

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

**Environmental Impact Assessment Study Brief No. ESB-175/2007**

**Project Title: Tuen Mun Chek Lap Kok Link**  
**(hereinafter known as the “Project”)**

**Name of Applicant:**  
**Highways Department**  
**(hereinafter known as the “Applicant”)**

**1. BACKGROUND**

- 1.1 An application (No. ESB-175/2007) 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 20 November 2007 with a Project Profile (No. PP-336/2007) (the Project Profile).
- 1.2 The Applicant is planning the Tuen Mun – Chek Lap Kok Link (TMCLKL), a dual two-lane highway connecting the proposed Tuen Mun Western Bypass (TMWB) at the southern coast of Tuen Mun Area 40 in the north with the Hong Kong International Airport and Tung Chung in the south. Location plan of the proposed works, as shown in the project profile, is reproduced in Figure 1 in Appendix A. The Project will comprise the following:
- (i) about 24ha reclamation near the Tuen Mun River Trade Terminal for the northern tunnel portal of TMCLKL;
  - (ii) about 1km elevated viaduct from TMWB to the northern tunnel portal on the new reclamation of (i) above and associated slip roads to connect with Lung Mun Road at Tuen Mun west;
  - (iii) about 4km long dual 2-lane immersed tube tunnel across the Urmston Road shipping channel towards western side of Tai Mo To/northeastern side of Airport Island;
  - (iv) about 12ha reclamation at Tai Mo To/northeastern side of Airport Island for the southern tunnel portal and a toll plaza; and
  - (v) about 4.6km long sea viaduct from the toll plaza at Tai Mo To/northeastern side of Airport Island to connect with the Airport Island and Tung Chung
- 1.3 The Project is a designated project under Item A.1, A.7, A.8, C.1, C.2 and Q.1 of Part 1, Schedule 2 of the EIAO. In accordance with section 5(1)(a) of the EIAO, a person who is planning a designated project shall apply to the Director of Environmental Protection (the Director) for an EIA study brief to proceed with an EIA study for the Project.
- 1.4 Pursuant to section 5(7)(a) of the EIAO, the Director issues this Environmental Impact Assessment (EIA) study brief to the Applicant to carry out an EIA study.
- 1.5 The purpose of this EIA study is to provide information on the nature and extent of environmental impacts arising from the construction and operation of the Project and related activities taking place concurrently. This information will contribute to decisions by the Director on:

- (i) the overall acceptability of any adverse environmental consequences that are likely to arise as a result of the proposed 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 identify and describe the elements of the community and environment likely to be affected by the Project and/or likely to cause adverse impacts to the Project, including both the natural and man-made environment;
- (iii) to provide information on the consideration of alternatives/options for the alignments(s) and built-forms of the Project to avoid and minimise potential environmental impacts to environmentally sensitive areas and other sensitive uses; to compare the environmental benefits and dis-benefits of each of the different options; to provide reasons for selecting the preferred option(s) and to describe the part of environmental factors played in the selection of the preferred option(s);
- (iv) to identify and assess air quality impact, noise impact, water quality impact, waste management implication, marine ecological impact, fisheries impact, cultural heritage impact and landscape and visual impact; and determine the significance of impacts on sensitive receivers and potential affected uses;
- (v) 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;
- (vi) 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;
- (vii) to identify, assesses and specify methods, measures and standards, to be included in the detailed design, construction and operation of the Project which are necessary to mitigate these environmental impacts and reducing them to acceptable levels;
- (viii) to investigate the extent of the secondary environmental impacts that may arise from the proposed mitigation measures, and to identify constraints associated with the mitigation measures recommended in the EIA study as well as the provision of any necessary modification;
- (ix) 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

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

### **3. DETAILED REQUIREMENTS OF THE EIA STUDY**

#### **3.1 The Purpose**

The purpose of this study brief is to scope the key issues of the EIA study. The Applicant has to demonstrate in the EIA report that the criteria in the relevant sections of the Technical Memorandum on the Environmental Impact Assessment Process of the Environmental Impact Assessment Ordinance (thereafter referred to as the TM), are fully complied with.

#### **3.2 The Scope**

The scope of the EIA study shall cover the Project mentioned in Section 1.2 above. The EIA study shall address the likely key issues described below, together with any other key issues identified during the course of the EIA study:

- (i) the need for and the size of the reclamation near Tuen Mun River Trade Terminal and Tai Mo To/northeastern side of Airport Island as stated in the Project Profile and to consider alternative design/alignment of the Project taking into account the latest development of interfacing projects on or near Lantau Island, in particular the latest proposed alignment of the North Lantau Highway Connection and the Hong Kong Boundary Crossing Facilities of the Hong Kong-Zhuhai-Macao Bridge, to reduce the size of the reclamation required for the Project as far as possible so as to minimise the potential environmental impacts in particular hydrodynamic and water quality impacts on sensitive areas and uses in the related water control zones;
- (ii) the potential air quality impacts from the construction and operation of the Project to sensitive receivers along or near the Project, taking into account the cumulative impact from the construction and operation of existing and planned/committed projects in the vicinity of the Project, in particular the proposed Tuen Mun Western Bypass, and major existing and planned/committed air pollutant emission sources within North West New Territories (NWNT) including Black Point Power Station, Castle Peak Power Station, industrial uses in and around Tuen Mun Area 38 and the proposed Sludge Treatment Facility, and within North West Lantau including the Chek Lap Kok Airport;
- (iii) the potential noise impacts from the construction and operation of the Project to sensitive receivers along or near the Project, taking into account the cumulative impact from the construction and operation of existing and planned/committed projects in the vicinity of the Project, in particular the proposed Tuen Mun Western Bypass, and the existing and planned/committed sources of pollution in the assessment area of the Project;
- (iv) the potential water quality impact caused by dredging, piling, fill extraction, filling and any other marine works activities from construction, in particular the potential release of toxic contaminants, and as a result of changes to the flow regime, flushing capacity, and water quality in Hong Kong waters from operation of the Project on the relevant water system(s);

- (v) the potential hydrodynamic and water quality impacts on the related water control zones and all the bays and beaches along the coast of Tuen Mun including the Butterfly Beach, Tai Ho Wan, Tai Ho Streams, Airport Channel, Tung Chung Bay arising from the construction and operation of the Project and to assess the sedimentary impacts on the Butterfly Beach;
- (vi) the potential water quality impact caused by the disposal of the storm-water runoff from the highway during the operation of the Project;
- (vii) confirmation on minimal or no potential losses or damage to flora, fauna and natural habitats and, if otherwise, the potential impact to the ecological sensitive areas, including the following and any other sensitive areas that may be identified during the course of the EIA study shall be identified and addressed:
  - (a) the vicinities along the marine portion of the Project which are frequented by the Chinese White Dolphins;
  - (b) the Sites of Special Scientific Interest (SSSI) at San Tau Beach and Tai Ho on Lantau;
  - (c) the nursery and breeding grounds for Horseshoe Crabs along the northwestern Lantau coastline;
  - (d) Sha Chau and Lung Kwu Chau Marine Park;
  - (e) Artificial Reefs in the Chek Lap Kok Marine Exclusion Zone 3 and inside Sha Chau and Lung Kwu Chau Marine Park; and
  - (f) Scenic Hill on Airport Island which might support a remnant population of the Romer's Tree Frog.
- (viii) the potential aquatic ecological impacts arising from the construction and operation of the Project, including loss of habitats and disturbance to wildlife in particular the Chinese White Dolphins;
- (ix) the potential fisheries impacts on capture and culture fisheries during the construction and operation of the Project, including the potential loss of fishing grounds, spawning and nursery grounds of fish and shrimp, and pollution, if any caused by run-off, or other impacts arising from the Project;
- (x) the potential impacts on sites of cultural heritage including marine archaeological deposit in the seabed of the project area likely to be affected from construction of the Project;
- (xi) the potential landscape and visual impacts from reclamation, highway structures and associated works on existing and planned sensitive receivers, in particular, on residents of Tung Chung, visitors on Scenic Hill and the planned Town Park in Tung Chung, Tung Chung Cable Car passengers and villagers in the vicinity of the Project such as San Tau and Tai Ho Valley during the construction and operation of the Project;
- (xii) the potential waste management issue associated with the use of filling materials such as marine sand and inert construction and demolition material (C&DM) for reclamation during construction of the Project;
- (xiii) the potential impacts of various types of wastes to be generated from the construction and operation of the Project, in particular the dredged sediment during reclamation; and
- (xiv) the potential cumulative environmental impacts of the Project, through interaction or in combination with other existing, committed and planned developments in the vicinity of the Project, and that those impacts may have a

bearing on the environmental acceptability of the Project. Consideration shall be given to account for impacts from likely concurrent projects, in particular, Tuen Mun Western Bypass, the proposed North Lantau Highway Connection and Hong Kong Boundary Crossing Facilities of the Hong Kong-Zhuhai-Macao Bridge, the New Contaminated Mud Marine Disposal Facility at Airport East/East Sha Chau Area and the existing River Trade Terminal in Tuen Mun.

### **3.3 Consideration of Alternative Options**

#### **3.3.1 Need for the project**

The Applicant shall provide information on the need of the Project, including the purpose and objectives of the Project, and describe the scenarios with and without the Project.

#### **3.3.2 Consideration of Size of Reclamation, Alignment Options and Built-forms**

In addition to the proposed reclamation size, the alignment and built-form set out in the Project Profile, the Applicant shall consider other feasible alignment options for the Project, provide justification regarding how the proposed scheme is arrived at, including the descriptions of the environmental factors considered in the option selection. In particular, the Applicant shall justify the need for the size of the reclamation near Tuen Mun River Trade Terminal and Tai Mo To/northeastern side of Airport Island as stated in the Project Profile and shall consider alternative design(s)/alignment(s) of the Project to reduce the size of the reclamation as far as possible to minimise the potential environmental impacts including hydrodynamic and water quality impacts on sensitive areas and uses in the related water control zones, especially all bays and beaches along the coast of Tuen Mun, Tai Ho Wan, Tai Ho Streams, Airport Channel and Tung Chung Bay and the disturbance to the ecological sensitive areas, sites of special scientific interest and cultural and heritage resources. Alternative built-forms (such as tunnel and viaduct along part of the proposed alignment) and design of the highway shall be reviewed and assessed so as to avoid or minimize potential operational noise and air quality impacts and landscape and visual impacts. A comparison of the environmental benefits and dis-benefits of possible reclamation size, alignment options and alternative built-forms and design shall be made and presented in the EIA report with a view to recommending the preferred option to avoid/minimize adverse environmental effects to the maximum practicable extent.

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

Taking into consideration the combined effect with respect to the severity and duration of the construction impacts to the affected sensitive receivers, the EIA study shall explore alternative construction methods and sequences of works for the Project with a view to minimising the duration and the extent of adverse environmental impacts to the maximum practicable extent. A comparison of the environmental benefits and dis-benefits of adopting different construction methods and sequences of works shall be made and presented in the EIA report with a view to recommending the preferred option to avoid/minimize adverse environmental effects to the maximum practicable extent.

#### **3.3.4 Selection of Preferred Construction Method(s) and Sequence(s) of Works**

Taking into consideration of the findings in sub-sections 3.3.2 and 3.3.3 above, the Applicant shall recommend with full justifications the adoption 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.

### **3.4 Technical Requirements**

The Applicant shall conduct the EIA study to address all environmental aspects of the activities 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 Air Quality Impact**

3.4.1.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing air quality impact as stated in Annexes 4 and 12 of the TM, respectively.

3.4.1.2 The study area for air quality impact assessment shall be defined by a distance of 500 metres from the Project shown in Appendix A or other project alignments as identified in the EIA, which shall be extended to include major existing and planned/committed air pollutant emission sources within NWNT including Black Point Power Station, Castle Peak Power Station, industrial uses in and around Tuen Mun Area 38 and the proposed Sludge Treatment Facility, and within North West Lantau including the Chek Lap Kok Airport, that may have a bearing on the environmental acceptability of the Project. The assessment shall include but not be limited to the existing, planned and committed sensitive receivers within the study area. Such assessment shall be based on the best available information at the time of the assessment.

3.4.1.3 The Applicant shall assess the air pollutant concentrations with reference to the relevant sections of the guidelines in Appendices B-1 to B-3 attached to this study brief, or other methodology as agreed by the Director. The Applicant shall also note that the PATH model may be used for estimating the cumulative background concentrations by taking into account all the major air pollutant emission sources in Hong Kong and nearby regions.

3.4.1.4 The air quality impact assessment shall include the following:

- (i) Background and Analysis of Activities
  - (a) Provide background information relating to air quality issues relevant to the Project, e.g. description of the types of activities of the Project that may affect air quality during construction and operation stages.
  - (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 air pollution impact. That is, the Applicant shall consider

- alternative construction methods/phasing programmes and alternative operation modes to minimize the air quality impact during construction and operation stages of the Project.
- (c) Present the background air quality levels in the assessment area for the purpose of evaluating the cumulative air quality impacts during construction and operation stages of the Project.
- (ii) Identification of Air Sensitive Receivers (ASRs) and Examination of Emission/Dispersion Characteristics
- (a) Identify and describe 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 the Town Planning Board. The Applicant shall select the assessment points of the identified ASRs that represent the worst impact point of these ASRs. A map showing the location and description such as name of buildings, their uses and height of the selected assessment points shall be given. The separation distances of these ASRs from the nearest emission sources shall also be given.
  - (b) Provide a list of air pollutant emission sources, including any nearby emission sources which are likely to have impact related to the Project based on the analysis of the activities during construction and operation stages of the Project in sub-section 3.4.1.4(i)(a). Confirmation regarding the validity of the assumptions adopted and the magnitude of the activities (e.g. volume of construction material handled, traffic mix and volume on a road etc.) shall be obtained from the relevant government departments /authorities and documented.
  - (c) The Applicant shall identify chimneys and obtain relevant chimney emission data in the study area by carrying out a survey for assessing the cumulative air quality impact of air pollutants through chimneys. The Applicant shall ensure and confirm that the chimney emission data used in their assessment have been validated and updated by their own survey. If there are any errors subsequently found in their chimney emission data used, the Applicant shall be fully responsible and the submission might be invalidated.
- (iii) Construction Phase Air Quality Impact
- (a) The Applicant shall follow the requirements stipulated under the Air Pollution Control (Construction Dust) Regulation to ensure that 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 for the construction phase shall be devised to verify the effectiveness of the control measures proposed so as to ensure proper construction dust control.
  - (b) If the Applicant anticipates that the Project will give rise to significant construction dust impacts likely to exceed the recommended limits in

the TM at the ASRs despite the incorporation of the dust control measures proposed in accordance with sub-section 3.4.1.4(iii)(a) above, a quantitative assessment should be carried out to evaluate the construction dust impact at the identified ASRs. The Applicant shall follow the methodology set out in sub-section 3.4.1.4(v) below when carrying out the quantitative assessment.

(iv) Operational Phase Air Quality Impact

- (a) The Applicant shall calculate the expected air pollutant concentrations at the identified ASRs based on an assumed reasonably worst-case scenario under normal operating conditions. The evaluation shall be based on the strength of the emission sources identified in sub-section 3.4.1.4(ii)(b) above. The Applicant shall follow sub-section 3.4.1.4(v) below when carrying out the quantitative assessment.
- (b) The air pollution impacts of future road traffic shall be calculated based on the highest emission strength from the road within the next 15 years upon commencement of operation of the proposed road. The applicant shall demonstrate that the selected year of assessment represents the highest emission scenario given the combination of vehicular emission factors and traffic flow for the selected year. The Fleet Average Emission Factors used in the assessment shall be agreed with the Director. If necessary, the Fleet Average Emission Factors shall be determined by a motor vehicle emission model such as EMFAC-HK model to be agreed with the Director. All the traffic flow data and assumptions that are used in the assessment shall be clearly and properly documented in the EIA report.
- (c) If full enclosures are proposed in the Project, it is the responsibility of the Applicant to ensure that the air quality inside these proposed structures shall comply with EPD's "*Practice Note on Control of Air Pollution in Vehicle Tunnels*". When assessing air quality impact due to emissions from full enclosures, the Applicant shall ensure prior agreement with the relevant ventilation design engineer over the amount and the types/kinds of pollutants emitted from these full enclosures; and such assumptions shall be clearly and properly documented in the EIA report.

(v) Quantitative Assessment Methodology

- (a) The Applicant shall apply the general principles enunciated in the modelling guidelines in Appendices B-1 to B-3 while making allowance for the specific characteristic of the Project. This specific methodology must be documented in such level of details, preferably assisted with tables and diagrams, to allow the readers of the EIA report to grasp how the model has been set up to simulate the situation under study without referring to the model input files. Detailed calculations of air pollutants emission rates for input to the modelling and a map showing all the road links shall be presented in the EIA report. The Applicant must ensure consistency between the text description and the model files at every stage of submissions for review. In case of doubt, prior agreement between the Applicant and the Director on the specific modelling details should be sought.



- (b) The Applicant shall identify the key/representative air pollutant parameters (types of pollutants and the averaging time concentrations) to be evaluated and provide explanation for selecting such parameters for assessing the impact from the Project. Ozone Limiting Method (OLM) or Discrete Parcel Method (DPM) or other method to be agreed with the Director shall be used to estimate the conversion ratio of  $\text{NO}_x$  to  $\text{NO}_2$  if  $\text{NO}_2$  has been identified as a key/representative air pollutant.
  - (c) The Applicant shall calculate the cumulative air quality impact at the ASRs identified under sub-section 3.4.1.4 (ii) above 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 table(s) and pollution contours, to be evaluated against the relevant air quality standards and on any effect they may have on the land use implications. Plans of a suitable scale should be used to present pollution contours to allow buffer distance requirements to be determined properly.
  - (d) If there are any direct technical noise remedies recommended in the study, the air quality implication due to these technical remedies shall be assessed. For instance, if barriers that may affect dispersion of air pollutants are proposed, then the implications of such remedies on air quality impact shall be assessed. If noise enclosure is proposed, then portal emissions of the enclosed road section and air quality inside the enclosed road section shall also be addressed. The Applicant shall highlight clearly the locations and types of agreed noise mitigating measures (where applicable), be they noise barriers, road enclosures and their portals, and affected ASR's, on contour maps for easy reference.
- (vi) **Mitigation Measures for Non-compliance**
- The Applicant shall propose remedies and mitigating measures where the predicted air quality impact exceeds the criteria set in section 1 of Annex 4 in the TM. These measures and other associated constraints on future land use planning shall be agreed with the relevant government departments /authorities and be clearly documented in the EIA report. The Applicant shall demonstrate quantitatively that the residual impacts after incorporation of the proposed mitigating measures will comply with the criteria stipulated in section 1 of Annex 4 in the TM.
- (vii) **Submission of Model Files**
- All input and output file(s) of the model run(s) shall be submitted to the Director in electronic format.

### 3.4.2 Noise Impact

- 3.4.2.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing noise impact as stated in Annexes 5 and 13 of the TM, respectively.

### 3.4.2.2 The noise impact assessment shall include the following:

(i) Determination of Assessment Area

The study area for the noise impact assessment shall generally include all areas within a distance of 300m from the Project as shown in Appendix A or other Project alignments as identified in the EIA. Subject to the agreement of the Director, the assessment area could be reduced accordingly if the first layer of noise sensitive receivers (NSRs), closer than 300m from the outer Project limit, provides acoustic shielding to those receivers at distances further away from the Project. Subject to the agreement of the Director, the assessment area shall be expanded to include NSRs at distances over 300m from the Project, which are affected by the construction and operation of the Project. The assessment area for the construction noise impact assessment shall also cover areas within 300m of any works sites proposed under the Project.

(ii) Provision of Background Information and Existing Noise Levels

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

(iii) Identification of Noise Sensitive Receivers

- (a) The Applicant shall refer to Annex 13 of the TM when identifying the NSRs. The NSRs shall include all existing NSRs and all planned/committed noise sensitive developments and uses earmarked on the relevant Outline Zoning 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 the Town Planning Board. Photographs of all existing NSRs shall be appended to the EIA report.
- (b) The Applicant shall select assessment points to represent all identified NSRs for carrying out quantitative noise assessment described below. The assessment points shall be agreed with the Director prior to the quantitative noise assessment. A map showing the location and description such as name of building, use, and floor of each and every selected assessment point shall be given. For planned noise sensitive land uses without committed site layouts, the Applicant should use the relevant planning parameters to work out representative site layouts for noise assessment purpose.

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

The Applicant shall provide an inventory of noise sources including representative construction equipment for construction noise assessment, such as for tunnelling and other construction works, and traffic flow/fixed plant equipment, as appropriate, for operational noise assessment. Confirmation of the validity of the inventory shall be obtained from the relevant government departments/authorities and documented in the EIA report.

(v) Construction Noise Assessment

- (a) The assessment shall cover the cumulative noise impacts due to the construction works of the Project and other concurrent projects identified during the course of the EIA study.
- (b) The Applicant shall carry out assessment of noise impact from construction (excluding percussive piling) of the Project during daytime, i.e. 7am to 7pm, on weekdays other than general holidays in accordance with methodology in paragraphs 5.3 and 5.4 of Annex 13 of the TM. The criteria in Table 1B of Annex 5 of TM shall be adopted in the assessment. In case blasting works is 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 proposed as far as practicable.
- (d) If the unmitigated construction noise levels are found exceeding the relevant criteria, the Applicant shall propose practicable direct mitigation measures (including movable barriers, enclosures, quieter alternative methods, rescheduling and restricting hours of operation of noisy tasks) to minimize the impact. If the mitigated noise levels still exceed the relevant criteria, the duration of the noise exceedance at the affected NSR shall be given.
- (e) The Applicant shall, as far as practicable, formulate a reasonable construction programme so that no work will be required in restricted hours as defined under the Noise Control Ordinance (NCO). In case the Applicant needs to evaluate whether construction works in restricted hours as defined under the NCO are feasible or not in the context of programming construction works, reference should be made to 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 recommendations chapter in EIA report.

(vi) Operational Noise Assessment(a) Road Traffic Noise

## (a1) Calculation of Noise Levels

The Applicant shall analyse the scope of the proposed road alignment(s) to identify road sections for the purpose of traffic noise impact assessment. In determining whether the traffic noise impact due to a road improvement project / work 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 road project is greater than that without the road project at the design year by 1.0 dB(A) or more. Figures showing extents of the road sections (both existing and new road sections) shall be provided in the EIA report.

The Applicant shall calculate 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 peak hour traffic flow at the design year, i.e., 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 (road sections within the meaning of Item A.1 of Schedule 2 of EIAO and other road sections) 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. 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:

- (1) the unmitigated scenario at assessment year;
- (2) mitigated scenario at assessment year; and
- (3) prevailing scenario for indirect technical remedies eligibility assessment.

The data shall be in 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 L10 (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 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 road alignments

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 within the meaning of Item A.1 of Schedule 2 of EIAO, exceeds the criteria in Table 1A of Annex 5 in the TM by 1 dB(A) or more; or, for situations where the overall traffic noise level at the NSRs with the road project exceeds the criteria in Table 1A of Annex 5 in the TM by 1 dB(A) or more and at the same time is greater than that without the road project at the design year by 1.0 dB(A) or more. The direct mitigation measures listed under Section 6.1, Annex 13 of the TM, including 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 existing NSRs shall be differentiated clearly from those proposed for the protection of future or planned NSRs as the latter is only required to be constructed before the 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 elements that will be benefitted from, and be protected by the provision of direct mitigation measures shall be provided. In order to clearly present the extents/locations of recommended noise mitigation measures, plans prepared from 1:1000 or 1:2000 survey maps showing the mitigation measures (e.g. enclosures/barriers, low noise road surfacing) 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 levels above the criteria with the implementation of all recommended direct mitigation measures shall be quantified. The Applicant shall provide, in the EIA report information of recommended noise mitigation measures (including at least barrier types, nominal dimensions at different cross-sections, extents/locations, lengths, mPD levels of barriers) in the format as agreed by the Director (including electronic format).

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 technical remedies, the associated costs and any implications for such implementation. For the purpose of determining eligibility of the affected premises for indirect technical remedies, reference shall be made to the following set of three criteria:

- (1) the predicted overall noise level at the NSR from the road sections and 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 and places of public worship, all in L10(1hr) );
- (2) the predicted overall noise level at the NSR is at least 1.0 dB(A) more than the prevailing traffic noise level, i.e. the total traffic noise level existing before the commencement of works to construct the road; and
- (3) the contribution from the road sections to the increase in predicted overall noise level from the new road at the NSR must be at least 1.0dB(A).

(b) Fixed Noise Sources

If the Project will cause any fixed noise sources, such as the ventilation buildings, if any, the following assessment shall be followed.

(b1) Assessment of Fixed Source Noise Levels

The Applicant shall calculate the expected noise using standard acoustics principles. Calculations for the expected noise shall be based on assumed plant inventories and utilization schedule for the worst-case scenario. The Applicant shall calculate noise levels taking into account correction of tonality, impulsiveness and intermittency in accordance with Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites issued under the NCO.

(b2) Presentation of Noise Levels

The Applicant shall present the existing and future noise levels in  $L_{eq}$  (30 min) 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 fixed noise source(s) shall be carried out and compared against the criteria set out in Table 1A of Annex 5 of the TM.

(b3) Proposals for Noise Mitigation Measures

The Applicant shall propose direct technical remedies within the Project limits in all situations where the predicted noise level exceeds the criteria set out in Table 1A of Annex 5 of the TM to protect the affected NSRs.

(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 by the EIA study to assess the development potential of concerned sites which shall be made known to the relevant parties.

### 3.4.3 **Water Quality Impact**

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

3.4.3.2 The study area for this water quality impact assessment shall cover the, North Western Water Control Zone, North Western Supplementary Water Control Zone, Deep Bay Water Control Zone, and Western Buffer Water Control Zone, as designated under the Water Pollution Control Ordinance (WPCO). Sensitive receivers including, but not limiting to, beaches, seawater intakes, cooling water intakes, marine parks, Chinese White Dolphin habitat, fish culture zones, SSSIs, artificial reefs and fish spawning grounds in the above areas shall be addressed in the water quality assessment. The study area could be extended to include other areas if they are found also being impacted during the course of the EIA study and have a bearing on the environmental acceptability of the Project.

3.4.3.3 The Applicant shall identify and analyse in the assessment all physical, chemical and biological disruptions of marine, coastal, estuarine, fresh water or ground water system(s) arising from construction and operation of the Project.

3.4.3.4 The Applicant shall predict, quantify and assess any water quality impacts arising from the Project on the water system(s) and the sensitive receivers by appropriate mathematical modelling and/or other techniques proposed by the Applicant and approved by the Director. The mathematical modelling requirements are set out in Appendix C attached to this study brief. Possible impacts due to the dredging, piling, fill extraction, filling, transportation and disposal of dredged materials and other marine works activities shall include but not be limited to changes in hydrology, flow regime, sediment erosion and deposition patterns, water and sediment quality, fisheries, marine and freshwater organisms/community. The prediction shall include possible different construction stages or sequences, and different operational stages for the preferred option and built-forms identified in section 3.3 of this Study Brief. Affected sensitive receivers shall be identified by the assessment tool with indications of degree of severity.

3.4.3.5 The Applicant shall take into account and include any likely different construction and

operational stages or sequences of the Project in the assessment. The assessment shall have regard to the phasing, frequency, duration and rate of dredging, filling and its sediment loading. Essentially the assessment shall address the following in the water quality impact assessment:

General

- (i) Collection and review of background information on the existing water system(s) and their respective catchments, and sensitive receivers which might be affected by the Project during construction and operation;
- (ii) Characterization of water and sediment quality of the related water system(s) and sensitive receivers, which might be affected by the Project during construction and operation, based on existing information or appropriate site survey/tests as appropriate;
- (iii) Identification and analysis of all existing and future activities and beneficial uses related to the water system(s) and identification of all water sensitive receivers. The Applicant shall refer to, inter alia, those developments and uses earmarked on the relevant Outline Zoning Plans, Development Permission Area Plans, Outline Development Plans and Layout Plans;
- (iv) Identification of pertinent water and sediment quality objectives, criteria and standards for the water system(s) and all the sensitive receivers;
- (v) Review of the construction sequences and methods, and the operation of the Project to identify any alteration of any water courses, natural streams/ponds, wetland, change of shoreline or bathymetry, change of flow regimes, change of ground water levels, change of catchment types or areas. The selected method shall take into consideration the need to protect relevant water sensitive receivers and let the marine sediments be left in place and not be disturbed as far as possible;
- (vi) Identification, analysis and quantification of existing and future water and sediment pollution sources, including point and non-point discharges to surface water runoff, and analysis of the provision and adequacy of future facilities to reduce such pollution. An emission inventory on the quantities and characteristics of all these existing and future pollution sources in the assessment area shall also be provided. Field investigation and laboratory tests, as appropriate, shall be conducted to fill in any relevant information gaps;
- (vii) Identification of the location of the water table within the project boundary and its distance to the proposed tunnel alignment;

Impact Prediction

- (viii) Prediction and quantification, by mathematical modelling or other technique approved by the Director, of impacts on the water system(s) and the sensitive receivers due to those alterations and changes identified in (v) above and the pollution sources identified in (vi) above. The mathematical modelling requirements are set out in Appendix C of this study brief. Possible impacts include changes in hydrology, flow regime, sediment erosion or deposition, water and sediment quality and the effects on the aquatic organism due to such changes. The prediction shall include possible different construction stages or sequences, and different operation stages for the preferred option and built-forms identified in section 3.3 of this Study Brief;
- (ix) Identification and quantification of all dredging, piling, fill extraction, filling, sediment/mud transportation and disposal activities and requirements. Potential



dumping ground(s) and sand borrowing ground(s) to be involved shall also be identified and cumulative environmental impacts during its operation shall be evaluated. Field investigation, sampling and chemical and biological laboratory tests to characterize the sediment/mud concerned shall be conducted as appropriate. The potential for the release of contaminants during dredging shall be addressed using the chemical testing results derived from sediment samples collected on site and relevant historic data. Appropriate laboratory tests such as elutriate tests shall be performed on the sediment samples to simulate and quantify the degree of mobilization of various contaminants such as metals, ammonia, trace organic contaminants into the water column during dredging. The ranges of parameters to be analyzed; the number, location, depth of sediment, type and methods of sampling; sample preservation; and chemical and biological laboratory test methods to be used shall be subject to the approval of the Director. 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) Cumulative impacts due to other projects, activities or pollution sources in the vicinity of the identified water system(s) and sensitive receivers that may have a bearing on the environmental acceptability of the Project through mathematical modelling or other technique approved by the Director. This shall include the potential cumulative construction and operational water quality impact arising from, inter alia the associated works of the Project;
- (xi) Recommendation of appropriate mitigation measures to avoid or minimize the impacts identified above, in particular suitable methods and arrangement for dredging, filling and mud disposal, shall be recommended to mitigate any adverse impact. Evaluation and quantification of residual impacts on the water system(s) and the sensitive receivers with regard to the appropriate water and sediment quality objectives, criteria, standards or guidelines shall be assessed using appropriate mathematical models as set out in Appendix C to this study brief.

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

- (xii) Proposal for upgrading or providing any effective infrastructure, water pollution prevention and mitigation measures to be implemented during the construction and operation stages so as to reduce the water and sediment quality impacts to within standards. Requirements to be incorporated in the project contract document shall also be proposed;
- (xiii) Best management practices to reduce storm water and non-point source pollution shall be investigated and proposed as appropriate; and
- (xiv) Evaluation and quantification of residual impacts on the water systems(s) and the sensitive receivers with regard to appropriate water and sediment quality objectives, criteria, standards or guidelines.

3.4.3.6 The Applicant shall describe clearly the frequency and rate of dredging, including detailed substantiation of the assumptions adopted, and shall assess and evaluate the recurrent water quality impacts of the maintenance dredging activities.

#### **3.4.4 Waste Management**

3.4.4.1 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, respectively.

3.4.4.2 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 arisen as a result of the construction and operation activities of the Project, based on the sequence and duration of these activities. The Applicant shall adopt design, general layout, construction methods, in-situ and/or ex-situ treatment methods and programme to avoid/minimise the generation of wastes (including public fill/inert construction and demolition (C&D) materials, dredged/excavated sediment, etc.) for disposal and maximise the use of public fill/inert C&D materials for reclamation and other construction works.

(ii) Proposal for Waste Management

- (a) Prior to considering the disposal options for various types of wastes, opportunities for reducing waste generation, on-site or off-site re-use and recycling shall be fully evaluated. Measures that 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) After considering all the opportunities for reducing waste generation and maximising 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 described in detail. The disposal methods/options recommended for each type of wastes shall take into account the result of the assessment in item (c) below.
- (c) The impact caused by handling (including stockpiling, labelling, packaging & storage), collection, transportation and re-use/disposal of wastes shall be addressed in detail and appropriate mitigation measures shall be proposed. This assessment shall cover the following areas:
- potential hazard;
  - air and odour emissions;
  - noise;
  - wastewater discharge; and
  - public transport.

(iii) Dredging, Filling and Dumping

- (a) The categories of sediments which are to be disposed of in accordance with a permit under the Dumping at Sea Ordinance (DASO) shall be identified by both chemical and biological tests and their quantities shall be estimated. If the presence of any seriously contaminated sediment which requires Type 3 disposal is confirmed, the Applicant shall identify the most appropriate treatment and/or disposal arrangement and demonstrate its feasibility; and
- (b) Identification and evaluation of the best practicable construction methods, treatment methods, in-situ/ex-situ arrangements, reuse/

recycling options and construction programme 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 possible and the inert C&DM shall be used to maximum practicable extent for reclamation works.

### 3.4.5 Marine Ecological Impact

3.4.5.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing ecological impact as stated in Annexes 8 and 16 of the TM.

3.4.5.2 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 areas likely to be impacted by the Project.

3.4.5.3 In the ecological impact assessment, the Applicant shall examine the flora, fauna and other components of the ecological habitats within the assessment area. The aim shall be to protect, maintain or rehabilitate the natural environment. In particular, the Project shall avoid impacts on wildlife groups or habitats/ species with conservation interests including but not limited to corals (including all hard corals, octocorals and black corals), Horseshoe Crabs and avifauna, in particular migratory birds. The assessment shall identify and quantify as far as possible the potential ecological impacts to the natural environment and the associated wildlife groups and habitats/species arising from the proposed Project including its construction and operation phases as well as the subsequent management and maintenance of the proposals.

3.4.5.4 The assessment shall include the following major tasks:

- (i) review the findings of relevant studies/surveys 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 impact;
- (iii) carry out necessary ecological field surveys, the duration of which shall be at least 9 months (covering dry and wet seasons), and investigations to fill in the information gaps identified, if any, in Sections 3.4.5.4 (ii) above and fulfil the objectives of the EIA study. The field surveys shall include but not limited to coral communities, marine benthic communities, Horseshoe Crabs and avifauna, in particular migratory birds.
- (iv) establish the general ecological profile of the Study Area based on data of relevant previous studies/ surveys and results of the ecological field surveys, and taking into consideration the seasonal variations, and describe the characteristics of each habitat found; major information to be provided shall include:
  - (a) description of the physical environment; including all recognized sites of conservation importance and assess whether these sites will be affected by the proposed Project or not;
  - (b) habitat maps of suitable scale showing the types and locations of habitats/species in the Study Area with special attention to those with conservation interests, including but not limited to the following:

- coral communities (including all hard corals, octocorals and black corals);
  - Horseshoe Crabs and any other notable marine benthic or littoral communities;
  - seagrass bed;
  - avifauna, in particular migratory birds; and
  - any other habitats/ species identified as having special conservation interest by this EIA study.
- (c) ecological characteristics of each habitat type such as extent, substrate, size, type, species present, dominant species found, species diversity and abundance, community structure, ecological value and inter-dependence of the habitats and species, and presence of any features of ecological importance;
- (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) investigation and description of the existing wildlife uses of the various habitats with special attention to those wildlife groups and habitats with conservation interests, including but not limited to coral communities, Horseshoe Crabs and avifauna in the context of the proposal;
- (vi) using suitable methodology and considering also other works activities from other projects reasonably likely to occur at the same time, identify and quantify as far as possible of any direct (e.g. loss of habitats due to construction of bridge structures and other supporting facilities, etc), indirect (e.g. changes in flight path, water qualities, hydrodynamics properties, sedimentation rates and pattern, hydrology, rotation, noise and other disturbance generated by the bridge structures and other supporting facilities, etc), on-site, off-site, primary, secondary and cumulative ecological impacts such as destruction of habitats, reduction of species abundance/diversity, loss of feeding grounds, reduction of ecological carrying capacity, habitat fragmentation, and in particular the following:
- (a) deterioration or disturbance to corals (including all hard corals, octocorals and black corals) or other marine habitats/species of conservation value, including any discovered during the course of the study;
  - (b) removal or disruption of potentially valuable benthic communities;
  - (c) potential impacts to avifauna, in particular migratory birds, during operational stage due to the increase in noise, air pollution, lighting, glare and physical barrier;
  - (d) impacts to aquatic organisms during construction and avifauna

during operational stage due to traffic noise and the glare due to lighting systems; and

- (e) potential impacts or disturbance to Horseshoe Crabs and their nursery areas.
- (vii) evaluation of ecological impact shall be based on the best and latest information available during the course of the EIA study, using quantitative approach as far as practicable and covering construction and operation phases of the Project as well as the subsequent management and maintenance requirement of the proposals;
- (viii) evaluation of significance and acceptability of the ecological impacts identified using criteria in Annex 8 of the TM;
- (ix) recommendations for all possible alternatives, such as modification/change of layout design, construction site and method, spacing, alignment and practicable mitigation measures to avoid, minimize and/or compensate for the adverse ecological impacts identified during construction and operation of the Project such as, construction of the project at times that minimize impacts to corals, Horseshoe Crabs and avifauna;
- (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) evaluate the severity and acceptability of the residual ecological impacts by making reference to the criteria in Annex 8 of the TM; and
- (xiii) review of the need for and recommendation on any ecological monitoring programme required.

#### 3.4.5.5 Impacts on Chinese White Dolphins

The assessment of impacts on Chinese White Dolphins (*Sousa chinensis*) shall include the following tasks:

- (i) review and incorporate the findings of relevant studies including the previous dolphins studies and collate available information regarding the ecological characters of the study area;
- (ii) evaluate the information collected and identify any information gap relating to the assessment of potential impacts on the Chinese White Dolphins;
- (iii) carry out necessary field surveys and investigations to verify the information collected, fill the information gaps identified, if any, and to fulfil the objectives of the EIA study;
- (iv) present relevant survey findings including previous survey conducted in relevant studies together with surveys carried out under this study, including the habitat maps as mentioned in Section 3.4.5.4 (iv) (b);

- (v) assess the direct and indirect impacts, including loss of habitat, water quality changes, release of toxic contaminants from sediments, underwater noise disturbance and their consequential ecological effects on the Chinese White Dolphins, during the construction and operational stages of the Project. The assessment shall include:
  - (a) impacts and disturbance to the Chinese White Dolphins associated with elevated bridges construction, reclamation, immersed tube tunnel construction, dredging, fill extraction, filling, transportation and disposal of dredged sediments;
  - (b) impacts on the Chinese White Dolphins of the possible use of underwater blasting and underwater percussive piling during construction stage, due to shock wave and underwater noise generated;
  - (c) predicted water quality changes and consequential ecological impacts on the Chinese White Dolphins. Parameters to be assessed should include suspended solids, dissolved oxygen and contaminants present in disturbed or dredged sediments;
  - (d) ecological impacts on the Chinese White Dolphins associated with potential bioaccumulation of toxic contaminants released from the disturbed or dredged sediment;
  - (e) potential risk on the Chinese White Dolphins colliding with marine vessels during construction;
  - (f) potential risk on the Chinese White Dolphins due to the chemical spillages arising from vehicle accident during operation of the Project.
- (vi) assess the overall cumulative ecological impacts on the Chinese White Dolphins due to this Project, any associated works of the Project, and any nearby development;
- (vii) identify precautionary and mitigatory measures for protection of the Chinese White Dolphins, The proposed measures may include, but need not be limited to, those recommended in previous EIA studies and dolphin studies;
- (viii) review the need for and recommend any dolphin monitoring programme; and
- (ix) assess and determine the acceptability of the overall residual ecological impact on the Chinese White Dolphins, after implementation of the precautionary and mitigatory measures as identified under Section 3.4.5.5 (vii) above.

### 3.4.6 Fisheries Impact

3.4.6.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing fisheries impact as stated in Annexes 9 and 17 of the TM.

3.4.6.2 The assessment area for fisheries impact assessment shall cover the Deep Bay, North Western and Western Buffer Water Control Zones as designated under the Water Pollution Control Ordinance or any areas likely to be impacted by the Project. Special

attention shall be given to the fishing activities within the Project area and fish culture zones at Ma Wan.

3.4.6.3 The assessment shall cover any potential impact on both capture and culture fisheries, during the construction and operation phases. Existing information available from relevant studies/surveys regarding the assessment area shall be reviewed. Based on the review results, the assessment shall identify data gap and determine if there is any need for field surveys. If field surveys are considered necessary, the assessment shall recommend appropriate methodology, duration and timing for the field surveys.

3.4.6.4 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 the 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;
- (v) Identification and evaluation of any direct/indirect and onsite-offsite impacts of fisheries and loss of fishing grounds;
- (vi) Identification and evaluation on any direct/indirect impacts on fish capture activities due to the disturbance of seabed profile by the Project;
- (vii) Recommendations on any environmental mitigation measures with justification, description of scope and programme, feasibility as well as staff and financial implications including those related to subsequent management and maintenance requirements of such recommendations; and
- (viii) Review the need for monitoring and, if necessary, recommend a monitoring and auditing programme.

### 3.4.7 Impact on Cultural Heritage

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

3.4.7.2 The cultural heritage impact assessment shall include a terrestrial archaeological review and a Marine Archaeological Investigation (MAI).

#### (a) Terrestrial archaeological review

The Applicant shall engage a qualified archaeologist to conduct a terrestrial archaeological review. If existing information is insufficient to ascertain the archaeological potential of the project area, further field investigation shall be conducted to obtain archaeological data. Special attention shall be paid to the Ha Law Wan Archaeological Site and Hau Wong Temple (Grade II Historic Building).

- (b) Marine Archaeological Investigation (MAI)
- (i) The Applicant shall engage a qualified marine archaeologist to conduct a MAI to include a desktop review of relevant available marine archaeological information and any relevant geophysical data within the project area prepared for the Antiquities and Monuments Office (AMO). The desktop review shall check and update the validity of the previous findings on the marine archaeological resources present within the Project area, and reconfirm their conclusions on the value of the resources if appropriate.
  - (ii) If the desktop review identified the need, geophysical survey(s) shall be carried out to collect additional information. The survey, if conducted, shall aim to identify whether there is any possible existence of sites or objects of cultural heritage, for example shipwreck, on the seabed that will be affected by the Project's marine activities or works to include dredging and permanent/temporary reclamation. The data obtained shall be interpreted by a qualified marine archaeologist. If anomalies identified in the geophysical survey are considered to be of potential archaeological significance, field dive survey(s) shall be conducted 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) for conducting the field dive survey(s).
  - (iii) Based on the desktop review and any additional information gathered from the geophysical survey(s) and dive survey(s), the Applicant shall evaluate the potential marine archaeological impacts and propose mitigation measures if adverse impact is identified.
  - (iv) The Applicant shall refer to Appendix D attached to this study brief for detailed requirements.

### 3.4.8 Landscape and Visual Impact

- 3.4.8.1 The Applicant shall follow the criteria and guidelines as stated in Annexes 10 and 18 of the TM and the EIAO Guidance Note No. 8/2002 on the preparation of Landscape and Visual Impact Assessment under the EIAO. Landscape and visual impacts during both construction and operation phases within the study area and the related works areas shall be assessed.
- 3.4.8.2 The assessment area for the landscape impact assessment shall include areas within a 500m distance from the site boundary of the Project, while the assessment area for the visual impact assessment shall be defined by the visual envelop of the Project.
- 3.4.8.3 The Applicant shall review relevant plan(s) and/or studies which may identify areas of high landscape value and recommend country 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 the statutory town plan(s) and any published land use plans shall be highlighted and appropriate follow-up action shall be recommended.



- 3.4.8.4 The Applicant shall describe, appraise, analyse and evaluate the existing and planned landscape resources and character of the assessment area. A system shall be derived for judging landscape and visual impact significance. 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 and visual 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 possible so as to illustrate the significance of such impacts arising from the proposed development. Clear mapping of the landscape impact is required. Tree survey shall be carried out and the impacts on existing trees shall be addressed.
- 3.4.8.5 The Applicant shall assess the visual impacts of the 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;
  - (ii) identification of the key groups of existing and planned sensitive receivers within the visual envelope with regard to views from ground level, sea level and elevated vantage points;
  - (iii) description of the visual compatibility of the Project with the surrounding and the planned setting, and its obstruction and interference with the key views of the study areas as defined in section 3.4.8.2; and
  - (iv) the severity of visual impacts in terms of distance, nature and number of sensitive receivers shall be identified. 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.
  - (v) clear evaluations and explanations of all the factors considered in arriving the significance thresholds of visual impacts.
- 3.4.8.6 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 alignment, site layout, design and construction methods that will avoid or reduce the identified landscape and visual impacts shall be evaluated for comparison before adopting other mitigation or compensatory measures to alleviate the impacts. The mitigation measures proposed shall not only be concerned with damage reduction but shall also include consideration of potential enhancement of existing landscape and visual quality. The Applicant shall recommend mitigation measures to minimise adverse effects identified above, including provision of a master landscape plan.
- 3.4.8.7 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, woodland restoration, 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 and visually sensitive receivers. 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.

- 3.4.8.8 Annotated illustration materials such as colour perspective drawings, 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 and visual impacts of the Project. In particular, the landscape and visual impacts of the Project with and without mitigation measures from representative viewpoints, particularly from views of the most severely affected visually sensitive receivers (i.e. worst case scenario), shall be properly illustrated in existing and planned setting at four stages (existing condition, Day 1 with no mitigation measures, Day 1 with mitigation measures and Year 10 with mitigation measures) by computer-generated photomontage so as to demonstrate the effectiveness of the proposed mitigation measures. Computer graphics shall be compatible with Microstation DGN file format. 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.

### **3.5 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, the environmental benefits of environmental protection measures recommended and residual impacts.

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

- 4.1 The Applicant shall identify in the EIA study whether there is any need for EM&A activities during the construction and operation phases of the Project and, if affirmative, to define the scope of the EM&A requirements for the Project in the EIA study.
- 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 the 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 check list as shown in Appendix E to this EIA 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 all 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. DURATION OF VALIDITY**

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

## 6. REPORT REQUIREMENTS

- 6.1 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.
- 6.2 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 in (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.
- 6.3 The Applicant shall, upon request, make additional copies of above documents available to the public, subject to payment by the interested parties of full costs of printing.
- 6.4 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 Report prepared in HyperText Markup Language (HTML) (version 4.0 or later) and in Portable Document Format (PDF version 1.3 or later), unless otherwise agreed by the Director. For the HTML version, a content page capable of providing hyperlink to each section and sub-section of the EIA Report and the Executive Summary Report 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.
- 6.5 The electronic copies of the EIA report and Executive Summary shall be submitted to the Director at the time of application for approval of the EIA Report.
- 6.6 When the EIA Report and the Executive Summary are made available for public inspection under s.7(1) of the EIA Ordinance, 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.

- 6.7 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.
- 6.8 To facilitate public involvement in the EIA process, the Applicant shall produce 3-dimensional electronic visualisations of the major findings (in particular the road traffic noise prediction, water quality and visual impacts) and elements of the EIA report, including baseline environmental information, the environmental situations with or without the project, key mitigated and unmitigated environmental impacts, and key recommended environmental mitigation measures so that the public can understand the project and the associated environmental issues. The visualisations shall be based on the EIA report and released to the public. The 3-dimensional visualizations shall be developed and constructed such that they can be accessed and viewed by the public through an internet browser at a reasonable speed and without the need for software license requirement at the client's end. The visualizations shall be deposited in 10 copies of CD-ROM, DVD±R or other suitable means agreed with the Director.

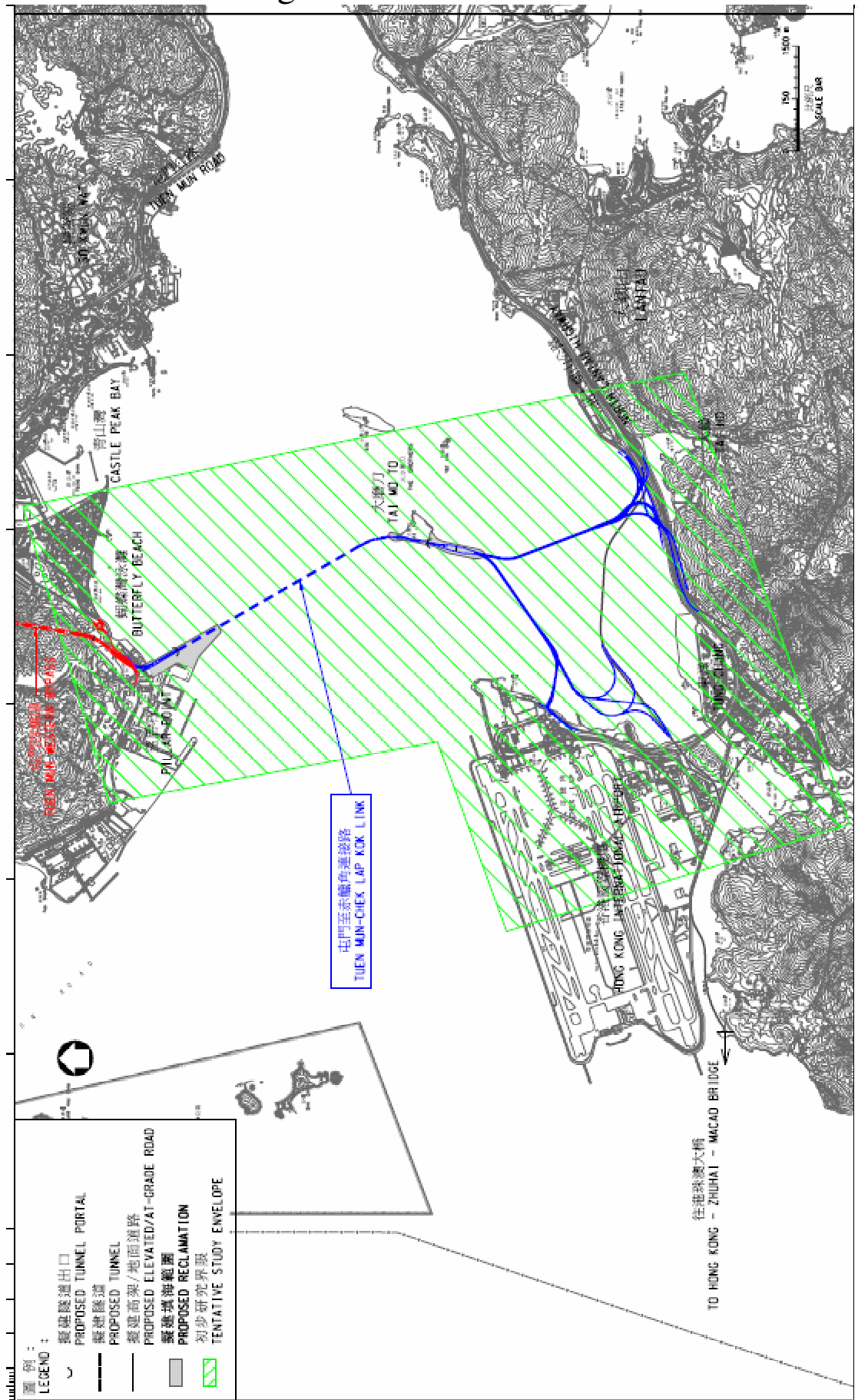
## **7. OTHER PROCEDURAL REQUIREMENTS**

- 7.1 During the EIA study, 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.
- 7.2 If there is any key change in the scope of the project mentioned in section 1.2 of this EIA study brief and in Project Profile (No. PP-336/2007), 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 another EIA study brief afresh.

--- END OF EIA STUDY BRIEF ---

December 2007  
Environmental Assessment Division,  
Environmental Protection Department

Figure 1 - Location Plan



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

*[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 the CALINE4 model due to its inability to handle lengthy data set.

- 3.1.3 For situations where, for example, (i) the model (such as CALINE4) does not allow easy handling of one full year of meteorological data; or (ii) model run time is a concern, the followings can be adopted in order to determine the daily and annual average impacts:
- (i) perform a frequency occurrence analysis of one year of meteorological data to determine the actual wind speed (to the nearest unit of m/s), wind direction (to the nearest 10°) and stability (classes A to F) combinations and their frequency of occurrence;
  - (ii) determine the short term hourly impact under all of the identified wind speed, wind direction and stability combinations; and
  - (iii) apply the frequency data with the short term results to determine the long term (daily / annual) impacts.

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

- 3.1.4 Note that the anemometer height (relative to a datum same for the sources and receptors) at which wind speed measurements were taken at a selected station should be correctly entered in the model. These measuring positions can vary greatly from station to station and the vertical wind profile employed in the model can be grossly distorted from the real case if incorrect anemometer height is used. This will lead to unreliable concentration estimates.
- 3.1.5 An additional parameter, namely, the standard deviation of wind direction,  $\sigma_{\theta}$ , needs to be provided as input to the CALINE4 model. Typical values of  $\sigma_{\theta}$  range from 12° for rural areas to 24° for highly urbanised areas under 'D' class stability. For semi-rural such as new development areas, 18° is more appropriate under the same stability condition. The following reference can be consulted for typical ranges of standard deviation of wind direction under different stability categories and surface roughness conditions.

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

### 3.2 Emission Sources

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

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

*Ref.(2): Compilation of Air Pollutant Emission Factors, AP-42, 5<sup>th</sup> 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 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 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 ( $< 30 \mu\text{m}$ ) and RSP ( $< 10 \mu\text{m}$ ) compositions should be used.

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

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

- (a) Ambient Ratio Method (ARM) - assuming 20% of NO<sub>x</sub> to be NO<sub>2</sub>; or
- (b) Discrete Parcel Method (DPM, available in the CALINE4 model); or
- (c) Ozone Limiting Method (OLM) - assuming the tailpipe NO<sub>2</sub> emission to be 7.5% of NO<sub>x</sub> and the background ozone concentration to be in the range of 57 to 68  $\mu\text{g}/\text{m}^3$  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 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 in Appendix B-3.

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

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

### 3.11 Background Concentrations

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

### 3.11 Output

The highest short-term and long-term averages of pollutant concentrations at prescribed receptor locations are output by the model and to be compared against the relevant air quality standards specified for the relevant pollutant. Contours of pollutant concentration are also required for indicating the general impacts of emissions over a study area.

Copies of model files in electronic format should also be provided for EPD's reference.

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**Schedule 1**

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

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

**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

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

**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:

<b>POLLUTANT</b>	<b>URBAN</b>	<b>INDUSTRIAL</b>	<b>RURAL / NEW DEVELOPMENT</b>
NO <sub>2</sub>	59	57	39
SO <sub>2</sub>	21	26	13
O <sub>3</sub>	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:

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

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

### 3.5 Provisions for 'double-counting'

The current approach is, by no means, a rigorous treatment of background air quality but aims to provide an as-realistic-as-possible approximation based on limited field data. 'Double-counting' of 'secondary contributions' may be apparent through the use of such 'monitoring-based' background data as some of the monitoring stations are of close proximity to existing emission sources. 'Primary contributions' due to a proposed project (which is yet to be 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.

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

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

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



**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, thermal and particle dispersion modules. All modules shall have been proven with successful applications locally and overseas.
3. The hydrodynamic, water quality, sediment transport and thermal 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:
  - 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 thermal model shall be based on the flow field produced by the hydrodynamic model. It shall incorporate the physical processes of thermal / cooled water discharge and abstraction flow, buoyancy effect of the thermal plume, and surface heat exchange. Dispersion of biocides in the discharge shall also be simulated with appropriate decay rates.
4. 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.
5. 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 grid shall also be able to reasonably represent coastal features existing and proposed in the project. 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, sediment transport and thermal modules, where appropriate, shall be run for (with proper model spin up) at least a real sequence of 15 days spring-neap tidal cycle in both the dry season and the wet season.
3. Water quality module shall run for a complete year incorporating monthly variations in Pearl River discharges, solar radiation, water temperature and wind velocity in the operational stage. Construction stage impacts, cooling water discharge and floating refuse and debris entrapment may be assessed by simulating typical spring-neap cycles in the dry and wet seasons.
4. The results shall be assessed for compliance of Water Quality Objectives. Any changes in hydrodynamic regime shall be assessed. Daily erosion / sedimentation rate shall be computed and its ecological impact shall be assessed.
5. The impact on all sensitive receivers shall be assessed.
6. Cumulative impacts due to other projects, activities or pollution sources within a boundary to the agreement of EPD shall also be predicted and quantified.

- END -

**Guidelines for Marine Archaeological Investigation (MAI)**  
**(As at Nov 2006)**

The standard practice for MAI should consist of four separate tasks, i.e. (1) Baseline Review, (2) Geophysical Survey, (3) Establishing Archaeological Potential and (4) Remote Operated Vehicle (ROV)/Visual Diver Survey/Watching Brief.

**(1) Baseline Review**

- 1.1 A baseline review should be conducted to collate the existing information in order to identify the potential for archaeological resources and, if identified, their likely character, extent, quality and value.
- 1.2 The baseline review will focus on known sources of archive data. It will include:
  - a. Geotechnical Engineering Office (GEO) – the Department holds extensive seabed survey data collected from previous geological research.
  - b. Marine Department, Hydrographic Office - the Department holds a substantial archive of hydrographic data and charts.
  - c. The Royal Naval Hydrographic Department in the UK - the Department maintains an archive of all survey data collected by naval hydrographers.
- 1.3 The above data sources will provide historical records and more detailed geological analysis of submarine features which may have been subsequently masked by more recent sediment deposits and accumulated debris.

**(2) Geophysical Survey**

- 2.1 Extensive geophysical survey of the study area should deploy high resolution boomer, side scan sonar, an echo sounder and high resolution multi beam sonar. The multi beam data must be presented as processed digital terrain models to facilitate the archaeological analysis. The data received from the survey would be analysed in detail to provide:
  - a. Exact definition of the areas of greatest archaeological potential.
  - b. Assessment of the depth and nature of the seabed sediments to define which areas consist of suitable material to bury and preserve archaeological material.

- c. Detailed examination of the boomer and side scan sonar records to map anomalies in and on the seabed which may be archaeological material.
- d. Detailed examination of the multi beam sonar data to assess the archaeological potential of the sonar contacts.

### **(3) Establishing Archaeological Potential**

- 3.1 The data examined during Task 1 and 2 will be analysed to provide an indication of the likely character and extent of archaeological resources within the study area. This would facilitate formulation of a strategy for investigation.
- 3.2 The results would be presented as a written report and charts. If there is no indication of archaeological material there would be no need for further work.
- 3.3 Charts should be presented at 1:500 scale and show each survey contact. Its dimensions and exact location should also be shown.

### **(4) Remote Operated Vehicle (ROV)/Visual Diver Survey/Watching Brief**

- 4.1 Subject to the outcome of Task 1, 2 and 3, accepted marine archaeological practice would be to plan a field evaluation programme to acquire more detailed data on areas identified as having archaeological potential. The areas of archaeological interest can be inspected by ROV or divers. ROV or a team of divers with both still and video cameras would be used to record all seabed features of archaeological interest.
- 4.2 Owing to the heavy marine traffic in Hong Kong, the ROV/visual diver survey may not be feasible to achieve the target. If that is the case, an archaeological watching brief is the most appropriate way to monitor the dredging operations in areas of identified high potential to obtain physical archaeological information.
- 4.3 A sampling strategy for an archaeological watching brief would be prepared based on the results of Task 1, 2 and 3 to focus work on the areas of greatest archaeological potential. Careful monitoring of the dredging operations would enable immediate identification and salvage of archaeological material. If archaeological material is found, the AMO should be contacted immediately to seek guidance on its significance and appropriate mitigation measures would be prepared.
- 4.4 If Task 4 is undertaken, the results would be presented in a written report with charts.

### **Report**

Three copies of the final report should be submitted to the AMO for record.

