1. Particle Model Setup and Modelling Scenarios

1.1 Background

1.1.1 In the present study, computer modelling is employed to assess the potential water quality impacts from polluted stormwater discharges on the harbour waters and the beneficial uses for different tidal conditions (dry and wet seasons, spring and neap tides). The hydrodynamic and water quality models were developed by the Danish Hydraulic Institute (DHI) and the program runs are performed by MEMCL. The DHI models have been calibrated and accepted by EPD for many EIA studies. Particularly relevant applications included the South East Kowloon Development (SEKD) Feasibility Study and Tseung Kwan O (TKO) Area 131 Cargo Working Area EIA Study, which are adjacent to the present study area.

1.1.2 The main objective of the modelling was to determine whether the polluted stormwater discharges from proposed development together with the pollutants from the nearby stormwater system would result in non-compliance with the WQOs of the Victoria Harbour WCZ as stipulated in the WPCO, during the operation phase. With a larger reclamation and development area, the Full Reclamation option is expected to have a greater effect on the flow and water quality in Victoria Harbour than the Minimized Reclamation option. The Full Reclamation option is therefore taken to represent the worst case scenario of the YTB reclamation and is quantitatively assessed in the present study.

1.2 Model Setup

1.2.1 DHI' s 2D model, namely MIKE 21, was employed for the assessment.

1.2.2 The HD model setup consists of a set of dynamically nested grids, distributed in a way to resolve the high resolution required in the harbour and narrow channels, while providing a total coverage of the whole of Hong Kong. Two sets of model grids are used:

- Large grid (3 levels) (Figure 5B.1):
  Grid size ranges from 675m down to 225m and 75m, covering the whole of Hong Kong and the Pearl Estuary. The resolution in the Victoria Harbour region is enhanced using the small grid size of 75m.

- Local grid (2 levels) (Figure 5B.2)
  Grid size ranges from 75m down to 25m, covering the Victoria Harbour with emphasis placed in the vicinity of YTB.

1.2.3 The different levels of the large and local grids are dynamically nested which enable the exchange of boundary conditions. The large grid is mainly used for the hydrodynamic (HD) simulation and the water level or tidal variation is extracted as boundary input to the local grid. The HD simulation is then re-run using the local grid to resolve the finer details in the proximity of YTB. Based on the local grid HD results, particle tracking (PA) model was used to assess the impact of the polluted stormwater during the operation phase.

1.2.4 The model were run for the following simulation periods:

- Dry season, spring and neap tides: 1990/2/7 – 1990/2/21 (14 days)
- Wet season, spring tide: 1990/6/19 – 1990/6/24 (4.5 days)
- Wet season, neap tide: 1990/6/26 – 1990/7/1 (4.5 days)

1.2.5 To ensure convergence of the model, a warm up period of 1.5 days was added to the beginning of the above periods in the nested HD simulations using both the large and the local grids. Typical time series plot of the SS elevation at the WSRs during the YTB reclamation are shown in Appendix 4D of the Final EIA report of the Reclamation of Yau Tong Bay.

1.2.6 A 2D particle model is then used to model the pollutant dilution and dispersion in Victoria Harbour near the storm outfall discharges. A conservative pollutant, i.e. without the incorporation of decay factor, is discharged at the outfall at an arbitrary rate of 1 kg s^{-1} (equivalent to a pollution load of 86,400 kg day^{-1}). Tidal current will then convey the pollutants and diluting it in the surrounding water. In order to estimate the actual increase in pollutant concentration in the receiving water, the ratio between the actual pollution loads of each pollutant and the assumed load of 86,400 kg day^{-1} is calculated. By assuming the same ratio between the actual and the modelled pollutant elevations in the neighbouring water, the actual pollutant elevation in Victoria Harbour can be estimated.

1.2.7 Parameters used in the nested particle model are summarized in Table 6B.1. These were adopted in the previous SEKD Feasibility Study.

Table 6B.1 Summary of parameters for the nested particle model (NPA)

Nested particle (NPA) model		
Longitudinal dispersion factor I_L	15 m	Minimum dispersion 1 m^2 s^{-1}
Transversal dispersion factor I_T	15 m	Minimum dispersion 1 m^2 s^{-1}
Neutral dispersion D_0	0.03 m^2 s^{-1}	
Vertical dispersion of suspended solids (SS) D_v	0.0001 m^2 s^{-1}	
Particle settling velocity	0.0001 m s^{-1}	Grain size diameter of 10 mm

1.3 HD Modelling Scenarios

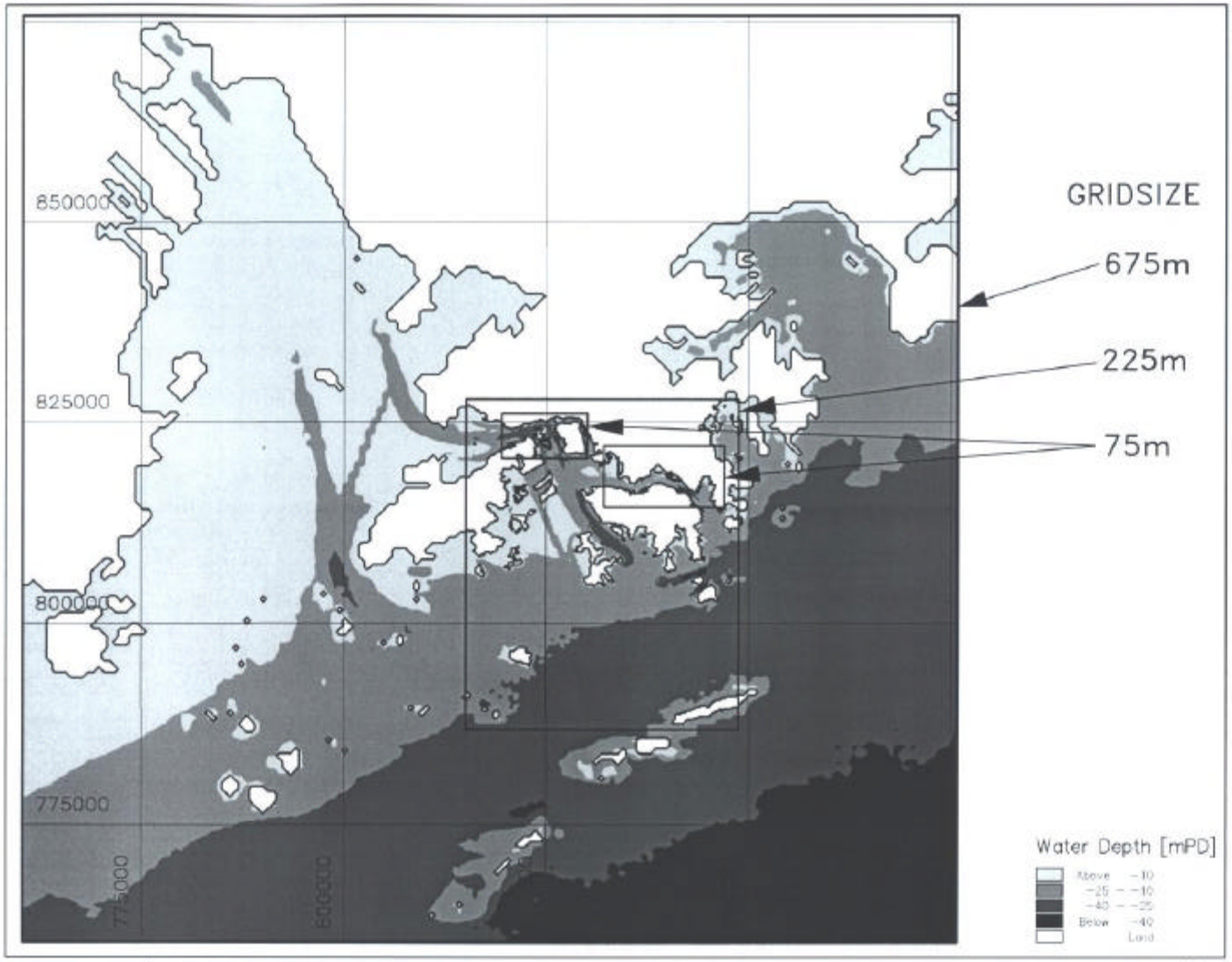
1.3.1 The year 2006 Scenario A2 in the SEKD Feasibility Study will be used as the basis of the present study. The bathymetry or coastline of the model is modified to reflect changes for each scenario as described in the following paragraphs.

1.3.2 The following scenarios have been considered in the Reclamation of YTB EIA study and is adopted as the basis for the present study:

- Scenario 1A – Baseline scenario excluding YTB reclamation
  The latest coastline is updated to include the recent modifications in the SEKD study as at March 1999 and the reclamation for the Western Coast Road (WCR-Coastal option), while excluding the YTB reclamation in year 2007.

- Scenario 1B – Development scenario with YTB reclaimed
  This is the same as Scenario 1A with the inclusion of the YTB reclamation (Full Reclamation option).

1.3.3 With YTB reclaimed, the coastline configuration of Scenario 1B represents the operation condition of the YTB development and thus it is adopted as the basis for the modelling of pollutant discharges from the new Kwung Tong Nullah and the New Stormwater Culvert from the Yau Tong area.



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YAU TONG BAY DEVELOPMENT
ENVIRONMENTAL IMPACT ASSESSMENT STUDY

MODEL GRID BOUNDARIES – LARGE GRID

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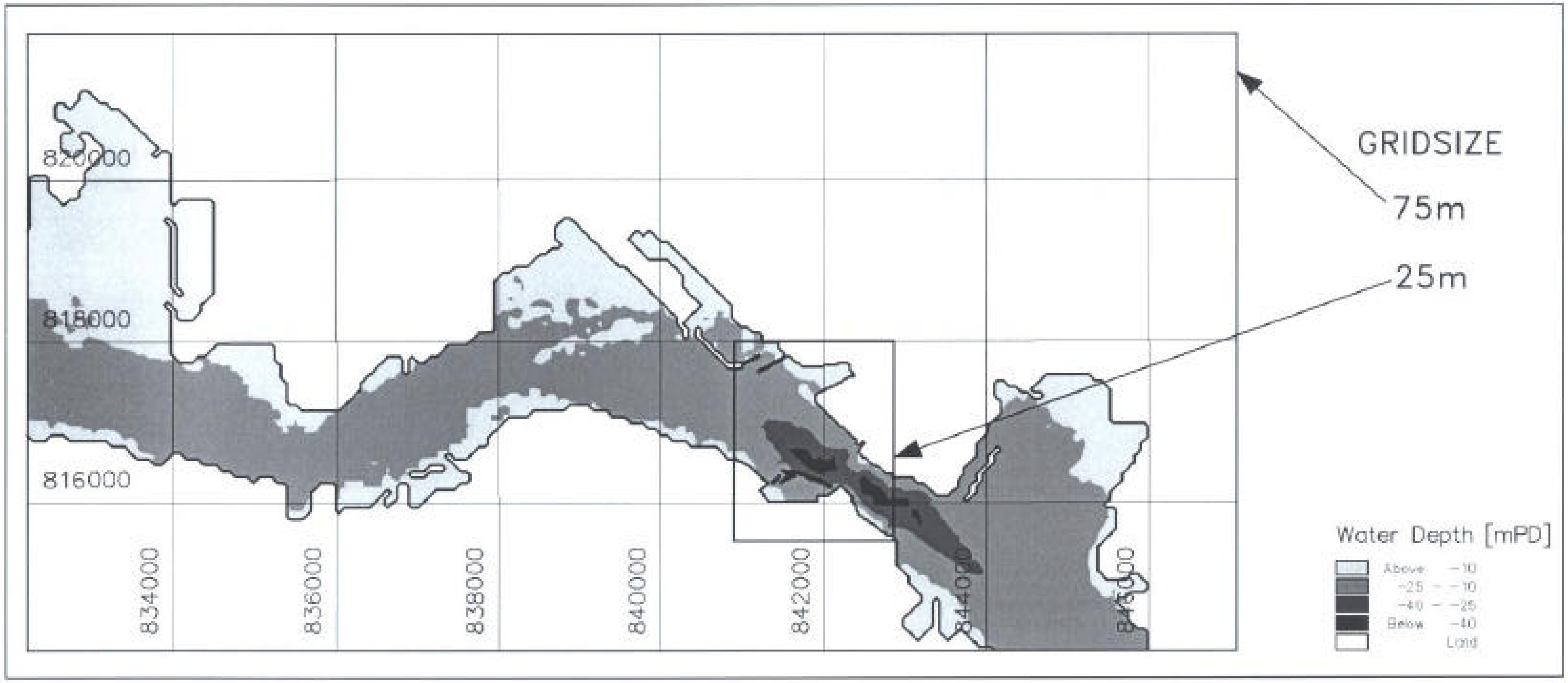
Scale: AS SHOWN
Date: JUNE 99
Figure No. 6B.1



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YAU TONG BAY DEVELOPMENT
ENVIRONMENTAL IMPACT ASSESSMENT STUDY

MODEL GRID BOUNDARIES – LOCAL GRID

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AS SHOWN	
JUNE 99	6B.2