

# Harbourfront Commission

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For discussion  
on 19 August 2014

HC/15/2014

## Further Enhancing Coastal Water Quality of Victoria Harbour

### PURPOSE

The Environmental Protection Department (EPD) plans to commission a consultancy study to enhance the leisure and amenity value of the coastal areas of Victoria Harbour. We would like to seek comments of Members on the proposed study.

### BACKGROUND

2. The Government has been implementing the Harbour Area Treatment Scheme (HATS) in phases since 1994 for the collection and proper treatment of sewage generated from both sides of Victoria Harbour. HATS Stage 1 delivers sewage collected from Kowloon and north-eastern Hong Kong Island via deep sewage tunnels to the Stonecutters Island Sewage Treatment Works (SCISTW) for chemically-enhanced primary treatment (CEPT), removing 70% of the organic pollutants in terms of biochemical oxygen demand; 80% of the suspended solids and 50% of sewage bacteria, *E.coli*. HATS Stage 1 was commissioned in 2001 and has significantly improved the water quality of Victoria Harbour.

3. Construction of HATS Stage 2A is underway to collect sewage generated from the northern and south-western parts of Hong Kong Island with newly constructed deep tunnels of 21 kilometres long. The sewage will then be transferred to the expanded SCISTW for CEPT and disinfection. The Advance Disinfection Facilities under HATS Stage 2A were commissioned in March 2010 to remove at least 99 per cent of *E.Coli* from the treated effluent of the SCISTW. Since then, the bacteria level in the western part of Victoria Harbour has been largely reduced. Major works under Stage 2A is expected to be completed by end of this year. Upon the full commissioning of Stage 2A, the overall water quality of Victoria Harbour will be further improved.

4. HATS Stages 1 and 2A will have improved the quality of the main water body of Victoria Harbour (see **Enclosure 1**). However, there are still residual pollution discharges from a number of activities in densely populated urban areas into the coastal waters. These discharges originate from various pollution sources, including overland polluted storm water

flow <sup>[1]</sup> and wastewater from mis-connections, causing odour and visual problems along the coastal areas of Victoria Harbour. Other possible sources of odour include marine refuse, grease and oil at sea, decaying algae, sediments and deposit at drainage outlets, seabed sediments. These problems remain subjects of concerns by the local community.

5. At present, a multi-pronged approach has been adopted by various departments concerned to deal with near shore pollution problems. For example, EPD takes enforcement actions to stop illegal discharge from building drains to public storm drains, and will request the Buildings Department to step in if necessary; the Food and Environmental Hygiene Department takes enforcement actions against food premises conducting scullery activities at rear lanes; the Drainage Services Department replaces broken sewers, rectifies wrong connections between public sewers and storm drains, desilts storm drains and culvert outlets as well as upgrades or installs dry weather flow interceptors (DWFIs) <sup>[2]</sup>.

6. Despite the concerted efforts of the departments, it is difficult to eliminate the problem of mis-connections and malpractices, particularly in densely populated areas with many old private buildings. Furthermore, albeit resource intensive, enforcement actions are unable to comprehensively prevent the various daily activities on the streets from polluting the coastal waters. Desilting and DWFIs at drainage outlets are only ad hoc mitigation measures. Besides, the installation of DWFIs is subject to the space constraint at strategic locations. Therefore, to improve near shore water quality, investigation in many aspects is necessary so that effective programmes can be developed to tackle the pollution at source.

## **PROPOSAL**

7. With the development of new waterfront promenades on both sides, Victoria Harbour has become increasingly accessible to the public. Public aspiration for a pleasant harbourfront will only increase. Hence it is necessary to find a more effective solution to enhance the quality of the coastal waters of Victoria Harbour, which will improve the associated aesthetic and odour problems of the near shore areas. The 2014 Policy Address has also proposed to enhance water quality of the coastal areas of Victoria Harbour.

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<sup>1</sup> The pollution is caused by a number of activities such as roadside shops/business operators and littering.

<sup>2</sup> Dry weather flow interceptors (DWFIs) are devices used during the dry season to intercept and divert polluted stormwater in the storm drains or nullahs to the sewerage system. In the rainy season, with higher water flow, stormwater mostly bypass the DWFIs and discharge through the stormwater drains. In general, DWFIs will be disabled during the rainy season.

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8. As there are diverse sources of near shore pollution, how odour is generated is a complicated matter. Nuisance caused by odour also varies with the seasons, weather conditions, wind directions, wind speeds and water current. In particular, odour problem is often found to be more severe in semi-enclosed water bodies such as typhoon shelters. A range of solutions are required to tackle the issues. To develop effective improvement measures, we need to identify the specific causes of near shore pollution through evidence-based reviews and various analyses, aiming to achieve the following objectives:

- (a) to explore various practicable options to effectively reduce near shore water pollution to improve the overall environment of both sides of Victoria Harbour (both aesthetic and odour) with the long-term objective of enhancing the leisure and amenity value of the coastal areas of Victoria Harbour; and
- (b) to work out a programme to improve the environment of our popular waterfront areas.

9. To achieve the above objectives, the proposed consultancy study will identify specific solutions through prevention at source and pollution control measures. The following tasks are proposed for the consultancy study:

- (a) to carry out initial baseline survey to establish overall conditions of near shore pollution levels in Victoria Harbour;
- (b) to review overseas experience in combating near shore water pollution that may be applicable to Victoria Harbour;
- (c) to identify priority areas for improvement;
- (d) to carry out evidence-based reviews to identify pollution sources affecting regional coastal waters, e.g., expedient connection survey, non-point source pollution survey, etc.;
- (e) to carry out regional environmental investigation to assess the nuisance such as aesthetic and odour arising from the near shore water pollution;
- (f) to review the current programmes, legislative provisions and institutional arrangements to combat near shore water

pollution;

- (g) to study practicable measures to prevent pollution at source (e.g. rectify any wrong connections in the public sewer and drainage systems, land use planning, legislative provision to increase enforcement efficacy, public education/participation, etc.) and to reduce pollution discharges with pollution control measures (e.g. engineering solutions, clean up actions, etc.); and
- (h) to draw up recommendations and timetable to enhance the water quality of Victoria Harbour, in particular the priority areas and areas of concern to the local community <sup>[3]</sup>, and in the long term its leisure and amenity value.

10. An initial baseline survey will be carried out in the consultancy study to establish the overall picture of near shore water pollution levels in Victoria Harbour. Evidence-based reviews and environmental investigations will identify regional pollution problems. To cope with developments on both sides of Victoria Harbour, we have considered the factors below and propose West Kowloon, Kowloon East, the New Central Harbourfront and Wan Chai/Causeway Bay as priority areas for improvement:

- (a) accessibility of waterfront areas;
- (b) current uses and popularity of waterfront areas;
- (c) developments with planned timetable along the waterfront areas;
- (d) on-going or planned improvement works in the waterfront areas; and
- (e) pollution level of coastal waters.

11. For pollution black spots in priority areas, we will carry out evidence-based reviews (e.g. walkover survey, water quality monitoring of storm drain system, expedient connection surveys, manhole inspection, non-point source pollution surveys, etc.) and environmental investigation (e.g. olfactometry odour assessment, headspace analysis, sediment analysis, etc.) to identify the specific sources of near shore pollution.

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<sup>3</sup> Areas of concern of the local community shall be confirmed through consultation with the relevant District Councils / stakeholders.

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12. In addition to detailed analysis of the specific causes of near shore pollution, we will also review existing measures in tackling near shore pollution as well as overseas experience. With an evaluation of the likely public reaction, preliminary environmental, traffic and drainage impacts, as well as sustainability, cost effectiveness and implementation timetable, we hope to recommend for example:

- (a) practicable solutions with tentative timetable;
- (b) suggestions on how to coordinate with ongoing improvement works at the waterfront areas;
- (c) best practices or protocols;
- (d) pilot demonstration scheme; and
- (e) long-term options.

13. Inspection audits (e.g. field inspections, odour patrols, expedient connection surveys, etc.) will be carried out under the consultancy study to investigate areas with serious near shore water pollution problems. Preliminary proposal on mitigation measures based on findings of inspection audits will be passed to relevant departments for follow up actions.

14. The removal of aesthetic and odour problems is our main target in enhancing quality of the coastal waters. To evaluate the effectiveness of various solutions, the consultancy study will examine objective indicators of water quality (See **Enclosure 2**), beneficial uses of the water bodies, overseas experience and international standards, etc.

15. We have already started consultation with relevant experts and bodies on the scope of the consultancy study. After consulting the Harbourfront Commission and other stakeholders, we will prepare the detailed scope and requirements of the consultancy study for consultation of the Panel on Environmental Affairs and funding application to the Finance Committee of the Legislative Council. Subject to the approval of funds, we plan to commence the proposed 24-month consultancy study in 2015. The implementation of HATS Stage 2B will be kept under review taking into account the water quality situation and the latest technological development in biological treatment.

## **ADVICE SOUGHT**

16. Members are invited to comment on the proposed objectives, scope, priority areas for improvement, preliminary practicable recommendations,

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objective indicators of nearshore water pollution, etc., of the consultancy study as given in paragraphs 7-14 above.

**Environmental Protection Department  
August 2014**

## Harbour Area Treatment Scheme

### Background

The Harbour Area Treatment Scheme (HATS) involves the implementation of an integrated sewerage system for collecting and treating sewage generated around Victoria Harbour in an efficient, effective and environmentally sustainable manner.

2. Construction of HATS Stage 1 commenced in early 1995 and was completed in 2001. Sewage generated from Tsuen Wan, Kwai Tsing, Tseung Kwan O, Kowloon and north-eastern Hong Kong Island is collected for treatment at the Stonecutters Island Sewage Treatment Works (SCISTW). HATS Stage 1 now collects 1.4 million cubic metres (m<sup>3</sup>) of sewage each day (representing about 75% of the total sewage generated from the harbour catchment) to the SCISTW via deep tunnels for centralised treatment before disposal. The SCISTW is one of the most efficient chemical treatment plants in the world, removing 70% of the organic pollutants, 80% of the suspended solids and 50% of *E.coli*. This has resulted in significant improvement in the marine environment.

3. The remaining 450,000 m<sup>3</sup> of sewage currently generated within the areas from North Point to Ap Lei Chau which is not handled by HATS Stage 1 (i.e. the remaining 25%) would be collected and transferred to the expanded SCISTW for centralised treatment under Stage 2A. For HATS Stage 2B, an underground biological treatment facility is proposed at a site adjacent to the existing SCISTW.



## **Current state of water quality of Victoria Harbour**

4. For the Victoria Harbour Water Control Zone, the compliance rate with the relevant Water Quality Objectives (WQOs) in 2013 was 83%. Non-compliance was mainly found with regard to the Total Inorganic Nitrogen (TIN) and Dissolved Oxygen objectives at some monitoring stations. The TIN compliance rate of the Victoria Harbour WCZ was 60% in 2013. This could be due to a higher background TIN level under the influence of Pearl River discharge (as reflected in the increase in TIN levels at many stations in the north-western and southern waters of Hong Kong), the year-to-year normal range of fluctuation of the discharge from surface run-offs, and the untreated sewage discharged from the four preliminary treatment works (PTW) located between North Point and Central. After the commissioning of HATS Stage 2A, the pollution load to Victoria Harbour will be further reduced when sewage from the above mentioned PTWs is collected for treatment at the SCISTW.

5. The DO compliance rate of the Victoria Harbour WCZ was 90% in 2013. The DO level in a water body can be affected by organic pollution as well as natural factors such as temperature <sup>[1]</sup> and stratification <sup>[2]</sup> of the water column. Since the monitoring data, on the basis of parameters such as organic nitrogen and 5-day Biochemical Oxygen Demand, did not show any obvious sign of an increase in organic pollution in the harbour waters in 2013, the 10% non-compliance rate with the DO objective was likely related to the occasional hot weather experienced during the summer months.

## **Water quality improvements of implementing HATS**

6. After commissioning HATS Stage 2A, the bulk of Victoria Harbour will comply with the applicable WQOs such as Dissolved Oxygen (DO) and Un-ionised Ammonia (UIA).

| <b>WQOs</b> | <b>HATS Stage 1</b> | <b>HATS Stage 2A</b>    |
|-------------|---------------------|-------------------------|
| DO          | Increased by 10%    | Further increased by 3% |
| UIA         | Reduced by 31%      | Further reduced by 12%  |
| TIN         | Reduced by 16%      | Further reduced by 7%   |

<sup>1</sup> Solubility of oxygen in water is affected nonlinearly by temperature, and decreases considerably in warm water.

<sup>2</sup> In summer, surface run-offs and river outflow increase significantly as a result of heavy rainfall. When the marine water body receives fresh water input from these sources, salinity difference between the upper layer and lower layer of the water body will lead to stratification of the water column. Stratification discourages mixing which in turn affects replenishment of DO in the water body.



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7. The additional benefits brought about by the implementation of HATS Stage 2B to the water quality of Victoria Harbour are that the level of DO would be marginally improved and the level of un-ionised ammonia would be reduced. However the level of total inorganic nitrogen would be increased due to the nitrification process of biological treatment.

8. The improvement will mainly be found in the western part of Victoria Harbour/around the HATS outfall area, away from the coastal waters and hence will not result in an obvious improvement of the quality of coastal waters. The residual pollution discharges into the urban coastal waters, i.e. those not collected by our sewerage system due to various factors such as drain misconnections, polluted surface run-offs from streets, etc., and the odour and visual impacts caused by near shore pollution to our urban coastal waters still remain.

## **Objective indicators for monitoring Victoria Harbour**

The removal of aesthetic and odour problems is our target in enhancing quality of the coastal waters. While improvement in aesthetic and, to an even greater extent, odour problems would be difficult to quantify, we will draw reference from relevant indicators of water pollution. For example:

- (a) *E.coli* : *E.coli* level is a common bacterial indicator of water pollution and is counted for compliance with the Water Quality Objective (WQO) for bathing beaches and secondary contact recreation subzones. Though there is no known scientific literature or report to directly link the foul odour detected in environmental water samples with high levels of *E.coli*, if organic matter such as sewage is discharged into the storm drain system, the anaerobic decomposition of the organic sediments under anoxic (e.g. no-oxygen) condition may generate hydrogen sulphide and hence bad smell, which may be released through openings and manholes of the storm drains, and culvert outlets at the waterfront when the sediments are exposed to air under low tide condition. And, the levels of *E.coli* in near shore water can indicate whether the “source” of the odour problem detected in a certain area is sewage-related.
  
- (b) Acid Volatile Sulphide (AVS) : To assess whether sea-bed sediment is causing odour, we need to monitor water quality (e.g. water depth, tidal patterns, the level of dissolved oxygen and biochemical oxygen demand, temperature, pH values and other nutrient parameters) and sediment conditions (such as pH values, total organic matters, AVS and other nutrients parameters). If sediments containing organic matters and lots of AVS are found under anoxic condition, and situated in water bodies with unfavourable circumstances (including low dissolved oxygen levels, stagnant water and shallow water), hydrogen sulphide formed by sediments is likely to be released to the air, thus causing odour problems.