

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

**Environmental Impact Assessment Study Brief No. ESB-179/2008**

**Project Title :** Construction of Cycle Tracks and the Associated Supporting Facilities at Nam Sang Wai, Yuen Long  
( hereinafter known as the “Project” )

**Name of Applicant :** Civil Engineering and Development Department  
( hereinafter known as the “Applicant” )

**1. BACKGROUND**

- 1.1 An application (no. ESB-179/2008) for an Environmental Impact Assessment (EIA) study brief under section 5(1)(a) of the Environmental Impact Assessment Ordinance (EIAO) was submitted by the captioned Applicant on 23 January 2008 with a project profile (no. PP-342/2008).
- 1.2 The Project is concerned with construction of cycle tracks of about 8.5 Km in length and 3.5 m in width and supporting facilities. The cycle tracks comprise 2 bridges crossing over Kam Tin River and Shan Pui River. The proposed cycle tracks start from the south of Yuen Long Bypass Floodway and run along Kam Tin River and Shan Pui River, with part falling within Deep Bay Buffer Zone 2. The tracks end at Tin Shui Wai and the alignments are as shown in Figure 1. The proposed supporting facilities include 1 resting place, streetscape, landscape, utilities diversions, traffic aids installation, street lighting, water, sewerage and drainage works, and environmental mitigation measures.
- 1.3 The Project is a designated project by virtue of items P.1 and Q.1 of Schedule 2 of the EIAO. In accordance with P.1, “A residential or recreational development, other than New Territories exempted houses within Deep Bay Buffer Zone 1 or 2” is a designated project. Q.1 specifies that “All projects including new access roads, railways, sewers, sewage treatment facilities, earthworks, dredging works and other building works partly or wholly in an existing or gazetted proposed country park or special area, a conservation area, an existing or gazetted proposed marine park or marine reserve, a site of cultural heritage, and a site of special scientific interest” constitute designated projects. In accordance with section 5(1)(a), a person who is planning a designated project shall apply to the Director for an environmental impact assessment study brief to proceed with an environmental impact assessment study for the project.
- 1.4 Pursuant to section 5(7)(a) of the EIAO, the Director of Environmental Protection (the Director) issues this Environmental Impact Assessment (EIA) study brief to the Applicant to carry out an EIA study.

- 1.5 The purpose of this EIA study is to provide information on the nature and extent of environmental impacts arising from the construction and operation of the Project and related activities taking place concurrently. 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;
  - (ii) the conditions and requirements for the detailed design, construction and operation of the Project to mitigate against adverse environmental consequences wherever practicable; and
  - (iii) the acceptability of residual impacts after 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 proposed project and associated works together with the requirements for carrying out the Project;
  - (ii) to identify and describe the 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;
  - (iii) to provide information on the consideration of alternatives to avoid and minimize the potential adverse environmental impacts on the sensitive uses that may be subject to the adverse environmental impacts of the proposed developments and associated works; to provide justifications and constraints for selecting the preferred option and to describe the part of environmental factors played in the selection;
  - (iv) to identify and quantify emission sources and determine the significance of impacts on sensitive receivers (SRs) and potential affected uses;
  - (v) to identify and quantify any potential losses or damage to flora, fauna and natural habitats;
  - (vi) to identify and quantify any potential landscape and visual impacts and to propose measures to mitigate these impacts;
  - (vii) to propose the provision of infrastructure or mitigation measures so as to minimize pollution, environmental disturbance and nuisance during construction and operation of the Project;

- (viii) to investigate the feasibility, practicability, effectiveness and implications of the proposed mitigation measures;
- (ix) to identify, predict and evaluate the residual (i.e. after practicable mitigation) environmental impacts and the cumulative effects expected to arise during the construction and operation phases of the Project in relation to the sensitive receivers and potential affected uses;
- (x) to identify, assesses and specify methods, measures and standards to be included in the detailed design, construction and operation of the Project which are necessary to mitigate these environmental impacts and reduce them to acceptable levels;
- (xi) 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
- (xii) to design and specify the environmental monitoring and audit requirements, if required, to ensure the implementation and the effectiveness of the environmental protection and pollution control measures adopted.

### **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. The Applicant has to demonstrate in the EIA report that the criteria in the relevant sections of the Technical Memorandum on Environmental Impact Assessment Process (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 mentioned in the Project Profile (no. PP-342/2008) and highlighted in section 1 above. The EIA study shall address the likely key issues described below, together with any other key issues identified during the course of the EIA study :

- (i) potential air quality impact from construction of the Project, taking into account the cumulative impact from the existing and planned sources of pollution in the vicinity of the Project and during the operational stage air quality impact from the existing and planned pollution sources in the vicinity on any part of the Project which would be considered as air sensitive receivers (ASRs);

- (ii) potential noise impact from construction of the Project, taking into account the cumulative impact from other concurrent projects in the vicinity of the Project and during the operational stage the noise impact from the existing and planned noise sources in the vicinity on any part of the Project which are identified to be noise sensitive receivers (NSRs);
- (iii) potential water quality impact from construction and operation of the Project on the relevant water system(s);
- (iv) potential impact of various types of waste arising from construction and operation of the Project;
- (v) potential adverse impact from construction and operation of the Project on the ecologically sensitive areas, in particular Mai Po Nature Reserve, Inner Deep Bay Site of Special Scientific Interest (SSSI), Mai Po Marshes SSSI, Mai Po Inner Deep Bay Ramsar Site, Hong Kong Wetland Park, Wetland Conservation Area, Wetland Buffer Area, as well as the mangroves and mudflats (along river embankments and at the confluence of Kam Tin River and Shan Pui River) serving as a feeding and roosting ground to waterbirds. The potential impact on the nearby ecological mitigation areas, including the engineered wetland for the Yuen Long Bypass Floodway, the abandoned meanders of Kam Tin River, and the compensatory plantation and mangrove areas for the main drainage channel project 60CD (Kam Tin River and Shan Pui River), shall be addressed;
- (vi) potential fisheries impacts, especially the impact on fish ponds, including reinstated fish ponds related to drainage channel projects 60CD (Kam Tin River and Shan Pui River), in the vicinity of the Project and measures for compensation;
- (vii) potential landscape and visual impacts from construction and operation of the Project; and
- (viii) potential impacts due to construction and operation of the Project and associated works on sites of cultural heritage if identified in the vicinity of the Project.

### **3.3 Consideration of Alternatives**

#### Purposes and Objectives for the Project

- 3.3.1 The Applicant shall provide information on the purposes and objectives of the Project, and describe the scenarios with and without the Project.

#### Consideration of Alternatives

- 3.3.2 In addition to the proposed cycle track alignments and bridge locations set out in the Project Profile (no. PP-342/2008), the Applicant shall consider other feasible alternative alignments and design for the Project, provide

justification for the selected cycle track and bridge alignments, which encroach onto the Mai Po Inner Deep Bay Ramsar Site, and the resting place, the need for the 2 proposed bridges and the selected locations for proposed bridge crossings, including description of the environmental factors considered in the selection of cycle track and bridge alignments such that encroachment of the proposed cycle track onto the Mai Po Inner Deep Bay Ramsar Site is justifiable and acceptable under the Ramsar Convention, and attempt made to avoid affecting ecologically sensitive areas, in particular the mangrove plantation areas and mudflats along river embankments and at the confluence of Kam Tin River and Shan Pui River serving as a feeding and roosting ground to waterbirds.

#### Consideration of Alternative Construction Methods and Sequences of Works

- 3.3.3 Taking into consideration the combined effect with respect to the severity and duration of the construction impacts to the affected sensitive receivers, the EIA study shall explore alternative construction methods and sequences of works for the Project, with a view to avoid prolonged adverse environmental impacts to the maximum practicable extent. A comparison of the environmental benefits and dis-benefits of applying different construction methods and sequence of works shall be made.

### **3.4 Technical Requirements**

- 3.4.1 The Applicant shall conduct the EIA study to address all environmental aspects of the activities as described in the Project Profile (no. PP-342/2008). The assessment shall be based on the best and latest information available during the course of the EIA study. The EIA study shall include the following technical requirements on specific impacts.

#### Definition of Project Site Area

- 3.4.2 The Project site shall cover the proposed cycle tracks, bridges, resting place and associated facilities/works, construction footprint area, including works area, storage area, site office, haul roads, etc., and the said areas shall be clearly demarcated on to scale plans.

### **3.4.3 Air Quality Impact**

- 3.4.3.1 The Applicant shall follow the criteria and guidelines stated in section 1 of Annex 4 and Annex 12 of the TM for evaluating and assessing the air quality impact.

#### Air Quality Impact during Construction Stage

- 3.4.3.2 During the construction stage, if the Applicant anticipates significant construction dust impact that will likely cause exceedance of the recommended limits in the TM at the ASRs despite incorporation of dust control measures, a quantitative assessment following the relevant technical requirements in sections 3.4.3.4 to 3.4.3.6 below shall be carried out to evaluate the construction dust impact at the identified ASRs.

Air Quality Impact during Operational Stage

- 3.4.3.3 For the air quality impact during the operational stage, if the Applicant anticipates significant air quality impact that will likely cause exceedance of the recommended limits in the TM on any part of the Project which would be considered as ASRs in accordance with Annex 12 of the TM, despite incorporation of control/mitigation measures, a quantitative assessment following the relevant technical requirements in sections 3.4.3.4 to 3.4.3.6 below shall be carried out to evaluate the operational air quality impact at the identified ASRs.

Technical Requirements – General

**Study Area**

- 3.4.3.4 The study area for construction and operational air quality impact assessments of the Project shall be defined by a distance of 500m from the boundary of the Project site area defined in section 3.4.2, yet it shall be extended to include major emission sources that may have a bearing on the environmental acceptability of the Project. Such assessment shall be based on the best available information at the time of the assessment.
- 3.4.3.5 The Applicant shall assess the air pollutant concentrations with reference to the Guidelines for Local-Scale Air Quality Assessment Using Models given in Appendices A-1 to A-3 or other methodologies as agreed by the Director.
- 3.4.3.6 The air quality impact assessment shall include the following :
- (i) Background and Analysis of Activities
    - (a) Provide background information relating to air quality issues relevant to the Project.
    - (b) Give an account, where appropriate, of the consideration / measures that have been taken into consideration in the planning of the Project to abate air pollution impact. The Applicant shall consider alternative construction methods/phasing programmes and alternative modes of operation to minimize the construction and operational air quality impacts respectively.
    - (c) For the evaluation of cumulative air quality impacts during construction and operational stages, present the background air quality levels in the study area.
  - (ii) Identification of ASRs and Examination of Emission/Dispersion Characteristics
    - (a) Identify and describe representative existing and planned/ committed ASRs arising from the Project or to be affected by the Project within the study area, including those

earmarked on the relevant Outline Zoning Plans, Development Permission Area Plans, Outline Development Plans, Layout Plans and other relevant published land use plans, including plans and drawings published by the Lands Department. The Applicant shall select the assessment points of the identified ASRs such that they represent the worst impact points of these ASRs. A map showing the location and description including the names of buildings, their uses and height of selected assessment points shall be given. Separation distances of these ASRs from the nearest emission sources shall also be given.

- (b) Provide a list of air pollutant emission sources, including any nearby emission sources which are likely to have impact on the Project based on the analysis of the construction and operational activities of the Project in section 3.4.3.6 (i) above. Examples of construction stage emission sources include stockpiling, material handling and vehicular movements on unpaved haul roads on site, etc. Examples of operational stage emission sources include exhaust emissions from vehicles. Confirmation of the validity of the assumptions and the magnitude of the activities shall be obtained from the relevant government departments/parties and documented in the EIA report.
  - (c) The Applicant shall identify chimneys and obtain relevant chimney emission data in the study area by carrying out a survey for assessing the cumulative air quality impact of air pollutants through chimneys. The Applicant shall ensure and confirm that the chimney emission data used in their assessment have been validated and updated by their own survey. If there are any errors subsequently found in their chimney emission data used, the Applicant shall be fully responsible and the submission might be invalidated.”
- (iii) Construction Phase Air Quality Impact
- (a) The Applicant shall follow the requirements of the Air Pollution Control (Construction Dust) Regulation to ensure construction dust impact is controlled within the relevant standards as stipulated in section 1 of Annex 4 of the TM. An audit and monitoring program for the construction stage shall be devised to verify the effectiveness of the control measures and to ensure that the construction dust levels will be brought under proper control. The Applicant shall follow the methodology set out in section 3.4.3.6 (v) and (vi) below when carrying out the quantitative assessment.

(iv) Operational Phase Air Quality Impact

- (a) The Applicant shall assess the expected air pollutant impact at the identified ASRs based on an assumed reasonably worst-case scenario under normal operating conditions. The evaluation shall be based on the strength of the emission sources identified in sub-section 3.4.3.6 (ii) (b) above. The Applicant shall follow the methodology set out in section 3.4.3.6 (v) and (vi) below when carrying out the quantitative assessment.
- (b) For calculation of future road traffic air pollution impact, this shall be based on the highest emission strength from the roads within the next 15 years upon commencement of operation of the Project. The Applicant shall demonstrate that the selected year of assessment represents the highest emission scenario given the combination of vehicular emission factors and traffic flow for the selected year. The Fleet Average Emission Factors used in the assessment shall be agreed with the Director. If necessary, the Fleet Average Emission Factors shall be determined by a motor vehicle emission model such as EMFAC-HK model to be agreed with the Director. All the traffic flow data and assumptions that used in the assessment shall be clearly and properly documented in the EIA report.

(v) Quantitative Assessment Methodology

- (a) The Applicant shall conduct the quantitative assessment with reference to relevant sections of the modelling guidelines stated in section 3.4.3.5 above or any other methodology as agreed with the Director. The specific methodology must be documented in such level of details (preferably with tables and diagrams) to allow the readers of the assessment report to grasp how the model is set up to simulate the situation at hand without referring to the model input files. Detailed calculations of the pollutant emission rates shall be presented in the EIA report. The Applicant must ensure consistency between the text description and the model files at every stage of submission. In case of doubt, the Applicant shall seek and obtain prior agreement of the Director on the specific modelling details.
- (b) The Applicant shall identify the key/representative air pollutant parameters (types of pollutants and the averaging time concentrations) to be evaluated and provide explanation for choosing these parameters for assessment of the impact of the Project.

- (c) The Applicant shall calculate the cumulative air pollutant concentrations at the identified ASRs and compare these results against the criteria set out in section 1 of Annex 4 in the TM. The predicted air quality impacts (both unmitigated and mitigated) shall be presented in the form of a summary table and pollution contours, to be evaluated against the relevant air quality standards and examination of the land use implications of these impacts. Plans of suitable scale should be used for presentation of pollution contours to allow proper determination of buffer distance requirements.
  
- (vi) Mitigating Measures for Non-compliance
  - (a) The Applicant shall propose remedies and mitigating measures where the predicted air quality impact exceeds the criteria set out in section 1 of Annex 4 in the TM. These measures and any constraints on future land use planning shall be agreed with the relevant government departments/authorities and documented. The Applicant shall demonstrate quantitatively that the resultant impacts after incorporation of the proposed mitigating measures will comply with the criteria stipulated in section 1 of Annex 4 in the TM.
  
- (vii) Submission of Model Files
  - (a) All input and output file(s) of the model run(s) shall be submitted to the Director in an electronic format.

### **3.4.4 Noise Impact**

3.4.4.1 The Applicant shall follow the criteria and guidelines stated in Annexes 5 and 13 of the TM for evaluating and assessing the noise impact.

3.4.4.2 The noise impact assessment for the proposed cycle track shall include the following :

- (i) Determination of Study Area
  - (a) The study area for the noise impact assessment shall generally include areas within 300m from the Project site boundary or alternative Project alignment(s) identified in the EIA. Subject to the agreement of the Director, the study area could be reduced accordingly if the first layer of noise sensitive receivers (NSRs) closer than 300m from the outer Project limit provides acoustic shielding to those receivers at distances further away from the Project. Subject to the agreement of the Director, the study area shall be expanded to include NSRs at distances over 300m from the Project site boundary, which would be affected by construction of the Project.

- (ii) Provision of Background Information and Existing Noise Levels
  - (a) The Applicant shall provide background information relevant to the Project, e.g. relevant previous or current studies. Unless required for determining the planning standards, e.g. 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 NSRs. The NSRs shall include the existing NSRs and planned/committed noise sensitive developments and uses earmarked on the relevant Outline Zoning Plans, Development Permission Area Plans, Outline Development Plans, Layout Plans and other relevant published land use plans, including plans and drawings published by Lands Department. Photographs of the existing NSRs shall be appended to the EIA report.
  - (b) The Applicant shall select assessment points to represent the 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 the name of building, use, and the floor of each and every selected assessment point shall be given. For planned noise sensitive land uses without committed site layouts, the Applicant should use the relevant planning parameters to work out representative site layouts for noise assessment purpose.
  
- (iv) Provision of Emission Inventory of the Noise Sources
  - (a) The Applicant shall provide an inventory of noise sources including representative construction equipment for the construction noise assessment. Confirmation of the validity of the inventory shall be obtained from the relevant government departments/authorities and documented in the EIA report.
  
- (v) Construction Noise Assessment
  - (a) The assessment shall cover the cumulative noise impact due to the construction works of the Project and other concurrent projects identified during the course of the EIA study.
  - (b) The Applicant shall carry out an assessment of noise impact from construction (excluding percussive piling) of the Project during daytime, i.e. 7 am to 7 pm, on weekdays other than general holidays in accordance with

methodology 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.
- (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 methods, re-scheduling and restricting hours of operation of noisy tasks) to minimize the impact. If the mitigated noise levels still exceed the relevant criteria, the duration of the noise exceedance shall be given.
- (e) The Applicant shall, as far as practicable, formulate a reasonable construction programme so 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 the 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 construction noise impact assessment for the restricted hours, the Noise Control Authority will process 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 EIA report.

#### Operational Noise Assessment

- 3.4.4.3 Any part of the Project identified to be NSRs in the EIA study, the Applicant shall assess the impact on these NSRs from existing and planned noise sources in the vicinity of the project following the criteria and guidelines set out in Annexes 5 and 13 of the TM.

#### **3.4.5 Water Quality Impact**

- 3.4.5.1 The Applicant shall follow the criteria and guidelines stated in Annexes 6 and 14 of the TM for evaluating and assessing the water quality impact.
- 3.4.5.2 The assessment area for the water quality impact assessment shall include all areas within 500m from the Project site boundary, including Kam Tin River, Shan Pui River, existing nullah(s), surrounding fish ponds and

wetland. This assessment area could be extended to include other areas such as stream courses and the associated water systems in the vicinity being impacted by the Project if found justifiable.

- 3.4.5.3 The Applicant shall identify and analyze physical, chemical and biological disruptions of marine, estuarine or fresh water system(s), catchment area(s), storm water channels, fish ponds and coastal water arising from construction and operation of the Project.
- 3.4.5.4 The Applicant shall assess the water quality impact arising from construction and operation of the Project. Essentially, the assessment shall address the following :
- (i) Collect and review the background information on the existing and planned water systems, their respective catchments and sensitive receivers which might be affected by the Project;
  - (ii) Characterize water and sediment quality of the water systems, their respective catchments and sensitive receivers which might be affected by the Project based on the existing best available information or through appropriate site surveys and tests;
  - (iii) Identify and analyze relevant existing and planned future activities, beneficial uses and water sensitive receivers related to the affected water system(s). The Applicant shall refer to, inter alia, those developments and uses specified in the relevant Outline Zoning Plans, Development Permission Area Plans, Outline Development Plans, Layout Plans and any other relevant published land use plans;
  - (iv) Identify pertinent water and sediment quality objectives and establish other appropriate water and sediment quality criteria or standards for the water system(s) and all the sensitive receivers identified in accordance with section 3.4.5.4 (i) (ii) and (iii) above, including ecological sensitive receivers for the assessment covered in section 3.4.7;
  - (v) Review the specific construction methods and configurations, provisional site formation plan, and operation of the Project. Identify any alteration of natural/artificial water courses, meanders, fish ponds, wetlands, change of drainage channels, flow regimes, ground water levels and catchment types or areas;
  - (vi) Identify and quantify all existing, likely future water and sediment pollution sources, and loadings. An emission inventory of the quantities and characteristics of these existing and likely future pollution sources in the study area shall also be provided. Field investigation and laboratory tests shall be conducted as appropriate to fill in relevant information gaps;

- (vii) Assess the cumulative impacts due to other related concurrent and planned projects and activities or pollution sources in the study area along the identified water system(s) and sensitive receivers that may have a bearing on the environmental acceptability of the Project;
- (viii) Assess and evaluate any potential water quality impact on the identified water system(s), respective catchments and sensitive receivers due to storm and surface water runoff and sewage arising from the construction of the Project. Any effluent generated will require appropriate collection, treatment and disposal to within standards and objectives and criteria established in section 3.4.5.4 (iv) above;
- (ix) Assess and evaluate any potential water quality impact due to sewage, storm water and surface runoff on the water system(s), respective catchments and sensitive receivers during operation phase so as to reduce the water and sediment quality impacts to within standards, objectives and criteria established in section 3.4.5.4 (iv) above. Best management practices shall be recommended to reduce any potential impacts arising from storm water runoff during both construction and operation phases;
- (x) Should dredging be required for construction of the proposed bridge crossings and/or supporting facilities, the Applicant shall evaluate and quantify the possible impacts arising from the dredging works and other marine works. The Applicant shall identify clearly the nature, extent and rate of the dredging works, and the volume of sediment disturbed. Field investigation, sampling and laboratory tests to characterize the sediment/mud concerned shall be conducted as appropriate. The potential release of contaminants during dredging and other marine works shall be addressed using the chemical testing results derived from sediment and marine water samples collected on site and relevant historical data. Appropriate laboratory tests such as elutriate tests in accordance with the USACE method and sediment pore water (interstitial water) analyses shall be performed on the sediment samples to simulate and quantify the degree of mobilization of various contaminants such as metals, oxygen demand, ammonia, nutrients, 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 laboratory test methods to be used shall be subject to the approval of the Director. Potential fill source and dumping ground to be involved shall be identified. 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, dumping and other marine works;

- (xi) In case of small scale dredging works and with the prior written agreement by the Director, the Applicant shall assess the potential increase in turbidity and suspended solids levels in the related water system(s) within the study sites. The potential for release of contaminants during dredging shall also be addressed using the chemical testing results derived from sediment samples collected on site and relevant historic data;

#### Waste Water and Non-point Sources Pollution

- (xii) Proposals for effective and practicable infrastructure upgrading or provision, water pollution prevention and mitigation measures to be implemented during construction and operation stages to reduce the water quality impacts to within acceptable levels of standards. Requirements to be incorporated in the project contract document shall also be proposed;
- (xiii) Best management practices to reduce storm water and non-point source pollution shall be investigated and proposed as appropriate;
- (xiv) Evaluate and quantify residual impacts on the affected water system(s) and the sensitive receivers with regard to the appropriate water quality criteria, standards or guidelines; and

#### Protection Against Accidental Spillage

- (xv) Specification of an emergency contingency plan for the construction and operational phases of the Project to contain and remove accidental spillage along the channels, nullah(s), access road(s)/haul road(s) at short notice and to prevent or to minimize the quantities of contaminants getting into the surrounding water courses and sensitive habitats.

### **3.4.6 Waste Management Implications**

3.4.6.1 The Applicant shall follow the criteria and guidelines stated in Annexes 7 and 15 of the TM for evaluating and assessing waste management implications.

3.4.6.2 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 waste arising as a result of the construction and operation activities of the Project, based on the sequence and duration of these activities. The Applicant shall adopt design, general layout, construction methods and programme to minimize generation of public fill/inert construction and demolition materials (C&DM) and maximize the use of public fill / inert C&DM for other construction works.

(ii) Proposal for Waste Management

- (a) Prior to considering disposal options for various wastes, opportunities for reducing waste generation, on-site/off-site re-use and recycling shall be evaluated. Measures which can be undertaken in the planning and design stages, e.g. by modifying design approach, and in the construction stage to maximize waste reduction shall be separately considered.
- (b) After considering 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 section 3.4.6.2 (ii) (c) below. The EIA report shall also state clearly the transportation routings and the frequency of the trucks/vessels involved, any barging point or conveyor system to be used, the stockpiling areas and the disposal outlets for the wastes identified;
- (c) The impact caused by handling (including labelling, packaging and storage), collection, and 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 commencement of the tests. 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 serious 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 practicable dredging methods to minimize dredging and dumping requirements and demand for fill sources based on the criterion that existing mud shall be left in place and not to be disturbed as far as practicable.

### **3.4.7 Ecological Impact (Terrestrial and Aquatic)**

- 3.4.7.1 The Applicant shall follow the criteria and guidelines stated in Annexes 8 and 16 of the TM for evaluating and assessing the ecological impact.
- 3.4.7.2 The assessment area for the purpose of terrestrial ecological assessment shall include all areas within 500 metres from the Project site boundary and the areas likely to be impacted by the Project. For aquatic ecology, the assessment area shall be the same as the water quality impact assessment area described in section 3.4.5.2.
- 3.4.7.3 In the ecological impact assessment, 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. In particular, the Project and associated works shall avoid impacts on recognized sites of conservation importance and other ecologically sensitive areas. The assessment shall identify and quantify as far as possible the potential ecological impact arising from the construction, in particular the impact of dredging, excavation, filling and paving of concrete and/or widening of the existing footpath at Fung Lok Wai and south of Nam Sang Wai, and operation of the Project and associated works. The assessment shall also identify if there is any impact on the ecological and wetland characters of the Mai Po Inner Deep Bay Ramsar Site and propose practical solutions commensurate to such encroachment to be justifiable and acceptable under the Ramsar Convention.
- 3.4.7.4 Construction and operation of the cycle tracks may lead to disturbance to the breeding and foraging behaviour of affected birds. These birds would include, but not limited to, (a) those foraging in Nam Sang Wai, in particular on the mudflats along the embankments and at the confluence of Kam Tin River and Shan Pui River; (b) using the fish ponds within and in the vicinity of the Project area; and (c) wintering in Kam Tin River, Shan

Pui River, Mai Po Inner Deep Bay Ramsar Site, etc.. Fish ponds, mangroves, and mudflat along Kam Tin River lying within the Mai Po Inner Deep Bay Ramsar Site to the north of Yau Pok Road are highly sensitive to any significant increase in human disturbance.

- 3.4.7.5 The Applicant shall follow the general policy set out in Annex 16 of the TM on EIA Process for mitigating impacts on important habitats and wildlife, in order of priority, by avoidance, minimization and compensation. The Applicant shall avoid potential impacts of the Project to the maximum extent practicable by adopting suitable alternatives, such as change of site, alignment, design, construction method and programme, etc.
- 3.4.7.6 The Applicant shall review the cycle track alignments, in particular the ecological impact of extending the cycle track to the Mai Po Inner Deep Bay Ramsar Site at the end of Yau Pok Road, the proposed bridges and resting place at the selected locations with an aim to explore better alternatives, by means of change of alignments, construction method and programme, etc., so as to minimize potential on-site or off-site ecological impacts to ecologically sensitive areas including the Mai Po Inner Deep Bay Ramsar Site. For instance, the Applicant shall consider making use of the existing bridge crossings, by means of widening if necessary, in place of provision of new bridges. If making use of existing bridges is proved not feasible, the Applicant shall consider relocating the bridges to ecologically less sensitive areas, such as the upstream sections of Kam Tin River and Shan Pui River.
- 3.4.7.7 The Applicant shall consider relocating the resting place away from the fishpond and river area, as the proposed resting place would incur human activities and hence impact on bird usage of the area, unless he could demonstrate that the noise and human impact could be minimized and mitigated.
- 3.4.7.8 The Applicant shall schedule the works in such a way as to minimize construction activities in ecologically sensitive parts of the cycle tracks at sensitive times of the year. For instance, construction period of the Project should be restricted to non-wintering period in order to avoid the peak season of bird migration in the Project site and Mai Po Inner Deep Bay Ramsar Site and to minimize any disturbance to migratory birds, in particular the species of conservation importance such as Black-faced Spoonbill.
- 3.4.7.9 The butterfly Old World Swallowtail (*Papilio machaon*) is only recorded at 2 locations in Hong Kong, one of which being Kai Shan situated to the south of the proposed cycle track between Yuen Long Industrial Estate and Tin Shui Wai. The assessment shall include the potential impact on the Old World Swallowtail (*Papilio machaon*) due to the Project.

3.4.7.10 The assessment shall include the following major tasks :

- (i) review the findings of relevant studies/surveys and collate all available information on the ecological characters of the assessment area;
- (ii) evaluate the information collected and identify any information gaps relating to the assessment of potential ecological impact to the aquatic and terrestrial environment;
- (iii) carry out any necessary field surveys, the duration of which shall be at least 9 months covering the migratory bird over-wintering season and the ardeid breeding season, and investigations to verify the information collected, fill the information gaps identified and fulfill the objectives of the EIA study;
- (iv) establish an ecological profile of the assessment area based on the data of relevant previous studies/surveys and results of additional ecological field surveys, 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, vegetation type, species present, dominant species found, species diversity, community structure, seasonal patterns, inter-dependence of the habitats and species, and presence of any features of ecological importance ;
  - (d) representative colour photographs of each habitat type and any important ecological features identified; and
  - (e) species found that are rare, endangered, such as Black-faced Spoonbill, and/or listed under local legislation, international conventions for conservation of wildlife/ habitats or Red Data Books;
- (v) investigate and describe the existing wildlife uses of the various habitats with special attention to those wildlife groups and habitats with conservation interests, including :
  - (a) wetlands including inter-tidal mudflat, mangroves, fish ponds, wet agricultural land and marshes;
  - (b) roosting, breeding and feeding sites of waterbirds;

- (c) natural stream courses and man-made drainage channels;  
and
  - (d) any other habitats identified as having special conservation interests by this study.
- (vi) describe all recognized sites of conservation importance in the vicinity of the Project site area, such as Wetland Conservation Area, Wetland Buffer Area, Mai Po Nature Reserve, Inner Deep Bay SSSI, Mai Po Marshes SSSI, Mai Po Inner Deep Bay Ramsar Site, and Hong Kong Wetland Park, etc., and assess whether these sites will be affected by the Project and associated works;
- (vii) using a suitable methodology to identify and quantify as far as possible any direct, indirect, on-site, off-site, primary, secondary and cumulative ecological impacts on the wildlife groups and habitats, the reduction of species abundance/diversity, the loss of feeding grounds, the reduction of ecological carrying capacity, the habitat fragmentation; and in particular the following :
- (a) ecological impacts of potential loss of habitats of conservation interest such as natural stream courses, fish ponds, mangrove plantation area and reed bed, etc.;
  - (b) disturbance effects to wildlife in particular waterbirds and sensitive wetland habitats in the vicinity such as intertidal mudflat, drainage channels and fish ponds during the construction and operational phases;
  - (c) indirect ecological impacts due to the potential deterioration of the water quality in the stream courses, fish ponds, intertidal mudflat, drainage channels or other wetland habitats in the study area during the construction and operational phases;
  - (d) ecological impacts due to increasing human activities based on a scenario where the largest number of waterbirds found in the Project site coincides with the peak flow of visitors to the area;
  - (e) ecological impacts to the existing/proposed ecological mitigation areas in the vicinity of the Project site during the construction and operational phases; and
  - (f) cumulative impacts due to other planned and committed development projects at or near the Project site area;
- (viii) evaluate the significance and acceptability of the ecological impacts identified using well defined criteria;

- (ix) recommend all possible alternatives (such as modification of layout, different alignment, reduced size and extent of reclamation, built form and/or using other construction methods) and practicable mitigation measures to avoid, minimize and/or compensate for the adverse ecological impacts identified, 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. If off-site mitigation is considered necessary, the guidelines and requirements laid down in Annex 16 of the TM should be followed;
- (x) determine and quantify as far as possible the residual ecological impacts after implementation of the proposed mitigation measures;
- (xi) evaluate the severity and acceptability of the residual ecological impacts using well-defined criteria; and
- (xii) review the need for and recommend any ecological monitoring and audit programme required.

### **3.4.8 Fisheries Impact**

- 3.4.8.1 The Applicant shall follow the criteria and guidelines stated in Annexes 9 and 17 of the TM for evaluating and assessing fisheries impact.
- 3.4.8.2 The area for fisheries impact assessment shall include all areas within 500m from the Project site boundary and any areas likely to be impacted by the Project. Special attention shall be given to the potential impact on both active and abandoned fish ponds in the assessment area.
- 3.4.8.3 The assessment shall cover any potential impact on pond and culture fisheries, during construction and operation of the Project.
- 3.4.8.4 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.
- 3.4.8.5 The fisheries impact assessment shall include the following :
  - (i) description of the physical environmental background;
  - (ii) description and quantification of existing fisheries activities;
  - (iii) description and quantification of the existing fisheries resources (e.g. major fisheries products);

- (iv) identification of parameters (e.g. water quality parameters) and areas of fisheries importance that will be affected by the Project;
- (v) identification and quantification as far as practicable of any direct and indirect, on-site and off-site impacts on fisheries (e.g. permanent loss or temporary occupation of fish ponds, and disturbance to pond culture activities);
- (vi) evaluation of impacts and recommendation of environmental mitigation measures, with details on justification, feasibility, scope and programme, as well as staff and financial implications including those related to subsequent management and maintenance requirements of such recommendations; and
- (vii) review the need for monitoring and, if necessary, recommend a monitoring and audit programme.

### **3.4.9 Landscape and Visual Impact**

- 3.4.9.1 The Applicant shall follow the criteria and guidelines stated in Annexes 10 and 18 of the TM and the EIAO Guidance Note No. 8/2002 for evaluating and assessing landscape and visual impacts of the Project, including any above ground structures and work areas associated with the Project. Landscape and visual impacts during both construction and operational stages within the study area shall be assessed.
- 3.4.9.2 The assessment area for landscape impact assessment shall include all area within 100m from the Project site boundary while the area for visual impact assessment shall be defined by the visual envelope of the Project. The defined visual envelope must be shown on a plan in the EIA report.
- 3.4.9.3 The Applicant shall review relevant Outline Zoning Plans, Development Permissions Area Plans, Outline Development Plans, Layout Plans, other relevant published land use plans, planning briefs and studies which may identify areas of high landscape value and recommended conservation area, open space, amenity area and green belt designations. Any guidelines on landscape strategies, landscape frameworks, urban design concepts, special design areas, open space networks, landscape links that may affect the appreciation of the Project shall also be reviewed. The aim is to gain an insight to the future outlook of the area so as to assess whether the Project can fit into the surrounding setting. Any conflict with statutory town plan(s) and any published land use plans should be highlighted and appropriate follow-up action should be recommended.
- 3.4.9.4 The Applicant shall describe, appraise, analyse and evaluate the existing and planned landscape resources and character of the study area. A system shall be derived for judging landscape and visual impact significance as required under the TM and EIAO Guidance Note No. 8/2002 "Preparation of Landscape and Visual Impact Assessment under

the Environmental Impact Assessment Ordinance”. Annotated oblique aerial photographs and plans of suitable scale showing the baseline landscape character areas and landscape resources and mapping of impact assessment shall be extensively used to present the findings of the impact assessment. Descriptive text shall provide a concise and reasoned judgment from a landscape and visual point of view. The assessment shall be particularly focused on the sensitivity of the landscape framework and its ability to accommodate change. The Applicant shall identify the degree of compatibility of the Project with the existing and planned landscape settings. The landscape impact assessment shall quantify potential landscape impacts as far as possible, so as to illustrate the significance of such impacts arising from the Project. Clear mapping of the landscape impact is required. A tree survey shall be carried out and the impacts on existing trees shall be addressed. Cumulative landscape and visual impacts of the Project with other existing, committed and planned developments in the study area shall be assessed.

3.4.9.5 The Applicant shall assess the visual impacts of the Project. Clear illustrations including mapping of visual impact is required. The assessment shall include :

- (i) identification and plotting of visual envelope of the Project;
- (ii) identification of the key groups of existing and planned sensitive receivers within the visual envelope with regard to views from the ground level and elevated vantage points;
- (iii) description of the visual compatibility of the Project with the surrounding and the existing and planned setting, and its obstruction and interference with the key views of the study areas as defined in section 3.4.9.2; and
- (iv) description of the severity of visual impacts in terms of nature, distance and number of sensitive receivers.
- (v) clear evaluations and explanations of all the factors considered in arriving the significance thresholds of visual impact

3.4.9.6 The Applicant shall evaluate the merits of preservation in totality, in parts or total destruction of existing landscape and establish a new landscape character area. In addition, alternative alignments, design and construction methods that would avoid or reduce the identified landscape and visual impacts shall be evaluated for comparison before adopting other mitigation or compensatory measures to alleviate the impacts. The mitigation measures proposed shall not only be concerned with damage reduction but shall also include consideration of potential enhancement of the existing landscape and visual quality. The Applicant shall recommend mitigation measures to minimize adverse effects identified above, including provision of landscape design.

- 3.4.9.7 Roadside trees should be retained as much as possible. As roadside trees are known to be an important habitat for urban birds, the ecological consideration should be incorporated in the landscape tree planting and maintenance plan.
- 3.4.9.8 The mitigation measures shall include preservation of vegetation and natural coastline, transplanting of trees, provision of screen planting, re-vegetation of disturbed land, woodland restoration, compensatory planting, provisioning / reprovisioning of amenity areas and open spaces, avoidance or minimization of noise barriers, design of structures, provision of finishes to structures, colour scheme and texture of material used and any measures to mitigate the impact on existing and planned land uses and sensitive receivers. Parties shall be identified and in principle agreement shall be reached with the related authorities during the EIA stage for the on going management and maintenance of the proposed mitigation works to ensure their effectiveness throughout the operation phase of the Project. A practical programme and funding proposal for the implementation of the recommended measures shall be provided. Presentation of photomontages of the Project in the existing and planned setting illustrating the effectiveness of the proposed mitigation measures shall be included.
- 3.4.9.9 Annotated illustration materials such as coloured perspective drawings, plans and section/elevation diagrams, oblique aerial photographs, photographs taken at vantage points, and computer-generated photomontage shall be adopted to illustrate the landscape and visual impacts of the Project. The landscape and visual impacts of the Project with and without mitigation measures from representative viewpoints, particularly from views of the most severely affected visually sensitive receivers (i.e. worst case scenario), shall be properly illustrated in existing and planned settings at four stages (existing condition, Day 1 with no mitigation measures, Day 1 with mitigation measures and Year 10 with mitigation measures) by computer-generated photomontage so as to demonstrate the effectiveness of the proposed mitigation measures. Computer graphics shall be compatible with Microstation DGN file format or as agreed with the Director. The Applicant shall record the technical details such as system set-up, software, data files and function in preparing the illustration, which may need to be submitted for verification of the accuracy of the illustrations.
- 3.4.10 Summary of Environmental Outcomes**
- 3.4.10.1 The EIA report shall contain a summary of 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.

### **3.4.11 Environmental Monitoring and Audit (EM&A) Requirements**

- 3.4.11.1 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 EM&A requirements for the Project.
- 3.4.11.2 Subject to 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 monitoring data for the Project through a dedicated internet website.
- 3.4.11.3 The Applicant shall prepare a Project Implementation Schedule (in the form of a checklist as shown in Appendix B to this EIA study brief) containing the EIA study recommendations and mitigation measures with reference to the implementation programme. The Project Implementation Schedule shall include the explicit agreement reached between the Applicant and relevant parties on the responsibility for funding, implementation, management and maintenance of mitigation measures. Alternatively, the Project Implementation Schedule shall include an undertaking from the Applicant to assume the responsibility of those mitigation measures until an agreement is reached between the Applicant and relevant parties on the funding, implementation, management and maintenance of mitigation measures.

## **4. DURATION OF VALIDITY**

- 4.1 The Applicant shall notify the Director of commencement of the EIA study. If the EIA study does not commence within 36 months after the date of issue of this EIA study brief, the Applicant shall apply to the Director for a fresh EIA study brief before 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 the review of an EIA report.
- 5.2 The Applicant shall supply the Director with the following numbers 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 in 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 above documents available to the public, subject to payment by the interested parties of full costs of printing.
- 5.4 In addition, to facilitate public inspection of the EIA report via EIAO Internet Website, the Applicant shall provide electronic copies of both the EIA report and executive summary prepared in HyperText Markup Language (HTML) (version 4.0 or later) and in Portable Document Format (PDF version 1.3 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 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 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 name of Applicant for this EIA study brief during the course of the EIA study, the Applicant must notify the Director of the change immediately.

- 6.2 If there is any key change in the scope of the Project mentioned in section 1.2 of this EIA study brief and in the Project Profile (no. PP-342/2008), the Applicant must seek confirmation from the Director in writing on whether or not the scope of issues covered by this EIA study brief can still cover the key changes and the additional issues, if any, that the EIA study must also address. 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 –

March 2008  
Environmental Assessment Division  
Environment Protection Department



## **Appendix A-1**

### **Guidelines on Choice of Models and Model Parameters**

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

#### **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 exercises 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.

<b><u>Model</u></b>	<b><u>Applications</u></b>
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'.

- 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 the 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 10°) 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,  $\sigma_{\theta}$ , needs to be provided as input to the CALINE4 model. Typical values of  $\sigma_{\theta}$  range from 12° for rural areas to 24° for highly urbanised areas under 'D' class stability. For semi-rural such as new development areas, 18° 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<sup>2</sup>) 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 classed 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 classed as rural.

#### 3.4 Surface Roughness Height

This parameter is closely related to 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 the 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 µgm) and RSP (< 10 µgm) compositions should be used.

#### 3.7 NO<sub>2</sub> to NO<sub>x</sub> Ratio

The conversion of NO<sub>x</sub> to NO<sub>2</sub> is a result of a series of complex photochemical reactions and has implications on prediction of near field impacts of traffic emissions. Until further data are available, three approaches are currently acceptable in the determination of NO<sub>2</sub> :

- (a) Ambient Ratio Method (ARM) - assuming 20% of NO<sub>x</sub> to be NO<sub>2</sub>; or
- (b) Discrete Parcel Method (DPM, available in the CALINE4 model); or
- (c) Ozone Limiting Method (OLM) - assuming the tailpipe NO<sub>2</sub> emission to be 7.5% of NO<sub>x</sub> and the background ozone concentration to be in the range of 57 to 68 µg/m<sup>3</sup> depending on the land use type (see also EPD reference paper 'Guidelines on Assessing the 'TOTAL' Air Quality Impacts').

#### 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:

<u>Stability Category</u>	<u>1-hour to 5-sec Conversion Factor</u>
A & B	45
C	27
D	9

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 EPD. The EPD's '*Guidelines on the Use of Alternative Computer Models in Air Quality Assessment*' should also be referred to.

*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. Refer to EPD reference paper 'Guidelines on Assessing the 'TOTAL' Air Quality Impacts' for further information.

### 3.12 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 EPD's reference.

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## 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 (USEPA)

**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 USEPA.

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

– End –

## **Appendix A-2**

### **Guidelines on Assessing the “Total” Air Quality Impacts**

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

#### **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 :        pollution not accounted for by the previous two (Background contributions)

#### **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 :

<b>POLLUTANT</b>	<b>URBAN</b>	<b>INDUSTRIAL</b>	<b>RURAL/NEW DEVELOPMENT</b>
NO2	59	57	39
SO2	21	26	13
O3	62	68	57
TSP	98	96	87

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 :

<b>DISTRICT</b>	<b>AIR QUALITY CATEGORY</b>
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 realised) 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.

– End –

## **Appendix A-3**

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

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

#### **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) complexity of situation to be modelled far exceeds capability of Schedule 1 models; and
- (ii) 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 EPD on a case-by-case basis. In such cases, the proponent will have to provide the followings for EPD's review :

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

Based on the above information, EPD will determine the acceptability of the proposed model for a specific or general application. 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 :
- (ii) mathematical formulation and data requirements of the model;
  - (iii) any previous performance evaluation of the model; and
  - (iv) 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”.
- 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”.
- 2.5 Should EPD 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 EPD 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 EPD to avoid sending in duplicate information.
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**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 (USEPA)

**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 USEPA.

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

– End –

