

Environmental Assessment of Public Fill Capping on the Marine Ecology at the East of Sha Chau

Introduction

The Hong Kong SAR Government has long recognised the need for environmentally-responsible management of disposal of contaminated dredged sediment generated from reclamations, river training and maintenance dredging works in the territory. The Contaminated Spoil Management Study in 1991 provided a framework for the disposal and recommended that, inter alia, contaminated marine sediment should be deposited in seabed pits to be subsequently capped with inert material to isolate the contaminated mud from the adjacent environment. In accordance with the Contaminated Spoil Management Study's recommendations, an area in the north-western waters to the east of Sha Chau Island (ESC) was selected as the preferred disposal location (a location Plan is appended at **Annex A**).

2. Disposal of contaminated dredged mud in ESC has been in operation since December 1992. At present, all private projects using the marine disposal areas are charged \$55.4 per cubic metre to cover the costs for dredging, managing, capping and environmental monitoring.

Public Fill Capping

3. Since October 2003, soft inert materials, i.e. naturally excavated soil from public fill, have been used to cap mud pits no. IVa & IVb as shown on Annex A. About 1.8 million tonnes of the suitable materials have been reused so far. It is estimated that mud pits in ESC provide total 7.2 million tonnes of public fill capacity and will be saturated by end 2007.

4. Before using public fill as capping materials in October 2003, these mud pits were capped with clean marine dredged mud. For capping purpose, public fill can provide better protection to the deposited contaminated mud than marine mud against natural weather such as typhoon. There will be a final maintenance capping layer of marine mud on top of the public fill layer so that the pits will be reinstated to the original state.

The Environmental Monitoring and Audit Programme

5. An extensive environmental monitoring and audit (EM&A) programme has been conducted at ESC since October 1992 to identify any impact these activities may have on the receiving environment and to determine appropriate mitigation measures to prevent and ameliorate unacceptable impacts. Independent consultants are engaged for the EM&A programme. A working group formed by Environmental Protection Department (EPD), Agriculture, Fisheries and Conservation Department (AFCD) and Civil Engineering and Development Department (CEDD) meet regularly to oversee the EM&A programme.

6. The monitoring programme covers water and sediment quality (both sediment chemistry and whole-sediment toxicity testing), contaminant concentrations in fisheries resources (together with ecological and human health risk assessment) and assessment of macrofaunal recolonisation of the capped pits. In addition, to validate the efficacy of the caps used to isolate the contaminated material in backfilled pits and also to verify the prediction that shear stresses during storm events would not mobilise material from partially-filled mud pits, sediment quality monitoring is also conducted after typhoon events. The EM&A programme has been operational for over 12 years and, to date, no significant impacts to environmental media or elevated risks have been observed. The mud pits have proved to be highly effective in isolating contaminated dredged material from the surrounding waters.

7. To further enhance the protection of the receiving environment after adopting public fill as capping material, a 24-hour on-site management team is in operation year-round. The on-site management team registers all incoming barges and allocates the disposal area in cells within the pits depending on the tidal current at the time of disposal.

Public Fill Capping Monitoring Results

8. Total suspended solids (SS), which are known to affect marine life at elevated concentrations, are collected at stations around the mud pits during capping activity. The locations of the monitoring stations are shown on the plan at **Annex B**. Statistical analysis was performed on the collected data and the monitoring results indicated that there was no overall decreasing gradient in SS concentrations from the impact to downstream stations. These results indicated that the public fill capping did not lead to significant increases in SS concentrations in waters around the mud pits. The variations to the SS concentration are due to background changes.

Routine Water Quality Monitoring

9. The ESC EM&A programme includes comprehensive water quality monitoring to determine the environmental performance of the disposal activities at the mud pits. The monitoring works include water column profiling and collection of water samples from representative locations around the mud pits. A wide range of water quality parameters are monitored including metals and metalloid, nutrients, biochemical oxygen demand and total suspended solids.

10. The overall results from the water quality monitoring have not indicated any consistent trend in contaminant concentrations with proximity to the mud pits. There also does not appear to be any trend of increasing contaminants over time. The results suggest that the capping and disposal operations were unlikely to pose significant impacts to the surrounding waters.

11. A specific water quality monitoring for the public fill material capping activities was implemented in addition to the regular EM&A programme. The frequency of the monitoring was weekly during the first four months (October 2003 and February 2004) of the public fill material capping operations. It was subsequently reduced to monthly since March 2004 and presently bi-monthly as no apparent significant deterioration of water quality was detected during monitoring.

Sediment Quality Monitoring

12. Marine sediment around the ESC mud pits is regularly monitored to assess any impacts from disposal activities outside of the active pit. The chemical testing component assesses a range of contaminants including eight metals (cadmium, chromium, copper, mercury, nickel, lead, silver & zinc), arsenic, polycyclic aromatic hydrocarbons (PAHs), total polychlorinated biphenyls (PCBs), organochlorine pesticides (4,4'-DDE and Total DDT) and tributyltin (TBT). The results to date suggest that the capping and disposal operations were unlikely to pose significant impacts to the surrounding seabed.

Fisheries Resources

13. The ESC EM&A programme include monitoring of demersal fishery resources around the mud pits. The monitoring was designed to elucidate any changes to the fisheries characteristics in areas near and distant to the mud pits. The results to date

have indicated that demersal fishery resources were similar between areas both adjacent and distant from the active pit. Pit operations (i.e., disposal and capping activity) do not, therefore, appear to have any major influence on fisheries resources.

Benthic Recolonisation on Capped Pits

14. The ESC EM&A programme includes quantitative monitoring of benthic macrofauna present in the capped pits and adjacent reference areas. The data collected from the capped pits are compared to the reference areas in order to provide an indication of whether the seabed has returned to its former state prior to pit formation. The assessment of the recolonisation of the uncontaminated material used for capping also provides a useful indication as to whether the cap is effectively sealing the contaminated material within the exhausted pit and also information on the overlying water quality. The results to date have indicated that recolonisation was evident and the macro-infauna at the capped pit and reference stations were reasonably similar. It was noted that recolonisation had occurred through time and the benthic communities and patterns present were reasonably similar to those in the reference areas.

Potential Impacts of Suspended Solid on Indo-Pacific Humpback Dolphins (Chinese White Dolphins)

15. Indo-Pacific Humpback Dolphins are one of the indicators of the monitoring programme. They are present in the ESC area and are usually associated with estuaries throughout their range. The dolphins are, therefore, naturally exposed to elevated concentrations of suspended materials present in the Pearl River Estuary. Whilst the water quality monitoring during public fill capping monitoring has not detected any consistently significant SS loadings into waters around the mud pits, it should be noted that there does not appear to be any evidence to suggest that high sediment loadings have direct negative effects on dolphins.

Annex A – Location Plan of ESC Contaminated Mud Disposal Facility

Annex B – Location Plan of Monitoring Stations

Fill Management Division

Civil Engineering and Development Department

April 2005

NOTES:

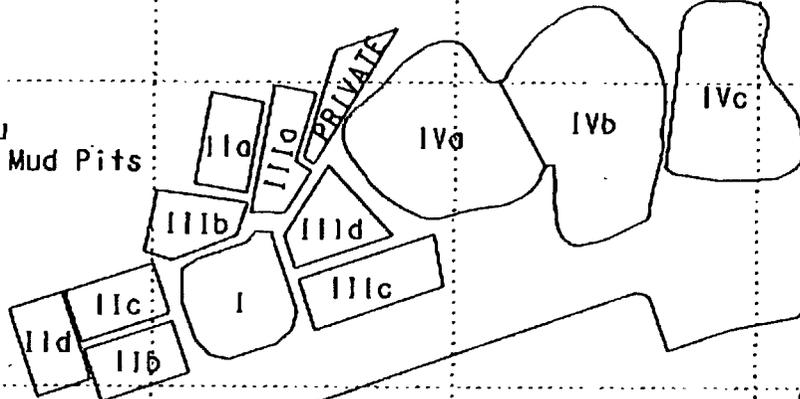
Siu Mo To
小磨刀

Tai Mo To
大磨刀

River Trade Terminal
內河碼頭

Sha Chau
沙洲

East Sha Chau
Contaminated Mud Pits
東沙洲
汚染海泥卸置坑



Hong Kong International Airport
香港國際機場

Lantau Island
大嶼山



Location of
East Sha Chau
Contaminated Mud
Disposal Facility

title no.

drawing no.

MFC/023B

scale

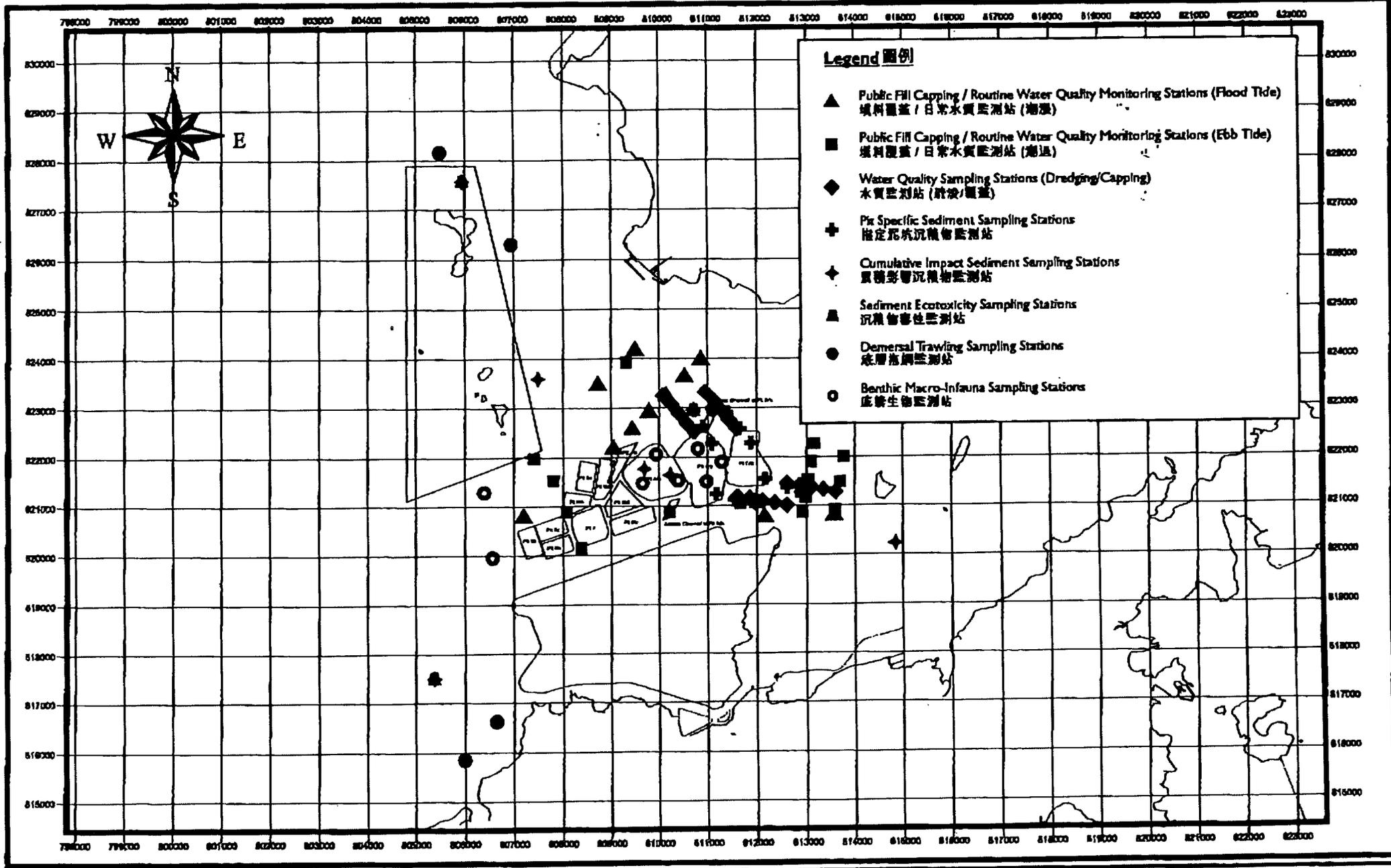
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office

FILL MANAGEMENT DIVISION
CIVIL ENGINEERING OFFICE



CIVIL ENGINEERING AND
DEVELOPMENT DEPARTMENT
HONG KONG



Location of Monitoring Stations 監測站位置圖

Environmental Monitoring and Audit for Contaminated Mud Pit IV at East of Sha Chau

Meinhardt Mouchel
Figure 1