Appendix B

Hydrodynamic and 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 effect of wind and tide on the water body within the model area.

2. The modelling software shall consist of hydrodynamic, water quality, thermal and particle dispersion modules. It shall have been proven with successful applications locally and overseas.

3. The models shall be strictly mass conserved at all levels.

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 Hong Kong waters, the Pearl Estuary and the Dangan (Lema) Channel with the relevant field data collected from:

    - 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 Development and Upgrading of Assessment Tool (1998)
    - EPD's routine monitoring data
    - Tidal data from HK Observatory., Macau 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:

Criteria	Level of fitness with field data
• tidal evaluation (rms)	< 8 %
• maximum phase error at HW and LW	< 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 be able to simulate and take account of the interaction of dissolved oxygen, phytoplankton, organic and inorganic nitrogen, phosphorus, silicate, BOD, temperature, suspended solids, air-water exchange, *E. coli.*, contaminant release of dredged and disposed material, and benthlic processes. It shall also be able to simulate salinity. Salinity results simulated by hydrodynamic models and water quality models shall be demonstrated to be consistent.

2. The thermal model shall be based on the flow field produced by the hydrodynamic model. It shall incorporate the physical processes of thermal/cooled water discharge and abstraction flow, buoyancy effect of the thermal plume, and surface heat exchange. Dispersion of biocides in the discharge shall also be simulated with appropriate decay rates.

3. The models shall at least cover the Hong Kong waters, the Pearl Estuary and the Lema Channel to incorporate all major influences and hydrodynamic and water quality. A fine grid model may be used for detailed assessment of this study. It shall either be dynamically linked to a far field model or form part of a larger model by gradual grid refinement. 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 Project. The model coverage area shall be agreed with EPD.

4. In general, grid size at the area affected by the project shall be less than 400m in open waters and less than 75m around sensitive receivers. The grid schematisation shall be agreed with EPD.

Modelling assessment

1. Scenarios to be assessed shall cover the baseline condition and scenarios with various effect 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. The models shall be run (with proper model spin up) for at least a real sequence of 15 days spring-neap tidal cycle in both dry season and wet season.

3. Where appropriate, the results shall be assessed for compliance of Water Quality Objectives. Any changes in hydrodynamic regime shall be assessed.

4. The impact on all sensitive receivers shall be assessed.

5. Cumulative impacts due to other project, activities or pollution sources within a boundary to the agreement of EPD shall also be predicted and quantified.

6. All modelling input data and results shall be submitted in digital media to EPD.