40/F, Revenue Tower, 5 Gloucester Road, Wan Chai, Hong Kong
香港灣仔告士打道 5 號稅務大樓 40 樓

ACE Paper 21/2008
For information

Harbour Area Treatment Scheme (HATS)
Planning Parameters for the Commencement of the Design and Construction of HATS Stage 2B

PURPOSE

This paper informs Members of the levels and trends of key planning parameters in relation to the design and construction of the HATS Stage 2B and the timing for the review of HATS Stage 2B.

BACKGROUND

2. In a paper submitted to the Panel on Environmental Affairs of the Legislative Council in 2005, the Government has indicated that we will report regularly to the Advisory Council on the Environment (ACE) on the trends and levels of the planning parameters and the timing for the review of the HATS Stage 2B.

3. In 2004, we consulted the ACE on various issues on HATS Stage 2 including the preferred option, acceptability of chlorination disinfection, centralization vs. decentralization, phased implementation approach, choice of biological treatment technology, need for nutrient removal, sludge handling and the findings of trials and studies relating to HATS Stage 2. In 2005, we further consulted the ACE on the proposed implementation programme and the results of the public consultation for Stage 2. In October 2007, the ACE has endorsed the EIA report with conditions for the advance disinfection facilities under Stage 2A.

4. HATS Stage 2 is being implemented in two phases, namely Stage 2A and Stage 2B, with centralized treatment at Stonecutters Island.

5. Stage 2A comprises a deep tunnel system to convey the currently virtually untreated sewage from eight preliminary treatment works around the northern and southwestern shores of Hong Kong Island to Stonecutters Island, the expansion of the existing chemical treatment facilities at Stonecutters Island Sewage Treatment Works (SCISTW) and the provision of disinfection facilities. Completion of Stage 2A is targeted for 2014 and the design is well underway. An EIA study is being conducted for Stage 2A. Part of the disinfection facilities has been advanced for completion in 2009 in order to improve water quality in the western harbour and facilitate the re-opening of four beaches in Tsuen Wan which have been closed since 2003. The construction of the advance disinfection facilities commenced in April 2008.

6. Stage 2B will further upgrade the sewage treatment level by the addition of a biological treatment plant adjacent to the SCISTW. A site has been proposed and a study on co-use of the land by the biological treatment plant and other container and port related uses commenced in May 2008. The programme will also depend upon a review of key planning parameters for Stage 2B planned for 2010/11.

7. In deciding to build Stage 2 of HATS in phases, the Government was conscious of the fact that the impacts of the treated sewage on the receiving environment would change with time as sewage flows build up. Consequently, the Government undertook to monitor the situation closely in order to be well informed of the likely direction of future trends and factor this into the planning process for the implementation timetable for Stage 2B.

PLANNING PARAMETERS FOR HATS STAGE 2B

8. The key planning parameters to be considered when reviewing the implementation timetable for HATS Stage 2B are sewage flow, unionized ammonia and dissolved oxygen (DO), which were the key parameters established in the "Environmental and Engineering Feasibility Assessment Studies in relation to the way forward for the Harbour Area Treatment Scheme" (the EEFS) and highlighted in the paper submitted to the Panel on Environmental Affairs in 2005. The sewage flow needs to be tracked as a means of ensuring that the polluting load is not building up faster than predicted. Similarly, the key water quality parameters need to be closely monitored to check for signs of unexpected early deterioration in the receiving water environment. The key water quality parameters are those for which earlier studies indicated that there could be a risk of a breach of the water quality objectives in the future.

9. Sewage flow is a function of population and economic activity and is made up of flows from housing, industry, commercial facilities, schools, and other sources. In developing the flow projections for HATS service areas, reference was made to the population projections and planning data in Planning Department's "Year 2030 Planning Data for HATS" covering all known development and redevelopment proposals within the territory from various sources. It has been used as the full development potential that can be achieved in the HATS service areas at some unspecified future date. On this basis, the ultimate sewage flow currently being used for the design of HATS Stage 2A is estimated to be 2.44 million m^3/day, a rise of some 32% over the 2003 sewage flow of 1.85 million m^3/day for the whole HATS service areas. Also, the sewage flows for 2010, 2020 and 2030 are estimated to be 1.96 million m^3/day, 2.12 million m^3/day and 2.32 million m^3/day respectively, rises of 6%, 15% and 25%. This represents a very modest projected average annual increase of less than 1% although it must be emphasized that the changes may not be linear.

10. At the moment, the measured flows at the SCISTW are quite steady, as is demonstrated by the data in **Figure 1**. This "steady state" is reflected in the BOD[1] and ammonia-nitrogen loading discharged from HATS Stage 1 (**Figure 2**).

11. Since 2006, we have been conducting dedicated annual marine surveys in the western harbour waters which receive the HATS discharge. This has allowed us to assess compliance with water quality criteria (WQC)[2] including the 4-day average unionized ammonia and minimum dissolved oxygen criteria. These two criteria provide benchmarks for unacceptable short-term impacts. The surveys are designed to have intensive and frequent sampling at critical tidal and seasonal conditions with a view to capturing the potentially worst field conditions which reflect the most adverse short-term impacts caused by the discharge of treated effluent from HATS Stage 1.

12. The 2006 and 2007 results for these dedicated surveys indicate that the 4-day average unionized ammonia level met the WQC and was equivalent to some 15% of the criterion value (**Figure 3**). Therefore there is no indication of any adverse short-term impact caused by the current HATS discharge during the critical tidal and seasonal conditions.

[1] BOD (biochemical oxygen demand) reflects the amount of organic matter in the discharge.

[2] A set of specific water quality criteria was developed under the EEFS for assessing the treatment level for HATS Stage 2B. The WQC was developed in 2002 and took into account the then latest local scientific findings.

13. The minimum DO criteria are generally met (see **Figure 4**) although on some occasions low DO has been detected. The water body is still generally well oxygenated based upon the depth-averaged data. Most of the low DO incidents are found to occur seasonally during hot summer periods and only last for relatively short periods. In the western harbour area, we believe that this is primarily due to the natural phenomenon of water column stratification[3], which restricts oxygen transfer, coupled with the presence of organic matter discharged from the HATS Stage 1 outfall, and from the Hong Kong Island screening plants.

14. For a number of years, we have also been conducting a routine programme of compliance monitoring for marine Water Quality Objectives and whilst it does not capture the worst case conditions, the data give an indication of general trends. The monitoring data for unionized ammonia and DO from 2002[4] to 2007 in the vicinity of the HATS Stage 1 outfall are presented graphically in **Figures 5, 6 and 7**. Analysis of these data indicates no statistically significant trends[5], and we therefore conclude that the water quality in the western harbour has neither improved nor deteriorated in the past few years.

CONCLUSION

15. Based upon the prevailing trends and projections in the planning parameters for HATS Stage 2B described above, it is concluded that it remains appropriate to review the programme for the commencement of the design of HATS Stage 2B in 2010/11. We will keep in view the development of the project and any changing circumstances.

16. Members are invited to note the levels and trends of the key planning parameters for HATS Stage 2B and the timing for the review of HATS Stage 2B.

Environmental Protection Department
July 2008

[3] Stratification in local waters is commonly caused by the Pearl River which brings considerable quantities of fresh water to Hong Kong during the rainy season.

[4] HATS Stage 1 began discharging to the western harbour at the end of 2001.

[5] The Seasonal Kendall Test, which is a non-parametric statistical tool, is used to assess trends in water quality of the western harbour over a longer period since the commissioning of HATS Stage 1. It gives an accurate indication of whether the water quality parameters show statistically significant increases or decreases with time (at $p < 0.05$), or whether no significant trends have developed.

Figure 1 Flow of treated effluent from HATS Stage 1

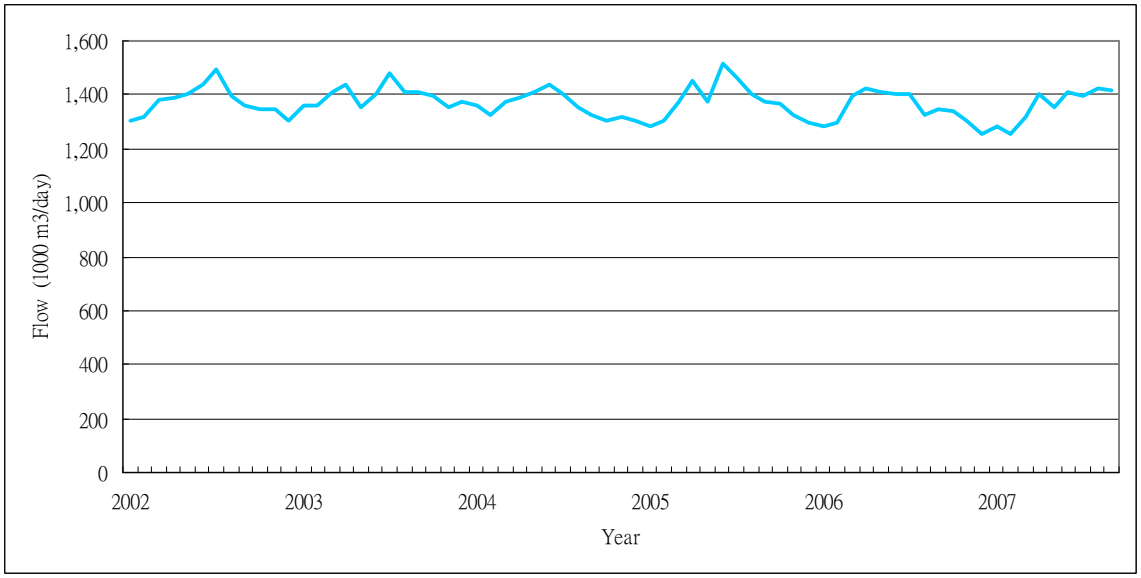

Figure 2 BOD and ammonia-nitrogen loading from the HATS Stage 1 discharge

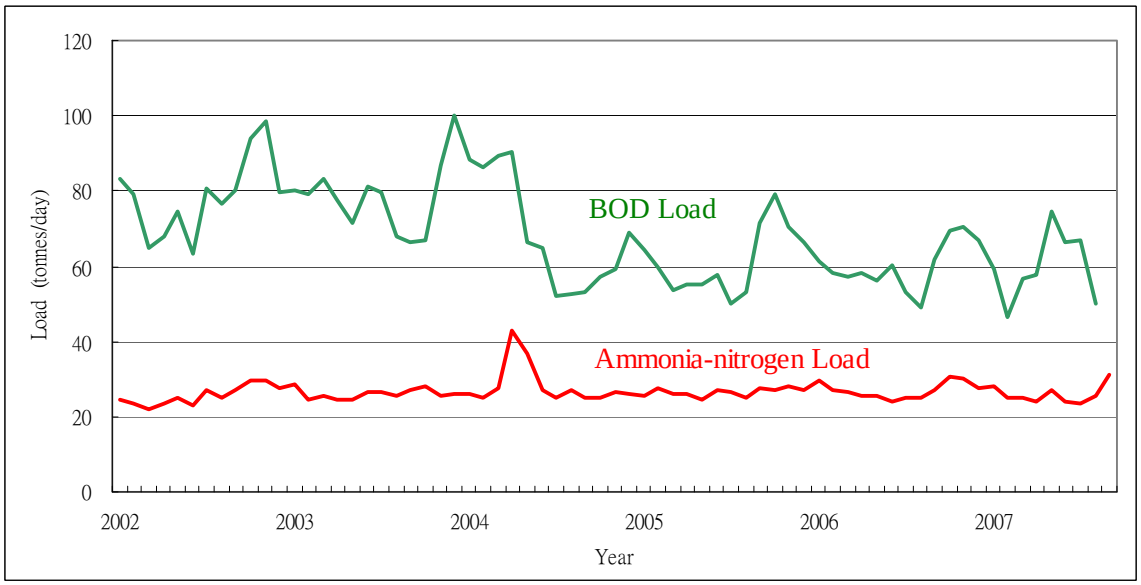

Figure 3 4-day average unionized ammonia levels in the vicinity of the HATS outfall

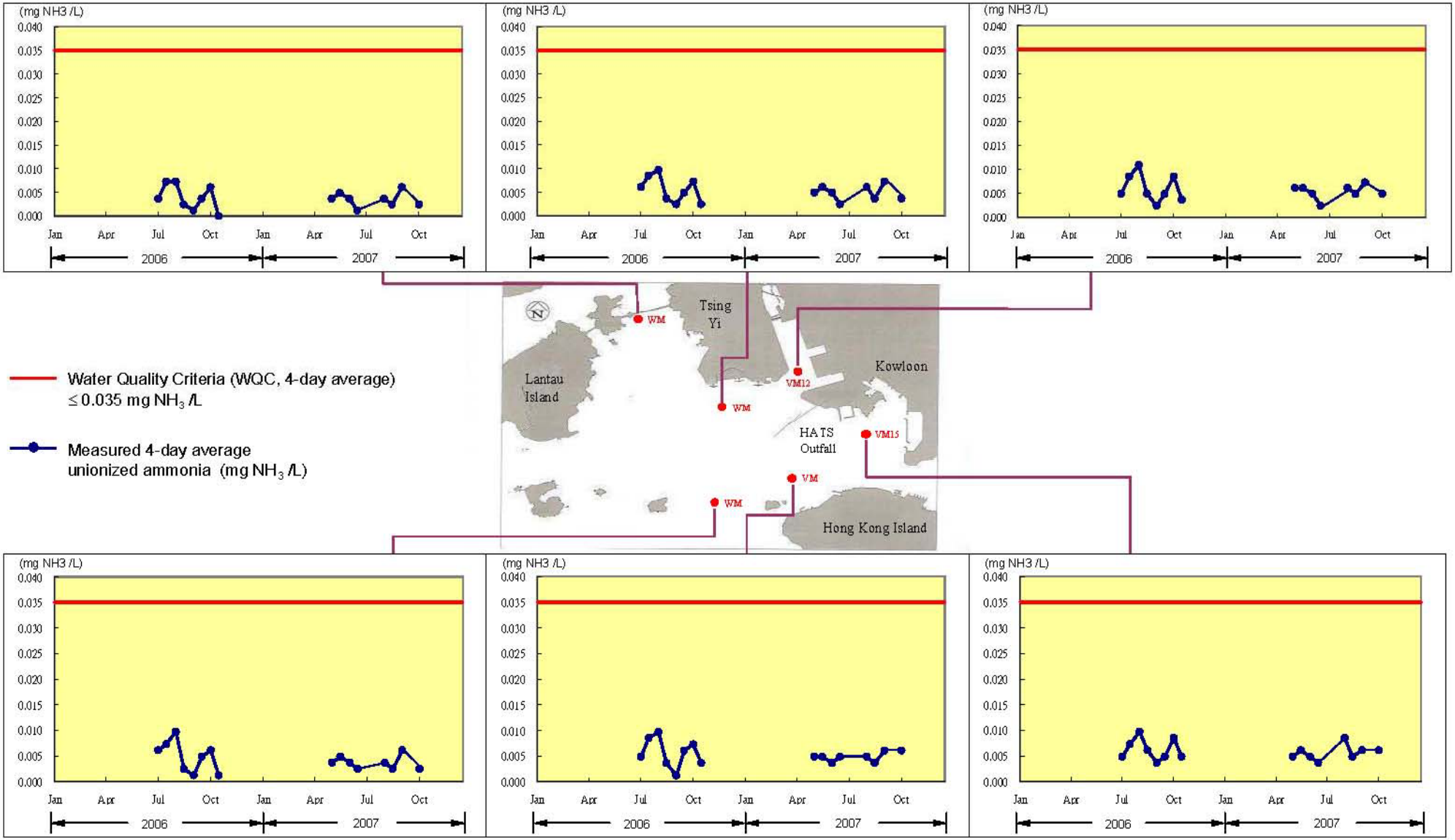

Figure 4 Minimum dissolved oxygen (DO) and depth average DO levels in the vicinity of the HATS outfall

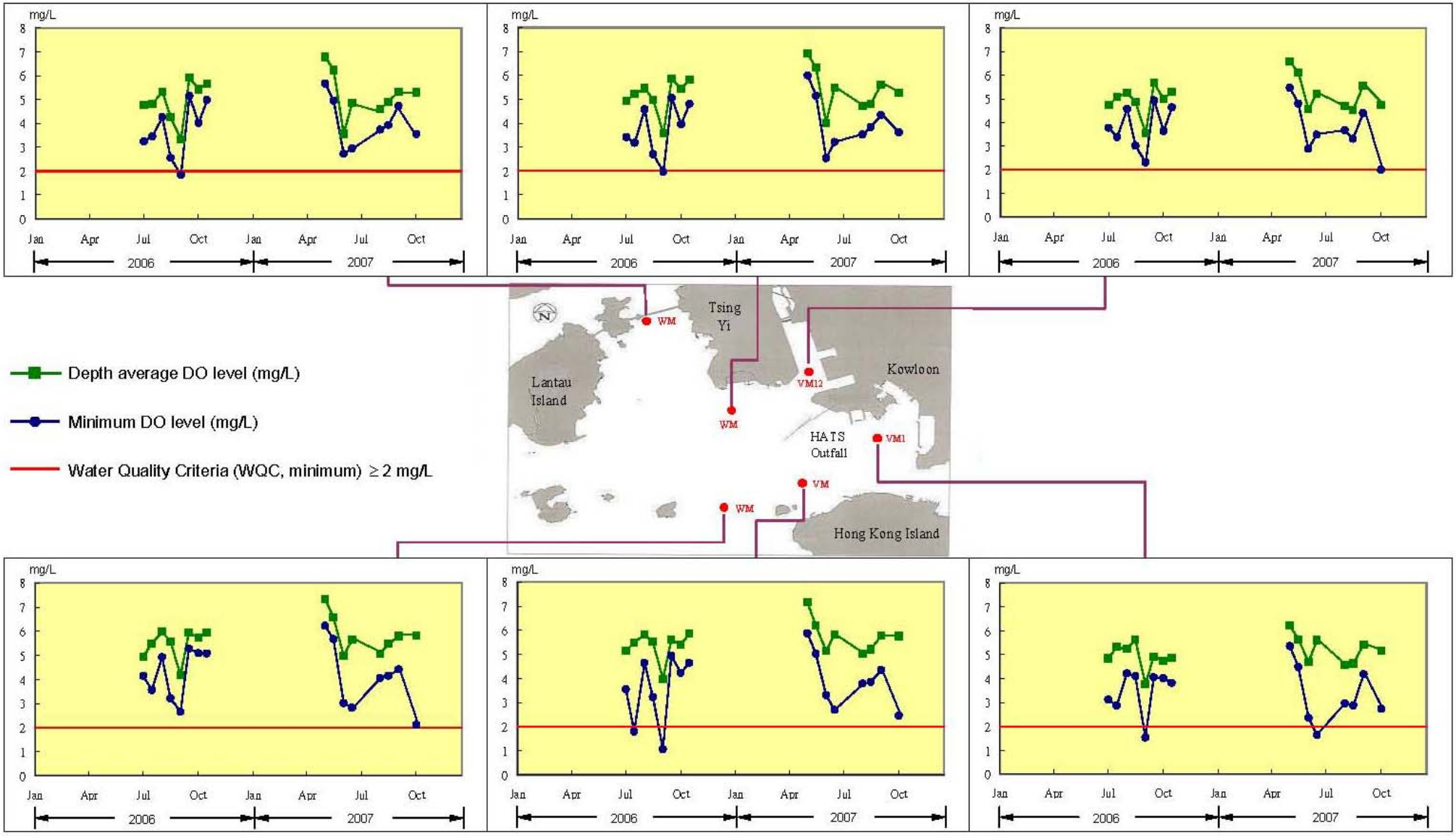

Figure 5 Long-term changes of unionized ammonia in the vicinity of the HATS outfall

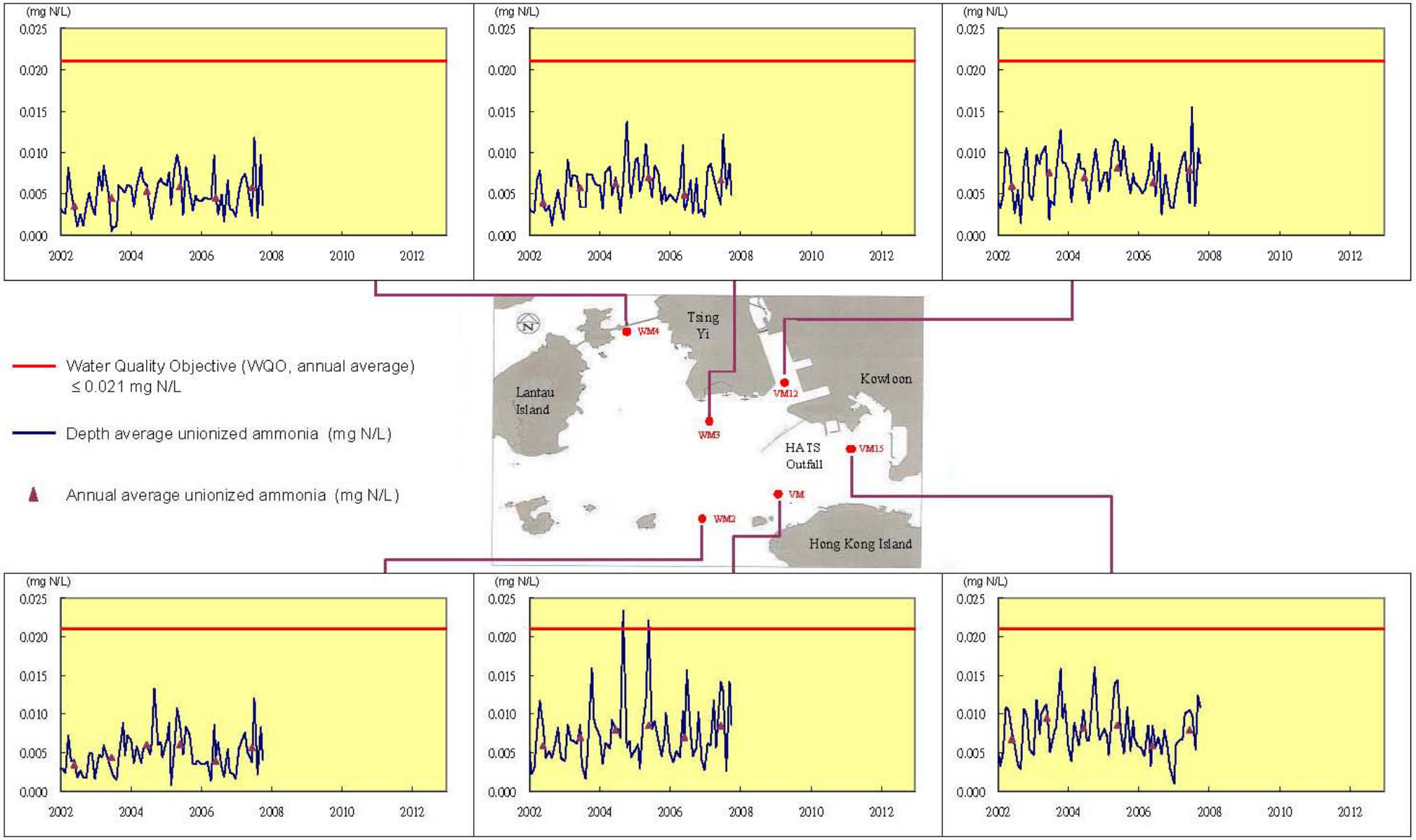

Figure 6 Long-term changes of depth average dissolved oxygen (DO) in the vicinity of the HATS outfall

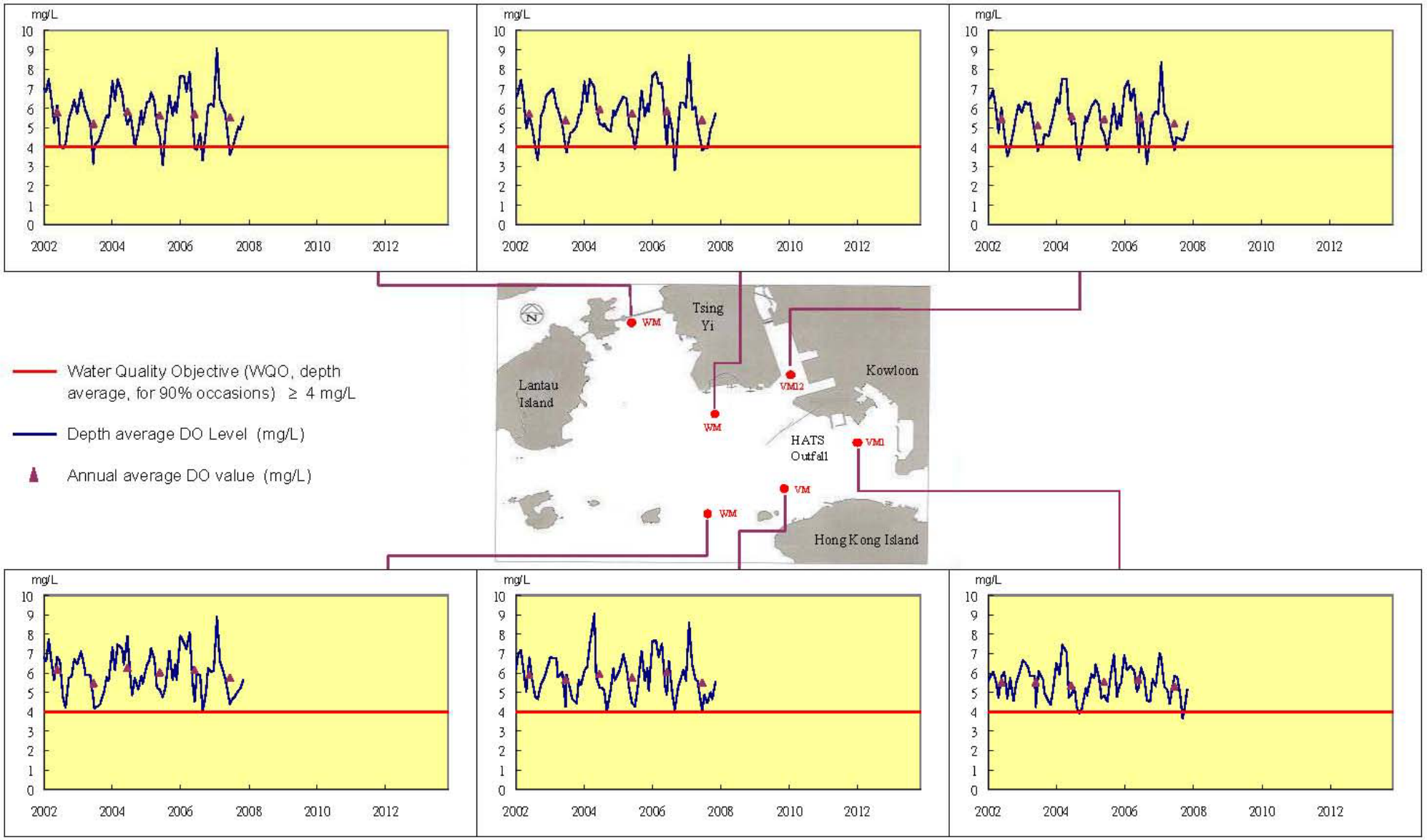

Figure 7 Long-term changes of bottom layer dissolved oxygen (DO) in the vicinity of the HATS outfall