

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

Environmental Impact Assessment Study Brief No. ESB-171/2007

Project Title: Installation of Submarine Gas Pipelines from Ma Tau Kok to North Point for Former Kai Tak Airport Development
(hereinafter referred to as “the Project”)

Name of Applicant: The Hong Kong and China Gas Company Limited
(hereinafter known as the “Applicant”)

1. BACKGROUND

- 1.1 An application (No. ESB-171/2007) for an Environmental Impact Assessment (EIA) study brief under section 5(1) of the Environmental Impact Assessment Ordinance (EIAO) was submitted by the Applicant on 28 September 2007 with a Project Profile (No. PP-328/2007).
- 1.2 The Project Profile proposes to construct a new gas pipeline network from To Kwa Wan to North Point so as to replace the existing one affected by the Proposed Cruise Terminal at Kai Tak and the proposed Central Kowloon Route at To Kwa Wan.
- 1.3 The Project will include the followings:
- (i) twin submarine gas pipelines across the Victoria Harbour from Ma Tau Kok in To Kwa Wan to North Point;
 - (ii) two land gas pipelines at To Kwa Wan and North Point respectively; and
 - (iii) two gas stations for pigging operation and provisional pressure regulation at Ma Tau Kok and North Point respectively.

The submarine gas pipelines from Ma Tau Kok to North Point are proposed to be laid within a corridor in Victoria Harbour as shown in Figure 1.

- 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 this EIA study is to provide information on the nature and extent of environmental impacts arising from 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 the proposed mitigation measures are implemented.

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 provide information on the consideration of alternatives/options for (a) alignment(s) of the submarine gas pipelines and (b) locations of the associated gas stations; and to compare the environmental benefits and dis-benefits in selecting the preferred alternative/option;
- (iii) to provide information for any proposed above ground structures to demonstrate that the proposed above ground structures would avoid/ minimize any adverse visual impacts to the surroundings areas;
- (iv) to identify and describe elements of community and environment likely to be affected by the Project and/or likely to cause adverse impacts to the Project, including natural and man-made environment;
- (v) to identify and assess water quality impact, waste management implication, marine ecological impact, fisheries impact, landscape impact, hazards to life, cultural heritage impact, construction noise impact and dust impact; and determine the significance of impacts on sensitive receivers and potential affected uses;
- (vi) 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;
- (vii) 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;
- (viii) 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 reducing them to acceptable levels;
- (ix) to investigate the extent of the secondary environmental impacts that may arise from the proposed mitigation measures, and to identify the constraints associated with the mitigation measures recommended in the EIA study as well as the provision of any necessary modification;
- (x) to identify any individual project element(s) and associated works of the Project that fall under Schedule 2 of the EIA Ordinance; to ascertain whether the findings of this EIA study have adequately addressed the environmental impacts of those projects; and, where necessary, to identify the outstanding issues that need to be addressed in any further detailed EIA study; and
- (xi) to design and specify 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

The purpose of this EIA 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 the Environmental Impact Assessment Process of the Environmental Impact Assessment Ordinance (hereinafter referred to as the TM) are fully complied with.

3.2 The Scope

The scope of this EIA study shall cover the Project mentioned in Sections 1.2 and 1.3 above, with the proposed works area as shown in Figure 1. 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) the potential water quality impacts arising from the dredging, backfilling and other associated activities of the Project;
- (ii) the potential impacts of various types of waste to be generated from the Project;
- (iii) the potential marine ecological impacts arising from the dredging, backfilling and other associated activities of the Project;
- (iv) the potential fisheries impacts arising from the dredging, backfilling and other associated activities of the Project;
- (v) the potential impacts on the landscape characters and resources caused by the proposed development and associated facilities, including the land gas pipelines and gas stations to the nearby environment during the construction and operation of the Project;
- (vi) the potential hazard to life arising from the construction and operation of the Project;
- (vii) the potential cultural heritage impact on marine archaeological deposit likely to be affected by the dredging activities of the Project;
- (viii) the potential construction noise and dust impacts arising from the Project;
- (ix) the potential cumulative environmental impacts of the Project through interaction or in combination with other concurrent existing, committed and planned developments in the vicinity of the Project (e.g. the Dredging Works for the Proposed Cruise Terminal at Kai Tak, the Decommissioning of the Former Kai Tak Airport, Wan Chai Development Phase II and Central-Wan Chai Bypass, Central Reclamation Phase III, Laying of Western Cross Harbour Main and Associated Land Mains from West Kowloon to Sai Ying Pun, any decommissioning/dredging works for the existing cross-harbour gas pipeline(s), etc.) Particular attention shall focus on those impacts identified to have a direct bearing on the environmental acceptability of the Project.

3.3 Consideration of Alternative Project Options and Construction Methods

3.3.1 The Need of the Project

The Applicant shall report on or provide information related to the need and justification for the Project described in Sections 1.2 and 1.3 above. The Applicant shall explain clearly the purpose and objectives of the Project and describe the scenarios with and without the Project. The Applicant shall explain the relationship between the existing cross-harbour gas pipeline(s)/gas pigging stations and the proposed gas pipelines and stations in the Project.

3.3.2 Consideration of Alternatives/Options for Pipeline Alignment and Gas Stations Locations/Deigns

The Applicant shall consider other feasible alternatives/options for the pipeline alignment for the Project. Alternative locations/design of the two gas stations shall be also investigated including the options of (i) locating the gas station(s) and associated facilities/gas pipes wholly or partly underground and/or outside the existing/planned "Open Space" zones as shown on the concerned Outline Zoning Plan; and (ii) connection to and expansion (if necessary) of the existing gas station(s) in the vicinity. The Applicant shall compare the environmental impacts as well as the environmental benefits and dis-benefits of each of the options of pipeline alignment and locations of gas stations, and provide reasons for selecting the final preferred option including the environmental factors played in the selection.

3.3.3 Consideration of Alternative Construction Method(s)

The EIA study shall explore alternative construction method(s) for the Project/part of the Project, such as methods to avoid/minimise disturbance to the seabed or methods adopted in other similar project(s) (e.g. horizontal directional drill, grab dredging and jetting), and compare the environmental benefits and disbenefits of applying different construction method(s) for the Project.

3.3.4 Selection of Preferred Scenario

Taking into the comparisons in Sections 3.3.1 to 3.3.3 above, the Applicant shall recommend/justify the selection of the preferred scenario that will avoid or minimize adverse environmental effects arising from the Project, and adequately describe the part that environmental factors played in arriving at the final selection. The Applicant shall provide descriptions of the Project and associated works to allow that the assessments as required in the EIA study brief be conducted. In particular:

- (i) The Applicant shall identify any individual project elements and associated works of the Project that fall under Schedule 2 of the EIA Ordinance, such as the twin submarine gas pipeline mentioned in the Project Profile to be a designated project under Item H.2, Part I, Schedule 2 of the EIA Ordinance; and any dredging operation which is less than 100m from a seawater intake point is also a designated project under Item C.12, Part I, Schedule 2 of the EIA Ordinance.

- (ii) The Applicant shall state whether or not, and if applicable describe any decommissioning/removal works of the existing cross-harbour submarine pipeline(s) and gas pigging station(s) that will be included in the scope of the Project.
- (iii) The Applicant shall provide location plans, layout plans, sections, elevations with dimensions in appropriate scales, and illustrative materials including perspective drawings, photomontages from key viewpoints for any proposed above ground structures in the planned context to demonstrate that the scale, form and appearance of the proposed above ground structures with visual mitigation measures would avoid/ minimize any adverse visual impacts to the surroundings areas.

3.4 Technical Requirements

The Applicant shall conduct the EIA study to address all environmental aspects of the Project as described in Sections 3.1, 3.2 and 3.3 above. The assessment shall be based on the best and latest information available during the course of the EIA study. 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 as identified in the EIA study, including any phased implementation of the Project and the associated works.

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

3.4.1 Water Quality Impact (Construction Stage)

- 3.4.1.1 The Applicant shall follow the relevant criteria and guidelines for evaluating and assessing water pollution as stated in the Main text, Annex 6 and Annex 14 of the TM respectively.
- 3.4.1.2 The assessment area for this water quality impact assessment shall cover the Victoria Harbour Water Control Zone, Western Buffer Water Control Zone and Eastern Buffer Water Control Zone as designated under the Water Pollution Control Ordinance (WPCO). Water quality sensitive receivers including seawater intakes and sensitive coral sites in the above areas shall be addressed in the water quality assessment. The assessment area could be extended to include other areas if they are found also being impacted during the course of the EIA study and have a bearing on the environmental acceptability of the Project.
- 3.4.1.3 The Applicant shall identify and analyse physical, chemical and biological disruptions of marine water and coastal water arising from the Project.
- 3.4.1.4 The Applicant shall predict, quantify and assess any water quality impacts arising from the Project on the water system(s) and the sensitive receivers by appropriate

mathematical modelling and/or other techniques proposed by the Applicant and agreed by the Director. The mathematical modelling requirements are set out in Appendix A to this study brief. The impacts shall include any significant changes in hydrology, flow regime, sediment erosion and deposition patterns, water and sediment quality and marine organisms/community due to the dredging and backfilling for the laying of the submarine pipeline and any marine works; any hydrostatic/commissioning tests of the gas pipeline system; sewage, wastewater and surface runoff from construction activities. The prediction shall include different implementation stages or sequences.

3.4.1.5 The Applicant shall take into account and include likely different implementation stages or sequences of the Project in the assessment. The assessment shall have regard to the phasing, frequency, duration and rate of dredging and its sediment loading. Essentially the assessment shall address the following:

- (i) Collection and review of background information on the existing and planned water system(s) and sensitive receivers which might be affected by the Project;
- (ii) Characterization of water and sediment quality of the water system(s) and sensitive receivers which might be affected by the Project based on existing information or appropriate site survey and tests;
- (iii) Identification and analysis of existing and planned future activities and beneficial uses related to the affected water system(s). The Applicant shall refer to, inter alia, those developments and uses earmarked on the relevant Preliminary Outline Development Plans, Outline Zoning Plans, Development Permission Area Plans, Outline Development Plans, Layout Plans and other relevant published land use plans;
- (iv) Identification of pertinent water and sediment quality objectives and establishment of other appropriate water and sediment quality criteria or standards for the water system(s) and all the sensitive receivers as mentioned in sub-section (i), (ii) and (iii) above, including ecological sensitive receivers for the assessments covered in Section 3.4.3;
- (v) Review of the construction sequences and methods of the Project to identify any alteration of shoreline, bathymetry and flow regimes;
- (vi) Review the specific construction sequence and methods of the Project, such as, the dredging and filling methods; dredging rates; handling, treatment and disposal of effluent arising from hydrostatic/commissioning test, if applicable. Evaluate and identify best practicable dredging and backfilling methods to minimize, to the maximum practicable extent, marine mud disturbance, the need for dumping and any demand for fill sources. The Applicant shall work on the presumption that existing marine mud shall be left in place and not be disturbed as far as practicable. The selected method shall take into consideration the need to protect relevant water sensitive receivers and the need to reduce to the maximum practicable extent the creation of visually intrusive sediment plume to key vantage points, such as

commercial buildings fronting the harbour. Where appropriate, the effectiveness of mitigation measures to reduce the size of such plumes shall be included.

- (vii) Identification and quantification of existing and likely future water and sediment pollution sources and loading. An emission inventory on the quantities and characteristics of these existing and likely future pollution sources in the assessment area shall also be provided. Field investigation and laboratory test, as appropriate, shall be conducted to fill relevant information gaps;
- (viii) Prediction and quantification, by mathematical modelling or other technique agreed by the Director, of impacts due to the Project on the water system(s) and the sensitive receivers. The mathematical modelling requirements are set out in Appendix A of this Study Brief. The impacts include any significant change in hydrology, flow regime, both the local and regional effects on erosion, sediment re-suspension, sediment dispersion, water and sediment quality and the effects on the marine organisms/communities due to the dredging of marine sediment, backfilling activities and any other marine works of the Project. The assessment shall also take into account the additional pollution loading and oxygen demand exerted by disturbed sediment during dredging and shall include different construction stages of the Project;
- (ix) Identification and quantification of all dredging, filling, sediment/mud transportation and disposal activities and requirements of the Project. Potential fill source and dumping ground to be involved shall also be identified and cumulative environmental impacts shall be evaluated. Field investigation, sampling and chemical and biological laboratory tests to characterize the sediment/mud concerned shall be conducted as appropriate. If significant amount of contaminants are found presence in the sediment/mud concerned, the potential for the release of contaminants during dredging shall be addressed using the chemical testing results derived from sediment samples collected on site and relevant historic data. Appropriate laboratory tests such as elutriate tests shall be performed on the sediment samples to simulate and quantify the degree of mobilization of various contaminants such as metals, ammonia, trace organic contaminants (including PCBs, PAHs, TBT and chlorinated pesticides) into the water column during dredging. The ranges of parameters to be analyzed; the number, location, depth of sediment, type and methods of sampling; sample preservation; and chemical and biological laboratory test methods to be used shall be subject to the agreement of the Director. If applicable, the Applicant can make reference to previous studies and investigations and confirm with the Director whether the information and findings of such studies/ investigations are still relevant and valid for the EIA Study. The Applicant shall also assess the pattern of the sediment deposition and the potential increase in turbidity and suspended solid levels in the water column and at the sensitive receivers due to the disturbance of sediments during dredging and filling;

- (x) Assessment of the cumulative impacts due to other concurrent and planned projects, activities or pollution sources along the identified water system(s) and sensitive receivers that may have a bearing on the environmental acceptability of the Project through mathematical modelling.
- (xi) Recommendation of appropriate mitigation measures to avoid or minimize the impacts identified above, in particular suitable mud dredging and disposal methods and arrangement shall be recommended to mitigate any adverse impacts. The residual impacts on the water system(s) and the sensitive receivers with regard to the relevant water and sediment quality objectives, criteria, standards or guidelines shall be assessed and quantified using appropriate mathematical models as set out in Appendix A to this study brief.

3.4.2 Waste Management Implications

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

3.4.2.2 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, in particular the dredged sediment, as a result of the construction 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 (in particular the dredged sediment), opportunities for reducing waste generation and on-site or off-site reuse 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 maximising waste reduction shall be separately considered.
- (b) Having taken into account the opportunities for reducing waste generation and maximizing reuse, 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 described in detail. The disposal method recommended for each type of wastes shall take into account the result of the assessment set out in (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 & odour emissions;
 - noise;
 - wastewater discharge; and
 - public transport.

- (iii) Dredging, Filling and Dumping
- (a) If dredging, filling or dumping is required, all dredging, fill extraction, filling, mud/sediment transportation and disposal activities and other requirements shall be identified and quantified. Potential fill source and dumping ground to be involved shall also be identified. The Applicant may refer to relevant historic data of sediment quality in previous EIA/studies or conduct appropriate field investigation, sampling and chemical and biological laboratory tests to characterize the sediment/mud concerned. The ranges of parameters to be analyzed; the number, type and methods of sampling; sample preservation; chemical and biological laboratory test method; and the laboratory to be used shall be subject to the approval of the Director. 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. The Applicant shall identify the most appropriate treatment and/or disposal arrangement for the dredged sediment 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 marine mud shall be left in place and not to be disturbed as far as practicable.

3.4.3 Marine Ecological Impact

- 3.4.3.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing ecological impact as stated in Annexes 8 and 16 of the TM, respectively.
- 3.4.3.2 The assessment area for the purpose of this ecological impact assessment shall be the same as the assessment area for Water Quality Impact Assessment, and to include any other area likely to be impacted by the Project.
- 3.4.3.3 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. The assessment shall identify and quantify the potential ecological impacts associated with the Project including both directly by physical disturbance and indirectly by changes of water quality.
- 3.4.3.4 The assessment shall include the following major tasks:
- (i) review the findings of relevant studies and collate the available information regarding the ecological characters of the assessment area;
- (ii) evaluate information collected and identify any information gap relating to the assessment of potential ecological impacts to coastal and aquatic environment;

- (iii) determine if there is any need for field surveys; and subsequently carry out the field surveys and investigations if necessary to verify the information collected, fill the information gaps identified and fulfil the objectives of the EIA study;
- (iv) establish the general ecological profile and describe the characteristics of each habitat found; major information to be provided shall include:
 - (a) description of the physical environment;
 - (b) habitat maps of suitable scale (1:1000 to 1:5000) showing the types and locations of habitats in the assessment area;
 - (c) ecological characteristics of each habitat type such as size, vegetation and/or substrate type, species present, dominant species found, species diversity and abundance, community structure, seasonal patterns, inter-dependence of the habitats and species, and presence of any features of ecological importance (e.g. corals);
 - (d) representative colour photos of each habitat type and any important ecological features identified;
 - (e) species found that are rare, endangered and/or listed under local legislation, international conventions for conservation of wildlife / habitats or red data books;
- (v) investigate and describe the existing wildlife uses of various habitats;
- (vi) describe recognized sites of conservation importance in the assessment area, and assess whether these sites will be affected by the Project or not;
- (vii) using suitable methodology and considering also other concurrent and planned projects to identify and quantify any direct, indirect (e.g. changes in water quality, hydrodynamic properties, flow regimes, sedimentation rates and patterns, hydrology, etc), on-site, off-site, primary, secondary and cumulative ecological impacts such as destruction of habitats, reduction of species abundance/diversity, loss of feeding and breeding grounds, reduction of ecological carrying capacity and habitat fragmentation, etc;
- (viii) identify ecological sensitive receivers including sensitive elements of marine subtidal habitats, (e.g. sensitive coral sites) and intertidal communities/ habitats which would be potentially affected directly or indirectly by the Project;
- (ix) evaluate the significance and acceptability of the ecological impacts identified using well-defined criteria;

Ecological Mitigation

- (x) consider, evaluate and recommend practicable alternatives and practicable mitigation measures to avoid, minimize, and/or compensate for the adverse ecological impacts identified;
- (xi) 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;
- (xii) determine and quantify the residual ecological impacts after implementation of the proposed mitigation measures;
 - (xiii) evaluate the severity and acceptability of the residual ecological impacts using well-defined criteria and determine if off-site mitigation measures are necessary to mitigate the residual impacts; and
 - (xiv) review and recommend any ecological monitoring programme required.

3.4.4 Fisheries Impact Assessment

- 3.4.4.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing fisheries impact as stated in Annex 9 and Annex 17 of the TM.
- 3.4.4.2 The assessment area for fisheries impacts shall be the same as that for water quality impact assessment stated in Section 3.4.1 and include any areas likely to be affected by the project.
- 3.4.4.3 The assessment shall cover any potential impact of the proposed project on both capture and culture fisheries during both the construction and operation stages. During the construction stage, works such as dredging for pipe laying and backfilling with rock armour may cause significant impact on fisheries resources. The Applicant shall assess the fisheries impact due to any temporary loss of fishing ground during the construction stage of the Project. During the operation stage, the gas pipeline would need protection by rock armour, which if protruding above the seabed, may affect some fishing activities such as trawling. The Applicant shall assess the long term fisheries impact during the operational stage of the Project.
- 3.4.4.4 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.
- 3.4.4.5 The fisheries impact assessment shall include the following tasks:
 - (i) Description of the physical environmental background;
 - (ii) Description and quantification as far as practicable of existing capture and culture fisheries activities;
 - (iii) Description and quantification as far as practicable of the existing fisheries resources (e.g. major fisheries products and stocks);
 - (iv) Identification of parameters (e.g. water quality parameters) and areas that will be affected by the project;

- (v) Identification and quantification as far as practicable of any direct/indirect and onsite/offsite impacts to fisheries;
- (vi) Evaluate the impacts and make recommendations for any environmental mitigation measures, with details on justification, description of scope and programme, feasibility as well as staff and financial implications including those related to subsequent management and maintenance requirements of the proposals; and
- (vii) Review the need for monitoring and, if necessary, recommend a monitoring and auditing programme.

3.4.5 Hazard To Life

3.4.5.1 It is noted that the gas safety aspect of the Project is controlled under the Gas Safety Ordinance (Cap. 51). Making reference to the Gas Safety Ordinance and/or other relevant guidelines, the Applicant shall provide hazard assessment information on the hazard associated with relevant aspects of the construction and operation of the proposed submarine gas pipeline, the gas stations and associated facilities. The information shall include the following:

- (i) description and review of the design of the submarine gas pipelines and the gas stations;
- (ii) identification of potential hazards associated with these installations and evaluation of the potential safety impacts to the public and the environment; and;
- (iii) recommendations on appropriate risk mitigation measures.

3.4.6 Landscape Impact

3.4.6.1 The Applicant shall follow the criteria and guidelines as stated in Annexes 10 and 18 of the TM and make reference to EIAO Guidance Note No.8/2002 on the preparation of Landscape Impact Assessment under the EIAO. Given that the pipeline alignment and the location/design/layout/scale of the gas stations have not been fixed; and the proposed gas stations are located at prominent waterfront locations facing the Victoria Harbour within "Open Space" zones as shown on the concerned Outline Zoning Plans, landscape impacts during both construction and operation phases within the assessment area for landscape impact assessment and the related works areas shall be assessed.

3.4.6.2 The assessment area for landscape impact assessment shall include areas within a 100m distance from the site boundary of the works areas.

3.4.6.3 The Applicant shall review relevant plan(s) and/or studies which may identify areas of high landscape value, open space/park, coastal protection area, green belt and conservation area designations. Any guidelines on landscape and urban design

strategies and frameworks 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 affected 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 shall be highlighted and appropriate follow-up action shall be recommended.

- 3.4.6.4 The Applicant shall describe, appraise, analyze and evaluate the existing and planned landscape resources and character of the assessment area. A system shall be derived for judging landscape impact significance as required under the TM and make reference to EIAO Guidance Note No. 8/2002. 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 impact assessment. Descriptive text shall provide a concise and reasoned judgement from a landscape point of view. 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 practicable so as to illustrate the significance of such impacts arising from the proposed development. Clear mapping of the landscape impact is required. If existing trees are found within the assessment area, a broad brush tree survey shall be carried out and the impacts on existing trees shall be addressed.
- 3.4.6.5 The Applicant shall evaluate the merits of preservation in totality, in parts or total destruction of existing landscape and the establishment of a new landscape character area. In addition, alternative location, site layout, design and construction methods that will avoid or reduce the identified landscape 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 existing landscape quality. The Applicant shall recommend mitigation measures to minimize the adverse effects identified above, including provision of a master landscape design.
- 3.4.6.6 The mitigation measures shall also include the preservation of vegetation, transplanting of mature trees, provision of screen planting, re-vegetation of disturbed lands, compensatory planting, design of structure, provision of finishes to structure, colour scheme and texture of material used and any measures to mitigate the impact on the existing and planned 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 recommendation measures shall be provided.
- 3.4.6.7 Annotated illustration materials such as colour perspective drawing, plans and section/elevation diagrams, annotated oblique aerial photographs, photographs taken at vantage points, and computer-generated photomontage shall be adopted to illustrate the landscape impacts of the Project. In particular, the landscape impacts of the Project with and without mitigation measures shall also be properly illustrated in

existing and planned setting 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. 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.

3.4.7 Cultural Heritage Impact

3.4.7.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing the cultural heritage impact as stated in Annexes 10 and 19 of the TM, respectively.

3.4.7.2 The Applicant shall engage a qualified marine archaeologist to conduct a marine archaeological review based on the best available information to identify whether there is any potential existence of sites or objects of cultural heritage within the seabed that will be affected by the marine works of the Project, whether the identified issues can be mitigated and whether there is a need for more detailed investigation. The review should take into account the results of previous marine archaeological investigations, the dredging history and other diving records. If marine archaeological potential is identified and the need for further investigation is confirmed, a marine archaeological investigation shall be carried out to ascertain the marine archaeological value of the affected seabed area. If a marine archaeological investigation is required, the applicant shall propose a suitable programme of investigation, including those investigations that may be necessary during the detailed design stage and should be followed up during the project implementation, for agreement with the Director. The marine archaeological investigation, if required, shall be carried out by a qualified marine archaeologist who shall obtain a Licence from the Antiquities Authority under the provision of the Antiquities and Monuments Ordinance (Cap. 53), and in accordance with the established guidelines set out by the Antiquities and Monuments Office. If significant archaeological remains are discovered, appropriate mitigation measures shall be designed for implementation.

3.4.8 Noise Impact (Construction Stage)

3.4.8.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing the construction noise impacts arising from the Project as stated in Annexes 5 and 13 of the TM respectively.

3.4.8.2 The noise impact assessment shall include the following:

(i) Determination of Assessment Area

The assessment area shall include all areas within a distance of 300m from the Project boundary. Subject to the agreement of the Director, the assessment area could be reduced accordingly if the first layer of noise sensitive receivers (NSRs) or other building structures, closer than 300m from the boundaries of the Project, provides acoustic shielding to those receivers at further distance behind. Similarly, subject to the agreement of the Director, the assessment area shall be expanded to include NSRs at distance greater than 300m from the boundaries of the Project which are noise sensitive if they may be affected by the construction

of the Project.

(ii) Provision of Background Information and Existing Noise Levels

The Applicant shall provide background information relevant to the Project, e.g. relevant previous or current studies. Unless involved in 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 existing NSRs and planned/ committed noise sensitive developments and uses earmarked on the relevant Outline Zoning Plans, Outline Development Plans and Layout Plans, and other relevant published land use plans (including schools close to the proposed Ma Tau Kok site).

(b) The Applicant shall select assessment points to represent all identified NSRs for carrying out quantitative noise assessment as described below. The assessment points shall be agreed with the Director prior to the quantitative noise assessment and may be varied subject to the best and latest information available during the course of the EIA study. A map shall be given showing the location of each and every selected assessment points.

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

The Applicant shall provide inventory of noise sources including representative construction equipment assumed for assessing construction noise. Confirmation of the validity of the inventory shall be obtained from the relevant government departments or authorities.

(v) Construction Noise Assessment

(a) Based on best information, the assessment shall cover the cumulative noise impacts due to the construction works of the Project and other projects and works in the vicinity.

(b) The Applicant shall carry out assessment of noise impact from construction (excluding percussive piling) of the project during day time, i.e. 7 a.m. to 7 p.m., on weekdays other than general holidays in accordance with the methodology stipulated in 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.

(c) 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 task) to

minimize the impact. If the mitigated noise levels still exceed the relevant criteria, the duration of the noise exceedance shall be given.

- (d) In case the Applicant would like to evaluate whether construction works in restricted hours as defined under the Noise Control Ordinance (NCO) are feasible or not in the context of programming construction works, reference should be made to the relevant technical memoranda issued under the NCO. Regardless of the results of the construction noise impact assessment for restricted hours, the Noise Control Authority will process the Construction Noise Permit (CNP) application, if necessary, based on the NCO, the relevant technical memoranda issued under the NCO, and the contemporary conditions/situations. This aspect should be explicitly stated in the noise chapter and the conclusions and recommendations chapter in the EIA report.

(vi) Assessment of Side Effects and Constraints

The Applicant shall identify, assess and propose means to minimise any side effects and to resolve any potential constraints due to the inclusion of any recommended direct technical remedies.

3.4.9 Construction Dust Impact

3.4.9.1 The Applicant shall follow the requirements of the Air Pollution Control (Construction Dust) Regulation in dust control to ensure construction dust impacts are controlled within the relevant standards as stipulated in section 1 of Annex 4 of the TM. A monitoring and audit programme during construction stage shall be initiated to verify the effectiveness of the control measures and to ensure that the construction dust levels be brought under control.

3.4.9.2 If the Applicant anticipates a significant construction dust impact that will likely cause exceedance of the recommended limits in the TM at the Air Sensitive Receivers (ASRs) despite incorporation of the dust control measures stated in Section 3.4.9.1 above, a quantitative assessment should be carried out to evaluate the construction dust impact at the identified ASRs. The Applicant shall follow the methodology below when carrying out the quantitative assessment. The construction dust impact assessment shall include the following:

- (i) The Applicant shall follow the criteria and guidelines for evaluating and assessing construction dust impact as stated in section 1 of Annex 4 and Annex 12 of the TM, respectively.
- (ii) The assessment area for construction dust impact assessment shall generally be defined by a distance of 500 m from the boundary of the Project site, yet it may be extended depending on the circumstances and the scale of the Project.

- (iii) The Applicant shall assess the air pollutant concentrations with reference to relevant sections of the Guidelines for Local-Scale Air Quality Assessment Using Models in Appendices B-1 to B-3 of this Study Brief, or any other methodology as agreed with the Director (with reference to S.4.4.2(c) of TM) prior to the commencement of the assessment.

- (iv) Background and Analysis of Activities
 - (a) Provide background information relating to air quality issues relevant to the Project, e.g. description of the types of activities of the Project.
 - (b) Give an account, where appropriate, of the consideration / measures that had been taken into consideration in the planning of the Project to abate the construction dust impact. That is, the Applicant shall consider alternative construction method(s) / phasing programme(s) to minimize the construction dust impact.
 - (c) Present the background air quality levels in the assessment area for the purpose of evaluating the cumulative construction dust impacts.

- (v) Identification of 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. The Applicant shall select the assessment points of the identified ASRs such that they represent the worst impact point of these ASRs. A map showing the location and a description including the name of the buildings, their uses and height of the selected assessment points shall be given. The separation distances of these ASRs from the nearest emission sources should 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. Examples of construction stage emission sources include stock piling, blasting, concrete batching and vehicular movements on unpaved haul roads on site, etc.

- (vi) Quantitative Assessment Methodology
 - (a) The Applicant shall apply the general principles enunciated in the modeling guidelines while making allowance for the specific characteristic of the Project. This 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. Details of the calculation of the emission rates of air pollutants for input to the modeling shall be presented in the report. The

Applicant must ensure consistency between the text description and the model files at every stage of submission. In case of doubt, prior agreement of the methodology between the Applicant and the Director should be sought.

- (b) The Applicant shall identify the key / representative air pollutant parameters (types of pollutants and the averaging time concentration) to be evaluated and provide explanation for choosing these parameters for the assessment of the impact of the Project.
- (c) The Applicant shall calculate the cumulative construction dust 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 construction dust impacts (both unmitigated and mitigated) shall be presented in the form of summary table and pollution contours, for comparison with 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 contour for determining buffer distances required.
- (d) The Applicant shall propose remedies and mitigation measures where the predicted construction dust impact exceeds the criteria set 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.
- (e) Input and output file(s) of the model run(s) shall be submitted to the Director in electronic format.

3.4.10 Impacts Summary

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

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

To facilitate efficient retrieval, a summary to include the assessment methodologies and key assessment assumptions adopted in this EIA study, the limitations of these

assessment(s) methodologies/assumptions, if any, plus all relevant prior agreement(s) with the Director or other Authorities on individual environmental media assessment components shall be provided in the EIA report. The proposed use of any alternative assessment tool(s) or assumption(s) of all environmental issues/media to be assessed have to be justified by the Applicant, with supporting documents based on cogent, scientific and objectively derived reason(s) before seeking the Director's agreement. This summary and all related supporting documents shall be provided in the form of an appendix to the EIA study report.

3.4.12 Summary of Environmental Outcomes

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

3.4.13 Environmental Monitoring and Audit (EM&A) Requirements

- 3.4.13.1 The Applicant shall identify and justify in the EIA study whether there is any need for EM&A activities, during the construction phase of the Project, if affirmative, to define the scope of the EM&A requirements for the Project in the EIA study.
- 3.4.13.2 Subject to the confirmation of the EIA study findings, the Applicant shall comply with the requirements as stipulated in Annex 21 of the TM.
- 3.4.13.3 The Applicant shall prepare a project implementation schedule in the form of a detailed checklist containing the EIA study recommendations and mitigation measures with reference to the implementation programme.

4. DURATION OF VALIDITY

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

5. REPORT REQUIREMENTS

- 5.1 In preparing the EIA report, the Applicant shall refer to Annex 11 of the TM for the contents of an EIA report. The Applicant shall also refer to Annex 20 of the TM, which stipulates the guidelines for review of an EIA report.
- 5.2 The Applicant shall supply the Director with the following number of copies of the EIA report and the executive summary:

- (i) 50 copies of the EIA report in English and 80 copies of the executive summary (each bilingual in both English and Chinese) as required under section 6(2) of the EIAO to be supplied at the time of application for approval of the EIA report.
 - (ii) when necessary, addendum to the EIA report and the executive summary submitted under sub-section 5.2 (i) above as required under section 7(1) of the EIAO, to be supplied upon advice by the Director for public inspection.
 - (iii) 20 copies of the EIA report in English and 50 copies of the executive summary (each bilingual in both English and Chinese) with or without Addendum as required under section 7(5) of the EIAO, to be supplied upon advice by the Director for consultation with the Advisory Council on the Environment.
- 5.3 The Applicant shall, upon request, make additional copies of the above documents available to the public, subject to payment by the interested parties of full costs of printing.
- 5.4 In addition, to facilitate the public inspection of the EIA report via the EIAO Internet Website, the applicant shall provide electronic copies of both the EIA report and the executive summary prepared in HyperText Markup Language (HTML) (version 4.0 or later) and in Portable Document Format (PDF version 4.0 or later), unless otherwise agreed by the Director. For the HTML version, a content page capable of providing hyperlink to each section and sub-section of the EIA report and the executive summary shall be included in the beginning of the document. Hyperlinks to all figures, drawings and tables in the EIA report and executive summary shall be provided in the main text from where the respective references are made. All graphics in the report shall be in interlaced GIF format unless otherwise agreed by the Director.
- 5.5 The electronic copies of the EIA report and the executive summary shall be submitted to the Director at the time of application for approval of the EIA report.
- 5.6 When the EIA report and the executive summary are made available for public inspection under section 7(1) of the EIAO, the content of the electronic copies of the EIA report and the executive summary must be the same as the hard copies and the Director shall be provided with the most updated electronic copies.
- 5.7 To promote environmentally friendly and efficient dissemination of information, both hardcopies and electronic copies of future EM&A reports recommended by the EIA study shall be required and their format shall be agreed by the Director.

6. OTHER PROCEDURAL REQUIREMENTS

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

Director immediately.

- 6.2 If there are any key changes in the scope of the Project mentioned in Sections 1.2 and 1.3 of this EIA study brief and in the Project Profile, the Applicant must seek confirmation in writing from the Director on whether or not the scope of this EIA study brief is still applicable to cover the key changes identified, and what additional issues, if any, that the EIA study must also cover to address these key changes. If the changes to the Project fundamentally alter the key scope of the EIA study brief, the Applicant shall apply to the Director for a fresh EIA study brief.

--- END OF EIA STUDY BRIEF ---

November 2007
Environmental Assessment Division,
Environmental Protection Department

Appendix A

Hydrodynamic and Water Quality Modelling Requirements

Modelling software general

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

Model details – Calibration & Validation

1. The models shall be properly calibrated and validated before its use in this study in the Hong Kong waters, the Pearl Estuary and the Dangan (Lema) Channel, with the field data collected by:
 - South East Kowloon Development Comprehensive Planning and Engineering Review – Stage I: Planning Review, CEDD (2005/2006)
 - Hydraulic and Water Quality Studies in Victoria Harbour (1987)
 - Port and Airport Development Strategy - Enhancement of WAHMO Mathematical Models (1990)
 - Strategic Sewage Disposal Scheme Stage II - Oceanic Outfall, Oceanographic Surveys and Modelling (1992)
 - Update on Cumulative Water Quality and Hydrological Effect of Coastal Developments and Upgrading of Assessment Tool (1998)
 - Environmental Protection Department (EPD)'s routine monitoring data
 - Tidal data from Hong Kong Observatory, Macau and relevant Mainland Authorities
2. Tidal data shall be calibrated and validated in both frequency and time domain manner.
3. For the purpose of calibration and validation, the model shall run for not less than 15 days of real sequence of tide (excluding model spin up) in both dry and wet seasons with due consideration of the time required to establish initial conditions.
4. In general the hydrodynamic models shall be calibrated to the following criteria:

<u>Criteria</u>	<u>Level of fitness with field data</u>
• tidal elevation (rms)	< 8 %
• maximum phase error at high water and low water	< 20 minutes

- maximum current speed deviation < 30 %
- maximum phase error at peak speed < 20 minutes
- maximum direction error at peak speed < 15 degrees
- maximum salinity deviation < 2.5 ppt

Model details – Simulation

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

Modelling assessment

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

in hydrodynamic regime shall be assessed. Daily erosion / sedimentation rate shall be computed and its ecological impact shall be assessed.

4. The impact on all sensitive receivers shall be assessed.
5. Cumulative impacts due to other projects, activities or pollution sources within a boundary to the agreement of EPD shall also be predicted and quantified.
6. All modelling results shall be submitted in digital media to EPD.

Appendix B-1

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

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

1. Introduction

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

2. Choice of Models

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

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

3. Model Input Requirements

3.1 Meteorological Data

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

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

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

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

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

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

- (i) perform a frequency occurrence analysis of one year of meteorological data to determine the actual wind speed (to the nearest unit of m/s), wind direction (to the nearest 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 classified as either rural or urban so as to reflect the enhanced mixing that occurs over urban areas due to the presence of buildings and urban heat effects. The selection of either rural or urban dispersion coefficients in a specific application should follow a land use classification procedure. If the land use types including industrial, commercial and residential uses account for 50% or more of an area within 3 km radius from the source, the site is classified as urban; otherwise, it is classified as rural.

3.4 Surface Roughness Height

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

3.5 Receptors

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

3.6 Particle Size Classes

In evaluating the impacts of dust-emitting activities, suitable dust size categories relevant to the dust sources concerned with reasonable breakdown in TSP ($< 30 \mu\text{m}$) and RSP ($< 10 \mu\text{m}$) 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 the 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 $\mu\text{g}/\text{m}^3$ depending on the land use type (see also the EPD reference paper 'Guidelines on Assessing the 'TOTAL' Air Quality Impacts' in Appendix B-2).

3.8 Odour Impact

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

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

Under 'D' class stability, the 5-second concentration is approximately 10 times the

hourly average result. Note, however, that the combined use of such conversion factors together with the ISCST results may not be suitable for assessing the extreme close-up impacts of odour sources.

Ref.(3): Richard A. Duffee, Martha A. O'Brien and Ned Ostojic, 'Odor Modeling – Why and How', Recent Developments and Current Practices in Odour Regulations, Controls and Technology, Air & Waste Management Association, 1991.

Ref.(4): A.W.C. Keddie, 'Dispersion of Odours', Odour Control – A Concise Guide, Warren Spring Laboratory, 1980.

3.9 Plume Rise Options

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

3.10 Portal Emissions

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

Ref.(5): XIXth World Road Congress Report, Permanent International Association of Road Congresses (PIARC), 1991.

Ref.(6): N. Ukegunchi, H. Okamoto and Y. Ide "Prediction of vehicular emission pollution around a tunnel mouth", Proceedings 4th International Clean Air Congress, pp. 205-207, Tokyo, 1977.

3.11 Background Concentrations

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

3.12 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 the Director's reference.

Schedule 1

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

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

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

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

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

Appendix B-2

Guidelines on Assessing the 'TOTAL' Air Quality Impacts

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

1. Total Impacts - 3 Major Contributions

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

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

2. Nature of Emissions

2.1 Primary contributions

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

2.2 Secondary contributions

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

2.3 Background contributions

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

hundreds of kms) is rather complex and cannot be adequately estimated by the 'Gaussian' type of models.

3. Background Air Quality - Estimation Approach

3.1 The approach

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

3.2 Categorisation

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

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

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

3.3 Background pollutant values

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

POLLUTANT	URBAN	INDUSTRIAL	RURAL / NEW DEVELOPMENT
NO ₂	59	57	39
SO ₂	21	26	13
O ₃	62	68	57
TSP	98	96	87
RSP	60	58	51

All units are in micrograms per cubic metre. The above values are derived from 1992 to 1996 annual averages with the exception of ozone which represent annual average of daily hourly maximum values for year 1996.

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

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

3.4 Site categories

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

DISTRICT	AIR QUALITY CATEGORY
Islands	Rural / New Development
Southern	Rural / New Development
Eastern	Urban
Wan Chai	Urban
Central & Western	Urban
Sai Kung	Rural / New Development
Kwun Tong	Industrial
Wong Tai Sin	Urban
Kowloon City	Urban

Yau Tsim	Urban
Mong Kok	Urban
Sham Shui Po	Urban
Kwai Tsing	Industrial
Sha Tin	Rural / New Development
Tsuen Wan	Industrial
Tuen Mun	Rural / New Development
Tai Po	Rural / New Development
Yuen Long	Rural / New Development
Northern	Rural / New Development

3.5 Provisions for 'double-counting'

The current approach is, by no means, a rigorous treatment of background air quality but aims to provide an as-realistic-as-possible approximation based on limited field data. 'Double-counting' of 'secondary contributions' may be apparent through the use of such 'monitoring-based' background data as some of the monitoring stations are of close proximity to existing emission sources. 'Primary contributions' due to a proposed project (which is yet to be realized) will not be double-counted by such an approach. In order to avoid over-estimation of background pollutant concentrations, an adjustment to the values given in Section 3.3 is possible and optional by multiplying the following factor:

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

where E stands for emission.

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

4. Conclusions

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

Appendix B-3

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

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

1. Background

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

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

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

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

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

2. Required Demonstration / Submission

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

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

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

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

- (i) mathematical formulation and data requirements of the model;
 - (ii) any previous performance evaluation of the model; and
 - (iii) a complete set of model input and output file(s) in commonly used electronic format.
- 2.3 On performance evaluation, the required approach and extent of demonstration varies depending on whether a Schedule 1 model is already available and suitable in simulating the situation under consideration. In cases where no Schedule 1 model is found applicable, the proponent must demonstrate that the proposed model passes the screening test as set out in USEPA Document "Protocol for Determining the Best Performing Model" (Ref. 1).
- Ref.(1): William M. Cox, 'Protocol for Determining the Best Performing Model'; Publication No. EPA-454/R-92-025; U.S. Environmental Protection Agency, Research Triangle Park, NC.*
- 2.4 For cases where a Schedule 1 model is applicable to the project under consideration but an alternative model is proposed for use instead, the proponent must demonstrate either that
- (i) the highest and second highest concentrations predicted by the proposed model are within 2 percent of the estimates obtained from an applicable Schedule 1 model (with appropriate options chosen) for all receptors for the project under consideration; or
 - (ii) the proposed model has superior performance against an applicable Schedule 1 model based on the evaluation procedure set out in USEPA Document "Protocol for Determining the Best Performing Model" (Ref. 1).
- 2.5 Should the Director find the information on technical details alone sufficient to indicate the acceptability of the proposed model, information on further performance evaluation as specified in Sections 2.3 and 2.4 above would not be necessary.
- 2.6 If the proposed model is an older version of one of the Schedule 1 models or was previously included in Schedule 1, the technical documents mentioned in Section 2.2 are normally not required. However, a performance demonstration of equivalence as stated in Section 2.4 (i) would become necessary.
- 2.7 If the Director is already in possession of some of the documents that describe the technical details of the proposed model, submission of the same by the proponent is not necessary. The proponent may check with the Director to avoid sending in duplicate information.
-

Schedule 1

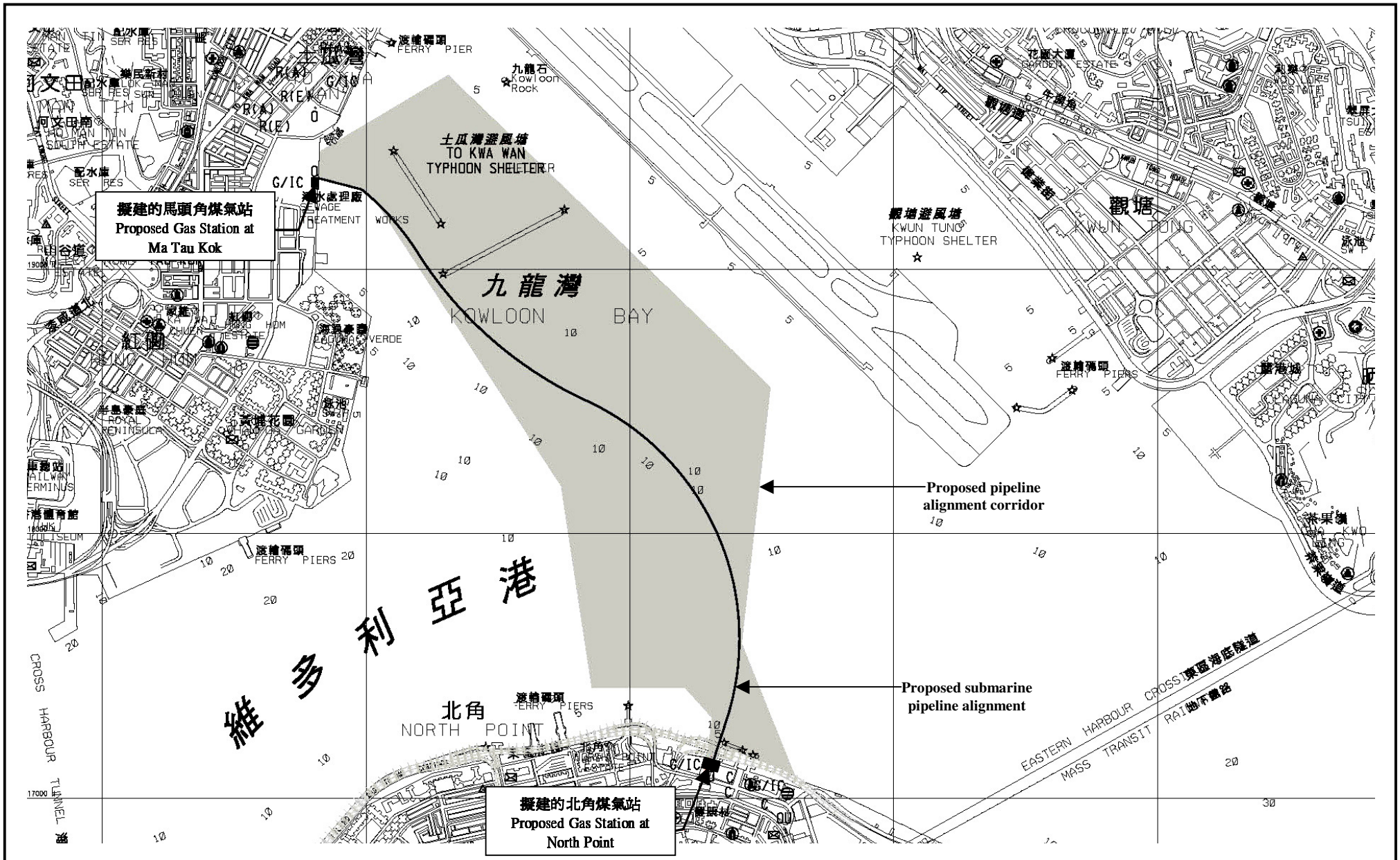
*Air Quality Models Generally Accepted by Hong Kong Environmental Protection Department
for Regulatory Applications as at 1 July 1998 : **

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

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

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

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



	<p>Figure 1: Location Plan</p>	<p>EIA Study Brief No.: ESB-171/2007</p>
	<p>Project Title: Installation of Submarine Gas Pipelines and Associated Facilities from Ma Tau Kok to North Point for Former Kai Tak Airport Development</p>	<p>Note: This figure is prepared based on Figure 1.1 of the Project Profile PP-328/2007 submitted on 28/09/2007</p>