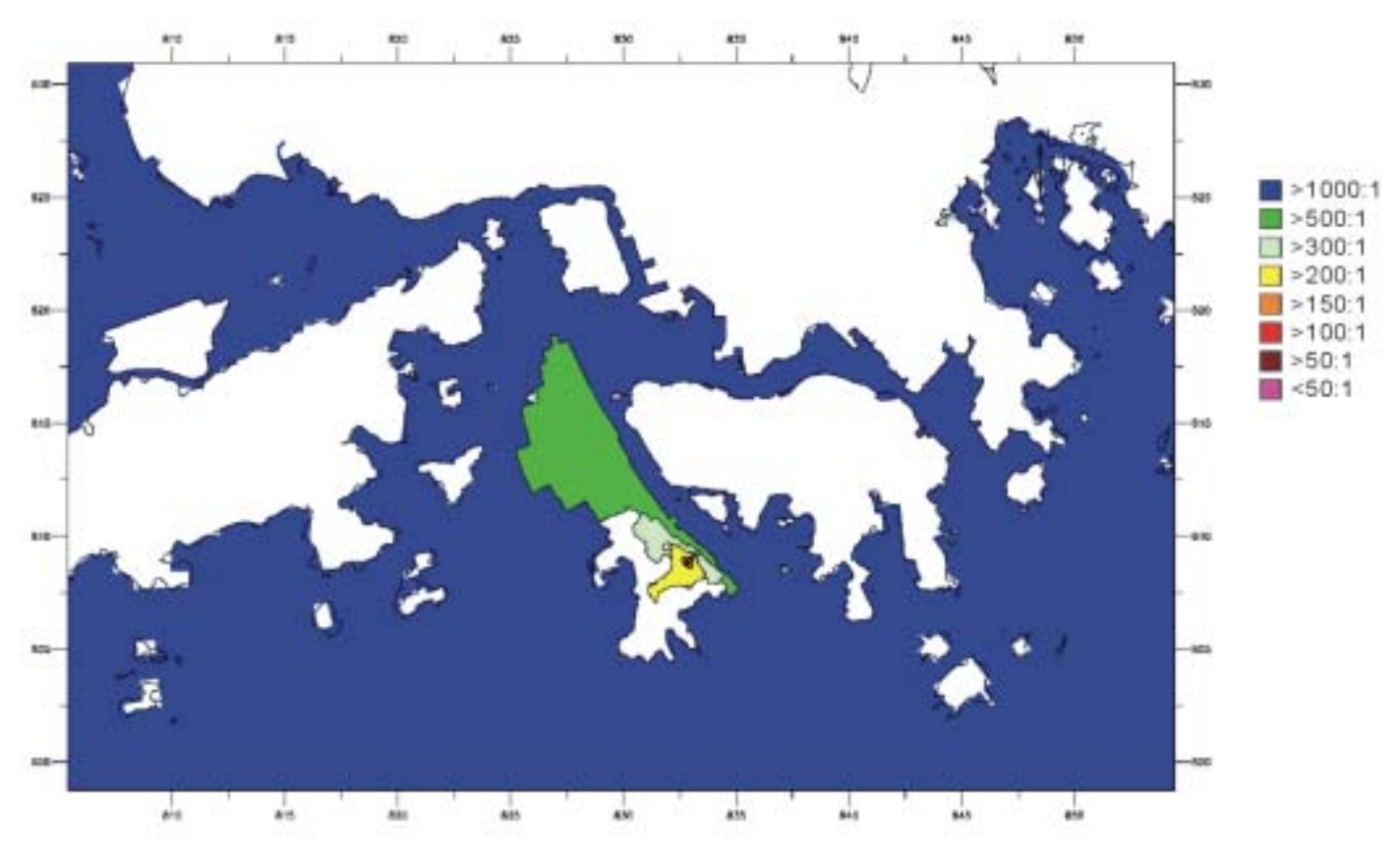
Sandy Bay Average Dilutions



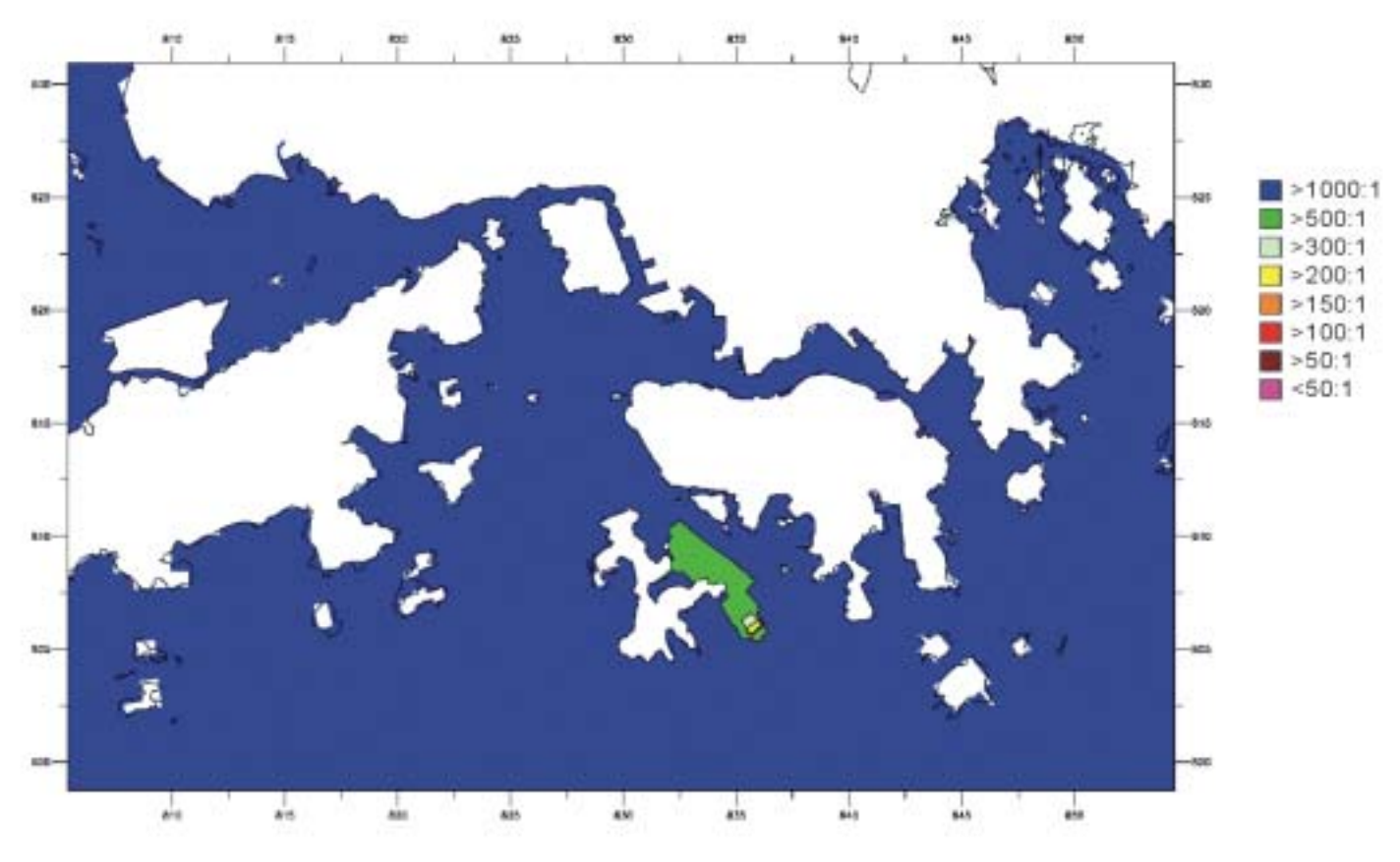
North Point Average Dilutions



Lamma Average Dilution



Lamma Average Dilution



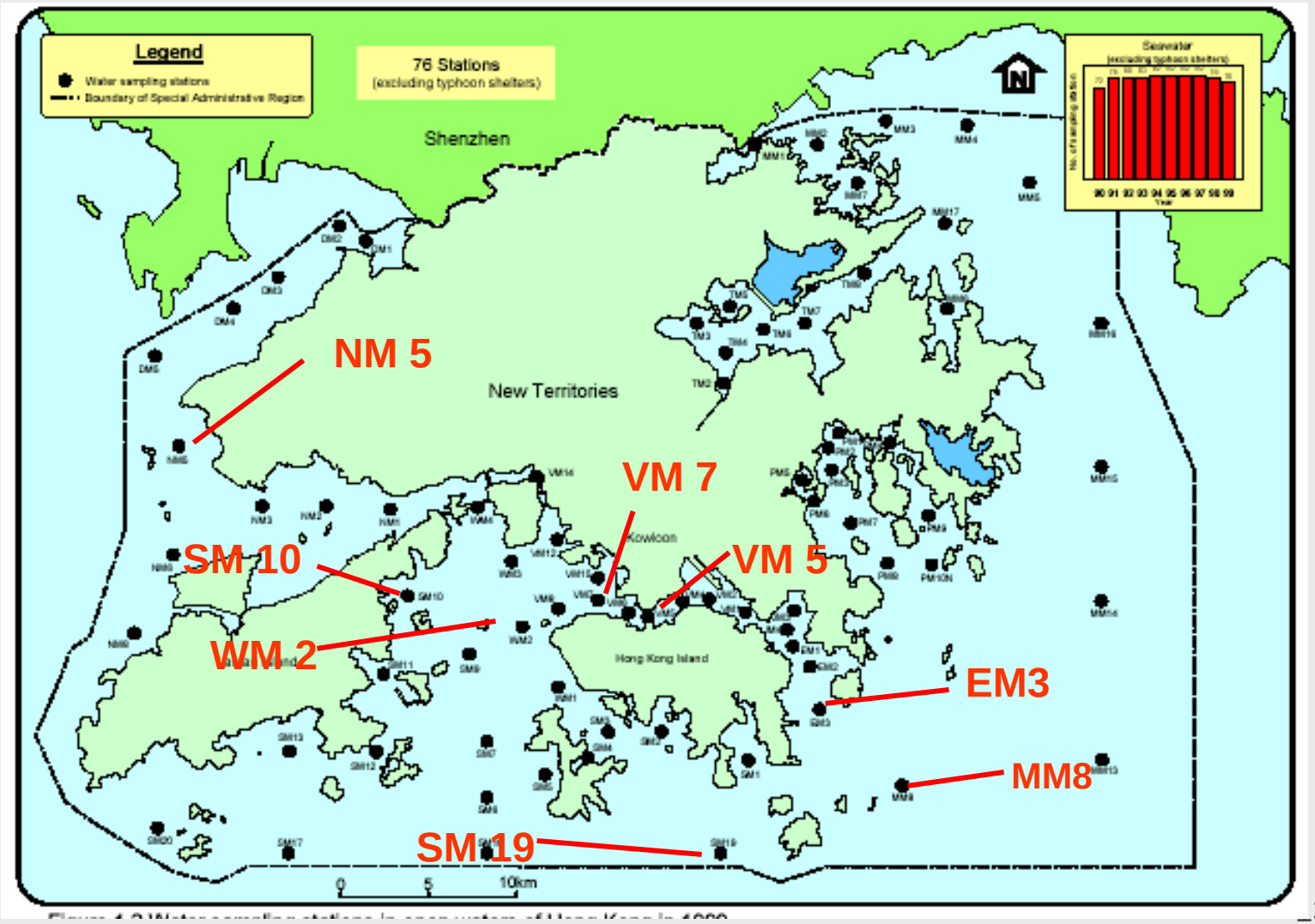
Key Points Regarding Circulation

- Harbour Very Energetic
- Residual Currents Much Greater Than STW Flows
- Flows Always Have A Significant Westward Or Southern Component
- Contributes To Relatively Cleaner Eastern Waters
- Note That Offshore Current Flow Reverses Direction Between Season

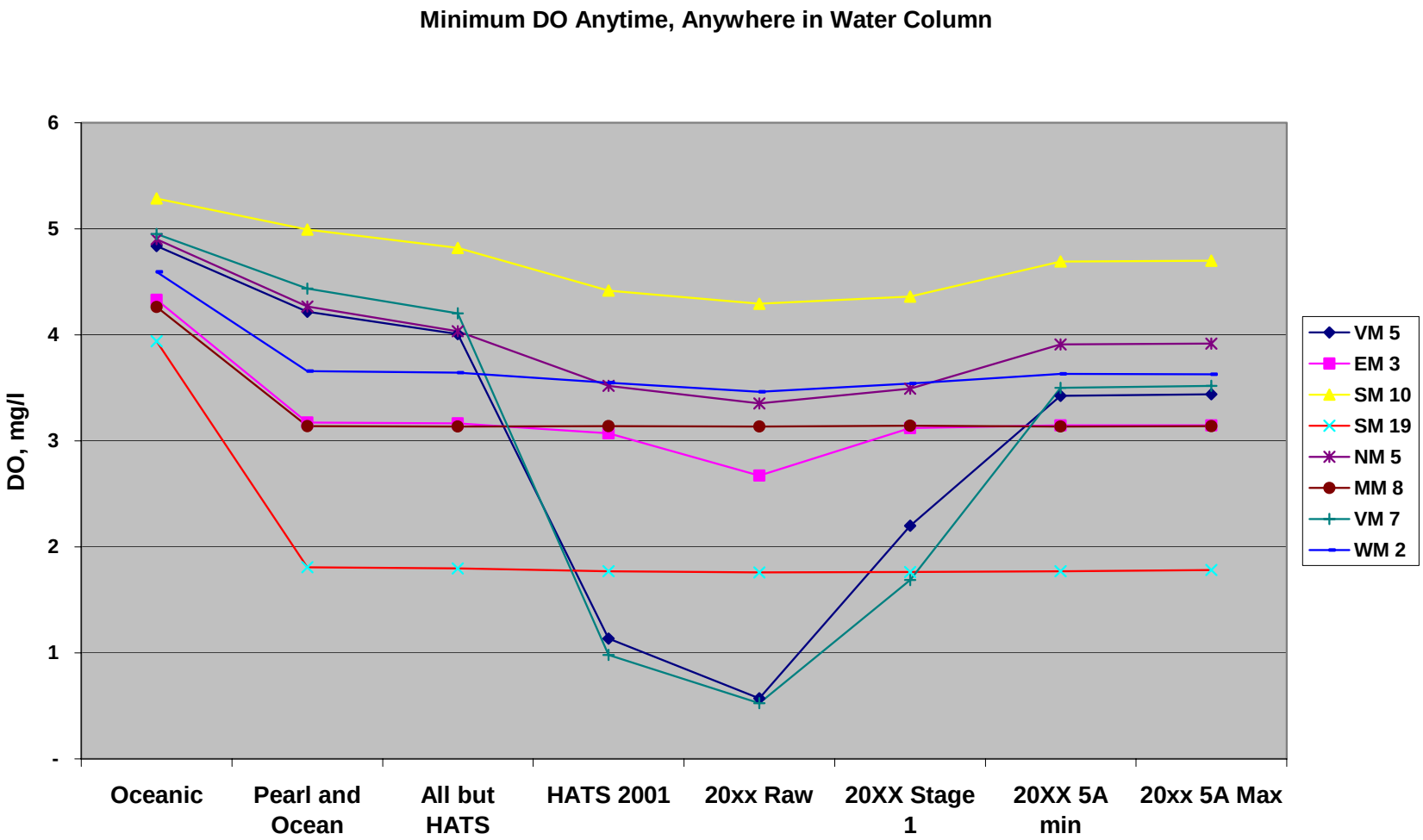
Water Quality – Dissolved Oxygen

- Criteria For Victoria Harbour And Western Waters Generally Achievable
- Criteria For Southern Waters Not Achievable Due To Non-HATS Issues
- Essentially Says HATS DO Is An Issue Only In Close Proximity To A Discharge

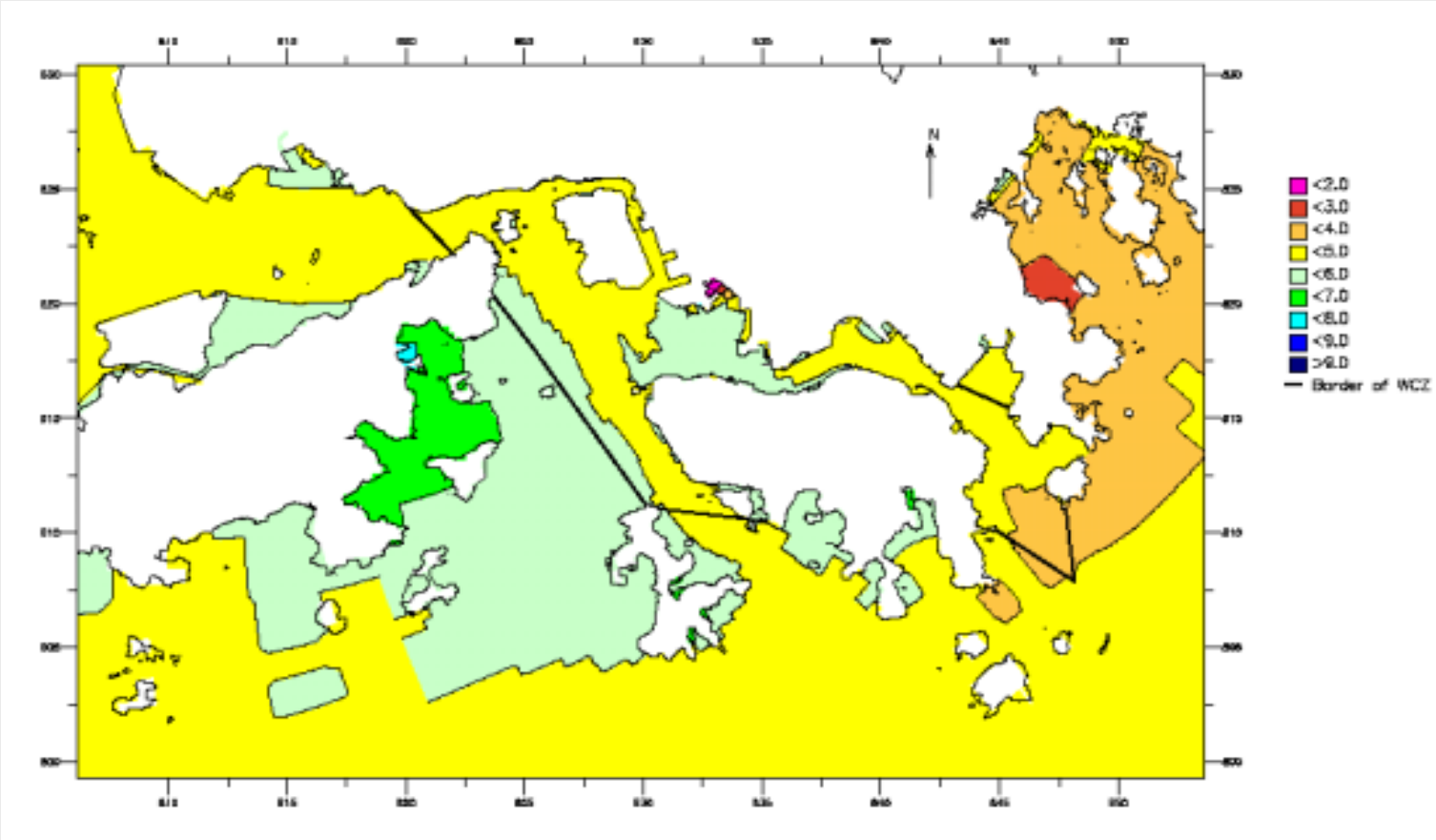
Reference Points



Differences in Level of Treatment

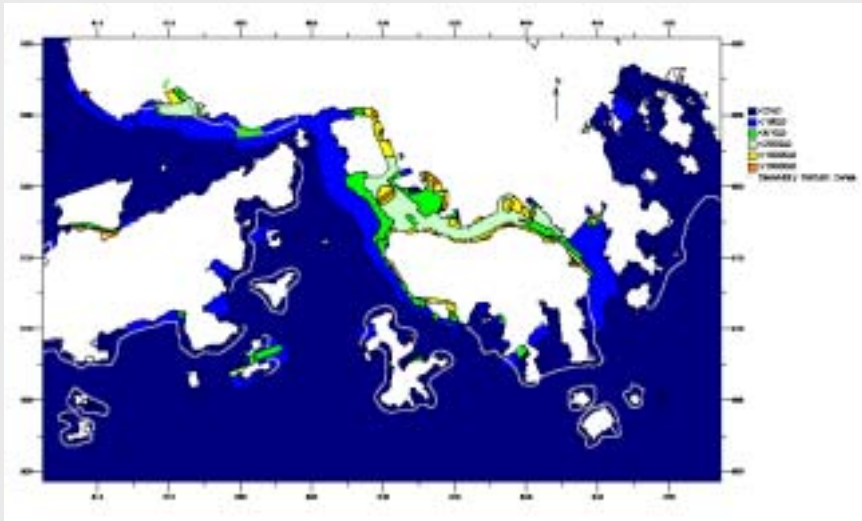


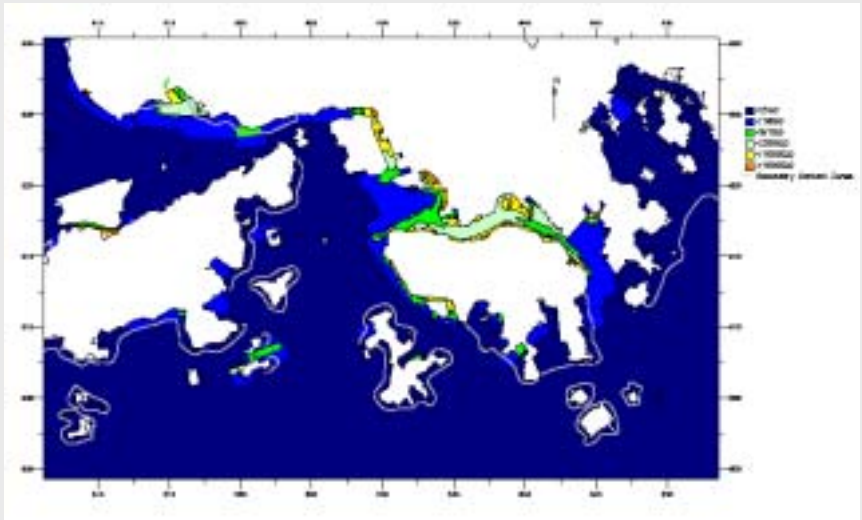
Minimum Monthly Average DO, 5A



Water Quality - Coliform

- On Average Coliform Criteria Met At Beaches W/O Disinfection
- Model not as variable as real world
- Expect some episodes of poor water quality at Tsuen Wan Beaches w/o disinfection



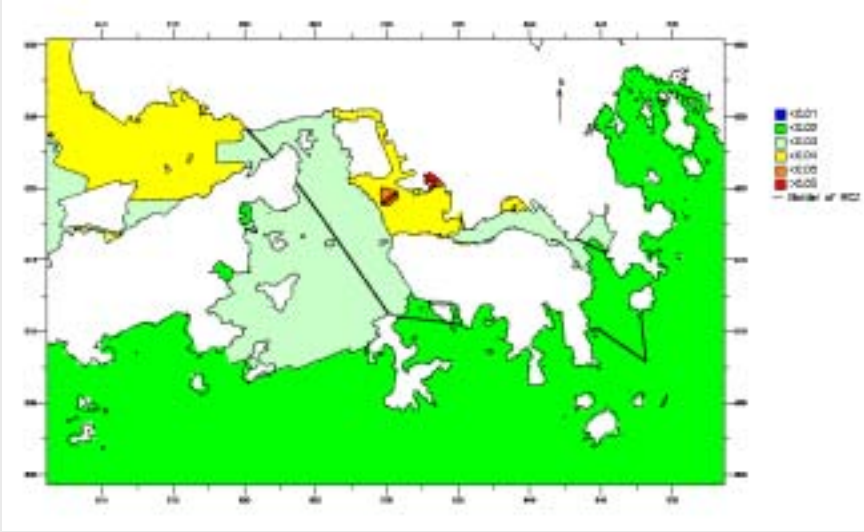


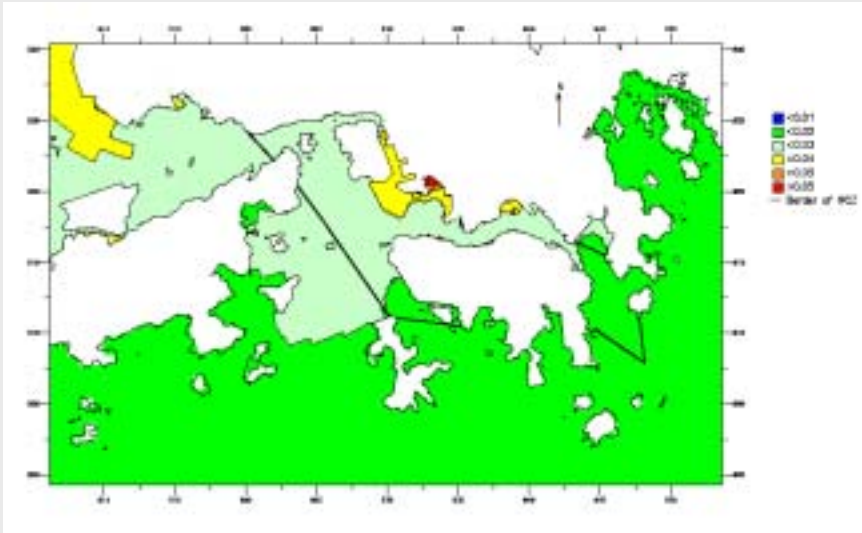
Water Quality: Nutrients

- Phosphorus
- Nitrogen
- Nutrient Control Strategy

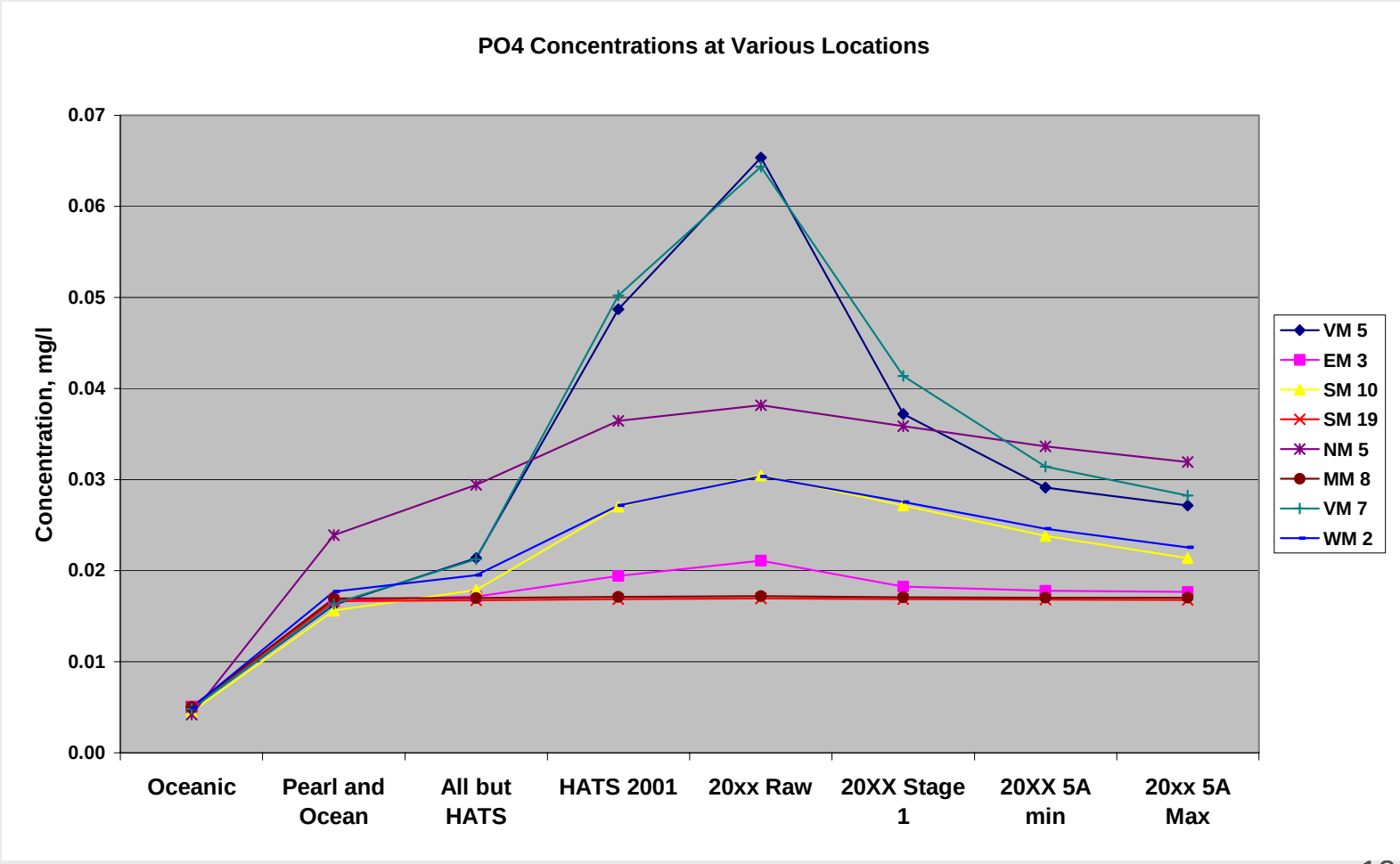
Phosphorus

- With 80 % P removal Victoria Harbour complies with 0.04 mg/l criteria except near expedient connections
- Offshore waters prevent compliance with 0.01 mg/l criteria in bays
- 0.02 mg/l generally met except in limited areas



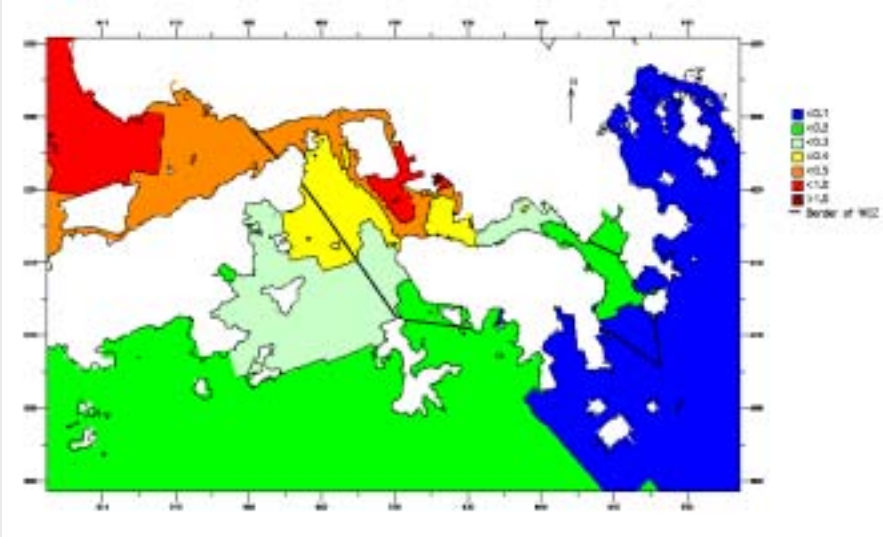


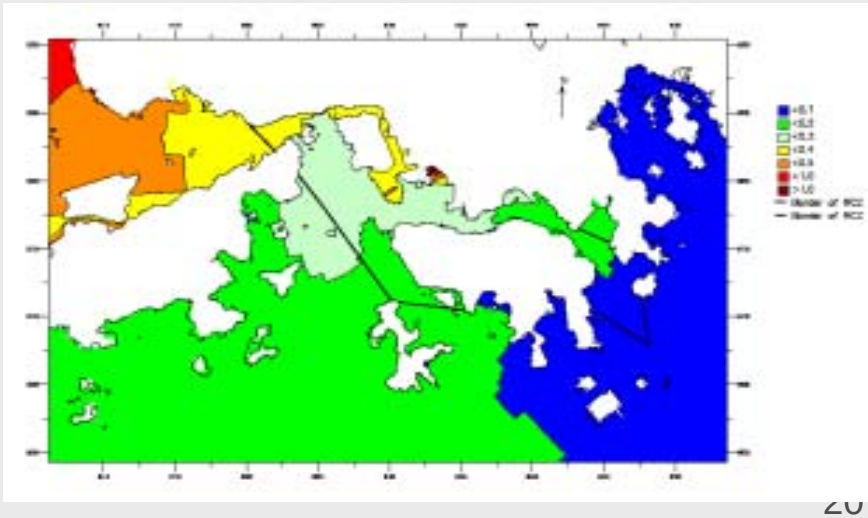
Phosphorus


PO4 Concentrations at Various Locations
Concentration, mg/l
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
Oceanic
Pearl and Ocean
All but HATS
HATS 2001
20xx Raw
20XX Stage 1
20XX 5A min
20xx 5A Max
VM 5
EM 3
SM 10
SM 19
NM 5
MM 8
VM 7
WM 2

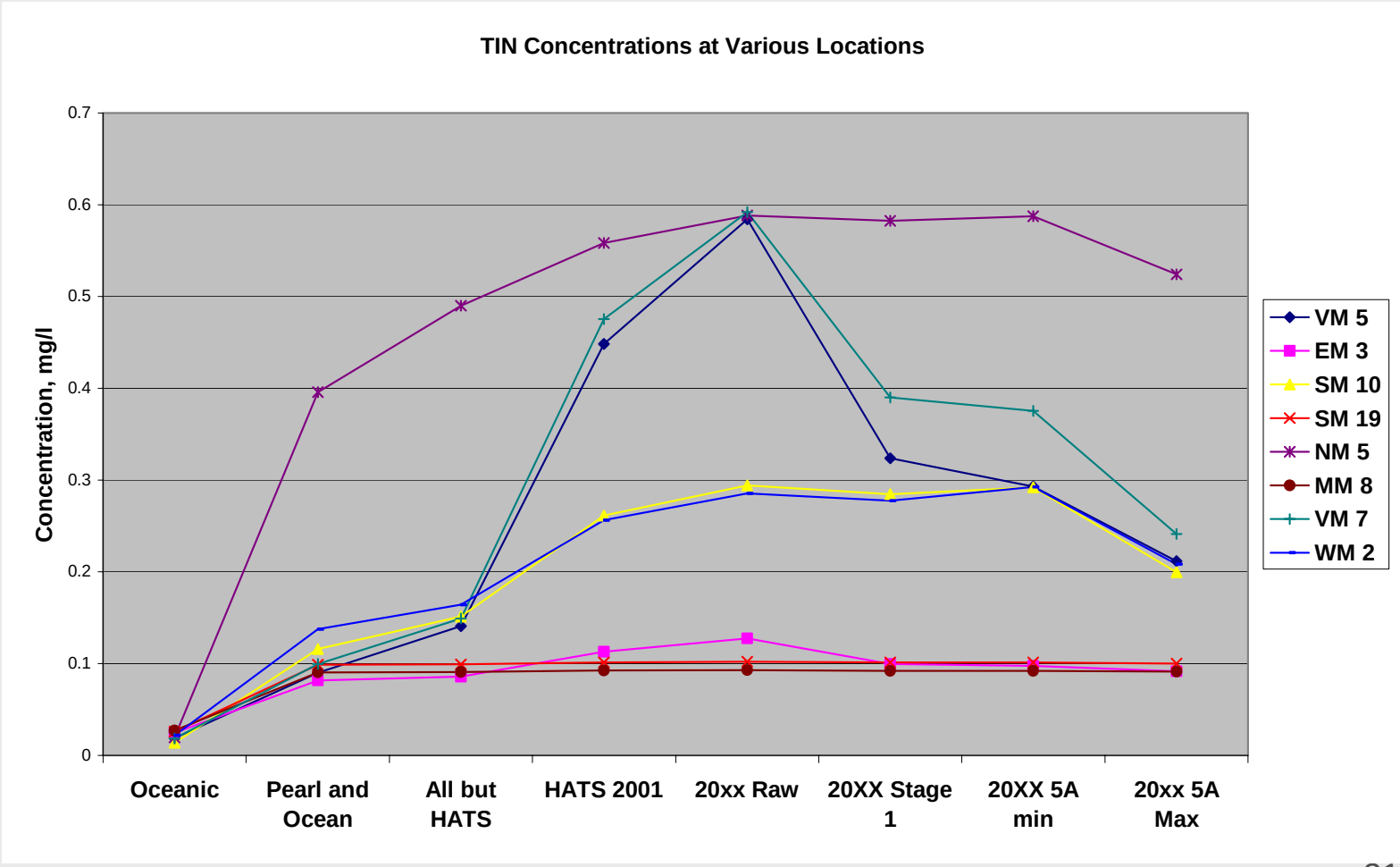
Nitrogen

- Criteria in eastern embayments met
- Criteria met in most southern waters
- Criteria not met in Victoria Harbour w/o denitrification



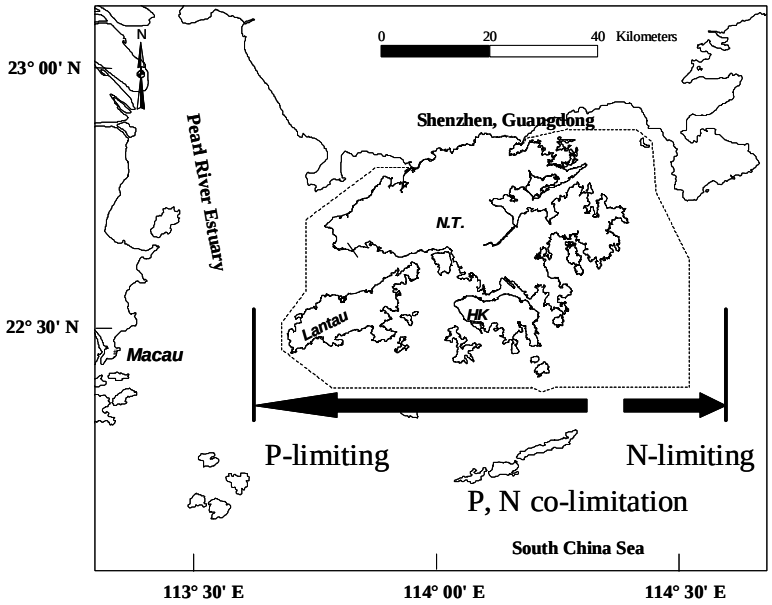


Nitrogen


TIN Concentrations at Various Locations
Concentration, mg/l
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Oceanic
Pearl and Ocean
All but HATS
HATS 2001
20xx Raw
20XX Stage 1
20XX 5A min
20xx 5A Max
VM 5
EM 3
SM 10
SM 19
NM 5
MM 8
VM 7
WM 2

Nutrient Control Strategies

- N & P by themselves not the concern – it is their impact in stimulating algae
- In waters impacted by the discharge:
  - phosphorus is the limiting nutrient in wet season
    - Enhanced p removal substantially reduces p to levels below that now experienced. Nitrogen removal unnecessary
  - Nutrient levels (and algae) are low in the dry season, and will stay so. N removal of marginal value



Water Quality Criteria Near the Discharge

- Criteria nominated for various constituents:
  - Unionized ammonia, pH, Temperature, Sulphide, Cyanide, Total residual chlorine, Surfactants, Copper, Nickel, Total chromium, Zinc, Mercury, Arsenic, Phenol, and Acute toxicity
- Must be Met after Initial Dilution

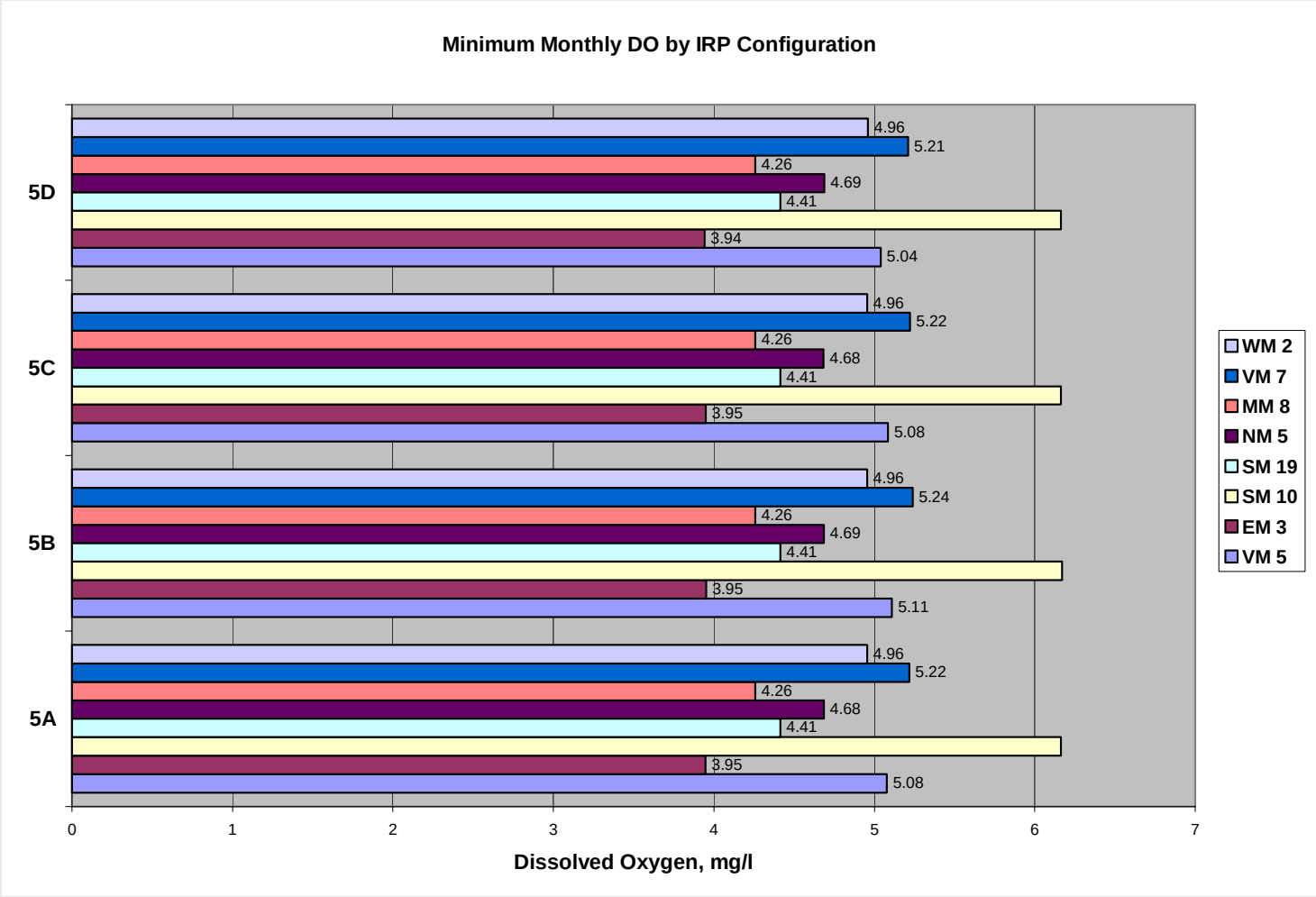
	Mean Dilution	10th Percentile Dilution
Stone-cutters	60:1	38:1
Sandy Bay	308:1	132:1
Lamma	275:1	166:1
North Point	108:1	81:1

Edge of ZID conclusions

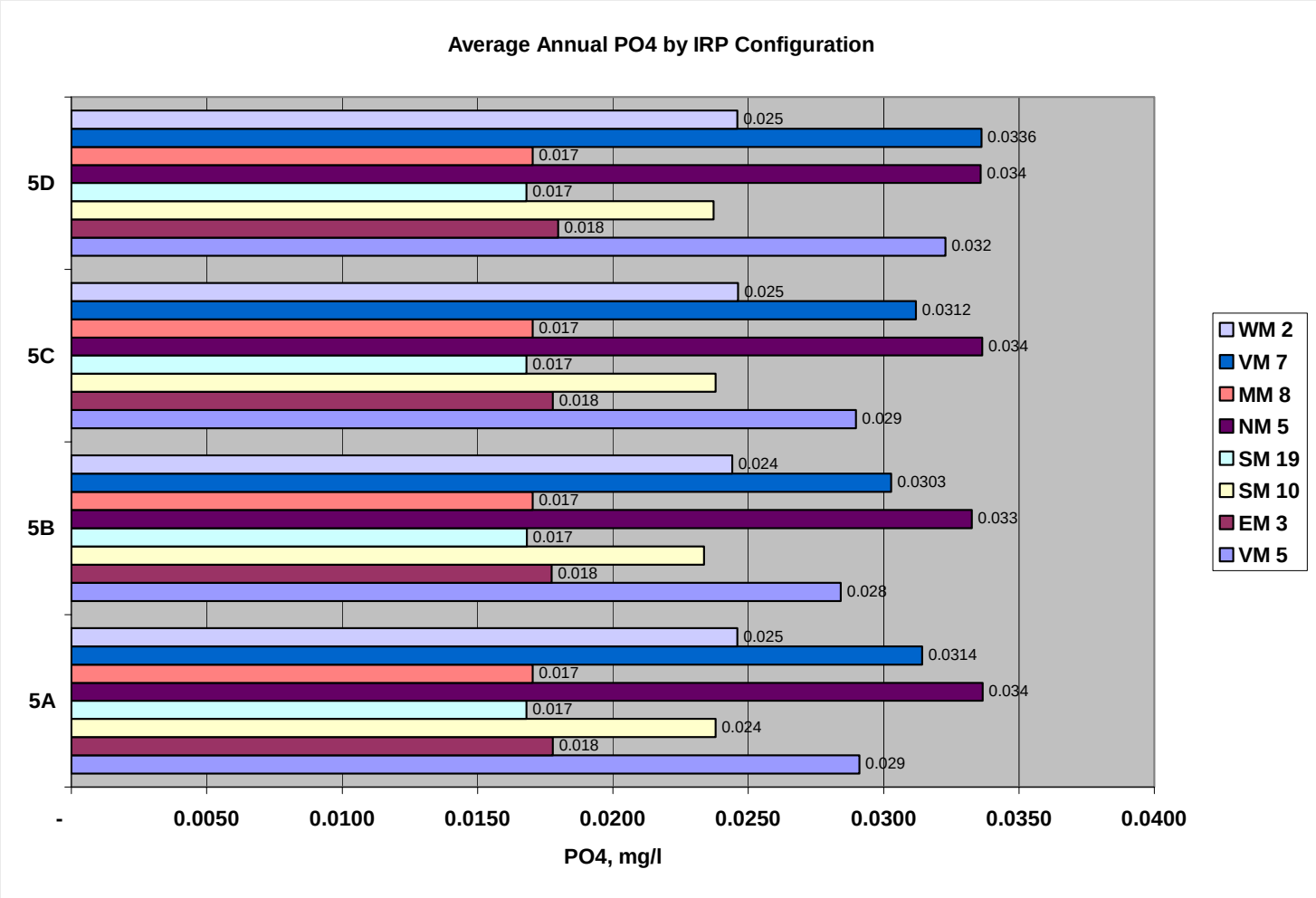
- **WQC met except for 2 compounds**
  - **Sulphide, and surfactants**
- **Existing Background exceeds WQC**
- **Diluted HATS effluents constitute very small fraction of total concentrations: 2 to 3 %**

Class/Analyte	Predicted Concentration	% from HATS Discharge
Metals		
Arsenic , 痢/L	1.5	2%
Chromium, total, 痢/L	0.77	29%
Copper , 痢/L	2.51	10%
Mercury (ng/L)	0.15	60%
Nickel , 痢/L	1.61	37%
Zinc , 痢/L	3.85	8%
Other Inorganics		
Unionized Ammonia , 1 hour, 痢/L	22.29	32%
Unionized Ammonia, 4 day, 痢/L	18.44	19%
Unionized Ammonia, average, 痢/L	5.2	NA
Sulphide, 痢/L	49.39	3%
Total Residual Chlorine1, 痢/L	-	
Organic Class		
Anionic surfactants (as MBAS), 痢/L	410	2%
Phenol, 痢/L	0.79	100%

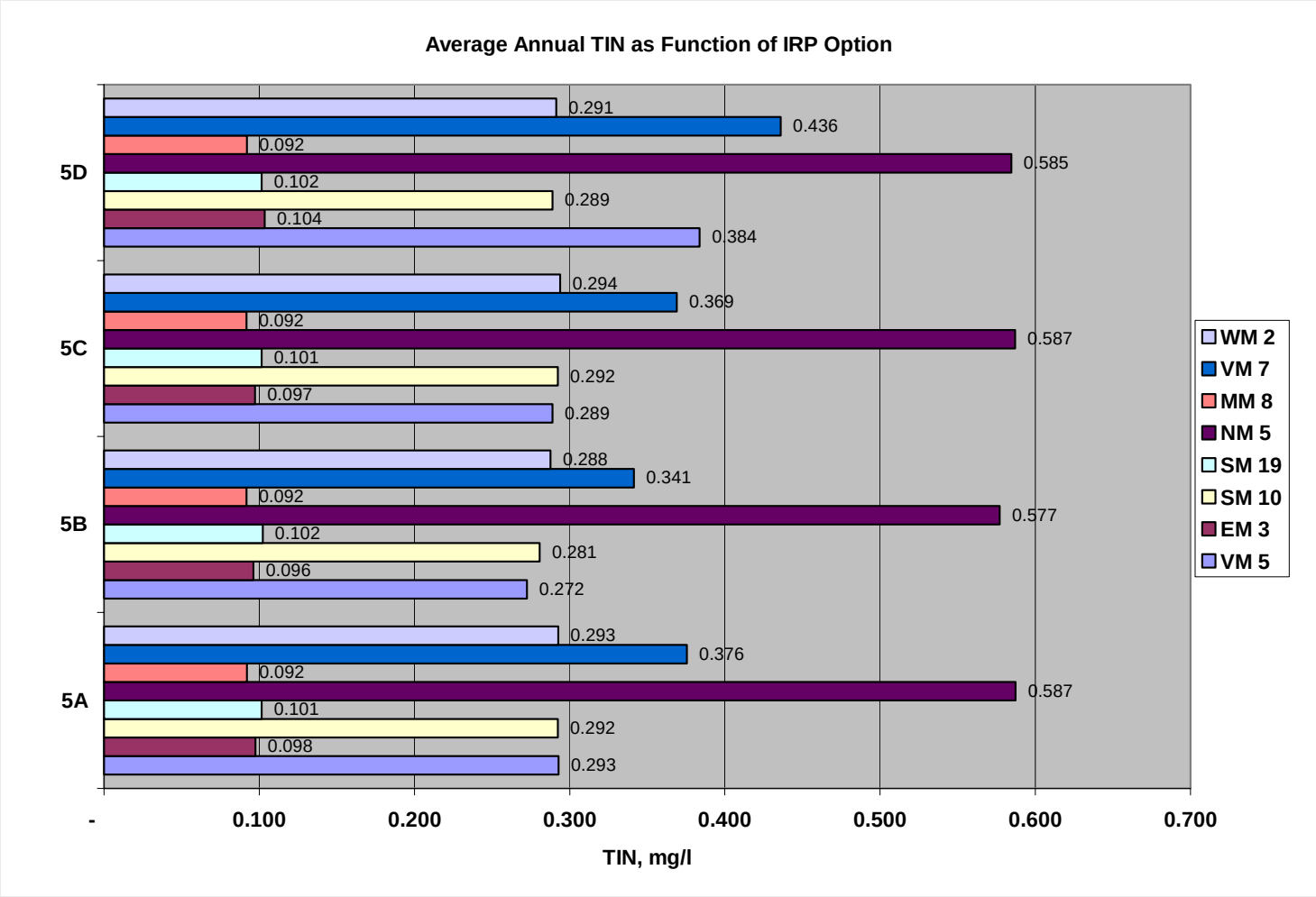
DO Differences Between IRP Configurations



Phosphate


Average Annual PO4 by IRP Configuration
5D
5C
5B
5A
0.025
0.0336
0.017
0.034
0.017
0.018
0.032
0.025
0.0312
0.017
0.034
0.017
0.018
0.029
0.024
0.0303
0.017
0.033
0.017
0.018
0.028
0.025
0.0314
0.017
0.034
0.017
0.024
0.018
0.029
-
0.0050
0.0100
0.0150
0.0200
0.0250
0.0300
0.0350
0.0400
PO4, mg/l
WM 2
VM 7
MM 8
NM 5
SM 19
SM 10
EM 3
VM 5

Total Inorganic Nitrogen



Summary

- Receiving Water affords high dispersion
- Residual Transport to West/South
- Offshore influences prevent full attainment of criteria
- IRP levels of treatment produce significant compliance with criteria
- Variety of locations where exceedances of criteria predicted
- IRP configurations do not make material difference in conclusions

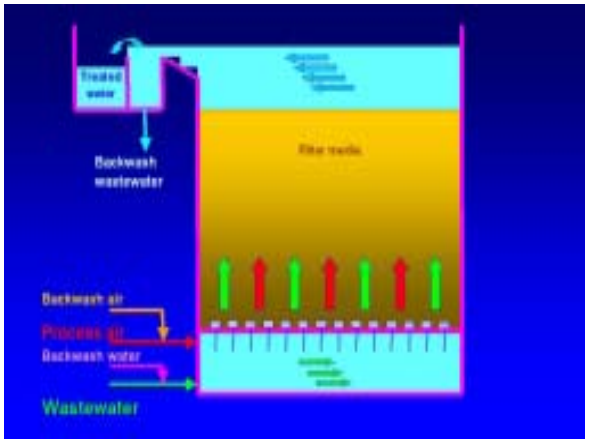
Harbour Area Treatment Scheme

Compact Sewage Treatment Technology Pilot Plant Trials

Objectives of the Pilot Plant Trials - Main Objectives

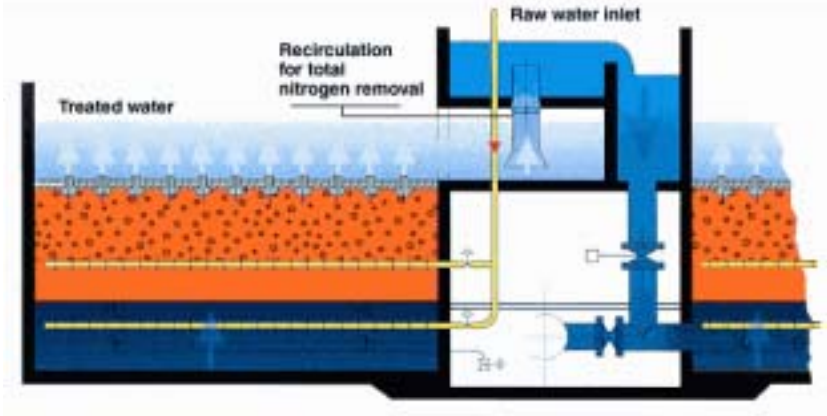
- To investigate the technical feasibility in treating saline CEPT effluent
- To evaluate the performance of the tested technologies
- To establish design criteria for Hong Kong
- To evaluate the feasibility for treating the whole or part of the HATS design flows

ATAL - BHU BAF



Sunken media, Upflow

CST – Vivendi Biostyr BAF

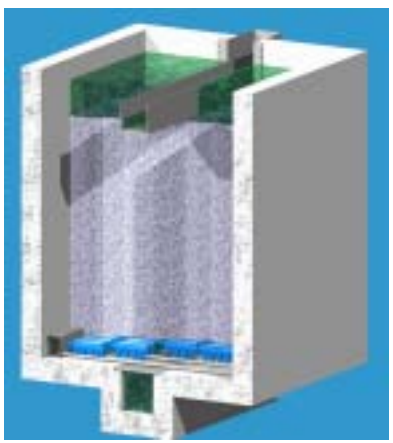


Floating media, Upflow

Black & Veatch - SAF + Denite

Submerged Aerated Filter (SAF)

Sunken media, Upflow



+

Denitrification Filter (Denite)

Sunken media, Downflow

CEPT Effluent Quality & Specified Pilot Plant Effluent Quality

Parameters(1)	CEPT Effluent (Average)(2)	Specified Pilot Plant Effluent(3)	
		(95 Percentile)	(Maximum)
BOD_5	59mg/L	20mg/L	40mg/L
TSS	37mg/L	30mg/L	60mg/L
NH_4-N	20mg/L	2mg/L	4mg/L
TN	28mg/L	8mg/L	16mg/L

(1) BOD_5 = 5 days biochemical oxidation demand; TSS = total suspended solids; NH_4-N = ammonia; TN= total nitrogen

(2) Average CEPT effluent quality during the trial period from April 2002 to February 2003

(3) Ref : SSDS EIA Study in January 2000, which is reported under EPD's web-site on SSDS Review - Resource Material (Technical Information) Table 4

Discussions on ATAL BHU's BAF

- It is the best performing pilot plant among the three tested pilot plants.
- It is able to treat the CEPT effluent in both summer and winter conditions.
- Ammonia removal is the limiting factor of the technology. The sizing of the nitrifying filters depends on the effluent ammonia standard.

Performance of ATAL BHU's Treatment Schemes

Contractor A - BAF	**Treatment Scheme 1**		**Treatment Scheme 3**	
	Summer	**Winter**	**Summer**	**Winter**
Sewage temperature (℃)	30	22		22
Treatment Capacity (m^3/hr)				
Design Capacity[1]	-	6.1	-	4.3
Maximum Capacity Achieved	11.5	9.0	-	6.0
Backwash requirement:				
Main backwash:				
BAF Unit 1	every 16hrs	every 22hrs	-	every 23hrs
BAF Unit 2	every 60hrs	every 50hrs	-	every 50hrs
BAF Unit 3	every 13hrs	every 16hrs	-	every 40hrs
Effluent Quality (95%tile)				
BOD_5 (mg/L)	6.1	6.8	-	6.5
TSS (mg/L)	6.9	15.4	-	7.9
NH_4-N (mg/L)	1.8	1.4	-	2.5
TN (mg/L)	5.7	7.0	-	5.3
Methanol dosage (g/m^3)	44	49	-	19
Sludge production (g/m^3)	73	97	-	56

Discussions on CST Vivendi's BAF

- It is able to treat the CEPT effluent in both summer and winter conditions.
- The Treatment Scheme 2 was terminated in late Nov 2002 after two months trial due to clogging of the upper air grid in the N/DN column.
- The technology has different limiting factors under summer and winter conditions:
  - Summer: The hydraulic velocity
  - Winter: The nitrification capacity

Performance of CST Vivendi's Treatment Schemes

Contractor C - BAF	**Treatment Scheme 1**		**Treatment Scheme 2**	
	Summer	Winter	Summer	Winter
Sewage temperature (℃)	29-31	23-24	29-30	-
Treatment Capacity (m^3/hr)				
Design Capacity	-	8.0	-	5.9
Maximum Capacity Achieved	12.0	8.0	5.0	-
Backwash requirement:				
Main Backwash				
BAF Unit 1	Once a day	Once a day	Once a day	-
BAF Unit 2	Once a day	Once a day	Once a day	-
Mini Backwash				
BAF Unit 1	-	-	-	-
BAF Unit 2	Once a day	Once a day	-	-
Effluent Quality (95%tile)				
BOD_5 (mg/L)	11.3	6.3	6.2	-
TSS (mg/L)	13.0	20	8.3	-
NH_4-N (mg/L)	2.2	1.8	3.1	-
TN (mg/L)	8.0	6.4	8.8	-
Methanol dosage (g/m^3)	50	51	33	
Sludge production (g/m^3)	52	51	40	

Overview of the Pilot Plant Trial Findings

- Feasible to treat saline CEPT effluent with BAF to meet the stringent nitrogen requirement.
- More frequent backwashing is required in Hong Kong.
- The treatment capacity were reduced by 26% & 33% in the winter as compared with summer.
- For SAF, the performance was not satisfactory.

Overview (Continued)

- Sludge yield from BAF was about 68g/m^3 sewage treated, representing an increase of 45% of current sludge production.
- Methanol dosage required was about 50 g/m^3 to meet the denitrification requirement. This amount to $133M per year for an average flow of 1.73 Mm^3/d.
- Pre-denitrification would reduce the methanol consumption by 34-60%, and reduce the sludge production by 23-42% . However, the trade-off would be 33% reduction in treatment capacity.

Overview (Continued)

- Both BAF contractors suggested that it is possible, although difficult, to install BAF facilities up to 3 or 4 levels at the available land at SCI STW (2.3 ha) to provide treatment for an average flow of 1.73 Mm^3/d and to meet the specified standard.
- However, for higher flows is considered technically very difficult.
- Moreover, multi-level BAF installation would make the design and operation more difficult.

Overview (Continued)

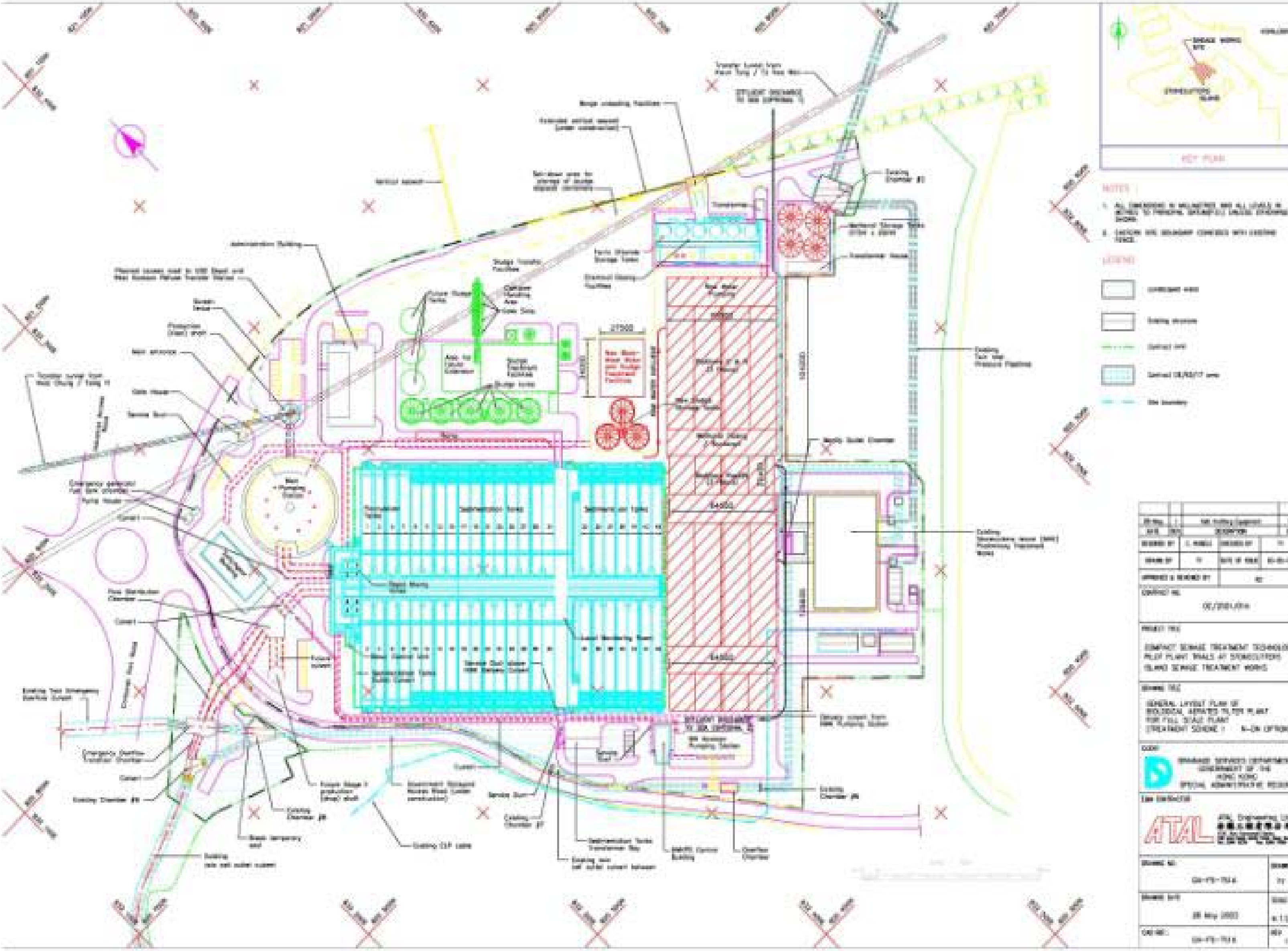
- The satisfactory operation of BAF depends heavily on:
  - the technical knowledge and experience of the operators on the respective BAF technology, and
  - the reliability of the on-line instrumentation & control system.
  - the complicated E&M installations and full automatic operation of the BAF system.
- Adequate No. of standby E&M equipment and filters should be provided to ensure the reliability.

Implications of the Effluent Quality

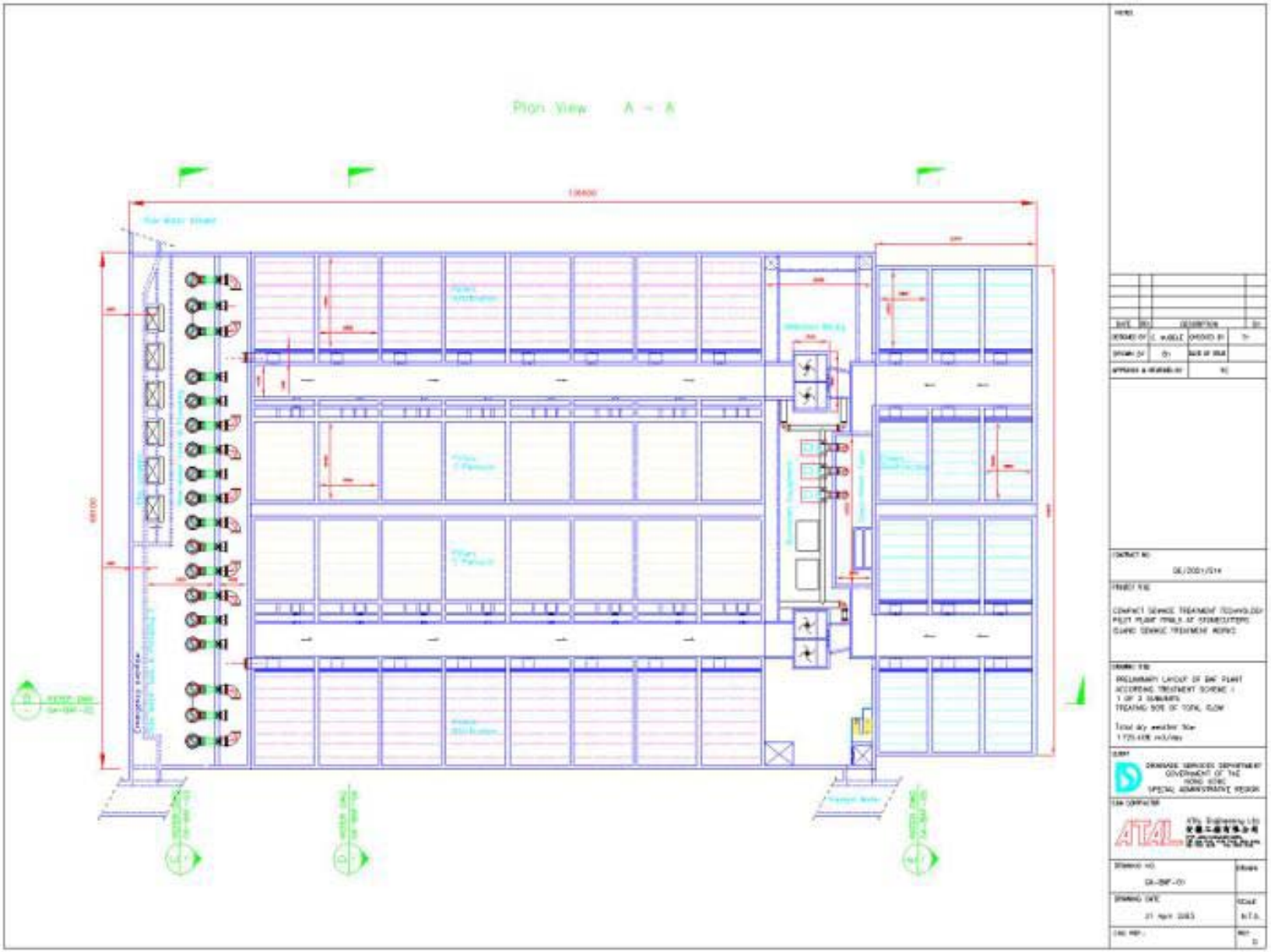
- The effluent ammonia standard controls the number of nitrifying filters required, which will have substantial implication on the capital and recurrent costs.
- The effluent total nitrogen standard will also have impacts on the capital and recurrent costs (in particular the cost of adding additional carbon (methanol)).

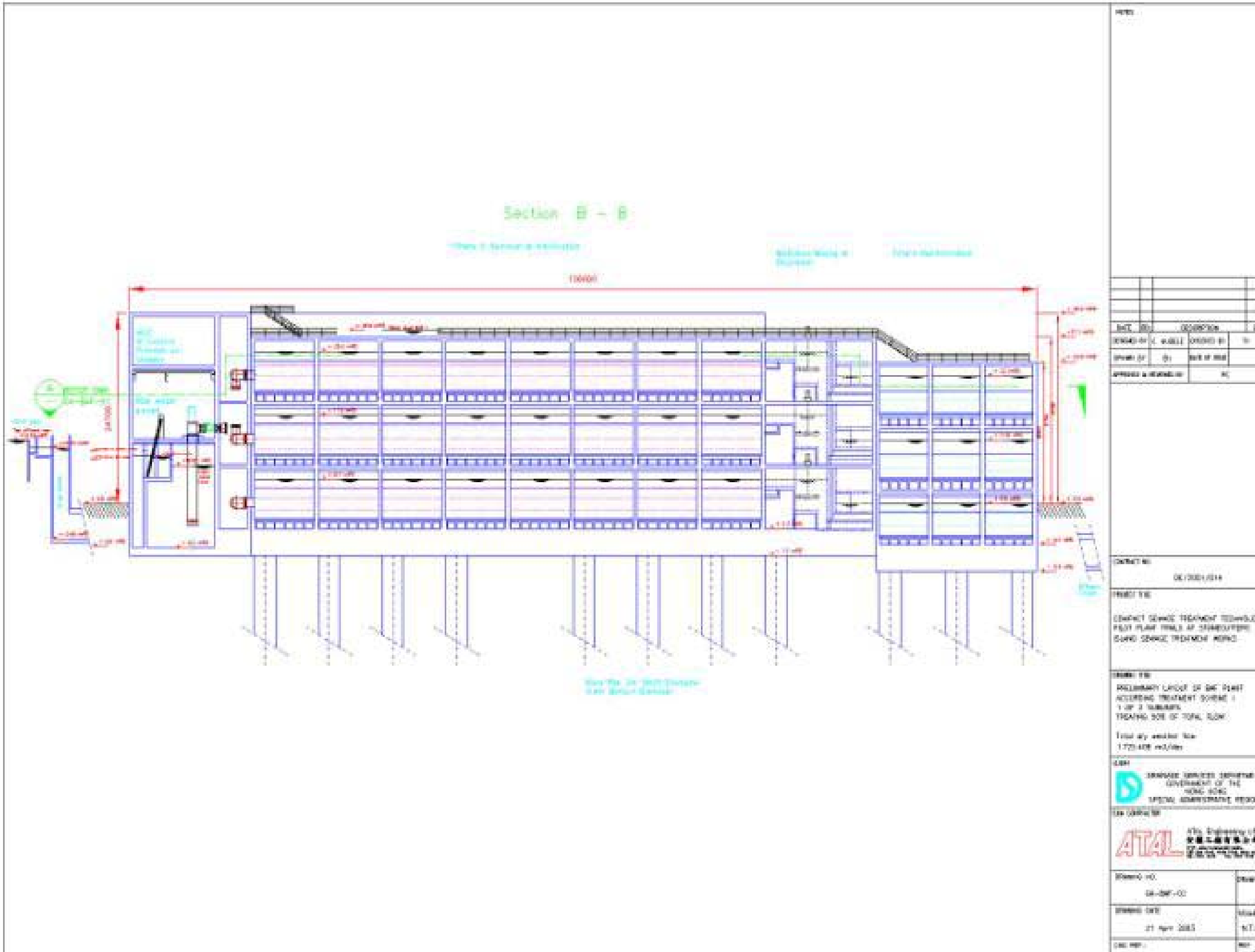
Preliminary Design of the Full Scale Plants

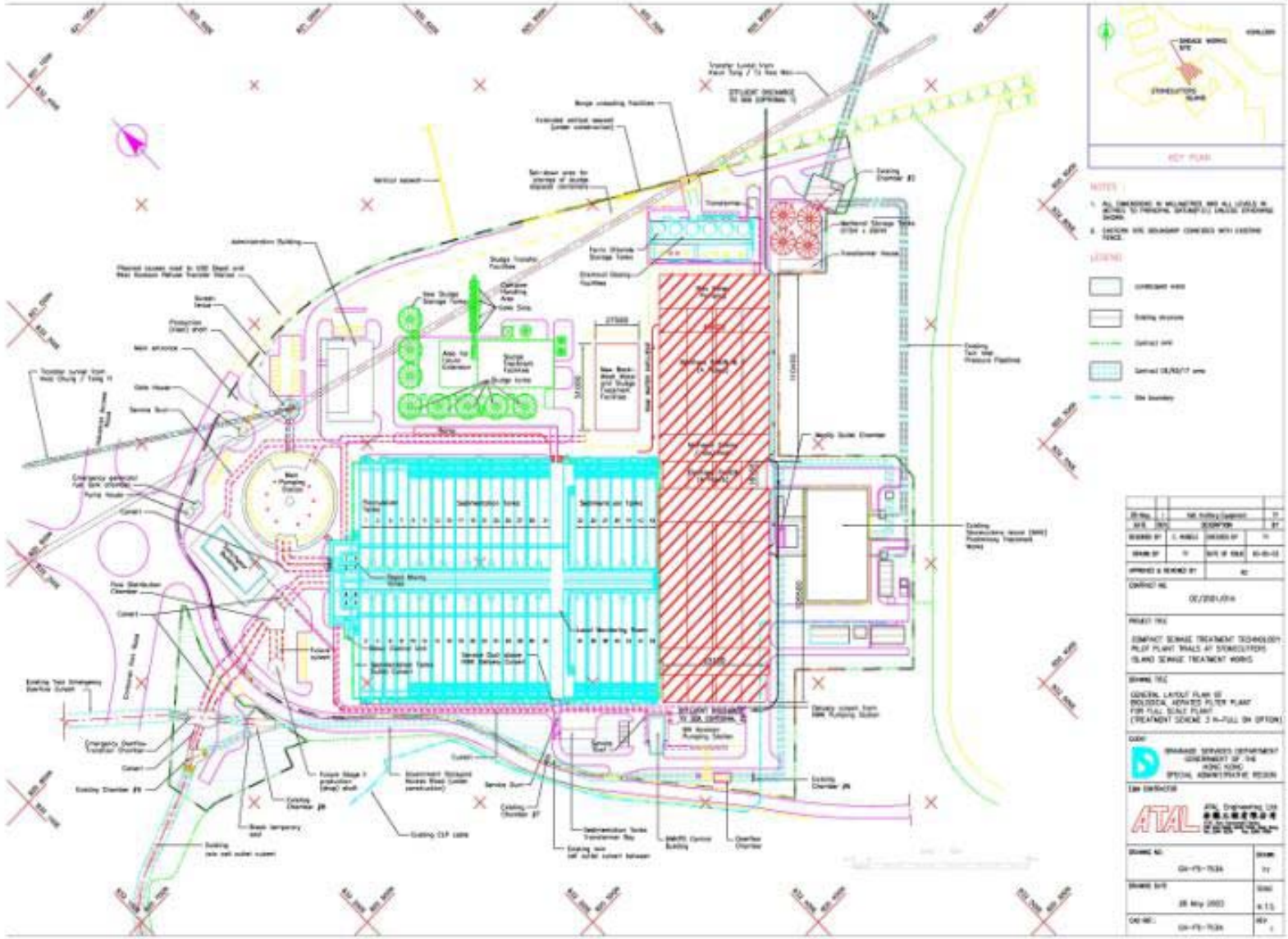
Plant Design	Contract A	Contract B	Contract C
Average Dry Weather Flow (m^3/d)	1,725,408	1,725,408	1,725,408
No. of Levels for Biofilters	3	2	4
No. of Biofilter Stages	3	2	2
No. of Biofilters	Stage 1 = 96 Stage 2 = 96 Stage 3 = 72 Total = 264	SAF = 86 Denite = 90 Total = 176	C/N = 140 DN = 38 Total = 178
Total Biofilter Surface (m^2)	Stage 1 = 8,467 Stage 2 = 9,919 Stage 3 = 5,141 Total = 23,527	SAF = 15,480 Denite = 5,886 Total = 21,366	C/N = 32,480 DN = 8,816 Total = 41,296
Media Height (m)	Stage 1 = 3.2 Stage 2 = 3.7 Stage 3 = 3.0	SAF = 8.0 Denite = 2.0	C/N = 3.5 DN = 3.0
Total Media Volume (m^3)	Stage 1= 27,095 Stage 2 = 36,699 Stage 3 = 15,422 Total = 79,216	SAF = 123,840 Denite= 11,772 Total = 135,612	C/N = 113,680 DN = 26,448 Total = 140,128



KEY PLAN
NOTES
LEGEND
COMPACT SEWAGE TREATMENT TECHNOLOGY PILOT PLANT TRIALS AT STONECUTTERS ISLAND SEWAGE TREATMENT WORKS
GENERAL LAYOUT PLAN OF BIOLOGICAL AERATED FILTER PLANT FOR FULL SCALE PLANT
DRAINAGE SERVICES DEPARTMENT
GOVERNMENT OF THE HONG KONG SPECIAL ADMINISTRATIVE REGION
ATAL


Plan View A - A


Section B – B
COMPACT SEWAGE TREATMENT TECHNOLOGY
PILOT PLANT TRIALS AT STONECUTTERS
ISLAND SEWAGE TREATMENT WORKS
PRELIMINARY LAYOUT OF BAF PLANT
ACCORDING TREATMENT SCHEME 1
1 OF 3 SUBUNITS
TREATING 50% OF TOTAL FLOW
DRAINAGE SERVICES DEPARTMENT
GOVERNMENT OF THE
HONG KONG
SPECIAL ADMINISTRATIVE REGION
ATAL
21 April 2003
N.T.S.



End of Presentation

Thank you

Monitoring Group on Trials and Studies for HATS
6th Meeting at 9:00 a.m. on Wednesday, 17 September 2003

Present:

Mrs Rita Lau	Permanent Secretary for the Environment, Transport and Works (Chairman)
Prof Leonard Cheng	
Dr Albert Koenig	
Prof Rudolf S S Wu	
Ms Iris Tam	Member of Advisory Council on the Environment
Dr Ng Cho-nam	Member of Advisory Council on the Environment
Dr Ho Kin-chung	Member of Advisory Council on the Environment
Mr Chan Bing-woon	
Mr Jimmy Kwok	
Mrs Josephine Mak	
Mr Robert Law	Director of Environmental Protection
Mr Raymond Cheung	Director of Drainage Services
Mr Raistlin Lau	Principal Assistant Secretary for the Environment, Transport and Works (E) 1(Secretary)

In attendance:

Ms Doris Cheung	Deputy Secretary for the Environment, Transport and Works (E) 1
Mr Benny Wong	Assistant Director of Environmental Protection
Dr. Malcolm Broom	Principal Environmental Protection Officer, EPD
Mr S K Aggarwal	Assistant Director of Drainage Services
Mr W W Chui	Chief Engineer, Drainage Services Department
Dr Samuel Chui	Assistant Secretary for the Environment, Transport and Works (E) 1A
Mr John Gall	CDM (on agenda items 4 and 5 only)
Mr James Chan	CDM (on agenda items 4 and 5 only)
Prof. Paul Harrison	CDM / Hong Kong University of Science and Technology (on agenda item 4 only)
Mr. Chris Chen	CDM(on agenda items 4 and 5 only)

Absent with apologies

Professor Peter Hills	Member of Advisory Council on the Environment
Mr W S Chan	Deputy Secretary for the Environment, Transport and Works (Works Policy)

Discussion

1. The Chairman welcomed Members to the 6th MG Meeting.

I. Confirmation of the minutes of the 5th meeting

2. The revised minutes of the 5th meeting sent to Members on 15 September 2003 were confirmed without further amendment.

II. Matters arising

3. **Paragraph 9** of the minutes of the 5th meeting – The Secretary reported that EPD/ETWB would prepare the consultation plan, taking into account the views of the Members on the water quality assessment and treatment levels required, for MG's discussion at the next meeting.

4. **Paragraph 17** – The Secretary reported that the technical meeting on nutrient issues had been organized on 17 July 2003. It was attended by Prof. Rudolf Wu, Dr. Albert Koenig and Dr. C.N. Ng. During the meeting, Prof. Paul Harrison of the Hong Kong University of Science and Technology (HKUST) had presented the marine survey and laboratory bioassay results and the basis of the algal growth phosphorus limitation hypothesis. The summary of discussion was attached to Paper MG(2003)09.

5. **Paragraph 50** – The Secretary reported that DSD had documented the operational problems encountered during the trials in the Compact Sewage Treatment Technology Trials (CSTTT) Final Report. The Executive Summary of the Final Report and the Independent Checker's Report were included in the Paper MG(2003)07. These reports were also uploaded to the Clean Harbour website. Members who were interested to see the full Final Report were welcome to contact DSD for arrangement.

III. Progress Report on Trials and Studies for HATS – (Paper No. MG(2003)08)

6. The Chairman invited Mr. Benny Wong of EPD to report on progress of the trials and studies for HATS. Mr Wong took Members through the paper. The Chairman pointed out that the trials and studies for HATS were approaching the final stage and there should not be any further slippage

other than that reported at the 5th MG meeting.

IV. Water Quality Assessment for the Environmental and Engineering Feasibility Studies – (Paper No. MG(2003)09)

7. The Chairman welcomed Mr. John Gall, Mr. James Chan, Prof. Paul Harrison and Mr. Chris Chen of CDM/HKUST. Mr. John Gall reported the discussion on nutrient issues that took place at the technical meeting and gave a PowerPoint presentation to Members on the supplementary findings of the water quality assessment (Presentation materials at Annex A).

8. In response to Dr. Albert Koenig's enquiry, Mr. Gall clarified that the *E.coli* criteria would be met on average but because of tidal movements there could be periodic exceedances which would be a cause for concern. It would be prudent to provide disinfection to reduce the human health risk associated with swimming activities at beaches, potential transmission of disease through human consumption of fish obtained from the sea and the potential ecological risk to the marine mammals. The Chairman also considered that disinfection would help address the public concern over the potential health hazards caused by the abstraction of seawater for keeping live seafood. Mr. Robert Law added that disinfection would also address the concern over disease transmission associated with secondary contact recreational activities such as sailing within the harbour. In response to Prof. Rudolf Wu, Mr. Gall undertook to provide information showing the water quality modeling results of the disinfection process under Option 5A and Option 5B. (**Action: CDM**)

9. Mr. Chan Bing-woon asked whether the consultants had assessed the risk of the outbreak of new diseases, such as SARS, attributable to the HATS system. Mr. Gall explained that although 30% of the sewage within the HATS catchment was untreated at the moment, disinfection would be provided for all sewage from the HATS catchment ultimately. The potential health risk attributable to the HATS discharge should therefore be very low. The Chairman commented that CDM might not be able to give a detailed risk assessment in this regard as it would not be within the scope of the EEFS.

10. Prof. Rudolf Wu asked whether CDM had assessed the potential impacts of nutrients on the corals. Prof. Paul Harrison replied that the potential impacts of nutrients on corals were minimal. Mr. Gall said that CDM would include information about the nutrient levels at the coral areas in the Final Report (**Action : CDM**).

11. In reply to Prof. Leonard Cheng's query, Mr. Gall explained that at present, the phosphorus removal was about 40-50%. By increasing the ferric chloride dose from 10 mg/L to 20 mg/L in the Chemically Enhanced Primary Treatment (CEPT) process, the phosphorus removal efficiency would be enhanced. This would not involve any additional capital cost but the running cost would increase by $47 million per annum. On the other hand, denitrification would require additional capital and recurrent costs of around $2 billion and $250 million per annum, respectively.

12. Dr. K.C. Ho noted that the last page of Paper MG(2003)09 stated that it was not possible to conduct comparisons between the bioassay experiments and the water quality model coefficients. He suggested further bioassay analysis be conducted in the future to improve the accuracy of the water quality model should resources allow. He asked whether it was possible to provide flexibility to expand the treatment works to include denitrification in the longer term, if only nitrification was provided initially.

13. Mr. Raymond Cheung responded that the design of the treatment works would affect the flexibility. As a BAF plant was based on a modular design, it would be relatively easy to add the denitrification process in future, provided that land was available. For other treatment technologies, although the addition of denitrification at a later stage might involve more retrofitting work, it could still be done provided that land and funding were available.

14. Mr. Chan opined that the technical issues would not be easily understood by members of the public. He was uncertain as to whether the public could be convinced of the need to make the huge investment in HATS. The Chairman agreed that the consideration of treatment technologies and standards might be too technical and complex for the general public to digest and the public might not be able to appreciate the improvement brought about by HATS easily. Yet, the cost involved would be substantial. The public consultation exercise had to be well thought out and planned with the benefits and all attendant implications clearly set out and explained. The content had to be reader friendly to enable informed opinion to be given.

15. Prof. Wu said that he had discussed the water quality assessment with Prof. Harrison at length and he was satisfied with the analysis provided by CDM. He considered that the discharge of CEPT effluent to the Harbour based on the configuration of Option 5A should be acceptable from the environmental point of view. However, he considered that Option 5B

would unlikely be acceptable from the environmental perspective because the waters south of Lamma Island were more sensitive. Having considered the cost implications, risks associated with the discharge and the potential environmental impacts, he advocated the adoption of a step-wise approach to implement the remaining stages of HATS, i.e. to enhance the level of treatment only when the actual need arises. Under this approach, he suggested that the Government could provide CEPT for all HATS flows at Stonecutters Island based on the configuration of Option 5A and then closely monitor the resultant water quality before investing in further treatment processes. If the monitoring results indicated that specific water quality objectives could not be met, additional treatment processes such as disinfection, BOD removal, nitrification, denitrification or enhanced phosphorus removal could be provided as the case might be. However, it was important for the Government to ensure that necessary land and funding could be reserved from the outset.

16. The Chairman concurred with Prof. Wu and considered that a step-wise and science-based approach would be prudent and rational. She said that it would help ensure the spending of public money in a well justified manner. She, however, cautioned that the eventual availability of the sites identified would be subject to a number of factors, including whether the relevant statutory and planning hurdles could be overcome etc.

17. In view of the fact that the bacterial levels at the Tsuen Wan beaches had increased after the full commissioning of HATS Stage 1, Mr. Rob Law asked whether Prof. Wu considered disinfection essential from the outset under his step-wise approach. Prof. Wu responded that the need of disinfection would depend on CDM's modeling results. Under Option 5A, only the beaches in Tsuen Wan were the sensitive receivers. If disinfection was required to meet the water quality criteria, then it should be provided up to the extent required to meet the criteria.

18. Dr. Ho supported the step-wise approach proposed by Prof. Wu. Prof. Wu added that the general principle was that if the risk was extremely high and the damage was irreversible, the precautionary principle should be adopted. However, as the remaining stages of HATS were only providing further treatment to the sewage currently being discharged into the harbour, the risk associated with the project should not be high. Moreover, as no water quality model could provide absolutely correct prediction, it would be prudent to provide additional treatment processes after the monitoring results had demonstrated their necessity. This would also prevent over-building. He therefore believed that the step-wise approach should be used for implementing the multi-billion-dollar HATS.

19. In light of the discussion that had taken place, Prof. Cheng asked whether the water quality criteria, such as ammonia, DO, BOD, were met at present. He remembered the discussion in the IRP stage was that CEPT alone clearly could not meet the water quality requirements in the future and therefore the only issue for debate was whether denitrification was necessary. He commented that if the water quality requirements could be met with only CEPT and direct discharge to the harbour area, not only the IRP but also the original Strategic Sewage Disposal Scheme (SSDS) were wrong because neither the tertiary treatment recommended by the former nor the long oceanic outfall proposed under the SSDS would be necessary.

20. Mr. Benny Wong explained that with the current HATS Stage 1 flow treated by CEPT, there was no immediate ammonia problem in most of the harbour area although elevated *E.coli* levels were detected in the western harbour area. However, both the SSDS and the IRP options were designed to cope with the ultimate sewage flow from the HATS catchment which was double the current HATS Stage 1 flow. He pointed out that all previous work had indicated that a treatment level of CEPT alone would not allow water quality objectives to be met in the long term. This was the reason why planning had proceeded originally on the basis of a long outfall which would allow residual pollutants to be diluted and dispersed, and now on the basis of a short outfall with a higher treatment level. Nevertheless, as it took time for the sewage flow to increase to the ultimate level, it should be possible to adopt the step-wise approach to enhance the treatment level according to the actual needs. Mr. Law added that the *E.coli* criteria for the Tsuen Wan beaches were not met at the moment. With an increased flow of CEPT effluent from the SCISTW, the *E.coli* levels in the region would further increase. Hence, it would be prudent to provide disinfection upfront.

21. Prof. Wu pointed out that under the configuration of Option 5A, all the treated effluent would be discharged through the Stonecutters Island outfall into the harbour area whereas the previous SSDS proposed to discharge the treated effluent to the water south of Lamma Island. As the harbour area was mainly used as a port and was less sensitive than the southern waters, a direct comparison of the step-wise approach based on the configuration of Option 5A and the original SSDS would not be appropriate. If the Government opted for Option 5B which was not a good option in his view, he might not advocate the step-wise approach. He also considered that as 30% of the sewage from the HATS catchment was still untreated at the moment, providing CEPT for the remaining untreated flow would mean a great improvement to the existing water quality.

22. Dr. Koenig asked whether the Government had promulgated any minimum effluent standards so far. Mr. Law explained that the effluent standards were set having regard to the water quality objectives and the assimilative capacity of the receiving waters. Nevertheless, the Government had an established policy that the minimum treatment level for major effluent discharges should be CEPT plus disinfection.

V. Schematic Designs and Cost Estimates for the Environmental and Engineering Feasibility Studies (Paper No. MG(2003)10)

23. The Chairman invited Mr. Gall to give a Powerpoint presentation to Members on the schematic designs and the cost estimates for the four IRP Options (Presentation materials at Annex B). To sum up, the capital cost estimates for the four IRP options would be some $21 – 22 billion while the recurrent cost estimates would be some $1.4 – 1.7 billion per year, at Year 2002 price level. For the STW near Stonecutters Island, apart from those essential facilities that had to be built at-grade, such as the methanol storage tanks, the power sub-station and the effluent pumping station, the other facilities would be built underground. For the satellite STWs at North Point and Sandy Bay, they would be built in caverns. The remaining one at Lamma Island was based on a standard at-grade (or above-ground) design.

24. In view of the fact that the projected ultimate full HATS flow had increased substantially as compared with the projection prevailing during the IRP stage, Prof. Cheng endorsed CDM's conclusion that the remaining space at the existing SCISTW was insufficient for accommodating enhanced treatment for even the ultimate HATS Stage 1 flow, even if the Biological Aerated Filter (BAF) technology was used. Nevertheless, he suggested that the consultants should consider building an above ground multi-storey BAF system at the potential site identified near Stonecutters Island because this might reduce the land footprint by two-thirds and avoid the need to build a big concrete slab for co-development with the planned Port Rail Terminal. Furthermore, Prof. Cheng also opined that the 60% contingency allowed for the treatment works appeared to be on the high side as most Government projects would only require 30 – 40% contingency. Finally, he questioned whether the projected ultimate full HATS flow of 2.8 million m^3/day would be too high, resulting in an over-built treatment facility.

25. As Prof. Cheng had to leave the meeting at this juncture due to other commitments, the Chairman invited him to provide further comments, if

any, in writing to the Secretary.

26. Mr. Gall continued his presentation on the schematic designs and cost estimates. In the light of Prof. Cheng's comment, he clarified that the contingency level for sewage treatment works at Stonecutters Island and Lamma Island was 40%. A higher contingency level of 60% was allowed for North Point and Sandy Bay because these two sewage treatment works would be constructed in caverns and there were great uncertainties concerning the geological conditions.

27. Mr. Gall pointed out that the design consideration for the BAF system near Stonecutters Island was to keep the site available for pursuing the planned use. Hence, underground facilities instead of an above ground multi-storey building were being proposed. On the sewage flow projections, Mr. Benny Wong clarified that the ultimate full HATS flow assumed under the EEFS was 2.8 million m^3/day for Year 20XX whilst that assumed by the IRP was about 2.4 million m^3/day for Year 2016.

28. Ms. Iris Tam asked whether CDM had assessed the impacts of STWs under the various IRP options on the surrounding land uses. Moreover, she asked about the constraints of the underground STW on the development potential of the site above ground system near Stonecutters Island. She also suggested that CDM should evaluate the land use opportunity costs of the underground option vis-à-vis the above ground multi-storey option.

29. Mr. Gall explained that the schematic design and cost estimate for the STW on the Stonecutters Island had factored in the requirement to allow for the co-development of a 10-storey building on top of the underground facilities. This should be sufficient for keeping the site for the planned use for the Port Rail Terminal and the storage of containers.

30. Mr. James Chan said that CDM had in fact assessed the impacts of the STWs on the surrounding land uses. As the site on the Stonecutters Island had been zoned for container related uses, it was unlikely that there would be residential developments on top. Moreover, as the site was next to the existing SCISTW and the majority of the new facilities would be constructed underground, the potential impacts of the new facilities to the neighbours would be minimal. For the two cavern STWs, the public would only see the cavern portals and therefore the potential environmental impacts of these STWs to the neighbours would also be minimal. The STW on the Lamma Island would probably have the most direct impacts on the surrounding land uses. However, in any case, there would be social issues related to siting of sewage treatment works that will need be taken

into account in the option evaluation task.

31. Dr. Koenig added that the two cavern STWs at Stockholm were larger than the two proposed STWs at North Point or Sandy Bay and they were right in downtown and surrounded by residential / recreational developments. The only major impact due to these cavern STWs would possibly be the need to erect a tall stack (a 120 m stack has been erected in Stockholm) for air emission. He therefore believed that the proposed STWs should not have any major impacts on the surrounding land uses. As for the cost estimates, Dr. Koenig opined that they were on the high side and might be reduced if disinfection and denitrification were not pursued and the contingency level was reduced at the later stage.

32. Dr. Ng opined that apart from the site near Stonecutters Island, the other proposed sites would probably be objected to by the local community. It would take much longer time to build up the consensus for HATS should options involving these sites be selected eventually.

33. Mr. Chan declared that he had property investment on Braemar Hill and Braemar Hill was his constituency. He believed Option 5D would be regarded as a non-starter by the local community. While Mr. Chan himself was open to all options, he believed the Eastern District Council would object to Option 5D vigorously. He echoed Prof. Cheng's view that CDM should consider a multi-storey treatment system near Stonecutters Island. He also pointed out that the Government should avoid over-building the treatment facilities.

34. As the HATS should be designed to cope with the long term needs of the harbour area for 50 years or more, the Chairman considered that it was sensible to build in some reserve capacity. Nevertheless, she agreed that the Government should be very cautious to avoid over-building the facilities. Mr. Law added that as BAF was a modular system, the treatment facilities could be built in stages to avoid over-building.

35. Ms. Tam opined that building a STW in a cavern was a good design given limited land resources in the urban areas. The Government should consider putting forward such an idea to the general public. However, she remained of the view that CDM should provide more information about the land use impact assessment to alleviate the local community's concern. Mr. Gall responded that this meeting was mainly focused on the schematic designs and he would provide further information on the impacts for surrounding land uses at the next meeting. (**Action : CDM**)

36. Mr. Law added that some of the IRP options were proposed to address the aspiration for a more distributed system from some sectors of the community. CDM's job was to assess the environmental and engineering feasibilities of these proposed options. From the initial findings presented by CDM, it appeared that there was not much difference among the options from the water quality point of view, although some options might appear to be more attractive than the others.

37. Mr. Jimmy Kwok opined that Option 5A appeared to be less objectionable. He said that the site was convenient for transportation of the chemicals required and the sludge generated which might therefore help reduce the operating cost and result in less traffic impact. The fact that the existing SCISTW was next to the site would also help reduce the objection from the local community. Moreover, the pumping cost and the impacts on the surrounding land uses would also be the least under Option 5A. In view of these factors, it would probably take the shortest time to take forward this option.

38. Dr. Ng said that he did not prefer the Lamma Island option in view of the potential impacts on the sensitive marine ecology in the southern waters and the fact that the ex-quarry site at Lamma Island had already been rehabilitated. He also anticipated that there would be strong objections from the local communities if any of the Lamma Island, North Point or Sandy Bay sites were selected for building STWs. He therefore considered that Option 5A together with the step-wise approach would be the best way forward.

39. In view of the fact that it would take less time and a lower cost, Dr. Koenig also favoured Option 5A. However, he observed that if the site near Stonecutters Island could not be made available, the Government would need to start all over again.

40. The Chairman pointed out that there was uncertainty as to whether the site near Stonecutters Island would be available eventually, even if co-development with the planned Port Rail development was assumed, due to various interfacing problems and competing uses. For instance, the feasibility of the co-development option would depend on whether the relevant construction programmes could be synchronized. A more secure site would be the ex-quarry site at Lamma Island although this might not be welcome by the local residents and the Islands District Council.

41. Dr. Koenig said that the IRP had not recommended a preferred option out of the four alternatives. He opined that the land value and potential revenue

generated by developments above the STWs should be included in the options evaluation. The Chairman pointed out that it would not be easy to quantify the land value or assess the potential revenue and CDM was not expected to do so according to the study brief requirements. Mr. Cheung added that CDM had developed the schematic design for the STW on the Port Rail Terminal site with a view to keeping the original land use potential of the site. As for the cavern STWs, they did not take up any virgin land. As for the STW on the Lamma Island site, it would affect the land value as the site might be used for other more appealing uses but it would be difficult to assess the land value change.

42. Dr. Ng considered that the public was under the impression that a more distributed system should be less risky as compared to a centralized system. However, this might not be true as the cavern options might have a higher risk of failure. He suggested CDM to address this issue in its final report. Mr. Chan concurred with Dr. Ng's view. Mr. Gall replied that construction and operational risk assessments of the four options were being conducted.

43. In response to the Chairman's query, Mr. Gall advised that the study would be completed by end of November. The Chairman suggested that the next meeting should probably be held in December after CDM had submitted its final report. She also noted that development of the phased implementation options was not within CDM's study brief and considered that EPD and DSD should work with CDM to draw up an implementation plan based on the step-wise approach for discussion at the next meeting. (**Action : EPD/DSD**)

44. Ms. Josephine Mak considered that there was a need to compare the various options with the help of a decision matrix which took into account all relevant factors such as the water quality impacts, engineering feasibility, cost implications etc. The public should be informed of why a particular option was recommended. Ms Tam reiterated that it was very important to clarify the impacts on the surrounding land uses as the public would probably object to an option if such information was not fully provided.

45. The Chairman concurred with the views tendered by Members. She suggested that the consultation strategy could be discussed at the next meeting. She requested CDM to take into account the views of Members and address them appropriately in the Final Report (**Action : CDM**). She observed that Members appeared to have a general preference for Option 5A using the step-wise approach. She then invited Members' view on whether a preferred option or all the feasible options should be included in the consultation.

46. Dr. Ng recommended putting forward a preferred option and considered that the Government should steer the consultation closely to avoid losing the focus. Dr. Ho, on the other hand, opined that the MG should not recommend a preferred option. Mr. Kwok shared Dr Ng's view and opined that the public should be informed about the cost implications of different treatment levels so that they could choose whether they would want to pay for the additional treatment costs.

47. Ms. Tam suggested expressing the cost implications in terms of the cost to be borne by each family to help the public understand their share of contribution (**Action : DSD/ETWB**). Mr. Chan concurred with Ms. Tam's view. The Chairman responded that the expenditure on sewage treatment was far above the revenue generated from the sewage charges as the Government had not been successful in increasing the sewage charges since the charges were first introduced in 1995. The Secretary added that the total recurrent cost for all existing sewerage facilities amounted to more than $1 billion at present. Since the recurrent cost of the full HATS would be around $1.4-$1.7 billion per annum, this would mean that the sewage charges would need to be doubled if the Government aimed to maintain the same cost recovery rate.

48. In response to Dr. Ho and Dr. Koenig, the Chairman said that the Government had intended to conduct a full-scale consultation exercise involving the LegCo, green groups, other major stakeholders and the general public. ETWB/EPD would develop a consultation plan for discussion at the next meeting. (**Action ETWB/EPD**)

VI. AOB

49. In response to Mr. Chan's query, the Secretary responded that the papers and discussion taken place should be regarded as confidential.

VII. Date of Next Meeting

50. The Chairman informed Members that the next meeting to be held in December 2003 would probably be the round up meeting to discuss the Final Report of the Environmental and Engineering Feasibility Study and the Consultation Plan. The Secretary would confirm the exact date with Members nearer the time.

Environment Transport and Works Bureau
September 2003

Further Briefing On Water Quality Impacts Of HATS Options

HATS Monitoring Group

September 17, 2003

Agenda

- Review Conclusions From Prior Meeting
- Discuss Impacts with Respect to Marine Resources

Summary of Prior Meeting Conclusions

- Receiving Water Affords High Dispersion
- Offshore Influences Prevent Full Attainment Of Criteria
- IRP Levels Of Treatment Produce Significant Compliance With Criteria
- Alternative IRP Configurations Do Not Make Material Difference In Conclusions
- Discussion over Nutrient Control Strategies

Follow-On Information

- **Issue: Potentially Limiting Nutrients Could Be Either Nitrogen Or Phosphorus**
- **Proportionally, Hong Kong's Phosphorous Contribution Greater Than Nitrogen Contribution**
- **Predictions Suggest Only Small Changes In Algal Productivity Regardless Of Control Strategy**
- **Enhanced Phosphorus Control Provides Cost Effective Approach To Minimizing Possible Problems**

Resource Assessments

- **Primary Resources**
  - Fisheries
  - Mammals & Sea Turtles
  - Corals
  - Bottom Organisms
- **Assessments of:**
  - Construction
  - Operation

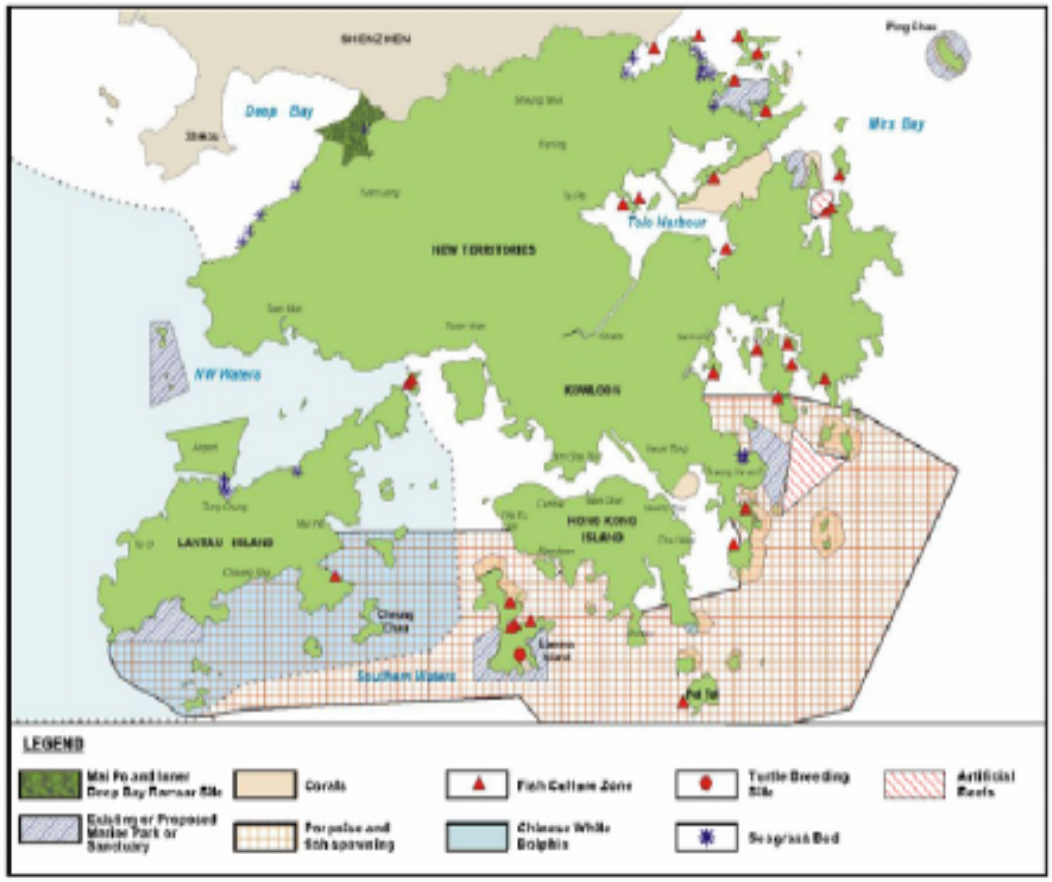


Figure 1 Natural Marine Resources in Hong Kong

Fisheries

- **High Level Of Treatment Reduces Stress From Low Dissolved Oxygen And Ammonia.**
- **High Dilutions And Treatment Mitigate Against Impacts At New Outfall Locations.**
- **Disinfection Advisable To Minimize Disease Transmission.**
- **Construction Poses No Threat To Fisheries At Northpoint Or Sandy Bay. Care In Construction Protects Resources At Lamma.**

Mammals and Sea Turtles

- **Important Habitats Are Relatively Remote From Discharges At Sandy Bay, SCI And North Point.**
- **Treatment And Dispersion Mitigate Against Impacts. Disinfection Minimizes Potential For Disease.**
- **Porpoise And Sea Turtles In Close Proximity To Lamma Discharges, But Treatment And Dispersion Mitigate Potential For Impacts.**
- **Proper Management Of Construction Techniques Serves To Minimize Impacts.**

Corals

- **Little To No Resources Near North Point Or Stonecutters Island. Somewhat More Valuable At Sandy Bay. Relatively More Extensive At Lamma**
- **Primary Impacts Arise From Sedimentation And Salinity Changes, neither of which at Issue for HATS**
- **Potential Construction Impacts at Sandy Bay considered relatively insignificant owing to small area of impact and modest value of resource.**

Bottom Organisms

- **Existing Resources Of Low Ecological Or Conservation Value.**
- **Reduction In Pollution Serves To Enhance Diversity**
- **Any Impacts Very Highly Localized**
- **Resources Disturbed By Construction Quickly Re-colonize.**

Overall Summary

- **Levels Of Treatment Represented By IRP Options And Dispersion Provide Significant Resource Protection**
- **Some Discharge Locations Have Greater Diversity Of Resources Than Others**
- **Care In Operations And Construction Can Mitigate Adverse Impacts**

Briefing On Schematic Designs of HATS Options

HATS Monitoring Group

September 17, 2003

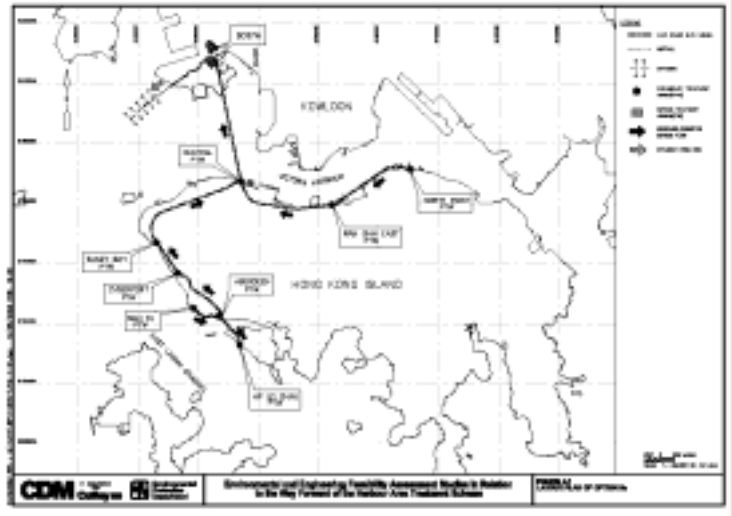
Agenda

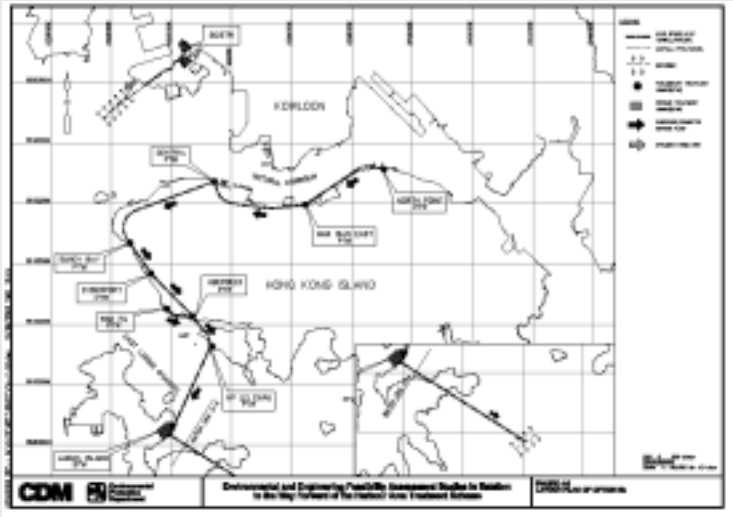
- Review Basis of Design
- Present Tunnel Alignments
- Present Plant Layouts
- Present Estimated Costs

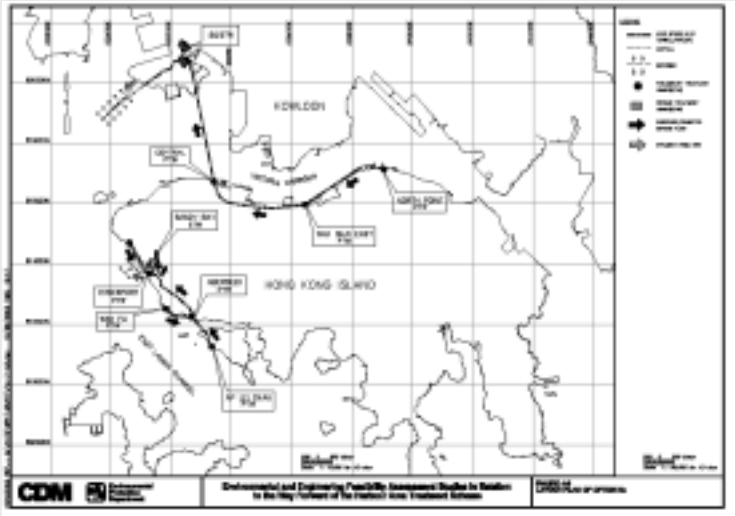
Basis of Design

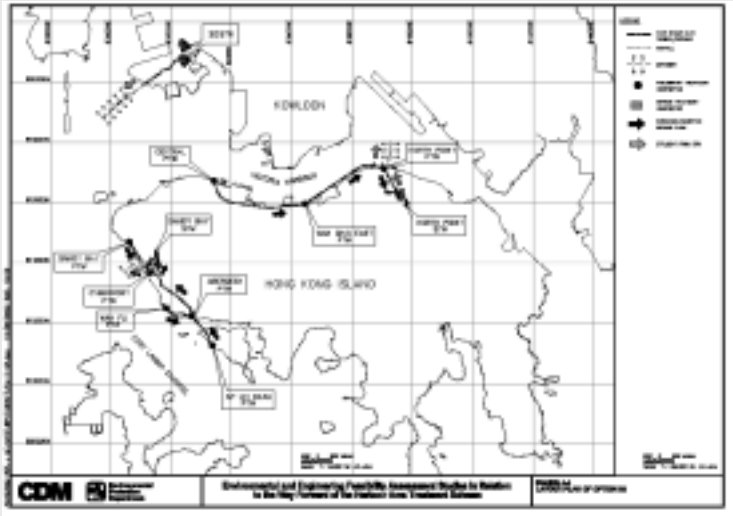
- **Design Flow Of 2.8 Million Cubic Metres Per Day**
  - **Lamma At 0.598, North Point At 0.466, Sandy Bay At 0.132**
  - **Balance At SCI**
  - **Peak Factor Of 1.5 For Process Design; 2 For Hydraulics**
- **Options To Meet Different Effluent Limits:**
  - **Denitrification To 8 Mg/L Total Nitrogen**
  - **Nitrification To 2 Mg/L Ammonia Nitrogen**
  - **Up To 80 % Phosphorus Removal**
  - **Disinfection**

Tunnel Alignments

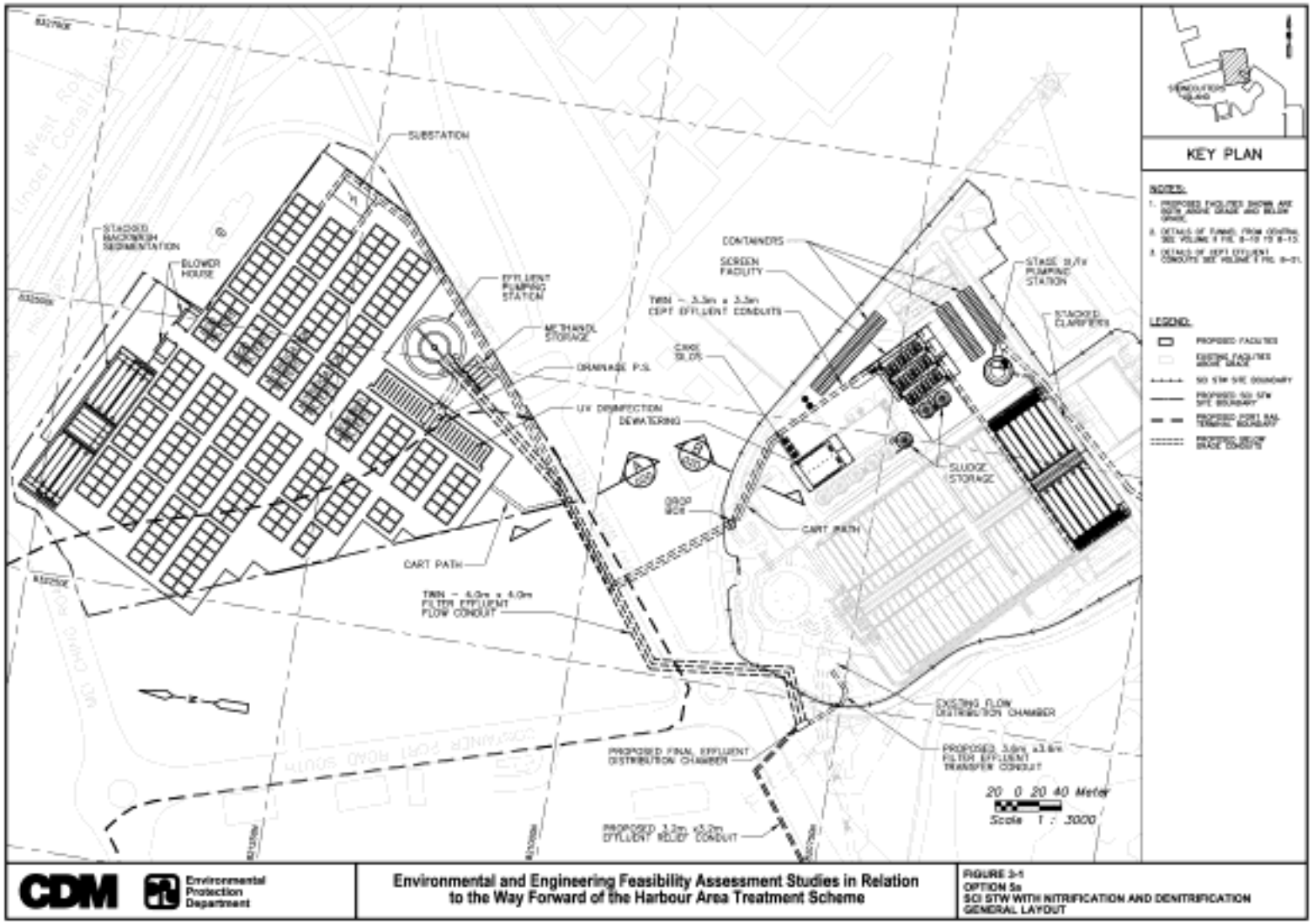




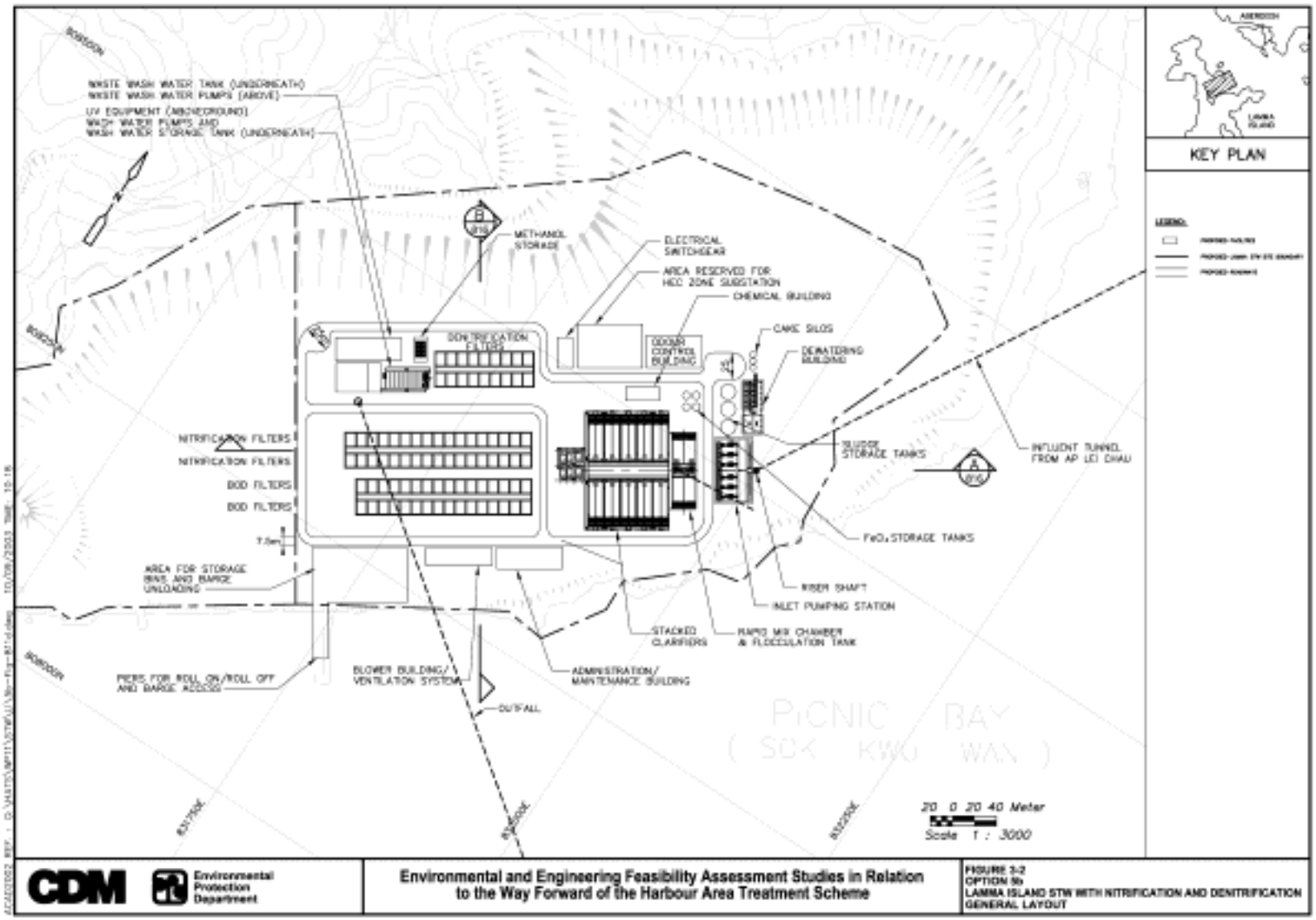




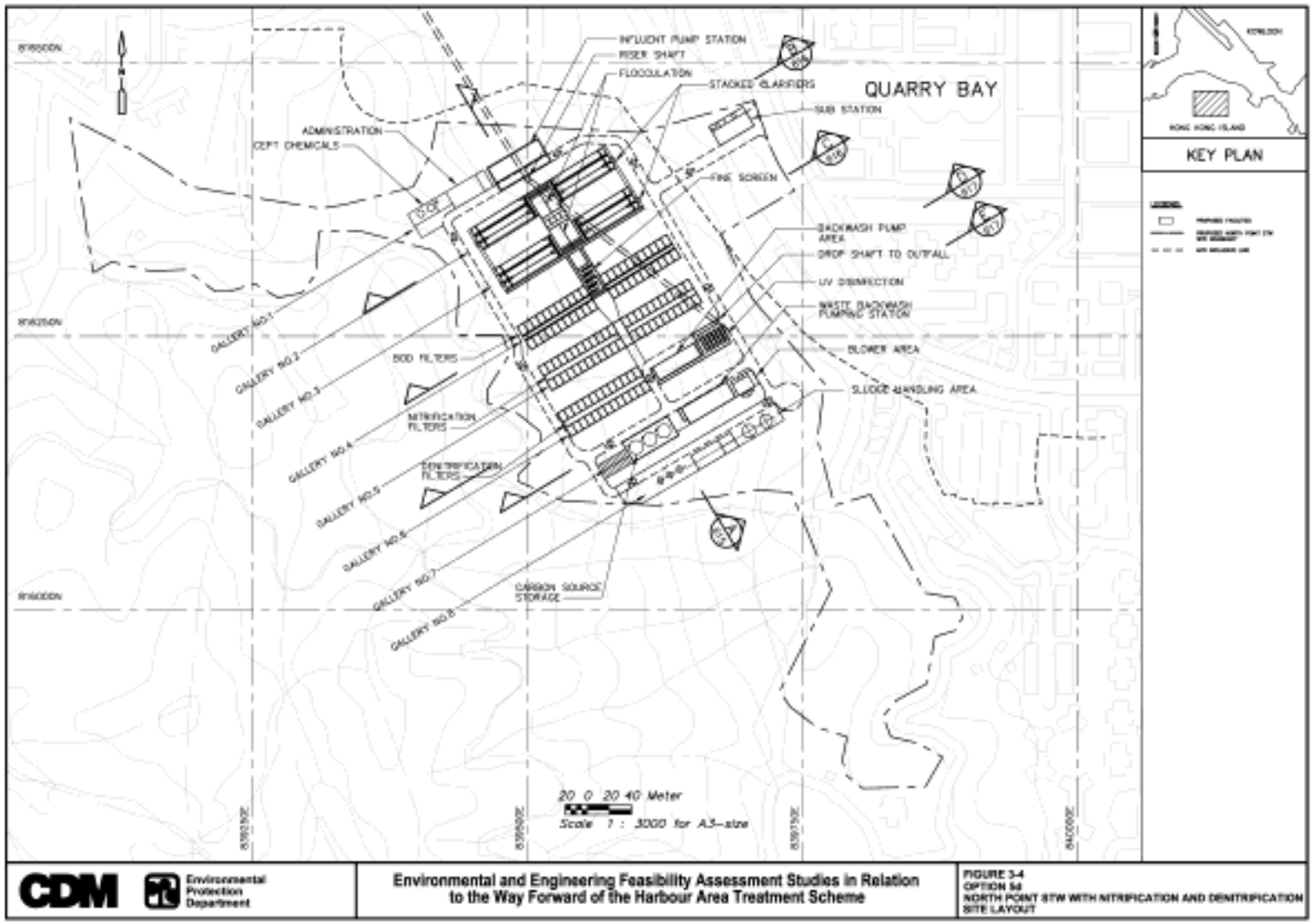
Stonecutters Island Layout



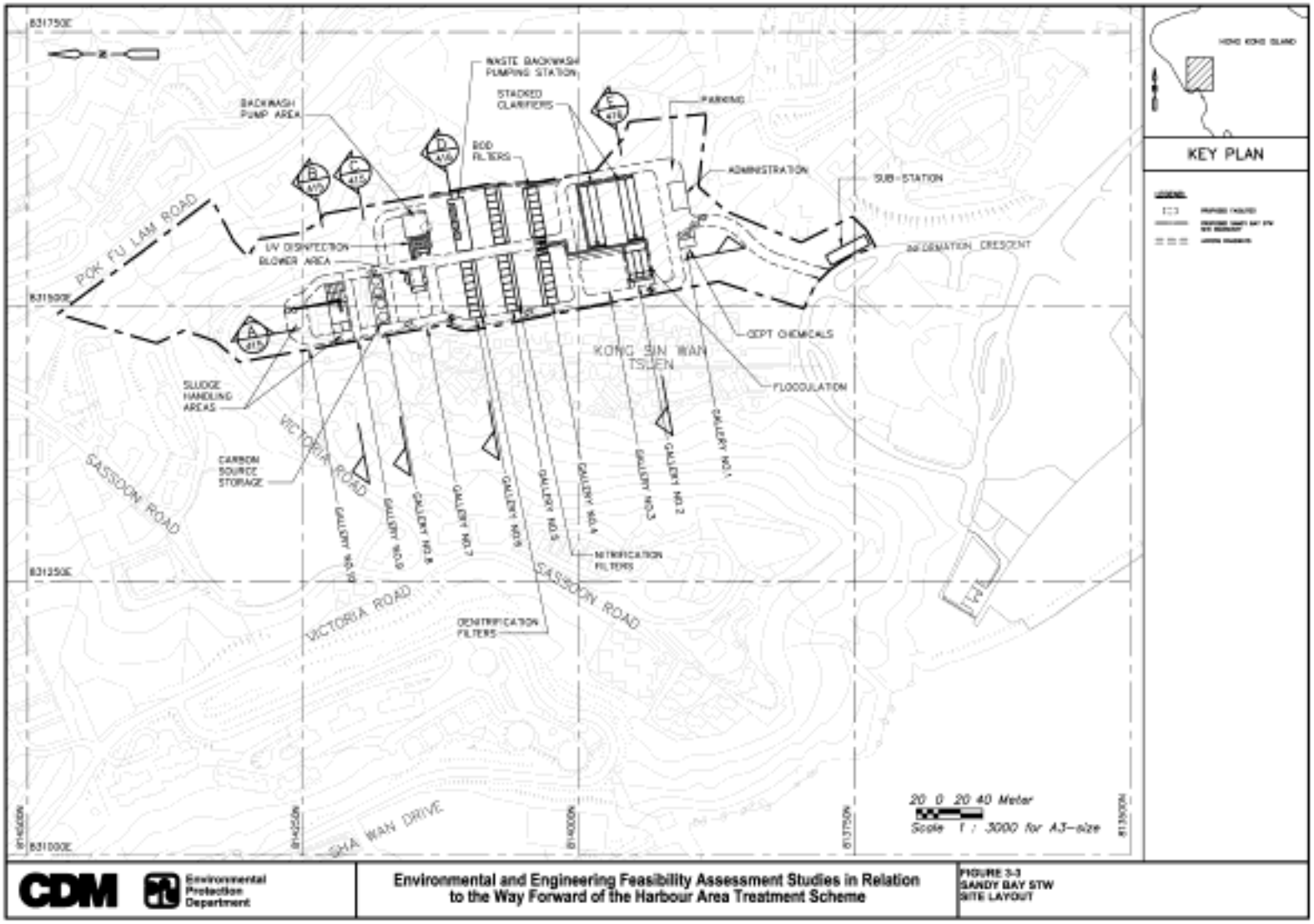
Lamma Island Layout



North Point Layout



Sandy Bay Layout



Important Aspects of Designs

- **At All Locations, Significant Ancillary Facilities**
  - **Influent Pumping, Effluent Pumping, Screening Facilities, Sludge Processing, UV, Electrical Supply, Administration, CEPT Facilities, Chemical Storage,**
- **Premium Associated with Below Grade/Cavern Facilities**
  - **Site Development/Circulation**
  - **Ventilation**
  - **Access, Safety, Equipment**

Cost of Alternatives

- Costs Based On Vendor Information, Prior Stage I Costs, Local Quotations And Experience.
- Construction Costs Include Contingency Allowances
- Costs Information Based On Maximum Treatment:
  - Denitrification, Disinfection, Enhanced Phosphorous,
  - Following Slides Identify Incremental Costs Associated With Denitrification, Disinfection, Enhanced Phosphorous

Estimated Capital Costs

	5A	5B	5C	5D
Treatment Works	14.1	13.7	14.9	15.8
Tunnel/Outfalls	3.8	4.7	3.6	3.3
PTW	1.3	1.3	1.3	1.3
Sludge Incineration	1.9	1.9	1.9	1.9
Total	21.1	21.6	21.7	22.3

Values in HK $Billions
Includes Engineering and Contingency Allowances

Denitrification Costs Approximately $ 2.0 Billion
Disinfection Costs Approximately $0.26 Billion

Estimated Recurrent Costs

	5A	5B	5C	5D
Stage I Works	0.292	0.292	0.292	0.292
Treatment	0.987	1.005	1.102	1.257
Tunnel/Outfall	0.026	0.020	0.027	0.026
Sludge Disposal	0.115	0.115	0.115	0.115
PTW	0.028	0.028	0.028	0.028
Total	1.448	1.460	1.564	1.718

Values in Billion HK$

Denitrification Adds Approximately $0.25 Billion Per Year

Disinfection Adds Approximately $0.060 Billion Per Year

Enhanced Phosphorus Adds $0.047 Billion Per Year

Monitoring Group on Trials and Studies for HATS
7th Meeting at 2:30 a.m. on Wednesday, 17 December 2003

Present:

Mrs Rita Lau	Permanent Secretary for the Environment, Transport and Works (Chairman)
Prof Leonard Cheng	
Dr Albert Koenig	
Prof Rudolf S S Wu	
Dr Ng Cho-nam	Member of Advisory Council on the Environment
Prof Peter Hills	Member of Advisory Council on the Environment
Mr Chan Bing-woon	
Mr Jimmy Kwok	
Mrs Josephine Mak	
Mr Robert Law	Director of Environmental Protection
Mr Raymond Cheung	Director of Drainage Services
Mr Raistlin Lau	Principal Assistant Secretary for the Environment, Transport and Works (E) 1 (Secretary)

In attendance:

Ms Doris Cheung	Deputy Secretary for the Environment, Transport and Works (E) 1
Mr Mike Stokoe	Deputy Director of Environmental Protection
Mr Benny Wong	Assistant Director of Environmental Protection
Dr Malcolm Broom	Principal Environmental Protection Officer, EPD
Mr S K Aggarwal	Assistant Director of Drainage Services
Mr W W Chui	Chief Engineer, Drainage Services Department
Dr Samuel Chui	Assistant Secretary for the Environment, Transport and Works (E) 1A
Mr Jake Vittands	Maunsell (on agenda item 4 only)
Mr Alex Kwan	Maunsell (on agenda item 4 only)
Mr Malcolm Pearson	Maunsell (on agenda item 4 only)
Mr. Paul Chung	CDM (on agenda items 5 and 6 only)
Mr John Gall	CDM (on agenda items 5 and 6 only)
Mr James Chan	CDM (on agenda item 5 and 6 only)
Ms Sherry Lo	CDM (on agenda items 5 and 6 only)

Absent with apologies

Ms Iris Tam	Member of Advisory Council on the Environment
Dr Ho Kin-chung	Member of Advisory Council on the Environment
Mr W S Chan	Deputy Secretary for the Environment, Transport and Works (Works Policy)

Discussion

1. The Chairman welcomed Members to the 7th MG Meeting.

I. Confirmation of the minutes of the 6th meeting

2. The revised minutes of the 6th meeting sent to Members on 15 December 2003 were confirmed without further amendments.

II. Matters arising

3. **Paragraph 8** of the minutes of the 6th meeting – The Secretary reported that the water quality modeling results (Annex A) for disinfection under Option 5A and 5B were tabled for Members' information.

4. **Paragraph 10** – The Secretary reported that CDM was finalizing the Final Report and would include the information as undertaken.

5. **Paragraph 35** – The Secretary reported that CDM would cover the impact on surrounding land uses under Agenda Item 5.

6. **Paragraph 43 –** The Secretary reported that the proposed implementation plan based on the step-wise approach would be discussed under Agenda Item 6.

7. **Paragraph 45 –** The Secretary reported that CDM was finalizing the Final Report and would take into account Members' views.

8. **Paragraph 47 –** The Secretary reported that the cost implications in terms of the cost to be borne by each family would be worked out and included in the consultation materials.

9. **Paragraph 48 –** The Secretary reported that the consultation plan would be discussed under Agenda Item 7.

III. Progress Report on Trials and Studies for HATS – (Paper No. MG(2003)11)

10. The Chairman invited Mr. Benny Wong to report on progress of the trials and studies for HATS. Mr Wong took Members through the paper. Mr. Wong said that the consultants had recently submitted the Draft Final Report for the Environmental and Engineering Feasibility Study **(EEFS)** which was being circulated to the concerned departments for comments. Members interested in the Report were welcome to approach EPD for a CD ROM version. Once the Executive Summary was ready, it would be circulated to Members for information.

IV. Study on Procurement Options – Key Findings (Paper No. MG(2003)12)

11. The Chairman welcomed Mr. Jake Vittands, Mr. Alex Kwan and Mr. Malcolm Pearson of Maunsell to join the meeting. Mr. Alex Kwan gave a PowerPoint presentation to Members on the key findings of the Study on Procurement Options (SPO) (Presentation materials at Annex B).

12. In response to Prof. Leonard Cheng's enquiry, Mr. Malcolm Pearson explained that the key difference between Design-Bid-Build (DBB) and Design-Build (DB) was that under DBB the contractor would be required to carry out the works in accordance with the design completed by the Engineer whilst under DB the contractor would have to carry out the detailed design and construction of the works. Hence, the contractor would have more freedom to bid for the contract according to their own expertise in design and construction and come up with the most competitive tender under DB.

13. Mr. Raymond Cheung added that, generally speaking, services in designing, constructing and operating as well as financing the works were the elements involved in considering the procurement options. For DBB, the design and construction services would be procured separately from two parties, namely the consultant to produce the design of the works and the contractor to carry out the construction according to the design. For DB, the design and construction services would be procured together from the same contractor. For Design-Build-Operate (DBO), the contractor would also

need to operate the treatment works for a certain period according to the contractual requirement, in addition to design and construction. For Design-Build-Operate-Transfer (BOT), the contractor would also need to provide the capital funding for the construction works which would then be recouped through the recurrent income received. The BOT contractor would however need to handover the treatment works to the Government after the operation period according to the contractual requirement.

14. On the difference between Enhanced DB and DB, Mr. Jake Vittands supplemented that the two options were basically the same although under the Enhanced DB, more specific requirement would be provided under the Enhanced DB tender document, for example, the preliminary design may be provided in the tender document although the contractor would still need to carry out the detailed design.

15. Mr. Chan Bing-woon asked if the key determinant for selection of the procurement option was cost. The Chairman responded that the Government would need to make a policy decision on the most suitable procurement option taking into account the SPO findings and its own constraints. For instance, if it was necessary to make use of private financing due to the fiscal constraint, the BOT would be the only practical option.

16. Mr. Rob Law added that another consideration for the selection of the procurement option was how to balance the flexibility and responsibility of the contractors. For example, under a DBO contract, the contractor would have a long term responsibility in ensuring the treatment works would operate efficiently to achieve overall cost effectiveness as they had to operate the plant for a number of years. On the other hand, the Government would have less flexibility to instigate changes as there would be a contract in place.

17. Mr. Chan Bing-woon observed that the public might not be able to grasp the significance of the project due to the complexity involved. Moreover, the public might easily be swayed by politics given that 2004 would be a LegCo election year. The Chairman responded that the Government would need to factor in these dimensions when formulating the consultation plan. However, since the Government had committed to consulting the public after the completion of the HATS trials and studies, the Government would aim to commence the public consultation in the second quarter of 2004. She suggested that the subject should be discussed further under Agenda Item 7.

18. Dr. Albert Koenig asked whether those options which involved the setting and collection of sewage charges by an operator were practical under Hong Kong's situation and whether case studies of the various options explored had been conducted. Mr. Vittands responded that theoretically, if BOT was selected for the HATS and the contractor was required to recoup its investment directly through sewage charges, the Government might need to single out the HATS catchment to implement a different sewage charging mechanism and at rates different from the rest of the territory. Alternatively, the Government might continue to collect sewage charges on a territory-wide basis and pay back the contractor separately with subsidy from the general revenue. As regards case studies, Mr. Vittands explained that the consultants had collected the contractual and operational information on the various procurement models from facility owners, operators, contractors and individual government bodies through their consultancy network. Visits had also been made to some of such facilities. The findings of the case studies were incorporated in the Technical Note No.1. The Chairman welcomed the interested Members to approach the Drainage Services Department (DSD) for reviewing the Technical Note No.1.

19. Mr. Jimmy Kwok considered both DBO and BOT promising for delivering the sewage treatment works. However, the availability of public funding would determine the choice between these two options. Mr. Law commented that even under the DBO arrangement, it would not be necessary for the Government to pay all the capital cost upfront. Depending on the terms of the contract, it would be possible to arrange for the payment of the capital cost by installments over a long period. He added that the Environmental Protection Department (EPD) had adopted the DBO option for the waste facilities because the cost of public financing was generally lower than that of private financing. Mr. Mike Stokoe added that BOT would basically involve private financing and the users would have to pay for the use of the service which would then become the income stream for the operator.

20. Prof. Cheng asked whether there were any successful cases which utilized the BOT model in the provision of sewage treatment systems. Mr. Kwan said that the new sewage treatment plant in Guangzhou was basically following the BOT model although it was still undergoing construction. However, under that case, the Government was the only user to pay for the services provided by the BOT contractor. Moreover, it appeared that the provision of new sewage treatment works in China generally followed BOT model nowadays. Mr. Law pointed out that the mentality of the public could seriously affect the viability of using the BOT model. While the

public generally accepted that they should pay for electricity and the use of transport infrastructure, they tended to regard that the Government should subsidize the sewage treatment cost. Moreover, while it is possible for other utility operators to stop providing services to those who fail to pay, there is no way for DSD to terminate the service provided to individual users.

21. Prof. Peter Hills opined that it would be extremely difficult to deal with the regulatory framework on the pricing of the operation. He asked whether the Government would consider adopting the model to combine the water supply and sewage disposal services such that they could be dealt with collectively. The Chairman responded that although the Government had a well-established policy to recover the treatment cost through sewage charges, we had not been able to increase the sewage charges so far. At present, the sewage charges are included in the water bills although they are separately shown and are charged under the authority of different ordinances.

22. In response to the Chairman's enquiry, Mr. Vittands responded that in general developed countries normally recovered the costs of providing sewage services through user charges whereas developing countries provided subsidies. He added that the US Federal Government had set up funds to subsidize the local governments on the capital costs for sewage treatment works but the operational costs would have to be fully paid by the users.

V. Environmental and Engineering Feasibility Studies – Options Evaluation (Paper No. MG(2003)13)

23. The Chairman welcomed Mr. Paul Chung, Mr. John Gall, Mr. James Chan and Ms. Sherry Lo of CDM. Mr. John Gall gave a PowerPoint presentation to Members on the Options Evaluation (Presentation materials at Annex C).

24. Prof. Cheng asked whether Option 5B would rank higher on the marine environment rating if the Lamma Island outfall was located on the West side or the North side of Lamma Island. He also questioned whether Option 5B should rank higher in the flexibility criteria as it involved building a sewage treatment works at ground level whilst the other options involved building treatment works underground or in caverns.

25. Mr. Gall responded that since the residual current in the West Lamma

Channel generally heading south where the marine ecology was more sensitive, the ranking in marine environmental criteria would remain the same even the outfall was located to the Western side of Lamma Island. Furthermore, since the Northern side of Lamma Island was the Western Anchorage area and the East Lamma Channel was a major navigation channel with heavy marine traffic, it was practically infeasible to locate the outfall to the Northern part of the Lamma Island. On the flexibility criteria, Mr. Gall explained that their consideration was that when upgrading the treatment levels, it was generally easier to upgrade one treatment works than several treatment works.

26. In response to Dr. Koenig's enquiry, Mr. Gall replied that sludge would be dewatered on-site and transported off-site for disposal.

27. In view of the fact that the treatment works would be operated for a very long time, Prof. Wu opined that the weighting be given to the operational criteria should be higher than the construction criteria. On the reliability criteria, he considered that since the treatment works would adopt a modular design, the reliability of a centralized option should be similar to that of a decentralized option. Mr. Gall responded that the main reliability issue of a centralized system was related to the risk of pump failure. As a distributive system would comprise several treatment works with independent pumping systems, the risk of pump failure would be lower.

28. Mr. Chan declared his interest as the elected District Council Member from the Braemar Hill constituency and said that he would be obliged to object to Option 5D on behalf of his constituency if it were to be recommended.

29. Dr. Ng Cho-nam pointed out that as the Lamma Quarry had been properly restored and had attracted some birds to live there lately, the local residents might react strongly if the Government was to build a sewage treatment works there. Prof. Wu echoed that by putting a sewage treatment works at the Lamma site, it might seriously hamper the development potential of the surrounding land and this might become a major obstacle for pursuing Option 5B.

30. Having reviewed the consultants' findings, the meeting accepted that Option 5A should be the best amongst the options evaluated and should be recommended to the public as the preferred option.

31. Dr. Koenig observed that the main concern of the public might change from time to time. He recalled that there was a strong public sentiment in favour of a decentralized treatment system when the International Review

Panel was appointed to review the original SSDS in Year 2000. He was also concerned that the availability of the additional land required for the biological treatment process under Option 5A was still uncertain at present. Mr. Law responded that only a relatively small number had strongly advocated a decentralized system in the past and the overall debate was rather emotional at that time.

32. The Chairman said that the Government had a duty to provide the basic infrastructure. If there was a need to provide land for construction of a sewage treatment works, then the need would have to be weighed against other competing uses and the Government would have to make a decision eventually. She was pleased that the Monitoring Group had reached a consensus that Option 5A was the best among all the feasible options in the light of the findings presented by the consultants. This should greatly help the Government to decide on the way forward.

33. Due to other commitments, Prof. Hills and Mr. Chan left the meeting at this juncture.

VI. Environmental and Engineering Feasibility Studies – Assessment of Staged Implementation of HATS (i) Water Quality Assessment and (ii) Engineering Design and Cost Estimates (Paper No. MG(2003)14 and MG(2003)15)

34. The Chairman invited Dr. Malcolm Broom to give a Powerpoint presentation to Members on the water quality assessment on the staged implementation of the HATS. Mr. Gall then gave a Powerpoint presentation on the schematic designs and the cost estimates for the Staged Implementation of HATS. (Presentation materials at Annex D).

35. In response to Prof. Cheng's enquiry, Mr. Gall clarified that chlorination and dechlorination disinfection would be more effective than UV disinfection for CEPT effluent. Chlorination and dechlorination disinfection was assumed under the Phased Implementation option whilst UV disinfection was assumed under the Non-Phased Implementation option. The operational cost for the former was slightly lower but the capital cost higher than the latter.

36. Noting that the modeling results indicated that nitrification would be required by 2013 to meet the dissolved oxygen and ammonia criteria, Dr. Koenig considered that there was no point to implement the project in phases.

37. Mr. Benny Wong responded that a phased implementation might be prudent because there was uncertainty on the rate of the sewage flow build-up. The sewage flow assumed in the model for 2013 was 2.5 million cu.m/day vis-à-vis 1.8 million cu.m/day at present. As the actual rate of sewage flow build-up might be different from the assumption adopted in the model, it might not be necessary to provide nitrification as soon as 2013. Mr. Law supplemented that population projections were often on the high side. Therefore, it was possible that the actual sewage flow in 2013 might be lower than the assumption used in the model. The question open to the public was therefore whether they would support the Government to commit substantial resources to bring in nitrification upfront, or to adopt a financially prudent midway approach whereby nitrification would only be provided when the actual needs could be ascertained. He, however, pointed out that there was always a time lag between the commencement and completion of a project. If it was decided that phased implementation should be adopted, the Government should also conduct the preparatory work for providing nitrification during the first phase so as to reduce the time lag.

38. Prof. Wu asked why there was no substantial difference in the bacterial levels between the with- and without-disinfection scenarios when biological treatment was provided. Dr. Broom explained that the Biological Aerated Filter (BAF) system was very effective in removing the sewage bacteria and therefore there was no great difference between the two scenarios. However, as Chemically Enhanced Primary Treatment (CEPT) was not so effective in removing the sewage bacteria, the difference between the with- and without-disinfection scenarios would be greater. In fact, the monitoring results also demonstrated that CEPT effluent had impacted on those beaches in Tsuen Wan and therefore disinfection was required.

39. Prof. Wu noted that the modeling results indicated that some criteria for two key parameters, i.e. dissolved oxygen and ammonia, could not be met in 2013 if only CEPT and disinfection were provided. He was not too concerned about the ammonia issue because he considered the ammonia criteria adopted might be over-stringent. On the dissolved oxygen issue, Prof. Wu said that the provision of nitrification might not help improve the situation in Rambler Channel as the area associated with the dissolved oxygen exceedance was also subject to local pollutant discharges from storm-drains. He wondered if it would be more cost effective to control local discharges instead of upgrading HATS to nitrification to improve the dissolved oxygen level in this area. Furthermore, he opined that as a water quality model was just a tool to provide guidelines for decision making, it

should be more reliable to count on actual water quality monitoring results to determine the effect of discharges. In his view, the whole issue could boil down to whether the public / the water body could afford the time lag between when the needs could be established and when the solution could be provided. In light of the marginal cost difference between the phasing and no-phasing approaches, Prof. Wu considered it prudent to provide CEPT first for all sewage in the HATS catchment and then closely monitor the sewage flow build-up rate as well as the dissolved oxygen and ammonia changes in the harbour area before proceeding to bring in the next phase. In parallel, however, the Government should investigate the effects of the local pollutant discharges on the marine waters.

40. Mr. Law responded that EPD and DSD had been looking into the storm-water pollution issue for a long time. However, this was not an easy task to tackle as there were numerous small dischargers in the territory and measures which might help address the issue might affect the flood prevention capability of the drainage system. Dr. Broom added that the consultants have conducted additional model runs with pollutants arising from storm-drains only. The modeling results demonstrated that the storm-drain discharges were not the sole cause for the exceedance of the dissolved oxygen criterion. Prof. Wu responded that he had not underestimated the difficulty in tackling the non-point source pollution problem. However, he considered the correct comparison should be between nitrification and CEPT scenarios instead of the no-load and CEPT scenarios. Dr. Broom said the scenario showing the minimum oxygen distribution with nitrification was presented in the draft Final Report so that it was possible to make the comparison suggested.

41. The Chairman echoed the comments made by Prof. Wu. She said that as the water quality modeling results were all predictions, Prof Wu's suggestion of establishing the need based on the actual measurements before proceeding to implement the more costly second phase was very sensible. Nevertheless, she opined that since there was no certainty that the water quality would be acceptable with CEPT and disinfection only, the Government should carry out the preparatory work for the second phase of biological treatment well in advance so that the latter could be provided promptly when the actual needs arose. The Chairman then requested Members to consider the way forward as set out in paragraph 22 of the Paper MG(2003)14.

42. Mr. Kwok observed that there was little cost difference between the phasing and no-phasing approaches and therefore he considered it sensible and logical to adopt implementation in phases. He further pointed out that the

annual recurrent cost for providing nitrification was very substantial and therefore the Government could achieve considerable savings if it only provided nitrification when the actual needs arose.

43. Dr. Koenig considered that it was very dangerous to adopt the phased implementation approach because there seemed to be greater uncertainty regarding the future financial position of the Government. He was concerned that the Government might not have the resources to proceed with the second phase in future even if the actual needs could be justified.

44. The Chairman assured Dr Koenig that the Government would only approve and take forward a project if it was able to meet the full financial implications. In fact, according to the Government funding guidelines, the full financial implications for the entire scope of a project would have to be assessed and the required resources be properly earmarked from the outset whether or not such a project would be implemented in phases. Hence, the concern raised by Dr. Koenig would not materialize in reality.

45. Dr. Koenig asked the consultants whether they had factored in the population build-up in Mainland China in the modeling results. Mr. Gall replied that the modeling scenarios had taken into account potential population growth in China up to 2016. In fact, the effect of population increase on the pollution load would balance out with the provision of better sewage treatment facilities in the Mainland.

46. Noting the potential uncertainty involved, Prof. Wu suggested the Government define clear trigger points for commencing the second phase of HATS with reference to the sewage flow build-up, changes in dissolved oxygen level and ammonia level in the harbour area etc. The Chairman welcomed the suggestion made by Prof. Wu.

47. The meeting agreed that it should be prudent to adopt the phased approach for implementing Option 5A as proposed in paragraph 22 of the paper MG(2003)14.

48. [Post Meeting Note: On 14 February 2004, Prof. Cheng requested to put his view as a post meeting note that he could support the idea of staged implementation if it meant that tertiary treatment was an integral part of the proposed project while the timing of the introduction of such treatment would be left open, pending future data on sewage flows and water quality near the outfall. Whether the actual date of introducing tertiary treatment was earlier or later than expected would be decided by future developments, but there was no need to make a new decision whether tertiary treatment

was to be adopted. Prof. Cheng could not support the idea of staged implementation, however, if it meant that tertiary treatment was not an integral part of the project but would be re-examined as a new issue in the future. There was a genuine risk that critical decisions might be delayed in the name of "rational" sequential decision-making, while indeed the MG squandered the hard won consensus about the goal of eventually adopting tertiary treatment. Prof. Cheng believed the content of the consultation documents would signify to society which approach the Government adopts. He would like to voice out his reservation if it was the latter approach.]

VII. Public Consultation Programme (Paper No. MG(2003)16)

49. The Chairman said that since it would take some time for the departments to review and the consultants to finalize the EFFS Final Report, and the Administration would also need some time to discuss and sort out the resources implications for the HATS programme, the Government currently aimed to report the findings of the Studies to the LegCo EA Panel in April and carry out the public consultation afterwards.

50. The Chairman stressed that the Government would like to maintain a high degree of transparency and therefore all the findings and recommendations of the studies and trials should be provided to the public for information. In order to win the public on side, the arguments for recommending Option 5A and the justifications for adopting a phased approach should be clearly articulated in the consultation materials. She welcomed Members to give their views on how this could be done.

51. Dr. Ng considered that MG(2003)13 concerning Options Evaluation should be understandable by the general public. He suggested this paper be incorporated into the consultation materials suitably. Mr. Law said that since Government had committed to keeping the HATS related studies and trials transparent, there was a need to produce a comprehensive consultation document to provide the background of the HATS and the key findings of the studies in simple terms for reference by the public. In parallel, the technical details could be uploaded to the website for reference by specific interest groups.

52. Dr. Koenig suggested that the consultation document should also provide the costs for the three levels of treatment, i.e. CEPT, nitrification and denitrification, all with provision for disinfection. Prof. Wu concurred that the public should be informed on the cost implications of different treatment levels. Mr. Law responded that the costs would be included in

the consultation document.

53. Dr. Koenig suggested the consultation document include a comparison of the expenditure incurred by overseas economies in providing sewage treatment. Prof. Cheng supported the idea. He further suggested the Government include sections on the history of the HATS programme, the implementation programme, and the reasons why the phased approach would be a financially prudent way for offering proper protection to our harbour. Dr. Ng suggested the Government should also conduct some informal briefings for the major stakeholders before proceeding to the formal consultation.

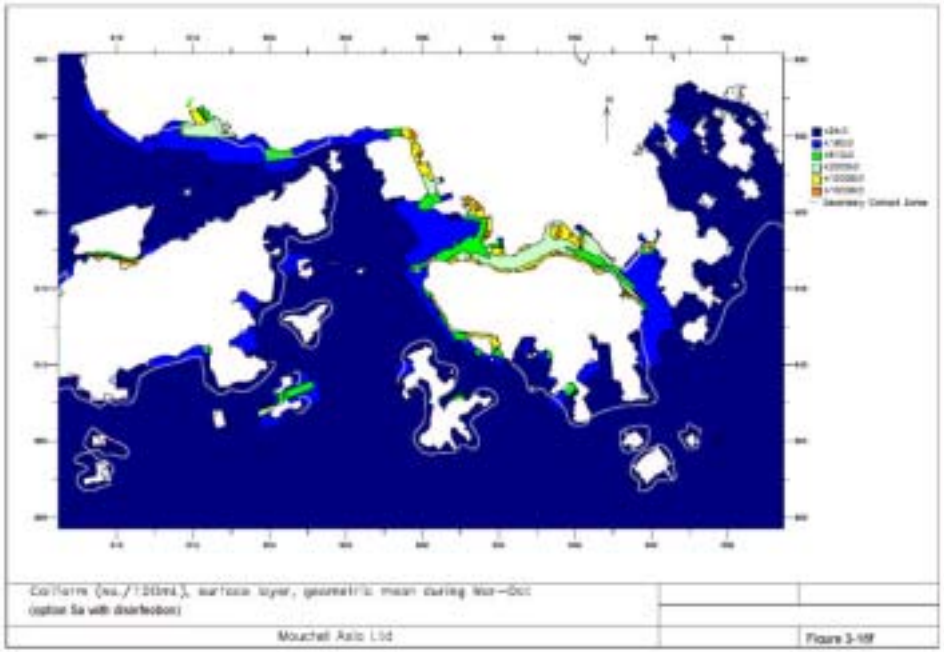
54. The meeting agreed that a bilingual Executive Summary of the EEFS should be produced. Noting that the EEFS Final Report was very technical and the professional / technical people would generally prefer reading the English version instead of the Chinese version, the meeting also agreed that it would not be necessary to translate the entire EEFS Final Report into Chinese.

VIII. AOB

55. The Chairman congratulated Members on successfully discharging the duties of the Monitoring Group and thanked them for providing a lot of useful comments and constructive views to the Government during the past two and a half years. She said that although the Monitoring Group had formally completed all its tasks, the Government would wish to continue to count on individual Members to help it out on future initiatives relating to the HATS consultation. In this connection, she appealed to Members to continue to provide comments on the consultation materials prepared by the Government in due course.

55. [Post Meeting Note: On 13 February 2004, Dr. Koenig requested Members to be provided with a copy of the Executive Summary and the Final Report of the consultancy studies for comments. The Draft Executive Summary and the Final Report of the Environmental and Engineering Feasibility Studies were provided to all Members on 19 February 2004.]

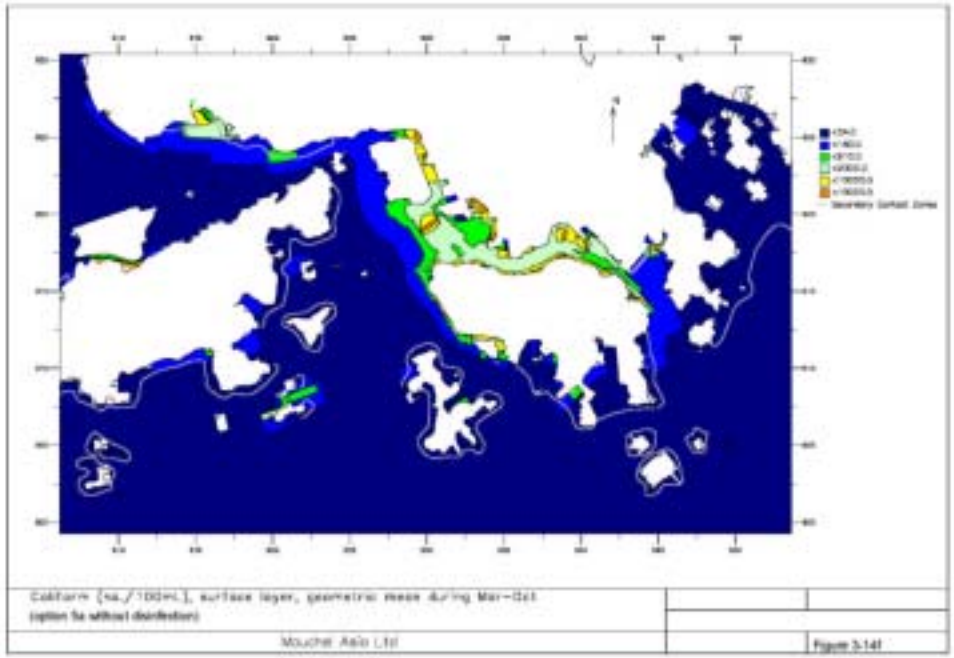
Environment Transport and Works Bureau
February 2004



Coliform (no./100mL), surface layer, geometric mean during Mar-Oct
(option 5a with disinfection)

Mouchel Asia Ltd

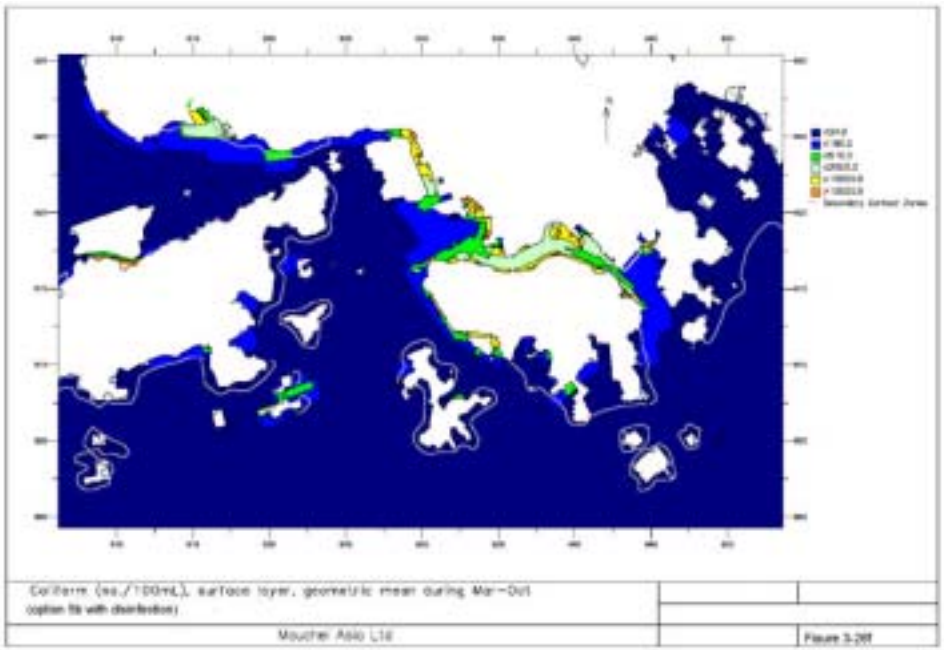
Figure 3-15f



Coliform (no./100mL), surface layer, geometric mean during Mar-Oct
(option 5a without disinfection)

Mouchel Asia Ltd

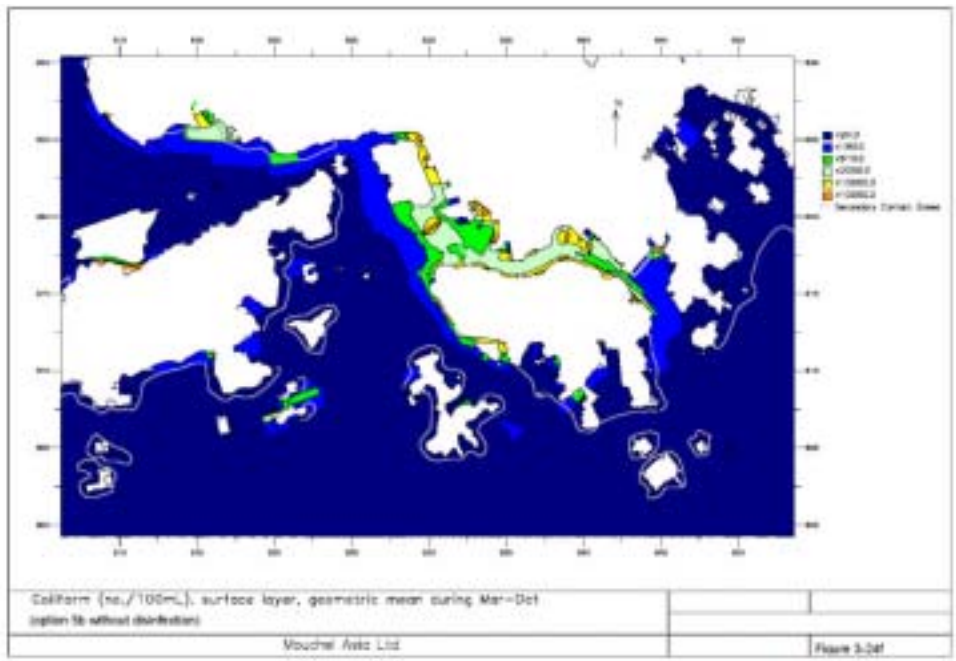
Figure 3-14f



Coliform (no./100mL), surface layer, geometric mean during Mar-Oct
(option 5b with disinfection)

Mouchel Asia Ltd

Figure 3-26f



Coliform (no./100mL), surface layer, geometric mean during Mar-Oct
(option 5b without disinfection)

Mouchel Asia Ltd

Figure 3-24f

Study on Procurement Options for Further Stages of the HATS

Maunsell

Metcalf & Eddy

Agenda

- Recommended Procurement Options and Basis for their Selection
- Implications on Implementation Programmes and Cost Estimates

Maunsell

Metcalf & Eddy

Project Objectives

- To identify the most effective and efficient procurement method
- To recommend the contracting/ tendering/ consultancy strategies
- To recommend the administration/ supervision structure

Key Output Variables

- Time – early completion
- Quality – exceeding the agreed standards including reliability/ efficiency of operations
- Value for Money – being cost-effective in life cycle terms.
- Control of Risks – mitigating identifiable risks in the delivery of HATS.

Recommended Procurement Arrangements and Basis for Selection

Alternative Procurement Methods

- Options relating to the design and construction
  - Design-bid-build (DBB)
  - Design-build (DB)
  - Design-bid-build with non-contractual partnering
  - Enhanced design-build
  - Design-build with alliance partnering
  - Design-build through management contracting

Alternative Procurement Methods (Cont'd)

- Options that include the design, construction, and operation
  - Design-build-operate (DBO)
  - Build-operate-transfer (BOT)
  - Build-own-operate (BOO)

Shortlisted Procurement Methods

Works and Services	DBB	DB	DBO	BOT
Upgrading of existing preliminary treatment works.	Yes	Yes	Yes	Yes
Construction of sewage conveyance system.	Yes	Yes	No	No (except for HATS as a whole)
Construction of satellite sewage treatment works and outfalls.	Yes	Yes	Yes	Yes
SCISTW upgrading	Yes	Yes	Yes (to include operation of existing SCISTW)	Yes (to include operation of existing SCISTW)

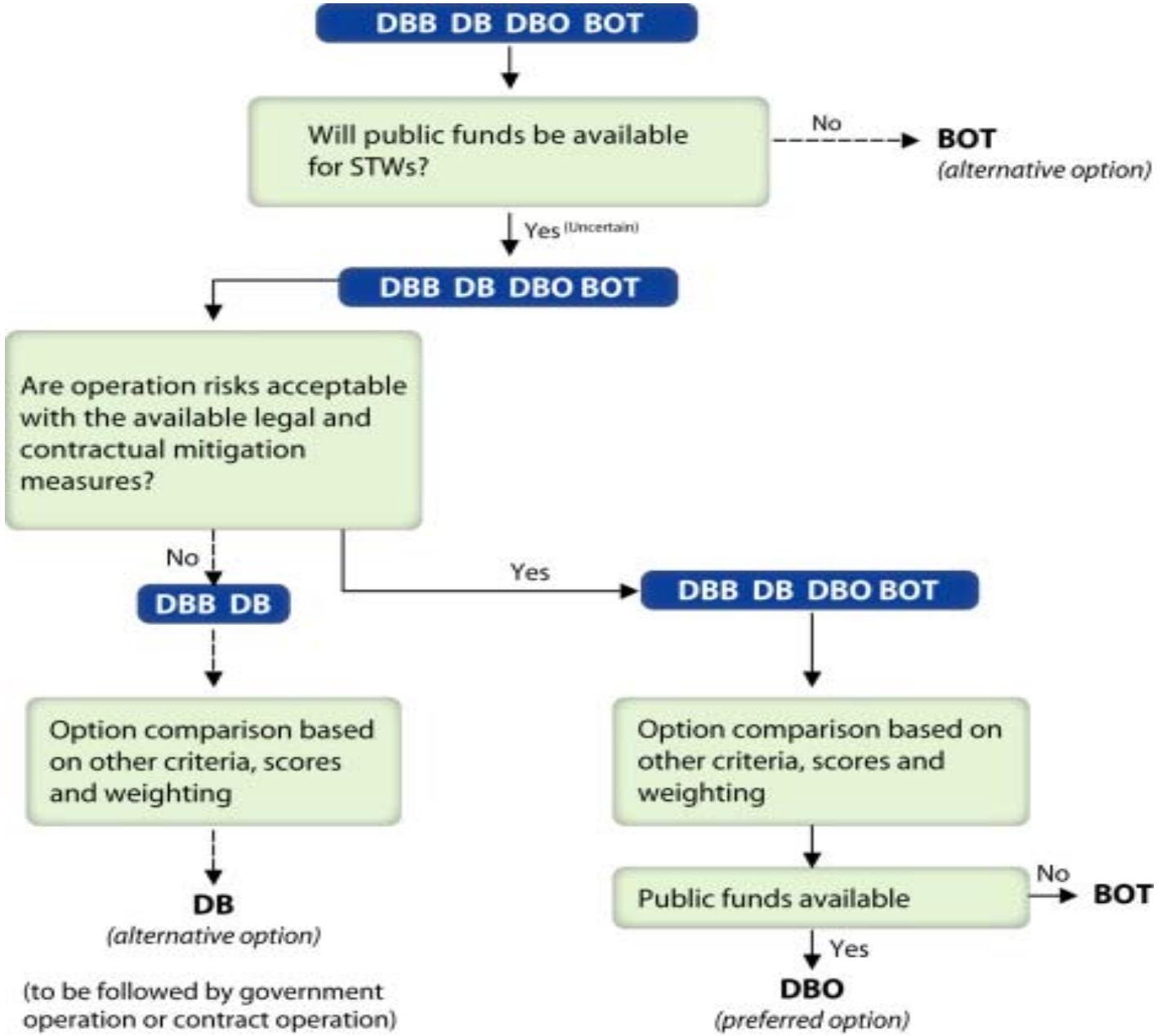
Evaluation Criteria

Early completion
Budget certainty
Quality/reliability
Design risks
Construction risks
Operation risks
Competitiveness
Flexibility to cope with change
Interface/demarcation
Innovation
Access to private financing
Avoiding additional O&M staff
Acceleration of private sector participation
Impact on existing O&M staff

SCISTW Upgrading and Satellite STWs

- DBB, DB, DBO and BOT
- Option Evaluation Against Criteria
- Governing Factors
  - Will public funds be available for STWs?
  - Are operation risks acceptable with the available legal and contractual mitigation measures?

Flow Chart for Choice of Procurement Arrangements



Sewage Treatment Works

- Preferred Option: DBO
- Minimizes interface problems
- Greater certainty in completion times and life-cycle costs
- Obviates the need for additional O&M staff
- Need for legal/contractual measures to mitigate financial risks during operation stage

Sewage Conveyance Systems

- DBB vs. DB
- Comparison Against Criteria
  - Timely completion
  - Budget certainty
  - Quality/Reliability and Innovation
  - Construction Risk, most important consideration

Sewage Conveyance Systems

- DBB and DB equally applicable.
- DB preferred because it may bring about potential time savings and minimize interface between the Engineer and Contractor

PTWs and Transfer Pumping Stations

- Enhanced DB, DBO and BOT
- Comparison Against Criteria:
  - Early completion
  - Budget certainty
  - Quality/Reliability
  - Construction Risks
  - Interface/Demarcation

PTWs and Transfer Pumping Stations

- Enhanced DB preferred because it may provide the Employer/Engineer with the control of the design to suit the constrained site conditions, and offers marginal time savings.
- Also, consistent with previous local experience under HATS Stage 1

Summary of Recommendations

IRP Options	Preferred Procurement Arrangements
5a	SCISTW Upgrading: Design-Build-Operate Sewage Conveyance Systems: Design-Build Preliminary Treatment Works/Transfer Pumping Stations: Enhanced Design-Build
5b	SCISTW Upgrading: Design-Build-Operate Lamma Island STW: Design-Build-Operate Sewage Conveyance Systems: Design-Build Preliminary Treatment Works/Transfer Pumping Stations: Enhanced Design-Build
5c	SCISTW Upgrading: Design-Build-Operate Sandy Bay STW: Design-Build-Operate Sewage Conveyance Systems: Design-Build Preliminary Treatment Works/Transfer Pumping Stations: Enhanced Design-Build
5d	SCISTW Upgrading: Design-Build-Operate Sandy Bay STW: Design-Build-Operate North Point STW: Design-Build-Operate Sewage Conveyance Systems: Design-Build Preliminary Treatment Works/Transfer Pumping Stations: Enhanced Design-Build

Implications on Implementation Programmes and Cost Estimates

Implementation Programmes

- Completion dates for the whole scheme are estimated to advance by about a year
- Similar time savings for four IRP options
- Potential time savings
  - During pre-contract stage
    - Reduced periods for design works
  - During contract stage
    - Fast-tracking design and construction activities,
    - reducing design and construction interface, and
    - employing designs to suit any time saving construction

Capital and Recurrent Costs

- There should be potential cost savings but not significant for option comparison purposes

- Capital Costs
  - Increased efficiency and more cost effective designs
- Recurrent Costs
  - Reduced staff costs when compared with government operation

Environmental Protection Department
Government of Hong Kong Special Administrative Region

Monitoring Group Briefing on Options Evaluation

December 17, 2003

Agenda

- Review Evaluation Process and Objectives
- Present Criteria
- Summarize Evaluations
- Discuss Summary Assessment

Evaluation Process

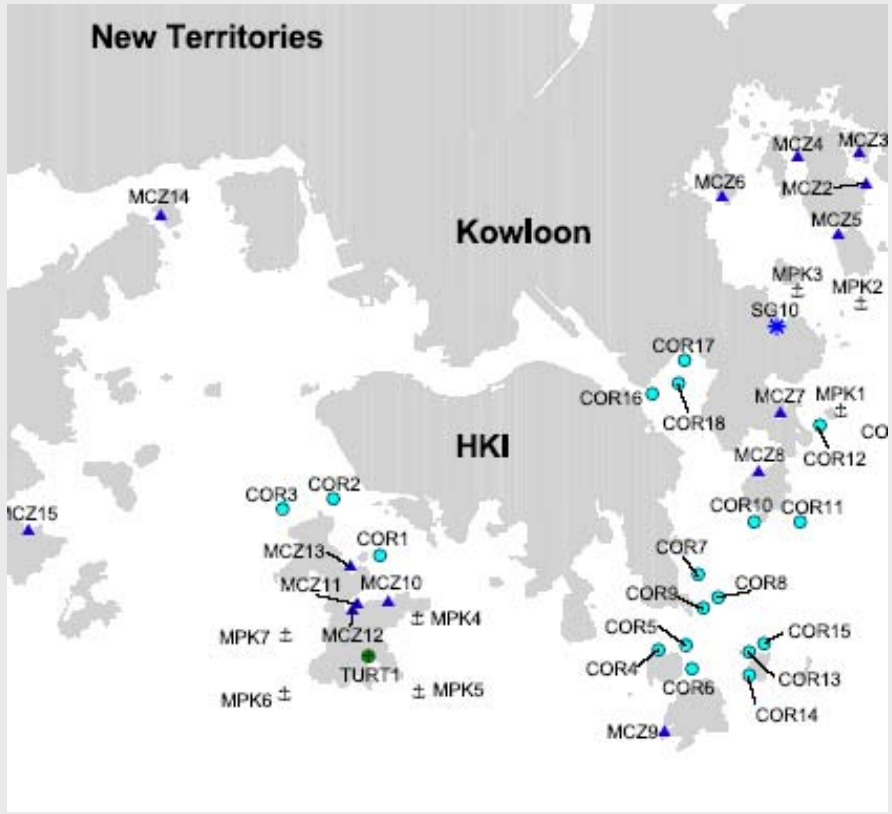
- Intended To Present Strengths And Weaknesses Of Options In Understandable Format
- Mostly Qualitative Rankings Between Options
- Uses Criteria Developed Through Stakeholder Interviews
- 24 Separate Evaluation Criteria, Grouped According To 6 Broad Topics

Criteria

No.	Criterion
Environment and Public Health	
1	Harmful Algal Blooms
2	Marine Ecology
3	Fisheries
4	Public Health
5	Hazard to the Public
6	Air Quality
7	Noise
8	Terrestrial Ecology
9	Landscape and Visual
10	Waste Management Implications
Engineering/Technical	
11	HATS System Reliability
12	Tunnel / Outfall Construction Risk
13	Sewage Treatment Works Construction Risk
14	Operational Risk
15	Flexibility
Social	
16	Community Facilities Impact
17	Road Traffic
18	Marine Traffic
19	Potential Public Resistance
20	Job Creation
Economics	
21	Total Lifecycle Cost
Land Resource	
22	Utilisation of Surface Land Resource
Statutory Land Procedures	
23	Land Zoning
24	Land Status

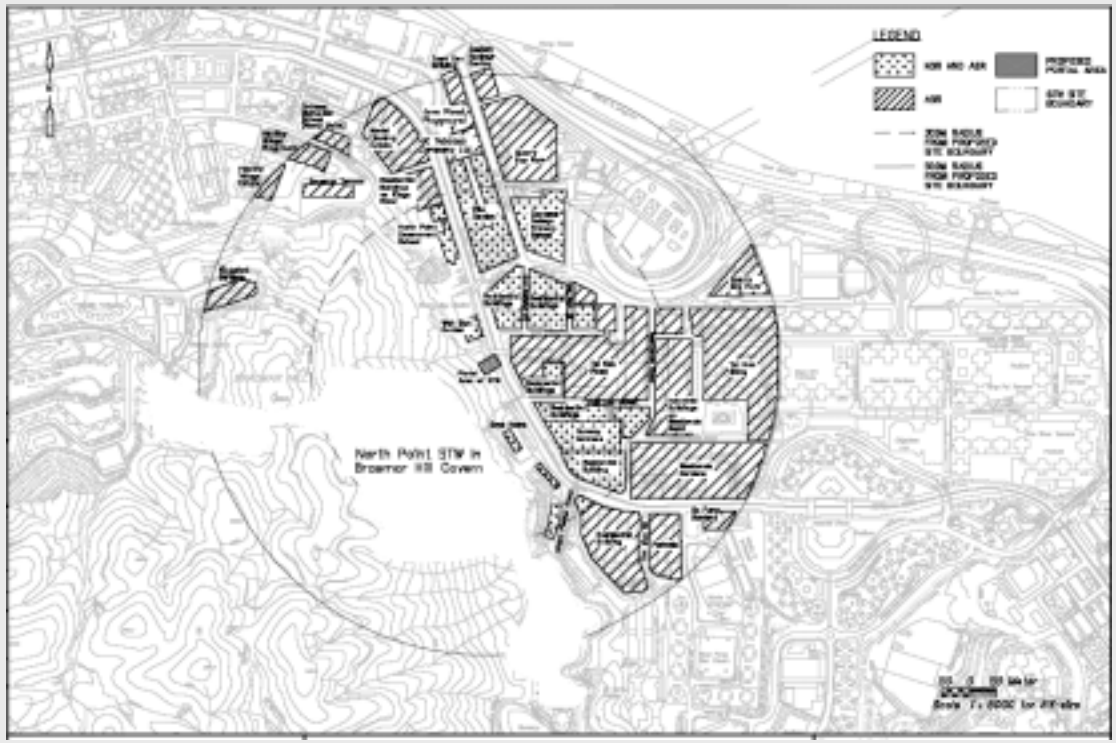
Marine Environmental Criteria

- **HABS & Public Health**
  - **High Treatment And Dispersion Make All Options Equal**
- **Fisheries And Marine Ecology**
  - **5b Ranked Below Others Due To Proximity Of Sensitive Resources**



Terrestrial Environmental Criteria

- Nearby Resources Mean Lowest Ranking For 5d, Then 5c For Hazards, Noise, Air, Terrestrial Ecology. 5a, 5b Equal
- Visual Impacts Of 5b Greatest. 5a Best, Followed By 5c Then 5d
- 5b Creates Least Construction Debris, Thus Best On Waste Management. Then 5a, 5c And 5d



Engineering Technical Criteria

- **Tunnel Construction Risk: Longer Tunnels Equals More Risks: Ranked 5d, 5c, 5a, 5b**
- **STW Construction Risk: 5a Best, As Only One Site: Then 5b, 5c And 5d**
- **System Reliability: As A System, More Plants Results In Smaller Individual Upsets. Ranked 5d Best, Then 5b, 5c And 5a**
- **System Flexibility: Addresses Difficulty Of Accommodating Future Changes. Changes To Fewer Facilities Easier To Implement: Changes In Caverns Very Difficult. Ranked 5a Best, As Only One Site: Then 5b, 5c And 5d**
- **Operational Risks: Risk Associated With Operation Of Individual Plants. Caverns Need Extensive Support Systems, Ranked Lowest. 5a And 5b Very Similar: Slight Advantage To 5a**

Social Criteria

- **Community Facilities: No Material Impact On Community Facilities Such As Parks, Recreation Areas, Etc. All Equal.**
- **Land Traffic: High Volume Traffic In North Point Especially And Sandy Bay Negative. 5b Has Lowest Volume Of Spoils. 5b,5a,5c,5d**
- **Marine Traffic: North Point Involves Outfall In Fairway, Thus Worst. 5b Poses Some Complications. Otherwise Equal.**
- **Public Resistance: Existing Site Most Acceptable. 5b And 5c Have Some Negatives. 5d Has Many Negatives**
- **Job Creation: All Equal, As No Material Difference In Job Creation**

Total Lifecycle Costs

- **Net Present Value: Long Term Cost**

Option	Nitrification (HK$ billion)	Denitrification (HK$ billion)
5a	28.75	34.96
5b	29.31	35.28
5c	31.72	37.76
5d	35.81	41.75

Land Resource Criteria

- **Surface Land Requirements**

Option	Temporary Surface Land Required (m^2)	Permanent Surface Land Required (m^2)	Total (m^2)
5a	71,375	5,287	76,662
5b	54,015	95,392	149,407
5c	72,655	5,616	78,271
5d	56,705	6,612	63,317

Statutory Land Procedures

- **Land Zoning: All Sites need rezoning thus all equal**
- **Land Status: Ranking driven by number of sites not allocated/perception of difficulty of allocation. Fewest for 5A, greatest at 5d.**

IRP Option	STW site already allocated or earmarked to HATS	STW site not allocated or earmarked to any particular use	STW site already allocated or committed to be allocated to other uses	Ranking
5a	▪ Existing SCI STW	▪ none	▪ Port Rail Terminal site	1st
5b	▪ Existing SCI STW ▪ Lamma STW	▪ none	▪ Port Rail Terminal site	2nd
5c	▪ Existing SCI STW	▪ Sandy Bay STW	▪ Port Rail Terminal site	3rd
5d	▪ Existing SCI STW	▪ Sandy Bay STW ▪ North Point STW	▪ Port Rail Terminal site	4th

Summary Overview

No.	Criterion	Option 5a	Option 5b	Option 5c	Option 5d
1	Water Quality (Excessive algal growth)	1st =	1st =	1st =	1st =
2	Marine Ecology	1st =	4th	1st =	1st =
3	Fisheries	1st =	4th	1st =	1st =
4	Public Health	1st =	1st =	1st =	1st =
5	Hazard to the Public	1st =	1st =	3rd	4th
6	Air Quality	1st =	1st =	3rd	4th
7	Noise	1st =	1st =	3rd	4th
8	Terrestrial Ecology	1st =	1st =	3rd	4th
9	Landscape and Visual	1st	4th	2nd	3rd
10	Waste Management Implications	2nd	1st	3rd	4th
11	HATS System Reliability	4th	2nd	3rd	1st
12	Tunnel / Outfall Construction Risk	3rd	4th	2nd	1st
13	Sewage Treatment Works Construction Risk	1st	2nd	3rd	4th
14	Operational Risk	1st	2nd	3rd	4th
15	Flexibility	1st	2nd	3rd	4th
16	Community Facilities	1st =	1st =	1st =	1st =
17	Road Traffic	2nd	1st	3rd	4th
18	Marine Traffic	1st =	3rd	1st =	4th
19	Potential Public Resistance	1st	2nd =	2nd =	4th
20	Job Creation	1st =	1st =	1st =	1st =
21	Total Lifecycle Cost	1st	2nd	3rd	4th
22	Utilisation of Surface Land Resource	1st =	4th	1st =	1st =
23	Land Zoning	1st =	1st =	1st =	1st =
24	Land Status	1st	2nd	3rd	4th
	Green is first ranked; Red is last ranked				

Different Possible Views on Options

- Marine Environment Perspective
  - 5b Less Favorable, Otherwise Indifferent
- Land Based Issues Perspective
  - 5d And 5c Much Less Favorable
  - 5b Somewhat Negative On Conservation Land
  - As SCI Is Existing Site And Common To All, 5a Preferred
- Engineering Issues Perspective
  - 5d And 5c Much Less Favorable
  - 5b Better On Plant, Less So On Tunnels
  - A Large Facility At Stonecutters Part Of All Options; Slight advantage to 5a

Rank Orders

Rank	Option 5a	Option 5b	Option 5c	Option 5d
First Rank	20	11	9	10
Second Rank	2	7	3	0
Third Rank	1	1	12	1
Fourth Rank	1	5	0	13

Environmental Protection Department
Government of Hong Kong
Special Administrative Region

Monitoring Group Briefing

Draft Engineering Matters for Staged Implementation of Treatment of HATS Discharges

December 17, 2003

Agenda

- Describe Alternatives
- Discuss Highlights
- Discuss Programme
- Discuss Costs

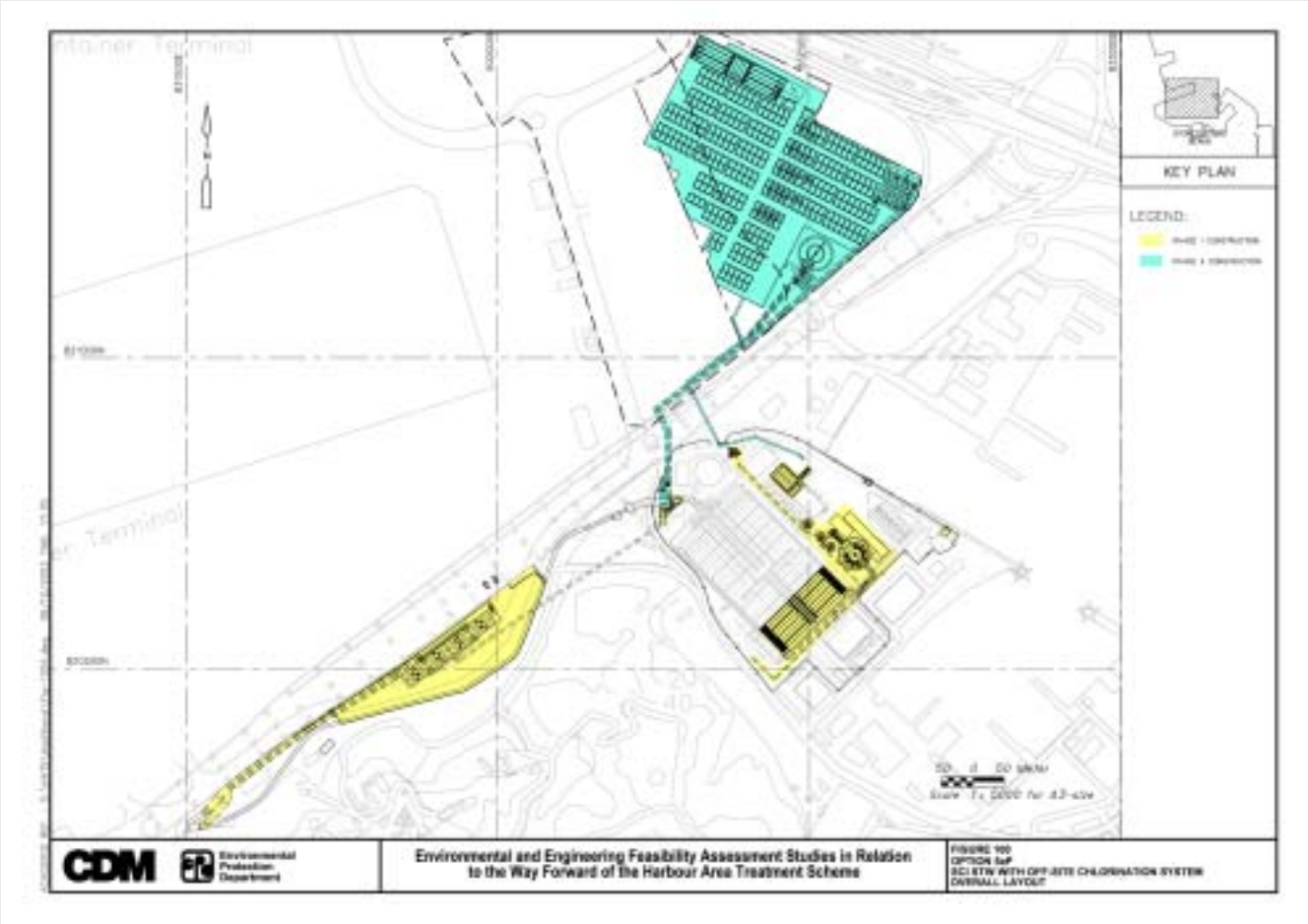
Basic Systems for Phasing

- CEPT Treatment
- Disinfection by Chlorine
  - On-site Production Cost Effective
  - 20 Minute Contact At 1.5 Times Average Flow
- Dechlorination To 0.2 mg/L 95 % Of Time
- Coliform Effluent Limit 20,000/100 ml, Mean

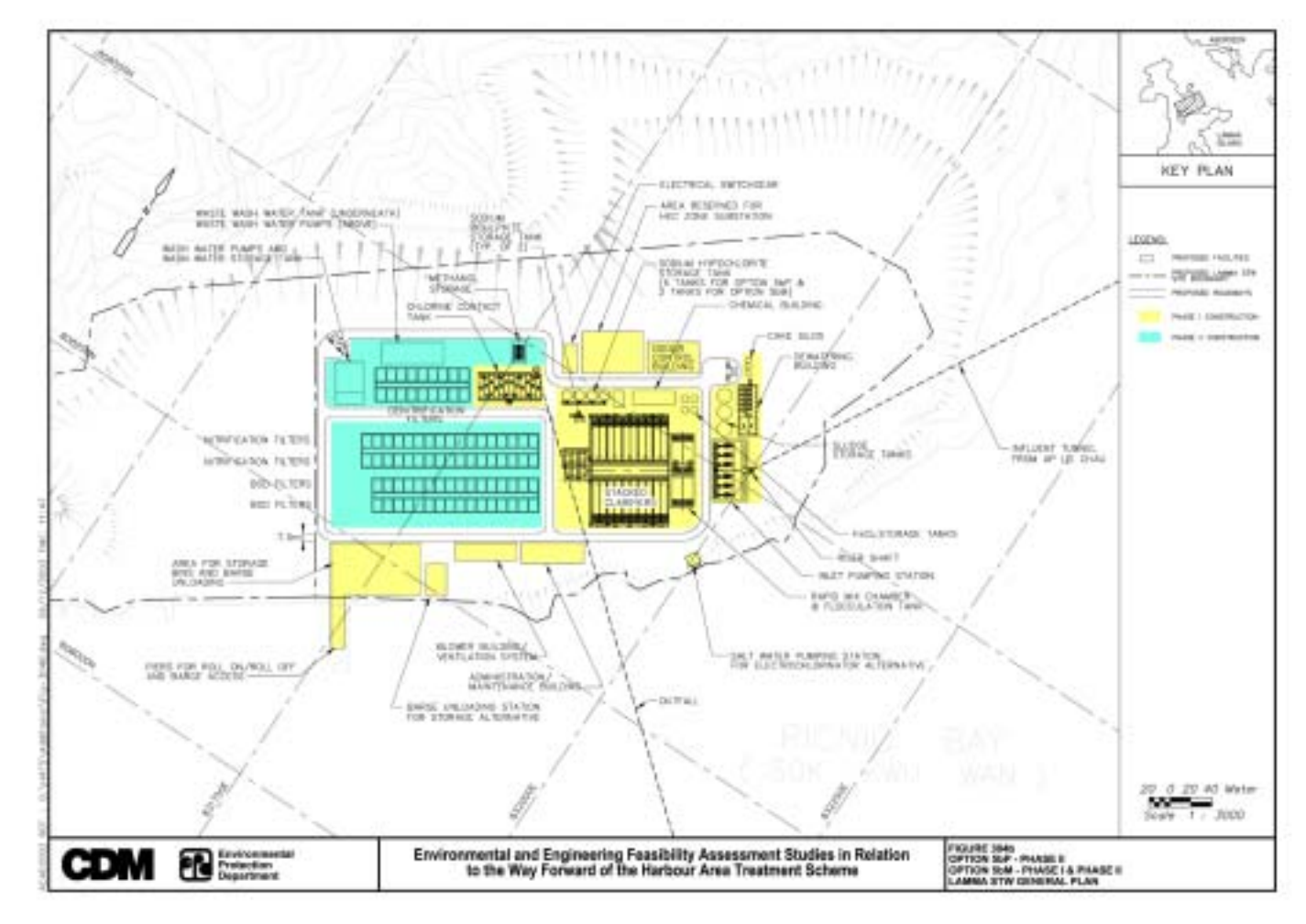
Alternatives

IRP Option	Location	Flow	Phase I	Phase II
5a	SCI	2.8	CEPT	CEPT plus BAF
5b	SCI	2.2	CEPT	CEPT plus BAF
	Lamma	0.6	CEPT	CEPT plus BAF
5b	SCI	2.2	CEPT	CEPT plus BAF
	Lamma	0.6	CEPT plus BAF (UV)	CEPT plus BAF

Stonecutters Island



Lamma Island



Programme Issues:

- Assuming Funding Available in Early 2005
- Stonecutters Island
  - Can be in service by late 2011
  - Stage III/IV tunnels by late 2013
- Lamma Island
  - Can be built as early as 2011
  - Stage III/IV Tunnels by late 2013

Recurrent Costs

Option	Phase I (million HK$)	Phase II (million HK$)	No Phasing (million HK$)
	CEPT at SCI	CEPT plus BAF at SCI	1,510
5a	730	1,500	
	CEPT at SCI / CEPT at Lamma	CEPT plus BAF at SCI and Lamma	1,520
5b Variant # 1	790	1,510	
	CEPT at SCI / CEPT plus BAF at Lamma	CEPT plus BAF at SCI and Lamma	1,520
5b Variant # 2	910	1,510	

Notes: Costs are for denitrification
Costs include sludge disposal
Cost of Existing Facilities 320 million

Construction Costs

	5a			5b – Variant 1			5b – Variant 2		
	Phase I	Phase II	No Phasing	Phase I	Phase II	No Phasing	Phase I	Phase II	No Phasing
Tank Offsite									
Treatment Works	3,592	10,643		4,508	9,436		5,525	8,342	
Tunnels	3,820			4,670			4,670		
Total Each Phase	7,412	10,643		9,179	9,436		10,196	8,342	
Total Both Phases		18,055	17,539		18,614	17,700		18,538	17,700

Notes: Assumes onsite generation of chlorine
No Phasing Alternatives Use UV for Disinfection
Costs for sludge incineration and PTW upgrading not included

Monitoring Group for HATS
Technical Exchange Meeting
held on Thursday, 17 July 2003 at 9:30 am
at the Conference Room, 28/F., Southorn Centre, Wan Chai.
Summary of Discussion

Present:

Mr. Benny Wong	Assistant Director (Waste and Water), Environmental Protection Department (EPD)
Professor Rudolf Wu	Member of the Monitoring Group for HATS (MG)
Dr. Albert Koenig	Member of the MG
Dr. C. N. Ng	Member of the MG
Mr. Peter Baldwin	Ag. Principal Environmental Protection Officer, EPD
Mr. C. H. Chung	Senior Environmental Protection Officer, EPD
Ms Florence Ling	Environmental Protection Officer, EPD
Dr. Samuel Chui	Assistant Secretary for the Environment, Transport and Works
Mr. Lawrence Ho	Senior Engineer, Drainage Services Department
Mr. John Gall	CDM International Inc. (CDM)
Prof. Paul Harrison	Hong Kong University of Science and Technology (HKUST)
Dr. Kedong Yin	HKUST
Mr. Joel Melanson	CDM

Action

Introduction

1. Mr. Wong (EPD) welcomed all to this technical exchange meeting for those members of the Monitoring Group (MG) who were interested in a more in-depth discussion with CDM on the phosphorus-limiting (or P-limiting) conclusion presented in the 3 July 2003 MG meeting.

2. In accordance with Prof. Leonard Cheng's suggestion via his email dated 10 July 2003, Mr. Wong (EPD) advised that EPD would prepare a non-technical summary of the discussions, containing agreements and disagreements reached in this meeting. The summary would be made available to all MG members. The participants raised no objection. EPD

3. It was noted that Dr. K.C. Ho could not attend this meeting because of a leg injury. However, he had expressed his views through his email dated 14 July 2003. Key points of his views are summarized below:

"Nevertheless, my views on the overall conclusion remain the same: there is no way to question about the findings of the consultants. They are based on very detailed analysis and scientific approach. However, taking into consideration that the N:P ratios in HK and nearby waters have been changing gradually from N-limiting in the 1970s to slightly P-limiting in the 2000s, we must take a very cautious way in considering which factor (N or P) must be controlled."

4. Prof. Harrison then gave a PowerPoint presentation on the oceanography and water quality issues of HK and explained how he came to the P-limitation conclusion.

5. Taking into account HKUST's findings, it is CDM's proposal to adopt phosphorus removal as the nutrient control strategy for future stages of HATS.

Discussion

6. General consensus was reached on the following points before detailed discussions on specific issues began:

(a) It was accepted in the scientific community that algal growth in environmental waters is, among others, generally affected by the ratio of two nutrients (i.e. nitrogen and phosphorus). The indicative rule is that waters having a nitrogen to phosphorus ratio (or N:P ratio) greater than 16 has the potential of P-limiting, while waters with N:P ratio smaller than 16 indicates N-limited. Nitrogen (or N) tends to limit algal growth in oceanic waters, which are normally nutrients-poor. Phosphorus tends to be the limiting nutrient in freshwater system such as lakes and rivers where supply of nitrogen is very large.

(b) However, it was noted that P-limitation is not uncommon in estuarine waters where river water meets with oceanic water. The P-limiting situation is especially conspicuous in rainy season (or wet season) when river flow is large.

(c) Waters of HK are affected by the Pearl River, in particular the western and southern waters. The analysis of HKUST indicates that these waters are generally P-limited in summer, and N-limited in winter. HK's eastern waters are less affected by the Pearl River and are generally N-limited for the whole year.

(d) In planning the treatment facilities, the more cost-effective approach is to control the discharge of the limiting nutrient.

7. Prof Wu opined that while he generally agreed with the conclusion on a macro scale, the outfall actually lies in a transitional zone between eastern waters (which are N limited) and western waters

(which are P limited). He would therefore like to see more justification on whether the same conclusion of P-limiting also applied in micro scale in the small water body in the vicinity of the Stonecutters Island discharge (i.e. waters between Tsing Yi, Kau Yi Chau and west of HK Island), as according to his knowledge, the waters there are only mixed with 25% of the Pearl River flow in summer. Prof. Harrison provided plots of N:P ratios (derived from EPD's monitoring data for the past 10 years) for a transect starting from Urmston Road in the western waters off-shore of Tuen Mun, through Ma Wan Channel, to the eastern parts of Victoria Harbour. The plots showed high N:P ratios in the summer for the Tsing Ti/Kau Yi Chau/West of HK Island waters, indicating a P-limited scenario.

8. Prof. Wu questioned what would be the outcome in winter when HK waters were predominately N-limited if only P was removed. Prof. Harrison pointed out that the N:P ratio indicates which nutrient limits algal growth. Algal growth still continues under any limiting conditions and the amount of growth would depend on the actual nutrient concentrations present in the waters. In winter, the Pearl River influence diminishes, and oceanic influence become more dominant. The nutrients-poor oceanic water moves on-shore, lowering the nutrient concentrations in the ambient waters and the related algal production would then be too low to cause any concern.

9. It was noted that algae requires light to support its growth. When all stages of HATS are completed, the harbour waters are expected to become less turbid due to the removal of suspended solids from the sewage. Better light penetration might be expected under such conditions. Prof Wu asked what the implications would be if nutrients were to be left in the effluent. Prof. Harrison pointed out that field data on light extinction obtained after the operation of HATS Stage I suggests that light penetration may not play a major role in limiting algal production. Other factors such as vertical mixing, wind, tidal flushing etc. would possibly contribute by discouraging excessive algal growth in harbour waters.

10. Given the fact that the Southern Waters are oligotrophic (i.e. nutrient poor waters), Dr. Koenig queried the need for P removal, even if the waters are P-limited in summer. He added that the information provided to him did not tell him if the discharge would lead to significant increases in nutrient concentrations in the receiving waters. If the nutrient concentrations remain low, algal growth should not be excessive enough to cause any concern. He added that P removal would have the drawback of producing more sludge.

11. Dr. Koenig asked if field tests on algal productivity had been carried out or would be carried out in HK waters by varying nutrient dosage to the tested algal samples. He noted that, although HKUST had done similar nutrient limitation tests in the laboratory, it was not certain whether what happened in the laboratory tests truly represented the real

life situation. In particular, he considered that some of HKUST's testing scenarios were too conservative (e.g. some scenarios do not take full account the actual dilution of the discharge achieved in the receiving waters). After some discussion, it was recognized that there would be resource constraints and practical difficulties in conducting such tests on site. HKUST remarked that their laboratory tests are in fact alternatives to field tests, in light of the said constraints and difficulties.

12. Mr. Gall confirmed that chlorophyll-*a*[(note 1)] is one of the outputs for their model simulations for various treatment levels. The model had been well calibrated against field data and the model results could be expected to give reasonably good predictions of algal growth in receiving waters for the effluents treated to different standards. In this regard, Dr. Koenig asked to see the chlorophyll-*a* results in respect of different treatment levels to see if algal growth is really a significant issue. He also asked for information on the relative loadings of HATS as compared to other pollutant sources. EPD/CDM

Note 1 : Algae possess chlorophyll for photosynthesis. It is adopted as an indicator parameter for algal population under the model simulations.

13. After the above discussions, Prof Wu and Dr Koenig were of the view that the data provided thus far are not conclusive. They would like to see more data before they could support or reject any proposal in respect of P removal or N removal. Data on the amount of algal growth under future stages of HATS is necessary. In this regard, Prof Wu suggested some comparison be made between assumptions used in calculating chlorophyll-*a* by the model and the results of HKUST's nutrient bioassay. Mr. Gall (CDM) advised that, since the model has been calibrated against field data, the chlorophyll-*a* results would largely be representative of future discharge scenarios. Mr. Wong proposed to send hard copies of the model calibration report to Prof Wu and Dr Koenig for their information. [PMN: The model calibration reports were sent to Prof Wu, Dr Koenig, and Dr KC Ho on 22 July 2003.] EPD/CDM

AOB

14. There being no other business, the meeting closed at 11:50am.