**Environmental Impact Assessment Ordinance (Cap. 499), Section 5(7)**
**Environmental Impact Assessment Study Brief No. ESB-213/2010**

**Project Title: Shatin to Central Link Protection Works at Causeway Bay Typhoon Shelter**
**(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-213/2010) 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 29 April 2010 with a Project Profile (No. PP-411/2010)(hereinafter known as "the Project Profile").

1.2 The MTR's "Shatin to Central Link" (SCL) on the Hong Kong Island side will interface with the on-going Central-Wanchai Bypass (CWB) project of the Highways Department (HyD) at the Causeway Bay Typhoon Shelter (CBTS). Having regard to the potential significant interface issue with the CWB project, the Applicant has liaised with HyD and proposes that some protection works would be implemented to protect the feasibility of the construction of the SCL during the operation of the CWB. The protection works together with the associated works (the "Project") would be entrusted to HyD and would be implemented together with the main CWB works. The location, general layout and scope of the Project are shown in Figures 1.1 to 1.3.

1.3 The Project involves the following works:

(i) Temporary reclamation works[1], which would occupy about 0.7ha of Government foreshore and seabed (of which 0.3 ha. has already authorized under the CWB project), including the associated dredging works and the construction of about 334m long temporary seawall (as shown in Figure 1.2);

(ii) Dredging works at the southeast corner of the CBTS to provide space for temporary relocation of anchorage area due to the proposed additional temporary reclamation at the CBTS for the Project (as shown in Figure 1.3);

(iii) Construction of a section of the twin track railway tunnel structure (approximately 160m long) above the proposed CWB located entirely offshore within the CBTS (hereinafter known as "the Protection Works") as shown in Figure 1.1. [*Remarks: As stated in Sections 1.2 and 1.4 of the Project Profile, the scope of Protection Works is limited to civil and structural elements; and cannot serve to function for any railway service or operation.*];

[1] Any proposed reclamation should be considered in the context of the Protection of the Harbour Ordinance (Cap. 531), giving due consideration to the judgment of the Court of Final Appeal of 9 January 2004 and the judgment of the Court of First Instance of 20 March 2008.

(iv) Relocation of the temporary Royal Hong Kong Yacht Club (RHKYC) jetty within the CWB temporary reclamation to a new location, as shown in Figure 1.2.

(v) Removal of the temporary reclamation in phases. [*Remarks: As stated in Sections 1.4 and 2.1 of the Project Profile, the temporary reclamation will be removed once the Protection Works is completed except a small area at the southwest corner of the reclamation which will be retained to enable construction of the future SCL tunnels connecting to the proposed South Ventilation Building (located at the Police Officer Club site). The small area of the temporary reclamation will be removed upon completion of the concerned tunnel works.* ]

A total of about 2.6ha of Government foreshore and sea-bed (of which 1.45 ha has already covered under the CWB gazettal) will be affected by the temporary reclamation and dredging works.

The Project is a designated project under Item C.12(b), Part I, Schedule 2 of the EIAO. As stated in the Project Profile, the Project will be undertaken together by the CWB contractor, the temporary reclamation in the Project together with that in the CWB project will be another designated project under Item C.1, Part I, Schedule 2 of the EIAO.

1.4 Pursuant to section 5(7)(a) of the EIAO, the Director of Environmental Protection (the Director) issues this Environmental Impact Assessment (EIA) study brief to the Applicant to carry out an EIA study.

1.5 The purpose of this EIA study is to provide information on the nature and extent of environmental impacts arising from the Project. 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 and any phased implementation;

(ii) the conditions and requirements for the detailed design and construction of the Project and any phased implementation to mitigate against adverse environmental consequences wherever practicable; and

(iii) the acceptability of residual impacts after the proposed mitigation measures are implemented.

## 2. OBJECTIVES OF THE EIA STUDY

2.1 The objectives of the EIA study are as follows:

(i) to describe the Project and associated works together with the requirements and environmental benefits for carrying out the Project;

(ii) to identify any individual designated project element(s) under Schedule 2 of the EIAO to be covered in the Project; to ascertain whether the findings of the EIA study have adequately addressed the environmental impacts of these project;

(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 consideration of alternatives/options of the Project 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 design, location, scale of works, extent of reclamation/dredging, programme, phased implementation, sequence of works, timing of removal of the temporary reclamation, construction method, etc. of the Project; to provide reasons for selecting the preferred options(s); and to describe the part that environmental factors played in the selection;

(v) to identify and assess water quality impacts, waste management implications, noise impacts and air quality impacts; and determine the significance of impacts on sensitive receivers and potential affected uses;

(vi) to propose provision of mitigation measures so as to minimize pollution, environmental disturbance and nuisance during construction of the Project and any phased implementation;

(vii) to investigate the feasibility, practicability, effectiveness and implications of the proposed avoidance or mitigation measures;

(viii) to identify, predict and evaluate the residual environmental impacts (i.e. after practicable mitigation) due to the Project and the cumulative effects expected to arise from the Project in relation to the sensitive receivers and potential affected uses;

(ix) to identify, assess and specify methods, measures and standards, to be included in the detailed design and implementation stage of the Project which are necessary to avoid or mitigate these environmental impacts and cumulative effects and reduce them to acceptable levels;

(x) 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

(xi) 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 known as "the TM") are fully complied with.

## 3.2 The Scope

3.2.1 The scope of this EIA study shall cover the Project mentioned in Sections 1.2 – 1.3 above. The EIA study shall address the likely key issues identify and provide information described below; together with any other key issues identified during the course of the EIA study;

(i) the potential water quality impacts arising from the dredging, filling, temporary reclamation and other associated activities of the Project;

(ii) the potential impacts of various types of waste to be generated from the Project including dredged marine sediment; excavated materials; and the waste generated from the removal of the temporary reclamation;

(iii) the potential construction noise impacts arising from the Project;

(iv) the potential construction dust impacts arising from the Project; and

(v) the potential cumulative environmental impacts of the Project through interaction or in combination with other interface/concurrent projects nearby, in particular the CWB project and the Wan Chai Development Phase II (WDII) project.

## 3.3 Consideration of Alternatives/Options for the Project

3.3.1 Background Information of the Project

The Applicant shall provide information on the background for the Project and provide plan(s) of a scale of at least 1:5000 to clearly present the scope of the Project, the Project boundary and associated work(s) area(s)/works sites locations. 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 Need of the Project

The Applicant shall report on or provide information related to the need and justification for the Project including the reason(s) for retaining a small area at the

southeast corner of the temporary reclamation area after the completion of the Protection Works. The Applicant shall explain clearly the purpose and objectives of the Project and describe the scenarios with and without the Project. The Applicant shall describe the geographical demarcation between the CWB project and this Project and the works to be carried out therein so that the responsibilities of relevant parties can be clearly defined. The Applicant shall explicitly identify who will be responsible for and the timing of the removal of the small area at the southeast corner of the temporary reclamation area.

3.3.3 Consideration of Alternatives/Options for the Project

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 on, when exploring various feasible alternative designs, the location and scale of works, extent of reclamation/dredging, works areas/works sites, size and location requirements, programme, phased implementation, timing of removal of the temporary reclamation, sequence of works, and construction method for the Project, etc. in order to avoid extensive periods of exposing sensitive receivers to adverse environmental impacts.

The EIA study shall explore the options/possibility of not retaining the small area at the southwest corner of the temporary reclamation after the completion of the Protection Works, as mentioned in Section 1.3(v) above. Sufficient justifications of retaining the small area shall be given and alternatives/options of minimizing the size of the small area and the length of time of its retention.

A comparison of the environmental benefits and dis-benefits of applying different construction method(s), sequences of work(s), works areas/works sites locations and size shall be made.

3.3.4 Selection of Preferred Option

Taking into consideration of the findings from Sections 3.3.2 – 3.3.3 above, the Applicant shall provide the recommendation(s) and justification(s) for the preferred option that will avoid or minimize adverse environmental effect(s) arising from the Project, and shall adequately describe the part that environment factor(s) played in arriving at the final selection.

## 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 Water Quality Impact (Construction Stage)

3.4.1.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing water pollution as set out in Annexes 6 and 14 of the TM, respectively.

3.4.1.2 The water quality impact assessment shall include the following:

(a) the water quality impacts associated with marine works (if any), e.g. any dredging, filling, temporary reclamation, removal of the temporary reclamation of the Project;

(b) the water quality impacts of the other construction works, including but not limited to site runoff, the effluents generated from dewatering associated with the Project; and

(c) the water quality impacts and any proposed monitoring and audit programme on the water quality, e.g. at the seawater intakes for cooling systems, if applicable.

3.4.1.3 The assessment area for the Project is the Victoria Harbour Water Control Zone (WCZ) as declared under the Water Pollution Control Ordinance and any areas within a distance of 300m from the Project boundary and works area. The assessment area shall be extended to include those areas that are found also being impacted.

3.4.1.4 The Applicant shall identify and analyse physical, chemical and biological disruptions of marine and coastal waters arising from the Project.

3.4.1.5 The Applicant shall predict, quantify and assess any water quality impacts arising from the Project on the water system(s) and the sensitive receivers by appropriate mathematical modelling and/or other techniques proposed by the Applicant and agreed with the Director. If mathematical modelling is necessary, such as to assess impact due to marine works, the mathematical modelling requirements are set out in **Appendix A** to this study brief. Possible impacts shall include but not limited to changes in hydrology, flow regime, sediment erosion and deposition pattern, water and sediment quality due to any dredging of marine sediment, filling, reclamation activities and the removal of the temporary reclamation.

3.4.1.6 The Applicant shall take into account and include likely different construction method(s), construction stages or sequences. The assessment shall have regard to the frequency, duration, volume and flow rate of discharges and their pollutant and sediment loading. The assessment shall address the following:

(a) Collection and review of background information on the existing and planned water system(s) and sensitive receivers which may be affected by the Project during construction, the temporary reclamation and removal of reclaimed area;

(b) Characterization of water and sediment quality of the water system(s) and

sensitive receivers which may be affected by the Project based on existing information or appropriate site surveys and tests;

(c) Identification and analysis of existing and planned future 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, Development Permission Area Plans, Outline Development Plans and Layout Plans, such as the existing and planned seawater intakes for cooling system;

(d) Identification of pertinent water and sediment quality objectives and establishment of other appropriate water and sediment quality criteria or standards for the water system(s) and all the sensitive receivers mentioned in (a), (b) and (c) above;

(e) Review of the construction sequences and methods of the Project and the removal of the temporary reclamation to identify any alteration of existing shoreline, bathymetry and flow regimes;

(f) Identification and quantification of existing and likely future water and sediment pollution sources and loading. An emission inventory on the quantities and characteristics of these existing and likely future pollution sources in the study area shall also be provided. Field investigation and laboratory tests, as appropriate, shall be conducted to fill relevant information gaps, if any;

(g) Identification and quantification of dredging, sediment/mud transportation, filling, reclamation, disposal activities and requirements. Potential fill source and dumping ground to be involved shall also be identified. Field investigation, sampling and chemical laboratory tests to characterize the sediment/mud concerned shall be conducted as appropriate. The potential for the release of contaminants during dredging shall be addressed using the chemical testing results derived from sediment and marine water samples collected on site and relevant historic data. Appropriate laboratory tests including elutriate tests and sediment pore water (interstitial water) analyses shall be performed on the sediment samples to simulate and quantify the degree of mobilization of various contaminants such as metals, ammonia, trace organic contaminants (including PCBs, PAHs, TBT and chlorinated pesticides) into the water column during dredging. The ranges of parameters to be analysed; the number, location, depth of sediment, type and methods of sampling; sample preservation; and chemical laboratory test methods to be used shall be subject to the agreement of the Director. The Applicant shall also assess the pattern of the sediment deposition and the potential increase in turbidity and suspended solid levels in the water column and at the sensitive receivers due to the disturbance of sediments during dredging, filling, dumping and removal of the temporary reclamation.

Impact Prediction

(h) Prediction, quantification and assessment of impacts on the hydrodynamic regime, water and sediment quality of the water system(s) and the sensitive receivers due to the activities identified above. The prediction and quantification of impacts caused by, among others, sediment re-suspension and contaminant release shall be carried out by mathematical modelling (see modelling requirement set out in Appendix A of this Study Brief) or other techniques to be agreed by the Director.

(i) Assessment of the cumulative impacts due to other concurrent and planned projects, including the CWB project and WDII project, activities or pollution sources along the identified water system(s) and sensitive receivers that may have a bearing on the environmental acceptability of the Project through mathematical modeling set out in Appendix A of this Study Brief.

(j) Review of the specific construction sequence and methods of the Project, such as, the dredging and filling methods; dredging rates; and identification and evaluation of the best practicable dredging and filling methods to minimize marine mud disturbance and dumping requirements and demand for fill sources based on the criterion that the existing marine mud shall be left in place and not to be disturbed as far as possible.

Mitigation

(k) Recommendation of appropriate mitigation measures to avoid or minimize the impacts identified above, in particular suitable mud dredging and disposal methods and arrangement shall be recommended to mitigate any adverse impacts. The residual impacts on the water system(s) and the sensitive receivers with regard to the relevant water and sediment quality objectives, criteria, standards or guidelines shall be assessed and quantified using appropriate mathematical models as set out in Appendix A to this study brief.

### 3.4.2 Waste Management Implications

3.4.2.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing the waste management implications of the Project as set out in Annexes 7 and 15 of the TM, respectively.

3.4.2.2 The assessment of waste management implications shall cover the following:

(i) Analysis of Activities and Waste Generation

The Applicant shall identify the quantity, quality and timing of the wastes arising as a result of the Project, based on the sequence and duration of the activities of the Project, including any dredged marine sediment, construction and demolition materials, floating refuse and other waste.

(ii) Proposal for Waste Management

(a) Prior to considering the disposal options for various types of wastes (in particular the dredged sediment and removed reclaimed material), opportunities for reducing waste generation, on-site or off-site re-use and recycling shall be fully evaluated. Measures that can be taken in the planning and design stages e.g. by modifying the design approach and in the construction stage for maximizing waste reduction shall be separately considered.

(b) Having taken into account the opportunities for reducing waste generation and maximizing re-use, the types and quantities of the wastes required to be disposed of as a consequence shall be estimated and the disposal options for each type of wastes shall be described in detail. The disposal methods/options recommended for each type of wastes shall take into account the result of the assessment in (c) below; and

(c) The impact caused by handling (including stock-piling, labelling, packaging and storage), collection, transportation and re-use/disposal of wastes shall be addressed in detail and appropriate mitigation measures shall be proposed. This assessment shall cover the following areas:

- potential hazard;
- air and odour emissions;
- noise;
- wastewater discharge; and
- public transport.

(iii) Dredging/Excavation, Filling and Dumping

(a) Identification and quantification as far as practicable of all dredging/excavation, fill extraction, filling, reclamation, sediment/mud transportation and disposal activities and requirements shall be conducted. Potential fill source and dumping ground to be involved shall also be identified. Field investigation, sampling and chemical and biological laboratory tests to characterize the sediment/mud concerned shall be conducted as appropriate. The ranges of parameters to be analyzed; the number, type and methods of sampling; sample preservation; chemical and biological laboratory test methods and the laboratory to be used shall be subjected to the approval of Director 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.

(b) Identification and evaluation of the practicable dredging/excavation methods to minimize dredging/excavation and dumping requirements and demand for fill sources based on the criterion that existing sediment/mud shall be left in place and not to be disturbed as far as practicable.

### 3.4.3 Noise Impact (Construction Stage)

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

3.4.3.2 The noise impact assessment shall include the following:

(i) Determination of Assessment Area

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

(ii) Provision of Background Information and Existing Noise Levels

The Applicant shall provide background information relevant to the Project, e.g. relevant previous or current studies. Unless involved in the planning standards, e.g. those for planning of fixed noise sources, no existing noise levels are particularly required.

(iii) Identification of Noise Sensitive Receivers

(a) The Applicant shall refer to Annex 13 of the TM when identifying the NSRs. The NSRs shall include existing NSRs and planned noise sensitive developments and uses earmarked on the relevant Outline Zoning Plans, Outline Development Plans and Layout Plans, and other relevant published land use plans (including the residential developments along Hing Fat Street, Victoria Park Road and Gloucester Road close to the Project sites).

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

shall be given showing the location of each and every selected assessment points.

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

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

(v) Construction Noise Assessment

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

(b) The Applicant shall carry out assessment of noise impact from construction (excluding percussive piling) of the project during day time, i.e. 7 a.m. to 7 p.m., on weekdays other than general holidays in accordance with the methodology stipulated in paragraphs 5.3. and 5.4 of Annex 13 of the TM. The criteria in Table 1B of Annex 5 of the TM shall be adopted in the assessment.

(c) If the unmitigated construction noise levels are found exceeding the relevant criteria, the Applicant shall propose practicable direct mitigation measures (including movable barriers, enclosures, quieter alternative methods, re-scheduling and restricting hours of operation of noisy task) to minimize the impact. If the mitigated noise levels still exceed the relevant criteria, the duration of the noise exceedance shall be given.

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

(vi) Assessment of Side Effects and Constraints

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

### 3.4.4 Construction Dust Impact

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

3.4.4.2 If the Applicant anticipates a significant construction dust impact that will likely cause exceedance of the recommended limits in the TM at the Air Sensitive Receivers (ASRs) despite incorporation of the dust control measures stated in Section 3.4.4.1 above, a quantitative assessment should be carried out to evaluate the construction dust impact at the identified ASRs. The Applicant shall follow the methodology below when carrying out the quantitative assessment. The construction dust impact assessment shall include the following:

(i) The Applicant shall follow the criteria and guidelines for evaluating and assessing construction dust impact as stated in section 1 of Annex 4 and Annex 12 of the TM, respectively.

(ii) The assessment area for construction dust impact assessment shall generally be defined by a distance of 500 m from the Project alignment and from any works sites, including works sites away from the Project alignment, proposed under the Project, yet it may be extended depending on the circumstances and the scale of the Project.

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

(iv) Background and Analysis of Activities

(a) Provide background information relating to air quality issues relevant to the Project, e.g. description of the types of activities of the Project.

(b) Give an account, where appropriate, of the consideration / measures that had been taken into consideration in the planning of the Project to abate the construction dust impact. That is, the Applicant shall consider alternative construction method(s) / phasing programme(s) to minimize the construction dust impact.

(c) Present the background air quality levels in the assessment area for the purpose of evaluating the cumulative construction dust impacts.

(v) Identification of ASRs and Examination of Emission / Dispersion Characteristics

(a) Identify and describe representative existing and planned / committed ASRs that would likely be affected by the Project. The Applicant shall select the assessment points of the identified ASRs such that they represent the worst impact point of these ASRs. A map showing the location and a description including the name of the buildings, their uses and height of the selected assessment points shall be given. The separation distances of these ASRs from the nearest emission sources should also be given.

(b) Provide a list of air pollutant emission sources, including any nearby emission sources which are likely to have impact on the Project. Examples of construction stage emission sources include stock-piling, blasting, concrete batching and vehicular movements on unpaved haul roads on site, etc.

(vi) Quantitative Assessment Methodology

(a) The Applicant shall apply the general principles enunciated in the modeling guidelines while making allowance for the specific characteristic of the Project. This specific methodology must be documented in such level of details (preferably with tables and diagrams) to allow the readers of the assessment report to grasp how the model is set up to simulate the situation at hand without referring to the model input files. Details of the calculation of the emission rates of air pollutants for input to the modeling shall be presented in the report. The Applicant must ensure consistency between the text description and the model files at every stage of submission. In case of doubt, prior agreement of the methodology between the Applicant and the Director should be sought.

(b) The Applicant shall identify the key/representative air pollutant parameters (types of pollutants and the averaging time concentration) to be evaluated and provide explanation for choosing these parameters for the assessment of the impact of the Project.

(c) The Applicant shall calculate the cumulative construction dust impact at the identified ASRs and compare these results against the criteria set out in section 1 of Annex 4 in the TM. The predicted construction dust impacts (both unmitigated and mitigated) shall be presented in the form of summary table and pollution contours, for comparison with relevant air quality standards and examination of the land use implications of these impacts. Plans of suitable scale should be used for presentation of pollution contour for determining buffer distances required.

(d) The Applicant shall propose remedies and mitigation measures where the predicted construction dust impact exceeds the criteria set in section 1 of Annex 4 in the TM. These measures and any constraints on future land use planning shall be agreed with the relevant government departments / authorities and documented. The Applicant shall demonstrate quantitatively whether the resultant impacts after incorporation of the proposed mitigating measures will comply with the criteria stipulated in section 1 of Annex 4 in the TM.

(e) Input and output file(s) of the model run(s) shall be submitted to the Director in electronic format.

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

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

### 3.4.6 Impacts Summary

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

### 3.4.7 Summary of Environmental Outcomes

3.4.13.1 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.

### 3.4.8 Environmental Monitoring and Audit (EM&A) Requirements

3.4.8.1 The Applicant shall identify and justify in the EIA study whether there is any need for EM&A activities during the implementation of the Project and, if affirmative, to define the scope of EM&A requirements for the Project.

3.4.8.2 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.

3.4.8.3 The Applicant shall prepare a project implementation schedule (in the form of a checklist as shown in **Appendix C** to this 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) 30 copies of the EIA report in English and 30 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. Addition 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 section 7(1) of the EIAO, the content of the electronic copies of the EIA report and the executive summary must be the same as the hard copies and the Director shall be provided with the most updated electronic copies.

5.7 To promote environmentally friendly and efficient dissemination of information, both hardcopies and electronic copies of future EM&A reports recommended by the EIA study shall be required and their format shall be agreed by the Director.

## 6. OTHER PROCEDURAL REQUIREMENTS

6.1 If there is any change in the name of Applicant for this EIA study brief during the course of the EIA study, the Applicant must notify the Director immediately.

6.2 If there is any key change in the scope of the Project mentioned in Sections 1.2 - 1.3 of this EIA study brief and in the Project Profile, 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 ---

Environmental Assessment Division,
Environmental Protection Department
June 2010

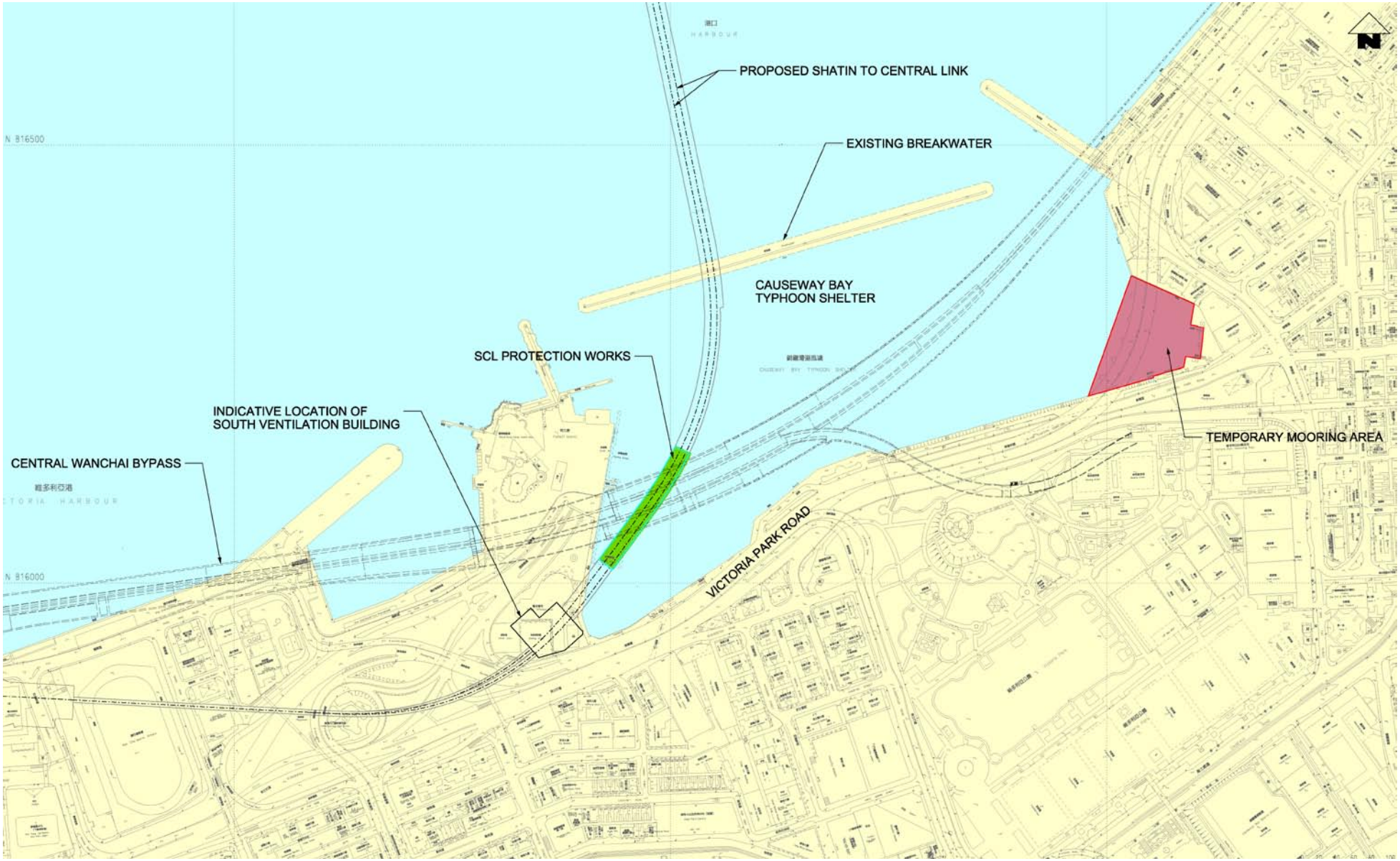


**Figure 1.1 : General Layout Plan**

**Project Title: Shatin to Central Link Protection works at Causeway Bay Typhoon Shelter**

**EIA Study Brief No. ESB-213/2010**

Note:
Reproduced from Figure 1.1 of the Project Profile
PP-411/2010 submitted on 29/04/2010 (Scale: NTS)

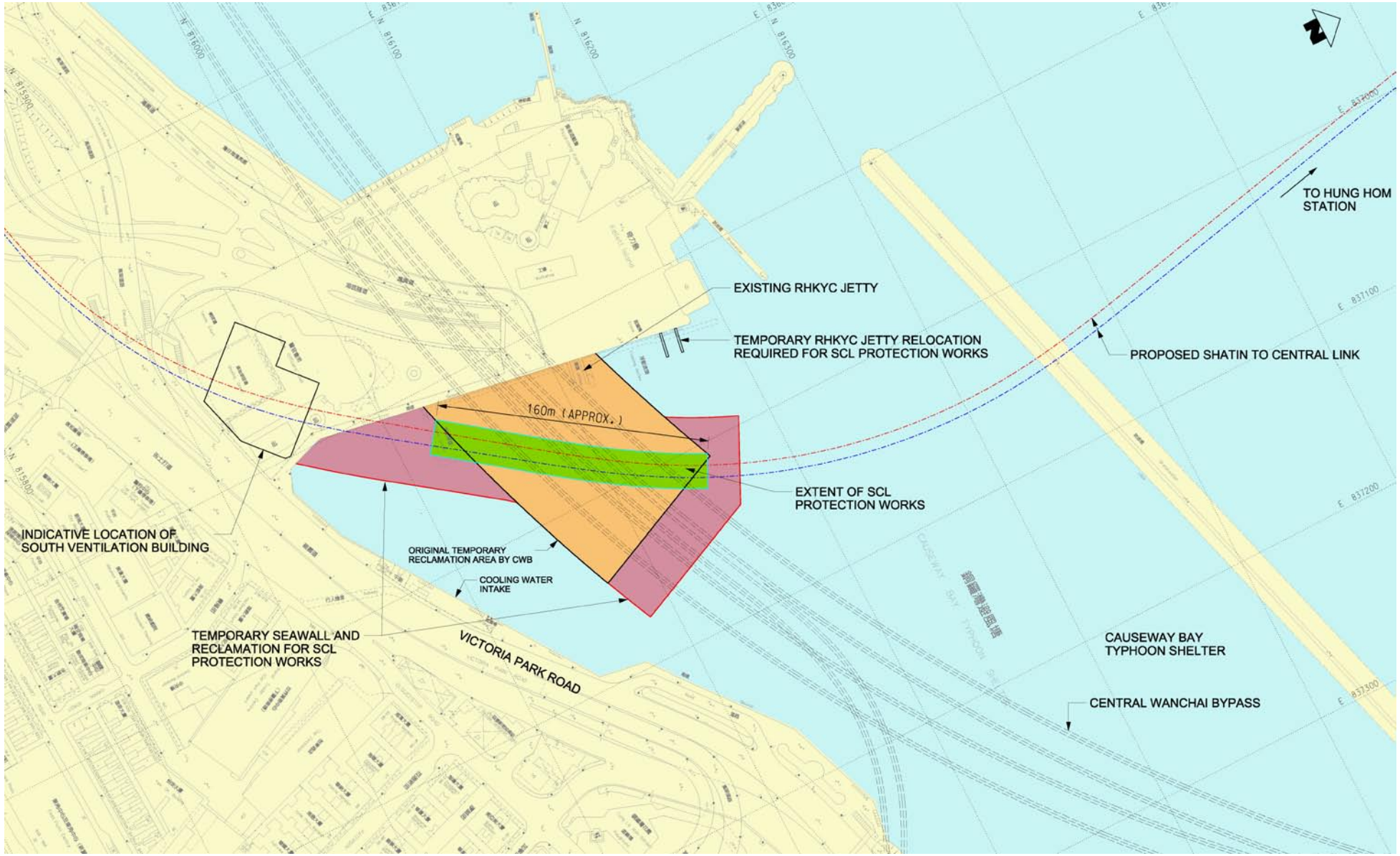


**Figure 1.2 : Scope of SCL Protection Works (Sheet 1 of 2)**

**Project Title: Shatin to Central Link Protection works at Causeway Bay Typhoon Shelter**

**EIA Study Brief No. ESB-213/2010**

Note:
Reproduced from Figure 1.2 of the Project Profile PP-411/2010 submitted on 29/04/2010 (Scale: NTS)

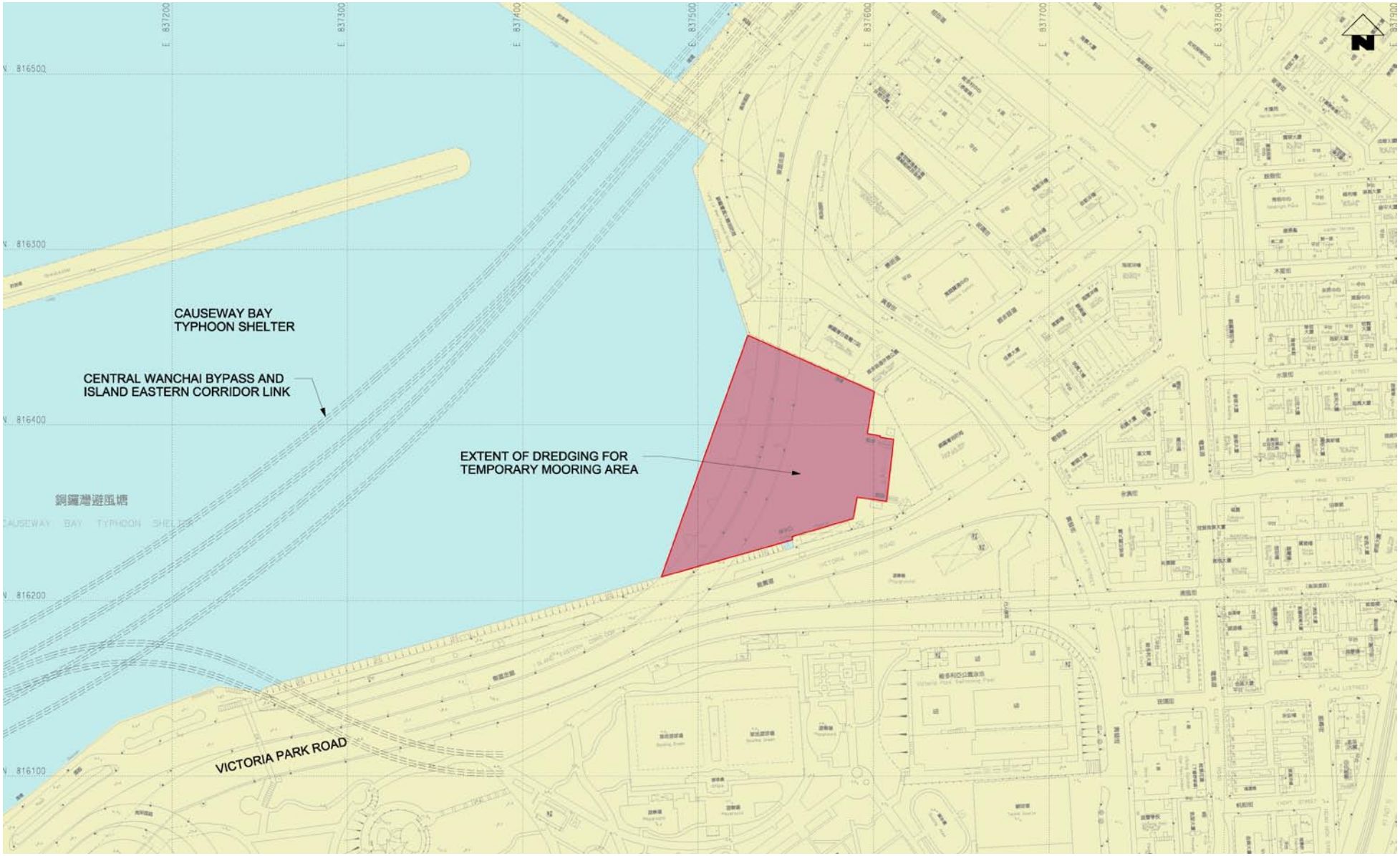


**Figure 1.3 : Scope of SCL Protection Works (Sheet 2 of 2)**

**Project Title: Shatin to Central Link Protection works at Causeway Bay Typhoon Shelter**

**EIA Study Brief No. ESB-213/2010**

Note:
Reproduced from Figure 1.3 of the Project Profile
PP-411/2010 submitted on 29/04/2010 (Scale: NTS)

**Appendix A**

## Hydrodynamic and Water Quality Modelling Requirements

Modelling software general

1. The modelling software shall be fully 3-dimensional capable of accurately simulating the stratified condition, salinity transport, and effects of wind and tide on the water body within the model area.

2. The modelling software shall consist of hydrodynamic, water quality, sediment transport, thermal and particle dispersion modules. All modules shall have been proven with successful applications locally and overseas.

3. The hydrodynamic, water quality, sediment transport and thermal modules shall be strictly mass conserved at all levels.

Model details – Calibration & Validation

1. The models shall be properly calibrated and validated against applicable existing and/or newly collected field data before their use in this study in the Hong Kong waters, the Pearl Estuary and the Dangan (Lema) Channel. The field data set for calibration and validation shall be agreed with EPD.

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:

| Criteria | Level of fitness with field data |
|---|---|
| • tidal elevation (@) | < 8 % |
| • maximum phase error at high water and low water | < 20 minutes |

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

@ Root mean square of the error including the mean and fluctuating components shall meet the criteria at no less than 80% of the monitoring stations in the model domain

5. The consultants shall be responsible for acquiring/developing and calibration of the models for use in this study themselves. They might make reference to the models developed under the Update on Cumulative Water Quality and Hydrological Effect of Coastal Developments and Upgrading of Assessment Tool (Agreement No. CE 42/97). They might also propose to use other models subject to agreement with EPD.

Model details – Simulation

1. The water quality modelling results shall be qualitatively explainable, and any identifiable trend and variations in water quality shall be reproduced by the model. The water quality model shall be able to simulate and take account of the interaction of dissolved oxygen, phytoplankton, organic and inorganic nitrogen, phosphorus, silicate, BOD, temperature, suspended solids, contaminants release of dredged and disposed material, air-water exchange, *E. coli* and benthic processes. It shall also simulate salinity. Salinity results simulated by hydrodynamic models and water quality models shall be demonstrated to be consistent.

2. The sediment transport module for assessing impacts of sediment loss due to marine works shall include the processes of settling, deposition and re-erosion. The values of the modelling parameters shall be agreed with EPD. Contaminants release and DO depletion during dredging and dumping shall be simulated by the model.

3. The thermal model shall be based on the flow field produced by the hydrodynamic model. It shall incorporate the physical processes of thermal / cooled water discharge and abstraction flow, buoyancy effect of the thermal plume, and surface heat exchange. Dispersion of biocides in the discharge shall also be simulated with appropriate decay rates.

4. The models shall at least cover the Hong Kong waters, the Pearl Estuary and the

Dangan Channel to incorporate all major influences on hydrodynamic and water quality. A fine grid model may be used for detailed assessment of this study. It shall either be linked to a far field model or form part of a larger model by gradual grid refinement. The coverage of the fine grid model shall be properly designed such that it is remote enough so that the boundary conditions would not be affected by the project. The model coverage area shall be agreed with EPD.

5. In general, grid size at the area affected by the project shall be less than 400 m in open waters and less than 75 m around sensitive receivers. The grid shall also be able to reasonably represent coastal features existing and proposed in the project. The grid schematization shall be agreed with EPD.

Modelling assessment

1. The assessment shall include the construction and operation phases of the project. Where appropriate, the assessment shall also include maintenance dredging. Scenarios to be assessed shall cover the baseline condition and scenarios with various different options proposed by the Applicant in order to quantify the environmental impacts and improvements that will be brought about by these options. Corresponding pollution load, bathymetry and coastline shall be adopted in the model set up.

2. Hydrodynamic, water quality, sediment transport and thermal modules, where appropriate, shall be run for (with proper model spin up) at least a real sequence of 15 days spring-neap tidal cycle in both the dry season and the wet season.

3. The results shall be assessed for compliance of Water Quality Objectives. Any changes in hydrodynamic regime shall be assessed. Daily erosion / sedimentation rate shall be computed and its ecological impact shall be assessed.

4. The impact on all sensitive receivers shall be assessed.

5. Cumulative impacts due to other projects, activities or pollution sources within a boundary to the agreement of EPD shall also be predicted and quantified.

- END -

**Appendix B-1**

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

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

## 1. Introduction

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

## 2. Choice of Models

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

| 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 CALINE4 model due to its inability to handle lengthy data set.

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

(i) perform a frequency occurrence analysis of one year of meteorological data to determine the actual wind speed (to the nearest unit of m/s), wind direction (to the nearest 10°) and stability (classes A to F) combinations and their frequency of occurrence;
(ii) determine the short term hourly impact under all of the identified wind speed, wind direction and stability combinations; and
(iii) apply the frequency data with the short term results to determine the long term (daily / annual) impacts.

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

3.1.4 Note that the anemometer height (relative to a datum same for the sources and receptors) at which wind speed measurements were taken at a selected station should be correctly entered in the model. These measuring positions can vary greatly from station to station and the vertical wind profile employed in the model can be grossly distorted from the real case if incorrect anemometer height is used. This will lead to unreliable concentration estimates.

3.1.5 An additional parameter, namely, the standard deviation of wind direction, $\sigma_\theta$, needs to be provided as input to the CALINE4 model. Typical values of $\sigma_\theta$ range from $12^o$ for rural areas to $24^o$ for highly urbanised areas under 'D' class stability. For semi-rural such as new development areas, $18^o$ 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 $g/s/m^2$) as required by the model should be clearly stated for verification. The physical dimensions, location, release height and any other emission characteristics such as efflux conditions and emission pattern of the sources input to the model should also correspond to site data.

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

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

3.3 Urban/Rural Classification

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

3.4 Surface Roughness Height

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

3.5 Receptors

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

3.6 Particle Size Classes

In evaluating the impacts of dust-emitting activities, suitable dust size categories relevant to the dust sources concerned with reasonable breakdown in TSP (< 30 $\mu$m) and RSP (< 10 $\mu$m) compositions should be used.

3.7 $NO_2$ to $NO_x$ Ratio

The conversion of $NO_x$ to $NO_2$ 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 $NO_2$:

(a) Ambient Ratio Method (ARM) - assuming 20% of $NO_x$ to be $NO_2$; or
(b) Discrete Parcel Method (DPM, available in the CALINE4 model); or
(c) Ozone Limiting Method (OLM) - assuming the tailpipe $NO_2$ emission to be 7.5% of $NO_x$ and the background ozone concentration to be in the range of 57 to 68 $\mu g/m^3$ 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 Odour Regulations, Controls and Technology, Air & Waste Management Association, 1991.*
*Ref.(4): A.W.C. Keddie, 'Dispersion of Odours', Odour Control – A Concise Guide, Warren Spring Laboratory, 1980.*

3.9 Plume Rise Options

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

3.10 Portal Emissions

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

*Ref.(5): XIXth World Road Congress Report, Permanent International Association of Road Congresses (PIARC), 1991.*
*Ref.(6): N. Ukegunchi, H. Okamoto and Y. Ide "Prediction of vehicular emission pollution around a tunnel mouth", Proceedings 4th International Clean Air Congress, pp. 205-207, Tokyo, 1977.*

3.11 Background Concentrations

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

3.12 Output

The highest short-term and long-term averages of pollutant concentrations at prescribed receptor locations are output by the model and to be compared against the relevant air quality standards specified for the relevant pollutant. Contours of pollutant concentration are also required for indicating the general impacts of emissions over a study area. Copies of model files in electronic format should also be provided for the Director's reference.

---

**Schedule 1**

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

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

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

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

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

**Appendix B-2**

## Guidelines on Assessing the 'TOTAL' Air Quality Impacts

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

### 1. Total Impacts - 3 Major Contributions

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

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

### 2. Nature of Emissions

2.1 Primary contributions

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

2.2 Secondary contributions

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

2.3 Background contributions

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

from 1km up to tens or hundreds of kms) is rather complex and cannot be adequately estimated by the 'Gaussian' type of models.

## 3. Background Air Quality - Estimation Approach

3.1 The approach

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

3.2 Categorisation

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

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

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

3.3 Background pollutant values

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

| POLLUTANT | URBAN | INDUSTRIAL | RURAL / NEW DEVELOPMENT |
|---|---|---|---|
| $NO_2$ | 59 | 57 | 39 |
| $SO_2$ | 21 | 26 | 13 |
| $O_3$ | 62 | 68 | 57 |
| TSP | 98 | 96 | 87 |
| RSP | 60 | 58 | 51 |

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

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

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

3.4 Site categories

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

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

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

3.5 Provisions for 'double-counting'

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

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

where E stands for emission.

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

## 4. Conclusions

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

**Appendix B-3**

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

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

## 1. Background

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

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

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

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

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

## 2. Required Demonstration / Submission

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

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

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

2.2 To provide technical details of the proposed model, the proponent should submit

documents containing at least the following information:

(i) mathematical formulation and data requirements of the model;
(ii) any previous performance evaluation of the model; and
(iii) a complete set of model input and output file(s) in commonly used electronic format.

2.3 On performance evaluation, the required approach and extent of demonstration varies depending on whether a Schedule 1 model is already available and suitable in simulating the situation under consideration. In cases where no Schedule 1 model is found applicable, the proponent must demonstrate that the proposed model passes the screening test as set out in USEPA Document "Protocol for Determining the Best Performing Model" (Ref. 1).

*Ref.(1): William M. Cox, 'Protocol for Determining the Best Performing Model'; Publication No. EPA-454/R-92-025; U.S. Environmental Protection Agency, Research Triangle Park, NC.*

2.4 For cases where a Schedule 1 model is applicable to the project under consideration but an alternative model is proposed for use instead, the proponent must demonstrate either that

(i) the highest and second highest concentrations predicted by the proposed model are within 2 percent of the estimates obtained from an applicable Schedule 1 model (with appropriate options chosen) for all receptors for the project under consideration; or

(ii) the proposed model has superior performance against an applicable Schedule 1 model based on the evaluation procedure set out in USEPA Document "Protocol for Determining the Best Performing Model" (Ref. 1).

2.5 Should the Director find the information on technical details alone sufficient to indicate the acceptability of the proposed model, information on further performance evaluation as specified in Sections 2.3 and 2.4 above would not be necessary.

2.6 If the proposed model is an older version of one of the Schedule 1 models or was previously included in Schedule 1, the technical documents mentioned in Section 2.2 are normally not required. However, a performance demonstration of equivalence as stated in Section 2.4 (i) would become necessary.

2.7 If the Director is already in possession of some of the documents that describe the technical details of the proposed model, submission of the same by the proponent is not necessary. The proponent may check with the Director to avoid sending in duplicate information.

---

*Schedule 1*

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

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

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

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

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

---

**Appendix C**

## Implementation Schedule of Recommended Mitigation Measures

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