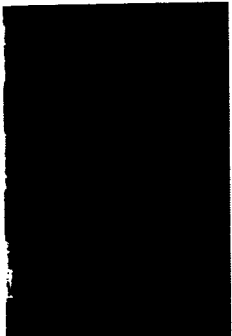

Existing Marine Environment



4. EXISTING MARINE ENVIRONMENT

4.1 INTRODUCTION

4.1.1 The key issue associated with this development relates to impacts of dredging and reclamation on the marine environment. This section outlines the existing marine environmental conditions in the area affected by the Phase 2 Development of the Club and includes general descriptions of:

- existing SRs; and
- existing and committed activities or pollution sources which affect the study area.

4.1.2 The baseline conditions consider the existing environment plus any contribution in terms of pollutant loads and other implications from committed projects, including the proposed project for the widening of Hiram's Highway.

4.2 SENSITIVE RECEIVERS (SRs)

4.2.1 The SRs in this study include the Ma Nam Wat Fish Culture Zone, the Hebe Haven Gazetted Beach and mangrove communities in the study area. Within the study area there is also an existing Site of Special Scientific Interest (SSSI), coastal protection area and conservation area which is indicated in the Hebe Haven Outline Zoning Plan. Part of the Pak Sha Wan peninsula is a designated SSSI, and almost all of the peninsula is within the Ma On Shan Country Park Extension. There is also a Conservation Area at the north of the same peninsula.

4.2.2 There are intertidal mudflats of over 0.5 hectares and established mangal communities in the area.

4.2.3 Hebe Haven is a popular focus for boating and other recreational activities. In the vicinity are Marina Cove, the Pak Sha Wan Scout Sea Activities Centre, Hong Kong Marina and the Royal Hong Kong Yacht Club. The local ferry service runs from the pier at Pak Sha Wan to Trio Beach and Kiu Tsui Chau. In addition, there are numerous other private moorings and slipways and boatyards in the area.

4.3 SEDIMENT QUALITY

Background

4.3.1 This section summarises the sampling records and testing results of marine mud vibrocore samples which were taken in October 1996. As mentioned in Section 2.5.5 the presence of contaminated marine sediments can have implications on the disposal or appropriate end uses of the dredged materials. The results taken during the site investigation procedure in October 1996 concluded that the sediments were of Class A classification i.e. uncontaminated and can be disposed of without using special requirements. These results provide useful baseline data for comparison with the latest sediment quality results discussed below.

- 4.3.2 Four samples of sediment located within the dredging Area A were analysed for heavy metal content by MaterialLab Limited, a HOKLAS accredited laboratory. The findings of the Test Report indicated that two samples fell marginally within Class B for Zinc content of the EPD Technical Circular No. (TC) NO 1-1-92 *Classification of Dredged Sediments for Marine Disposal*. Subsequent discussions between Halcrow China Limited and EPD confirmed that treatment of the dredged sediment as uncontaminated was appropriate under these circumstances.
- 4.3.3 The proposed dredging area A measures 100m x 90m and the volume of sediment to be dredged is estimated to be 15,000m³. The volume of dredged material in Area B is approximately 8,000m³. Sediments in Area B have also been sampled at locations labelled MB7, MB8 and MB9 shown in Figure 1.1. Due to the number of shipyards and boats permanently moored in the Haven, analysis for Tributyl tin (TBT) was also undertaken. Results of the TBT analysis are discussed below.
- 4.3.4 Analytical methods for trace metals are in accordance with the procedures outlined in Table A1 'Analytical Methodology' of Works Branch Technical Circular 22/92. Laboratory testing was carried out in accordance with the American Public Health Association (APHA) testing standards 3111 x 3112B and the American Society for Testing Materials (ASTM) D3974-81 (Practice B).

Standards and Guidelines

- 4.3.5 The sediment samples have been classified by metal content according to the criteria used in the EPD Technical Circular 'Classification of Dredged Sediments for Marine Disposal', which is shown in Table 4.1 below:

Table 4.1 Classification of Dredged Sediments for Marine Disposal

	Cu	Cd	Cr	Pb	Ni	Zn	Hg
Class A	0 - 54	0.0 - 0.9	0 - 49	0 - 64	0 - 34	0 - 140	0.0 - 0.7
Class B	55 - 64	1.0 - 1.4	50 - 79	65 - 74	35 - 39	150 - 190	0.8 - 0.9
Class C	65 or more	1.5 or more	80 or more	75 or more	40 or more	200 or more	1.0 or more

Results

- 4.3.6 The full analytical results have been assessed and interpreted with reference to:
- EPD Technical Circular No. TC 1-1-192;
 - the position of the sampling locations; and
 - the proper disposal / end-uses of the dredged sediments.
- 4.3.7 The concentrations (expressed as mg/kg) of metals in the samples collected from the five different sampling points, which are located within dredging areas A and B, are shown in Table 4.2.

Table 4.2 Analytical Results of Sediment Samples

Conc. metal in samples (mg/kg)	<i>MB1</i> (depth=0-1m)	<i>MB2</i> (depth=2-2.5m)	<i>MB3</i> (depth=0-1m)	<i>MB4</i> (depth=0-1m)	<i>MB8</i> (depth=0-1m)
Copper	18.0	1.4	33.0	18.0	18.8
Cadmium	< 0.2	< 0.2	< 0.2	< 0.2	0.07
Chromium	5.0	4.6	25.0	9.9	9.4
Lead	12.0	6.1	36.0	16.0	17.5
Nickel	1.1	< 1.0	3.8	1.6	2.7
Zinc	49	150	150	82	74
Mercury	< 0.05	< 0.05	0.09	< 0.05	< 0.1

4.3.8 The concentrations of copper, cadmium, chromium, lead, nickel, zinc and mercury in the samples are well within the range specified for Class A. Class A sediment consists of uncontaminated material which do not require special dredging, transport or disposal methods.

4.3.9 However, zinc content recorded in two samples taken at MB2 and MB3 fall marginally within Class B. The lower limit for Class B Zinc concentration is 150 mg/kg and in both cases the concentration of Zn was exactly 150 mg/kg. This compares to the other two samples taken from MB1 and MB4, where the zinc values range from 49 to 82 mg/kg.

4.3.10 Sediments do not therefore contain unacceptable heavy metal concentrations and no special dredging, transport or disposal techniques are required as a consequence of contaminant levels. Discussion with EPD have confirmed that the sediment should be treated as uncontaminated Class A.

4.4 TRIBUTYL TIN (TBT)

4.4.1 Existing conditions with respect to TBT, a man made anti-foulant used in the paint on ship's hulls to control marine growth, have been based on a review of data collected for a study undertaken for EPD by CES (Asia) Ltd. in 1994.

4.4.2 EPD's study of the extent of TBT contamination in the sediments of Hong Kong's shipyards and marinas involved the collection of sediment samples around shipyards. Samples were collected along transects to investigate the concentration variation with distance from the shipyard. Samples were also collected from the sediments in marinas.

4.4.3 The results indicated that sediments in the shipyards and marinas of Hong Kong were contaminated with TBTs. The average concentration of TBTs found in the sediments are given in Tables 4.3 and 4.4. The results illustrate the concentration of TBT and its degradation products, which include Monobutyl tin (MBT) and Dibutyl Tin (DBT), in the sample area of Pak Sha Wan Shipyard.

Table 4.3 Mean TBT Concentration Found in Sediments in Hong Kong

Site	Mean TBT Concentration (ng Sn/g)	Mean TBT Concentration (ng TBT/g)
Causeway Bay Marina	11,618.0	30206.8
Marina Cove	507.0	1318.2
Hong Kong Marina	598.0	1554.8
Aberdeen Boat Club	3,468.0	9016.8
Gold Coast Marina	6.0	15.6
Pak Sha Wan Shipyards	747.0	1942.2
Sai Kung	349.0	907.4
Tsing Yi North 1	35.0	91.0
Tsing Yi North 2	1,970.0	5122.0
Tsing Yi South 1	319.0	829.4
Tsing Yi South 2	372.0	967.2
Tai Po	190.0	494.0
Aberdeen South	1,153.0	2997.8
Aberdeen 2 Typhoon Shelter	181.0	470.6
Control	17.2	44.7

Source: TBT Contamination in Coastal Sediment in Hong Kong - Final Report (1994)

Table 4.4 Levels of TBT and its Degradation Products in the sample area of Pak Sha Wan Shipyard

Sample Location	Monobutyl tin (MBT) ng Sn/g dry weight	Dibutyl tin (DBT) ng Sn/g dry weight	Tributyl tin (TBT) ng Sn/g dry weight
PSW 1-1	340	620	1800
PSW 2-1	150	250	200
PSW 3-1*	180	350	240

* note: Hebe Haven Yacht Club is located within the area PSW 3-1.

Source: TBT Contamination in Coastal Sediment in Hong Kong - Final Report (1994)

4.4.4 As indicated by the results in Table 4.3, analysis of sub-samples produced greatly differing results, indicating that TBT pollution is probably localised. Variability may be a result of the presence of paint flakes containing the anti-foulant, released during maintenance and repair of boats. , Table 4.4 shows the level of DBT at PSW 3-1 were higher than TBT. The presence of these TBT degradation products near the Club indicates that there are effective degradation processes, such as those caused by sunlight and bacteria, in this area. Should the source of TBT pollution be eliminated then it is likely that TBT levels would return to background levels, typical for Hong Kong waters due to these degradation processes. Further investigations into TBT concentrations were considered necessary to confirm the

presence of TBT some 4 years after the EPD Study.

Three samples were collected from the vicinity of the dredging site and analysed by a HOKLAS accredited laboratory in November 1998. Analysis of samples again revealed great variability between samples with results ranging from 2 μ g Sn/kg to 998 μ g Sn/kg. Sample locations are shown in Figure 5.1 and summarised in the table below.

Table 4.5 Concentrations of TBT measured in marine sediments November 1998

Sample	TBT (μ gSn/kg)
M6	998
M7	19
M8	2

The potential increases of TBT concentrations in the water column resulting from the proposed dredging works have been investigated and results are discussed in Chapter 5.

4.5 MARINE WATER QUALITY

4.5.1 The following legislation applies to water quality and are relevant to this study:

- Water Pollution Control Ordinance (WPCO) Chapter 358 (as amended by the Water Pollution Control (Amendment) Ordinance 1990 and 1993)
- Water Pollution Control (General) Regulations (as amended by the Water Pollution Control (General) (Amendment) Regulations 1990 and 1994)
- Water Pollution Control (Appeal Board) Regulations
- Technical Memorandum Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters

4.5.2 Hebe Haven falls within the Port Shelter Water Quality Control Zone (WCZ) which was declared and enacted in 1989. The whole zone is designated as a secondary contact recreational zone, thus many members of the public use these waters for water sports including sailing, wind surfing and even scuba diving. The general water quality is described as "good" according to the 'Marine Water Quality in Hong Kong in 1997' issued by EPD.

4.5.3 The annual averaged marine water quality data for the years 1993 - 1997 from two EPD routine monitoring stations were collected and are tabulated in Tables 4.6-4.10 for Dissolved Oxygen (DO), Suspended Solids (SS), Total Nitrogen (TN), Ortho-phosphorus (OP) and Total Phosphorus (TP) respectively.

Table 4.6 Depth-Averaged Dissolved Oxygen Concentrations for 1993-1997 (in mg/l)

Station ID	1993	1994	1995	1996	1997
PM5	-	-	7.6	6.5	6.7
PM6	-	-	7.3	6.7	6.8

Table 4.7 Depth-Averaged Suspended Solids Concentrations for 1993-1997 (in mg/l)

Station ID	1993	1994	1995	1996	1997
PM5	9.6	16.1	12.3	10.4	10.7
PM6	3.1	4.4	4.3	2.2	2.7

Table 4.8 Depth-Averaged Total Nitrogen Concentrations for 1993-1997 (in mg/l)

Station ID	1993	1994	1995	1996	1997
PM5	0.56	0.41	0.27	0.29	0.87
PM6	0.47	0.35	0.20	0.25	0.80

Table 4.9 Depth-Averaged Ortho-Phosphorus Concentrations for 1993-1997 (in mg/l)

Station ID	1993	1994	1995	1996	1997
PM5	0.04	0.03	0.02	0.02	0.02
PM6	0.03	0.02	0.02	0.01	0.01

Table 4.10 Depth-Averaged Total Phosphorus Concentrations for 1993-1997 (in mg/l)

Station ID	1993	1994	1995	1996	1997
PM5	0.11	0.08	0.08	0.12	0.07
PM6	0.08	0.05	0.07	0.1	0.05

4.5.4 From the EPD data we can gain a clearer indication of the existing water quality in this area and this can be used as a baseline for comparison with the results of the water quality model. The Water Quality Objectives (WQO) set out for Port Shelter are shown in Table 4.11 for comparison with existing data.

Table 4.11 Water Quality Objectives for Port Shelter water Control Zone

parameter	Objective
DO within 2m of bottom	not less than 2 mg/l for 90% samples
Depth Averaged DO	not less than 4 mg/l for 90% samples
Suspended Solids	Not greater than 30% of natural ambient level
Nutrients - Inorganic Nitrogen	Annual mean depth average not to exceed 0.1mg/l

4.5.5 EPD water quality data shows that for depth averaged DO, bottom DO, and total Inorganic Nitrogen measured at both stations, full compliance with the WQO was achieved between 1994 and 1997. This indicates that the water quality at Hebe Haven has remained relatively stable in recent years.

4.5.6 Averaging over the period 1993-1997 for PM5 which lies closest the study area, the averaged SS value can be taken as 11.8 mg/l. With this value taken as the baseline concentration, the allowable 30% rise above ambient levels due to dredging is 3.5mg/l in order to comply with the SS WQO. Compliance with this standard and other WQOs is addressed in Chapter 5.