

## **Appendix D**

### **Water Quality Modelling Requirements**

#### **Modelling software general**

1. The modelling software shall be fully 3-dimensional capable of accurately simulating the stratified condition, salinity transport, and effects of wind and tide on the water body within the model area.
2. The modelling software shall consist of hydrodynamic, water quality, sediment transport and particle dispersion modules. The hydrodynamic, water quality and sediment transport modules shall have been proven with successful applications locally and overseas.
3. The hydrodynamic, water quality and sediment transport modules shall be strictly mass conserved at all levels.
4. The assessment and modelling tool for spill events should be quantitative with proven applications locally or overseas.

#### **Model details – Calibration & Validation**

1. No field data collection is required for model calibration for this study. However, the models shall be properly calibrated and validated before its use in this study in the area including Deep Bay, North Western, North Western Supplementary, Western Buffer, Victoria Harbour, Southern and Second Southern Supplementary Water Control Zones, defined under the WPCO, and the Pearl Estuary with the field data collected by:
  - Hydraulic and Water Quality Studies in Victoria Harbour (1987)
  - Port and Airport Development Strategy - Enhancement of WAHMO Mathematical Models (1990)
  - Strategic Sewage Disposal Scheme Stage II - Oceanic Outfall, Oceanographic Surveys and Modelling (1992)
  - Update on Cumulative Water Quality and Hydrological Effect of Coastal Developments and Upgrading of Assessment Tool (1998)
  - Environmental Protection Department (EPD)'s routine monitoring data
  - Tidal data from Hong Kong Observatory, Macao and relevant Mainland Authorities
2. Tidal data shall be calibrated and validated in both frequency and time domain manner.
3. For the purpose of calibration and validation, the model shall run for not less than 15 days of real sequence of tide (excluding model spin up) in both dry and wet seasons with due consideration of the time required to establish initial conditions.

4. In general the hydrodynamic models shall be calibrated to the following criteria:

<u>Criteria</u>	<u>Level of fitness with field data</u>
• tidal elevation (rms)	< 8 %
• maximum phase error at high water and low water	< 20 minutes
• maximum current speed deviation	< 30 %
• maximum phase error at peak speed	< 20 minutes
• maximum direction error at peak speed	< 15 degrees
• maximum salinity deviation	< 2.5 ppt

#### Model details – Simulation

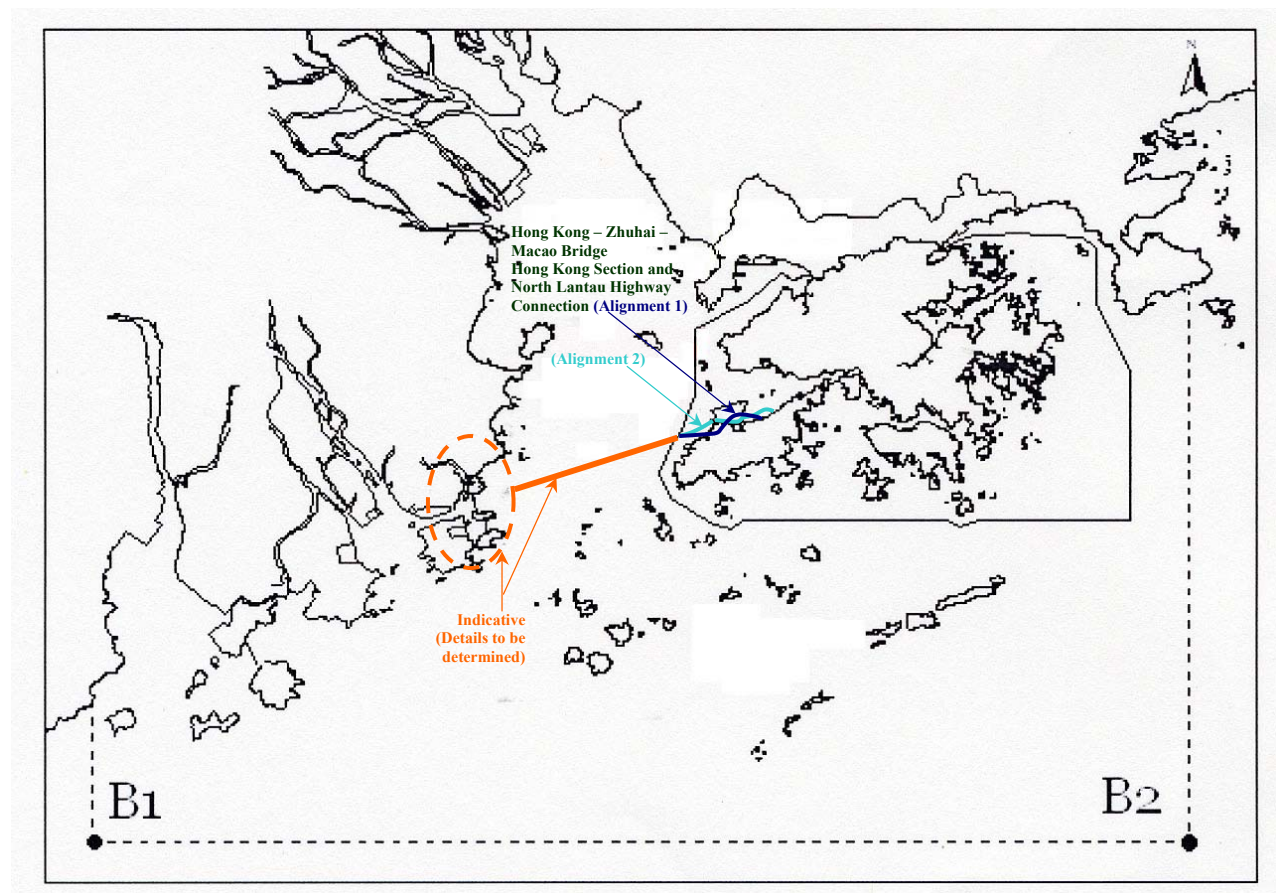
1. The water quality modelling results shall be qualitatively explainable, and any identifiable trend and variations in water quality shall be reproduced by the model. The water quality model shall at least be able to simulate and take account of the interaction of dissolved oxygen, phytoplankton, organic and inorganic nitrogen, phosphorus, silicate, BOD, temperature, suspended solids, contaminants release of dredged and disposed material, air-water exchange, *E. coli* and benthic processes. It shall also simulate salinity. Salinity results simulated by hydrodynamic models and water quality models shall be demonstrated to be consistent.
2. The sediment transport module for assessing impacts of sediment loss due to marine works shall include the processes of settling, deposition and re-erosion. The values of the modelling parameters shall be agreed with EPD. Contaminants release and DO depletion during dredging and dumping shall be simulated by the model.
3. The models shall at least cover the Hong Kong waters, the Pearl River Estuary and the Lema (Dangan) Channel to incorporate all major influences on hydrodynamic and water quality. The coverage of the proposed model shall be properly designed such that it is remote enough so that the boundary conditions would not be affected by the waterway and the proposed disposal ground. The model coverage area shall be agreed with EPD. The indicative coverage area is shown in Figure 1.
4. In general, grid size at the area affected by the project shall be less than 400 m in open waters and less than 75 m around sensitive receivers. The grid schematization shall be agreed with EPD.

#### Modelling assessment

1. The assessment shall include the construction and operation phases of the Project. Scenarios to be assessed shall cover the baseline condition and scenarios with various different options proposed by the Applicant in order to quantify the environmental impacts and improvements that will be brought about by these options. Corresponding pollution load, bathymetry and coastline shall be adopted in the model set up.
2. Hydrodynamic and sediment transport modules, where appropriate, shall be run for (with proper model spin up) at least a real sequence of 15 days spring-neap tidal cycle in both the dry season and the wet season.

3. Water quality module shall run for a complete year incorporating monthly variations in Pearl River discharges, solar radiation, water temperature and wind velocity in the operational stage. Construction stage impacts may be assessed by simulating typical spring-neap cycles in the dry and wet seasons.
4. The results shall be assessed for compliance of Water Quality Objectives. Any changes in hydrodynamic regime shall be assessed. Daily erosion / sedimentation rate shall be computed and its ecological impact shall be assessed.
5. The impact on all sensitive receivers shall be assessed.
6. Cumulative impacts due to other related concurrent and planned projects, activities or pollution sources within a boundary to the agreement of the EPD shall also be predicted and quantified.
7. All modelling input data and results shall be submitted in digital media to EPD.

Fig.1. Indicative coverage area of the water quality model. The geographic positions (Lat., Long.) of B1 and B2 are 21.68°N, 112.99°E and 21.68°N, 114.59°E, respectively.



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