

Appendix 1
EIA Study Brief

Hang Hau Tsuen Channel at Lau Fau Shan

EIA Study Brief No.ESB-167/2007
July 2007**Environmental Impact Assessment Ordinance (Cap. 499)
Section 5(7)****Environmental Impact Assessment Study Brief No. ESB-167/2007****Project Title :** Hang Hau Tsuen Channel at Lau Fau Shan
(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-167/2007) 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 7 June 2007 with a Project Profile (No. PP-318/2007) for the Project.
- 1.2 The Project is intended to alleviate the flooding problem in the area by converting the existing Hang Hau Tsuen stream between Deep Bay and Deep Bay Road into an engineered channel. The proposed location and layout of the Project are shown in Figure 1. The proposed project works comprise –
- (i) training of Hang Hau Tsuen stream including construction of a drainage channel of 370m in length connecting the downstream ends of Fung Kong Tsuen Channel and San Hing Tsuen Channel to Deep Bay;
 - (ii) construction of a 25m long triple-cell box culvert of 5.5m (w) x 3m (H) beneath the Deep Bay Road and 4 nos. of footbridges across the channel; and
 - (iii) provision of an access road of 3.5 m in width with passing bays along the northern bank of the channel and footpaths of 2 m in width on both sides of the channel.
- 1.3 The Project is a designated project by virtue of item I.1(b) (vi) of Schedule 2 of the EIAO. In accordance with item I.1 (b) (vi), "A drainage channel or river training and diversion works which discharges or discharge into an area which is less than 300 m from the nearest boundary of an existing or planned coastal protection area" is a designated project. 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 EIA study brief to the Applicant to carry out an EIA study.
- 1.5 The purpose of the 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 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 consideration of alternatives to avoid and minimize potential environmental impacts to environmentally sensitive areas and other sensitive uses; to compare the environmental benefits and dis-benefits of each of different options; to provide reasons for selecting the preferred option(s) and to describe the part environmental factors played in the selection of preferred option(s);
- (iv) to identify any potential impacts from point and non-point pollution sources on the identified water systems and sensitive receivers during the construction and operation stages;
- (v) to identify and quantify any potential losses and damage to flora, fauna and natural habitats and to propose measures to avoid or mitigate these impacts;

- (vi) to identify and quantify any potential landscape and visual impacts and determine the significance of impacts on sensitive receivers;
- (vii) to propose provision of infrastructure or mitigation measures so as to minimize pollution, environmental disturbance and nuisance during construction and operation of the Project;
- (viii) to identify, predict and evaluate the residual environmental impacts (i.e. after practicable mitigation) 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;
- (ix) to identify, assess 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 the acceptable levels;
- (x) to investigate the extent of 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 the provision of any necessary modification; and
- (xi) 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 for the EIA study. The Applicant has to demonstrate in the EIA report that the criteria in the relevant sections of the Technical Memorandum on EIA Process of the EIAO (hereinafter referred to as the TM) are fully complied with.

3.2 The Scope

- 3.2.1 The scope of this EIA study covers the Project mentioned in section 1.2 above. The EIA study shall address the likely key issues described below; together with any key issues identified during the course of the EIA study –
- (i) the potential impact arising from the Project and associated activities on Hang Hau Tsuen stream and the coastal protection area in the vicinity, and the assessment shall include but not be limited to the stream course, stream meander, mangrove, inter-tidal mudflats and existing ponds within or near to Hang Hau Tsuen stream;

- (ii) the potential noise and air quality impacts to sensitive receivers during construction and operation of the Project;
- (iii) the potential aquatic and terrestrial ecological impacts arising from the Project, including loss of habitats, removal of vegetation and disturbance to plants and animals. The assessment shall fully address all direct, indirect and cumulative impacts arising from construction and operation of the Project on the integrity and viability of the ecosystems of Hang Hau Tsuen stream and Inner Deep Bay;
- (iv) the potential impacts arising from the Project on the drainage and hydrology, the water quality and aquatic ecology of Hang Hau Tsuen stream floodplain, in particular the potential impacts on the flow regime, water level and water quality on the stream meanders, mangrove, inter-tidal mudflat habitats and Inner Deep Bay; and
- (v) the potential landscape and visual impacts arising from the removal of stream meanders, vegetation cover, mangroves and mudflats and the cutting of bank(s) along channel sides.

3.3 Consideration of Alternatives

Need for the Project

- 3.3.1 The Applicant shall provide information on the need for the Project and justification for the need and scale of the proposed works. The Applicant shall explain clearly the purpose and objectives of the Project and describe the scenarios with and without the Project.

Consideration of Alternative Drainage Options, Channel Alignments and Designs

- 3.3.2 The Applicant shall identify feasible alternatives other than the proposed option presented in the Project Profile (No. PP-318/2007) to alleviate the flooding problem in the area. In considering alternative flood alleviation options, channel alignments and lining designs, the Applicant shall take into account the need to minimize negative effects on Hang Hau Tsuen stream course, the mangrove colony, nearby fish pond habitats and the inter-tidal mudflats.
- 3.3.3 An evaluation system shall be set up to assess the environmental benefits and dis-benefits of all possible flood alleviation alternatives and channel design options.

Consideration of Alternative Construction Methods and Sequences of Works

- 3.3.4 Having regard to the cumulative effects of the construction period and the severity of the construction impacts to the affected sensitive receivers in the vicinity of the drainage channel, the EIA study shall also explore alternative construction methods and work sequences for the Project with a view to avoid adverse environmental impacts to the maximum practicable extent. A comparison of the environmental benefits and dis-benefits of various construction methods shall be made. The Applicant shall take into account the environmental implications of possible release of heavy metals from mud during excavation works and the potential water quality impact during the construction phase.

Need for Maintenance Dredging

- 3.3.5 The Applicant shall investigate any need for maintenance dredging during the operation stage. If such a need is identified, the Applicant shall assess and quantify the frequency, the likely extent of maintenance dredging required and associated potential environmental impacts.

3.4 Technical Requirements

- 3.4.1 The Applicant shall conduct an EIA study to address all environmental aspects of the activities described in the scope set out in section 3.2 above subject to the findings of the evaluation process specified in section 3.3. The EIA study shall be based on the best and latest information available during the course of the 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 study.
- 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 criteria and guidelines as stated in section 1 of Annex 4 and Annex 12 of the TM for evaluating and assessing the air quality impact.

Determination of Assessment Area

- 3.4.5.2 The area for air quality impact assessment shall be defined by a distance of 500m from the boundary of the Project works site, and may be extended depending on the circumstances and the scale of the Project. The assessment shall include but not limited to the existing, planned and committed sensitive receivers within the assessment area.
- 3.4.5.3 The Applicant shall assess the air pollutant concentrations with reference to the relevant sections of the guidelines attached to this study brief in Appendices A-1 to A-3 or other methodology as agreed by the Director.
- 3.4.5.4 The air quality assessment shall be based on the best available information at the time of assessment. The 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 had been taken into account in the planning of the Project to abate the air pollution impact. That is, the Applicant shall consider alternative construction methods/phasing programmes to minimize the air quality impact
- (c) Present the background air quality levels in the assessment area for the purpose of evaluating the cumulative air quality impact.

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

- (a) Identify and describe representative existing and planned/ committed ASRs that would likely be affected by the Project, 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 Lands Department, and any land use and development applications approved by Town Planning Board. 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 locations and description, including the names and uses of buildings and the height of the selected assessment points, shall be given. The separation distances of these ASRs from the nearest emission sources should also be provided.

- (b) Provide a list of air pollutant emission sources, including any nearby emission sources which are likely to have impact related to the Project based on the analysis of the constructional and operational activities of the Project in section 3.4.5.4 (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 odour from dredging activities during maintenance. Confirmation of the validity of the assumptions and the magnitude of the activities (e.g. volume of construction materials handled) shall be obtained from the relevant government/authorities and documented.
- (c) The Applicant shall confirm if dredging operation is required during the construction and operation stages, and, if affirmative, if odour nuisance would arise. In case of odour nuisance arising, the Applicant shall propose mitigation measures, including good site practices, for implementation.

(iii) Impact Assessment

Constructional Phase Impact

- (a) The Applicant shall follow the requirements of the Air Pollution Control (Construction Dust) Regulation to ensure constructional dust impacts are controlled within the relevant standards as stipulated in section 1 of Annex 4 of the TM. A monitoring and audit program shall be implemented during the construction stage to verify the effectiveness of the control measures and to ensure that the construction dust levels are brought under control. 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 shall be carried out to evaluate the construction dust impact at the identified ASRs. The Applicant shall follow the methodology set out in section 3.4.5.4 (iv) and (v) below when carrying out the quantitative assessment.

Operational Phase Impact

- (b) The Applicant shall assess the expected air pollution impacts at the identified ASRs based on the emission sources identified in section 3.4.5.4 (ii) (b) above. The Applicant shall propose suitable measures to ensure that the air quality impacts are brought under control.

(iv) Quantitative Assessment Methodology

- (a) If a quantitative assessment is required, the Applicant shall conduct the quantitative assessment with reference to relevant sections of modelling guidelines in Appendices A1 to A3 or any other methodology as agreed with the Director. The specific methodology must be documented to 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 calculation 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 related to activities identified in section 3.4.5.4 (i) above (types of pollutants and the averaging time concentration) to be evaluated and provide explanation for choosing these parameters for assessment of the air quality impact of the Project.
- (c) The Applicant shall calculate the cumulative air quality impact 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 summary tables 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 for determining buffer distances required.

(v) 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 proposed mitigating measures will comply with the criteria stipulated in section 1 of Annex 4 in the TM.

(vi) 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.

3.4.6 Noise Impact

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

3.4.6.2 The noise impact assessment for the Project shall include the following –

(i) Determination of Assessment Area

- (a) The area for the noise impact assessment shall include all areas within 300m from the Project site boundary or alternative Project alignment identified in the EIA study. 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 site boundary, provides acoustic shielding to those receivers further from the Project site. Subject to the agreement of the Director, the assessment area shall be expanded to include noise sensitive receivers (NSRs) at distances over 300m from the Project site boundary, which would be affected by the Project.

(ii) Provision of Background Information and Existing Noise Levels

- (a) The Applicant shall provide all background information relevant to the Project, including relevant previous or current studies. Unless required for determining planning standards, it will not be necessary to investigate the existing noise levels.

(iii) Identification of Noise Sensitive Receivers

- (a) The Applicant shall refer to Annex 13 of the TM when identifying noise sensitive receivers (NSRs). The NSRs shall include all existing NSRs and all 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 plans, including plans and drawings published by

Lands Department, and any land use and development applications approved by Town Planning Board. Photographs of the existing NSRs shall be appended to the EIA report.

- (b) The Applicant shall select assessment points to represent all identified NSRs for carrying out a 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 names and uses of buildings, 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 shall use the relevant planning parameters to work out representative site layouts for operational noise assessment purpose. Such assumptions together with any constraints identified, such as setback of building, building orientation and extended podium, shall be agreed with the relevant responsible parties including Planning Department and Lands Department.
- (iv) Provision of an Emission Inventory of the Noise Sources
- (a) The Applicant shall provide an inventory of noise sources including representative construction equipment for construction noise assessment, and traffic flow for operational noise assessment as appropriate. 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 impacts due to 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 arising from construction of the Project (excluding percussive piling) 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 paragraphs 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. In case blasting works are involved, it shall 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 from the removal of debris and rocks shall be fully assessed and adequate mitigation measures shall be recommended to reduce the noise impact.

- (c) To minimize the construction noise impact, alternative construction methods to replace percussive piling shall be explored and recommended as far as practicable.
- (d) If the unmitigated construction noise levels are found to exceed the relevant criteria, the Applicant shall propose practicable direct mitigation measures (including but not limited to movable barriers, enclosures, quieter alternative 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 to be undertaken in the restricted hours as defined in the Noise Control Ordinance (NCO). In case the Applicant needs to evaluate whether construction works in the restricted hours as defined in the NCO are feasible or not in the context of programming construction works, reference shall be made to the relevant technical memoranda issued under the NCO. In case the Applicant considers that there is an unavoidable need to conduct certain type of construction works during the restricted hours, detailed justifications should be provided with the assessment of the degree and duration of the noise impact. Regardless of the results of construction noise impact assessment for 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 recommendation chapter in the EIA report.

(vi) Operational Noise Assessment

The Applicant shall confirm in the EIA study if the proposed access road(s) will be open for use by channel maintenance vehicles only or open to use by the public. In the case that the proposed access road(s) will be open to use by the public in addition to maintenance vehicles, the Applicant shall conduct operational traffic noise impact assessment in accordance with the requirements set out below.

(a) Road Traffic Noise

(a1) Calculation of Noise Levels

The Applicant shall analyse the scope of the proposed road alignment(s) to identify the road sections for the purpose of traffic noise impact assessment. In determining whether the

traffic noise impact due to a road is considered significant, detailed information with respect to factors including at least change of nature of road, change of alignment and change of traffic capacity or traffic composition shall be assessed. The traffic noise impact shall be considered significant if the traffic noise level with the Project is greater than that without the Project at the design year by 1.0 dB(A) or more. Figures showing extents of new roads and existing roads shall be provided in the EIA report.

The Applicant shall calculate the expected road traffic noise using methods described in the U.K. Department of Transport's "Calculation of Road Traffic Noise" (1988). Calculations of future road traffic noise shall be based on the peak hour traffic flow in respect of the maximum traffic projection within a 15 years period upon commencement of operation of the Project. The Applicant shall calculate traffic noise levels in respect of each road section and the overall noise levels from combined road sections (both new and existing) at NSRs. The EIA report shall contain sample calculations and input parameters for at least 10 assessment points as requested by the Director. The Applicant shall provide the input data set of the traffic noise model in the format of electronic files in the EIA. Furthermore, the Applicant shall prepare and provide drawings (i.e. road-plots of the traffic noise model) of appropriate scale to show the road segments, topographic barriers, and assessment points of sensitive receivers input into the traffic noise model.

The Applicant shall provide input data sets of traffic noise prediction model adopted in the EIA study as requested by the Director for the following scenarios –

- (i) the unmitigated scenario in the assessment year;
- (ii) the mitigated scenario in the assessment year; and
- (iii) the prevailing scenario for indirect technical remedies eligibility assessment.

The data shall be in an electronic text file (ASCII format) containing road segments, barriers and noise sensitive receivers information. The data structure of the above file shall be agreed with the Director. CD-ROM(s) containing the above data shall be attached in the EIA report.

(a2) Presentation of Noise Levels

The Applicant shall present the prevailing and future noise levels in L_{10} (1 hour) at the NSRs at various representative floor levels (in m P.D.) on tables and plans of suitable scale.

A quantitative assessment at the NSRs for the proposed road alignments shall be carried out and compared against the criteria set out in Table 1A of Annex 5 of the TM. The potential noise impact of the Project shall be quantified by estimating the total number of dwellings, classrooms and other noise sensitive elements that will be exposed to noise levels exceeding the criteria set in Table 1A of Annex 5 in the TM.

(a3) Proposals for Noise Mitigation Measures

After rounding of the predicted noise levels according to the U.K. Department of Transport's "*Calculation of Road Traffic Noise*" (1988), the Applicant shall propose direct mitigation measures in all situations where the predicted traffic noise level due to the road sections exceeds the criteria in Table 1A of Annex 5 in the TM by 1 dB(A) or more. The direct mitigation measures listed under section 6.1, Annex 13 of the TM, such as the option of alternative land use arrangement, shall be thoroughly explored and evaluated with a view to reducing the noise level at the NSRs concerned to the level meeting the relevant noise criteria. Also, the feasibility, practicability, programming and effectiveness of the recommended mitigation measures should be assessed in accordance with section 4.4.2(k) of the TM. Specific reasons for not adopting certain direct mitigation measures in the design to reduce the traffic noise to a level meeting the criteria in the TM or to maximize the protection for NSRs as far as possible shall be clearly and specifically quantified and laid down in the EIA report.

Sections of barriers proposed to protect the existing NSRs shall be differentiated clearly from those proposed for protection of future or planned NSRs as the latter is only required to be constructed before occupation of the planned NSRs. To facilitate the phased implementation of the barriers under this principle, a barrier inventory showing intended NSRs (i.e. existing NSRs as distinct from planned NSRs) to be protected by different barrier sections to achieve different extent of noise reduction (to be quantified in terms of how many dB(A)) should be provided. The total number of dwellings, classrooms and other noise sensitive element that will be benefited by the provision of direct technical remedies shall be provided. In order to clearly present the extents/locations of the recommended noise mitigation measures, plans prepared

from 1:1,000 or 1:2,000 survey maps showing the mitigation measures (e.g. enclosures/barriers, low noise road surfacing, etc.) shall be included in the EIA report.

The total number of dwellings, classrooms and other noise sensitive elements that will still be exposed to noise above the criteria with the implementation of all recommended direct technical remedies shall be quantified. The Applicant shall provide in the EIA report the information of the recommended noise mitigation measures (such as barrier types, nominal dimensions at different cross-sections, extents/locations, lengths, mPD levels of barriers) in an electronic format as agreed by the Director.

In case where a number of NSRs cannot be protected by the recommended direct mitigation measures, the Applicant shall identify and estimate the total number of existing dwellings, classrooms and other noise sensitive elements which may qualify for indirect mitigation measures, the associated costs and any implications for such implementation. For the purpose of determining the eligibility of the affected premises for indirect technical remedies, reference shall be made to the following set of three criteria –

- (i) the predicted overall noise level from the road sections together with other traffic noise in the vicinity must be above a specified noise level (e.g. 70 dB(A) for domestic premises and 65 dB(A) for education institutions, all in $L_{10}(1hr)$);
- (ii) the predicted overall noise level is at least 1.0 dB(A) more than the prevailing traffic noise level, i.e. the total traffic noise level existing before commencement of the works to construct the road; and
- (iii) the contribution of the road sections to the increase in the predicted overall noise level from the new road must be at least 1.0 dB(A).

(vii) Assessment of Side Effects and Constraints

The Applicant shall identify, assess and propose means to minimize any side effects and to resolve any potential constraints due to the inclusion of any recommended direct mitigation measures.

(viii) Evaluation of Constraints on Planned Noise Sensitive Developments/
Land uses

For planned noise sensitive uses which will still be affected even with practicable direct mitigation measures in place, the Applicant shall propose, evaluate and confirm the practicability of additional measures within the planned noise sensitive uses and shall make recommendations on how these noise sensitive uses will be designed for the information of relevant parties.

The Applicant shall take into account agreed environmental requirements/constraints identified in the EIA study to assess the development potential of concerned sites, which shall be made known to the relevant parties.

3.4.7 Water Quality Impact

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

3.4.7.2 The study area for the water quality impact assessment shall include all areas within 300m from the Project site boundary, including but not limited to Hang Hau Tsuen stream catchment area and Inner Deep Bay. This assessment area could be extended to include other areas such as stream courses and the associated water system in the vicinity being impacted during the course of the EIA study if found justifiable.

3.4.7.3 The Applicant shall identify and analyze physical, chemical and biological disruptions of marine, estuarine or fresh water system(s), drainage system, catchment area(s), storm water channel and coastal water arising from the construction and operation of the Project.

3.4.7.4 The Applicant shall address water quality impacts due to construction and operation (including maintenance works) of the Project. Essentially, the assessment shall address the following –

- (i) Collect and review background information on the affected existing and planned water systems, their respective catchments and sensitive receivers which might be affected by the Project;
- (ii) Characterize water 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 survey 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, Outline Development Plans and Layout Plans, and any other relevant published landuse plans;

- (iv) Identify pertinent water quality objectives and establish other appropriate water quality criteria or standards for the water system(s) and all the sensitive receivers in section 3.4.7.4 (i), (ii) & (iii), including ecological sensitive receivers for the assessment covered in section 3.4.9 below;
- (v) Review the specific construction methods and configurations, and operation of the Project (including the proposed access road, footpaths, and maintenance works). Identify any alteration of the existing water courses, meander, natural streams, shoreline or bathymetry, flow regimes and ground water levels;
- (vi) Identify and quantify the existing and likely future water pollution sources and loading. An emission inventory on the quantities and characteristics of these existing and likely future pollution sources in the study area shall also be provided. Field investigation and laboratory test shall be conducted as appropriate to fill relevant information gaps;
- (vii) Assess the cumulative impacts due to other related concurrent and planned projects, and activities or pollution sources in Lau Fau Shan 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 impacts on the identified water system(s), respective catchments and sensitive receivers due to sewage arising from the construction stage. Any effluent generated will require appropriate collection, treatment and disposal to within the standards and objectives and criteria established in section 3.4.7.4 (iv) above;
- (ix) Assess and evaluate any potential storm water and construction runoff impacts on the water system(s), respective catchments and sensitive receivers during the construction stage and operational maintenance works (such as regular desilting and/or dredging) as to reduce the water quality impacts to within the standards, objectives and criteria established in section 3.4.7.4 (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) Assess the pattern of the sediment deposition and the potential increase in turbidity and suspended solids levels in the water column due to the disturbance of sediments during dredging, if any. The potential for the 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;

- (xi) Proposals for effective and practicable infrastructure upgrading or provision, water pollution prevention and mitigation measures to be implemented during the construction and operation stages to reduce water quality impacts to within the standards. Requirements to be incorporated in the Project contract document shall also be proposed;
- (xii) Best management practices to reduce storm water and non-point source pollution shall be investigated and proposed as appropriate;
- (xiii) Evaluate and quantify residual impacts on the affected water system(s) and sensitive receivers with regard to the appropriate water quality criteria, standards or guidelines; and
- (xiv) Specify an emergency contingency plan for the construction phase of the Project to contain and remove accidental spillage along the channel, access road(s) /haul road(s) at short notice and to prevent or to minimize the quantities of contaminants from the stream water and sensitive habitats.

3.4.8 Waste Management Implications

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

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

(i) Analysis of Activities and Waste Generation

- (a) Identification of the quantity, quality and timing of the waste arising as a result of the construction and operation activities, 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 and on-site or off-site re-use 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. Pre-treatment processes for slurry before disposal shall be addressed in detail. The disposal method recommended for each type of waste shall take into account the result of the assessment in section 3.4.8.2 (ii) (c) below.

- (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 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 analysed; 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 practical dredging methods to minimize dredging and dumping requirements and demand for fill sources based on the criterion that the existing marine mud shall be left in place and not to be disturbed as far as possible.

3.4.9 Ecological Impact (Both Terrestrial and Aquatic)

- 3.4.9.1 The Applicant shall follow the criteria and guidelines as stated in Annex 8 and Annex 16 of the TM for evaluating and assessing ecological impact. The assessment area for the purpose of terrestrial ecological assessment shall include all areas within 500m from the boundary of the works areas, or the area likely to be impacted by the Project. For aquatic ecology, the assessment area shall be the same as for water quality assessment described in section 3.4.7.2.
- 3.4.9.2 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. The assessment shall identify and quantify as far as possible the potential ecological impacts associated with the Project, including the impacts of any haul roads and temporary access. The potential impact on water quality and aquatic ecology from the discharge of storm water into Inner Deep Bay waters during the operational phase shall also be addressed.
- 3.4.9.3 The assessment shall include the following –
- (i) Review of the findings of relevant studies and collating all the available information regarding the ecological characters of the assessment area;
 - (ii) Evaluation of the information collected and identification of any information gap relating to the assessment of potential ecological impacts to the terrestrial and aquatic environment;
 - (iii) Carrying out necessary field surveys (the duration of which shall be at least 6 months covering the winter migratory bird season) and investigations to verify the information collected, fill the information gaps identified and fulfil the objectives of the EIA study;
 - (iv) Establishing a general ecological profile and describing the characteristics of each habitat found; major information to be provided shall include –
 - (a) Description of the physical environment;
 - (b) Preparation of habitat maps of suitable scale (1:1000 to 1:5000) showing the types and locations of habitats in the assessment area;
 - (c) Definition and characterization of the ecological characteristics of each habitat type, including size, vegetation type, species present, dominant species found, species diversity and abundance, community structure, seasonality and inter-dependence of the habitats and species, and presence of any features of ecological importance;

- (d) Presentation of representative colour photos of each habitat type and of any important ecological features identified; and
 - (e) Listing the species found that are rare, endangered and/or listed under local legislation, international conventions for conservation of wildlife/habitats or red data books.
- (v) Investigation and description of the existing wildlife uses of various habitats with special attention to those wildlife groups and habitats with conservation interest including –
- (a) the coastal protection area near Hang Hau Tsuen;
 - (b) the natural stream course and meanders of Hang Hau Tsuen stream;
 - (c) the ponds, inter-tidal mudflats and mangrove at or near the Project area;
 - (d) avifauna in particular waterbirds; and
 - (e) any other habitats and wildlife groups identified as having special conservation interest by the study.
- (vi) Description of all recognized sites of conservation importance in the proposed development site and its vicinity and assessment of whether these sites will be affected by the proposed development;
- (vii) Using suitable methodology, identification and quantification as far as possible of any direct, indirect, on-site, off-site, primary, secondary and cumulative ecological impacts such as destruction of habitats, reduction of species abundance/diversity, loss of feeding, nesting and/or breeding grounds, reduction of ecological carrying capacity, habitat fragmentation; and in particular the following –
- (a) ecological impacts of potential loss of areas of conservation interest such as natural stream courses, fish ponds, inter-tidal mudflats and mangrove;
 - (b) disturbance to wildlife during the construction stage in particular the impacts on waterbirds;
 - (c) impacts due to the potential sedimentation to the inter-tidal mudflats and Deep Bay during the construction stage;
 - (d) operational impacts on aquatic life and other wildlife in Deep Bay through periodic storm discharges at the portal; and

- (e) cumulative impacts due to other planned and committed development projects at or near the Project area.

If off-site mitigation is considered necessary to mitigate the environmental impact, the guidelines and requirements laid down in Annex 16 of the TM should be followed.

- (viii) Evaluation of the significance and acceptability of the ecological impacts identified using well-defined criteria;
- (ix) Recommendation of all possible alternatives, such as modifications of channel alignment, layout and design and practicable mitigation measures to avoid, minimize and/or compensate for the adverse ecological impacts identified, such as reinstatement of habitats temporarily affected by the proposed development to its original state and if appropriate with some enhancement features;
- (x) Evaluation of the feasibility and effectiveness of the recommended mitigation measures and definition of the scope, type, location, implementation arrangement, resources requirement, subsequent management and maintenance of such measures;
- (xi) Determination and quantification as far as possible of the residual ecological impacts after implementation of the proposed mitigation measures;
- (xii) Evaluation of the severity and acceptability of the residual ecological impacts using well-defined criteria; and
- (xiii) Review of the need for and recommendation for any ecological monitoring programme required.

3.4.10 Fisheries Impact

3.4.10.1 The Applicant shall follow the criteria and guidelines as specified in Annex 9 and Annex 17 of the TM for assessing fisheries impact.

3.4.10.2 The assessment area shall include 500m from the limit of the Project site boundary and any areas likely to be impacted by the Project. Special attention shall be given to the surrounding fish ponds and the oyster beds in Lau Fau Shan and Inner Deep Bay.

3.4.10.3 The study shall review and collate the existing information to provide adequate and accurate data for prediction and evaluation of impacts of the Project on fisheries. Any data gap shall be identified and the need for field surveys shall be determined. If field surveys are considered necessary, appropriate methodology, duration and timing of the surveys shall be recommended to provide the required data.

3.4.10.4 The fisheries impact assessment shall include the following major tasks –

- (i) Description of the physical environmental background;
- (ii) Description and quantification of the existing fisheries activities (e.g. pond culture and oyster farming);
- (iii) Description and quantification of the existing fisheries resources;
- (iv) Identification of parameters (e.g. water quality parameters) and areas that are important in the fisheries aspect;
- (v) Identification and quantification of any direct, indirect, on-site and off-site impacts to fisheries during the construction and operation phases (e.g. loss of fish ponds/oyster beds and temporary occupied areas);
- (vi) Evaluation of impacts and proposals for any practical alternatives or mitigation measures to prevent or minimize adverse impacts on fisheries; and
- (vii) Determination of any need for fisheries monitoring and, if necessary, recommendation of a monitoring and audit programme.

3.4.11 Landscape and Visual Impact

- 3.4.11.1 The Applicant shall follow the criteria and guidelines as stated in section 1 of Annex 10 and Annex 18 of the TM for evaluating and assessing landscape and visual impacts of the Project, including any above ground structures and work areas associated with the Project. The Landscape and visual impacts during both construction and operation phases within the assessment area shall be assessed.
- 3.4.11.2 The area for landscape impact assessment shall include all areas within 500m of the work limit of the Project while the area for the visual impact assessment shall be defined by the visual envelope of the Project.
- 3.4.11.3 The Applicant shall review relevant Outline Development Plan(s), Outline Zoning Plan(s) (OZP) such as Lau Fau Shan & Tsim Bei Tsui OZP and Ha Tsuen OZP, layout plan(s), other published land use plans, planning briefs and studies such as the North West New Territories (Yuen Long District) Development Statement, which may identify areas of high landscape value and recommended green belt and coastal protection area designations. Any guidelines on landscape strategy, landscape framework, urban design concept, building height profiles, designated view corridors, open space network and landscape link that may affect appreciation of the Project shall also be

reviewed. The aim is to gain an insight into the future outlook of the area affected so as to assess whether the Project can fit into the surrounding setting. Any conflict with statutory land use plan(s) shall be highlighted and appropriate follow-up action shall be recommended.

- 3.4.11.4 The Applicant shall describe, appraise, analyze and evaluate the existing landscape resources and character of the assessment area. A system should be derived for judging the significance of the landscape and visual impact as required under the TM. The sensitivity of the landscape framework and its ability to accommodate change shall be particularly focused on. The Applicant shall identify the degree of compatibility of the Project with the existing and planned landscape setting. The landscape impact assessment shall quantify the potential landscape impact 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.
- 3.4.11.5 The Applicant shall assess the visual impacts of the proposed project. Clear illustration including mapping of visual impact is required. The assessment shall include the following –
- (i) identification and plotting of visual envelope of the Project within the assessment area;
 - (ii) identification of the key groups of sensitive receivers within the visual envelope with regard to views from both ground/sea level and elevated vantage points;
 - (iii) description of the visual compatibility of the Project such as channel walls and associated access road(s), footbridge(s) and footpath(s) with the surrounding and the planned setting, and interference with key views of the adjacent areas; and
 - (iv) identification of the severity of visual impacts in terms of distance, nature and number of sensitive receivers. The visual impacts of the Project with and without mitigation measures shall be included so as to demonstrate the effectiveness of the proposed mitigation measures.
- 3.4.11.6 The Applicant shall evaluate the merits of preservation in totality, in parts or total destruction of existing landscape. In addition, alternative alignment, design and construction method that would avoid or reduce the landscape and visual impact 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 existing landscape. The Applicant shall recommend mitigation measures to minimize the adverse effects identified above, including provision of a landscape design.

- 3.4.11.7 The mitigation measures shall also include preservation of vegetation, transplanting of mature trees, provision of screen planting, re-vegetation of disturbed land, compensatory planting, design of structures, provision of finishes to structures, colour scheme and texture of material used and any measures to mitigate the disturbance of the existing land use. Parties shall be identified 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.
- 3.4.11.8 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 fully illustrate the landscape and visual impacts of the Project to the satisfaction of the Director. The Applicant shall record the technical details in preparing the illustration, which may need to be submitted for verification of the accuracy of the illustration.

4. ENVIRONMENTAL MONITORING & AUDIT (EM&A) REQUIREMENTS

- 4.1 The Applicant shall identify in the EIA study if there is a need for EM&A activities during construction and operation of the Project and, if affirmative, define the scope of the EM&A requirements for the Project in the EIA study.
- 4.2 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 monitoring data for the Project through a dedicated internet website.
- 4.3 The Applicant shall prepare a Project Implementation Schedule, in the form of a checklist as shown in Appendix B attached to this study brief, containing all 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.

5. SUMMARY OF ENVIRONMENTAL OUTCOMES

- 5.1 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.

6. DURATION OF VALIDITY

- 6.1 If the EIA study does not commence within 36 months after the date of issue of this study brief, the Applicant shall apply to the Director for a fresh EIA study brief before commencement of the EIA study.

7. REPORT REQUIREMENTS

- 7.1 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.
- 7.2 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, any addendum to the EIA report and the executive summary submitted in accordance with section 7.2 (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.
- 7.3 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.
- 7.4 In addition, to facilitate 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 Hyper Text 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 hyperlinks 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.

- 7.5 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.
- 7.6 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 up to date electronic copies.
- 7.7 To promote environmentally friendly and efficient dissemination of information, both hard copies 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.

8. OTHER PROCEDURAL REQUIREMENTS

- 8.1 If there is any change in the name of the Applicant for this EIA study brief, the Applicant mentioned in this study brief must notify the Director immediately.
- 8.2 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-318/2007), 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.

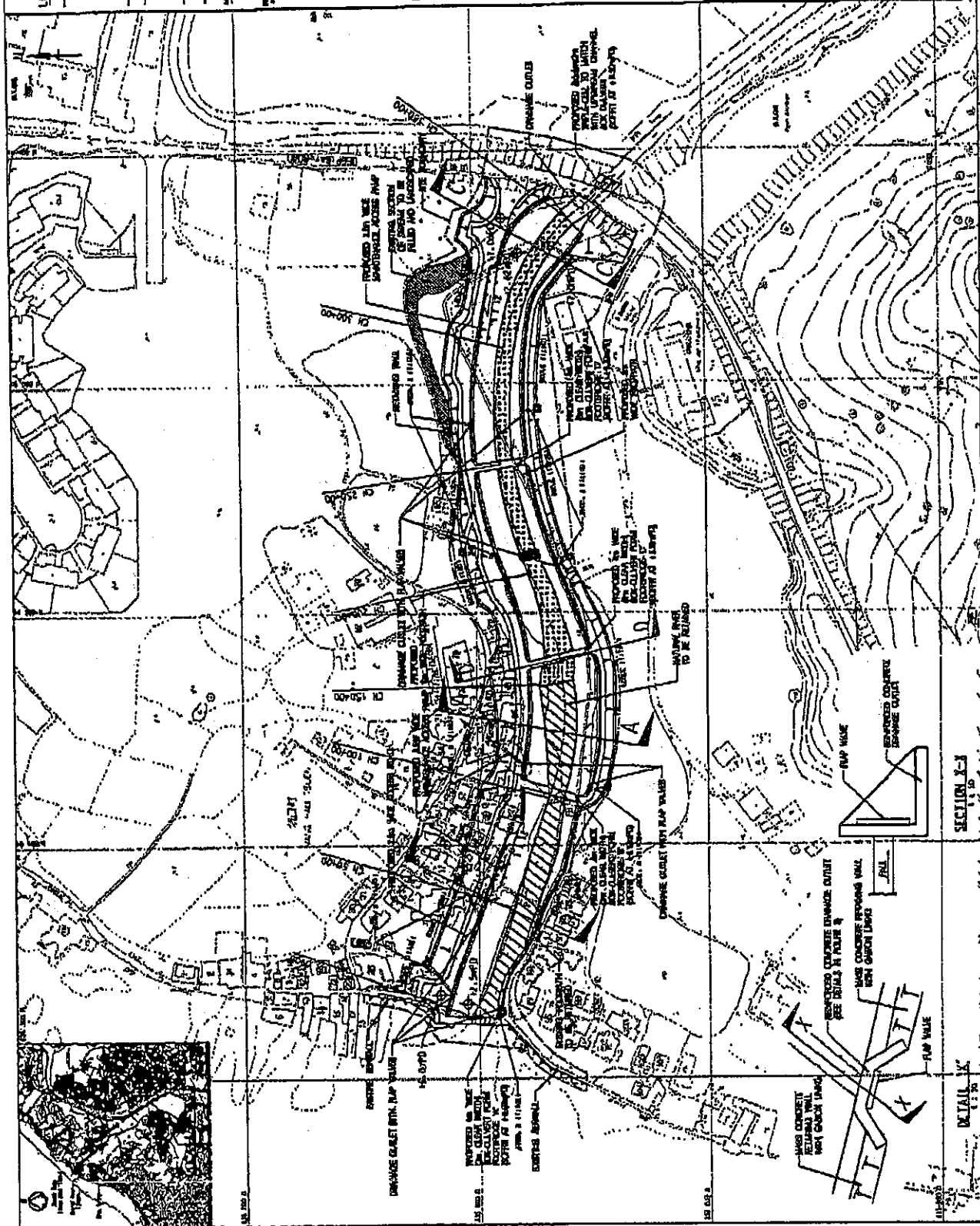
July 2007
Environmental Assessment Division
Environmental Protection Department



ESB-167/2007

Figure 1

Project Title - Hang Hau Tsuen Channel at Lau Fau Shan



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

- 1.1.1 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.

<u>Model</u>	<u>Applications</u>
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, σ_θ , needs to be provided as input to the CALINE4 model. Typical values of σ_θ 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/m²) 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 NO₂ to NO_x Ratio

The conversion of NO_x to NO₂ 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 NO₂:

- (a) Ambient Ratio Method (ARM) - assuming 20% of NO_x to be NO₂; or
- (b) Discrete Parcel Method (DPM, available in the CALINE4 model); or
- (c) Ozone Limiting Method (OLM) - assuming the tailpipe NO₂ emission to be 7.5% of NO_x and the background ozone concentration to be in the range of 57 to 68 µg/m³ 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): XLIXth 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.

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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.

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 Categorization

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 categorization 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 :

<u>POLLUTANT</u>	<u>URBAN</u>	<u>INDUSTRIAL</u>	<u>RURAL/NEW DEVELOPMENT</u>
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 :

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 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 :
- (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".
- 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 -

Appendix B

Project Implementation Schedule

EIA Ref.	EM&A Ref.	Recommended Mitigation Measures	Objectives of the Recommended Measures & Main Concerns to Address	Who to implement the measure ?	Location of the measure	When to implement the measure ?	What requirements or standards for the measure to achieve ?

- End -