Environmental Impact Assessment Ordinance (Cap. 499), Section 5 (7)

Environmental Impact Assessment Study Brief No. ESB-159/2006

Project Title : Dredging Works for Proposed Cruise Terminal at Kai Tak
(hereinafter referred as "the Project")

Name of Applicant : Civil Engineering and Development Department
(hereinafter referred as "the Applicant")

1. BACKGROUND

1.1 An application (No. ESB-159/2006) for an Environmental Impact Assessment (EIA) study brief under section 5(1)(a) of the Environmental Impact Assessment Ordinance (EIAO) was submitted by the Applicant on 22 November 2006 with a project profile (No. PP-304/2006) (hereinafter referred as "the Project Profile").

1.2 "A dredging operation exceeding 500 000 m^3" is a designated project in accordance with Item C.12 of Part I, Schedule 2 of the EIAO. In accordance with section 5(1)(a), a person who is planning a designated project shall apply to the Director of Environmental Protection (hereinafter referred as "the Director") for an environmental impact assessment study brief to proceed with an environmental impact assessment study for the project.

1.3 The Project[1] involves dredging of about:

(i) 1.81 million m^3 of sediment from the existing seabed in a harbour area of about 57 hectares close to the southern tip of the former airport runway to provide the necessary manoeuvring basin of adequate draught for cruise vessels;
(ii) 0.40 million m^3 of existing seawall at the southern tip of the former airport runway by marine plant.

The Project is a designated project under Item C.12 of Part I, Schedule 2 of the EIAO. The location of the dredging area is shown in Figure 1

1.4 Pursuant to section 5(7)(a) of the EIAO, the Director issues this EIA study brief to the Applicant to carry out an EIA study of the Project described in section 1.3 above.

1.5 The purpose of this EIA study is to provide information on the nature and extent of environmental impacts arising from the Project and works that take place concurrently in the vicinity of the Project. This information will contribute to decisions by the Director on:

(i) the overall acceptability of any adverse environmental consequences that are likely to arise as a result of the Project;

[1] Removal of about 0.20 million m^3 of the existing seawall/runway by land plant as stated in the Project Profile (No.PP-304/2006) is not dredging works and is not covered in the project scope of this EIA Study.

(ii) the conditions and requirements for the detailed design and implementation of the Project to mitigate against adverse environmental consequences wherever practicable; and

(iii) the acceptability of residual impacts after the implementation of the proposed mitigation measures.

2. OBJECTIVES OF THE EIA STUDY

2.1 The objectives of the EIA study are as follows:

(i) to describe the Project together with the requirements for carrying out the Project;

(ii) to identify and describe elements of the community and environment likely to be affected by the Project and/or likely to cause adverse impacts to the Project, including both the natural and man-made environment and associated environmental constraints;

(iii) to provide information on the consideration of alternatives to avoid or minimize the potential adverse environmental impacts on the sensitive uses at the Project and adjacent areas that may be subject to the adverse environmental impacts of the Project; to provide justifications and constraints for selecting the preferred option(s) and to describe the part environmental factors played in the selection;

(iv) to identify and quantify emission sources and determine the significance of impacts on sensitive receivers and potential affected uses;

(v) to identify and quantify waste management requirements and to propose measures to avoid or mitigate these impacts;

(vi) to identify any negative impacts on fisheries and marine ecology and to propose measures to mitigate these impacts;

(vii) to identify and quantify any potential losses or damage to flora, fauna and natural habitats and to propose measures to avoid or mitigate these impacts;

(viii) to identify any negative impacts on site of cultural heritage and to propose measures to avoid or mitigate these impacts;

(ix) to identify the negative impacts and propose measures to avoid or provision of mitigation measures to minimize pollution, environmental disturbance and nuisance during the implementation of the Project;

(x) to investigate the feasibility, practicability, effectiveness and implications of the proposed impact avoidance or mitigation measures;

(xi) to identify, predict and evaluate the residual environmental impacts (i.e. after practicable avoidance or mitigation measures) and the cumulative effects expected to arise during the implementation of the Project and other works in vicinity (eg. the decommissioning of the former Kai Tak Airport, the gas main diversion, etc.) in relation to the sensitive receivers and potential affected uses;

(xii) to identify, assess and specify methods, measures and standards to be included in the detailed design and implementation of the Project which are necessary to mitigate these environmental impacts and cumulative effects

and reduce them to the acceptable levels;

(xiii) to investigate the extent of the secondary environmental impacts that may arise from the proposed mitigation measures and to identify constraints associated with the mitigation measures recommended in the EIA study, as well as provision of any necessary modification; and

(xiv) to design and specify environmental monitoring and audit requirements to ensure effective implementation of the recommended environmental protection and pollution control measures.

3. DETAILED REQUIREMENTS OF THE EIA STUDY

3.1 The Purpose

3.1.1 The purpose of this study brief is to scope the key issues of the EIA study and to specify the environmental issues that are required to be reviewed and assessed in the EIA report. The Applicant has to demonstrate in the EIA report that the criteria in the relevant sections of the Technical Memorandum on the Environmental Impact Assessment Process of the Environmental Impact Assessment Ordinance (hereinafter referred to as "the TM"), are fully complied with.

3.2 The Scope

3.2.1 The scope of this EIA study shall cover the Project described in section 1.3 above. The EIA study shall address the key issues described below, together with any other key issues identified during the course of the EIA study and the cumulative environmental impacts of the Project, through interaction or in combination with other existing, committed, and planned and known potential developments in the vicinity of the Project:

(i) the potential water quality impacts arising from the dredging and other associated activities of the Project and works in the vicinity of the Project;

(ii) the potential odour impacts arising from the dredging and other associated activities of the Project;

(iii) the potential construction noise impacts arising from the Project;

(iv) the potential cultural heritage impact on marine archaeological deposit likely to be affected by the dredging activities of the Project;

(v) the potential marine ecological and fisheries impacts arising from the dredging activities of the Project;

(vi) the potential impacts of various types of waste to be generated from the Project; and

(vii) the potential cumulative environmental impacts of the Project through interaction or in combination with other concurrent existing, committed and planned developments in the vicinity of the Project (eg. the decommissioning of the former Kai Tak Airport, the gas main diversion, etc.)

Particular attention shall focus on those impacts identified to have a direct bearing on the environmental acceptability of the Project.

3.3 Consideration of Alternative Options and Construction Methods

3.3.1 The Need of Project

The Applicant shall report on or provide information related to the need and justification for the Project described in Section 1.3 above. The Applicant shall explain clearly the purpose and objectives of the Project and describe the scenarios with and without the Project.

3.3.2 Consideration of Alternatives

The Applicant shall consider and present information on identified feasible alternatives other than the proposed option as presented in the Project Profile, taking into account the relevant findings of those options addressed in previous studies as well as any studies conducted to reflect the latest changes and developments identified during the course of the EIA study. A comparison of the environmental benefits and dis-benefits of possible options, in respect of the alignments of channels for cruise vessels, dredging methods/ rates, and phased or staged implementation, shall be made on the sensitive areas within the study boundary. The comparison shall assist in the formulation of the recommended preferred option, which shall, in principle, avoid or minimize adverse environmental impacts to the maximum practicable extent. The EIA report shall focus on and describe adequately the part that environmental factors played in arriving at the preferred option for the Project.

3.3.3 Need for Maintenance Dredging

The Applicant shall investigate whether there would be any need for maintenance dredging during the operation stage of the proposed cruise terminal at Kai Tak. If such a need is identified, the Applicant shall assess and quantify the frequency as well as the likely extent of maintenance dredging required, and the associated potential environmental impacts. It is also necessary to assess and quantify (as appropriate) such environmental impacts if the maintenance dredging is expected to deploy dredging method and sequence different from that of the Project.

3.4 Technical Requirements

3.4.1 The Applicant shall conduct the EIA study to address all environmental aspects of the Project as described in sections 3.1, 3.2 and 3.3 above. The assessment shall be based on the best and latest information available during the course of the EIA study.

3.4.2 The Applicant shall include in the EIA report details of the construction programme and methodologies. The Applicant shall clearly state in the EIA report the time frame and work programmes of the Project and other concurrent projects, and assess the cumulative environmental impacts from the Project with all interacting projects, including staged implementation of the Project.

Use of Relevant Findings of Approved EIA Reports and Relevant Studies

3.4.3 The Applicant shall review all previously approved studies and EIA reports which are relevant to the Project and extract relevant information for the purpose of this EIA Study, including at least the following:

(i) Kai Tak Airport North Apron Decommissioning EIA Report (EIAO Register No. AEIAR –002/1998);

(ii) Comprehensive Feasibility Study for The Revised Scheme of South East Kowloon Development (EIAO Register No. AEIAR-044/2001).

3.4.4 The EIA study shall include the following technical requirements on specific impacts.

3.4.5 Air Quality Impact

3.4.5.1 The Applicant shall follow the relevant criteria and guidelines laid down in the Main text, Annex 4 and Annex 12 of the TM for evaluating and assessing air quality impact as stated in Main text, Annex 4 and Annex 12 of the TM respectively.

3.4.5.2 The air quality impact assessment shall include the following:

(i) Determination of Assessment Area

The area for air quality impact assessment shall generally be defined by a distance of 500 metres expanded from the boundary of the Project.

(ii) Background and Analysis of Activities

(a) Provide background information relating to odour issues relevant to the Project;

(b) Give an account, where appropriate, of the works/ measures that have been considered during the course of planning the Project (including maintenance dredging, if it is needed) to abate air quality impact including odour impact.

(iii) Identification of Air Sensitive Receivers (ASRs) and Examination of Emission/Dispersion Characteristics

(a) Identify and describe the representative existing, planned and committed ASRs likely be affected by the potential adverse odour impact caused by the Project within the assessment area (section 3.4.5.2(i)), both on-site and off-site, including those earmarked on the relevant Preliminary Outline Development Plans, Outline Zoning Plans, Outline Development Plans, Recommended Outline Development Plan, Layout Plans and other relevant published land use plans. The Applicant shall select assessment points of the identified ASRs that would represent the worst impact point of these ASRs. A map clearly showing the locations and descriptions, such as names of buildings, uses and heights of the selected assessment points shall be included. The separation distances of these ASRs from

the nearest emission sources shall also be given.

(b) The emissions from any concurrent projects identified as relevant during the course of the EIA study, shall be taken into account as contributing towards the overall cumulative odour impact. The impacts as affecting the existing, planned and committed air sensitive receivers within the assessment area (section 3.4.5.2(i)) shall be assessed, based on the best information available at the time of assessment.

(iv) Odour Impact

(a) The Applicant shall consider the odour impact that may arise from the Project and propose suitable measures to minimise the odour problem, if any, arising from the dredging activities. If the Applicant anticipates that the Project will give rise to significant odour impacts at the ASRs despite the incorporation of the odour control measures, a quantitative assessment should be carried out to evaluate the odour impact at the identified ASRs.

(b) If the need of quantitative odour assessment is confirmed, the Applicant shall calculate the expected odour concentrations at the identified ASRs based on an assumed reasonable worst-case scenario under normal operating conditions. The evaluation shall be based on the strength of the emission sources identified in section 3.4.5.2(iii)(b) above. The Applicant shall follow section 3.4.5.2(v) below when carrying out the quantitative assessment.

(v) Quantitative Assessment Methodology

(a) If a quantitative assessment is required, the Applicant shall apply the general principles enunciated in the modelling guidelines in Appendices A-1 to A-3 while making allowance for the specific characteristics of the Project. The Applicant shall assess the odour impact of the Project at the ASRs identified under section 3.4.5.2(iii) above and evaluate the significance of the odour impact. The predicted odour impacts (both unmitigated and mitigated) shall be presented in the form of summary table(s) and pollution contours, to be evaluated. Plans of a suitable scale should be used to present pollution contours to allow buffer distance requirements to be determined accurately.

(vi) Mitigation Measures

The Applicant shall propose remedies and mitigating measures where the significant odour impact is identified. These measures and other associated constraints on future land use planning shall be agreed with the relevant government departments/authorities and be clearly documented in the EIA report. The Applicant shall demonstrate that the residual impact after incorporation of the proposed mitigating measures will comply with the relevant guidelines and criteria set out in the main text and Annex 4 of the TM. The Applicant shall also justify the assumptions adopted in the assessment for effectiveness of the proposed mitigation measures.

(vii) Submission of Model Files

All input and output file(s) of the model run(s) shall be submitted to the Director in electronic format together with submission of the EIA report.

3.4.6 Noise Impact

3.4.6.1 The Applicant shall follow the relevant criteria and guidelines for evaluating and assessing the constructing noise impact as stated in the Main text, Annex 5 and Annex 13 of the TM, respectively.

3.4.6.2 The noise impact assessment shall include the following:

(i) Determination of Assessment Area

The area for the noise impact assessment shall include all areas within 300m from the Project boundary. Subject to the agreement of the Director, the assessment area could be reduced accordingly if the first layer of noise sensitive receivers, closer than 300m from the Project boundary, provides acoustic shielding to those receivers at further distance behind. Similarly, subject to the agreement of the Director, the assessment area shall be expanded to include noise sensitive receivers at distance greater than 300m from the boundary of the Project if they may be affected by the Project.

(ii) Provision of Background Information and Existing Noise Levels

The Applicant shall provide all background information relevant to the Project, e.g. relevant previous or current studies. Unless required for determining the planning standards such as those for planning of fixed noise sources, no existing noise levels are particularly required.

(iii) Identification of Noise Sensitive Receivers

(a) The Applicant shall refer to Annex 13 of the TM when identifying the noise sensitive receivers (NSRs). The NSRs shall include all existing NSRs and all planned/committed noise sensitive developments and uses earmarked on the relevant Preliminary Outline Development Plans, Outline Zoning Plans, Outline Development Plans, Recommended Outline Development Plans, Layout Plans and other relevant published land use plans.

(b) The Applicant shall select assessment points to represent all identified NSRs for carrying out quantitative noise assessment described below. The assessment points shall be agreed with the Director prior to the quantitative noise assessment. A map showing the location and description such as name of building, use, and floor of each and every selected assessment point shall be given.

(iv) Provision of an Emission Inventory of the Noise Sources

The Applicant shall provide an inventory of noise sources, including representative equipment for noise impact assessment (including maintenance dredging, if it is needed). Confirmation on the validity of the inventory shall

be obtained from the relevant government departments/authorities and documented.

(v) Construction Noise Impact Assessment

(a) The assessment shall cover the cumulative noise impacts due to the works of the Project (including maintenance dredging, if it is needed) and any other relevant concurrent projects identified during the course of the EIA study.

(b) The Applicant shall carry out assessment of noise impact from construction (excluding percussive piling) of the Project during day time, i.e. 7 a.m. to 7 p.m., on weekdays other than general holidays in accordance with the methodology stipulated in sections 5.3 and 5.4 of Annex 13 of the TM. The criteria in Table 1B of Annex 5 of the TM shall be adopted in the assessment.

(c) To minimize the construction noise impact, alternative construction methods to replace percussive piling shall be proposed as far as practicable. In case blasting works will be involved, it should be carried out, as far as practicable, outside the sensitive hours of 7 p.m. to 7 a.m. on Monday to Saturday and any time on a general holiday, including Sunday. For blasting that must be carried out during the above-mentioned sensitive hours, the noise impact associated with the removal of debris and rocks should be fully assessed and adequate mitigation measures should be recommended to reduce the noise impact as appropriate.

(d) If the unmitigated construction noise levels are found exceeding the relevant criteria, the Applicant shall propose practicable direct mitigation measures (including movable barriers, enclosures, quieter alternative construction methods, re-scheduling and restricting hours of operation of noisy task) to minimize the impact. If the mitigated noise levels still exceed the relevant criteria, the duration of the noise exceedance at the affected NSRs shall be given.

(e) The Applicant shall formulate a reasonable construction programme as far as practicable such that no work will be required in the restricted hours as defined under the Noise Control Ordinance (NCO). In case the Applicant needs to evaluate whether construction works in restricted hours as defined under the NCO are feasible or not in the context of programming construction works, reference should be made to the relevant technical memoranda issued under the NCO. Regardless of the results of the construction noise impact assessment for restricted hours, the Noise Control Authority will process the Construction Noise Permit (CNP) application, if necessary, based on the NCO, the relevant technical memoranda issued under the NCO, and the contemporary conditions/situations. This aspect should be explicitly stated in the noise chapter and the conclusions and recommendations chapter in the EIA report.

3.4.7 Water Quality Impact

3.4.7.1 The Applicant shall follow the relevant criteria and guidelines for evaluating and assessing water pollution as stated in the Main text, Annex 6 and Annex 14 of the TM respectively.

3.4.7.2 The study area for this water quality impact assessment shall cover the Western Buffer Water Control Zone, Victoria Harbour Water Control Zone, Junk Bay Water Control Zone, Eastern Buffer Water Control Zone, Port Shelter Water Control Zone, and part of Southern Water Control Zone (east of Tai Tam Bay), as designated under the Water Pollution Control Ordinance (WPCO). Sensitive receivers including, but not limiting to, seawater intakes, sensitive coral sites and fish culture zones in the above areas shall be addressed in the water quality assessment. The study area could be extended to include other areas if they are found also being impacted during the course of the EIA study and have a bearing on the environmental acceptability of the Project.

3.4.7.3 The Applicant shall identify and analyse all physical, chemical and biological disruptions of marine water and coastal water arising from the Project (including maintenance dredging, if it is needed).

3.4.7.4 The Applicant shall predict, quantify and assess any water quality impacts arising from the Project on the water system(s) and the sensitive receivers by appropriate mathematical modelling and/or other techniques proposed by the Applicant and approved by the Director. The mathematical modelling requirements are set out in Appendix B to this study brief. Possible impacts due to the dredging, transportation and disposal of dredged materials shall include but not be limited to changes in hydrology, flow regime, sediment erosion and deposition patterns, water and sediment quality, fisheries and marine organisms/community. The prediction shall include possible different implementation stages or sequences.

3.4.7.5 The Applicant shall take into account and include likely different implementation stages or sequences (including maintenance dredging, if it is needed) of the Project in the assessment. The assessment shall have regard to the phasing, frequency, duration and rate of dredging and its sediment loading. Essentially the assessment shall address the following:

(i) Collection and review of background information on the existing and planned water system(s) and sensitive receivers which might be affected by the Project (including maintenance dredging, if it is needed);

(ii) Characterization of water and sediment quality of the water system(s) and sensitive receivers which might be affected by the Project (including maintenance, if it is needed) based on existing information or appropriate site survey and tests;

(iii) Identification and analysis of all existing and planned future activities and beneficial uses related to the affected water system(s). The Applicant shall refer to, inter alia, those developments and uses earmarked on the relevant Preliminary Outline Development Plans, Outline Zoning Plans, Development Permission Area Plans, Outline Development Plans, Layout Plans and other relevant published land use plans;

(iv) Identification of pertinent water and sediment quality objectives and establishment of other appropriate water and sediment quality criteria or

standards for the water system(s) and all the sensitive receivers in sub-section (i), (ii) and (iii) above, including ecological and fisheries sensitive receivers for the assessments covered in sections 3.4.10 and 3.4.11;

(v) Review of the construction sequences and methods of the Project (including maintenance dredging, if it is needed) to identify any alteration of bathymetry and flow regimes;

(vi) Identification and quantification of all existing and likely future water and sediment pollution sources and loading (which shall include maintenance dredging of marine sediment of the Project, if it is needed). An emission inventory on the quantities and characteristics of all these existing and likely future pollution sources in the study area shall also be provided. Field investigation and laboratory test, as appropriate, shall be conducted to fill relevant information gaps;

(vii) Prediction and quantification, by mathematical modelling or other technique approved by the Director, of impacts due to the Project on the water system(s) and the sensitive receivers. The mathematical modelling requirements are set out in Appendix B of this Study Brief. Possible impacts include change in hydrology, flow regime, both the local and regional effects on erosion, sediment re-suspension, sediment dispersion, water and sediment quality and the effects on the marine organisms/communities or fisheries due to such changes in the affected water bodies. The assessment shall also take into account the additional pollution loading and oxygen demand exerted by disturbed sediment during dredging and shall include possible different construction stages of the Project;

(viii) Identification and quantification of all dredging, sediment/mud transportation and disposal activities and requirements. Potential dumping ground to be involved shall also be identified and cumulative environmental impacts shall be evaluated. Field investigation, sampling and chemical and biological laboratory tests to characterize the sediment/mud concerned shall be conducted as appropriate. The potential for the release of contaminants during dredging shall be addressed using the chemical testing results derived from sediment samples collected on site and relevant historic data. Appropriate laboratory tests such as elutriate tests shall be performed on the sediment samples to simulate and quantify the degree of mobilization of various contaminants such as metals, ammonia, trace organic contaminants (including PCBs, PAHs, TBT and chlorinated pesticides) into the water column during dredging. The ranges of parameters to be analyzed; the number, location, depth of sediment, type and methods of sampling; sample preservation; and chemical and biological laboratory test methods to be used shall be subject to the approval of the Director. If applicable, the Applicant can make reference to previous studies and investigations and confirm with the Director whether the information and findings of such studies/investigations are still relevant and valid for the EIA Study. The Applicant shall also assess the pattern of the sediment deposition and the potential increase in turbidity and suspended solid levels in the water column and at the sensitive receivers due to the disturbance of sediments during dredging;

(ix) Assessment of the cumulative impacts due to other concurrent and planned projects, activities or pollution sources along the identified water system(s)

and sensitive receivers that may have a bearing on the environmental acceptability of the Project through mathematical modelling.

(x) Recommendation of appropriate mitigation measures to avoid or minimize the impacts identified above, in particular suitable mud dredging and disposal methods and arrangement shall be recommended to mitigate any adverse impacts. The residual impacts on the water system(s) and the sensitive receivers with regard to the relevant water and sediment quality objectives, criteria, standards or guidelines shall be assessed and quantified using appropriate mathematical models as set out in Appendix B to this study brief.

3.4.7.6 The Applicant shall describe clearly the frequency and rate of maintenance dredging (if it is needed), including detailed substantiation of the assumptions adopted, and shall assess and evaluate the recurrent water quality impacts of the maintenance dredging activities.

3.4.8 Waste Management Implications

3.4.8.1 The Applicant shall follow the relevant criteria and guidelines for evaluating and assessing waste management implications as stated in the Main text, Annex 7 and Annex 15 of the TM respectively.

3.4.8.2 The assessment of waste management implications shall cover the following:

(i) Analysis of Activities and Waste Generation

The Applicant shall identify the quantity, quality and timing of the wastes arising as a result of the activities of the Project (including maintenance dredging, if it is needed), based on the sequence and duration of these activities.

(ii) Proposal for Waste Management

(a) Prior to considering the disposal options for various types of wastes, opportunities for reducing waste generation, on-site or off-site re-use and recycling shall be fully evaluated. Measures which can be taken in the planning and design stages (e.g. by modifying the design approach) and in the construction stage for maximizing waste reduction shall be separately considered.

(b) After considering all the opportunities for reducing waste generation and maximizing re-use, the types and quantities of the wastes required to be disposed of as a consequence shall be estimated and the disposal options for each type of waste shall be described in detail. The disposal method recommended for each type of waste shall take into account the result of the assessment in (c) below.

(c) The impact caused by handling (including labelling, packaging and storage), collection, and reuse/ disposal of wastes shall be addressed in detail and appropriate mitigation measures shall be proposed. This assessment shall cover the following areas:

- potential hazard;
- air and odour emissions;
- noise;
- wastewater discharge; and
- public transport.

(iii) Dredging, Filling and Dumping

(a) Identification and quantification as far as practicable of all dredging, fill extraction, filling, reclamation, mud/ sediment transportation and disposal activities and requirements shall be conducted. Potential fill source and dumping ground to be involved shall also be identified. Field investigation, sampling and chemical and biological laboratory tests to characterize the sediment/ mud concerned shall be conducted as appropriate. The ranges of parameters to be analyzed; the number, type and methods of sampling; sample preservation; chemical and biological laboratory test methods to be used shall be agreed with the Director (with reference to Section 4.4.2(c) of the TM) prior to the commencement of the tests. If applicable, the Applicant can make reference to previous studies and investigations and confirm with the Director whether the information and findings of such studies/investigations are still relevant and valid for the EIA Study. The categories of sediments which are to be disposed of in accordance with a permit granted under the Dumping at Sea Ordinance (DASO) shall be identified by both chemical and biological tests and their quantities shall be estimated. If the presence of any seriously contaminated sediment which requires special treatment/ disposal is confirmed, the Applicant shall identify the most appropriate treatment and/or disposal arrangement and demonstrate its feasibility.

(b) Identification and evaluation of the best practical dredging methods to minimise dredging and dumping requirements and demand for fill sources based on the criterion that existing marine mud shall be left in place and not to be disturbed as far as possible.

3.4.9 Impact on Cultural Heritage

3.4.9.1 The Applicant shall ensure that works to the existing seawall masonry should be kept to the minimum. The affected seawall should be salvaged and reused in the future development scheme as far as possible.

3.4.9.2 The Applicant shall engage a qualified marine archaeologist to conduct a marine archaeological review based on the best available information to identify whether there is any possible existence of sites or objects of cultural heritage within the seabed that will be affected by the marine works of the Project, whether the identified issues can be mitigated and whether there is a need for more detailed investigation. The review should take into account the results of previous marine archaeological investigations, the dredging history and other diving records. The need for more detailed investigation and the programme for investigation should be agreed with the Antiquities and Monuments Office. If marine archaeological potential is identified and the need for further investigation is confirmed, a marine archaeological investigation shall be carried out to ascertain the marine

archaeological value of the affected seabed area. If a marine archaeological investigation is required, the applicant shall propose a suitable programme of investigation, including those investigations that may be necessary during the detailed design stage and should be followed up during the project implementation, for agreement with the Antiquities and Monuments Office. The marine archaeological investigation, if required, shall be carried out by a qualified marine archaeologist who shall obtain a Licence from the Antiquities Authority under the provision of the Antiquities and Monuments Ordinance (Cap. 53), and in accordance with the established guidelines set out by the Antiquities and Monuments Office. If significant archaeological remains are discovered, appropriate mitigation measures shall be designed for implementation.

3.4.10 Marine Ecological Impact

3.4.10.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing ecological impact as stated in the Main text, Annex 8 and Annex 16 of the TM, respectively.

3.4.10.2 The assessment area shall be the same as for the water quality impact assessment or the area likely to be impacted by the Project.

3.4.10.3 The Applicant shall examine the flora, fauna and other components of the ecological habitats within the assessment area. The aim shall be to protect, maintain or rehabilitate the natural environment. The assessment shall identify and quantify as far as possible the potential ecological impacts associated with the Project including both directly by physical disturbance and indirectly by changes of water quality.

3.4.10.4 The assessment shall include the following:

(i) review the findings of relevant studies and collate all the best available information regarding the ecological characters of the assessment area;

(ii) evaluate the information collected and identify any information gap relating to the assessment of potential ecological impacts to the aquatic environment;

(iii) where necessary, carry out field surveys and investigations to verify the information collected, fill the key and relevant information gaps identified and fulfill the objectives of the EIA study;

(iv) establish the general ecological profile and describe the characteristics of each habitat found; major information to be provided shall include:

(a) description of the physical environment;

(b) habitat maps of suitable scale (1:1000 to 1:5000) showing the types and locations of habitats in the assessment area;

(c) ecological characteristics of each habitat type such as size, species present, dominant species found, species diversity and abundance, community structure, seasonal patterns, inter-dependence of the habitats and species, and presence of any features of ecological importance (eg. coral);

(d) representative colour photos of each habitat type and any important ecological features identified;

(e) species found that are rare, endangered and/or listed under local legislation, international conventions for conservation of habitats or Red Data books;

(v) describe all recognized sites of conservation importance in the proposed dredging area and its vicinity and assess whether these sites will be potentially affected by the Project;

(vi) using suitable methodology and considering also other concurrent and planned projects to identify and quantify as far as possible any direct, indirect (eg. changes in water quality, hydrodynamic properties, flow requires, sedimentation rates and patterns, hydrology, etc.), on-site, off-site, primary, secondary and cumulative ecological impacts such as destruction of habitats, reduction of species abundance/ diversity, reduction of ecological carrying capacity and habitat fragmentation; and in particular the following:

(a) removal or disruption of potentially valuable benthic communicates;

(b) deterioration or disturbance to sensitive marine ecological habitats/species, such as coral communities;

(c) deterioration of environmental quality (eg. water quality) resulting from the Project (including maintenance dredging, if it is needed) and the subsequent impacts to the marine ecological resources and habitats.

(vii) demonstrate that the ecological impacts due to the Project (including maintenance, if it is needed) are avoided to the maximum practicable extent;

(viii) evaluate the significance and acceptability of the ecological impacts identified using well-defined criteria;

(ix) recommend all possible alternatives (such as modifications of dredging area, rate and methods) and practicable mitigation measures to avoid, minimize and/or compensate for the adverse ecological impacts identified;

(x) evaluate the feasibility and effectiveness of the recommended mitigation measures and define the scope, type, location, implementation arrangement, subsequent management and maintenance of such measures;

(xi) determine and quantify as far as possible the residual ecological impacts after implementation of the proposed mitigation measures;

(xii) evaluate the severity and acceptability of the residual ecological impacts using well-defined criteria; and

(xiii) review the need for and recommend any ecological monitoring programme required.

3.4.11 Fisheries Impact

3.4.11.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing fisheries impact as stated in the Main text, Annex 9 and Annex 17 of the TM.

3.4.11.2 The area for fisheries impact assessment shall include all areas within 500m from the boundary of the study area and any area likely to be impacted by the Project. Special attention shall be given to the potential impacts on the mariculture activities at Tung Lung Chau fish culture zone and the loss of fishing ground.

3.4.11.3 The assessment shall cover any potential impact on both capture and culture fisheries, arising from the Project (including maintenance dredging, if it is needed).

3.4.11.4 Existing information regarding the assessment area shall be reviewed. Based on the review results, the study shall identify data gap and determine if there is any need for field surveys. If field surveys are considered necessary, the study shall recommend appropriate methodology, duration and timing for the field surveys.

3.4.11.5 The fisheries impact assessment shall include the following :

(i) description of the physical environmental background;

(ii) description and quantification of existing capture and culture fisheries activities;

(iii) description and quantification as far as possible the existing fisheries resource;

(iv) identification of parameters (e.g. water quality parameters) and areas that are important to fisheries and will be affected;

(v) identification and quantification any direct/indirect and on-site/off-site impacts to fisheries;

(vi) evaluation of impacts and make proposals for any practical alternatives or mitigation measures with details on justification, description of scope and programme, feasibility as well as manpower and financial implications including those related to subsequent management and maintenance requirements of the proposals; and

(vii) review the need for monitoring during the construction and operation phases of the Project and associated works and, if necessary, propose a monitoring and audit programme.

3.4.12 Documentation of Key Assessment Assumptions, Limitation of Assessment Methodologies and related Prior Agreement(s) with the Director

To facilitate efficient retrieval, a summary to include the assessment methodologies and key assessment assumptions adopted in this EIA study, the limitations of these assessment(s) methodologies/assumptions, if any, plus all relevant prior agreement(s) with the Director or other Authorities on individual environmental media assessment components. The proposed use of any alternative assessment tool(s) or assumption(s) have to be justified by the Applicant, with supporting documents based on cogent, scientific and objectively derived reason(s) before seeking the Director's agreement. This summary and all related supporting

documents shall be provided in the form of an Appendix to the EIA study report.

3.4.13 Impacts Summary

3.4.13.1 To facilitate effective retrieval of pertinent key information, a summary of environmental impacts in the form of a table (or in any other form approved by the Director) showing the assessment points (such as ASRs, NSRs), results of impact predictions, relevant standards or criteria, extents of exceedances predicted, impact avoidance measures considered, mitigation measures proposed and residual impacts (after mitigation) shall be provided to cover each individual impact in the EIA report. This impact summary shall form an essential part of the Executive Summary.

3.4.14 Summary of Environmental Outcomes

3.4.14.1 The EIA report shall contain a summary of the key environmental outcomes arising from the EIA study, including the population and environmentally sensitive areas protected, environmentally friendly designs recommended, key environmental problems avoided, compensation areas included and the environmental benefits of environmental protection measures recommended.

3.4.15 Environmental Monitoring and Audit (EM&A) Requirements

3.4.15.1 The Applicant shall identify and justify in the EIA study whether there is any need for EM&A activities during the construction and operation phases of the Project and, if affirmative, to define the scope of the EM&A requirements for the Project in the EIA study.

3.4.15.2 Subject to the confirmation of the EIA study findings, the Applicant shall comply with the requirements as stipulated in Annex 21 of the TM. The Applicant shall also propose real-time reporting of construction monitoring data, wherever practicable, for the Project through a dedicated internet website.

3.4.15.3 The Applicant shall prepare an implementation schedule, in the form of a checklist containing all the EIA study recommendations and mitigation measures with reference to the Project implementation programme.

4. DURATION OF VALIDITY

4.1 This EIA study brief is valid for 36 months counting from the date of its issuance. If the EIA study does not commence within this period, the Applicant shall apply to the Director for a fresh EIA study brief before commencement of the EIA study. The Applicant shall advise the Director the date of commencement of the EIA study.

5. REPORT REQUIREMENTS

5.1 In preparing the EIA report, the Applicant shall refer to Annex 11 of the TM for the contents of an EIA report. The Applicant shall also refer to Annex 20 of the TM,

which stipulates the guidelines for review of an EIA report.

5.2 The Applicant shall supply the Director with the following number of copies of the EIA report and the executive summary:

(i) 50 copies of the EIA report in English and 80 copies of the executive summary (each bilingual in both English and Chinese) as required under section 6(2) of the EIAO to be supplied at the time of application for approval of the EIA report.

(ii) when necessary, addendum to the EIA report and the executive summary submitted under sub-section 5.2 (i) above as required under section 7(1) of the EIAO, to be supplied upon advice by the Director for public inspection.

(iii) 20 copies of the EIA report in English and 50 copies of the executive summary (each bilingual in both English and Chinese) with or without Addendum as required under section 7(5) of the EIAO, to be supplied upon advice by the Director for consultation with the Advisory Council on the Environment.

5.3 The Applicant shall, upon request, make additional copies of the above documents available to the public, subject to payment by the interested parties of full costs of printing.

5.4 In addition, to facilitate the public inspection of the EIA report via the EIAO Internet Website, the applicant shall provide electronic copies of both the EIA report and the executive summary prepared in HyperText Markup Language (HTML) (version 4.0 or later) and in Portable Document Format (PDF version 4.0 or later), unless otherwise agreed by the Director. For the HTML version, a content page capable of providing hyperlink to each section and sub-section of the EIA report and the executive summary shall be included in the beginning of the document. Hyperlinks to all figures, drawings and tables in the EIA report and executive summary shall be provided in the main text from where the respective references are made. All graphics in the report shall be in interlaced GIF format unless otherwise agreed by the Director.

5.5 The electronic copies of the EIA report and the executive summary shall be submitted to the Director at the time of application for approval of the EIA report.

5.6 When the EIA report and the executive summary are made available for public inspection under section 7(1) of the EIAO, the content of the electronic copies of the EIA report and the executive summary must be the same as the hard copies and the Director shall be provided with the most updated electronic copies.

5.7 To promote environmentally friendly and efficient dissemination of information, both hardcopies and electronic copies of future EM&A reports recommended by the EIA study shall be required and their format shall be agreed by the Director.

6. OTHER PROCEDURAL REQUIREMENTS

6.1 If there is any change in the Applicant (as representing his or her organization) for this EIA study brief during the course of the EIA study, the Applicant must notify the Director immediately.

6.2 If there are any key changes in the scope of the Project described in section 1.3 of this EIA study brief, the Applicant must seek confirmation in writing from the Director on whether or not the scope of this EIA study brief is still applicable to cover the key changes identified, and what additional issues, if any, that the EIA study must also cover to address these key changes. If the changes to the Project fundamentally alter the key scope of the EIA study brief, the Applicant shall apply to the Director for a fresh EIA study brief.

--- END OF EIA STUDY BRIEF ---

December 2006
Environmental Assessment Division,
Environmental Protection Department

Appendix A-1

Guidelines on Choice of Models and Model Parameters in Air Quality Assessment

[The information contained in this Appendix is only meant to assist the Applicant in performing the air quality assessment. The Applicant must exercise professional judgment in applying this general information for the Project.]

1. Introduction

1.1 To expedite the review process by the Authority and to assist project proponents or environmental consultants with the conduct of air quality modelling exercise which are frequently called for as part of environmental impact assessment studies, this paper describes the usage and requirements of a few commonly used air quality models.

2. Choice of Models

2.1 The models which have been most commonly used in air quality impact assessments, due partly to their ease of use and partly to the quick turn-around time for results, are of Gaussian type and designed for use in simple terrain under uniform wind flow. There are circumstances when these models are not suitable for ambient concentration estimates and other types of models such as physical, numerical or mesoscale models will have to be used. In situations where topographic, terrain or obstruction effects are minimal between source and receptor, the following Gaussian models can be used to estimate the near-field impacts of a number of source types including dust, traffic and industrial emissions.

Model	Applications
FDM	for evaluating fugitive and open dust source impacts (point, line and area sources)
CALINE4	for evaluating mobile traffic emission impacts (line sources)
ISCST3	for evaluating industrial chimney releases as well as area and volumetric sources (point, area and volume sources); line sources can be approximated by a number of volume sources.

These frequently used models are also referred to as Schedule 1 models (see attached list).

2.2 Note that both FDM and CALINE4 have a height limit on elevated sources (20 m and 10m, respectively). Source of elevation above these limits will have to be modelled using the ISCST3 model or suitable alternative models. In using the latter, reference should be made to the 'Guidelines on the Use of Alternative Computer Models in Air Quality Assessment' in Appendix B-3.

2.3 The models can be used to estimate both short-term (hourly and daily average) and long-term (annual average) ambient concentrations of air pollutants. The model results, obtained using appropriate model parameters (refer to Section 3) and assumptions, allow direct comparison with the relevant air quality standards such as the Air Quality Objectives (AQOs) for the relevant pollutant and time averaging period.

3. Model Input Requirements

3.1 Meteorological Data

3.1.1 At least 1 year of recent meteorological data (including wind speed, wind direction, stability class, ambient temperature and mixing height) from a weather station either closest to or having similar characteristics as the study site should be used to determine the highest short-term (hourly, daily) and long-term (annual) impacts at identified air sensitive receivers in that period. The amount of valid data for the period should be no less than 90 percent.

3.1.2 Alternatively, the meteorological conditions as listed below can be used to examine the worst case short-term impacts:

Day time: stability class D; wind speed 1 m/s (at 10m height); worst-case wind angle; mixing height 500 m

Night time: stability class F; wind speed 1 m/s (at 10m height); worst case wind angle; mixing height 500 m

This is a common practice with using CALINE4 model due to its inability to handle lengthy data set.

3.1.3 For situations where, for example, (i) the model (such as CALINE4) does not allow easy handling of one full year of meteorological data; or (ii) model run time is a concern, the followings can be adopted in order to determine the daily and annual average impacts:

(i) perform a frequency occurrence analysis of one year of meteorological data to determine the actual wind speed (to the nearest unit of m/s), wind direction (to the nearest 10o) and stability (classes A to F) combinations and their frequency of occurrence;
(ii) determine the short term hourly impact under all of the identified wind speed, wind direction and stability combinations; and
(iii) apply the frequency data with the short term results to determine the long term (daily / annual) impacts.

Apart from the above, any alternative approach that will capture the worst possible impact values (both short term and long term) may also be considered.

3.1.4 Note that the anemometer height (relative to a datum same for the sources and receptors) at which wind speed measurements were taken at a selected station should be correctly entered in the model. These measuring positions can vary greatly from station to station and the vertical wind profile employed in the model can be grossly distorted from the real case if incorrect anemometer height is used. This will lead to unreliable concentration estimates.

3.1.5 An additional parameter, namely, the standard deviation of wind direction, σ_θ, needs to be provided as input to the CALINE4 model. Typical values of σ_θ range from 12^o for rural areas to 24^o for highly urbanised areas under 'D' class stability. For semi-rural such as new development areas, 18^o is more appropriate under the same stability condition. The following reference can be consulted for typical ranges of standard deviation of wind direction under different stability categories and surface roughness conditions.

Ref.(1): Guideline On Air Quality Models (Revised), EPA-450/2-78-027R, United States Environmental Protection Agency, July 1986.

3.2 Emission Sources

All the identified sources relevant to a process plant or a study site should be entered in the model and the emission estimated based on emission factors compiled in the AP-42 (Ref. 2) or other suitable references. The relevant sections of AP-42 and any parameters or assumptions used in deriving the emission rates (in units g/s, g/s/m or $g/s/m^2$) as required by the model should be clearly stated for verification. The physical dimensions, location, release height and any other emission characteristics such as efflux conditions and emission pattern of the sources input to the model should also correspond to site data.

If the emission of a source varies with wind speed, the wind speed-dependent factor should be entered.

Ref.(2): Compilation of Air Pollutant Emission Factors, AP-42, 5th Edition, United States Environmental Protection Agency, January 1995.

3.3 Urban/Rural Classification

Emission sources may be located in a variety of settings. For modelling purposes these are classified as either rural or urban so as to reflect the enhanced mixing that occurs over urban areas due to the presence of buildings and urban heat effects. The selection of either rural or urban dispersion coefficients in a specific application should follow a land use classification procedure. If the land use types including industrial, commercial and residential uses account for 50% or more of an area within 3 km radius from the source, the site is classified as urban; otherwise, it is classified as rural.

3.4 Surface Roughness Height

This parameter is closely related to the land use characteristics of a study area and associated with the roughness element height. As a first approximation, the surface roughness can be estimated as 3 to 10 percent of the average height of physical structures. Typical values used for urban and new development areas are 370 cm and 100 cm, respectively.

3.5 Receptors

These include discrete receptors representing all identified air sensitive receivers at their appropriate locations and elevations and any other discrete or grid receptors for supplementary information. A receptor grid, whether Cartesian or Polar, may be used to generate results for contour outputs.

3.6 Particle Size Classes

In evaluating the impacts of dust-emitting activities, suitable dust size categories relevant to the dust sources concerned with reasonable breakdown in TSP (< 30 μm) and RSP (< 10 μm) compositions should be used.

3.7 NO_2 to NO_x Ratio

The conversion of NO_x to NO_2 is a result of a series of complex photochemical reactions and has implications on the prediction of near field impacts of traffic emissions. Until further data are available, three approaches are currently acceptable in the determination of NO_2:

(a) Ambient Ratio Method (ARM) - assuming 20% of NO_x to be NO_2; or
(b) Discrete Parcel Method (DPM, available in the CALINE4 model); or
(c) Ozone Limiting Method (OLM) - assuming the tailpipe NO_2 emission to be 7.5% of NO_x and the background ozone concentration to be in the range of 57 to 68 $\mu g/m^3$ depending on the land use type (see also the EPD reference paper 'Guidelines on Assessing the 'TOTAL' Air Quality Impacts' in Appendix B-2).

3.8 Odour Impact

In assessing odour impacts, a much shorter time-averaging period of 5 seconds is required due to the shorter exposure period tolerable by human receptors. Conversion of model computed hourly average results to 5-second values is therefore necessary to enable comparison against recommended standard. The hourly concentration is first converted to 3-minute average value according to a power law relationship which is stability dependent (Ref. 3) and a result of the statistical nature of atmospheric turbulence. Another conversion factor (10 for unstable conditions and 5 for neutral to stable conditions) is then applied to convert the 3-minute average to 5-second average (Ref. 4). In summary, to convert the hourly results to 5-second averages, the following factors can be applied:

Stability Category	1-hour to 5-sec Conversion Factor
A & B	45
C	27
D	9
E & F	8

Under 'D' class stability, the 5-second concentration is approximately 10 times the hourly average result. Note, however, that the combined use of such conversion factors together with the ISCST results may not be suitable for assessing the extreme close-up impacts of odour sources.

Ref.(3): Richard A. Duffee, Martha A. O'Brien and Ned Ostojic, 'Odor Modeling – Why and How', Recent Developments and Current Practices in Odor Regulations, Controls and Technology, Air & Waste Management Association, 1991.
Ref.(4): A.W.C. Keddie, 'Dispersion of Odours', Odour Control – A Concise Guide, Warren Spring Laboratory, 1980.

3.9 Plume Rise Options

The ISCST3 model provides by default a list of the U.S. regulatory options for concentration calculations. These are all applicable to the Hong Kong situations except for the 'Final Plume Rise' option. As the distance between sources and receptors are generally fairly close, the non-regulatory option of 'Gradual Plume Rise' should be used instead to give more accurate estimate of near-field impacts due to plume emission. However, the 'Final Plume Rise' option may still be used for assessing the impacts of distant sources.

3.10 Portal Emissions

These include traffic emissions from tunnel portals and any other similar openings and are generally modelled as volume sources according to the PIARC 91 (or more up-to-date version) recommendations (Ref. 5, section III.2). For emissions arising from underpasses or any horizontal openings of the like, these are treated as area or point sources depending on the source physical dimensions. In all these situations, the ISCST3 model or more sophisticated models will have to be used instead of the CALINE4 model. In the case of portal emissions with significant horizontal exit velocity which cannot be handled by the ISCST3 model, the impacts may be estimated by the TOP model (Ref. 6) or any other suitable models subject to prior agreement with the Director (with reference to Section 4.4.2(c) of the TM). The EPD's 'Guidelines on the Use of Alternative Computer Models in Air Quality Assessment' should also be referred to in Appendix B-3.

Ref.(5): XIXth World Road Congress Report, Permanent International Association of Road Congresses (PIARC), 1991.
Ref.(6): N. Ukegunchi, H. Okamoto and Y. Ide "Prediction of vehicular emission pollution around a tunnel mouth", Proceedings 4th International Clean Air Congress, pp. 205-207, Tokyo, 1977.

3.11 Background Concentrations

Background concentrations are required to account for far-field sources which cannot be estimated by the model. These values, to be used in conjunction with model results for assessing the total impacts, should be based on long term average of monitoring data at location representative of the study site. Please make reference to the paper 'Guidelines on Assessing the 'TOTAL' Air Quality Impacts' in Appendix B-2 for further information.

3.11 Output

The highest short-term and long-term averages of pollutant concentrations at prescribed receptor locations are output by the model and to be compared against the relevant air quality standards specified for the relevant pollutant. Contours of pollutant concentration are also required for indicating the general impacts of emissions over a study area. Copies of model files in electronic format should also be provided for the Director's reference.

Schedule 1

Air Quality Models Generally Accepted by Hong Kong Environmental Protection Department for Regulatory Applications as at 1 July 1998 : *

Industrial Source Complex Dispersion Model - Short Term Version 3 (ISCST3) or the latest version developed by U.S. Environmental Protection Agency
California Line Source Dispersion Model Version 4 (CALINE4) or the latest version developed by Department of Transportation, State of California, U.S.A.
Fugitive Dust Model (FDM) or the latest version developed by U.S. Environmental Protection Agency

* * EPD is continually reviewing the latest development in air quality models and will update this Schedule accordingly.

Appendix A-2

Guidelines on Assessing the 'TOTAL' Air Quality Impacts

[The information contained in this Appendix is only meant to assist the Applicant in performing the air quality assessment. The Applicant must exercise professional judgment in applying this general information for the Project.]

1. Total Impacts - 3 Major Contributions

1.1 In evaluating the air quality impacts of a proposed project upon air sensitive receivers, contributions from three classes of emission sources depending on their distance from the site should be considered. These are:

Primary contributions:	project induced
Secondary contributions:	pollutant-emitting activities in the immediate neighbourhood
Other contributions: (Background contributions)	pollution not accounted for by the previous two

2. Nature of Emissions

2.1 Primary contributions

In most cases, the project-induced emissions are fairly well defined and quite often (but not necessarily) the major contributor to local air quality impacts. Examples include those due to traffic network, building or road construction projects.

2.2 Secondary contributions

Within the immediate neighbourhood of the project site, there are usually pollutant emitting activities contributing further to local air quality impacts. For most local scale projects, any emission sources in an area within 500m radius of the project site with notable impacts should be identified and included in an air quality assessment to cover the short-range contributions. In the exceptional cases where there is one or more significant sources nearby, the study area may have to be extended or alternative estimation approach employed to ensure these impacts are reasonably accounted for.

2.3 Background contributions

The above two types of emission contributions should account for, to a great extent, the air quality impacts upon local air sensitive receivers, which are often amenable to estimation by the 'Gaussian Dispersion' type of models. However, a background air quality level should be prescribed to indicate the baseline air quality in the region of the project site, which would account for any pollution not covered by the two preceding contributions. The emission sources contributing to the background air quality would be located further afield and not easy to identify. In addition, the transport mechanism by which pollutants are carried over long distances (ranging from 1km up to tens or hundreds of kms) is rather complex and cannot be adequately estimated by the 'Gaussian' type of models.

3. Background Air Quality - Estimation Approach

3.1 The approach

In view of the difficulties in estimating background air quality using the air quality models currently available, an alternative approach based on monitored data is suggested. The essence of this approach is to adopt the long-term (5-year) averages of the most recent monitored air quality data obtained by EPD. These background data would be reviewed yearly or biennially depending on the availability of the monitored data. The approach is a first attempt to provide a reasonable estimate of the background air quality level for use in conjunction with EIA air quality assessment to address the cumulative impacts upon a locality. This approach may be replaced or supplemented by superior modelling efforts such as that entailed in PATH (Pollutants in the Atmosphere and their Transport over Hong Kong), a comprehensive territory-wide air quality modelling system currently being developed for Hong Kong. Notwithstanding this, the present approach is based on measured data and their long term regional averages; the background values so derived should therefore be indicative of the present background air quality. In the absence of any other meaningful way to estimate a background air quality for the future, this present background estimate should also be applied to future projects as a first attempt at a comprehensive estimate until a better approach is formulated.

3.2 Categorisation

The monitored air quality data, by 'district-averaging' are further divided into three categories, viz, Urban, Industrial and Rural/New Development. The background pollutant concentrations to be adopted for a project site would depend on the geographical constituency to which the site belongs. The categorisation of these constituencies is given in Section 3.4. The monitoring stations suggested for the 'district-averaging'(arithmetic means) to derive averages for the three background air quality categories are listed as follows:

Urban:	Kwun Tong, Sham Shui Po, Tsim Sha Tsui and Central/Western
Industrial:	Kwun Tong, Tsuen Wan and Kwai Chung
Rural/New Development:	Sha Tin, Tai Po, Junk Bay, Hong Kong South and Yuen Long

The averaging would make use of data from the above stations wherever available. The majority of the monitoring stations are located some 20m above ground.

3.3 Background pollutant values

Based on the above approach, background values for the 3 categories have been obtained for a few major air pollutants as follows:

POLLUTANT	**URBAN**	**INDUSTRIAL**	**RURAL / NEW DEVELOPMENT**
NO_2	59	57	39
SO_2	21	26	13
O_3	62	68	57
TSP	98	96	87
RSP	60	58	51

All units are in micrograms per cubic metre. The above values are derived from 1992

to 1996 annual averages with the exception of ozone which represent annual average of daily hourly maximum values for year 1996.

In cases where suitable air quality monitoring data representative of the study site such as those obtained from a nearby monitoring station or on-site sampling are not available for the prescription of background air pollution levels, the above tabulated values can be adopted instead. Strictly speaking, the suggested values are only appropriate for long term assessment. However, as an interim measure and until a better approach is formulated, the same values can also be used for short term assessment. This implies that the short term background values will be somewhat under-estimated, which compensates for the fact that some of the monitoring data are inherently influenced by secondary sources because of the monitoring station location.

Indeed, if good quality on-site sampling data which cover at least one year period are available, these can be used to derive both the long term (annual) and short term (daily / hourly) background values, the latter are usually applied on an hour to hour, day to day basis.

3.4 Site categories

The categories to which the 19 geographical constituencies belong are listed as follows:

DISTRICT	**AIR QUALITY CATEGORY**
Islands	Rural / New Development
Southern	Rural / New Development
Eastern	Urban
Wan Chai	Urban
Central & Western	Urban
Sai Kung	Rural / New Development
Kwun Tong	Industrial
Wong Tai Sin	Urban
Kowloon City	Urban
Yau Tsim	Urban
Mong Kok	Urban
Sham Shui Po	Urban
Kwai Tsing	Industrial
Sha Tin	Rural / New Development
Tsuen Wan	Industrial
Tuen Mun	Rural / New Development
Tai Po	Rural / New Development
Yuen Long	Rural / New Development
Northern	Rural / New Development

3.5 Provisions for 'double-counting'

The current approach is, by no means, a rigorous treatment of background air quality but aims to provide an as-realistic-as-possible approximation based on limited field

data. 'Double-counting' of 'secondary contributions' may be apparent through the use of such 'monitoring-based' background data as some of the monitoring stations are of close proximity to existing emission sources. 'Primary contributions' due to a proposed project (which is yet to be realized) will not be double-counted by such an approach. In order to avoid over-estimation of background pollutant concentrations, an adjustment to the values given in Section 3.3 is possible and optional by multiplying the following factor:

$$(1.0 - E_{\text{Secondary contributions}}/E_{\text{Territory}})$$

where E stands for emission.

The significance of this factor is to eliminate the fractional contribution to background pollutant level of emissions due to 'secondary contributions' out of those from the entire territory. In most cases, this fractional contribution to background pollutant levels by the secondary contributions is minimal.

4. Conclusions

4.1 The above described approach to estimating the total air quality impacts of a proposed project, in particular the background pollutant concentrations for air quality assessment, should be adopted with immediate effect. Use of short term monitoring data to prescribe the background concentrations is no longer acceptable.

Appendix A-3

Guidelines on the Use of Alternative Computer Models in Air Quality Assessment

[The information contained in this Appendix is only meant to assist the Applicant in performing the air quality assessment. The Applicant must exercise professional judgment in applying this general information for the Project.]

1. Background

1.1 In Hong Kong, a number of Gaussian plume models are commonly employed in regulatory applications such as application for specified process licences and environmental impact assessments (EIAs). These frequently used models (as listed in Schedule 1 attached; hereafter referred to as Schedule 1 models) have no regulatory status but form the basic set of tools for local-scale air quality assessment in Hong Kong.

1.2 However, no single model is sufficient to cover all situations encountered in regulatory applications. In order to ensure that the best model available is used for each regulatory application and that a model is not arbitrarily applied, the project proponent (and/or its environmental consultants) should assess the capabilities of various models available and adopt one that is most suitable for the project concerned.

1.3 Examples of situations where the use of an alternative model is warranted include:

(i) the complexity of the situation to be modelled far exceeds the capability of the Schedule 1 models; and
(ii) the performance of an alternative model is comparable or better than the Schedule 1 models.

1.4 This paper outlines the demonstration / submission required in order to support the use of an alternative air quality model for regulatory applications for Hong Kong.

2. Required Demonstration / Submission

2.1 Any model that is proposed for air quality applications and not listed amongst the Schedule 1 models will be considered by the Director on a case-by-case basis. In such cases, the proponent will have to provide the followings for the Director's review:

(i) Technical details of the proposed model; and
(ii) Performance evaluation of the proposed model

Based on the above information, the Director will determine the acceptability of the proposed model for a specific or general applications. The onus of providing adequate supporting materials rests entirely with the proponent.

2.2 To provide technical details of the proposed model, the proponent should submit documents containing at least the following information:

(i) mathematical formulation and data requirements of the model;
(ii) any previous performance evaluation of the model; and

(iii) a complete set of model input and output file(s) in commonly used electronic format.

2.3 On performance evaluation, the required approach and extent of demonstration varies depending on whether a Schedule 1 model is already available and suitable in simulating the situation under consideration. In cases where no Schedule 1 model is found applicable, the proponent must demonstrate that the proposed model passes the screening test as set out in USEPA Document "Protocol for Determining the Best Performing Model" (Ref. 1).

Ref.(1): William M. Cox, 'Protocol for Determining the Best Performing Model'; Publication No. EPA-454/R-92-025; U.S. Environmental Protection Agency, Research Triangle Park, NC.

2.4 For cases where a Schedule 1 model is applicable to the project under consideration but an alternative model is proposed for use instead, the proponent must demonstrate either that

(i) the highest and second highest concentrations predicted by the proposed model are within 2 percent of the estimates obtained from an applicable Schedule 1 model (with appropriate options chosen) for all receptors for the project under consideration; or

(ii) the proposed model has superior performance against an applicable Schedule 1 model based on the evaluation procedure set out in USEPA Document "Protocol for Determining the Best Performing Model" (Ref. 1).

2.5 Should the Director find the information on technical details alone sufficient to indicate the acceptability of the proposed model, information on further performance evaluation as specified in Sections 2.3 and 2.4 above would not be necessary.

2.6 If the proposed model is an older version of one of the Schedule 1 models or was previously included in Schedule 1, the technical documents mentioned in Section 2.2 are normally not required. However, a performance demonstration of equivalence as stated in Section 2.4 (i) would become necessary.

2.7 If the Director is already in possession of some of the documents that describe the technical details of the proposed model, submission of the same by the proponent is not necessary. The proponent may check with the Director to avoid sending in duplicate information.

Schedule 1

Air Quality Models Generally Accepted by Hong Kong Environmental Protection Department for Regulatory Applications as at 1 July 1998 : *

Industrial Source Complex Dispersion Model - Short Term Version 3 (ISCST3) or the latest version developed by U.S. Environmental Protection Agency

California Line Source Dispersion Model Version 4 (CALINE4) or the latest version developed by Department of Transportation, State of California, U.S.A.

Fugitive Dust Model (FDM) or the latest version developed by U.S. Environmental Protection Agency

* ***** EPD is continually reviewing the latest development in air quality models and will update this Schedule accordingly.

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 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. All 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. 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 field data collected by:

    - South East Kowloon Development Comprehensive Planning and Engineering Review – Stage I: Planning Review, CEDD (2005/2006)
    - 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, 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 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 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 Estuary and the Dangan Channel to incorporate all major influences on hydrodynamic and water quality. A fine grid model may be used for detailed assessment of this study. It shall either be linked to a far field model or form part of a larger model by gradual grid refinement. The coverage of the fine grid 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.

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 Kai Tak Approach Channel shall have at least 4 grids across it to better resolve transverse variations of the Channel. The grid schematization shall be agreed with EPD.

Modelling assessment

1. The assessment shall include the construction and operation phases of the project. Where appropriate, the assessment shall also include maintenance dredging. 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 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, where appropriate, 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.

3. If assessment of accidental spillage is required, potential locations, quantities and rates of spill shall be identified and quantified. The spill modelling shall cover combinations of different tides, wind and season conditions. The methodology for modelling spill and scenarios to be covered should be agreed with EPD.

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 projects, activities or pollution sources within a boundary to the agreement of EPD shall also be predicted and quantified.

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

- END -

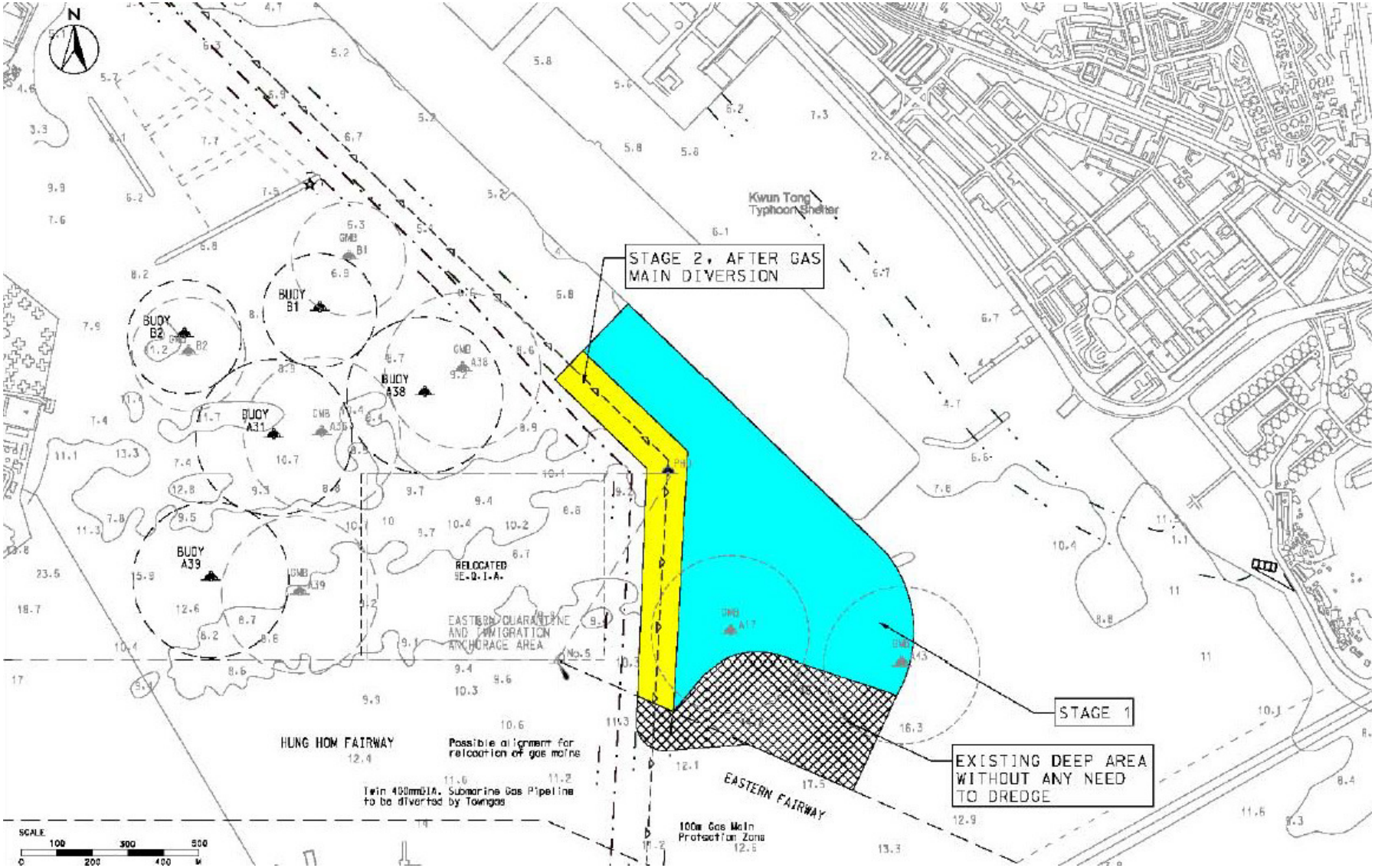

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Figure 1: Location of Dredging Area