

**Environmental Impact Assessment Ordinance (Cap. 499), Section 5(7)**  
**Environmental Impact Assessment Study Brief No. ESB-181/2008**

**Project Title : South Island Line (East)**  
**(hereinafter known as the "Project")**

**Name of Applicant : MTR Corporation Limited (MTRCL)**  
**(hereinafter known as the "Applicant")**

## **1. BACKGROUND**

- 1.1 An application (No. ESB-181/2008) 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 5 February 2008 with a Project Profile (No. 344/2008) (the Project Profile).
- 1.2 The proposed Project is to construct and operate a new railway line to serve the southern part of Hong Kong Island. The indicative route(s) of the system is shown in the Project Profile and is reproduced in Appendix A in this study brief. The development and operation of the Project will comprise the following:
- (i) Approximately 7km of partly underground and partly viaduct railway alignment from Ap Lei Chau via South Horizons, Lei Tung, Wong Chuk Hang, Ocean Park to Admiralty directly or through Happy Valley as an alternative option;
  - (ii) Construction of tunnels and underground stations by drill-and-blast, tunnel boring machine, cut-and-cover and/or sequential excavation method (also known as New Austrian Tunnelling Method);
  - (iii) Construction of viaduct section from Lei Tung on Ap Lei Chau via Wong Chuk Hang and Ocean Park to the tunnel entrance adjacent to Nam Fung Road portal;
  - (iv) Construction of a railway bridge across the Aberdeen Channel;
  - (v) Construction of above-ground stations and ventilation shafts along the alignment, and a depot at Ex-Wong Chuk Hang Estate site; and
  - (vi) Operation of the railway system and the depot.
- 1.3 Pursuant to section 5(7)(a) of the Environmental Impact Assessment Ordinance, the Director of Environmental Protection (the Director) issues this Environmental Impact Assessment (EIA) study brief to the Applicant to carry out an EIA study.

1.4 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 that take place concurrently. This information will contribute to decisions by the Director on:

- (i) the overall acceptability of any adverse environmental consequences that are likely to arise as a result of the Project;
- (ii) the conditions and requirements for the detailed design, construction and operation of the Project to mitigate against adverse environmental consequences wherever practicable; and
- (iii) the acceptability of residual impacts after the proposed mitigation measures are implemented.

## **2. OBJECTIVES OF THE EIA STUDY**

2.1 The objective of the EIA study are as follows:

- (i) to describe the Project, associated works, and any option(s) of alignment together with the requirements and environmental benefits for carrying out the Project;
- (ii) to identify any individual Designated Project under Part I, Schedule 2 of the EIAO to be covered in the Project to ascertain whether the findings of this EIA Study have adequately addressed the environmental impacts of these projects;
- (iii) 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 and the associated environmental constraints;
- (iv) to present the considerations of alternatives with regard to avoiding and minimizing the potential environmental impacts on the sensitive receivers; to compare the environmental benefits and dis-benefits of the options (including project alignment, station and depot locations, train system, locations and size of works sites and construction methods); to provide reasons for selecting the preferred option(s) and to describe the part that environmental factors played in the selection;
- (v) to identify and assess noise impacts, ecological impacts, water quality impacts, landscape and visual impacts, hazard to life, waste management implications, air quality impacts and impacts on sites of cultural heritage, and determine the significance of impacts on sensitive receivers and potential affected uses;
- (vi) to investigate the feasibility, practicability, effectiveness and implications of the proposed mitigation measures;

- (vii) to identify, predict and evaluate the residual environmental impacts (i.e. after practicable mitigation) and the cumulative effects expected to arise during the construction and operational phases in relation to the sensitive receivers and potential affected uses;
- (viii) to identify, assess and specify methods, measures and standards, to be included in the detailed design, construction and operational stages of the Project which are necessary to mitigate these environmental impacts and cumulative effects and reduce them to acceptable levels;
- (ix) to investigate the extent of the secondary environmental impacts that may arise from the proposed mitigation measures and to identify constraints associated with the mitigation measures recommended in the EIA study, as well as the provision of any necessary modification; 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**

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

#### **3.2 The Scope**

- 3.2.1 The scope of this EIA study shall cover the Project proposed in the Project Profile and shall include the major elements mentioned in Section 1.2 above. The EIA study shall address the key issues and provide information as described below, together with any other key issues identified during the course of the EIA study and the cumulative environmental impacts of the Project through interaction or in combination with other existing, committed, planned and known potential development in the vicinity of the Project, including, but not limited to, “Repositioning and Long Term Operation Plan of Ocean Park”, “Shatin to Central Link”, “Drainage Improvement in Northern Hong Kong Island – Hong Kong West Drainage Tunnel” and decking of Wong Chuk Hang Nullah:

- (i) the potential noise impacts on the existing and planned sensitive receivers, including, but not limited to, South Horizons, Lei Tung Estate, Wong Chuk Hang Complex for the Elderly, Wong Chuk Hang Hospital and Wong Chuk Hang San Wai, during the construction and operation of the Project;
- (ii) the potential ecological impacts arising from the construction and operation of the Project, including, but not limited to, the impacts on Site of Special Scientific Interest (SSSI) at Nam Fung Road, Aberdeen Country Park and marine habitats (including intertidal and subtidal);
- (iii) the potential water quality impacts arising from the construction and operation of the Project, including, but not limited to, the impacts on the Aberdeen Channel (Typhoon Shelter) and the Wong Chuk Hang Nullah;
- (iv) the potential landscape and visual impacts on existing and planned sensitive receivers during the construction and operation of the Project;
- (v) the potential hazard to life during the construction and operation of the Project;
- (vi) the potential impacts of various types of waste arising, including, but not limited to, excavated materials from constructing tunnels and stations of the railway and, any other construction waste and chemical waste to be generated from the construction and operation of the Project;
- (vii) the potential air quality impacts during the construction stage of the Project; and
- (viii) the potential impacts on cultural heritage likely to be affected by the construction works of the Project.

### **3.3 Consideration of Alternative Alignment Options and Construction Methods**

#### **3.3.1 The Background Information of the Project**

The Application shall provide information on the background for the construction and operation of this Project. The Applicant shall explain clearly the purpose and objectives of the Project, and shall include a description of the potential environmental benefits of the Project.

#### **3.3.2 Consideration of Alternative Alignment(s), Station(s) and Depot Option(s) and Train System**

In addition to the proposed alignment and station option(s) mentioned in the Project Profile and Section 1.2 above, the Applicant shall describe the considerations given, when exploring various feasible alternative option(s) for alignment, station and depot locations and train system, to avoid adverse environmental impacts to the maximum practicable extent, taking into account previous studies and any lessons learned from other similar projects. A comparison of the environmental benefits and dis-benefits of feasible alternative options shall be presented to support the selection of the preferred option(s).

Operational considerations or other constraints affecting the selection of the preferred option(s) shall also be stated. In particular, the need for any above ground viaduct, bridge and at grade section(s) instead of underground tunnels shall be clearly justified in view of their potential nuisance, disturbance and impacts on nearby residents, sensitive receivers, and SSSI at Nam Fung Road. The considerations given in the design and location of ventilation shafts shall also be provided to justify the selection of the preferred options.

### 3.3.3 Consideration of Alternative Construction Methods, Sequences of Works, Work Site Requirements and Locations

Taking into consideration the potential cumulative effects during the construction period and the degree of the construction impacts on affected sensitive receivers, the EIA study shall describe the considerations given, when exploring various feasible alternative construction methods (including at least Cut and Cover, New Austrian Tunnelling Method/Shield Tunnelling, Tunnel Boring Machine, drill-and-blast, Mini and micro-tunnelling) and sequence of works, work site size requirements (including Tunnel Boring Machine launching and retrieval sites) and work site locations for the Project, to avoid extensive periods of exposing sensitive receivers to adverse environmental impacts. The EIA study shall also explore with a view to select feasible method(s) for constructing the railway tunnels that would not adversely affect the underground water levels that would in turn affect the SSSI at Nam Fung Road, Aberdeen Country Park and other ecological sensitive areas. A comparison of the environmental benefits and dis-benefits of applying different construction methods and sequences of works shall be made.

### 3.3.4 Selection of Preferred Options

Taking into consideration of the findings resulting from Sections 3.3.2 and 3.3.3 above, the Applicant shall provide the recommendations and justifications for the preferred option that has tried to avoid or minimize adverse environmental effects arising from the construction and operation of the Project, and shall adequately describe the part that environmental factors played in arriving at the final selection.

### 3.3.5 Description of the Project

The Applicant shall describe the Project in details, including, but not limited to, the alignment and train system to be adopted, the stations and depot locations, the construction programme, the work sites size requirements and their locations, the explosives magazine location (if any), the form of construction and construction methods for various above ground and underground structures of the railway system.

### **3.4 Technical Requirements**

The Applicant shall conduct the EIA study to address the environmental aspects as described in Section 3.2 above. The assessment shall be based on the best and latest information available during the course of the EIA study.

#### **3.4.1 Noise Impact**

3.4.1.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing both the construction and operation noise impacts arising from the Project as stated in Annexes 5 and 13 of the TM respectively. In response to Section 4.4.2(h) of the TM, the Applicant shall review and consider any lessons learnt from other similar projects for incorporation in the current proposal to avoid in the first instance or minimize potential noise impacts.

3.4.1.2 The Applicant shall address the potential noise impacts, including but not limited to, (1) the potential air-borne and ground-borne construction noise impacts; (2) the potential air-borne and ground-borne operational rail noise impacts; and (3) the potential fixed noise impacts during the operation stage, such as ventilation systems and fixed plants at stations and depots.

3.4.1.3 The noise impact assessment shall include the following:

(i) Determination of Assessment Area

The assessment area shall include all areas within a distance of 300m from the Project boundary and of all work sites, including work areas away from the railway alignment, proposed under the Project. The assessment area may 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 located further away. In this case, the assessment area shall be agreed with the Director. Subject to the agreement of the Director, the assessment area shall be expanded to include NSRs at greater distance which would be affected by the construction and operation of the project.

(ii) Provision of Background Information and Existing Noise Levels

The Applicant shall provide background information relevant to the Project, e.g. relevant previous or current studies. Unless 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 and Layout Plans, and other relevant published land use plans.
- (b) The Applicant shall select assessment points to represent all identified NSRs for carrying out quantitative noise assessment as described below. The assessment points shall be agreed with the Director prior to the quantitative noise assessment and may be varied subject to the best and latest information available during the course of the EIA study. A map shall be given showing the location and description such as name of building, use, and floors of each and every selected assessment points. 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 operational noise assessment purpose.

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

The Applicant shall provide inventory of noise sources including representative construction equipment assumed for assessing construction noise associated with, for example tunnelling and other construction works, and plant/ equipment/ railway/ rolling stock for operation noise assessment. The inventory shall assume appropriate railway traffic data for the purpose of assessment.

(v) Construction Noise Assessment

- (a) The assessment shall cover the cumulative noise impacts due to the construction works of the Project and other likely concurrent projects identified during the course of the EIA study.
- (b) The Applicant shall carry out assessment of noise impact from construction (excluding percussive piling) of the Project during day time, i.e. 7 a.m. to 7 p.m., on weekdays other than general holidays in accordance with the methodology stipulated in paragraphs 5.3. and 5.4 of Annex 13 of the TM. The criteria in Table 1B of Annex 5 of the TM shall be adopted in the assessment.
- (c) For ground-borne noise impacts, the criteria and assessment methodology shall be agreed with the Director (with reference to Section 4.4.2(c) of the TM). Site measurements at appropriate locations may be required in order to obtain the empirical input parameters required in the ground-borne noise model.
- (d) To minimize the construction noise impact, alternative construction methods to replace percussive piling and blasting shall be proposed as far as practicable. In case blasting cannot be avoided, it should be carried out, as far as practicable,

outside the sensitive hours (7pm to 7am on Monday to Saturday and any time on a general holiday, including Sunday). For blasting that must be carried out during the above-mentioned sensitive hours, the noise impact associated with the removal of debris and rocks should be fully assessed and mitigation measures should be recommended to reduce the construction noise impact. Also, a mechanism should be recommended in the EIA Report such that the blasting schedule should be submitted to the concerned authority for approval prior to its implementation.

- (e) For tunnelling, noise impact (including air-borne noise and ground-borne noise) associated with the operation of powered mechanical equipment, in particular, tunnel boring machines or equivalent, shall be assessed. If the equipment, such as a tunnel boring machine and associated facilities, is used, the methodology/model for assessing ground-borne noise impact from these equipments/facilities shall be agreed with the Director prior to obtaining the empirical parameters required in the ground-borne noise model. Cumulative impacts with other projects shall be covered if appropriate.
- (f) If the unmitigated construction noise levels are found to exceed the relevant criteria, the Applicant shall propose practicable direct mitigation measures (including at least movable barriers, enclosures, quieter alternative methods, re-scheduling and restricting hours of operation of noisy tasks), particularly at open-cut areas, tunnel boring machine launching and retrieval shafts and tunnel portal(s), to minimize the impact. If the mitigated noise levels still exceed the relevant criteria, the duration of the noise exceedance and population being affected shall be given.
- (g) The Applicant shall formulate a construction programme as far as practicable such that no work will be required in the restricted hours as defined under the Noise Control Ordinance (NCO). In case the Applicant needs to evaluate whether construction works during restricted hours as defined under the NCO are feasible or not in the context of programming construction works, reference should be made to the relevant technical memoranda issued under the NCO. Regardless of the results of construction noise impact assessment for 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 condition/situations of adjoining land uses and any previous complaints against construction activities at the site before making his decision in granting a CNP. This should be explicitly stated in the noise chapter and the conclusions and recommendations chapter in the EIA report.

(vi) Operational Rail Noise Assessment

- (a) The Applicant shall assess the air-borne rail noise impacts during the operational phase of the proposed railway and the associated depot facilities, including worst case scenario, normal, abnormal, transient and emergency operations, if applicable, with respect to the acceptable levels contained in Table 1A in Annex 5 in the TM. The assessment methodology including the railway/train design noise level shall be agreed with the Director prior to the commencement of the assessment.
- (b) For operation ground-borne noise impact, the criteria and assessment methodology shall be agreed with the Director with special reference to Section 4.4.2(c) of the TM. The assessment shall also cover the cumulative ground-borne noise impact due to the Project and the railways in the vicinity (such as the existing Mass Transit Railway and Shatin to Central Link, if appropriate). Site measurements at appropriate locations on a "like-to-like" basis (e.g. under similar situations) may be required in order to obtain the empirical input parameters required in the ground-borne noise model.
- (c) In assessing the noise level, the Applicant shall allow for a deterioration in rail and rolling stock condition from brand new to an operating level and shall address the reasonable and worst case scenarios, taking into account any other planned noise sources. The Applicant shall present the noise levels in  $Leq(30min)$ ,  $Leq(24 hr)$  and  $L_{max}$  during the day and at night at the NSRs at various representative floor levels (in mPD) on tables and plans of suitable scale. Quantitative assessment at the identified NSRs for different alignment of the rail shall be compared against the relevant criteria or limits. The potential noise impact of each proposed alignment on the existing and planned NSRs shall be quantified by estimating the total number of dwellings and/or classrooms and other sensitive elements that will be exposed to levels above the relevant planning criteria and statutory limits.
- (d) The Applicant shall make recommendations for noise amelioration/direct technical remedies for any existing or planned NSR which would be subject to predicted cumulative noise level in excess of the relevant planning criteria or statutory limits in the appropriate design year. A manual detailing the schedule of maintaining/capping the wheel/rail noise to suit the design specification shall be provided.
- (e) In case where a number of the NSRs cannot be protected by the recommended noise amelioration/direction technical remedies, the Applicant shall consider alternatives to reduce the impact.

(vii) Fixed Noise Source Assessment

For fixed noise sources, such as ventilation systems and fixed plants at stations and depot, the following assessment shall be followed:

- (a) Assessment of Fixed Source Noise Levels – The Applicant shall calculate the expected noise using standard acoustic principles. Calculations for the expected noise shall be based on the assumed plant inventories and utilization schedule for the reasonable and worst case scenarios. The Applicant shall calculate the noise levels taking into account the correction of tonality, impulsiveness and intermittency in accordance with the Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites. The cumulative impacts due to the fixed noise sources proposed for the Project (such as the ventilation shafts) and other existing and planned noise sources shall also be assessed.
- (b) Presentation of Noise Levels – The Application shall present the existing and future noise levels in Leq(30min) at the NSRs at various representative floor levels (mPD) on tables and plans of suitable scale. A quantitative assessment at the NSRs for the proposed fixed noise sources shall be carried out and compared against the criteria set out in Table 1A of Annex 5 of the TM.
- (c) Proposal for Noise Mitigation Measures – To protect the affected NSRs, the Applicant shall propose direct technical remedies within the project limits in all situations where the predicted noise levels exceed the criteria set out in Table 1A of Annex 5 of the TM.

(viii) Assessment of Side Effects and Constraints

The Applicant shall identify, assess and propose means to avoid or minimize any consequential adverse impacts from the construction of noise impact mitigation measures and to resolve any potential constraints due to the inclusion of the recommended direct technical remedies.

(ix) Evaluation of Constraints on Planned Noise Sensitive Developments/Land Uses

- (a) For planned noise sensitive uses which will still be affected even with all practicable direct technical remedies in place, the Applicant shall propose, evaluate and confirm the practicality of additional measures within the planned noise sensitive uses boundary and shall make recommendations on how these noise sensitive uses should be designed for the information of relevant parties.
- (b) The Applicant shall take into account the agreed environmental requirements/constraints identified by the study to assess the development potential of the concerned sites, and shall make such information known to the relevant parties.

### 3.4.2 Ecological Impact

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

3.4.2.2 The assessment area for the purpose of terrestrial ecological assessment shall include all areas within 500 m distance from the site boundary of the works areas, and the area likely to be impacted by the Project. For aquatic ecology, the study area shall be the same as the water quality impact assessment or the area likely to be impacted by the Project.

3.4.2.3 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 recognized sites of conservation importance including, but not limited to, Sites of Special Scientific Interest (SSSI) at Nam Fung Road and Aberdeen Country Park, and other ecological sensitive areas/species e.g. natural woodlands and stream courses, corals and valuable marine benthic communities. The assessment shall identify and quantify as far as possible the potential ecological impacts to the natural environment and the associated wildlife/marine fauna arising from the Project, including the impacts due to the construction of railway tunnel, viaduct structures, haul roads, temporary work sites and access. Impacts to marine habitats (including intertidal and subtidal) due to construction and operation of the railway bridge and viaduct structures should also be assessed and addressed. The assessment shall include the following:

- (i) Review of the findings of relevant studies and collating all the available information regarding the ecological characters of the assessment area;
- (ii) Evaluation of the information collected and identification of any information gap relating to the assessment of potential ecological impacts to the terrestrial and aquatic environment;
- (iii) Carrying out the necessary field surveys for a duration of at least four months in the wet season, and investigations to verify the information collected, fill the information gaps identified and fulfil the objectives of the EIA study;
- (iv) Establishment of the general ecological profile of the assessment area and description of the characteristics of the habitats found. Major information to be provided shall include.

- (a) description of the physical environment, including all recognised sites of conservation importance including, but not limited to, SSSI at Nam Fung Road and Aberdeen Country Park, and assess whether these sites will be affected by the Project and associated works or not;
  - (b) habitat maps of suitable scale (1:1000 to 1:5000) showing the types and locations of the habitats in the Study Area;
  - (c) ecological characteristics of each habitat types such as size, vegetation type, species present, dominant species found, species diversity and abundance, community structure, 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; and
  - (e) species found that are of conservation importance, rare, endangered and/or listed under local legislation, international conventions for conservation for wildlife/habitats or red data book;
- (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 woodlands, natural stream courses, herpetofauna, avifauna (in particular egrets roosting along Wong Chuk Hang Nullah), corals and marine benthic communities;
- (vi) Using suitable methodology, identification and quantification as far as possible of any direct, indirect, on-site, off-site, primary, secondary and cumulative ecological impacts such as destruction of habitats, reduction of species abundance/diversity, loss of feeding grounds, reduction of ecological carrying capacity, habitat fragmentation, change in underground water levels and in particular the following;
- (a) habitat loss and disturbance to wildlife during construction stage; and
  - (b) deterioration of environmental qualities (e.g. water qualities), change in hydrodynamic condition and the subsequent impacts to the biological communities, in particular within SSSI at Nam Fung Road, and Aberdeen Country Park during and after construction stage;

- (vii) Evaluation of the significance and acceptability of the ecological impacts identified using well-defined criteria;
- (viii) Recommendations for all feasible alternatives, such as modifications of layout and design (in particular the viaduct alignment), alternative route and portal locations (in particular the Nam Fung Road portal) and practicable mitigation measures to avoid, minimize and/or compensate for the adverse ecological impacts identified;
- (ix) 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;
- (x) Determination and quantification as far as possible of the residual ecological impacts after implementation of the proposed mitigation measures; and
- (xi) Evaluation of the severity and acceptability of the residual ecological impacts using well-defined criteria; and
- (xii) Review of the need for and recommendation on any ecological monitoring programme required.

### **3.4.3 Water Quality Impacts**

- 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 assessment area for the water quality impact assessment shall include the Victoria Harbour, Western Buffer, Southern Water and Southern Supplementary Water Control Zones stipulated under the Water Pollution Control Ordinance (WPCO, Cap. 358); and all areas within 500 m from the Project boundary. This assessment area could be extended to include other areas such as water gathering ground, existing and new drainage system; and the associated water system(s) which may be affected by the Project.
- 3.4.3.3 The Applicant shall identify and analyse physical, chemical and biological disruptions of marine water or ground water system(s), drainage system, catchment area(s), stormwater channel(s) and coastal water arising from the construction and operation of the Project.
- 3.4.3.4 The Applicant shall predict, quantify and assess the water quality impacts arising from the Project on the water system(s) and sensitive receivers by appropriate techniques.

Possible impacts shall include (1) change in flow regime and hydrology in the Aberdeen Channel (Typhoon Shelter) and the Wong Chuk Hang Nullah due to the railway bridge and viaduct structures; (2) dredging and backfilling for the construction of piers/ pier foundations of bridge/viaduct in Aberdeen Channel and the Wong Chuk Hang Nullah; (3) spent cooling water discharge (if applicable); and (4) sewage, wastewater, pumped groundwater and surface runoff arising from the Project.

3.4.3.5 The Applicant shall include (1) the construction stage impacts on water quality at the site; and (2) operational stage impacts on water quality. Essentially, the assessment shall address the following:

- (i) Collection and review of background information on the existing and planned water systems and their respective catchments and sensitive receivers which might be affected by the Project.
- (ii) Characterization of water and sediment quality of the water systems and respective catchments and sensitive receivers which might be affected by the Project based on existing information or site survey and tests as appropriate.
- (iii) Identification and analysis of existing and planned activities and beneficial uses related to the water system(s) and identification of water sensitive receivers. The Applicant shall refer to, *inter alia*, those developments and uses earmarked on the relevant outline zoning plans, outline development plans and layout plans.
- (iv) Identification of pertinent water and sediment quality objectives and establishment of other appropriate water and sediment quality criteria or standards for the water system(s) and the sensitive receivers.
- (v) Review of specific design, construction methods and configurations of the tunnels, viaduct, bridge, depot, stations and ancillary facilities of the railway system; and operation of the Project. Identification of any alteration of water course, drainage system, change of hydrodynamic regimes, change of ground water levels, change of catchment types or areas.
- (vi) Identification, analysis and quantification of existing, likely future water and sediment pollution sources including point discharges and non-point sources to surface water runoff, sewage or polluted discharge generated from the Project and spent cooling water discharge.
- (vii) Establishment and provision of a pollution load inventory on the quantities and characteristics of existing and likely future water pollution sources identified in

(vi) above. Field investigation and laboratory tests shall be conducted as appropriate to fill in any major information gaps.

### Impact Prediction

- (viii) The Applicant shall demonstrate that there would be no adverse impact on the flow regime by adopting appropriate design measures for the railway bridge piers/pier foundations at Aberdeen Channel (Typhoon Shelter) (ATS). If the railway bridge piers/pier foundations at the ATS will result in changes in flushing capacity and water quality of ATS, the changes in flushing capacity and water quality of ATS shall be assessed using a water quality model. Flushing capacity shall be assessed by simulating the removal rate of tracer(s) specified in the model in accordance with identified pollution sources over a minimal period of a spring-neap cycle in both the dry season and the wet season. The Applicant shall propose detailed methodology for flushing analysis and water quality assessment for the agreement of the Director. The water quality modelling assessment specifications are in Appendix B to this Study Brief.
- (ix) The Applicant shall demonstrate that there would be no adverse impact on the flow regime by adopting appropriate design measures for the viaduct section at the Wong Chuk Hang Nullah. If the new pier structures of the viaduct section will be placed on the Nullah, its flushing capacity shall be assessed quantitatively using an open channel model of at least one-dimensional. The Applicant shall propose detailed methodology for flushing analysis and water quality assessment for the agreement of the Director.
- (x) If seawater will be used in cooling system and spent cooling effluent will be discharged into marine water, prediction and quantification by mathematical modeling shall be required to assess the impacts on the water system and sensitive receivers, in respect of thermal and chemical discharge. The water quality modeling specifications in Appendix B to this Study Brief could be used as a guideline subject to amendment in respect of the model calibration area and the fine grid model area<sup>1</sup>. If the spent cooling water discharge will not be significant in terms of discharge rate and impact on sensitive waters or sensitive receivers, the Applicant may propose alternative assessment methodology for the agreement of the Director.

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<sup>1</sup> The models areas specified in the modeling specification focus on the Aberdeen typhoon shelter where no new effluent discharge is allowed. The project profile submitted by MTRCL did not indicate location of discharge, flow rate or chemical dosing regime of the cooling system. Therefore, if modeling assessment is needed, at least the aspect of model coverage has to be reviewed.

- (xi) Assessment of the cumulative impacts due to other related concurrent and planned projects, activities or pollution sources within a boundary around the study area, that may have a bearing on the aquatic environment.
- (xii) Assessment and evaluation of any potential stormwater, pumped groundwater and surface runoff impacts on the identified water system(s), respective catchments and sensitive receivers due to sewage and wastewater arising from the Project. Any effluent generated will require appropriate collection, treatment and disposal to within standards and objectives and criteria established in (iv) above.
- (xiii) Assessment and evaluation of any potential stormwater, pumped groundwater and surface runoff impacts on the identified water system(s), respective catchments and sensitive receivers during construction and operation stages as to reduce the water and sediment quality impacts to within standards, objectives and criteria established in (iv) above. Best management practices shall be recommended to reduce any potential impacts arising from stormwater runoff and pumped groundwater during both construction and operation stages.

#### Mitigation

- (xiv) Proposal of effective and practicable infrastructure upgrading or provision, water pollution prevention and mitigation measures to be implemented during the construction and operation stages to reduce water quality impacts to within acceptable levels of standards. Requirements to be incorporated in the Project contract document shall also be proposed.
- (xv) Evaluation and quantification of residual impacts (if any) on the water system(s) and sensitive receivers with regard to the appropriate water quality criteria, standards or guidelines.

### **3.4.4 Landscape and Visual Impacts**

- 3.4.4.1 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 "Preparation of Landscape and Visual Impact Assessment under the Environmental Impact Assessment Ordinance" for evaluating and assessing the Landscape and Visual Impact Assessment (LVIA).
- 3.4.4.2 The Applicant shall address the potential landscape and visual impacts due to the above-ground structure, including but not limited to, viaduct, railway bridge, ventilation shafts/buildings and associated access roads during the construction and operation stages.

- 3.4.4.3 The assessment area for landscape impact assessment shall include all areas within a 100m distance from the works limit of the Project. The assessment area for the visual impact assessment shall be defined by the visual envelope of the Project.
- 3.4.4.4 The Applicant shall review relevant outline development plan(s), outline zoning plan(s), layout plan(s) or planning briefs and studies which may identify areas of high landscape value, e.g. green belt and woodland areas with sensitive landscape designations. The aim is to gain an insight to the future outlook of the area affected so as to assess whether the Project can fit into the surrounding setting. Any conflict with statutory town plan(s) shall be highlighted and appropriate follow-up action shall be recommended.
- 3.4.4.5 The Applicant shall describe, appraise, analyze and evaluate the existing landscape resources and character of the assessment area. A system shall be derived for judging landscape and visual impact significance as required under the TM. The sensitivity of the landscape framework and its ability to accommodate change shall be particularly focused on. The Applicant shall identify the degree of compatibility of the Project with the existing and planned landscape setting. The landscape impact assessment shall evaluate the potential landscape impact as far as possible so as to illustrate the significance of such impacts arising from the proposed Project. Clear mapping of the landscape impact is required.
- 3.4.4.6 The Applicant shall assess the visual impacts of the proposed Project. Clear illustration including mapping of visual impact is required. The assessment shall adopt a systematic methodology and include the following:
- (i) Identification and plotting of visual envelope of the proposed Project within the study area;
  - (ii) Identification of the key groups of sensitive receivers within the visibility envelope and their views at both ground 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 adjacent areas. Among other receivers, sensitive receivers shall include nearby residents and users of country parks;
  - (iv) Description of the severity of visual impacts in terms of distance, nature and number of sensitive receivers. The visual impacts of the Project with and without mitigation measures shall also be included so as to demonstrate the effectiveness of the proposed mitigation measures; and

- (v) Clear evaluations and explanation with supportive arguments of all relevant factors considered in arriving the significance thresholds of visual impact.

3.4.4.7 The Applicant shall evaluate the merit of preservation in totality, in parts or total destruction of existing landscape and the establishment of a new landscape character area. Alternative rail alignment, station design, ventilation shafts and construction methods that would avoid or reduce the identified landscape and visuals impacts shall first be considered and be evaluated for comparison before adopting other mitigation or compensatory measures to alleviate the impacts. The mitigation measures proposed shall not only be concerned with damage reduction but shall also include consideration of potential enhancement of the existing landscape and visual quality. The Applicant shall recommend mitigation measures to minimize the adverse effects identified above, including provision of a landscape design.

3.4.4.8 The mitigation measures shall also include the preservation of vegetation, transplanting of trees of good amenity value, provision of screen planting, re-vegetation of disturbed lands, compensatory planting, re-provisioning of amenity areas and open spaces, sensitive landscape treatment on slope works, design of structure, provision of finishes to structure, colour scheme and texture of material used and any measures to mitigate the disturbance of the existing land use. Parties shall be identified for the on-going management and maintenance of the proposed mitigation works to ensure their effectiveness throughout the operation phase of the Project. A practical programme and funding proposal for the implementation of the recommended measures shall be provided.

3.4.4.9 Annotated illustration such as coloured perspective drawings, plans and section/elevation diagrams, oblique aerial photographs, photographs taken at vantage points and computer-generated photomontage shall be adopted to illustrate the significance of the landscape and visual impacts of the Project.

### **3.4.5 Hazard to Life**

3.4.5.1 If the Project will use explosives, the Applicant shall describe the statutory/licensing requirements with respect to explosives under the Dangerous Goods Ordinance (Cap. 295). The Applicant shall also document any guidelines and/or advice obtained from relevant departments/ authorities on the proposed transport and storage of explosives for the blasting activities.

3.4.5.2 If the proposed use of explosives for rock blasting is required and the location of overnight storage of explosives magazine is in close vicinity to populated areas and/or Potentially

Hazardous Installation site (e.g. LPG Transit Depot at Lee Nam Road, Ap Lei Chau), the Applicant shall carry out hazard assessment as follows:

- (i) Identify hazardous scenarios associated with the storage and transport of explosives and then determine a set of relevant scenarios to be included in a Quantitative Risk Assessment (QRA);
- (ii) Execute a QRA of the set of hazardous scenarios determined in (i), expressing population risks in both individual and societal terms;
- (iii) Compare individual and societal risks with the criteria for evaluating hazard to life stipulated in Annex 4 of the TM; and
- (iv) Identify and assess practicable and cost-effective risk mitigation measures. (e.g. selection of the shortest practicable road transport routes to and from the magazine)

The methodology to be used in the hazard assessment should be consistent with previous studies having similar issues.

3.4.5.3 The Applicant shall carry out hazard assessment to evaluate potential hazard to life due to the construction and operation of those parts of the Project which fall within the Consultation Zone of the LPG Transit Depot/Bulk Domestic Supply at Lee Nam Road. The hazard assessment shall include the following:

- (i) Identify hazardous scenarios associated with the facilities/activities of the LPG Transit Depot/Bulk Domestic Supply at Lee Nam Road and then determine a set of relevant scenarios to be included in a Quantitative Risk Assessment (QRA);
- (ii) Execute a QRA of the set of hazardous scenarios determined in (i), expressing population risks in both individual and societal terms;
- (iii) Compare individual and societal risks with the criteria for evaluating hazard to life stipulated in Annex 4 of the TM; and
- (iv) Identify and assess practicable and cost-effective risk mitigation measures.

The methodology of the hazard assessment shall be agreed and approved by the Director.

### 3.4.6 **Waste Management Implications, including Land Contamination Impact if necessary**

3.4.6.1 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.

3.4.6.2 The Applicant shall address the potential waste management implications due to the construction and operation phases of the Project, including, but not limited to, railway

tunnel excavation, marine-based construction activities for the railway bridge in Aberdeen Channel and other construction activities for the viaduct, stations and ventilation shafts/buildings. 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 and chemical waste arising as a result of the construction and operation activities of the Project, based on the sequence and duration of these activities. The Applicant shall adopt design, general layout, construction methods and programme to minimize the generation of public fill/inert construction and demolition material (C&DM) and maximise the use of public fill/inert C&DM for 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 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 maximizing waste reduction shall be separately considered;
- (b) After considering the opportunities for reducing waste generation and maximizing re-use, the types and quantities of the wastes required to be disposed of as a consequence and the disposal programme shall be estimated and the disposal options for the wastes shall be described in detail. The disposal options recommended for each type of wastes shall take into account the result of the assessment in item (c) below; and
- (c) The impact caused by handling (including stockpiling, labelling, packaging & storage), collection, transportation and disposal of wastes shall be addressed in detail and appropriate mitigation measures shall be proposed. This assessment shall cover the following areas :
  - potential hazard;
  - air and odour emissions;
  - noise;
  - wastewater discharge; and
  - public transport.

(iii) Dredging/Excavation and Dumping of Sediment/Mud

- (a) Identification and quantification as far as practicable of all dredging/excavation, transportation and disposal activities and requirements for the sediment/mud shall be conducted. Potential dumping ground to be

involved shall also be identified. Field investigation, sampling and chemical and biological laboratory tests to characterize the sediment/mud concerned shall be conducted as appropriate. The ranges of parameters to be analyzed; the number, type and methods of sampling; sample preservation; chemical and biological laboratory test methods to be used shall be agreed with the Director (with reference to Section 4.4.2(c) of the TM) prior to the commencement of the tests. The categories of sediment/mud which are to be disposed of in accordance with a permit granted under the Dumping at Sea Ordinance (DASO) shall be identified by both chemical and biological tests and their quantities shall be estimated. If the presence of any serious contamination of sediment/mud which requires special treatment/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 practical dredging/excavation methods to minimize dredging/excavation and dumping requirements based on the criterion that existing sediment/mud shall be left in place and not to be disturbed as far as possible.

#### Land Contamination Assessment

- 3.4.6.3 If any contaminated land use as stated in Section 3.1 of Annex 19 of the TM is identified, the Applicant shall carry out the necessary land contamination assessment as detailed from sub-sections 3.4.6.4 to s.3.4.6.10 below.
- 3.4.6.4 The Applicant shall follow the guidelines for evaluating and assessing potential land contamination issues as stated in Sections 3.1 and 3.2 of Annex 19 of the TM.
- 3.4.6.5 The "Assessment Area" for the land contamination shall include any potential land contamination site(s), within the Project area, identified in this EIA study.
- 3.4.6.6 The Applicant shall provide a clear and detailed account of the present land use (including description of the activities, chemicals and hazardous substances handled, with clear indication of their storage and location, by reference to a site map) and the relevant land use history in relation to possible land contamination (including accident records and change of land use(s) and the like).
- 3.4.6.7 During the course of the EIA study, the Applicant shall submit a Contamination Assessment Plan (CAP) to the Director for endorsement prior to conducting the contamination impact assessment of the relevant land or site(s). The CAP shall include

proposal with details on representative sampling and analysis required to determine the nature and the extent of the contamination of the relevant land or site(s).

3.4.6.8 Based on the endorsed CAP, the Applicant shall conduct a land contamination impact assessment and submit a Contamination Assessment Report (CAR) to the Director for endorsement. If land contamination is confirmed, a Remedial Action Plan (RAP) shall also be submitted to the Director for endorsement to formulate necessary remedial measures.

3.4.6.9 If there is/are potential contaminated site(s) that is/are inaccessible for preparing sampling and analysis during the course of the EIA study to meet the s.3.4.6.8, e.g. due to site access problem, the Applicant's CAP shall include :

- (i) A review of the available information;
- (ii) An initial contamination evaluation of this/these site(s) and possible remediation methods;
- (iii) A confirmation of whether the contamination problem at this/these site(s) would be surmountable;
- (iv) A sampling and analysis proposal which shall aim at determining the nature and the extent of the contamination of this/these site(s); and
- (v) A schedule of submission of revised CAP (if necessary), CAR and RAP upon this/these site(s) is/are accessible.

3.4.6.10 The Applicant shall complete land contamination assessment and remediation (if necessary) at the potential contaminated site(s) prior to the commencement of the construction works at the respective site(s).

3.4.6.11 To prevent contamination problems arising in future due to the operation of depot in Ex-Wong Chuk Hang Estate site or other alternative site, the Applicant shall:

- (i) identify the possible sources of contamination in their operations; and
- (ii) formulate appropriate structural/engineering design(s), adopt appropriate operational practices, waste management strategies and precautionary measures for prevention of contamination problems.

### **3.4.7 Air Quality Impacts (Construction Stage)**

3.4.7.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing air quality impact as stated in Section 1 of Annex 4 and Annex 12 of the TM, respectively.

3.4.7.2 The study area for air quality impact assessment shall generally be defined by a distance of 500 meters from the boundary of the project site, with consideration be given to extend the area to include major emission sources that may have a bearing on the environmental acceptability of the Project. The emissions from associated works of the Project shall also be included in the determining the cumulative impacts. Besides, if any other concurrent projects are identified relevant during the course of the EIA study, their possible emissions shall also be taken into account in the air quality assessment.

3.4.7.3 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 the construction 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 to minimize the constructional air quality impact.
- (c) Present background air quality levels in the assessment area for the purpose of evaluating cumulative constructional air quality impacts.

(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 and Layout Plans and other relevant published land use plans. The Applicant shall select the assessment points of the identified ASRs that represent the worst impact point of these ASRs. A map clearly showing the location and description such as name of buildings, 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 pollution emission sources, including any nearby emission sources which are likely to have impact related to the Project based on the analysis of the constructional activities in Sub-section 3.4.7.3(i)(a) above. Examples of

construction stage emission sources include stock piling, blasting, construction plant, concrete batching plant and vehicular movements on unpaved haul roads on site, etc. Confirmation of the validity of the assumptions and the magnitude of the activities (e.g. volume of construction materials handled and traffic volume on a haul road etc.) shall be obtained from the relevant government department/authorities and documented.

(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 Project will give rise to significant construction dust impacts likely to exceed recommended limits in the TM at the ASRs despite the incorporation of the dust control measures proposed in accordance with Sub-section 3.4.7.3(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 3.4.7.3(iv) below when carrying out the quantitative assessment.

(iv) Quantitative Assessment Methodology

- (a) If quantitative assessment is to be carried out following Section 3.4.7.3 (iii)(b), the Applicant shall apply the general principles enunciated in the modelling guidelines in Appendices C1 to C3 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 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 pollution parameters (types of pollutants and averaging time concentrations) to be evaluated and provide explanation for selecting such parameters for assessing the impact from the Project.

(c) The Applicant shall calculate the overall cumulative air quality impact at the ASRs identified under Sub-section 3.4.7.3 (ii)(a) 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.

(v) 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 any constraints on future land use planning shall be agreed with the relevant government departments/authorities and documented. The Applicant shall demonstrate quantitatively that the residual impacts after incorporation of the proposed mitigating measures will comply with the criteria stipulated in Section 1 of Annex 4 in the TM.

(vi) Submission of Model Files

All input and output file(s) of the model run(s) shall be submitted to EPD in electronic format.

### **3.4.8 Impact on Cultural Heritage**

3.4.8.1 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.

3.4.8.2 The Applicant shall conduct a Cultural Heritage Impact Assessment (CHIA), including built heritage impact assessment (BHIA) and archaeological impact assessment (AIA), taking the results of previous studies and other background of the site into account, to identify known and unknown heritage items within the assessment area, including, but not limited to, Wong Chuk Hang San Wai, Wong Chuk Hang Rock Carving and the potential archaeological site at the area east of the Aberdeen Tunnel (which shall be within 300m from either side along the full length of the Project boundary) that may be affected by the Project and its associated works. Based on the results of the CHIA, appropriate mitigation measures shall be recommended in the CHIA. A checklist including all the affected sites of cultural heritage, impacts identified, recommended mitigation measures as well as the implementation agent and period shall also be included in the EIA report.

- 3.4.8.3 The Applicant shall demonstrate that all reasonable efforts have been made to avoid or keep the adverse impacts on cultural heritage sites to the minimum through modification of design of the Project, or use of latest construction/engineering techniques.
- 3.4.8.4 The CHIA should be conducted by qualified persons with proven records to archaeological and historical building research works in Hong Kong. The AIA shall be carried out by a qualified archaeologist who shall obtain a Licence from the Antiquities Authority before undertaking the field evaluation under the Antiquities and Monuments Ordinance (Cap.53).
- 3.4.8.5 The Applicant shall refer to the “*Criteria for Cultural Heritage Impact Assessment*” at Appendix D for detailed requirement.

### **3.4.9 Summary of Environmental Outcomes**

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

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

- 3.4.10.1 The Applicant shall identify and justify in the EIA study whether there is any need for EM&A activities during construction and operation phases of the Project and, if affirmative, to define the scope of EM&A requirements for the Project.
- 3.4.10.2 Subject to confirmation of EIA findings, the Applicant shall comply with requirements as stipulated in Annex 21 of the TM. The Applicant shall also propose real-time reporting of monitoring data for the Project through a dedicated internet website.
- 3.4.10.3 The Applicant shall prepare a project implementation schedule (in the form of a checklist as shown in Appendix E to this EIA study brief) containing the EIA study recommendations and mitigation measures with reference to the implementation programme.

## **4. DURATION OF VALIDITY**

- 4.1 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.

## **5. REPORT REQUIREMENTS**

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

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

- (i) 40 copies of the EIA report in English and 40 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. Additional copies of the EIA report and the executive summary shall be supplied upon advice by the Director.
- (ii) when necessary, addendum to the EIA report and the executive summary submitted in 5.2 (i) above as required under section 7(1) of the EIAO, to be supplied upon advice by the Director for public inspection.
- (iii) 20 copies of the EIA report in English and 20 copies of the executive summary (each bilingual in both English and Chinese) with or without Addendum as required under section 7(5) of the EIAO, to be supplied upon advice by the Director for consultation with the Advisory Council on the Environment.

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

5.4 In addition, to facilitate public inspection of the EIA report via the EIAO Internet Website, the Applicant shall provide electronic copies of both the EIA report and the executive summary prepared in HyperText Markup Language (HTML) (version 4.0 or later) and in Portable Document Format (PDF version 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 shall be included in the beginning of the document. Hyperlinks to all figures, drawings and tables in the EIA report and executive summary shall be provided in the main text from where the respective

references are made. All graphics in the report shall be in interlaced GIF format unless otherwise agreed by the Director.

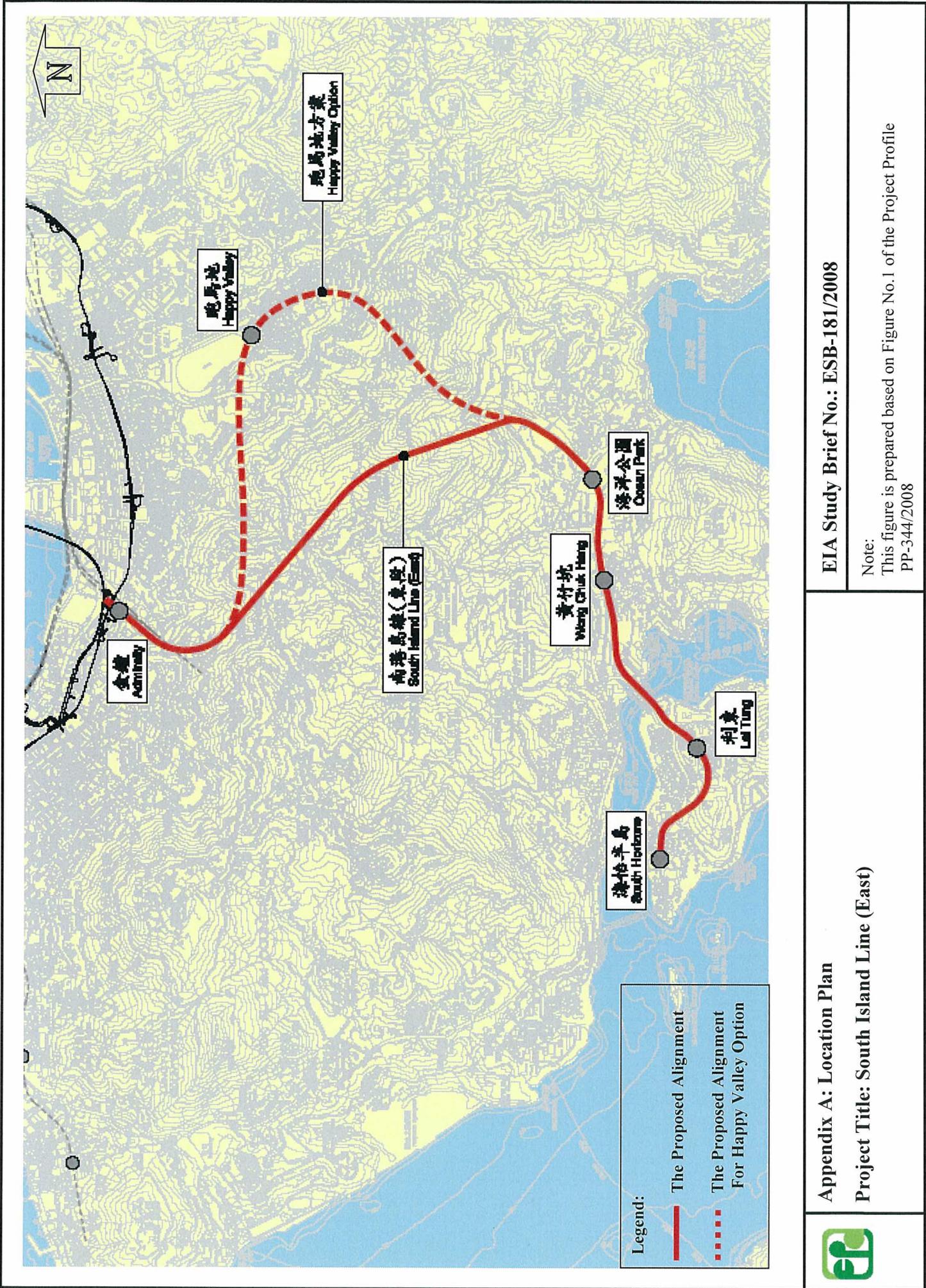
- 5.5 The electronic copies of the EIA report and the executive summary shall be submitted to the Director at the time of application for approval of the EIA report.
- 5.6 When the EIA report and the executive summary are made available for public inspection under s.7(1) of the EIAO, the content of the electronic copies of the EIA report and the executive summary must be the same as the hard copies and the Director shall be provided with the most updated electronic copies.
- 5.7 To promote environmentally friendly and efficient dissemination of information, both hardcopies and electronic copies of future EM&A reports recommended by the EIA study shall be required and their format shall be agreed by the Director.

## **6. OTHER PROCEDURAL REQUIREMENTS**

- 6.1 If there is any change in the name of Applicant for this EIA study brief during the course of the EIA study, the Applicant must notify the Director immediately.
- 6.2 If there is any key change in the scope of the Project mentioned in Section 1.2 of this EIA study brief and in Project Profile (No. PP-344/2008), the Applicant must seek confirmation from the Director in writing on whether or not the scope of issues covered by this EIA study brief can still cover the key changes, and the additional issues, if any, that the EIA study must also address. If the changes to the Project fundamentally alter the key scope of the EIA study brief, the Applicant shall apply to the Director for a fresh EIA study brief.

--- END OF EIA STUDY BRIEF ---

March 2008  
Environmental Assessment Division,  
Environmental Protection Department



**Appendix A: Location Plan**  
**Project Title: South Island Line (East)**

**EIA Study Brief No.: ESB-181/2008**

Note:  
 This figure is prepared based on Figure No.1 of the Project Profile  
 PP-344/2008



**Appendix B****Hydrodynamic and Water Quality Modelling Requirements****Modelling Software General**

1. The modelling software shall be fully 3-dimensional capable of accurately simulating the stratified condition, salinity transport, and effect of wind and tide within the model area.
2. The modelling software shall consist of hydrodynamic, water quality and particle dispersion modules. The hydrodynamic and water quality modules shall have been proven with successful applications locally and overseas.
3. The hydrodynamic and water quality 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 area including the East Lamma Channel and the Aberdeen Typhoon Shelter with the relevant field data collected from:
  - 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 Development and Upgrading of Assessment Tool (1998)
  - EPD's routine monitoring data
  - Tidal data from HK Observatory, Macau and relevant Mainland Authorities.

Where necessary, additional field data may have to be collected in the Aberdeen Typhoon Shelter for model calibration.

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 HW and LW	<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, air-water exchange, *E. coli.*, contaminant release of dredged and disposed material, and benthic processes. It shall also be able to simulate salinity. Salinity results simulated by hydrodynamic models and water quality models shall be demonstrated to be consistent.
2. A fine grid model shall be used for detailed assessment of this study. It shall cover at least the whole Aberdeen Typhoon Shelter, including the Wong Chuk Hang Nullah. The fine grid model shall either be linked to a far field model or form part of a larger model by gradual grid refinement. The outer models shall at least cover the Hong Kong waters, the Pearl Estuary and the Lema Channel to incorporate all major influences of hydrodynamic and water quality.
3. In general, grid size at the area affected by the project shall be less than 400m in open waters and less than 75m around sensitive receivers. The grid schematization shall be agreed with EPD.

#### Modelling assessment

1. Scenarios to be assessed shall cover the baseline condition and scenarios with various different options proposed by the Applicant in order to quantify the environmental impacts and improvements that will be brought about by these options. Corresponding pollution load, bathymetry and coastline shall be adopted in the model set up.
2. Hydrodynamic and water quality models, 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 dry season and wet season.

3. Where appropriate, the results shall be assessed for compliance of Water Quality Objectives. Any changes in hydrodynamic regime shall be assessed.
4. The impact on all sensitive receivers including the application of bacterial dispersion module shall be assessed.
5. Cumulative impacts due to other projects, activities or pollution sources within a boundary to the agreement of EPD shall also be predicted and quantified.
6. All modelling input data and results shall be submitted in digital media to EPD.

~ End ~

**Appendix C-1****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.

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

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

- 2.2 Note that both FDM and CALINE4 have a height limit on elevated sources (20 m and 10m, respectively). Source of elevation above these limits will have to be modelled using the ISCST3 model or suitable alternative models. In using the latter, reference should be made to the 'Guidelines on the Use of Alternative Computer Models in Air Quality Assessment' in Appendix B-3.
- 2.3 The models can be used to estimate both short-term (hourly and daily average) and long-term (annual average) ambient concentrations of air pollutants. The model results, obtained using appropriate model parameters (refer to Section 3) and assumptions, allow direct comparison with the relevant air quality standards such as the Air Quality Objectives (AQOs) for the relevant pollutant and time averaging period.

**3. Model Input Requirements****3.1 Meteorological Data**

- 3.1.1 At least 1 year of recent meteorological data (including wind speed, wind direction, stability class, ambient temperature and mixing height) from a weather station either closest to or having similar characteristics as the study site should be used to determine the highest short-term (hourly, daily)

and long-term (annual) impacts at identified air sensitive receivers in that period. The amount of valid data for the period should be no less than 90 percent.

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

Day time:

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

Night time:

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

This is a common practice with using 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 10o) and stability (classes A to F) combinations and their frequency of occurrence;
- (ii) determine the short term hourly impact under all of the identified wind speed, wind direction and stability combinations; and
- (iii) apply the frequency data with the short term results to determine the long term (daily / annual) impacts.

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

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

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

## 3.2 Emission Sources

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

characteristics such as efflux conditions and emission pattern of the sources input to the model should also correspond to site data.

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

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

### 3.3 Urban/Rural Classification

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

### 3.4 Surface Roughness Height

This parameter is closely related to 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:

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

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

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

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

### 3.9 Plume Rise Options

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

### 3.10 Portal Emissions

These include traffic emissions from tunnel portals and any other similar openings and are generally modelled as volume sources according to the PIARC 91 (or more up-to-date version) recommendations (Ref. 5, section III.2). For emissions arising from underpasses or any horizontal openings of the like, these are treated as area or point sources depending on the source physical dimensions. In all these situations, the ISCST3 model or more sophisticated models will have to be used instead of the CALINE4 model. In the case of portal emissions with significant horizontal exit velocity which cannot be handled by the ISCST3 model, the impacts may be estimated by the TOP model (Ref. 6) or any other suitable models subject to prior agreement with 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.

### 3.10 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

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

**Appendix C-2****Guidelines on Assessing the 'TOTAL' Air Quality Impacts**

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

**1. Total Impacts - 3 Major Contributions**

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

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

**2. Nature of Emissions****2.1 Primary contributions**

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

**2.2 Secondary contributions**

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

**2.3 Background contributions**

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

**3. Background Air Quality - Estimation Approach****3.1 The approach**

In view of the difficulties in estimating background air quality using the air quality models

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

### 3.2 Categorisation

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

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

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

### 3.3 Background pollutant values

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

<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).
- 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**  
**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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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.

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

**Criteria for Cultural Heritage Impact Assessment**

(As at Jan 2008)

**(1) Baseline Study**

1.1 A baseline study shall be conducted:

- a. to compile a comprehensive inventory of archaeological sites (including marine archaeological sites), historic buildings and structures within the proposed project area, which include:
  - (i) all sites of archaeological interest (including marine archaeological sites);
  - (ii) all pre-1950 buildings and structures;
  - (iii) selected post-1950 buildings and structures of high architectural and historical significance and interest; and
  - (iv) landscape features include sites of historical events or providing a significant historical record or a setting for buildings or monuments of architectural or archaeological importance, historic field patterns, tracks and fish ponds and cultural element such as *fung shui* woodlands and clan grave.
- b. to identify the direct and indirect impacts on the site of cultural heritage at the planning stage in order to avoid causing any negative effects. The impacts include the direct loss, destruction or disturbance of an element of cultural heritage, impact in its settings causing impinge on its character through inappropriate sitting or design, potential damage to the physical fabric of archaeological remains, historic buildings or historic landscapes through air pollution, change of ground water level, vibration, recreation pressure and ecological damage by the development. The impacts listed are merely to illustrate the range of potential impacts and not intended to be exhaustive.

1.2 The baseline study shall also include a desk-top study and a field evaluation.

1.3. Desk-top Study

- 1.3.1 Desk-top searches should be conducted to analyse, collect and collate extant information. They include but not limited to:
  - a. Search of the list of declared monuments protected by the Antiquities and Monuments Ordinance (Chapter 53).
  - b. Search of the list of deemed monuments through the Antiquities and Monuments Office (AMO) of the Leisure and Cultural Services Department.

- c. Search of the list of sites of cultural heritage identified by the AMO.
- d. Search of publications on local historical, architectural, anthropological, archaeological and other cultural studies, such as, Journals of the Royal Asiatic Society (Hong Kong Branch), Journals of the Hong Kong Archaeological society, Antiquities and Monuments Office Monograph Series and so forth.
- e. Search of other unpublished papers, records, archival and historical documents through public libraries, archives, and the tertiary institutions, such as the Hong Kong Collection and libraries of the Department of Architecture of the University of Hong Kong and the Chinese University of Hong Kong, Public Records Office, photographic library of the Information Services Department and so forth.
- f. Search of any other unpublished archaeological investigation and excavation reports kept by the AMO.
- g. Search of historical documents in the Public Records Office, the Land Registry, District Lands Office, District Office and the Hong Kong Museum of History and so forth.
- h. Search of cartographic and pictorial documents. Old and recent maps and aerial photos searched in the Maps and Aerial Photo Library of the Lands Department.
- i. Study of existing geological information (for archaeological desk-top research).
- j. Discussion with local informants.

#### 1.4 Field Evaluation

1.4.1 The potential value of the project area with regard to the cultural heritage could be established easily where the area is well-documented. However, it does not mean that the area is devoid of interest if it lacks information. In these instances, a site visit combined with discussions with appropriate individuals or organisations should be conducted by those with expertise in the area of cultural heritage to clarify the position.

#### 1.4.2 Historic buildings and structures survey

- a. Field scan of all the historic buildings and structures within the project area.
- b. Photographic recording of each historic building or structure including the exterior (the elevations of all faces of the building premises, the roof, close up for the special architectural details) and the interior (special architectural details), if possible, as well as the surroundings of each historic building or structure.
- c. Interview with local elders and other informants on the local historical, architectural, anthropological and other cultural information related to the historic buildings and structures.
- d. Architectural appraisal of the historic buildings and structures.

### 1.4.3 Archaeological Survey

- a. Appropriate methods for pricing and valuation of the archaeological survey, including by means of a Bill of Quantities or a Schedule of Rates should be considered in preparing specifications and relevant documents for calling tenders to carry out the archaeological survey. The specifications and relevant documents should be sent to the Antiquities and Monuments Office for agreement prior to calling tenders to conduct the archaeological survey.
- b. A licence shall be obtained from the Antiquities Authority for conducting an archaeological survey. It takes at least two months to process the application.
- c. A detailed archaeological survey programme should be designed to assess the archaeological potential of the project area. The programme should clearly elaborate the strategy and methodology adopted, including what particular question(s) can be resolved, how the archaeological data will be collected and recorded, how the evidence will be analyzed and interpreted and how the archaeological finds and results will be organized and made available. Effective field techniques should also be demonstrated in the programme. The programme should be submitted to the Antiquities and Monuments Office for agreement prior to applying for a licence.
- d. The following methods of archaeological survey (but not limited to) should be applied to assess the archaeological potential of the project area:
  - (i) Definition of areas of natural land undisturbed in the recent past.
  - (ii) Field scan of the natural land undisturbed in the recent past in detail with special attention paid to areas of exposed soil which were searched for artifacts.
  - (iii) Conduct systematic auger survey and test pitting. The data collected from auger survey and test pitting should be able to establish the horizontal spread of cultural materials deposits.
  - (iv) Excavation of test pits to establish the vertical sequence of cultural materials. The hand digging of 1 x 1 m or 1.5 x 1.5 m test pits to determine the presence or absence of deeper archaeological deposits and their cultural history.
  - (v) The quantity and location of auger holes and test pits should be agreed with the Antiquities and Monuments Office prior to applying for a licence.
  - (vi) A qualified land surveyor should be engaged to record reduced levels and coordinates as well as setting base points and reference lines in the course of the field survey.

- e. A Marine Archaeological Investigation (MAI) following *Guidelines for MAI* may be required for projects involving disturbance of seabed.

1.4.4 If the field evaluation identifies any additional sites of cultural heritage within the study area which are of potential historic or archaeological importance and not recorded by AMO, the office should be reported as soon as possible.

## 1.5 The Report of Baseline Study

1.5.1 The study report should have concrete evidence to show that the process of the above desk-top and field survey has been satisfactorily completed. This should take the form of a detailed inventory of the sites of cultural heritage supported by full description of their cultural significance. The description should contain detailed geographical, historical, archaeological, architectural, anthropological, ethnographic and other cultural data supplemented with illustrations below and photographic and cartographic records.

### 1.5.2 Historic Buildings and Structures

- a. A map in 1:1000 scale showing the boundary of each historic building or structure.
- b. Photographic records of each historic building or structure.
- c. Detailed record of each historic building or structure including its construction year, previous and present uses, architectural characteristics, as well as legends, historic persons and events, and cultural activities associated with the structure.

### 1.5.3 Archaeological Sites

- a. A map showing the boundary of each archaeological site as supported and delineated by field walking, augering and test-pitting;
- b. Drawing of stratigraphic section of test-pits excavated which shows the cultural sequence of a site.
- c. Reduced levels, coordinates, base points and reference lines should be clearly defined and certified by a qualified land surveyor.
- d. *Guidelines for Archaeological Reports* should be followed (Annex 1).

1.5.4 A full bibliography and the source of information consulted should be provided to assist the evaluation of the quality of the evidence. To facilitate verification of the accuracy, the AMO will reserve the right to examine the full details of the research materials collected under the baseline study.

## 1.6 Finds and Archives

1.6.1 Archaeological finds and archives should be handled following *Guidelines for Handling of Archaeological Finds and Archives (Annex 2)*.

### (2) Impact Assessment

- 2.1 Culture heritage impact assessment must be undertaken to identify the impacts of the sites of cultural heritage which will be affected by the proposed development subject to the result of desktop research and field evaluation. The prediction of impacts and an evaluation of their significance must be undertaken by an expert in cultural heritage. During the assessment, both the direct impacts such as loss or damage of important features as well as indirect impacts such as change of ground water level which may affect the preservation of the archaeological and built heritage in situ should be stated. A detailed description and plans should be provided to elaborate to what extent the site of cultural heritage will be affected.
- 2.2 Preservation in totality must be taken as the first priority. Please refer to paragraph 4.3.1(c), item 2 of Annex 10, items 2.6 to 2.9 of Annex 19 and other relevant parts of the Technical Memorandum on Environmental Impact Assessment Process for the detailed requirements of the impact assessment.

### (3) Mitigation Measures

- 3.1 It is always a good practice to recognise the site or monument early in the planning stage and site selection process, and to avoid it, i.e. preserve it in-situ, or leaving a buffer zone around the site. Built heritage, sites and landscapes are to be in favour of preservation unless it can be shown that there is a need for a particular development which is of paramount importance and outweighs the significance of the heritage feature.
- 3.2 If avoidance of the cultural heritage is not possible, amelioration can be achieved by reduction of the potential impacts and the preservation of heritage features, such as physically relocating it. Measures like amendments of the sitting, screening and revision of the detailed design of the development are required to lessen its degree of exposure if it causes visual intrusion to the cultural heritage and affecting its character.
- 3.3 All the assessments should be conducted by an expert in cultural heritage and further evaluated and endorsed by the Antiquities and Monuments Office and the Antiquities Advisory Board.

- 3.4 Please refer to paragraph 4.3.1(d), items 2.10 to 2.14 of Annex 19 and other relevant parts of the Technical Memorandum. Proposals for mitigation measures should be accompanied with a master layout plan together with all detailed treatment, elevations, and landscape plan. A rescue programme, when required, may involve preservation of the historic building or structure together with the relics inside, and its historic environment through relocation, detailed cartographic and photographic survey or preservation of an archaeological site "by record", i.e. through excavation to extract the maximum data as the very last resort.
- 3.5 The programme for implementation of agreed mitigation measures should be able to be implemented. It is to be clearly stated in the EIA report, as required in Annex 20 of the Technical Memorandum. In particular, item 6.7 of Annex 20 requires to define and list out clearly the proposed mitigation measures to be implemented, by whom, when, where, to what requirements and the various implementation responsibilities. A comprehensive plan and programme for the protection and conservation of the partially preserved Site of Cultural Heritage, if any, during the planning and design stage of the proposed project must be detailed.

**Guidelines for Archaeological Reports**  
**(As at November 2007)**

**I. General**

1. All reports should be written in a clear, concise and logical style.
2. The reports should be submitted in A4 size and accompanying drawings of convenient sizes.
3. Draft reports should be submitted to the Antiquities and Monuments Office (AMO) for comments within two months after completion of archaeological work unless otherwise approved by AMO.
4. The draft reports should be revised as required by AMO and relevant parties. The revised reports should be submitted to AMO within three weeks after receiving comments from AMO and relevant parties.
5. At least 3 hard copies of the final reports should be submitted to AMO for record purpose.
6. At least 2 digital copies of the final reports in both Microsoft Word format and Acrobat (.PDF) format without loss of data and change of appearance compared with the corresponding hard copy should be submitted to AMO. The digital copies should be saved in a convenient medium, such as compact discs with clear label on the surface and kept in protective pockets.

**II. Suggested Format of Reports**

1. Front page:
  - Project/Site name
  - Nature of the report  
e.g. (Draft/Final)  
Archaeological Investigation/Survey Report  
Archaeological Impact Assessment Report  
Watching Brief Report  
Rescue Excavation Report  
Post-excavation Report
  - Organization
  - Date of report
2. Contents list  
Page number of each section should be given.
3. Non-technical summary (both in English and Chinese with not less than 300 words each)  
This should outline in plain, non-technical language, the principal reasons for the archaeological work, its aims and main results, and should include reference to authorship and commissioning body.
4. Introduction  
This should set out background leading to the commission of the reports. The location, area, scope and date of conducting the archaeological work must be given. The location of archaeological work should be shown on maps in appropriate scales and with proper legends.

5. **Aims of archaeological work**  
These should reflect the aims set in the project design.
6. **Archaeological, historical, geological and topographical background of the site**  
Supporting aerial photos and maps (both old and present) in appropriate scales, with proper legends and with the site locations clearly marked on should be provided.
7. **Methodology**  
The methods used including any variation to the agreed project design should be set out clearly and explained as appropriate.
8. **Result**  
This should outline the findings, known and potential archaeological interests by period and/or type. Their significance and value with reference/inclusion of supporting evidence should be indicated. For impact assessment, the likely effect of the proposed development on the known or potential archaeological resource should be outlined.
9. **Conclusion**  
This should include summarization and interpretation of the result.
10. **Recommendation**  
Recommendations on further work and the responsible party as well as a brief planning framework should be outlined.
11. **Reference and bibliography**  
A list of all primary and secondary sources used should be given. Director and members of the archaeological team and author of the report should be listed.
12. **Supporting illustrations**  
They should be clearly numbered and easily referenced to the text. They should be scanned and saved in TIFF or JPEG formats.

A. **Maps**

Archaeological work locations, such as auger hole and test pit locations (with relevant coordinates certified by a qualified surveyor), should be clearly shown on maps in appropriate scales, with proper legends, grid references (in 8 digits) and captions.

B. **Drawings of test pits, archaeological features and finds**

The below scales should be followed:

Cross section and profile drawings of test pits	1:20
Archaeological feature drawings	1:10
Finds drawings	1:1

If drawings of the above stated scales are not appropriate to be incorporated into the report under certain occasions, reduced copy of the drawings with the same scales are acceptable. Proper captions, legends and indication of reduced size should be given.

C. Photos of site and finds

All photos should be at least in 3R size with proper captions and scales. They should be clearly numbered and easily referenced to the text. They should be scanned and saved in TIFF or JPEG formats.

13. Supporting data in appendices

These should consist of essential technical details to support the result. These may include stratigraphy record of test pits and auger holes, record of general and special finds discovered with description, quantity and context number/stratigraphical sequence, index of field archives.

14. Comment and Response

All comments and responses from AMO and relevant parties should be attached.

### III. Green Measures

1. All reports should be of single line spacing and printed on both sides of the paper.
2. Excessive page margins should be avoided. A top/bottom margin of 2 cm and left/right margin of 2.5 cm are sufficient.
3. Use of blank paper should be avoided as far as possible.
4. Suitable font type of font size 12 should be used generally in balancing legibility and waste reduction objective.

**Guidelines for Handling of Archaeological Finds and Archives**  
(As at Oct 2006)

**I. General**

1. Site Code

The Licensee should contact the Central Archaeological Repository (CAR) of the Antiquities and Monuments Office (AMO) [Contact Person: Mr. Michael TANG, Tel: 2384 5446; Email: mkstang@lcsd.gov.hk] about the allocation of site code before the commencement of the project to avoid duplicate of site code assignment.

**II. Archaeological Finds**

2. Cleaning

Every excavated finds should be properly cleaned before handing over to the CAR of the AMO.

3. Marking

- All the excavated finds should be cleaned before marking object number.
- "Sandwich" technique<sup>1</sup> should be adopted for marking permanent identification number on an object.
- Every special finds should be marked with site code, context number and object number, etc.
- All representative samples collected from general finds should be marked.
- For the finds which is too small, has unstable surface, or leather, textiles or wood, it should not be marked/labeled directly and should be bagged separately or attached with tags by tying. The tag should contain information about the object number, context number and site code, etc.

4. Labeling and bagging

- A label should be attached on each bag.
- Information about the object number, context number, test-pit number, site code and bag number should be stated clearly on the label.
- Finds excavated within the same context should be bagged together. However, if they have been categorized according to their types, materials or characteristics, separate bagging is required.

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<sup>1</sup> *Steps for "Sandwich" technique*

1. First of all, the object should be marked in appropriate area and size that does not impact important diagnostic or aesthetic parts of the object.
2. Clean the area to be marked.
3. Apply a thin coat of clear reversible lacquer on the area. Use white lacquer if the object is dark in colour. Let the base coat dry completely.
4. Use a permanent water-based ink to write the object number on top of the base coat. Let ink dry completely.
5. Apply a top coat of clear varnish.
6. Let the marking dry completely before packing.

5. Conservation
  - To refit and reconstruct pottery vessels by appropriate adhesive. A heat and waterproof adhesive, e.g. product of H. Marcel Guest Ltd., is recommended.
  - Any adhesives which are not reversible or will damage artefacts, e.g. the pottery vessel should not be applied on the finds.
6. Finds register

A clear finds register with information about the finds description, quantity, form, weight, dimensions and field data should be prepared for handover to the CAR.

### III. Field Archives and Laboratory Records

7. Field archives include field dairy, context recording sheet, special finds recording sheet, soil sample/sample recording sheet, map, survey sheet and video/visual records etc. Laboratory records also form part of the archaeological archives, which include finds processing record, conservation record, finds drawings and photos, records of typological analysis and objects card etc.
8. All the aforesaid archives should be handed over to the CAR after the compilation of the excavation report. Attention should be drawn to the followings:
  - All the field archives should be submitted together with their indexes.
  - The video footage should be submitted together with a detailed script introducing the content of the video record.
  - All the slides, colour/black & white negatives and digital photographs should be submitted together with their contact prints and indexes.

#### *Handover of Finds*

9. Packing
  - Every special finds should be protected with tissue paper, bubble sheet or P.E. foam with shock-proofed packing. No packing material other than the aforesaid items should be used.
  - All the general finds should be stored in heavy duty plastic container with shock-proofed packing.
  - The heavy duty plastic container, e.g. product of the Star Industrial Co., Ltd. (No. 1849 or 1852), is recommended.
  - For oversized finds, prior advice on packing method should be sought from the AMO.
10. Handover procedure
  - The Licensee should arrange to transport the finds and archives to the CAR upon the completion of the finalized excavation report.
  - Separate handover forms for finds and archives should be signed by the representatives of the Licensee and the AMO.

