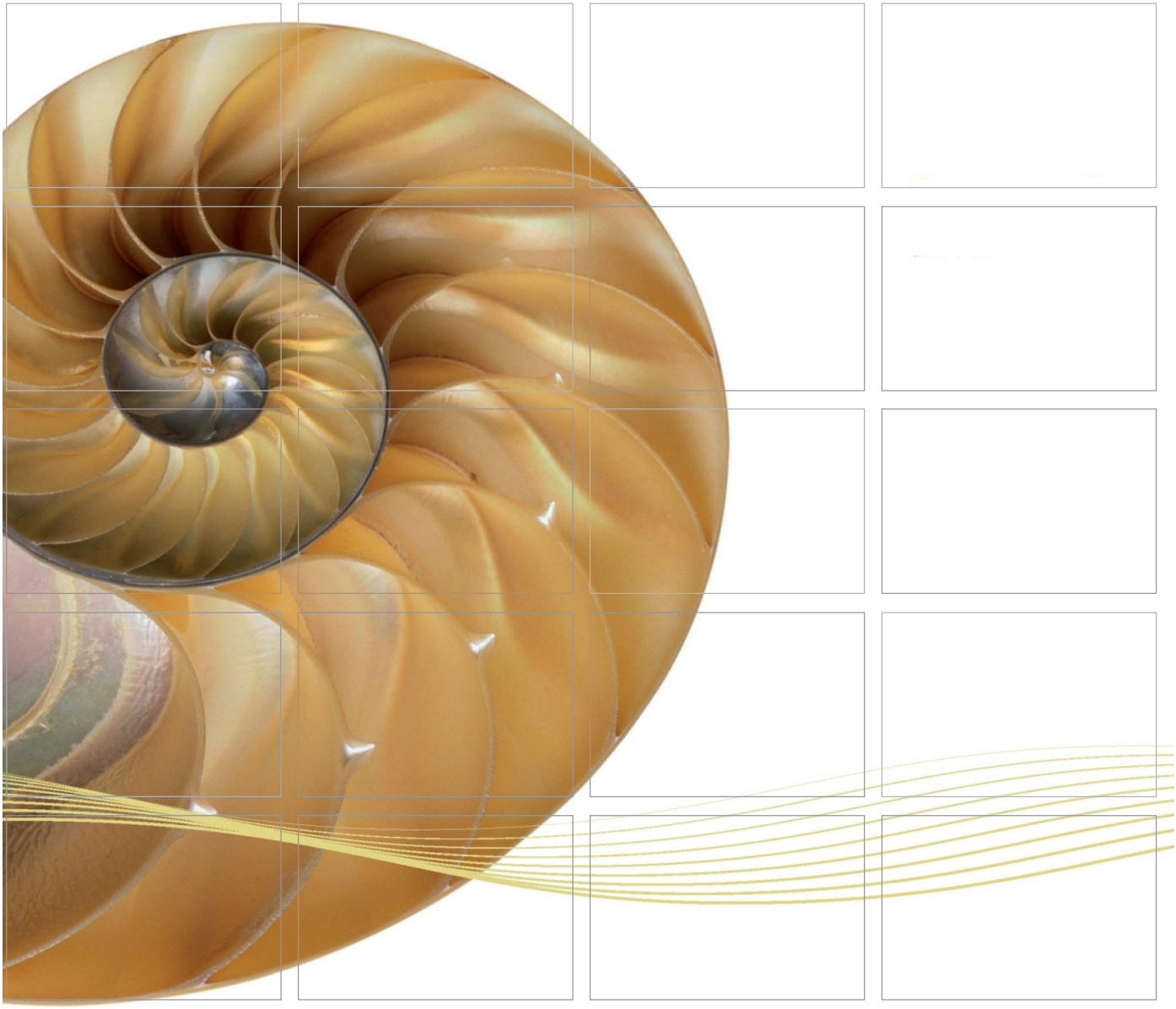

Contract No. HY/2012/07
Tuen Mun – Chek Lap Kok Link – Southern Connection Viaduct Section

Contract Specific EM&A Manual

21 February 2014

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Contract No. HY/2012/07
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Summary: This document presents the Contract Specific EM&A Manual for Tuen Mun – Chek Lap Kok Link – Southern Connection Viaduct Section.	Date: 21 February 2014
	Approved by:  *Mr Craig Reid* *Partner*
	Certified by:  *Mr Jovy Tam* *ET Leader*

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AECOM By Fax (2492 2057) and By Post
Supervising Officer Representative's Office
6 Hoi Kok Street,
Tsuen Wan, N.T.

Attention: Mr. Daniel Ip

Dear Sir,

Re: Agreement No. CE 48/2011 (EP)
Environmental Project Office for the
HZMB Hong Kong Link Road, HZMB Hong Kong Boundary Crossing Facilities, and Tuen Mun-Chek Lap Kok Link – Investigation

Contract No. HY/2012/07 TM-CLKL Southern Connection Viaduct Section
Contract Specific EM&A Manual

We refer to the captioned submission of a revised Contract Specific EM&A Manual certified by environmental team (ERM's ref: "0215660_TM-CLKL_EM&A_(Gammon) Rev 0_2014_02_21.doc" dated on 21 February 2014) provided to us via email on 21 February 2014.

We are pleased to inform you that we have no adverse comment on the captioned Manual.

Thank you for your kind attention. Please do not hesitate to contact the undersigned or the ENPO Leader Mr. Y H Hui should you have any queries.

Yours sincerely,

Tony Cheng
Independent Environmental Checker
Tuen Mun – Chek Lap Kok Link

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Contract No. HY/2012/07
Tuen Mun – Chek Lap Kok Link –
Southern Connection Viaduct Section

Contract Specific Environmental Monitoring and Audit Manual

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1 INTRODUCTION

1.1 Background Information

1.1.1.1 According to the findings of the Northwest New Territories (NWNT) Traffic and Infrastructure Review conducted by the Transport Department, Tuen Mun Road, Ting Kau Bridge, Lantau Link and North Lantau Highway (NLH) will be operating beyond capacity after 2016 due to the increase in cross boundary traffic, developments in the NWNT, and possible developments in North Lantau, including the Airport developments, the Lantau Logistics Park (LLP) and the Hong Kong – Zhuhai – Macao Bridge (HZMB). In order to cope with the anticipated traffic demand, two new connections between NWNT and North Lantau – Tuen Mun – Chek Lap Kok Link (TM-CLKL) and Tuen Mun Western Bypass (TMWB) are proposed.

1.1.1.2 The proposed TM-CLKL if combined with the TMWB will provide a direct route linking NWNT and North Lantau, from north to south, the Kong Sham Western Highway (KSWH), port back-up areas in NWNT, Tuen Mun River Trade Terminal, the existing EcoPark in Tuen Mun Area 38, the Airport, the proposed LLP, HZMB and North Lantau developments. The new connection will significantly reduce the travelling time between the KSWH and the NWNT region at its northern side, and North Lantau at its southern side.

1.1.1.3 In 2005, Highways Department (HyD) commissioned an engineering feasibility study (FS), namely Tuen Mun Chek Lap Kok Link and Tuen Mun Western Bypass – Feasibility Study (Agreement No. CE 28/2005 (HY)), to evaluate the technical feasibility and impacts of the Project. The FS recommended that the TM-CLKL should be a dual 2-lane road with a total length of about 9 km with about 4 km long submarine tunnel and 5 km long elevated structure.

1.1.1.4 In order to progress this project, Maunsell Consultants Asia Ltd. were appointed by HyD to carry out the Assignment on Tuen Mun – Chek Lap Kok Link - Investigation under Agreement No. CE 52/2007 (HY). The Assignment commenced on 19 May 2008 and shall be completed within 24 months, i.e. by mid-May 2010.

1.1.1.5 The Feasibility Study initially proposed an alignment of the TM-CLKL comprising a toll plaza island at Tai Mo To and this alignment formed the basis of the EIA Study Brief (ESB 175/2007). However, subsequent to these documents being prepared and based upon the proposed schemes for the Hong Kong-Zhuhai- Macao Bridge (HZMB) and Hong Kong Boundary Crossing Facilities (HKBCF), it was decided to integrate the TM-CLKL southern landfall reclamation with the HKBCF reclamation. It was considered that this arrangement would also provide a cost-effective connection between the HKBCF and North Lantau. Following a full option assessment, the preferred scheme was selected, as detailed in Section 2 of this EM&A Manual.

1.1.1.6 The project is a designated project under *Section A.1 of Schedule 2 of the Environmental Impact Assessment Ordinance (EIAO)*. As such, the statutory procedures under the EIAO need to be followed and an environmental permit (EP) will be required prior to the commencement of construction. Thus, as part of this assignment, an Environmental Impact Assessment (EIA) has been undertaken.

1.1.1.7 The EIA for the project has recommended comprehensive Environmental Monitoring and Audit requirements to be undertaken during the design, construction and operational stages of the project. This Report constitutes the Environmental Monitoring and Audit (EM&A) Manual for the proposed Tuen Mun - Chek Lap Kok Link (TM-CLKL) Project, providing details of the EM&A recommendations.

1.1.1.8 The Hong Kong SAR Government's applicable environmental regulations for noise, air quality, ecology, water quality, landscape and visual resources and waste management and heritage protection, the Hong Kong Planning Standards and Guidelines and recommendations in the TM-CLKL EIA Report have served as guidance documents in the preparation of this Manual. This EM&A Manual fulfills the requirements of the Study Agreement and follows the approach recommended in EPD's Generic EM&A Manual, Annex 21 of the Technical Memorandum on the EIA Process and EM&A Guidelines for Development Projects in Hong Kong.

1.2 Policy

1.2.1.1 The Supervising Officer's Representative (SOR) and the Contractor shall adopt Environmental Policy Statements in accordance with the requirements of this Manual in order to foster a sound EM&A programme to protect the environment. The following policy statements shall be adopted:

- establish a commitment to environmental excellence in all activities arising from the development project;
- encourage the adoption of environmental management principles to prevent potential impacts and minimise adverse impacts; and
- commit to the recommendations in the EIA study report and related EIA process requirements.

1.3 EM&A Programme Objectives

1.3.1.1 The broad objective of this EM&A Manual is to define the procedures of the EM&A programme for monitoring the environmental performance of the TM-CLKL project during design, construction and implementation.

1.3.1.2 The manual provides details of the environmental monitoring requirements arising from the EIA including air, noise and water quality, as well as audit recommendations for the noise, air, water quality, ecology, landscape and visual, waste and cultural heritage. The purposes of the defined EM&A programme are as

follows:

- to ensure the specified mitigation recommendations of the EIA are included in the design of the project;
- to clarify and identify sources of pollution, impact and nuisance arising from the works;
- to confirm compliance with legal, contract specifications and EIA study recommendations;
- to provide an early warning system for impact prevention;
- to provide a database of environmental parameters against which to determine any short term or long term environmental impacts;
- to propose timely, cost-effective and viable solutions to actual or potential environmental issues;
- to monitor performance of the mitigation measures and to assess their effectiveness and, whenever necessary, identify any further need for additional measures;
- to verify the EIA predicted impacts;
- to collate information and evidence for use in public, District Council and Government consultation; and
- to audit environmental performance.

1.3.1.3 EM&A procedures are required during the design, construction and operational phases of the project implementation and a summary of the requirements for each of the environmental parameters is detailed in **Table 1.1** below.

Table 1.1 Summary of EM&A Requirements

Parameter	EM&A Phase		
	Desig n	Construction Phase	Operational Phase
Air Quality		Y	
Noise		Y	
Ecology	Y	Y	Y
Water Quality		Y	Y
Landscape and Visual	Y	Y	Y
Waste/Contaminated Land		Y	
Cultural Heritage	Not applicable as cultural heritage resource is not identified for the works area of the Contract.		

1.4 Scope of the EM&A Programme

1.4.1.1 The scope of the EM&A programme is to undertake the following, which follows the demarcation of monitoring responsibilities set out in Environmental Project Office's letter dated 29.10.2013:

a) Implement monitoring and audit activities for each environmental parameter as follows:

Dust:
- i) Establish baseline dust levels at specified locations and review these levels on a regular basis.
- ii) Implement construction dust impact monitoring programme.

Noise:
- i) Establish baseline noise, levels at specified locations and review these levels on a regular basis.
- ii) Implement construction noise impact monitoring

Ecology:
- i) Implement design phase audit for ecological dolphin protection specifications, ecological translocation specifications and design integrated ecological mitigation measures.
- ii) Implement baseline survey to establish existing ecological conditions.
- iii) Implement construction phase monitoring and audit requirements for ecology resources.
- iv) Implement operational phase monitoring.

Water Quality:
- i) Establish baseline water quality levels at specified locations and review these levels on a regular basis.

	ii)	Implement construction water quality impact monitoring programme.
	iii)	Implement operational phase water quality impact monitoring programme.
Landscape and Visual:	i)	Design detailed landscape specifications.
	ii)	Implement baseline survey to establish/confirm existing landscape and visual conditions.
	iii)	Implement construction phase audit requirements for landscape and visual resources.
	iv)	Implement operational phase audit requirements for landscape and visual aspects.
Waste:	i)	Implement construction phase audit requirements for waste aspects.
Heritage:	i)	Not applicable

b) Liaison and provision of advice to construction site staff on the purposes and implementation of the EM&A programme.

c) Identify and resolve environmental issues that may arise from the project.

d) Check and quantify the Contractor's overall performance, implement Event/Action Plans and recommend and implement remedial actions to mitigate adverse environmental effects as identified by the EM&A programme and EIA.

e) Conduct monthly reviews of monitored impact data during the construction phase and bi-monthly reviews during the operational phase as the basis for assessing compliance with defined criteria and ensuring that necessary mitigation measures are identified, designed and implemented and to undertake additional *ad hoc* monitoring and audit as required by particular circumstances.

f) Evaluate and interpret all environmental monitoring data to provide an early indication should any of the environmental control measures or practices fail to achieve the acceptable standards and to verify the environmental impacts predicted in the EIA.

g) Manage and liaise with other individuals or parties concerning any relevant environmental issues.

h) Audit the effectiveness of the Environmental Management System (EMS) practices and procedures and implement any changes as appropriate.

i) Conduct regular site audits of formal or informal nature to assess:

- the level of the Contractor's general environmental awareness;
- the Contractor's implementation of the recommendations in the EIA;
- the Contractor's performance as measured by the EM&A;
- the need for specific mitigation measures to be implemented or the continued usage of those previously agreed; and
- to advise the site staff of any identified potential environmental issues.

j) Submit EM&A reports which summarise project monitoring and auditing data, with full interpretation, illustrating the acceptability or otherwise of any environmental impacts and identification or assessment of the implementation status of agreed mitigation measures.

1.4.1.2 Thus, this EM&A Manual provides the following information:

a) Description of the project.

b) Identification and recommendations for monitoring requirements for all phases of development, including:

- identification of sensitive receivers;
- monitoring locations;
- monitoring parameters and frequencies;
- monitoring equipment to be used;
- programmes for baseline monitoring and impact monitoring; and
- data management of monitoring results.

c) The organisation management structure, and procedures for auditing of the Project and implementation of mitigation measures that are recommended for the Project.

d) The environmental quality performance limits for compliance auditing for each of the recommended monitoring parameters to ensure compliance with relevant environmental quality objectives, statutory or planning standards.

e) Organisation and management structure, and procedures for reviewing the design submissions, monitoring results and auditing the compliance of the monitoring data with the environmental quality performance limits, contractual and regulatory requirements, and environmental policies and standards.

f) Event and Action plans for impact and compliance procedures.

g) Complaints handling, liaison and consultation procedures.

h) Interim notification of exceedances, reporting procedures, report formats and reporting frequency including periodical quarterly summary reports and annual reviews to cover all construction, post-Project and operational phases of the development.

i) Implementation schedules, summarising all recommended mitigation measures.

1.4.1.3 This Manual is considered to be a working document and should be reviewed periodically and revised once substantial changes have been made.

1.5 Project Organisation

1.5.1.1 For the purpose of this EM&A Manual, the Highways Department of the Hong Kong SAR Government is referred to as the "Employer" and the Project "Supervising Officer" defined as the Supervising Officer's Representative (SOR), who will be responsible for the supervision of the construction of the Project.

1.5.1.2 The mitigation/enhancement measures recommended by the TM-CLKL EIA that will require a design audit or preparation of specifications during the detailed design phase of the project will include:

- bored piling monitoring programme;
- pre, during and post construction dolphin monitoring;
- 250m dolphin exclusion zone for use during dredging, reclamation, sheet, bored piling works and temporary staging construction;
- acoustic decoupling methods for use during reclamation and dredging works;
- marine vessel control specifications;
- deployment of an artificial reef (Not applicable);
- installation of hoarding for the protection of the pitcher plants and surrounding habitat (Not applicable);
- coral translocation;
- design of toll plaza for grave G1 set back and protection (Not applicable); and
- landscape design drawings.

1.5.1.3 In respect of the design phase EM&A, the Consultant commissioned to undertake the Detailed Design contract will be required to designate an auditor(s) to

undertake the preparation of the design specifications as detailed above, in addition to an environmental audit of the design of the specified landscape measures in order to ensure that the recommendations of the EIA have been fully and properly specified. The Consultant shall use suitably qualified staff to undertake the audit requirements to the satisfaction of the EPD and the AFCD as appropriate. A flow chart of the design phase EM&A procedures is shown in **Figure 1.1**.

1.5.1.4 During the construction and operational phases of the project, an Environmental Team (ET) is to be employed by the Contractor. The ET will be headed by an Environmental Team Leader (ETL). He shall ensure the Contractor's compliance with the project's environmental performance requirements during construction and undertake the post construction EM&A works and his responsibilities will include field measurements, sampling, analysis of monitoring results, reporting and auditing. The ETL shall be approved by the SOR and the Director of Environmental Protection (DEP) and shall be competent and shall have at least 7 years relevant environmental monitoring and audit experience on projects of a similar scale and nature.

1.5.1.5 The ET will comprise suitably qualified support staff to carrying out the EM&A programme. The ET shall be independent and shall not be in any way connected to the Contractor's company. Due to the specialist nature of some of the EM&A works required for this project, the ET should comprise professionals proficient to undertake the tasks involved. Thus, the ET should include personnel experienced in noise, dust and water quality monitoring and mitigation, supervision of waste management, compensatory tree planting, coral relocation and dolphin monitoring and supervision.

1.5.1.6 Accordingly, a qualified dolphin specialist(s), together with a suitably experienced team of dolphin spotters, and a coral specialist, to the satisfaction of AFCD, will be required as part of the ET to undertake the dolphin abundance monitoring, implement the dolphin exclusion zones and undertake the coral relocation process. In addition, a Registered Landscape Architect, as defined by the Landscape Architect's Registration Board, will be required on the ET to monitor and audit the landscaping installation works and assist in the audit of the ecological transplantation and restoration works.

1.5.1.7 The overall duties of ETL and the team are as follows:

- Sampling, analysis and statistical evaluation of monitoring parameters with reference to the EIA study recommendations and requirements in respect of noise, dust and water quality.
- Environmental site surveillance
- Audit of compliance with environmental protection and pollution prevention and control regulations.
- Monitor the implementation of environmental mitigation measures.

- Monitor compliance with the environmental protection clauses/specifications in the Contract.

- Review construction programme and comment as necessary.

- Review construction methodology and comment as necessary.

- Complaint investigation, evaluation and identification of corrective measures.

- Audit of the EMS and recommend and implement any changes as appropriate.

- Liaison with the Independent Environmental Checker (IEC) on all environmental performance matters.

- Advice to the Contractor on environmental improvement, awareness, enhancement matter, etc., on site.

- Timely submission of the designated EM&A reports to the SOR, the IEC, the DEP, the AFCD and the AMO as appropriate.

1.5.1.8 In addition to the ETL and ET, an Independent Environmental Checker (IEC) shall be employed to advise the SOR on environmental issues related to the project. The role of the IEC shall be independent from the management of construction works, but the IEC shall be empowered to audit the environmental performance of the construction activities and operational mitigation. The IEC shall have project management experience in addition to the requirements of the ET specified above and the appointment of the IEC will be subject to the approval of the SOR and the DEP. The IEC may require specialist support staff in order to properly carry out his duties, which shall include the following:

- Review and audit all aspects of the EM&A programme.

- Validate and confirm the accuracy of monitoring results, monitoring equipment, monitoring locations, monitoring procedures and locations of sensitive receivers.

- Carry out random sample check and audit on monitoring data and sampling procedures, etc.

- Conduct random site inspection.

- Audit the EIA recommendations and requirements against the status of implementation of environmental protection measures on site.

- Review the effectiveness of environmental mitigation measures and project environmental performance.

- Audit the Contractor's construction methodology and agree the least impact alternative in consultation with the ET and the Contractor.

- Check complaint cases and the effectiveness of corrective measures.

- Review EM&A report submitted by the ET.

- Feedback audit results to ET by signing off relevant EM&A proformas.

1.5.1.9 An organisation chart showing the lines of communication between the key parties with respect to the EM&A works is provided on **Figure 1.2**. Both the ET and IEC shall be retained for the duration of the EM&A works which will span both the construction phase and one year into the operational phase of the project. The operational EM&A works will be the responsibility of the Contractor and will be undertaken in parallel to the maintenance period after the completion of construction.

1.5.1.10 Notwithstanding the above, given that the TM-CLKL, HKBCF and HKLR will be constructed concurrently, an Environmental Protection Office (ENPO) or equivalent to oversee the cumulative construction projects in North Lantau area will be established by the Project Proponent. The responsibility of the ENPO would be similar to that of the IEC but should also include:

- coordination of the monitoring and auditing works for all the on-going projects in the area in order to identify possible sources/causes of exceedances and recommend suitable remedial actions where appropriate;

- identify and assess cumulative impacts including possible sources/causes of exceedance and recommending suitable remedial actions;

- undertake liaison with the mainland project teams counterparts to identify and assess any cross-boundary cumulative impacts; and

- coordinate the assessment and response to complaints/enquires from locals, green groups, district councils or the public at large.

1.5.1.11 The exact responsibilities and organisation of the ENPO will be defined during the detailed design stage.

1.6 Terminology

1.6.1.1 To clarify the terminology for impact monitoring and audit, key definitions are specified below and are used throughout this Manual.

1.6.1.2 Monitoring refers to the systematic collection of data through a series of repetitive measurements. The stages of monitoring are defined in this document as follows:

a) Baseline Monitoring refers to the measurement of parameters, such as noise and air quality impact parameters, during a representative pre-project period for the purpose of determining the nature and ranges of natural variation and to establish, where appropriate, the nature of change.

b) Impact Monitoring involves the measurement of environmental impact parameters, such as noise and air quality, during Project construction and implementation so as to detect changes in these parameters which can be

attributed to the Project.

1.6.1.3 Audit is a term that infers the verification of a practice and certification of data. The types of audit are defined below:

a) Compliance audit is defined as follows:

- the process of verification that all or selected parameters measured by a noise or air quality impact monitoring programme or levels of an operation are in compliance with regulatory requirements and internal policies and standards; and

- the determination of the degree and scope of any necessary remediation in the event of exceedance of compliance.

b) Post Project Audit is carried out after the implementation and commissioning of a Project.

1.6.1.4 For the purpose of noise, air and water quality impact monitoring and audit, the Action and Limit Levels are defined as follows:

a) The Action Level is the level defined in which there is an indication of a deteriorating ambient level for which a typical response could be an increase in the monitoring frequency.

b) The Limit Level is the level beyond the appropriate remedial pollution control ordinances, noise and air quality impact objectives or Hong Kong Planning Standards and Guidelines established by the EPD for a particular project, such that the works should not proceed without appropriate remedial action, including a critical review of plant and work methods.

2 PROJECT DESCRIPTION

2.1 Scope of the Project

2.1.1.1 Further to the recommendations of the Option Assessment and subsequent alignment developments detailed in *Section 2* of the EIA report, the preferred TM-CLKL scheme comprises Northern Connection Option N1b, Main Connection Option M3 and Southern Connection Option S1. This preferred alignment is shown in **Figure 2.1** and will comprise:

a) construction of approximately 5.0 km long dual 2-lane road tunnel between Tuen Mun Area 40 and the HZMB HKBCF at north-east of HKIA;

b) construction of approximately 4.2km seawalls and approximately 35.6 ha of reclamation to the Government foreshore and sea-bed at Tuen Mun Area 40 and Lantau for the tunnel portals and the associated roads, as shown in **Figures 2.2a and 2.2b**;

c) construction of approximately 1.6km long dual 2-lane viaduct between HZMB HKBCF and NLH and the associated roads at Tai Ho;

d) construction of a toll plaza at Tuen Mun Area 46 and the associated roads at Tuen Mun;

e) construction of footpaths areas;

f) construction of administration building, ventilation buildings and other ancillary buildings to facilitate ventilation and tunnel control operation serving the proposed road tunnel in (a) above and toll plaza in (d) above;

g) modification and realignment of sections of Lung Fu Road and Lung Mun Road at Tuen Mun;

h) modification and realignment of sections of North Lantau Highway and Cheung Tung Road at Tai Ho;

i) permanent closure and demolition of sections of existing at-grade carriageways, footpaths and central median/refuge islands;

j) temporary closure and reconstruction/modifications of sections of existing at-grade carriageways, footpaths and central median/refuge islands;

(k) ancillary works including site formation, slope, drainage, utilities, footbridge, noise barriers, retaining walls, berths and temporary pontoon;

(l) temporary staging construction for the viaduct construction between HKBCF and North Lantau.

2.1.1.2 Details of the various elements of the selected TM-CLKL alignment are detailed in the sections below.

2.2 Northern Section in Tuen Mun (not applicable)

2.3 Submarine Tunnel (not applicable)

2.4 Southern Section at HKBCF / North Lantau (not applicable)

2.4.2 Viaduct Connection and Slip Roads

Marine Viaduct

2.4.2.1 The marine viaduct comprises a dual 2-lane carriageway with a straight alignment connecting the TM-CLKL southern landfall to North Lantau, connecting at Tai Ho Wan, as shown in **Figures 2.4c-j and 2.7**. The structural form will consist of a pair of prestressed concrete box girders supported on reinforced concrete piers. Each box girder will be around 14.6m wide. The vertical profile will involve rising gradients from both ends of the viaduct to a high point above the navigation channel.

2.4.2.2 Span lengths will typically be 60m using a constant structural deck depth of 3.2m.

At the navigation channel off the south-east corner of the southern landfall, a 160m span with a haunched deck will be used to achieve the minimum navigation clearance of 100m horizontally and a minimum of +26.25mPD vertically. The haunched segment at pier will be about 11m deep. The spans adjacent to the navigation span will be 100m long to provide a transition to the typical 60m spans. In total about 50 piers will be constructed in the marine environment, with a predicted loss of seabed of about 0.2ha. The piers supporting the viaduct will sit on bored piles founded on rock at some 40m below seabed level. Pile caps will be positioned above the high water level for marine safety.

Land Connections and Slip Roads

2.4.2.3 There are four slip roads connecting the marine viaduct to the North Lantau Highway (NLH) for eastbound and westbound traffic on the highway connecting to and from the marine crossing. The slip roads comprise four viaducts curving out from the marine viaduct and crossing over the MTR Airport Express Railway before ramping down to connect with the North Lantau Highway. The two viaducts on the west provide for a 1-lane carriageway and the two viaducts on the east provide for 2-lane carriageways.

2.4.2.4 The viaducts are all prestressed concrete box girders supported on reinforced concrete piers. The viaducts for a 1-lane carriageway will each be around 11.3m wide, and the viaducts for the 2-lane carriageways, around 14.6m wide. Span lengths will typically be 60m using a constant structural deck depth of 3.2m, while for crossings over the MTR Airport Express Railway and the North Lantau

Highway, larger spans of 90m are required, together with a haunched deck of a depth of around 6m at piers.

2.4.2.5 The piers supporting the viaducts will all be constructed within the disturbed area of the NLH transport corridor, and sit on bored piles founded on rock at some 20m below ground level, or deeper if underground cavities are encountered (as the site falls within the Designated Area of Northshore Lantau with regards to foundation works). In order to accommodate the viaduct connections to the North Lantau Highway, diversion of Cheung Tung Road including some of the existing utilities below this road will be required, with associated slope cutting works at the west.

2.4.3 Slope Works

2.4.3.1 Diversion of the existing Cheung Tung Road will require cutting back the road side slope features 9SE-B/C8 and 9SE-B/C9. The features comprise soil and rock cut slopes, and a similar cut slope profile to the existing would be proposed. If necessary, soil nails will be installed to ensure adequate current safety standard. Some streams pass through the existing slopes works in the form of U shaped channels, and these existing channels will need to be extended up hill to accommodate the new slope extent and profile.

2.4.4A Temporary Staging Construction

2.4.4.1A Temporary staging is required to provide a stable working platform and transfer of materials for the piling work in connection of the viaduct construction between HKBCF and North Lantau.

The proposed temporary staging scheme comprises a combination of temporary access bridges (TABs) and isolated working platforms. Such design scheme can facilitate the transfer of material and hence save time for the construction work. Moreover, the use of a combination of TABs and isolated working platforms can minimise obstructions to the navigation channel/marine traffic around the works area and minimise propeller wash in shallow waters offshore. The temporary staging works also require construction of three landing platforms along the seawall as the landing points of the TABs and for the temporary storage and transfer of material from land to the staging platforms.

The preliminary layout plan of the proposed temporary staging is shown in **Figure 2.1A** in **Annex A**, which corresponds to the permanent bridge pile layout. The temporary staging consists of 12 isolated working platforms (spaced from approximately 73m to approximately 195m apart, centre to centre) and two TABs with three landing points near the North Lantau Highway. The typical pile configurations and details of the temporary staging are provided in **Figures 2.2A and 2.3A** in **Annex A**. The landing point of the TABs comprises three landing platforms to be formed along the seawall near the NLH as shown in **Figure 2.4A** in **Annex A**. Design drawings of these landing platforms are shown in **Figure 2.5A to 2.8A** in **Annex A**. These platforms will be removed and the seawall will be reinstated upon completion of the TM-CLKL construction works.

2.5 Works Areas

2.5.1.1 Six works areas have been identified for use during the construction period of TM-CLKL, and will be used for locating site offices and for storage of materials

and viaduct segments, etc. The locations of the works areas are shown in **Figure 2.8b** and described in **Table 2.2** below.

Table 2.2 Details of TM-CLKL Proposed Works Areas

Works Area	Location	Proposed Use
Lantau		
WA4	At the existing reclaimed land near Tai Ho Offtake and Pigging Station at Cheung Tung Road in Lantau	Works area for storage of materials and viaduct segment and site office
WA5	At the existing site offices for Yam O Road Watermains near Yam O Wan at Cheung Tung Road in Lantau	Works area for storage of materials and viaduct segment and site office
WA6	At the existing site offices and storage yard for Penny's bay Reclamation near Yam O Wan at Cheung Tung Road in Lantau	Works area for storage of materials and viaduct segment and site office
WA23	At the existing reclaimed land at Wok Tai Wan in Tsing Yi	Casting yard for fabrication of precast units, storage of work boats, materials and site office
Tuen Mun*		

* **Note:** Not applicable

2.5.1.2 All the works areas are currently formed on developed land, with some already being used as works areas for on-going construction projects.

2.6 Sewage and Drainage

2.6.1.1 Stormwater drainage systems will be provided to collect stormwater from the carriageway surfaces. The stormwater will enter into gullies along the kerb lines. The gullies will be fitted with sumps to trap silt and grit prior to discharging the stormwater into the stormwater drainage systems. The drainage systems will eventually discharge the stormwater into the sea at discrete locations. Similar systems will be provided along the marine viaduct. Sump traps will be built into the deck structure, and the collected stormwater will discharge into the sea at the column locations.

2.6.1.2 Not applicable

2.6.1.3 Not applicable

2.6.1.4 Not applicable

2.7 Project Programme

2.7.1.1 The Design and Construction Contract of the Southern Connection Viaduct Section of TM-CLKL commenced in June 2013. An indicative construction programme showing the key activities in different major construction areas is shown in Figure **2.9b**. Locations of the construction areas are shown in **Figure 2.9d**. This is based upon working 12 hours per day for all land works and 16 hours per

day for the marine works, although piling works for the marine sheet piled wall will, also, be restricted to 12 hours per day.

2.7.1.2 Not applicable

2.7.1.3 Not applicable

2.7.1.4 Not applicable

2.7.1.5 Not applicable

2.8 Concurrent Projects

2.8.1 Interface with HKBCF and HZMB HKLR

2.8.1.1 The southern landfall reclamation of the TM-CLKL forms an integrated part of the HKBCF reclamation and interfaces with the latter at a temporary seawall along its eastern edge. Reclamation works sequencing and programme have been planned to match those of the HKBCF in order to achieve its Phase 1 commissioning date target in 2014. HKLR is also scheduled to open in 2014 in matching the Phase 1 commissioning date of HKBCF. Detailed coordination of the interfacing construction activities will be required, including construction access, layout of mitigation measures to control water quality during the construction stage, joint water quality monitoring system, and engineering and construction details at the interface. The layout of the TM-CLKL, HKBCF and HKLR in relation to each other is shown in Figure 2.1.

2.8.1.2 As the projects are proposed to be constructed concurrently and will be operational at the same time, cumulative impacts are possible and have been assessed.

2.8.2 Interface with Tuen Mun Western By-pass (not applicable)

2.8.3 Other Concurrent Projects

2.8.3.1 In addition to the interface with the major concurrent projects described above, details of other concurrent projects during either the construction and/or the operational phases, together with details of how these are assessed in the EIA, are described in the summary table of concurrent projects included as **Appendix A2** of the EIA report.

2.9 Traffic Data and Assumptions

2.9.1.1 A Local Area Model was developed to provide traffic forecasts for EIA purposes. The EIA requires cumulative traffic forecasts and, hence, EIA flows were produced assuming the HZMB, HKLR, HKBCF, TMWB and TM-CLKL were all in place. In order to achieve consistency, a consistent set of model input assumptions have been adopted for the interfacing studies of TM-CLKL, HKBCF,

HKLR and TMWB.

2.9.1.2 The TMWB was assumed to be "non tolled" for the purposes of the TM-CLKL EIA forecasts. This would make a marginal difference to the predicted TM-CLKL traffic forecasts, increasing the traffic flows slightly and, therefore, would represent a potentially worst case for assessing the environmental impacts. The traffic flows have been divided into the 16 vehicle classes required to determine the emissions of the traffic.

2.9.1.3 The opening year for the whole TM-CLKL, i.e. both northern and southern sections, is 2016. Design year peak hour traffic forecasts have, therefore, been prepared for the years 2016, 2021 and 2031 which reflect the full operation of the TM-CLKL. In addition, to assess the environmental impacts at the interim year of 2014, when the southern section will be opened to form part of the new road network servicing the HKBCF Phase 1 commissioning, the relevant traffic forecasts for this year have also been prepared. A summary of the traffic data for the prevailing year of 2007 and the future years of 2014, 2016, 2021 and 2031 and the road links are included in the EIA Report.

3 AIR QUALITY

3.1 Air Quality Parameters

3.1.1.1 Monitoring of the Total Suspended Particulates (TSP) levels shall be carried out by the Environmental Specialist (ET) (see *Section 1*) to ensure that construction works are not generating dust which exceeds the acceptable level. Timely action should be taken to rectify the situation if an exceedance is detected.

3.1.1.2 1-hour and 24-hour TSP levels shall be measured to indicate the impacts of construction dust on air quality. The TSP levels shall be measured by following the standard high volume sampling method as set out in the *Title 40 of the Code of Federal Regulations, Chapter 1 (Part 50)*, **Appendix B**. Upon approval by the Supervising Officer's Representative (SOR) and the Environmental Protection Department (DEP), 1-hour TSP levels may be measured by direct reading methods for *ad hoc* measurements.

3.1.1.3 All relevant data including temperature, pressure, weather conditions, elapsed-time meter reading for the start and stop of the sampler, identification and weight of the filter paper, any other special phenomena and work progress of the concerned site shall be recorded in detail by the ET. A sample data sheet is shown in **Figure 3.1** (at the end of Section 3).

3.2 Monitoring Equipment

3.2.1.1 A high volume sampler in compliance with the following specifications shall be used for carrying out the 1-hr and 24-hr TSP monitoring:

i) 0.6-1.7 m^3/min (20-60 SCFM) adjustable flow range;

ii) equipped with a timing/control device with +/- 5 minutes accuracy for 24 hours operation;

iii) installed with elapsed-time meter with +/- 2 minutes accuracy for 24 hours operation;

iv) capable of providing a minimum exposed area of 406 cm2 (63 in2);

v) flow control accuracy: +/- 2.5% deviation over 24-hr sampling period;

vi) equipped with a shelter to protect the filter and sampler;

vii) incorporated with an electronic mass flow rate controller or other equivalent devices;

viii) equipped with a flow recorder for continuous monitoring;

ix) provided with a peaked roof inlet;

x) equipped with a manometer;

xi) able to hold and seal the filter paper to the sampler housing in a horizontal position;

xii) easy to change the filter; and

xiii) capable of operating continuously for 24-hr period.

3.2.1.2 The Contractor is responsible for provision of the monitoring equipment and shall ensure that sufficient number of high volume samplers with an appropriate calibration kit are available for carrying out the baseline monitoring, impact monitoring and *ad hoc* monitoring. The high volume samplers shall be equipped with an electronic mass flow controller and be calibrated against a traceable standard at regular intervals. All the equipment, calibration kit, filter papers, etc. shall be clearly labeled by the ET.

3.2.1.3 Calibration of dust monitoring equipment shall be conducted by the ET upon installation and thereafter at bi-monthly intervals. The transfer standard shall be traceable to the internationally recognised primary standard and be calibrated annually. The calibration data shall be properly documented for future reference by concerned parties, such as the IEC. All the data shall be converted into standard temperature and pressure condition.

3.2.1.4 The flow-rate of the sampler before and after the sampling exercise with the filter in position shall be verified to be constant and recorded in the data sheet as described in *Section 3.1*.

3.2.1.5 If the ET proposes to use a direct reading dust meter to measure 1-hr TSP levels on an *ad hoc* basis, he shall submit sufficient information to the IEC to prove that the instrument is capable of achieving a comparable result as that the High Volume Sampler (HVS) and may be used for the 1-hr sampling. The instrument should also be calibrated regularly and the 1-hr sampling shall be checked periodically by the HVS to check the validity and accuracy of the results measured by the direct reading method.

3.2.1.6 Wind data monitoring equipment shall also be provided and set up at suitable locations for logging wind speed and wind direction near to the dust monitoring locations. The equipment installation location shall be proposed by the ET and agreed with the SOR, in consultation with the IEC.

3.2.1.7 For installation and operation of wind data monitoring equipment, the following points shall be observed:

i) the wind sensors should be installed on masts at an elevated level 10 m above ground so that they are clear of obstructions or turbulence caused by the buildings;

ii) the wind data should be captured by a data logger to be down-loaded for processing at least once a month;

iii) the wind data monitoring equipment should be re-calibrated at least once every six months; and

iv) wind direction should be divided into 16 sectors of 22.5 degrees each.

3.2.1.8 In exceptional situations, the ET may propose alternative methods to obtain representative wind data upon approval from the SOR and agreement from the IEC.

3.3 Laboratory Measurement/Analysis

3.3.1.1 A clean laboratory with constant temperature and humidity control and equipped with necessary measuring and conditioning instruments shall be used for sample analysis and equipment calibration and maintenance. The laboratory shall be HOKLAS accredited.

3.3.1.2 If a site laboratory is set up or a non-HOKLAS accredited laboratory is hired for carrying out the laboratory analysis, the laboratory equipment shall be approved by the SOR, in consultation with the IEC. Measurement performed by the laboratory shall be demonstrated to the satisfaction of the SOR and the IEC. The IEC shall conduct regular audits of the measurements performed by the laboratory to ensure the accuracy of the results. The ES shall provide the SOR and the IEC with one copy each of the Title 40 of the Code of Federal Regulations, Chapter 1 (Part 50), Appendix B for reference.

3.3.1.3 Filter paper of size 8"x10" shall be labeled before sampling. It shall be a clean filter paper with no pin holes and shall be conditioned in a humidity controlled chamber for over 24-hr and be pre-weighed before use for the sampling.

3.3.1.4 After sampling, the filter paper loaded with dust shall be kept in a clean and tightly sealed plastic bag. The filter paper shall then be returned to the laboratory for reconditioning in the humidity controlled chamber followed by accurate weighing by an electronic balance with a readout down to 0.1 mg. The balance shall be regularly calibrated against a traceable standard.

3.3.1.5 All the collected samples shall be kept in a good condition for 6 months before disposal.

3.4 Monitoring Locations

3.4.1.1 The air quality sensitive receivers, as determined by the EIA, are shown in **Figure 3.2** and these will also form the recommended dust monitoring locations. The status and locations of dust sensitive receivers may change after issue of this manual. If this happens, the ET shall propose updated monitoring locations and seek approval from the SOR and agreement from IEC.

3.4.1.2 When alternative monitoring locations are proposed, the following preferred locations and factors shall be considered:

i) the site boundary or locations close to the major dust emission source;

ii) close to the sensitive receptors; and

iii) the prevailing meteorological conditions.

3.4.1.3 The ET shall agree with the SOR, in consultation with the IEC, the position of the high volume samplers. When positioning the samplers, the following points shall be noted:

i) a horizontal platform with appropriate support to secure the samplers against gusty wind shall be provided;

ii) the distance between the sampler and an obstacle, such as buildings, shall be at least twice the height that the obstacle protrudes above the sampler;

iii) a minimum of 2 metres of separation from walls, parapets and penthouses is required for rooftop samplers;

iv) a minimum of 2 metres separation from any supporting structure, measured horizontally is required;

v) no furnace or incinerator flue is nearby;

vi) airflow around the sampler is unrestricted;

vii) the sampler is more than 20 metres from the dripline;

viii) any wire fence and gate, to protect the sampler, shall not cause any obstruction during monitoring;

ix) permission must be obtained to set up the samplers and to obtain access to the monitoring stations;

x) a secured supply of electricity is needed to operate the samplers; and

xi) no two samplers should be placed less than 2 metres apart.

3.4.1.4 Prior to construction, the dust monitoring schedule shall be developed by the ET based upon the construction schedule supplied by the Contractor. The ET shall inform the IEC of the impact monitoring programme such that he can conduct on-site audits to ensure accuracy of the impact monitoring results. The environmental monitoring schedule shall be approved by the SOR.

3.5 Baseline Monitoring

3.5.1.1 The ET shall carry out baseline monitoring at two representative dust monitoring locations (ASR9A and ASR9C). The monitoring at these locations shall be undertaken for at least 14 consecutive days prior to the start of the construction works to obtain daily 24-hr TSP samples. 1-hr sampling shall also be carried out

at least 3 times per day during the same period. Monitoring shall take place within a 3 week period prior to the commencement of construction works.

3.5.1.2 During the baseline monitoring, there should not be any construction or dust generation activities in the vicinity of the monitoring stations.

3.5.1.3 In case the baseline monitoring cannot be carried out at the designated monitoring locations during the baseline monitoring period, the ET shall carry out the monitoring at alternative locations which can effectively represent the baseline conditions at the impact monitoring locations. The alternative baseline monitoring locations shall be approved by the SOR, IEC and agreed with DEP.

3.5.1.4 In the event that insufficient baseline monitoring data or questionable results are obtained, the ET shall liaise with the DEP to agree on an appropriate set of data to be used as a baseline reference and submit this data to the SOR and IEC for approval.

3.5.1.5 Ambient conditions may vary seasonally and shall be reviewed at three monthly intervals. If the ET considers that the ambient conditions have changed and a repeat of the baseline monitoring is required to be carried out for obtaining updated baseline levels, the monitoring should be at times when the Contractor's activities are not generating dust, at least in the proximity of the monitoring stations. Should a change in ambient conditions be determined, the baseline levels and, in turn, the air quality criteria, shall be revised. The revised baseline levels and air quality criteria shall be agreed with the DEP and supplied to the IEC.

3.5.1.7 The Baseline Air Quality Monitoring at ASR9A and ASR9C was conducted during October 2011. Monitoring results are presented in the *Baseline Environmental Monitoring for Hong Kong-Zhuhai-Macao Bridge Hong Kong Projects – Investigation* (1). The baseline data will be adopted in the current EM&A Programme.

3.6 Impact Monitoring

3.6.1.1 The ET shall carry out impact monitoring during the course of the works. For regular impact monitoring, the sampling frequency of at least once in every six days shall be strictly observed at two of the designated monitoring stations for 24-hr TSP monitoring (ASR9A and ASR9C). For 1-hr TSP monitoring, the sampling frequency of at least three times in every six days should be undertaken at two locations (ASR9A and ASR9C) when the highest dust impact occurs. The stations to be monitored should be selected based on the prevailing wind direction and their proximity to the active construction works.

3.6.1.2 The specific time to start and stop the 24-hr TSP monitoring shall be clearly defined for each location and be strictly followed by the operator.

(1) Agreement No. CE 35/2011 (EP) Baseline Environmental Monitoring for Hong Kong-Zhuhai-Macao Bridge Hong Kong Projects-Investigation.
http://www.hzmbenpo.com/ep_docs/HKBCF_HY201002/503/Baseline_Report_Version_C.pdf

3.6.1.3 In case of non-compliance with the air quality criteria, more frequent monitoring, as specified in the Action Plan in *Section 3.7*, shall be conducted within 24 hours after the non-compliance is detected. This additional monitoring shall be continued until the excessive dust emission or the deterioration in air quality is rectified.

3.7 Event and Action Plan for Air Quality

3.7.1.1 The baseline monitoring results formed the basis for determining the air quality criteria for the impact monitoring. The ET shall compare the impact monitoring results with air quality criteria set up for 24-hour TSP and 1-hour TSP. **Table 3.1a** and **Table 3.1b** show the method of derivation and the Action and Limit levels to be used, respectively. Should non-compliance with the air quality criteria occur, the ET, the IEC and the SOR and the Contractor shall undertake their specified actions in accordance with the Action Plan shown in **Table 3.2**.

Table 3.1a Method of Derivation of Action and Limit Levels for Air Quality

Parameter	**Action Level**	**Limit Level**
24-hour TSP Level in µg/m^3	For baseline level ≤ **200 µg/m³** Action level = (Baseline*1.3+ Limit level)/2	260
	For baseline level **>200 µg/m³** Action level = Limit level	
1-hour TSP Level in µg/m^3	For baseline level ≤ **384 µg/m³** Action level = (Baseline*1.3+ Limit level)/2	500
	For baseline level **> 384 µg/m³** Action level = Limit level	

Table 3.1b Action and Limit Levels for Air Quality

Parameters	Action	Limit
24 Hour TSP Level in µg/m³	ASR9A = 178 ASR9C = 178	260
1 Hour TSP Level in µg /m³	ASR9A = 394 ASR9C = 393	500

3.7.1.2 In case of non-compliance with the air quality criteria, more frequent monitoring exercise, shall be conducted within 24 hours after the result is obtained. This additional monitoring shall be continued until the excessive dust emission or the deterioration in air quality is rectified. The Event/Action Plan for air quality is given in the attached **Table 3.2.**

3.7.1.3 The Independent Environmental Checker (IEC) shall be empowered to audit the environmental performance of construction, all aspects of the EM&A programme, validate and confirm the accuracy of monitoring results, monitoring equipment, monitoring locations and procedures. If any exceedances occur, the IEC shall follow the actions stated in the Event and Action Plan in **Table 3.2.**

3.8 Dust Mitigation Measures

3.8.1.1 The EIA report has recommended dust control and mitigation measures. The Contractor shall be responsible for the design and implementation of the following measures. The recommended construction dust mitigation measures are summarised in the *Air Quality Environmental Mitigation Implementation Schedule* provided in **Appendix A**.

i) All unpaved roads/exposed area shall be watered which results in dust suppression by forming moist cohesive films among the discrete grains of road surface material. An effective watering programme of twice daily watering with complete coverage, is estimated to reduce by 50%. This is recommended for all areas in order to reduce dust levels to a minimum;

ii) Watering of the construction area 8 times per day is recommended to reduce dust emissions by 87.5% and shall be undertaken;

iii) The Contractor shall, to the satisfaction of the Supervising Officer, install effective dust suppression measures and take such other measures as may be necessary to ensure that at the Site boundary and any nearby sensitive receiver, dust levels are kept to acceptable levels;

iv) The Contractor shall not burn debris or other materials on the works areas;

v) In hot, dry or windy weather, the watering programme shall maintain all exposed road surfaces and dust sources wet;

vi) Where breaking of oversize rock/concrete is required, watering shall be implemented to control dust. Water spray shall be used during the handling of fill material at the site and at active cuts, excavation and fill sites where dust is likely to be created;

vii) Open dropping heights for excavated materials shall be controlled to a maximum height of 2m to minimise the fugitive dust arising from unloading;

viii) During transportation by truck, materials shall not be loaded to a level higher than the side and tail boards, and shall be dampened or covered before transport. Materials having the potential to create dust shall not be loaded to a level higher than the side and tail boards, and shall be covered by a clean tarpaulin. The tarpaulin shall be properly secured and shall extend at least 300mm over the edges of the side and tail boards;

ix) No earth, mud, debris, dust and the like shall be deposited on public roads.

x) Wheel washing facility shall be usable prior to any earthworks excavation activity on the site;

xi) Areas of exposed soil shall be minimised to areas in which works have been

completed shall be restored as soon as is practicable; and

xii) All stockpiles of aggregate or spoil shall be enclosed or covered and water applied in dry or windy condition.

3.8.1.2 If the above measures are not sufficient to restore the air quality to acceptable levels upon the advice of the ET, the Contractor shall liaise with the ET regarding other mitigation measures and consult the IEC for their effectiveness, and then propose these measures to the SOR for approval prior to the implementation of the measures.

Table 3.2 Event / Action Plan for Air Quality

EVENT	ACTION			
	ET [1]	IEC [1]	SOR [1]	Contractor
Action Level				
1. Exceedance for one sample	1. Identify the source. 2. Inform the IEC and the SOR. 3. Repeat measurement to confirm finding. 4. Increase monitoring frequency to daily.	1. Check monitoring data submitted by the ET. 2. Check Contractor's working method.	1. Notify Contractor.	1. Rectify any unacceptable practice 2. Amend working methods if appropriate
2. Exceedance for two or more consecutive samples	1. Identify the source. 2. Inform the IEC and the SOR. 3. Repeat measurements to confirm findings. 4. Increase monitoring frequency to daily. 5. Discuss with the IEC and the Contractor on remedial actions required. 6. If exceedance continues, arrange meeting with the IEC and the SOR. 7. If exceedance stops, cease additional monitoring.	1. Check monitoring data submitted by the ET. 2. Check the Contractor's working method. 3. Discuss with the ET and the Contractor on possible remedial measures. 4. Advise the SOR on the effectiveness of the proposed remedial measures. 5. Supervisor implementation of remedial measures.	1. Confirm receipt of notification of failure in writing. 2. Notify the Contractor. 3. Ensure remedial measures properly implemented.	1. Submit proposals for remedial actions to IEC within 3 working days of notification 2. Implement the agreed proposals 3. Amend proposal if appropriate

EVENT	ACTION			
Limit Level	ET [1]	IEC [1]	SOR [1]	Contractor
1. Exceedance for one sample	1. Identify the source. 2. Inform the SOR and the DEP. 3. Repeat measurement to confirm finding. 4. Increase monitoring frequency to daily. 5. Assess effectiveness of Contractor's remedial actions and keep the IEC, the DEP and the SOR informed of the results.	1. Check monitoring data submitted by the ET. 2. Check Contractor's working method. 3. Discuss with the ET and the Contractor on possible remedial measures. 4. Advise the SOR on the effectiveness of the proposed remedial measures. 5. Supervisor implementation of remedial measures.	1. Confirm receipt of notification of failure in writing. 2. Notify the Contractor. 3. Ensure remedial measures are properly mplemented.	1. Take immediate action to avoid further exceedance 2. Submit proposals for remedial actions to IEC within 3 working days of notification 3. Implement the agreed proposals 4. Amend proposal if appropriate
2. Exceedance for two or more consecutive samples	1. Notify the IEC, the SOR, the DEP And the Contractor. 2. Identify the source. 3. Repeat measurements to confirm findings. 4. Increase monitoring frequency to daily. 5. Carry out analysis of the Contractor's working procedures to determine possible mitigation to be implemented. 6. Arrange meeting with the IEC and the SOR to discuss the remedial actions to be taken. 7. Assess effectiveness of he Contractor's remedial actions	1. Discuss amongst the SOR, ET and the Contractor on the potential remedial actions. 2. Review the Contractor's remedial actions whenever necessary to assure their effectiveness and advise the SOR accordingly. 3. Supervise the implementation of remedial measures.	1. Confirm receipt of notification of failure in writing. 2. Notify the Contractor. 3. In consultation with the IEC, agree with the Contractor on the remedial measures to be implemented. 4. Ensure remedial measures are properly implemented. 5. If exceedance continues, consider what activity of the work is responsible and instruct the Contractor to stop that activity of work until the exceedance is abated.	1. Take immediate action to avoid further exceedance. 2. Submit proposals for remedial actions to IEC within 3 working days of notification. 3. Implement the agreed proposals. 4. Resubmit proposals if problem still not under control. 5. Stop the relevant activity of works as determined by the SOR until the exceedance is abated.

EVENT	ACTION			
Limit Level	ET [1]	IEC [1]	SOR [1]	Contractor
	and keep the IEC, the DEP and the SOR informed of the results. 8. If exceedance stops, cease additional monitoring.			

Note: ET – Environmental Team, IEC – Independent Environmental Checker, SOR – Supervising Officer's Representative

Figure 3.1 Data Sheet for TSP Monitoring

Monitoring Location:		
Details of Location:		
Sampler Identification:		
Date & Time of Sampling:		
Elapsed-time Meter Reading	Start (min.)	
	Stop (min.)	
Total Sampling Time (min.):		
Weather Conditions:		
Site Conditions:		
Initial Flow Rate, Qsi	Pi (mmHg):	
	Ti (^{o}C):	
	Hi (in.):	
	Qsi (Std. m^3):	
Final Flow Rate, Qsf	Pf (mmHg):	
	Tf (^{o}C):	
	Hf (in.):	
	Qsf (Std. m^3):	
Average Flow Rate (Std. m^3):		
Total Volume (Std. m^3):		
Filter Identification No.:		
Initial Wt. of Filter (g):		
Final Wt. of Filter (g):		
Measured TSP Level ()g/m^3):		

		Name & Designation	Signature	Date
Field Operator	:	_____	_____	_____
Laboratory Staff	:	_____	_____	_____
Checked by	:	_____	_____	_____

4 NOISE

4.1 Introduction

4.1.1.1 Based upon the EIA Report, while impacts are not predicted, as the results are marginally within the criteria, EM&A is recommended at existing Noise Sensitive Receivers (NSRs) in North Lantau during the construction phase to ensure the noise levels are reduced to acceptable levels.

4.2 Noise Parameters

4.2.1.1 The construction noise level shall be monitored by the ET and shall be measured in terms of the A-weighted equivalent continuous sound pressure level (L_{eq}). $L_{eq\ (30\ min)}$ shall be used as the monitoring parameter for the time period between 0700-1900 hours on normal weekdays. In respect of all other time periods, $L_{eq(5\ min)}$ shall be employed for comparison with the Noise Control Ordinance criteria.

4.2.1.2 As supplementary information for data auditing, statistical results such as L_{10} and L_{90} shall also be obtained for reference and shall be recorded by the ES. A sample data record sheet is shown in **Figure 4.1** (at the end of *Section 4*) for reference.

4.3 Monitoring Equipment

4.3.1.1 As referred to in the Technical Memorandum (TM) issued under the Noise Control Ordinance (NCO), sound level meters in compliance with the International Electrotechnical Commission Publications 651: 1979 (Type 1) and 804: 1985 (Type 1) specifications shall be used for carrying out the noise monitoring.

4.3.1.2 Immediately prior to and following each noise measurement the accuracy of the sound level meter shall be checked using an acoustic calibrator generating a known sound pressure level at a known frequency. Measurements may be accepted as valid only if the calibration level from before and after the noise measurement agree to within 1.0dB.

4.3.1.3 Noise measurements shall not be made in fog, rain, wind with a steady speed exceeding 5m/s or wind with gusts exceeding 10m/s. The wind speed shall be checked with a portable wind speed meter capable of measuring the wind speed in m/s.

4.3.1.4 The Contractor shall ensure that sufficient noise measuring equipment and associated instrumentation are available for carrying out the baseline monitoring, construction phase impact monitoring and *ad hoc* monitoring. All the equipment and associated instrumentation shall be clearly labeled.

4.4 Monitoring Locations

4.4.1.1 The representative noise monitoring stations/sensitive receiver at Pak Mong Village (NSR1) is shown in **Figure 3.2.** If the status or locations of noise sensitive receiver changes after issuing this manual, the ET shall propose the updated monitoring location and seek approval from the Supervising Officer's Representative (SOR) and agreement from the Independent Environmental Checker (IEC) and Environmental Protection Department (DEP) of the proposal to amend the monitoring location.

4.4.1.2 When alternative monitoring locations are proposed, the monitoring locations shall be chosen based on the following criteria:

a) monitoring at sensitive receivers close to the major site activities which are likely to have noise impacts;

b) monitoring at the noise sensitive receivers as defined in the Technical Memorandom; and

c) assurance of minimal disturbance to the occupants during monitoring.

4.4.1.3 The monitoring station shall normally be at a point 1m from the exterior of the sensitive receivers building facade and, in the case the measurement is not being carried out at a building, be at a position 1.2m above the ground. If there is problem with access to the normal monitoring position, an alternative position may be chosen and a correction to the measurements shall be made.

4.4.1.4 For reference, a correction of +3dB(A) shall be made to the free field measurements. Noise levels shall be corrected in accordance with *Section 2.10, 2.11 and 2.13* of the "Technical Memorandum on Noise From Construction Works Other Than Percussive Piling". The ET shall agree with the IEC on the monitoring position and the corrections adopted prior to the commencement of the works.

4.4.1.5 Once the positions for the monitoring stations are chosen, the baseline monitoring and the construction phase impact monitoring shall be carried out at the same positions.

4.4.1.6 The Contractor shall establish the construction equipment list and construction schedule which shall be checked and approved by the SOR and agreed by the IEC. The timing of the noise impact monitoring work shall be developed by the ES based upon the construction schedule prepared by the Contractor. The monitoring programme shall be approved by the SOR, the IEC and the DEP and shall be reviewed on a regular basis in light of any changes to the Contractor's construction schedule.

4.5 Baseline Monitoring

4.5.1.1 The Baseline Noise Monitoring was conducted at NSR1 during the period of 18 October and 1 November 2011. Monitoring results are presented in the *Baseline Environmental Monitoring for Hong Kong-Zhuhai-Macao Bridge Hong Kong Projects - Investigation*(1). The baseline data will be adopted for analysis in the current EM&A Programme.

4.5.1.2 Not applicable

4.5.1.3 Not applicable

4.6 Construction Phase Impact Monitoring

4.6.1.1 Noise monitoring shall be carried out at the designated monitoring station (NSR1) directly affected by the construction works once every 6 days after the commencement of construction. During construction works between 0700-1900 hours, one set of Leq (30 mins) measurements on normal weekdays shall be taken. If construction works are extended to include works during the hours of 1900-0700, additional weekly impact monitoring comprising 3 consecutive $L_{eq(5\ mins)}$ shall be carried out during evening and nighttime works and applicable permits shall be obtained by the Contractor in accordance with the NCO.

4.6.1.2 In case of non-compliance with the construction noise criteria, more frequent monitoring as specified in the Event/Action Plan in **Table 4.2** shall be carried out. This additional monitoring shall be continued until the recorded noise levels are rectified or proved to be unrelated to the construction activities.

4.7 Event and Action Plan for Construction Noise

4.7.1.1 The Action and Limit levels for construction noise are defined in **Table 4.1.** Should non-compliance of the criteria occur, the ET, the IEC, the SOR and the Contractor shall undertake their specified actions in accordance with the Action Plan shown in **Table 4.2.**

Table 4.1 Action and Limit Levels for Construction Noise

Time Period	Action	Limit
0700-1900 hrs on normal weekdays	When one documented complaint is received	75* dB(A)

Note:
If works are to be carried during restricted hours, the conditions stipulated in the construction noise permit issued by the Noise Control Authority have to be followed.

(1) Agreement No. CE 35/2011 (EP) Baseline Environmental Monitoring for Hong Kong-Zhuhai-Macao Bridge Hong Kong Projects-Investigation.
http://www.hzmbenpo.com/ep_docs/HKBCF_HY201002/503/Baseline_Report_Version_C.pdf

* reduce to 70 dB(A) for schools and 65 dB(A) during school examination periods.

4.8 Noise Mitigation Measures

4.8.1.1 As no impacts are predicted during the construction stage at the existing NSRs in north Lantau, no specific mitigation measures have been recommended. However, the Contractor will be responsible for ensuring noise levels are minimized as far as possible through the application of good site practices, including maintenance of equipment. During the operational phase, no mitigation is required.

Table 4.2 Event / Action Plan for Construction Noise

EVENT	ACTION			
	ET	IEC	SOR	Contractor
Action Level	1. Notify the IEC and the Contractor. 2. Carry out investigation. 3. Report the results of investigation to the IEC and the Contractor. 4. Discuss with the Contractor and formulate remedial measures. 5. Increase monitoring frequency to check mitigation effectiveness.	1. Review the analysed results submitted by the ET. 2. Review the proposed remedial measures by the Contractor and advise the SOR accordingly. 3. Supervise the implementation of remedial measures.	1. Confirm receipt of notification of failure in writing. 2. Notify the Contractor. 3. Require the Contractor to propose remedial measures for the analysed noise problem. 4. Ensure remedial measures are properly implemented.	1. Submit noise mitigation proposals to IEC 2. Implement noise mitigation proposals
Limit Level	1. Notify the IEC, the SOR, the DEP and the Contractor. 2. Identify the source. 3. Repeat measurement to confirm findings. 4. Increase monitoring frequency. 5. Carry out analysis of Contractor's working procedures to determine possible mitigation to be implemented. 6. Inform the IEC, the SOR and the DEP the causes & actions taken for the exceedances. 7. Assess effectiveness of the Contractor's remedial actions and keep the IEC, the DEP and the SOR informed of the results. 8. If exceedance stops, cease additional monitoring.	1. Discuss amongst the SOR, the ET and the Contractor on the potential remedial actions. 2. Review the Contractor's remedial actions whenever necessary to assure their effectiveness and advise the SOR accordingly. 3. Supervise the implementation of remedial measures.	1. Confirm receipt of notification of failure in writing. 2. Notify the Contractor. 3. Require the Contractor to propose remedial measures for the analysed noise problem. 4. Ensure remedial measures are properly implemented. 5. If exceedance continues, consider what activity of the work is responsible and instruct the Contractor to stop that activity of work until the exceedance is abated.	1. Take immediate action to avoid further exceedance 2. Submit proposals for remedial actions to IEC within 3 working days of notification 3. Implement the agreed proposals 4. Resubmit proposals if problem still not under control 5. Stop the relevant activity of works as determined by the SOR until the exceedance is abated.

Note: ET – Environmental Team, IEC – Independent Environmental Checker, SOR – Supervising Officer's Representative

Figure 4.1 Noise Monitoring Field Record Sheet

Monitoring Location:	
Description of Location:	
Date of Monitoring:	
Measurement Start Time (hh:mm):	
Measurement Time Length (min.):	
Noise Meter Model/Identification:	
Calibrator Model/Identification:	
Measurement Results	L_{90} (dB(A)):
	L_{10} (dB(A)):
	Leq (dB(A)):
Major Construction Noise Source(s) During Monitoring:	
Other Noise Source(s) During Monitoring:	
Remarks:	

		Name & Designation	Signature	Date
Recorded By	:	_____	_____	_____
Checked By	:	_____	_____	_____

5 WATER QUALITY

5.1 Introduction

5.1.1.1 Since the marine works of TM-CLKL will be concurrent with HKBCF and HKLR and the southern landfall of TM-CLKL is indeed an integrated part of the HKBCF The potential water quality impacts of TM-CLKL has been assessed jointly with HKBCF and HKLR. The EIA has, therefore, recommended that the water quality monitoring works of the three concurrent projects, also by the same project proponent, be conducted as a whole to enhance the efficiency and cost-effectiveness of the monitoring programme. Based on this, the water quality monitoring scheme designed assuming the monitoring will be implemented jointly and be coordinated with a project ENPO office.

5.2 Mitigation Measures

5.2.1.1 The EIA Report has assessed the water quality impacts caused by the construction and operation stages. Mitigation measures have been recommended in the EIA to ensure compliance with the relevant legislative requirements. These mitigation measures are summarised below.

For construction of the marine viaduct:

- Bored piling shall be undertaken within a metal casing for the construction of marine viaducts; and

- The minimum distance between two pile cap construction sites shall be 50m and maximum pier sites simultaneously under construction shall be limited to 15 piers. The pier locations shall be enclosed by cofferdams.

Additional mitigation measures regarding the temporary staging works are listed as follow:

- Regular inspection for the accumulation of floating refuse and collection of floating refuse if required;

- Provision of temporary drainage system on the temporary staging for collection of construction site runoff to allow appropriate treatment before discharge into the sea;

- Wastewater generated from construction works such as bored / drilling water will be collected, treated, neutralized and de-silted through silt trap or sedimentation tank before disposal; and

- One additional water quality monitoring station for EM&A is proposed at the coral communities in the proximity of the temporary staging (station

SR4a as shown in **Figure 3.2**), as some coral colonies are not feasible to be translocated. In case elevated SS or turbidity is identified during the water quality monitoring, the source of pollution will be tracked down and be removed as soon as possible. In case depletion of dissolved oxygen is identified, artificial aeration will be arranged at the monitoring station SR4a where corals are identified.

5.2.1.2 Prior to the commencement of the construction work, a detailed site drainage management plan should be submitted to EPD. The plan should cover measures to minimize all potential water quality impact arising from the surface runoffs of all the related constructions.

5.2.1.3 The guidelines outlined in the *Practice Note for Professional Persons (ProPECC), Construction Site Drainage (PN 1/94)* should be adopted to control construction site runoff. Mitigation measures to minimise water quality impacts from construction site runoff and wastewater and sewage generated from construction activities are:

- Provision of site drainage systems over the entire construction site with sediment control facilities. Regular inspection and maintenance of the site drainage systems are required to ensure proper and efficient operation at all times.

- Sedimentation tanks or package treatment systems are required to treat the large amount of sediment-laden wastewater generated from foundation construction work, wheel washing, site runoff. Any construction activities that generate wastewater with high concentrations of SS should also be collected to these facilities for proper treatment prior to disposal. Treated wastewater can be reused for vehicle washing, dust suppression and general cleaning. Bentonite slurry used in bore-pile construction should be reconditioned and reused to minimise the disposal volume of the used slurry.

- The construction programme should be properly planned to avoid soil excavation in rainy seasons. Exposed stockpiles of excavated soils or construction materials should be covered with tarpaulin or impervious sheets to avoid release of pollutants into the drainage channels.

- Sewage generated from site toilets and canteen should be collected using a temporary storage system. Chemical toilets should be provided at different locations for use by the workers on site. Licensed waste collectors should be employed for collection and disposal of the sewage. The drainage system for collection of wastewater generated from canteen, if any, should be equipped with grease trap capable of providing at least 20 minutes retention during peak flow.

- Wheel washing facilities should be installed at all site entrances/exits.

- An emergency plan should be developed by the contractors to deal with accidental spillage of chemicals.

5.2.1.4 Upon completion of the TM-CLKL / HKLR / HKBCF development, stormwater drainage systems would be completed to collect stormwater generated from the whole area including new roads. Sewage generated from the TM-CLKL southern landfall and HKBCF development would be treated on site to fulfill effluent limit for discharge. Additional mitigation measures would not be required.

5.2.1.5 Not applicable

5.2.1.6 The EIA Report has recommended construction and operational phase mitigation measures. All the prepared mitigation measures are summarised in the *Environmental Mitigation Implementation Schedules* in **Appendix A**.

5.3 Water Quality Parameters

5.3.1.1 As identified in the EIA Report, key water quality issues during construction phase will be dredging and filling works for the reclamation. Marine water quality monitoring shall be carried out during the construction phase to ensure that any unacceptable increase in suspended solids / turbidity and decrease in dissolved oxygen due to dredging and filling activities could be readily detected and timely action be taken to rectify the situation.

5.3.1.2 Dissolved oxygen (DO), turbidity (NTU), suspended solids (SS) levels and other general in-situ parameters shall be monitored at all designated marine water quality monitoring stations during the whole construction phase. DO and turbidity should be measured *in-situ* whereas SS should be determined by an accredited laboratory.

5.3.1.3 Other relevant data shall also be recorded in a Water Quality Monitoring Logs, including monitoring location / position, time, water depth, pH value, salinity, temperature, tidal stages, weather conditions and any special phenomena or work underway at the construction site. A sample monitoring record sheet is shown in **Figure 5.7**.

5.3.1.4 According to the EIA report, there is low concentration for PAH, PCB, TBT, and chlorinated pesticides. Monitoring of these chemicals would not be required during the construction stage.

5.3.1.5 The proposed water quality monitoring schedule shall be submitted to EPD at least 2 weeks before the first day of the monitoring month. EPD shall also be notified immediately for any changes in schedule by fax.

5.3.1.6 For TM-CLKL southern viaducts, surveys of the watercourse NL1 in North Lantau (**Figure 6.4**) which may be affected by slope works or gabion wall construction

shall, also, be undertaken. The surveys shall include a description of the stream course/bay, influencing factors, photographs and a map showing areas of active project construction works and areas of stockpiled materials.

5.4 Monitoring Equipment

5.4.1 Dissolved Oxygen and Temperature Measuring Equipment

5.4.1.1 The instrument should be a portable and weatherproof dissolved oxygen (DO) measuring instrument complete with cable and sensor, and use a DC power source. The equipment should be capable of measuring:

- DO level in the range of 0 - 20 mg/ L and 0 - 200% saturation; and
- Temperature of 0 - 45 degree Celsius.

5.4.1.2 It should have a membrane electrode with automatic temperature compensation complete with a cable.

5.4.1.3 Should salinity compensation not be built-in to the DO equipment, in-situ salinity should be measured to calibrate the DO equipment prior to each DO measurement.

5.4.2 Turbidity Measurement Instrument

5.4.2.1 The instrument should be a portable and weatherproof turbidity measuring instrument using a DC power source. It should have a photoelectric sensor capable of measuring turbidity between 0 - 1000 NTU (for example, Hach model 2100P or an approved similar instrument).

5.4.3 Sampler

5.4.3.1 A water sampler is required. It should comprise a transparent PVC cylinder, with a capacity of not less than 2 litres, which can be effectively sealed with latex cups at both ends. The sampler should have a positive latching system to keep it open and prevent premature closure until released by a messenger when the sampler is at the selected water depth (for example, Kahlsico Water Sampler or an approved similar instrument).

5.4.4 Water Depth Detector

5.4.4.1 A portable, battery-operated echo sounder should be used for the determination of water depth at each designated monitoring station. This unit can either be hand held or affixed to the bottom of the work boat, if the same vessel is to be used throughout the monitoring programme.

5.4.5 Salinity

5.4.5.1 A portable salinometer capable of measuring salinity in the range of 0 - 40 parts per thousand (ppt) should be provided for measuring salinity of the water at each monitoring location.

5.4.6 pH Measuring Equipment

5.4.6.1 A portable pH meter capable of measuring a range between 0.0 and 14.0 shall be provided to measure pH under the specified conditions (e.g., Orion Model 250A or an approved similar instrument).

5.4.7 Sample Containers and Storage

5.4.7.1 Water samples for SS should be stored in high density polythene bottles, packed in ice (cooled to 4°C without being frozen) and keep in dark during both on-site temporary storage and shipment to the testing laboratory. The samples shall be delivered to the laboratory within 24 hours of collection and be analysed as soon as possible after collection.

5.4.8 Monitoring Position Equipment

5.4.8.1 A hand-held or boat-fixed type digital Differential Global Positioning System (DGPS) with way point bearing indication and Radio Technical Commission for maritime (RTCM) Type 16 error message 'screen pop-up' facilities (for real-time auto-display of error messages and DGPS corrections from the Hong Kong Hydrographic Office), or other equipment instrument of similar accuracy, should be provided and used during marine water monitoring to ensure the monitoring vessel is at the correct location before taking measurements.

5.4.9 Calibration of In-Situ Instruments

5.4.9.1 The pH meter, DO meter and turbidimeter shall be checked and calibrated before use. DO meter and turbidimeter shall be certified by a laboratory accredited under HOKLAS or any other international accreditation scheme, and subsequently re-calibrated at 3 monthly intervals throughout all stages of the water quality monitoring. Responses of sensors and electrodes should be checked with certified standard solutions before each use. Wet bulb calibration for a DO meter shall be carried out before measurement at each monitoring location.

5.4.10 Back-up Equipment and Vessels

5.4.10.1 Sufficient stocks of spare parts shall be maintained for replacements when necessary. Backup monitoring equipment shall also be made available so that monitoring can proceed uninterrupted even when some equipment is under

maintenance, calibration, etc. For the on site calibration of field equipment, the BS127:1993, "*Guide to Field and on-site test methods for the analysis of waters*" shall be observed.

5.4.10.2 The Water Quality Monitoring will involve a large number of monitoring stations and measurements should be conducted within the prescribed tidal conditions (within ± 1.75 hour of the predicted mid-ebb or mid-flood tides) in order to ensure the measurement/samples are representative. A multi-probe monitoring equipment set integrated with water sampler(s) is highly recommended to improve the monitoring efficiency. It is, also, likely that more than one field survey vessels will be required simultaneously to ensure the monitoring are conducted within the acceptable monitoring windows. The ET shall also consider the use of unattended automatic sampling/monitoring devices at fixed stations where monitoring are required throughout the construction period. The use of such unattended automatic devices, however, shall be subject to the approval of the SOR, IEC and EPD.

5.5 Laboratory Measurement / Analysis

5.5.1.1 Duplicate samples from each independent sampling event are required for all the suspended solids measurement, which shall be carried in a HOKLAS or other international accredited laboratory. Sufficient water samples shall be collected at the monitoring stations for carrying out the laboratory measurement and analysis. The laboratory determination work shall start within 24 hours after collection of the water samples. The analysis for SS is summarized in **Table 5.1**.

Table 5.1 Laboratory Analysis for SS

Parameters	Instrumentation	Reference Method	Reporting Limit	Detection Limit
Suspended Solid (SS)	Weighting	APHA 2540-D	0.5 mg/L	0.5 mg/L

5.5.1.2 If a site laboratory is set up or a non-HOKLAS and non-international accredited laboratory is hired for carrying out the laboratory analysis, the laboratory equipment, analytical procedures, and quality control shall be approved by EPD. All the analysis shall be witnessed by the SOR. The ET Leader shall provide the SOR with one copy of the relevant chapters of the "*APHA Standard Methods for the Examination of Water and Wastewater*" 19th edition and any other relevant document for his reference.

5.6 Monitoring Locations

5.6.1.1 Locations of the seven (7) water quality monitoring stations are shown in **Figure 3.2**. The demarcation of the monitoring stations for different projects will be further determined by the ENPO before the commencement of the construction. The selection of these stations is based on the following criteria:

ii) Impact stations (IS/GG) within 250m – 500m envelope of the construction

works and within the Mf sediment backfilling sites (i.e., 3 impact locations).

iii) Sensitive receiver (SR) stations near to key sensitive receivers (i.e. 2 SR stations).

iv) Control stations at representative locations with less influence by the projects (i.e. 2 Control stations). Control stations should be located, as far as practicable, both upstream and downstream of the works area.

v) Not applicable

vi) Not applicable

vii) Mf receiving pit are not required based on the supporting documents for application for variation of environmental permit (EP 354/2009). Therefore, monitoring of nutrients and heavy metals of Mf Stations are no longer required.

5.6.1.2 The co-ordinates of the proposed monitoring stations during construction, post-construction and operation phases are listed in **Tables 5.2a and 5.2b** and their distribution shown in **Figure 3.2.** As shown in **Figure 3.2**, the proposed locations for the sensitive receiver monitoring stations represent the typical sensitive receivers around the project works.

Table 5.2a Proposed Water Quality Monitoring Stations (Construction and Post-construction Phases)

Station	Description	Easting	Northing	Parameters to be measured
IS(Mf)9	Impact Station (Close to HKBCF construction site)	813273	818850	DO, Turbidity, SS
IS(Mf)16	Impact Station (Close to HKBCF construction site)	814328	819497	DO, Turbidity, SS
IS8	Impact Station (Close to HKBCF construction site)	814251	818412	DO, Turbidity, SS
SR4	Sensitive receiver (Tai Ho Inlet)	814760	817867	DO, Turbidity, SS
SR4a	Sensitive receiver	815247	818067	DO, Turbidity, SS
CS(Mf)3	Control Station	809989	821117	DO, Turbidity, SS
CS(Mf)5	Control Station	817990	821129	DO, Turbidity, SS

Notes:
DO = Dissolved Oxygen;
SS = Suspended Solid;

Table 5.2b Proposed Water Quality Monitoring Stations (Operation Phase)

Station	Description	Easting	Northing	Parameters to be measured
SR3	Sensitive receivers (San Tau Beach SSSI)	810525	816456	DO, Turbidity, SS, pH, Salinity, Temperature
SR4	Sensitive receivers (Tai Ho Wan)	814760	817867	DO, Turbidity, SS, pH, Salinity, Temperature
CS2	Control Station	805849	818780	DO, Turbidity, SS, pH, Salinity, Temperature
CS(Mf)5	Control Station	817990	821129	DO, Turbidity, SS, pH, Salinity, Temperature

Notes:
DO = Dissolved Oxygen;
SS = Suspended Solid;

5.6.1.3 Control stations (CS(Mf)3 and CS(Mf)5) are necessary to compare the water quality from potentially impacted sites with the ambient water quality. Control stations shall be located within the same body of water as the impact monitoring stations but should be outside the area of influence of the works and, as far as practicable, not affected by any other works. The Control stations shown in **Figure 3.2** are indicative subject to further review before construction phase. During the review, the location of the Impact stations for boundary of mixing zones will also be re-visited. If there are any changes to the monitoring locations, these shall be submitted 4 weeks before commencement of baseline monitoring for EPD approval.

5.6.1.4 In-situ monitoring (DO, temperature, turbidity, pH, salinity) and water sample for SS shall be taken at 3 water depths, namely, 1 m below water surface, mid-depth and 1 m above sea bed, except where the water depth is less than 6 m, in which case the mid-depth station may be omitted. Should the water depth be less than 3 m, only the mid-depth station will be monitored. No marine construction activities should be conducted in the vicinity of the stations during the Baseline Monitoring period. The status and locations of water sensitive receivers and the marine activities may change after issuing this Manual. If such cases exist, the ET Leader shall propose with justification for changes to monitoring locations or other requirements of the EM&A programme, and seek approval from the IEC and EPD.

5.6.1.5 The ENPO may, depending on site conditions and monitoring results, decides whether additional monitoring locations shall be included or any monitoring locations could be removed/relocated during any stage of the construction phase, after getting approval from EPD.

5.7 Baseline Monitoring for Water Quality

5.7.1.1 Baseline conditions for marine water quality shall be established and agreed with EPD prior to the commencement of works. The purpose of the baseline monitoring is to establish ambient conditions prior to the commencement of the works and to

demonstrate the suitability of the proposed impact and control monitoring stations. The baseline conditions shall normally be established by measuring the DO, temperature, turbidity, pH, salinity and SS at all designated locations specified in *Section 5.6* above. The measurements shall be taken at all designated monitoring stations including control stations, 3 days per week, at mid- flood (within ± 1.75 hour of the predicted time) and mid-ebb (within ± 1.75 hour of the predicted time) tides, for at least 4 weeks prior to the commencement of marine works. Replicate *in-situ* measurements and samples collected from each independent sampling event shall be collected to ensure a robust statistically interpretable database.

5.7.1.2 Baseline monitoring programme may overlap with other reclamation activities. The monitoring exercise should be scheduled as far as possible to avoid concurrent dredging / backfilling activities around the monitoring stations such that representative ambient data could be sampled.

5.7.1.3 Other relevant data shall also be recorded, such as monitoring location / position, time, water depth, tidal stages, weather conditions and any special phenomena underway near the monitoring station. There shall not be any marine construction activities in the vicinity of the stations during the baseline monitoring.

5.7.1.4 As this project will last for a few years, the ET Leader should seek approval from the IEC and EPD on an appropriate set of data to be used with the baseline data collected by this study to establish two set of AL levels respectively for the wet and dry season.

5.7.1.5 Baseline monitoring schedule shall be faxed to EPD 2 weeks prior to the commencement of baseline monitoring. The interval between two sets of monitoring shall not be less than 36 hours.

5.7.1.6A Baseline Water Quality Monitoring was conducted at sensitive receiver SR4a from 29 August to 24 September 2013.

5.7.1.7A For the other six water quality monitoring stations, baseline monitoring was conducted during the period of 6 October and 31 October 2011. Monitoring results are presented in the *Baseline Environmental Monitoring for Hong Kong-Zhuhai-Macao Bridge Hong Kong Projects – Investigation* (1). The baseline data will be adopted for analysis in the current EM&A Programme.

5.8 Efficiency of Silt Curtains (not applicable)

(1) Agreement No. CE 35/2011 (EP) Baseline Environmental Monitoring for Hong Kong-Zhuhai-Macao Bridge Hong Kong Projects-Investigation.
http://www.hzmbenpo.com/ep_docs/HKBCF_HY201002/503/Baseline_Report_Version_C.pdf

5.9 Impact Monitoring for Water Quality

5.9.1 Reclamation (not applicable)

5.9.2 Relocation of Mf Sediment with Reclamation Area

5.9.2.1 The preliminary ground investigation conducted for TM-CLKL did not detect Mf material (ie. Category M Sediment which fails the biological test as per ETWB TC 34/2002) in the project site and no handling of Mf has been predicted. Therefore, this sub-section is only relevant to HKBCF and HKLR projects.

5.9.2.2 Not applicable

5.9.2.3 Not applicable

5.9.3 Water Quality Monitoring along the Water Boundary of Hong Kong and Mainland (not applicable)

5.9.4A Water Quality Monitoring for TM-CLKL Southern Connection

5.9.4.1 During the course of construction works, impact monitoring should be undertaken at seven (7) monitoring stations in **Table 5.2a** three days per week, at mid-ebb and mid-flood tides, with sampling/ measurement. Replicate *in-situ* measurements and samples collected from each independent sampling event shall be collected to ensure a robust statistically interpretable database. The measurement parameters for Post- construction monitoring shall include DO, temperature, turbidity, pH, salinity and SS. The measurement shall be taken at all designated monitoring stations including control stations, 3 days per week, at mid-flood (within ± 1.75 hour of the predicted time) and mid-ebb (within ± 1.75 hour of the predicted time) tides.

5.10 Post-construction Monitoring

5.10.1.1 Upon completion of all marine-based construction activities, a post-project monitoring exercise on water quality shall be carried out for 4 weeks in the same manner as the Baseline Monitoring. Replicate *in-situ* measurements and samples collected from each independent sampling event shall be collected to ensure a robust statistically interpretable database. The measurement parameters for Post-construction monitoring shall include DO, temperature, turbidity, pH, salinity and SS. The measurement shall be taken at all designated monitoring stations including control stations, 3 days per week, at mid-flood (within ± 1.75 hour of the predicted time) and mid-ebb (within ± 1.75 hour of the predicted time) tides, for at least 4 weeks.

5.10.1.2 Not applicable

5.11 Operational Phase Monitoring

5.11.1.1 The marine water quality monitoring shall be performed monthly during the first year of Project operation at all designated monitoring stations including control stations. Each monthly monitoring event shall consist of one monitoring and sampling event during both mid-ebb (within ± 1.75 hour of the predicted time) and mid-flood (within ± 1.75 hour of the predicted time) tides of the same monitoring day. The operation phase monitoring shall be ceased after the first year of operation of the Project subject to the first year review. No marine construction activities should be conducted in the vicinity of the stations during the Operational Phase monitoring period.

5.11.1.2 Sampling shall be taken at three water depths, namely, 1m below water surface, mid-depth and 1m above sea bed, except where the water depth is less than 6m, in which case the mid-depth station may be omitted. If the water depth be less than 3m, only the mid-depth station will be monitored. In-situ measurements at DO, turbidity, SS, pH, salinity and temperature shall be taken at all the monitoring stations SR2, SR3, CS2 and CS(Mf)5 (refer to **Table 5.2b**). A full set of in duplicated situ measurement and water samples shall be collected during each of the mid-ebb (within ± 1.75 hour of the predicted time) and mid-flood (within ± 1.75 hour of the predicted time) tides.

5.12 Event and Action Plan

5.12.1.1 The Action and Limit levels for water quality are defined in **Table 5.3**. Should non-compliance of the criteria occur, action in accordance with the Action Plan in **Table 5.4** shall be carried out.

5.12.1.2 Not applicable

Table 5.3 Action and Limit Levels for Water Quality

Parameters	Action[#]	Limit[#]
DO in mg L^{-1} (Surface, Middle & Bottom)	Surface and Middle **5.0 mg/L** Bottom **4.7 mg/L**	Surface and Middle **4.2 mg/L** Bottom **3.6mg/L**
SS in mg L^{-1} (depth-averaged) at all monitoring stations and control stations	120% of upstream control station at the same tide of the same day and 95%-ile of baseline data, i.e., **23.5 mg/L**	130% of upstream control station at the same tide of the same day and and 99%-ile of baseline data, i.e., **34.4 mg/L**
Turbidity in NTU (depth-averaged)	120% of upstream control station at the same tide of the same day and 95%-ile of baseline data, i.e., **27.5 NTU**	130% of upstream control station at the same tide of the same day and 99%-ile of baseline data, i.e., **47.0 NTU**

Notes:

Baseline data: data from HKZMB Baseline Water Quality Monitoring between 6 and 31 October 2011.

(a) For DO, non-compliance of the water quality limits occurs when monitoring result is lower than the limits.

(b) "Depth-averaged" is calculated by taking the arithmetic means of reading of all three depths

(c) For turbidity and SS, non-compliance of the water quality limits occurs when monitoring result is higher than the limits.

(d) All figures given in the table are used for reference only, and EPD may amend the figures whenever it is considered as necessary

(e) The 1%-ile of baseline data for surface and middle DO is 4.2 mg/L, whilst for bottom DO is 3.6 mg/L.

Table 5.4 Event and Action Plan for Water Quality

Event	ET Leader	IEC	SOR	Contractor
Action level being exceeded by one sampling day	1. Repeat *in situ* measurement on next day of exceedance to confirm findings; 2. Identify source(s) of impact; 3. Inform IEC, contractor and SOR; 4. Check monitoring data, all plant, equipment and Contractor's working methods.	1. Check monitoring data submitted by ET and Contractor's working methods.	1. Confirm receipt of notification of non-compliance in writing; 2. Notify Contractor.	1. Inform the SOR and confirm notification of the non-compliance in writing; 2. Rectify unacceptable practice; 3. Amend working methods if appropriate.
Action level being exceeded by two or more consecutive sampling days	1. Repeat measurement on next day of exceedance to confirm findings; 2. Identify source(s) of impact; 3. Inform IEC, contractor, SOR and EPD; 4. Check monitoring data, all plant, equipment and Contractor's working methods; 5. Discuss mitigation measures with IEC, SOR and Contractor; 6. Ensure mitigation measures are implemented;	1. Check monitoring data submitted by ET and Contractor's working method; 2. Discuss with ET and Contractor on possible remedial actions; 3. Review the proposed mitigation measures submitted by Contractor and advise the SOR accordingly; 4. Supervise the implementation of mitigation measures.	1. Discuss with IEC on the proposed mitigation measures; 2. Ensure mitigation measures are properly implemented; 3. Assess the effectiveness of the implemented mitigation measures.	1. Inform the Supervising Officer and confirm notification of the non-compliance in writing; 2. Rectify unacceptable practice; 3. Check all plant and equipment and consider changes of working methods; 4. Submit proposal of additional mitigation measures to SOR within 3 working days of notification and discuss with ET, IEC

Event	ET Leader	IEC	SOR	Contractor
	7. Increase the monitoring frequency to daily until no exceedance of Action level;			and SOR; 5. Implement the agreed mitigation measures.
Limit level being exceeded by one sampling day	1. Repeat measurement on next day of exceedance to confirm findings; 2. Identify source(s) of impact; 3. Inform IEC, contractor, SOR and EPD; 4. Check monitoring data, all plant, equipment and Contractor's working methods; 5. Discuss mitigation measures with 6. IEC, SOR and Contractor;	1. Check monitoring data submitted by ET and Contractor's working method; 2. Discuss with ET and Contractor on possible remedial actions; 3. Review the proposed mitigation measures submitted by Contractor and advise the SOR accordingly.	1. Confirm receipt of notification of failure in writing; 2. Discuss with IEC, ET and Contractor on the proposed mitigation measures; 3. Request Contractor to review the working methods.	1. Inform the SOR and confirm notification of the non-compliance in writing; 2. Rectify unacceptable practice; 3. Check all plant and equipment and consider changes of working methods; 4. Submit proposal of mitigation measures to SOR within 3 working days of notification and discuss with ET, IEC and SOR.
Limit level being exceeded by two or more consecutive sampling days	1. Repeat measurement on next day of exceedance to confirm findings; 2. Identify source(s) of impact; 3. Inform IEC, contractor, SOR and EPD;	1. Check monitoring data submitted by ET and Contractor's working method; 2. Discuss with ET and Contractor on possible remedial actions;	1. Discuss with IEC, ET and Contractor on the proposed mitigation measures; 2. Request Contractor to critically review the working methods;	1. Take immediate action to avoid further exceedance; 2. Submit proposal of mitigation measures to SOR within 3 working days of notification and discuss with ET, IEC and

Event	ET Leader	IEC	SOR	Contractor
	4. Check monitoring data, all plant, equipment and Contractor's working methods; 5. Discuss mitigation measures with IEC, SOR and Contractor; 6. Ensure mitigation measures are implemented; 7. Increase the monitoring frequency to daily until no exceedance of Limit level for two consecutive days;	3. Review the Contractor's mitigation measures whenever necessary to assure their effectiveness and advise the SOR accordingly; 4. Supervise the implementation of mitigation measures.	3. Make agreement on the mitigation measures to be implemented; 4. Ensure mitigation measures are properly implemented; 5. Consider and instruct, if necessary, the Contractor to slow down or to stop all or part of the construction activities until no exceedance of Limit level.	SOR; 3. Implement the agreed mitigation measures; 4. Resubmit proposals of mitigation measures if problem still not under control; 5. As directed by the Supervising Officer, to slow down or to stop all or part of the construction activities until no exceedance of Limit level.

6 ECOLOGY

6.1 Introduction

6.1.1.1 The EIA has recommended that an EM&A for ecology is undertaken during the design, construction and operational phases of the project. The objectives of the design phase EM&A are to prepare detailed specifications for translocation works to be undertaken prior to construction. The construction and operational EM&A objectives are to ensure that the ecological contract works and construction mitigation procedures recommended in the EIA are carried out as specified and are effective. The construction and operational phase EM&A will be carried out as part of the site monitoring and audit programme.

6.2 Ecology EM&A Procedures

6.2.1.1 The design phase audit procedures are detailed in *Section 1.5.3* and **Figure 1.1**. Ecological specifications for species translocation will be designed as part of the project detailed design phase. The specifications and designs will be reviewed as and when they are produced. The final ecological specifications and designs shall be signed off by the design auditor(s) using the appropriate proforma (see **Appendix B**).

6.2.1.2 The construction phase ecological audit is concerned with checking the effectiveness of the implementation of the ecology contract works, together with auditing the effectiveness of site mitigation. Operational phase EM&A will comprise the audit of the reestablishment of habitat areas and the on-going effectiveness of mitigation measures as appropriate. The operational phase EM&A shall be undertaken during the Contractor's one year maintenance period. The overall procedures for the ecological EM&A during construction and operation are shown in **Figures 1.2 and 6.1**.

6.3 Design Phase Audit

6.3.1.1 Ecological measures proposed by the EIA to mitigate the ecology impacts of the scheme will be incorporated into the detailed design of the project. In particular, ecology specifications will be produced for the elements detailed in **Table 6.1** below.

Table 6.1 Ecological Design Specifications

Number	Specification
1	Hoarding along the works boundary for protecting the pitcher plants and its surrounding habitat (Not applicable to the current EM&A Programme)
2	Translocation specifications for corals
3	Pre, during and post construction dolphin monitoring.
4	Vessel speed limits and restrictions specification
5	Bored piling monitoring programme specification
6	Design of dredging and reclamation works acoustic decoupling methods (Not applicable)
7	Specification for dolphin exclusion zone during dredging, reclamation, sheet, bored piling and temporary staging
8	Artificial reef deployment (Not applicable)

6.3.1.2 The specifications should be issued to the EPD and AFCD and other relevant Authorities for approval before being implemented prior to construction.

6.3.1.3 Designs and specifications will be prepared during the detailed design stage by suitably qualified staff on the design team. The designs will be checked by a design auditor(s) to ensure that the measures are fully incorporated and that potential conflicts with the engineering are resolved prior to construction. In the event of a non conformity, the Event/Action plan detailed in Table 6.2 below shall be followed by the relevant parties.

Table 6.2 Event / Action Plan for Design Phase

Action Level	Ecology Auditor	Project Engineer (PE)	Project Ecologist
Non Conformity (with Design Standards and Specification)	- Identify Source - Inform PE and PEC - Discuss remedial actions with PE, and PEC - Verify remedial actions when complete	- Notify PEC - Discuss remedial actions with PEC - Ensure remedial designs are fully incorporated	- Amend designs - Discuss remedial actions with PE

6.4 Baseline Monitoring

6.4.1 Background

6.4.1.1 Ecological baseline EM&A will consist of undertaking the following:

- Walk-over survey, prior to construction works, of the land and streams where works will be undertaken. It may be necessary to rope off and protect specific habitats or species of special interest identified during the ecological surveys;
- Audit of species translocation works (corals);
- Pre-construction dolphin monitoring; and
- Bored piling monitoring.

6.4.2 Baseline Walkover Survey

6.4.2.1 The purpose of the walk over survey will be to confirm the existing ecological conditions, with reference to the habitat maps included in the EIA Report and the established baseline conditions, in relation to the extent and condition of the habitats and species noted during the walkover survey. No detailed ecological surveys of flora and fauna will be required at this stage.

6.4.3 Baseline Translocation Works

6.4.3.1 In respect of translocation works, the ET will be required to audit the effectiveness of the implementation of the ecology translocation contract works, item 2 detailed in **Table 6.1** above. Prior to the translocation works, pre-construction surveys of corals were conducted at Tai Ho Wan and the potential receptor site of Tai Mo To (**Figure 6.2**). An alternative receptor site at Yam Tsui Wan is proposed for the translocated coral from Tai Ho Wan. Finding of the pre-construction survey are included in the Detailed Coral Translocation Methodology which was submitted to the EPD in accordance with *Condition 2.6* of the *EP-354/2009A*. The implementation of the specification for translocation of the corals should be undertaken prior to any major relevant construction works and thus, the EM&A for these will be undertaken early in the Contract. The audit will continue into the construction phase after the translocations have been completed.

6.4.3.2 A qualified ecologist(s), as part of the ET, will carry out the audit. The ecological contract works, detailed in **Table 6.1**, shall be audited with reference to the audit schedule detailed in **Table 6.3** below.

Table 6.3 Audit Schedule for Ecological Contract Works

Specification Number (Table 6.1)	Baseline Phase	Construction Phase
2	Audit compliance at least once per week during implementation which will be prior to the start of the main construction activities. After translocation is complete, carry out audit survey to determine if all corals have been moved.	Audit success of translocation once every 3 months after completion by assessing survival of transplanted species. Continue for a period of 12 months.

6.4.4 Baseline Dolphin Monitoring

6.4.4.1 Perhaps the most important ecological measure of all is to conduct surveys to monitor the density and behavior of the animals before, during, and after the period of the potential disturbance. This objective is to determine if the other mitigation measures have been effective in protecting the animals from disturbance and maintaining their habitat quality. In addition, it is necessary to monitor the effects of the construction works on the use of dolphin travelling corridors. While there is not expected to be a complete physical blockage of the travelling corridors, the works may have some impacts in terms of reducing dolphin use of these corridors. As data on this is scarce, dolphin monitoring is, also, required to monitor the use of the travel corridors and if the dolphins stop using the corridors, then it will be necessary to provide some remediation to deal with this, in the form of adaptive management.

6.4.4.2 In order for such monitoring to be effective, it needs to be divided into three phases: pre-disturbance (i.e., baseline phase), disturbance (i.e, construction phase), and post-disturbance (i.e., operational phase). Survey techniques must be held constant from phase to phase and survey equipment and personnel should ideally be the same as well.

6.4.4.3 Project-specific dolphin monitoring using line transect surveys combined with photo-identification studies, also, have the advantage of being able to provide evaluation of dolphin fine-scale habitat use patterns. This includes 1 km^2 per grid densities and grid-based patterns of feeding, socializing and calving, as well as individual ranging patterns, allowing the detection of any smaller-scale impacts and changes in core area use (see Hung 2008).

6.4.4.4 Considering that AFCD monitoring provides useful data, the monitoring programme should comprise undertaking surveys, 2 days per month for a period of 12 months during each phase. Notwithstanding, as 9 months of baseline surveys have been undertaken for the purposes of this EIA, a further 3 months only would be required for the pre-construction phase. In summary, the following

monitoring would be required:

- Six, one-day survey events to be undertaken at a frequency of 2 per month over a period of 3 months before commencement of construction;
- One-day survey events to be undertaken at a frequency of 2 per month for the duration of the marine works construction period; and
- Forty-eight, one-day survey events to be undertaken at a frequency of 2 per month over a period of 24 months following cessation of the construction.

6.4.4.5 The period required for the monitoring is considered to be adequate to derive a reasonably large amount of data, thereby allowing any significant trends in dolphin distribution to be detected (Jefferson pers. comm.).

6.4.4.6 The monitoring should also be undertaken by a suitably qualified person (in biology) and should be independent of the construction contractor and should form part of the independent Environmental Team (ET). The IEC may audit the work of the ET if deemed necessary. Monitoring should be conducted following the methodology detailed below:

Vessel-based Observations

6.4.4.7 Line transect surveying techniques have now been standardized in Hong Kong Special Administrative Region Waters so that data from all surveys are directly comparable. The study area with line transects is presented in **Figure 6.3** which covers the Northeast Lantau (NEL) and Northwest Lantau (NWL). In order to provide a suitable long-term dataset for comparison, pre-, during and post-construction phase dolphin monitoring will employ an identical methodology and follow the same line transects as those in the EIA Report. Additional transect lines that are used in the AFCD long-term dolphin monitoring are also included, such that the monitoring data collected in this project is comparable to the long-term databases maintained by AFCD.

6.4.4.8 On each survey day, the survey vessel will depart from Tung Chung New Pier. Observation for incidental sighting will begin immediately on departure from the assigned pier and continue until the vessel reaches the survey area. The survey vessel shall have an open upper deck, allowing for observer eye heights of 4 to 5m above water level and relatively unobstructed forward visibility between 270º and 90º. When on-effort, the vessel shall travel along the survey lines at a speed of approximately 7 to 8 knots (13 to 15 km/hr). The direction of the survey shall be alternated on different days to avoid possible biases related to the timing of the survey coverage.

6.4.4.9 Vessel-based transect observations by a three-person team shall be conducted by searching the 180q swath in front of the survey vessel (270º to 90º). The area behind the vessel need not be searched, although dolphins observed in this area should be recorded as off-effort sightings. The primary observer will scan the

entire search path (270º to 90º) continuously with Fujinon 7x50 marine binoculars or equivalent as the second member of the team, designated the data "recorder", scans the same area with the naked eye and occasional binocular check. The third observer on the boat is required to rotate into the observation team after half an hour, thus relieving one of the initial team. Observers should rotate every half an hour. While on-effort, observers shall ignore potential sighting cues that could bias the sighting distance calibration (eg pair-trawl fishing vessels).

6.4.4.10 A critical consideration in the survey will be to ensure a strict timed quantification of "sighting effort" in order to maximise the comparative value of the field survey results. The time and position for the start and end of a period of intensive, uninterrupted effort, and the sighting conditions such as visibility range and Beaufort scale associated with it shall be recorded. The collection of effort data allows comparisons within a single study as well as between studies. Strict recording of time and speed travelling along the assigned transect ("on-effort") shall, therefore, be recorded. Time spent during any deviation from the transect will be recorded as "off-effort".

6.4.4.11 During periods of poor weather, when visibility is hindered (e.g., below 1km) or when a Beaufort force 5 is reached, the survey should normally be postponed.

6.4.4.12 Sightings distant to 500m perpendicular distance and sightings of single dolphins that were hard to track should not be pursued (although those distant to 500m ahead of the vessel should be pursued). The initial sighting distance between the dolphin and the survey vessel and sighting angle shall be recorded in order to estimate the positions of the dolphins. These and other details of the sighting, including the exact location of the sighting and number of individuals should be agreed among the observation team and recorded immediately. Distances and angles shall be as accurate as possible.

6.4.4.13 A global positioning system shall be used during the surveys. A sighting record shall be filled out at the initial sighting with time, position, distance and angle data filled in immediately and verified between primary observer and recorder. All other information on sea state, weather conditions (Beaufort Scale), as well as notes on dolphin appearance, behaviour, and any other information shall also be completed.

6.4.4.14 A summary of equipment requirement is summarized in **Table 6.5** below.

Table 6.5 Summary of Dolphin Monitoring Equipment Requirements

Equipment	Type
Vessel for Monitoring	A monitoring boat which should have a flying bridge or upper deck with a relatively unobstructed forward visibility ($270^{o} - 90^{o}$) allowing for observer eye height of 4-5m above water
Observation	Fujinon 7x50 marine binoculars (or similar) with compass/reticule
Calibration	Leica Geovid laser range finder binnacles or equivalent
Navigation and Positioning	Global Positioning System Device (Magellen NAV 5000D or similar approved) (+ spare batteries)

6.4.4.15A The three-month vessel-based Baseline Dolphin Monitoring was conducted between 5 September and 7 November 2011. The monitoring results are presented in the *Baseline Environmental Monitoring for Hong Kong-Zhuhai-Macao Bridge Hong Kong Projects – Investigation* (1). The baseline data will be adopted for analysis in the current EM&A Programme.

6.4.5 Bored Piling Monitoring Programme

6.4.5.1 Based upon the specification prepared during the detailed design phase (Item 5 in *Table 6.1* above), a comprehensive monitoring plan should be implemented before, during and after the bored piling works is proposed. The monitoring plan would include both underwater acoustic monitoring, the study the acoustic behaviour of dolphins near the bored piling works site and theodolite tracking of dolphin movement from land in order to determine the actual magnitude of impacts.

Acoustic Monitoring

6.4.5.2 In order to ensure that bored piling noise will not affect the Chinese White Dolphins, noise levels from bored piling activities should be measured, with details of frequency/intensity spectra to be evaluated. The acoustic results of the monitoring should be analysed in terms of both the Broadband range (100 Hz to 25.6 kHz) and, also, the dolphin sensitive range (400 Hz to 12.6 kHz). The monitoring will study the acoustic behaviour of dolphins near the bored piling works site and at a control site for comparison, to determine whether foraging behaviour is affected by the bored piling activities and whether dolphin echolocation clicks are masked by bored piling activity noise.

6.4.5.3 The specification and detailed methodology for the bored piling acoustic monitoring

(1) Agreement No. CE 35/2011 (EP) Baseline Environmental Monitoring for Hong Kong-Zhuhai-Macao Bridge Hong Kong Projects-Investigation. http://www.hzmbenpo.com/ep_docs/HKBCF_HY201002/503/Baseline_Report_Version_C.pdf

should be prepared as part of the detailed design and submitted to the EPD and AFCD for approval.

6.4.5.4 The acoustic monitoring will be undertaken during the construction phase and commence at the start of the bored piling works. The exact monitoring period will be determined and detailed in the specification to be prepared during the detailed design stage but is likely to comprise as a minimum:

- underwater noise levels measurements from bored piling activities for 10 days from the start of bored piling activities; and
- study the acoustic behaviour of dolphins from a small boat during periods with and without bored piling for 30 days from the start of bored piling activities.

6.4.5.5 The monitoring works will consist of data acquisition and analysis of sound to be gathered by an experienced bio-acoustician with specialised experience in processing of appropriate low frequency (to infrasound, down to 20 Hz) and high frequency (into ultrasound, to at least 100 kHz) hydrophone and digital recording equipment, as well as the appropriate analysis devices and programmes. The bio-acoustician should have at least ten years of dolphin sound data gathering and analysis experience, at least three technical publications related to dolphin sounds.

6.4.5.6 As bored piling will also be undertaken for the HKLR project, it is possible that a combined monitoring could be undertaken. The monitoring should be conducted at a location at which significant impacts on dolphins are unlikely.

Land-based Theodolite Tracking

6.4.5.7 The objective of the land-based theodolite tracking of dolphins is to monitor their movements and behaviour near the bored piling works site before, during and after the works and record and note any changes in response to the bored piling noise. The details of the land-based dolphin tracking methodology and frequency will be defined in a specification prepared during detailed design phase. However, as a minimum the monitoring is likely to comprise 30 days before, 30 days during and 30 days after bored piling works

6.4.5.8 This monitoring would consist of data acquisition and analyses of movement and behavioural information of CWD, as gained from a 5-sec. resolution conventional theodolite and a 5-sec. resolution "total station" theodolite with laser range-finding capability, appropriate hand-held range finders, binoculars with distance-measuring reticles and built-in compass, recording gear of digital voice recorder, data sheets, and computer slaved to theodolites.

6.4.5.9 Two experienced theodolite/behavioural data gathering operators should undertake the monitoring. The primary and secondary theodolite operators should have at least ten years of theodolite and behavioural data gathering and analysis experience, at least three technical publications to cover the subject, and appropriate long-term familiarity with the latest version of the tracking program "Pythagoras".

These experienced operators need to have further experience in detailed power analyses for efficient evaluation of number of samples and time/energy needed for statistical evaluations.

6.5 Construction and Operational Phase EM&A

6.5.1 Background

6.5.1.1 During the construction and operational phases the ET will be required to undertake the following:

- continued audit of the translocation works as per the requirements in **Table 6.3** above;

- audit of habitat protection measures as follows:

  - ensure that work site boundaries are not breached and that damage does not occur to surrounding areas;

  - provided and scheduled environmental briefing/training sessions for site staff to raise their awareness on environmental protection;

  - ensure placement of equipment is within designated areas within the existing disturbed land;

  - ensure construction activities are restricted to within the proposed works boundary;

  - ensure spoil heaps are be covered at all times;

  - ensure that disturbed areas are reinstated immediately after completion of the works; and

  - ensure temporary disturbance and gabion wall works of steam NL1 in North Lantau (if required) are undertaken during the dry season (**Figure 6.4**)

  - ensure enhancement planting works undertaken.

- audit of acoustic decoupling for dredging and reclamation work and the vessel restrictions requirements, as specified by the specifications prepared during the design stage (items 4 and 6 in **Table 6.1** above);

- implement any further recommendations, if any, of the bored piling monitoring;

- implementation of the dolphin exclusion zone during dredging, reclamation , sheet, piling works and temporary staging construction;

- audit the avoidance of peak CWD calving season in May and June for driving of metal caissons during bored piling works; and

- audit the pre-construction, construction and operational phase dolphin monitoring.

6.5.2 Construction Ecological Audit

6.5.2.1 A dolphin exclusion zone within a radius of 250m around the dredging, reclamation, sheet, bored piling works as well as temporary staging construction should be implemented and the area visually inspected for dolphins prior to commencement of the marine works. The principles of the exclusion zone are that, during daylight hours, the area should be visually inspected for dolphins prior to commencement of dredging, reclamation or sheet piling works. The sheet piling works will be restricted to 12 hours a day and visual inspection will be possible. However, it is possible that the other marine works for the TM-CLKL would continue for 16 hours per day. As such, as the visual exclusion zone relies on the visual detection of dolphins, it would not suitable during evening or nighttime periods. Based upon this, an alternative method using Passive Acoustic Monitoring (PAM) would be required for any dredging and reclamation works undertaken outside daylight hours. PAM involves the use of hydrophones or cetacean detectors. The specification prepared during the detailed design should further specify the use of PAM.

6.5.2.2 The dolphin exclusion zone should be monitored by independent dolphin observers with an unobstructed, elevated view of the area. Piling should not begin until the observer certifies that the area is continuously clear of dolphins for a period of 30 minutes (thereby adequately spanning the approximate maximum dive time of the dolphins of 4 minutes). The observers must be suitably trained in biology and should be independent of the construction contractor and should form part of the independent Environmental Team (ET) to be employed by the Contractor. An Independent Environmental Checker (IEC) would be required to audit the work of the ET.

6.5.2.3 For the overall audit of habitat protection, acoustic decoupling, dolphin exclusion zone and the vessel restrictions requirements, in the event of non-compliance, the Event /Action plan detailed in **Table 6.6** below should be implemented.

Table 6.6 Event / Action Plan for General Ecology

Action Level	ET	IEC	SOR	Contractor
Non-conformity on one occasion	1. Identify Source 2. Inform the IEC and the SOR 3. Discuss remedial actions with the IEC, the SOR and the Contractor 4. Monitor remedial actions until rectification has been completed	1. Check report 2. Check the Contractor's working method 3. Discuss with the ET and the Contractor on possible remedial measures 4. Advise the SOR on effectiveness of proposed remedial measures. 5. Check implementation of remedial measures.	1. Notify Contractor Ensure remedial measures are properly implemented 2. Consider and instruct, if necessary, the Contractor to slow down or to stop all or part of the works in the case of a serious non- conformity until situation rectified.	1. Amend working methods 2. Rectify damage and undertake any necessary replacement
Repeated Non conformity	1. Identify Source Inform the IC(E) and the SOR 2. Increase monitoring frequency Discuss remedial actions with the IC(E), the SOR and the Contractor 3. Monitor remedial actions until rectification has been completed 4. If exceedance stops, cease additional monitoring	1. Check monitoring report 2. Check the Contractor's working method 3. Discuss with the ES and the Contractor on possible remedial measures 4. Advise the SOR on effectiveness of proposed remedial measures 5. Supervise implementation of remedial measures	1. Notify the Contractor 2. Ensure remedial measures are properly implemented 3. Consider and instruct, if necessary, the Contractor to slow down or to stop all or part of the works in the case of a serious non- conformity until situation rectified.	1. Amend working methods 2. Rectify damage and undertake any necessary replacement

Note: ET – Environmental Specialist, IC(E) – Independent Checker (Environmental), SOR – Supervising Officer's Representative

6.5.3 Construction and Operational Phase Dolphin Monitoring

6.5.3.1 The dolphin monitoring methodology is described in *Section 6.4* above and this should be continued both during construction and post construction (operational) phase based using the same transect, method and survey techniques, based upon the following frequency:

- one-day surveys to be undertaken at a frequency of 2 per month for the duration of the marine works construction; and

- forty-eight, one-day survey events to be undertaken at a frequency of 2 per month over a period of 24 months following cessation of the construction.

6.5.3.2 The data after each phase should be compared the pre-construction baseline findings. Any apparent differences in density among survey phases should be analysed for trends and the statistical power of the analysis to detect effects of the desired size should be tested. Comparison of the during and post construction dolphin monitoring with that of over the pre-construction dolphin monitoring will allow the assessment of the overall efficacy of the project-specific mitigation measures through the implementation of an Event and Action Plan detailed in the Table 6.9b below. Statistical procedures shall be used for data comparison. A range of applicable statistical procedures exist (e.g., t-test, ANOVA and ANCOVA, etc.) and the ET shall propose the procedure to be applied as part of the during and post-construction phase dolphin monitoring programme design to be agreed with AFCD prior to the monitoring being undertaken.

6.5.3.3 Should dolphin sighting numbers in the construction or post-construction phases be significantly different (taking into account naturally occurring alterations to distribution patterns such as due to seasonal change) to the pre-construction activity, recommendations for a further post-construction monitoring survey will be made. Data should then be re-assessed and the need for any further monitoring established. Comparison of the pre-construction dolphin monitoring with that of the during and post- construction dolphin monitoring will allow the assessment of the overall efficacy of the project-specific mitigation measures and an Event and Action Plan for the dolphin is provided in **Table 6.9b** below.

6.5.3.4 An action plan should be defined to indicate that should dolphin numbers be significantly different (taking into account naturally occurring alterations to distribution patterns such as due to seasonal change) to the pre-construction activity following the during and post-construction monitoring, recommendations for further monitoring and mitigation will be required. The Action and Limit level which will trigger the Event and Action Plan is proposed for the EM&A programme of the HKBCF. The Action and Limit Level and the Event and Action Plan of the HKBCF EM&A Programme will both be adopted for the current EM&A Programme given the same area of dolphin monitoring of the two programmes (ie Northeast Lantau (NEL) and Northwest Lantau (NWL)).

Table 6.9a Action and Limit Level for Dolphin Monitoring

	NEL	NWL
Action Level	(STG < 4.2) & (ANI < 15.5)	(STG < 6.9) & (ANI < 31.3)
Limit Level	(STG < 2.4) & (ANI <8.9)	(STG < 3.9) & (ANI < 17.9)

Note:
(1) AL will be trigger if either NEL **or** NWL fall below the criteria; LL will be triggered if both NEL **and** NWL fall below the criteria

Table 6.9b Event / Action Plan for During and Post Construction Dolphin Monitoring

Event	**ET Leader**	**IEC**	**SOR**	**Contractor**
Action Level	1. Repeat statistical data analysis to confirm findings; 2. Review all available and relevant data, including raw data and statistical analysis results of other parameters covered in the EM&A, to ascertain if differences are as a result of natural variation or previously observed seasonal differences; 3. Identify source(s) of impact; 4. Inform the IEC, SOR and Contractor; 5. Check monitoring data. 6. Review to ensure all the dolphin protective measures are fully and properly implemented and advise on additional measures if necessary.	1. Check monitoring data submitted by ET and Contractor; 2. Discuss monitoring results and findings with the ET and the Contractor.	1. Discuss monitoring with the IEC and any other measures proposed by the ET; 2. If SOR is satisfied with the proposal of any other measures, SOR to signify the agreement in writing on the measures to be implemented.	1. Inform the SOR and confirm notification of the non-compliance in writing; 2. Discuss with the ET and the IEC and propose measures to the IEC and the SOR; 3. Implement the agreed measures.

Event	ET Leader	IEC	SOR	Contractor
Limit Level	1. Repeat statistical data analysis to confirm findings; 2. Review all available and relevant data, including raw data and statistical analysis results of other parameters covered in the EM&A, to ascertain if differences are as a result of natural variation or previously observed seasonal differences; 3. Identify source(s) of impact; 4. Inform the IEC, ER/SOR and Contractor of findings; 5. Check monitoring data; 6. Repeat review to ensure all the dolphin protective measures are fully and properly implemented and advise on additional measures if necessary; 7. If ET proves that the source of impact is caused by any of the construction activity by the works contract, ET to arrange a meeting to discuss with IEC, ER/SOR and Contractor the necessity of additional dolphin monitoring and/or any other potential mitigation measures (e.g., consider to modify the perimeter silt curtain or consider to control/temporarily stop relevant construction activity etc.) and submit to IEC a proposal of additional dolphin monitoring and/or mitigation measures where necessary.	1. Check monitoring data submitted by ET and Contractor; 2. Discuss monitoring results and findings with the ET and the Contractor; 3. Attend the meeting to discuss with ET, ER/SOR and Contractor the necessity of additional dolphin monitoring and any other potential mitigation measures; 4. Review proposals for additional monitoring and any other mitigation measures submitted by ET and Contractor and advise ER/SOR of the results and findings accordingly; 5. Supervise / Audit the implementation of additional monitoring and/or any other mitigation measures and advise ER/SOR the results and findings accordingly.	1. Attend the meeting to discuss with ET, IEC and Contractor the necessity of additional dolphin monitoring and any other potential mitigation measures; 2. If ER/SOR is satisfied with the proposals for additional dolphin monitoring and/or any other mitigation measures submitted by ET and Contractor and verified by IEC, ER/SOR to signify the agreement in writing on such proposals and any other mitigation measures; 3. Supervise the implementation of additional monitoring and/or any other mitigation measures.	1. Inform the ER/SOR and confirm notification of the non-compliance in writing; 2. Attend the meeting to discuss with ET, IEC and ER/SOR the necessity of additional dolphin monitoring and any other potential mitigation measures; 3. Jointly submit with ET to IEC a proposal of additional dolphin monitoring and/or any other mitigation measures when necessary; 4. Implement the agreed additional dolphin monitoring and/or any other mitigation measures.

6.5.3.5A It should be noted that the current Southern Connection Viaduct Section EM&A programme is exempted from carrying out the vessel-based line transect dolphin monitoring until the completion of the dolphin monitoring carried out under the HKBCF Reclamation Contract and the Northern Connection Sub-sea Tunnel Section Contract. Vessel-based line transect dolphin monitoring data from the impact monitoring of *Contract No. HY/2011/03 - HZMB HKLR - Section between Scenic Hill and HKBCF* will be adopted for the current Southern Connection Viaduct Section EM&A programme.

6.6 Mitigation and Enhancement Measures

6.6.1.1 Ecological mitigation and enhancement measures recommended by the EIA are largely related to the protection of key floral and fauna species and are summarized below. In addition, measures recommended to minimise impacts on water quality will, also, reduce impacts on marine ecological resources. The ecological mitigation and enhancement measures to be implemented during the construction phase are as follows:

- use acoustic decoupling methods to minimise noise being transmitted through the dredging and reclamation barges;
- Vessel speed limit and restrictions required for other parts of the works under the TM-CLKL will be implemented;
- 250m dolphin exclusion zone during dredging, reclamation, sheet, bored piling works and temporary staging work;
- avoidance of the peak calving season of May and June for installation of metal caisson during bored piling works;
- survey and translocation of corals before the temporary staging construction as an enhancement measure;
- regularly check the work site boundaries to ensure that they are not breached and that damage does not occur to surrounding areas;
- provided environmental briefing/training sessions for site staff;
- planting of approximately 33ha as an enhancement measure for vegetation loss; and
- gabion wall works in steam NL1 in Lantau to be undertaken in the dry season.

6.6.1.2 The mitigation measures shall be audited at least once every week as part of the site audit programme. In the event of a non-compliance, the Event /Action plan detailed above shall be followed by the relevant parties.

6.6.1.3 In addition, in order to address the cumulative impacts from all the projects and compensate for the cumulative Chinese White Dolphin and fisheries habitat loss, the Government has made a firm commitment to seek to designate the Brothers Islands as a marine park for enhancing the CWD habitat in accordance with the statutory process stipulated in the Marine Parks Ordinance. The designation of the proposed marine park would proceed after the completion of these projects. A study will be conducted to confirm the details of the proposed marine park before the commencement of the statutory procedures as stipulated in the Marine Parks Ordinance. The Government's commitment to the marine park and its control and management in accordance with the Marine Parks Ordinance, as well as the Marine Parks and Marine Reserves Regulations, would significantly help conserve the CWD, and hence serves as an effective mitigation measure for the loss of CWD habitat arising from these projects. With this committed measures, the residual cumulative impacts to the CWD in terms of permanent habitat loss would be acceptable.

7. LANDSCAPE AND VISUAL ASSESSMENT

7.1 Introduction

7.1.1.1 The EIA has recommended landscape and visual mitigation measures to be undertaken during both the construction and operational phases of the project. This section outlines the monitoring and audit of these measures.

7.1.1.2 The sensitive receivers are shown in **Figures 7.1.1.3 to 7.1.1.5, 7.2.1.3 to 7.2.1.5, 7.3.1.2, 7.3.1.4 and 7.3.2.1.**

7.2 Relevant Legislation

7.2.1.1 The following legislation, standards and guidelines are applicable to landscape and visual impact assessment associated with the construction and operation of the project:

- Environmental Impact Assessment Ordinance (Cap.499.S.16) and the Technical
- Memorandum on EIA Process (EIAO TM), particularly Annexes 10 and 18
- Environmental Impact Assessment Ordinance Guidance Note 8/2002
- ETWB No. 36/ 2004 - Advisory Committee on the Appearance of Bridges and Associated Structures (ACABAS)
- ETWB TCW No. 10/2005 - Planting on Footbridges and Flyovers
- ETWB TCW No. 2/2004 - Maintenance of Vegetation and Hard Landscape Features
- ETWB TCW No. 29/2004 - Registration of Old and Valuable Trees, and Guidelines for their Preservation
- ETWB TCW No. 3/2006 - Tree Preservation
- ETWB TCW No. 5/2005 on Protection of natural streams/rivers from adverse impacts arising from construction works
- Hong Kong International Airport Approved Plant Species List (Revision 3: June 2007)
- Hong Kong Planning Standards and Guidelines, particular Chapter 4, Chapter 8, Chapter 10 and Chapter 11
- HQ/GN/13 - Interim Guidelines for Tree Transplanting Works under Highways Department's Vegetation Maintenance Ambit

- HyDTC No. 3/2008 - Independent Vetting of Tree Works under the Maintenance of Highways Department
- HyDTC No. 5/2000 on Control in the Use of Shotcrete (Sprayed Concrete) in Slope Works
- Protection of Endangered Species of Animals And Plants Ordinance (Cap 586)
- Study on Landscape Value Mapping of Hong Kong
- Town Planning Ordinance (Cap 131)
- WBTC No. 17/2000 on Improvement to the Appearance of Slopes
- WBTC No. 25/92 - Allocation of Space for Urban Street Trees
- WBTC No. 25/93 on Control of Visual Impact of Slopes
- WBTC No. 7/2002 - Tree Planting in Public Works

7.3 Methodology and Criteria

7.3.1.1 The design, implementation and maintenance of landscape and visual mitigation measures should be checked to ensure that they are fully realised and that potential conflicts between the proposed landscape measures and any other project works and operational requirements are resolved at the earliest possible date and without compromise to the intention of the mitigation measures.

7.3.1.2 Site inspection and audit is necessary in the operation stage.

Table 7.1 Monitoring Programme

Stage	Monitoring Task	Monitoring Report	Form of Approval	Frequency
Design	Monitoring of design works against the recommendations of the landscape and visual impact assessments within the EIA should be undertaken during detailed design and tender stages, to ensure that they fulfil the intentions of the mitigation measures.Any changes to thedesign, including design changes on site should also be checked.	Report by SOR confirming that the design conforms to requirements of EP	Approved by Client	At Completion of Design Stage
Construction	Monitoring of the contractor's operations during the construction period.	Report on Contractor's compliance, by ET	Counter-signature of report by IEC	Weekly
Establishment Works	Monitoring of the planting works during the 24-month establishment period after completion of the construction works.	Report on Contractor's compliance, by ET	Counter-signature of report by IEC	3 months

Design Phase

7.3.1.3 The mitigation measures proposed within the EIA to mitigate the landscape and visual impacts of the scheme should be embodied into the detailed engineering design and landscape design drawings and contract documents. Detailed landscaping drawings and specification should be checked during detailed design stage and before tender stage by a Registered Landscape Architect to ensure that the measures are fully incorporated and that potential conflicts with civil engineering, geo-technical, structural, lighting, signage, drainage, underground utility and operational requirements are resolved prior to construction. Monitoring of design works against the recommendations of the landscape and visual impact assessments within the EIA should be undertaken when the designs are produced to ensure that they fulfill the intentions of mitigation measures.

Construction & Establishment Period

7.3.1.4 The implementation of landscape construction works and subsequent maintenance operations during the 12-month establishment period must be supervised by fully qualified Landscape Resident Site Staff (Registered Landscape Architect or Professional Member of the Hong Kong Institute of landscape Architects).

7.3.1.5 Measures to mitigate landscape and visual impacts during construction should be checked and monitored by a Registered Landscape Architect to ensure compliance with the intended aims of the mitigation measures.

7.3.1.6 The progress of the engineering works shall be regularly reviewed on site to identify the

earliest practical opportunities for the landscape works to be undertaken.

7.4 Baseline Monitoring

7.4.1.1 A one off survey shall be conducted prior to commencement of any construction works. A photographic record of the site at the time of the contractor's possession of the site shall be prepared by the Contractor and approved by the SOR. The approved photographic Record shall be submitted to the Project proponent, ET, IEC and EPD for record.

7.5 Event and Action Plan

7.5.1.1 Should non-compliance of the landscape and visual impacts occur, actions in accordance with the action plan stated in **Table 7.2** should be carried out.

Table 7.2 Event and Action Plan for Landscape and Visual Impact

EVENT ACTION LEVEL	Action			
	ET	**IEC**	**SOR**	**Contractor**
Design Check	· Check final design conforms to the requirements of EP and prepare report.	· Check report. · Recommend remedial design if necessary	· Undertake remedial design if necessary	
Non-conformity on one occasion	· Identify Source · Inform IEC and · Discuss remedial actions with IEC, SOR and Contractor · Monitor remedial actions until rectification has been completed	· Check report · Check Contractor's working method · Discuss with ET and Contractor on possible remedial measures · Advise SOR on effectiveness of proposed remedial measures. · Check implementation of remedial measures.	· Notify Contractor · Ensure remedial measures are properly implemented	· Amend working methods · Rectify damage and undertake any necessary replacement
Repeated Non-conformity	· Identify Source · Inform IEC and SOR · Increase monitoring frequency · Discuss remedial actions with IEC, SOR and Contractor · Monitor remedial actions until rectification has been completed · If non-conformity stops, cease additional monitoring	· Check monitoring report · Check Contractor's working method · Discuss with ET and Contractor on possible remedial measures · Advise SOR on effectiveness of proposed remedial measures · Supervise implementation of remedial measures.	· Notify Contractor · Ensure remedial measures are properly implemented	· Amend working methods · Rectify damage and undertake any necessary replacement

7.6 Mitigation Measures

7.6.1.1 The landscape and visual impact assessment of the EIA recommends a series on mitigation measures, as noted below:

Design Landscape and Visual Mitigation Measures

- Round angle, patterned finishes, and oval shaped pier were considered in the viaduct design, and further details will be developed under ACABAS submission (DM3);
- Details of the street furniture will be developed in the detailed design stage (DM4); and
- Aesthetic design of the viaduct, retaining wall and other structures will be developed under ACABAS submission (DM5).

Landscape and Visual Mitigation Measures during Construction Phase

- Existing trees on boundary of the Project Area shall be carefully protected during construction. Detailed Tree Protection Specification shall be provided in the Contract Specification. Under this specification, the Contractor shall be required to submit, for approval, a detailed working method statement for the protection of trees prior to undertaking any works adjacent to all retained trees, including trees in contractor's works areas. (Tree protection measures will be detailed at Tree Removal Application stage) (CM1),
- Trees unavoidably affected by the works shall be transplanted where practical. Trees will be transplanted straight to their final receptor site and in the Contract Specification. Sufficient time for necessary tree root and crown preparation periods shall be allowed in the project programme (CM2),not held in a temporary nursery. A detailed Tree Transplanting Specification shall be provided
- Hillside and roadside screen planting to proposed roads, associated structures and slope works (CM3),
- Hydroseeding or sheeting of soil stockpiles with visually unobtrusive material (in earth tone) (CM4),
- Screening of construction works by hoardings around works area in visually unobtrusive colours, to screen works (CM5),

- Control night-time lighting and glare by hooding all lights (CM6),
- Ensure no run-off into water body adjacent to the Project Area (CM7),
- Avoidance of excessive height and bulk of buildings and structures (CM8),
- Recycle/Reuse all felled trees and vegetation, e.g. mulching (CM9),
- Compensatory tree planting shall be provided to the satisfaction of relevant Government departments. Required numbers and locations of compensatory trees shall be determined and agreed separately with Government during the Tree Felling Application process under ETWBTC 3/2006 (CM10).

Landscape and Visual Mitigation Measures during Operation Phase

- Re-vegetation of affected woodland/shrubland with native species (OM1),
- Tall buffer screen tree / shrub / climber planting should be incorporated to soften hard engineering structures and facilities (OM2),
- Streetscape elements (e.g. paving, signage, street furniture, lighting etc.) shall be sensitively designed in a manner that responds to the local context, and minimises potential negative landscape and visual impacts. Lighting units should be directional and minimise unnecessary light spill (OM3),
- Structure, ornamental tree / shrub / climber planting should be provided along roadside amenity strips, central dividers and newly formed slopes to enhance the townscape quality and further greenery enhancement (OM4),
- Aesthetically pleasing design (visually unobtrusive and non-reflective) as regard to the form, material and finishes shall be incorporated to all buildings, engineering structures and associated infrastructure facilities (OM5),
- Avoidance of excessive height and bulk of buildings and structures (OM6).

8 WASTE MANAGEMENT AND CONTAMINATED LAND

8.1 Waste Issues

8.1.1 Summary of Waste Arisings

8.1.1.1 The Contractor is responsible for waste control within the construction site, removal of waste material produced from the site and to implement any mitigation measures to minimise waste or redress problems arising from the waste from the site. Activities during the construction phase will result in the generation of a variety of wastes which can broadly be classified into distinct categories based on their nature and the options for their disposal. These include:

- Marine dredged sediment;
- Excavated construction and demolition (C&D) materials suitable for public fill, including the alluvium from the tunnel construction;
- Construction and demolition waste, including cleared vegetation, which is not suitable for public fill;
- Chemical waste;
- Sewage; and
- General refuse.

8.1.1.2 Not applicable

8.1.1.3 Not applicable

8.1.1.4 A total of 0.028Mm^3 of dredged material is predicted to be generated, comprising approximately 0.02Mm^3 of Category L, 0.005 Mm^3 of Category Mp and 0.003 Mm^3 of Category M_f materials.

8.1.1.5 The Construction and Demolition (C&D) materials generated from the TM-CLKL project will comprise the following:

- Alluvium and CDG from the submarine tunnel and deep sections of the marine viaduct bridge piers and building foundations;

- Excavation materials from the land viaduct construction, slope cutting, utility diversions, site formation of the toll plaza and administration buildings formation; and

- Road and pavement demolition waste from the modification of the existing roads for new roads connections.

8.1.1.6 In accordance with the waste hierarchy, the amounts of materials to be generated has been minimised by optimizing the slope profiles. However, a total of 141,994 m^3 of soft C&D material will be generated and will require off site disposal or to be reused. All the material will be suitable for public fill, although alluvium and small amounts of CDG generated by the deeper sections of the marine viaduct piles will require to be treated at a slurry treatment plant and suitably dried before

transfer to a fill bank. The by- product of the treatment comprises both a coarser, dry material and a wet spoil, and, where required, the spoil material shall be scarified to ensure it is "suitably" dried before it can be disposed of to the fill bank. This principle of disposal has been agreed by the Public Fill Committee.

8.1.1.7 An estimated total of 129,006 m^3 of C&D materials will be reused on site. In addition, 1,249 m^3 of various new material will, also, required importing. The onsite transfer and off site removal of the material has the potential for impacting any local residents associated with the possible dust generation from the exported fill, deposition of material on public roads and emissions and noise from the construction vehicles. However, the additional traffic is not expected to cause any additional impacts to sensitive receivers along this route. It should be noted that the forecast of the volume of generated C&D materials would be updated upon completion of the Design works for the Project

8.1.1.8 The volumes C&D waste, are expected to be limited but the material, not being suitable for public fill, will require disposal to landfill. It is, also, unlikely that any large quantities of chemical wastes will be generated during the construction of this project but any materials should be handled, stored, transported and disposed of in an appropriate manner. Other wastes including sewage and general refuse will be generated and these will also need to be collected and disposed offsite appropriately.

8.1.2 Mitigation Measures

8.1.2.1 Based on the mitigation measures recommended in the EIA Report, the following measures, as summarized in the Environmental Mitigation Implementation Schedule in **Appendix A**, shall be undertaken when handling waste material during construction phase:

i) The requirements as stipulated in the ETWB TC(W) No.19/2005 Environmental Management on Construction Sites and the other relevant guidelines should be included in the Particular Specification for the Contractor as appropriate.

ii) The TM-CLKL Contractor should be requested to submit an outline Waste Management Plan (WMP) prior to the commencement of construction work, in accordance with the ETWB TC(W) No.19/2005 so as to provide an overall framework of waste management and reduction. The WMP should include:

- *Waste management policy;*
- *Record of generated waste;*
- *Waste reduction target;*
- *Waste reduction programme;*
- *Role and responsibility of waste management team;*

- *Benefit of waste management;*
- *Analysis of waste materials;*
- *Reuse, recycling and disposal plans;*
- *Transportation process of waste products; and*
- *Monitoring and action plan.*

iii) The waste management hierarchy below should be strictly followed. This hierarchy should be adopted to evaluate the waste management options in order to maximise the extent of waste reduction and cost reduction. The records of quantities of waste generated, recycled and disposed (locations) should be properly documented.

iv) A trip-ticket system should be established in accordance with ETWB(W) 31/2004 and Waste Disposal (Charges for Disposal of Construction Waste) Regulation to monitor the disposal of public fill and solid wastes at public filling facilities and landfills, and to control fly-tipping. A trip- ticket system would be included as one of the contractual requirements for the Contractor to strictly implement. The Supervising Officer would also regularly audit the effectiveness of the system.

v) A recording system for the amount of waste generated, recycled and disposed (locations) should be established. The future Contractor should also provide proper training to workers regarding the appropriate concepts of site cleanliness and waste management procedures, e.g. waste reduction, reuse and recycling all the time.

vi) The CEDD should be timely notified of the estimated spoil volumes to be generated and the Public Fill Committee should be notified and agreement sort on the disposal of surplus inert C&D materials e.g. good quality rock during detailed design of the TM-CLKL project. Wherever practicable, C&D materials should be segregated from other wastes to avoid contamination and to ensure acceptability at public filling areas or reclamation sites.

vii) The extent of cutting operation should be optimised where possible. Earth retaining structures and bored pile walls should be proposed to minimise the extent of cutting.

viii) Inert C&D materials from slopes and road pavement will be reused for construction of the raised platform for the toll plaza.

ix) C&D materials generated by construction of cut slopes along NLH at North Lantau shall be reused in reclamation works where possible.

x) The surplus surcharge should be transferred to a fill bank.

xi) TMB generated alluvium and CDG material should be treated at a slurry

treatment plant prior to transfer to a fill bank (Not applicable).

xii) Rock armour from the existing seawall should be reused on the new sloping seawall as far as possible.

xiii) The site and surroundings shall be kept tidy and litter free.

xiv) No waste shall be burnt on site.

xv) Make provisions in contract documents to allow and promote the use of recycled aggregates where appropriate.

xvi) Prohibit the Contractor to dispose of C&D materials at any sensitive locations e.g. natural habitat,, etc. The Contractor should propose the final disposal sites in the EMP and WMP for approval before implementation.

xvii) Stockpiled material shall be covered by tarpaulin and /or watered as appropriate to prevent windblown dust and surface run off.

xviii) Excavated material in trucks shall be covered by tarpaulins to reduce the potential for spillage and dust generation.

xix) Wheel washing facilities shall be used by all trucks leaving the site to prevent transfer of mud onto public roads.

xx) Dredged marine mud shall be disposed of in a gazetted marine disposal ground under the requirements of the Dumping at Seas Ordinance.

xxi) Standard formwork or pre-fabrication should be used as far as practicable so as to minimise the C&D materials arising. The use of more durable formwork or plastic facing for construction works should also be considered. The use of wooden hoardings should be avoided and metal hoarding should be used to facilitate recycling. Purchasing of construction materials should be carefully planned in order to avoid over-ordering and wastage.

xxii) The Contractor should recycle as many C&D materials (this is a waste section) as possible on-site. The public fill and C&D waste should be segregated and stored in separate containers or skips to facilitate the reuse or recycling of materials and proper disposal. Where practicable, the concrete and masonry should be crushed and used as fill materials. Steel reinforcement bar should be collected for use by scrap steel mills. Different areas of the sites should be considered for segregation and storage activities.

xxiii) All falsework will be steel instead of wood.

xxiv) Chemical waste producers should register with the EPD. Chemical waste should be handled in accordance with the Code of Practice on the Packaging, Handling and Storage of Chemical Wastes as follows:

- Suitable for the substance to be held, resistant to corrosion, maintained in good conditions and securely closed;
- Having a capacity of <450L unless the specifications have been approved by the EPD; and
- Displaying a label in English and Chinese according to the instructions prescribed in *Schedule 2* of the Regulations.
- Clearly labelled and used solely for the storage of chemical wastes;
- Enclosed with at least 3 sides;
- Impermeable floor and bund with capacity to accommodate 110% of the volume of the largest container or 20% by volume of the chemical waste stored in the area, whichever is greatest;
- Adequate ventilation;
- Sufficiently covered to prevent rainfall entering (water collected within the bund must be tested and disposed of as chemical waste, if necessary); and
- Incompatible materials are adequately separated.

xxv) Waste oils, chemicals or solvents shall not be disposed of to drain;

xxvi) Adequate numbers of portable toilets should be provided for on-site workers. Portable toilets should be maintained in reasonable states, which will not deter the workers from utilising them. Night soil should be regularly collected by licensed collectors.

xxvii) General refuse arising on-site should be stored in enclosed bins or compaction units separately from C&D and chemical wastes. Sufficient dustbins shall be provided for storage of waste as required under the Public Cleansing and Prevention of Nuisances By-laws. In addition, general refuse shall be cleared daily and shall be disposed of to the nearest licensed landfill or refuse transfer station. Burning of refuse on construction sites is prohibited.

xxviii) All waste containers shall be in a secure area on hardstanding;

xxix) Aluminum cans are usually collected and recovered from the waste stream by individual collectors if they are segregated and easily accessible. Separately labelled bins for their deposition should be provided as far as practicable.

xxx) Office wastes can be reduced by recycling of paper if such volume is sufficiently large to warrant collection. Participation in a local collection scheme by the Contractor should be advocated. Waste separation facilities for paper, aluminum cans, plastic bottles, etc should be provided on-site.

xxxi) Training shall be provided to workers about the concepts of site cleanliness and appropriate waste management procedure, including waste reduction, reuse and recycling.

8.1.3 Waste Disposal Recommendations

8.1.3.1 The recommended disposal sites for the different types of waste are detailed in **Table 8.1** below:

Table 8.1 Recommended Waste Disposal Sites

Type of Waste	Disposal Site
Marine Dredged Mud (1)	Category L and M_p – South Dangan Liedao, South Cheung Chau Open Sea Sediment Disposal Area and ESC/SB Contaminated Mud Pits. Category M_f – ESC/SB Contaminated Mud Pits.
C&D materials	Tuen Mun Areas 38 public fill bank
C&D waste (plastics, glass, wood, including cleared vegetation etc.)	North Lantau Refuse Transfer Station; or NWNT Refuse Transfer Station
Chemical waste (as defined under Schedule 1 of the Waste Disposal (Chemical Waste) Regulation)	Chemical Treatment Facility at Tsing Yi: or Other approved facility
General refuse	North Lantau Refuse Transfer Station; or NWNT Refuse Transfer Station

Note: (1) Subject to DASO application

8.2 Contaminated Land

8.2.1.1 The results of the contaminated land assessment did not reveal any contamination hotspots that might be affected by the proposed TM-CLKL works and as such no mitigation measures in the form of contaminated land remediation is required. Therefore, no EM&A activities for the construction nor operational phases have been recommended as no significant impacts are predicted.

8.3 Waste EM&A Requirements

8.3.1.1 EM&A requirements are required for waste management during the construction phase only and the effective management of waste arisings during the construction phase will be monitored through the site audit programme. The aims of the waste audit are:

- to ensure the waste arising from the works are handled, stored, collected, transferred and disposed of in an environmentally acceptable manner; and
- to encourage the reuse and recycling of material.

8.3.1.2 The Contractor shall be required to pay attention to the environmental standard and guidelines and carry out appropriate waste management and obtain the relevant licence/permits for waste disposal. The Environmental Team (ET) shall ensure that the Contractor has obtained from the appropriate authorities the necessary waste disposal permits or licences including:

- Chemical Waste Permits/licenses under the Waste Disposal Ordinance (Cap 354);
- Public Dumping Licence under the Land (Miscellaneous Provisions) Ordinance (Cap 28);
- Marine Dumping Permit under the Dumping at Sea Ordinance (Cap 466); and
- Effluent Discharge Licence under the Water Pollution Control Ordinance.

8.3.1.3 The Contractor shall refer to the relevant booklets issued by the DEP when applying for the licence/permit and the Environmental Team (ET) (see *Section 1*) shall refer to these booklets for auditing purposes.

8.3.1.4 During the site inspections and the document review procedures as mentioned in Chapter 10 of this Manual, the ET shall pay special attention to the issues relating to waste management and check whether the Contractor has followed the relevant contract specifications and the procedures specified under the laws of Hong Kong. In addition to the site inspections, the ET shall review the documentation procedures prepared by the Waste Coordinator once a week to ensure proper records are being maintained and procedures undertaken in accordance with the Waste Management Plan.

8.3.1.5 The Contractor's waste management practices should be audited with reference to the checklist detailed in **Table 8.2** below:

Table 8.2 Waste Management Checklist

Activities	Timing	Monitoring Frequency	If non-compliance, Action Required
All necessary waste disposal permits or licences have been obtained	Before the commencement of demolition works	Once	Apply for the necessary permits/ licences prior to disposal of the waste. The ET shall ensure that corrective action has been taken.
Only licensed waste haulier are used for waste collection.	Throughout the works	Weekly	The ET shall inform the SOR and IEC of the non- compliance. The SOR shall instruct the Contractor to use a licensed waste haulier. The Contractor shall temporarily suspend waste collection of that particular waste until a licensed waste haulier is used. Corrective action shall be undertaken within 48 hours.
Records of quantities of wastes generated, recycled and disposed are properly kept. For demolition material/waste, the number of loads for each day shall be recorded (quantity of waste can then be estimated based on average truck load. Should landfill charging be implemented, the receipts of the charge could be used for estimating the quantity).	Throughout the works	Weekly	The Contractor shall estimate the missing data based on previous records and the activities carried out. The ET shall audit the results and forward to the SOR and IEC for approval.
Wastes are removed from site in a timely manner. General refuse is collected on a daily basis.	Throughout the works	Weekly	The ET shall inform the SOR and IEC of the non- compliance. The SOR shall instruct the Contractor to remove waste accordingly.
Waste storage areas are properly cleaned and do not cause windblown litter and dust nuisance.	Throughout the works	Weekly	The ET shall inform the SOR and IEC of the non- compliance. The SOR shall instruct the Contractor to clean the storage area and/or cover the waste.
Different types of waste are segregated in different containers or skip to enhance recycling of material and proper disposal of waste.	Throughout the works	Weekly	The ET shall inform the SOR and IEC of the non- compliance. The SOR shall instruct the Contractor to provide separate skips/ containers. The Contractor shall ensure the workers place the waste in the appropriate containers.

Chemical wastes are stored, handled and disposed of in accordance with the Code of Practice on the Packaging, Handling and Storage of Chemical Wastes, published by the EPD.	Throughout the works	Weekly	The ET shall inform the SOR and IEC of the non- compliance. The SOR shall instruct the Contractor to rectify the problems immediately. Warning shall be given to the Contractor if corrective actions are not taken within 24 hrs and the Waste Control Group of the EPD shall be identified.
Demolition material/waste in dump trucks are properly covered before leaving the site.	Throughout the works	Weekly	The ET shall inform the SOR and IEC of the non- compliance. The SOR shall instruct the Contractor to comply. The Contractor shall prevent trucks shall leaving the site until the waste are properly covered.
Wastes are disposal of at licensed sites.	Throughout the works	Weekly	The ET shall inform the SOR and IEC of the non- compliance. The SOR shall warn the Contractor and instruct the Contractor to ensure the wastes are disposed of at the licensed sites. Should it involve chemical waste, the Waste Control Group of EPD shall be notified.

Note: ET – Environmental Team, IEC – Independent Environmental Checker, SOR – Supervising Officer's Representative

9 CULTURAL HERITAGE

9.1 Introduction

9.1.1.1 Cultural heritage resources are not identified within the works area of TM-CLKL Southern Connection Viaduct Section. As such, EM&A requirements for cultural heritage are Not applicable to the Southern Connection Viaduct Section.

10 Landfill Gas Hazard Assessment

10.1 Introduction

10.1.1.1 The landfill gas hazard assessment undertaken in the EIA identified the hazards that are likely to be generated from the Pillar Point Valley (PPV) Landfill, during the construction and operation phases of this Project and evaluate the associated risk. The EIA Report recommended that some precautionary measures are required to protect the proposed TM-CLKL toll plaza from the landfill gas risk due to the PPV Landfill. As such, the EM&A requirements for landfill gas hazard are Not applicable for the current Southern Connection Viaduct Section EM&A Programme.

11 SITE ENVIRONMENTAL AUDIT

11.1 Site Inspections

11.1.1.1 Site inspections provide a direct means to assess and ensure the Contractor's environmental protection and pollution control measures are in compliance with the contract specifications. Site inspections shall be undertaken routinely by the Environmental Team (ET) (see *Section 1*) to inspect the construction activities in order to ensure that appropriate environmental protection and pollution control mitigation measures are properly implemented in accordance with the EIA.

11.1.1.2 The ET is responsible for the formulation of an environmental site inspection, deficiency and remedial action reporting system and for carrying out the site inspection works. In consultation with the Independent Environmental Checker (IEC), the ET shall prepare a procedure for the site inspection, deficiency and remedial action reporting requirements and submit this to the Contractor for agreement and to the Supervising Officer's Representative (SOR) for approval within 21 days of commencement to the construction contract.

11.1.1.3 Regular site inspections shall be carried out at least once per week. The areas of inspection shall not be limited to the site area and should also include the environmental conditions outside the site which are likely to be affected, directly or indirectly, by the site activities.

11.1.1.4 The ET shall make reference to the following information while conducting the inspections:

i) the EIA recommendations on environmental protection and pollution control mitigation measures as stated in the EIA report;

ii) work progress and programme;

iii) individual works methodology proposals;

iv) the contract specifications on environmental protection;

v) the relevant environmental protection and pollution control laws;

vi) previous site inspection results; and

vii) environmental monitoring data.

11.1.1.5 The Contractor shall update the ET with all relevant information on the construction works prior to carrying out the site inspections. The site inspection results and associated recommendations on improvements to the environmental protection and pollution control works shall be submitted, in a site inspection

proforma (see **Appendix B**), by the ET to the IEC, the SOR and the Contractor within 24 hours for reference and for taking immediate action. The Contractor shall follow the procedures and time-frame, as stipulated in the environmental site inspection, deficiency and remedial action reporting system to report on any remedial measures subsequent to site inspections.

11.1.1.6 *Ad hoc* site inspections shall also be carried out by the ET and IEC if significant environmental problems are identified. Inspections may also be required subsequent to receipt of an environmental complaint (an example of the complaint log is provided in **Appendix B)** or as part of the investigation work as specified in the Action Plan for environmental monitoring and audit.

11.2 Compliance with Legal and Contractual Requirements

11.2.1.1 There are contractual environmental protection and pollution control requirements as well as environmental protection and pollution control laws in Hong Kong with which the construction activities shall comply.

11.2.1.2 In order that the works are in compliance with the contractual requirements, all the works method statements submitted by the Contractor to the SOR for approval shall be sent to the ET for vetting to see whether sufficient environmental protection and pollution control measures have been included.

11.2.1.3 The ET shall also review the progress and programme of the works to check that relevant environmental laws have not been violated and that any foreseeable potential for violating the laws can be prevented.

11.2.1.4 The Contractor shall regularly copy relevant documents to the ET so that the checking work can be carried out. The documents shall include at minimum the updated Work Progress Reports, the updated Works Programme, the application letters for different licence/permits under the environmental protection laws and all valid licence/permit. The site diaries shall also be available for the ET's inspection upon request.

11.2.1.5 After reviewing the document, the ET shall advise the IEC, the SOR and the Contractor of any non-compliance with the contractual and legislative requirements on environmental protection and pollution control for them to take follow-up actions. The ET shall also advise the IEC, the Contractor and the SOR on the current status on licence/permit applications and any environmental protection and pollution control preparation works that may not be suitable for the works programme or may result in potential violation of environmental protection and pollution control requirements.

11.2.1.6 Upon receipt of the advice, the Contractor shall undertake immediate action to remedy the situation. The ET, IEC and the SOR shall follow up to ensure that appropriate action has been taken by the Contractor in order that the environmental protection and pollution control requirements are fulfilled.

11.3 Environmental Complaints

11.3.1.1 Complaints shall be referred to the ET for carrying out complaint investigation procedures. The ET shall prepare a flow chart of the complaint response procedures that addresses, complaint receiving channels, responsible parties/contacts for information, the investigation process, procedures for the implementation of mitigation/remedial action, guidelines for communication and public relation with the complainant etc. The flow chart should be agreed by all parties and issued to the Contractor, SOR and IEC for reference.

11.3.1.2 The ET shall undertake the following procedures upon receipt of a complaint:

i) log complaint and date of receipt into the complaint database and inform the IEC immediately;

ii) investigate the complaint and discuss with the Contractor to determine its validity and to assess whether the source of the problem is due to works activities;

iii) if a complaint is considered valid by the SOR or EPD and due to the works, the ET shall identify mitigation measures in consultation with the IEC;

iv) if mitigation measures are required, the ET shall advise the Contractor accordingly;

v) review the Contractor's response on the identified mitigation measures and the updated situation;

vi) if the complaint is transferred from EPD, an interim report shall be submitted to EPD on the status of the complaint investigation and follow-up action within the time frame assigned by EPD;

vii) (vii) undertake additional monitoring and audit to verify the situation if necessary and ensure that any valid reason for complaint does not recur;

viii) report the investigation results and the subsequent actions on the source of the complaint for responding to complainant. If the source of complaint is EPD, the results should be reported within the time frame assigned by EPD; and

ix) record the complaint, investigation, the subsequent actions and the results in the monthly EM&A reports.

11.3.1.3 During the complaint investigation work, the Contractor and SOR shall cooperate with the ET in providing all the necessary information and assistance for completion of the investigation. If mitigation measures are identified in the investigation by the ET, in consultation with the IEC, the Contractor

shall promptly carry out the mitigation measures. The ET and SOR shall approve the proposed mitigation measures and check that the measures have been carried out by the Contractor.

11.4 Choice of Construction Method

11.4.1.1 At times during the construction phase the Contractor may submit method statements for various aspects of construction. This state of affairs would only apply to those construction methods that the EIA has not imposed conditions while for construction methods that have been assessed in the EIA, the Contractor is bound to follow the requirements and recommendations in the EIA study. The Contractor's options for alternative construction methods may introduce adverse environmental impacts into the project. It is the responsibility of the ET, in accordance with established standards, guidelines and EIA study recommendations and requirements, to review and determine the adequacy of the environmental protection and pollution control measures in the Contractor's proposal in order to ensure no unacceptable impacts would result. To achieve this end, the ET shall provide a copy of the Proactive Environmental Protection Proforma as shown in Appendix B to the IEC for approval. The IEC should audit the review of the construction method and endorse the proposal on the basis of no adverse environmental impacts.

12 REPORTING

12.1 General

12.1.1.1 The following reporting requirements are based upon a paper documented approach. However, the same information can be provided in an electronic medium upon agreeing the format with the Supervising Officer's Representative (SOR). The reports are required to be prepared by the Environmental Team (ET).

12.2 Documentation

12.2.1.1 All documentation is required to be filed in a traceable and systematically manner. Site documentation, including monitoring field records, laboratory analysis records, meeting minutes, correspondences etc.(some examples are provided in **Appendix B**) shall be cross-referenced by the ET and be ready for inspection upon request. All EM&A results and findings shall be documented in the respective construction and operational phase EM&A reports prepared by the ET and endorsed by the Independent Environmental Checker (IEC) prior to dissemination to the Contractor, the SOR and EPD. All reports including details of water quality monitoring, ecology, landscape and visual and archaeological EM&A shall also be issued to the AFCD and the AMO as appropriate.

12.2.1.2 All documentation shall be in paper form and/or electronic (in an agreed format) upon request. All documents and data shall be kept for at least one year after the completion of the operational phase EM&A works. All submissions (reports, data and correspondences etc.) shall be liable to free use for the purposes of communicating environmental data and the owner of information shall claim no copyright. Any request to treat all or part of a submission in confidence will be respected, but if no such request is made it will be assumed that the submission is not intended to be confidential.

12.3 Design Audit Report

12.3.1.1 The Design Audit Report shall provide the means for the Consultant undertaking the detailed design of the project to certify that environmental design elements and specifications have been completed in accordance with the EIA requirements. The Consultant shall include in the report a signed off proforma (see Appendix B) to confirm that there are no outstanding environmental measures, identified as requiring design phase audit, that require further action. The Design Audit Report and specifications shall be prepared by the Consultants and issued to EPD, the AFCD and the PlanD, as appropriate, prior to the commencement of the tendering period.

12.4 Baseline Monitoring Report

12.4.1.1 In respect of the construction phase EM&A works, the ET shall prepare and submit a Baseline Environmental Monitoring Report within 10 working days of completion of baseline monitoring. Copies of the Baseline Environmental Monitoring Report shall be submitted to the following: the Contractor, the IEC,

the SOR, EPD, the AFCD and the AMO as appropriate. The ET shall liaise with the relevant parties on the exact number of copies required.

12.4.1.2 The baseline monitoring reports for both the construction and operational phases

12.4.1.2 The baseline monitoring reports for both the construction and operational phases shall include at least the following:

i) Up to half a page executive summary.

ii) Background information.

iii) Drawings showing locations of the baseline monitoring stations.

iv) An updated construction programme with milestones of environmental protection/mitigation activities annotated.

v) Monitoring results (in both hard and diskette copies) together with the following information:

- monitoring methodology;
- name of laboratory and equipment used and calibration details;
- parameters monitored;
- monitoring locations (and depth);
- monitoring date, time, frequency and duration; and
- QA/QC results and detection limits.

vi) Details on influencing factors, including:

- major activities, if any, being carried out on the site during the period;
- weather conditions during the period; and
- other factors which might affect the results.

vii) Determination of the Action and Limit Levels for each monitoring parameter and statistical analysis of the baseline data.

viii) Revisions for inclusion in the EM&A Manual. (ix) Comments and conclusions.

12.5 EM&A Reports

12.5.1.1 The results and findings of all construction phase EM&A work required in this

Manual shall be recorded in the EM&A Reports prepared by the ET on a monthly basis and endorsed by the IEC. The EM&A Reports shall be prepared and submitted within 10 working days of the end of each reporting month, with the first report due one month and 10 days after construction commences.

12.5.1.2 A maximum of 4 copies of each EM&A Report shall be submitted to each of the following parties: the Contractor, the IEC, the SOR, EPD, the AFCD, the AMO and the PlanD, as appropriate. Before submission of the first EM&A Report, the ET shall liaise with the parties on the exact number of copies and format of the reports in both hard copy and electronic medium.

12.5.1.3 Not applicable

12.5.1.4 The ET shall review the monitoring programme every 6 months or on an as needed basis in order to cater for any changes in the surrounding environment and nature of works in progress and shall document all observations in the monthly/bi-monthly reports.

12.6 First EM&A Report

12.6.1.1 The first EM&A report for both the construction and operational phases shall include at least the following:

i) 1-2 pages executive summary, comprising:
- Breaches of AL levels;
- complaint Log;
- notifications of any summons and successful prosecutions;
- reporting Changes; and
- future key issues.

ii) Basic Project information including a synopsis of the Project organisation (including key personnel, contact names and telephone numbers), a drawing of the Project area showing the environmentally sensitive receivers and the locations of monitoring and control stations, programme, management structure and the work undertaken during the month.

iii) Environmental Status, comprising:

- works undertaken during the month with illustrations (such as location of works, daily dredging/filling rates, percentage fines in the fill material used); and

- drawing showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations.

iv) A brief summary of EM&A requirements including:

- all monitoring parameters;
- environmental quality performance limits (Action and Limit levels);
- Event-Action Plans;
- environmental mitigation measures, as recommended in the Project EIA study final report; and
- environmental requirements in contract documents.

v) Advice on the implementation status of environmental protection and pollution control/mitigation measures as recommended in the Project EIA study report and summarised in the updated implementation schedule.

vi) Monitoring results (in both hard and diskette copies) together with the following information:

- monitoring methodology;
- name of laboratory and equipment used and calibration details;
- parameters monitored;
- monitoring locations (and depth);
- monitoring date, time, frequency, and duration; and
- QA/QC results and detection limits.

vii) Graphical plots of trends of monitored parameters at the representative monitoring stations annotated against the following:

- major activities being carried out on site during the period;
- weather conditions during the period; and
- any other factors which might affect the monitoring results;
- QA/QC results and detection limits.

viii) Advice on the solid and liquid waste management status.

ix) A summary of noncompliance (exceedances) of the environmental quality performance limits (Action and Limit levels).

x) A review of the reasons for and the implications of noncompliance including a review of pollution sources and working procedures.

xi) A description of the actions taken in the event of noncompliance and deficiency reporting and any follow-up procedures related to earlier noncompliance.

xii) A summary record of all complaints received (written or verbal) for each media, including locations and nature of complaints, liaison and consultation undertaken, actions and follow-up procedures taken and summary of complaints.

xiii) A summary of notifications of summons, successful prosecutions for breaches of environmental protection/pollution control legislation and actions to rectify such breaches.

xiv) An account of the future key issues as assessed from the works programme and work method statements.

xv) Advice on the solid and liquid waste management status.

xvi) Comments, recommendations and conclusions for the monitoring period.

xvii) Submission of implementation status proforma, proactive environmental protection proforma, regulatory compliance proforma, site inspection proforma, data recovery schedule and complaint log summarizing the EM&A of the period.

12.7 Subsequent EM&A Reports

12.7.1.1 The subsequent EM&A reports prepared by the ES for both the construction and operational phases shall include the following:

i) Title page.

ii) Executive summary (1-2 pages), including:

- breaches of all Action and Limit levels;
- complaint log;
- notifications of any summons and successful prosecutions;
- reporting changes; and
- future key issues.

iii) Contents page.

iv) Environmental status, comprising:

- drawing showing the Project area, any environmental sensitive receivers and the locations of the monitoring and control stations;

- summary of non-compliance with the environmental quality performance limits; and

- summary of complaints.

v) Environmental issues and actions, comprising:

- review issues carried forward and any follow-up procedures related to earlier non-compliance (complaints and deficiencies);

- description of the actions taken in the event of noncompliance and deficiency reporting;

- recommendations (should be specific and target the appropriate party for action); and

- implementation status of the mitigatory measures and the corresponding effectiveness of the measures.

vi) Future key issues.

vii) Appendices, including:

- action and limit levels;

- graphical plots of trends of monitored parameters at key stations over the past four reporting periods for representative monitoring stations annotated against the following: major activities being carried out on site during the period; weather conditions during the period and any other factors which might affect the monitoring results;

- monitoring schedule for the present and next reporting period;

- cumulative complaints statistics; and

- details of complaints, outstanding issues and deficiencies.

12.8 Quarterly EM&A Summary Reports

12.8.1.1 The ET shall submit Quarterly EM&A Summary Reports for the construction phase EM&A works only. These reports should be around 5 pages (including about three pages of text and tables and two pages of figures) and shall contain at minimum the following information:

i) Up to half a page executive summary.

ii) Basic Project information including a synopsis of the Project organisation,

programme, contacts of key management, and a synopsis of work undertaken during the quarter.

iii) A brief summary of EM&A requirements including:

- monitoring parameters;
- environmental quality performance limits (Action and Limit levels); and
- environmental mitigation measures, as recommended in the Project EIA study final report.

iv) Advice on the implementation status of environmental protection and pollution control/mitigation measures as recommended in the Project EIA study report and summarised in the updated implementation schedule.

v) Drawings showing the Project area, any environmental sensitive receivers and the locations of the monitoring and control stations.

vi) Graphical plots of the trends of monitored parameters over the past 4 months (the last month of the previous quarter and the present quarter) for representative monitoring stations annotated against:

- the major activities being carried out on site during the period;
- weather conditions during the period; and
- any other factors which might affect the monitoring results.

vii) Advice on the solid and liquid waste management status.

viii) A summary of noncompliance (exceedances) of the environmental quality performance limits (Action and Limit levels).

ix) A brief review of the reasons for and the implications of non-compliance including review of pollution sources and working procedures.

x) An assessment of the construction impacts on suspended solids, including but not limited to, a comparison of the difference between the quarterly mean and the 1.3 times the ambient mean value, the latter being defined as a 30% increase of the baseline data or EPD data, using appropriate statistical procedures. Suggestions of appropriate mitigation measures shall be made if the quarterly assessment analytical results demonstrate that the quarterly mean is significantly higher than the 1.3 ambient mean value ($p<0.05$).

xi) A summary description of the actions taken in the event of non- compliance and any follow-up procedures related to earlier non- compliance.

xii) A summary record of all complaints received (written or verbal) for each media,

liaison and consultation undertaken, actions and follow-up procedures taken.

xiii) Comments (e.g. effectiveness and efficiency of the mitigation measures), recommendations (e.g. any improvement in the EM&A programme) and conclusions for the quarter.

xiv) Proponents' contacts and any hotline telephone number for the public to make enquiries.

12.9 Annual/Final EM&A Review Reports

12.9.1.1 An annual EM&A report should be prepared by the ET at the end of each construction year during the course of the project. A final EM&A report should be prepared by the ET at the end of both the construction and operational phases. The annual/final EM&A reports should contain at least the following information:

i) Executive Summary (1-2 pages).

ii) Drawings showing the project area any environmental sensitive receivers and the locations of the monitoring and control stations.

iii) Basic project information including a synopsis of the project organization, contacts for key management staff and a synopsis of work undertaken during the course of the project or past twelve months.

iv) A brief summary of EM&A requirements including:

- environmental mitigation measures as recommended in the project EIA study final report;
- environmental impact hypotheses tested;
- environmental quality performance limits (Action and Limit Levels);
- all monitoring parameters; and
- Event-Action Plans.

v) A summary of the implementation status of environmental protection and pollution control/mitigation measures as recommended in the project EIA study report and summarised in the updated implementation schedule.

vi) Graphical plots and the statistical analysis of the trends of monitored parameters over the course of the projects including the post-project monitoring (or the past twelve months for annual reports) for all monitoring stations annotated against the following:

- the major activities being carried out on site during the period;

- weather conditions during the period;
- any other factors which might affect the monitoring results; and
- the return of ambient environmental conditions in comparison with baseline data.

vii) A summary of noncompliance (exceedances) of the environmental quality performance limits (Action and Limit levels).

viii) A review of the reasons for and the implications of non-compliance including review of pollution sources and working procedures as appropriate.

ix) A description of the actions taken in the event of non-compliance.

x) A summary record of all complaints received (written or verbal) for each media, liaison and consultation undertaken, actions and follow-up procedures taken.

xi) A summary record of notifications of summonses and successful prosecutions for breaches of the current environmental protection/pollution control legislations, locations and nature of the breaches investigation, follow-up actions taken and results.

xii) A comparison of the EM&A data with the EIA predictions with annotations and explanations for any discrepancies, including a review of the validity of EIA predictions and identification of shortcomings in the EIA recommendations.

xiii) A review of the monitoring methodology adopted and with the benefit of hindsight, comment on its effectiveness, including cost effectiveness;

xiv) A review of the success of the EM&A programme, including a review of the effectiveness and efficiency of the mitigation measures, and recommendations for any improvements in the EM&A programme.

xv) A clear cut statement on the environmental acceptability of the project with reference to specific impact hypotheses and a conclusion to state the return to ambient and/or the predicted scenario as the EIA findings.

12.10 Data Keeping

12.10.1.1 The site documents such as the monitoring field records, laboratory analysis records, site inspection forms, etc. are not required to be included in the EM&A Reports for submission. However, the documents shall be kept by the ET and be ready for inspection upon request. All relevant information shall be clearly and systematically recorded in the documents. The monitoring data shall also be recorded in magnetic media, and the software copy shall be available upon request. All the documents and data shall be kept for at least one year after the completion

of the operational phase EM&A works.

12.11 Interim Notifications of Environmental Quality Limit Exceedances

12.11.1.1 With reference to Event/Action Plans, when the environmental quality limits are exceeded, the ET shall immediately notify the Contractor, the SOR, EPD and the AFCD as appropriate. The notification shall be followed up with advice to each party on the results of the investigation, proposed action and success of the action taken, with any necessary follow-up proposals. A sample template for the interim notifications is shown in **Figure 12.1.**

Appendix A

Environmental Mitigation and Enhancement Measure Implementation Schedules

(Adopted from: CINOTECH (2011) Agreement No. CE35/2011 EP Baseline Environmental Monitoring for Hong Kong-Zhuhai-Macao BridgeTuen Mun-Chep Lap Kok Link – Investigation. UpdatedEM&A Manual for Tuen Mun-Chek Lap Kok Link)

Contract No. HY/2012/07
Tuen Mun – Chek Lap Kok Link
Southern Connection Viaduct Section
Environmental Mitigation and Enhancement Measure Implementation Schedule

EIA Reference	EM&A Manual Reference	Environmental Protection Measures	Location/ Timing	Implementation Agent	Relevant Standard or Requirement	Implementation Stages			Maintenance Agency
						D	C	O	
AIR QUALITY									
4.8.1	3.8	An effective watering programme of twice daily watering with complete coverage, is estimated to reduce by 50%. This is recommended for all areas in order to reduce dust levels to a minimum;	All areas / throughout construction period	Contractor	TMEIA Avoid smoke impacts and disturbance		Y		n/a
4.8.1	3.8	The Contractor shall, to the satisfaction of the Engineer, install effective dust suppression measures and take such other measures as may be necessary to ensure that at the Site boundary and any nearby sensitive receiver, dust levels are kept to acceptable levels.	All areas / throughout construction period	Contractor	TMEIA Avoid dust generation		Y		n/a
4.8.1	3.8	The Contractor shall not burn debris or other materials on the works areas.	All areas / throughout construction period	Contractor	TMEIA Avoid dust generation		Y		n/a
4.8. 1	3.8	In hot, dry or windy weather, the watering programme shall maintain all exposed road surfaces and dust sources wet.	All unpaved haul roads / throughout construction period in hot, dry or windy weather	Contractor	TMEIA Avoid smoke impacts and disturbance		Y		n/a
4.8.1	3.8	Where breaking of oversize rock/concrete is required, watering shall be implemented to control dust. Water spray shall be used during the handling of fill material at the site and at active cuts, excavation and fill sites where dust is likely to be created.	All areas / throughout construction period	Contractor	TMEIA Avoid dust generation		Y		n/a
4.8. 1	3.8	Open dropping heights for excavated materials shall be controlled to a maximum height of 2m to minimise the fugitive dust arising from unloading.	All areas / throughout construction period	Contractor	TMEIA Avoid dust generation		Y		n/a
4.8.1	3.8	During transportation by truck, materials shall not be loaded to a level higher than the side and tail boards, and	All areas / throughout construction period	Contractor	TMEIA Avoid dust generation		Y		n/a

EIA Reference	EM&A Manual Reference	Environmental Protection Measures	Location/ Timing	Implementation Agent	Relevant Standard or Requirement	Implementation Stages			Maintenance Agency
						D	C	O	
		shall be dampened or covered before transport.							
4.8.1	3.8	Materials having the potential to create dust shall not be loaded to a level higher than the side and tail boards, and shall be covered by a clean tarpaulin. The tarpaulin shall be properly secured and shall extend at least 300mm over the edges of the side and tail boards.	All areas / throughout construction period	Contractor	TMEIA Avoid dust generation		Y		n/a
4.8.1	3.8	No earth, mud, debris, dust and the like shall be deposited on public roads. Wheel washing facility shall be usable prior to any earthworks excavation activity on the site.	All site exits / throughout construction period	Contractor	TMEIA Avoid dust		Y		n/a
4.8.1	3.8	Areas of exposed soil shall be minimised to areas in which works have been completed shall be restored as soon as is practicable.	All exposed surfaces / throughout construction period	Contractor	TMEIA Avoid dust generation		Y		n/a
4.8.1	3.8	All stockpiles of aggregate or spoil shall be enclosed or covered and water applied in dry or windy condition.	All areas / throughout construction period	Contractor	TMEIA Avoid dust generation		Y		n/a
4.11	Section 3	EM&A in the form of 1 hour and 24 hour dust monitoring and site audit	All representative existing ASRs / throughout construction period	Contractor	EM&A Manual		Y		n/a
NOISE									
5.11	Section 4	Noise monitoring	All existing representative sensitive receivers / during North Lantau Viaduct construction	Contractor	EM&A Manual		Y		n/a
WATER QUALITY									
General Marine Works									
6.10	-	Bored piling to be undertaken within a metal casing.	Marine viaducts of TM-CLKL and HKLR/ bored piling	Contractor	TM-EIAO		Y		n/a
6.10	-	Barges and hopper dredgers shall have tight fitting seals to their bottom openings to prevent leakage of material.	All areas/ throughout construction period	Contractor	Marine Fill Committee Guidelines. DASO		Y		n/a

EIA Reference	EM&A Manual Reference	Environmental Protection Measures	Location/ Timing	Implementation Agent	Relevant Standard or Requirement	Implementation Stages			Maintenance Agency
						D	C	O	
					permit conditions.				
6.10	-	Any pipe leakages shall be repaired quickly. Plant should not be operated with leaking pipes.	All areas/ throughout construction period	Contractor	Marine Fill Committee Guidelines. DASO permit conditions.		Y		n/a
6.10	-	Loading of barges and hoppers shall be controlled to prevent splashing of dredged material to the surrounding water. Barges or hoppers shall not be filled to a level which will cause overflow of materials or pollution of water during loading or transportation.	All areas/ throughout construction period	Contractor	Marine Fill Committee Guidelines. DASO permit conditions.		Y		n/a
6.10	-	Excess material shall be cleaned from the decks and exposed fittings of barges and hopper dredgers before the vessel is moved	All areas/ throughout construction period	Contractor	Marine Fill Committee Guidelines. DASO permit conditions.		Y		n/a
6.10	-	Adequate freeboard shall be maintained on barges to reduce the likelihood of decks being washed by wave action;	All areas/ throughout construction period	Contractor	Marine Fill Committee Guidelines. DASO permit conditions.		Y		n/a
6.10	-	All vessels shall be sized such that adequate clearance is maintained between vessels and the sea bed at all states of the tide to ensure that undue turbidity is not generated by turbulence from vessel movement or propeller wash.	All areas/ throughout construction period	Contractor	Marine Fill Committee Guidelines. DASO permit conditions.		Y		n/a
6.10	-	The works shall not cause foam, oil, grease, litter or other objectionable matter to be present in the water within and adjacent to the works site.	All areas/ throughout construction period	Contractor	Marine Fill Committee Guidelines. DASO permit conditions.		Y		n/a
Temporary Staging work									
	5.2	Regular inspection for the accumulation of floating refuse and collection of floating refuse if required	During temporary staging works	Contractor			Y		n/a
	5.2	Provision of temporary drainage system on the temporary staging for collection of construction site runoff to allow appropriate treatment before discharge into the sea	During temporary staging works	Contractor			Y		n/a
	5.2	Wastewater generated from construction works such as bored / drilling water will be collected, treated, neutralized and de-silted through silt trap or sedimentation tank before disposal	During temporary staging works	Contractor			Y		n/a

EIA Reference	EM&A Manual Reference	Environmental Protection Measures	Location/ Timing	Implementation Agent	Relevant Standard or Requirement	Implementation Stages			Maintenance Agency
						D	C	O	
	5.2	One additional water quality monitoring station is proposed at station SR4a In case elevated SS or turbidity is identified during the water quality monitoring, the source of pollution will be tracked down and be removed as soon as possible. In case depletion of dissolved oxygen is identified, artificial aeration will be arranged at the monitoring station SR4a,	During temporary staging works	Contractor			Y		n/a
Land Works									
6.10	-	Wastewater from temporary site facilities should be controlled to prevent direct discharge to surface or marine waters.	All areas/ throughout construction period	Contractor	TM-EIAO		Y		n/a
6.10	-	Sewage effluent and discharges from on- site kitchen facilities shall be directed to Government sewer in accordance with the requirements of the WPCO or collected for disposal offsite. The use of soakaways shall be avoided.	All areas/ throughout construction period	Contractor	TM-EIAO		Y		n/a
6.10	-	Storm drainage shall be directed to storm drains via adequately designed sand/silt removal facilities such as sand traps, silt traps and sediment basins. Channels, earth bunds or sand bag barriers should be provided on site to properly direct stormwater to such silt removal facilities. Catchpits and perimeter channels should be constructed in advance of site formation works and earthworks.	All areas/ throughout construction period	Contractor	TM-EIAO		Y		n/a
6.10	-	Silt removal facilities, channels and manholes shall be maintained and any deposited silt and grit shall be removed regularly, including specifically at the onset of and after each rainstorm.	All areas/ throughout construction period	Contractor	TM-EIAO		Y		n/a
6.10	-	Temporary access roads should be surfaced with crushed stone or gravel.	All areas/ throughout construction period	Contractor	TM-EIAO		Y		n/a
6.10	-	Rainwater pumped out from trenches or foundation excavations should be discharged into storm drains via silt removal facilities.	All areas/ throughout construction period	Contractor	TM-EIAO		Y		n/a
6.10	-	Measures should be taken to prevent the washout of construction materials, soil, silt or debris into any drainage	All areas/ throughout construction period	Contractor	TM-EIAO		Y		n/a

EIA Reference	EM&A Manual Reference	Environmental Protection Measures	Location/ Timing	Implementation Agent	Relevant Standard or Requirement	Implementation Stages			Maintenance Agency
						D	C	O	
		system.							
6.10	-	Open stockpiles of construction materials (e.g. aggregates and sand) on site should be covered with tarpaulin or similar fabric during rainstorms.	All areas/ throughout construction period	Contractor	TM-EIAO		Y		n/a
6.10	5.8	Manholes (including any newly constructed ones) should always be adequately covered and temporarily sealed so as to prevent silt, construction materials or debris from getting into the drainage system, and to prevent storm run-off from getting into foul sewers.	All areas/ throughout construction period	Contractor	TM-EIAO		Y		n/a
6.10	-	Discharges of surface run-off into foul sewers must always be prevented in order not to unduly overload the foul sewerage system.	All areas/ throughout construction period	Contractor	TM-EIAO		Y		n/a
6.10	-	All vehicles and plant should be cleaned before they leave the construction site to ensure that no earth, mud or debris is deposited by them on roads. A wheel washing bay should be provided at every site exit.	All areas/ throughout construction period	Contractor	TM-EIAO		Y		n/a
6.10	-	Wheel wash overflow shall be directed to silt removal facilities before being discharged to the storm drain.	All areas/ throughout construction period	Contractor	TM-EIAO		Y		n/a
6.10	-	Section of construction road between the wheel washing bay and the public road should be surfaced with crushed stone or coarse gravel.	All areas/ throughout construction period	Contractor	TM-EIAO		Y		n/a
6.10	-	Wastewater generated from concreting, plastering, internal decoration, cleaning work and other similar activities, shall be screened to remove large objects.	All areas/ throughout construction period	Contractor	TM-EIAO		Y		n/a
6.10	-	Vehicle and plant servicing areas, vehicle wash bays and lubrication facilities shall be located under roofed areas. The drainage in these covered areas shall be connected to foul sewers via a petrol interceptor in accordance with the requirements of the WPCO or collected for off site disposal.	All areas/ throughout construction period	Contractor	TM-EIAO		Y		n/a
6.10	-	The Contractor shall prepare an oil / chemical cleanup plan and ensure that leakages or spillages are contained and cleaned up immediately.	All areas/ throughout construction period	Contractor	TM-EIAO		Y		n/a
6.10	-	Waste oil should be collected and stored for recycling or disposal, in accordance with the Waste Disposal	All areas/ throughout	Contractor	TM-EIAO Waste		Y		n/a

EIA Reference	EM&A Manual Reference	Environmental Protection Measures	Location/ Timing	Implementation Agent	Relevant Standard or Requirement	Implementation Stages			Maintenance Agency
						D	C	O	
		Ordinance.	construction period		Disposal Ordinance				
6.10	-	All fuel tanks and chemical storage areas should be provided with locks and be sited on sealed areas. The storage areas should be surrounded by bunds with a capacity equal to 110% of the storage capacity of the largest tank.	All areas/ throughout construction period	Contractor	TM-EIAO		Y		n/a
6.10	-	Surface run-off from bunded areas should pass through oil/grease traps prior to discharge to the stormwater system.	All areas/ throughout construction period	Contractor	TM-EIAO		Y		n/a
6.10	-	Roadside gullies to trap silt and grit shall be provided prior to discharging the stormwater into the marine environment. The sumps will be maintained and cleaned at regular intervals.	Roadside/design and operation	Design Consultant/ Contractor	TM-EIAO	Y		Y	n/a
6.10	Section 5	All construction works shall be subject to routine audit to ensure implementation of all EIA recommendations and good working practice.	All areas/ throughout construction period	Contractor	EM&A Manual		Y		n/a
Water Quality Monitoring									
6.10	Section 5	Water quality monitoring shall be undertaken for suspended solids, turbidity, and dissolved oxygen. Nutrients and metal parameters shall also be measured for Mf sediment operations (only HKBCF and HKLR required handling of Mf sediment) during baseline, backfilling and post construction period. One year operation phase water quality monitoring at designated stations	Designated monitoring stations as defined in EM&A Manual, Section 5/ Before, through-out marine construction period, post construction and monthly operational phase water quality monitoring for a year.	Contractor	EM&A Manual		Y	Y	n/a
ECOLOGY									
8.14	6.3	Specification for and implement pre, during and post construction dolphin abundance monitoring.	All Areas/Detailed Design/ during construction works/post construction	Design Consultant/ Contractor	TMEIA	Y	Y	Y	n/a
8.14	6.3	Specification for bored piling monitoring	Detailed Design	Design Consultant	TMEIA	Y			n/a

EIA Reference	EM&A Manual Reference	Environmental Protection Measures	Location/ Timing	Implementation Agent	Relevant Standard or Requirement	Implementation Stages			Maintenance Agency
						D	C	O	
8.14	6.3	Implement any recommendations of the bored piling monitoring	Southern marine viaduct/Throughout construction during bored piling	Contractor	TMEIA		Y		n/a
8.14	6.3,6.5	Avoidance of peak CWD calving season in May and June for driving of metal caissons during bored piling works	Southern marine viaduct/ May and June during bored piling	Contractor	TMEIA		Y		n/a
8.14	6.3,6.5	Specification and implementation of 250m dolphin exclusion zone.	All marine bored piling and temporary staging works areas/Detailed Design/during all marine bored piling and temporary staging works	Design Consultant/ Contractor	TMEIA	Y	Y		n/a
8.15	6.3, 6.5	Specification and deployment of an artificial reef of an area of 3,600m2 in an area where fishing activities are prohibited.	Area of prohibited fishing activities/Detailed Design/towards end of construction period	TM-CLKL/ HKBCF Design Consultant/ TM-CLKL/ HKBCF Contractor	TMEIA	Y		Y	AFCD
8.14	6.3, 6.5	Specification and implementation of marine vessel control specifications	All areas/Detailed Design/during construction works	Design Consultant/ Contractor	TMEIA	Y	Y		n/a
8.14	6.3, 6.5	Design and implementation of acoustic decoupling methods for marine bored piling and the whole lifespan of temporary staging works.	All areas/ Detailed Design/during marine bored piling and temporary staging works	Design Consultant/ Contractor	TMEIA	Y	Y		n/a
8.15	6.3, 6.4	Pre-construction phase survey and coral translocation	Tai Ho Wan (donar site) and Yam Tsui Wan (receptor site) /Detailed Design/Prior to construction	Design Consultant/ Contractor	TMEIA	Y	Y		n/a
8.15	6.5	Audit coral translocation success	Yam Tsui Wan (receptor site)/Post translocation	Contractor	TMEIA		Y		n/a

EIA Reference	EM&A Manual Reference	Environmental Protection Measures	Location/ Timing	Implementation Agent	Relevant Standard or Requirement	Implementation Stages			Maintenance Agency
						D	C	O	
7.13	6.5	Undertaken gabion wall works in Stream NL1 in the dry season	North Lantau slope works/dry season/construction phase	Contractor	TMEIA		Y		n/a
7.13	6.5	The loss of habitat shall be supplemented by enhancement planting in accordance with the landscape mitigation schedule.	All areas / As soon as accessible	Contractor	TMEIA		Y		AFCD/LCSD
7.13	6.5	Spoil heaps shall be covered at all times.	All areas / Throughout construction period	Contractor	TMEIA		Y		n/a
7.13	6.5	Avoid damage and disturbance to the remaining and surrounding natural habitat	All areas / Throughout construction period	Contractor	TMEIA		Y		n/a
7.13	6.5	Placement of equipment in designated areas within the existing disturbed land	All areas / Throughout construction period	Contractor	TMEIA		Y		n/a
7.13	6.5	Disturbed areas to be reinstated immediately after completion of the works.	All areas / Throughout construction period	Contractor	TMEIA		Y		n/a
7.13	6.5	Construction activities should be restricted to the proposed works boundary	All areas / Throughout construction period	Contractor	TMEIA		Y		n/a
LANDSCAPE AND VISUAL									
10.9	7.6	Round angle, patterned finishes, and oval shaped pier were considered in the viaduct design, and further details will be developed under ACABAS submission (DM3)	All areas/detailed design	Design Consultant	TMEIA	Y			n/a
10.9	7.6	Details of the street furniture will be developed in the detailed design stage (DM4)	All areas/detailed design	Design Consultant	TMEIA	Y			n/a
10.9	7.6	Aesthetic design of the viaduct, retaining wall and other structures will be developed under ACABAS submission (DM5)	All areas/detailed design	Design Consultant	TMEIA	Y			n/a
10.9	7.6	Existing trees on boundary of the Project Area shall be carefully protected during construction. Detailed Tree Protection Specification shall be provided in the Contract Specification. Under this specification, the Contractor shall be required to submit, for approval, a detailed working method statement for the protection of trees	All areas/detailed design/ during construction	Design Consultant/ Contractor	TMEIA	Y	Y		n/a

EIA Reference	EM&A Manual Reference	Environmental Protection Measures	Location/ Timing	Implementation Agent	Relevant Standard or Requirement	Implementation Stages			Maintenance Agency
						D	C	O	
		prior to undertaking any works adjacent to all retained trees, including trees in contractor's works areas. (Tree protection measures will be detailed at Tree Removal Application stage) (CM1)							
10.9	7.6	Trees unavoidably affected by the works shall be transplanted where practical. Trees will be transplanted straight to their final receptor site and not held in a temporary nursery. A detailed Tree Transplanting Specification shall be provided in the Contract Specification. Sufficient time for necessary tree root and crown preparation periods shall be allowed in the project programme (CM2)	All areas/detailed design/ during construction	Design Consultant/ Contractor	TMEIA	Y	Y		n/a
10.9	7.6	Hillside and roadside screen planting to proposed roads, associated structures and slope works (CM3).	All areas/detailed design/ during construction/post construction	Design Consultant/	TMEIA	Y	Y		n/a
10.9	7.6	Hydroseeding or sheeting of soil stockpiles with visually unobtrusive material (in earth tone) (CM4)	All areas/detailed design/ during construction/post construction	Design Consultant/ Contractor	TMEIA	Y	Y		n/a
10.9	7.6	Screening of construction works by hoardings around works area in visually unobtrusive colours, to screen works (CM5)	All areas/detailed design/ during construction/post construction	Design Consultant/ Contractor	TMEIA	Y	Y		n/a
10.9	7.6	Control night-time lighting and glare by hooding all lights (CM6)	All areas/detailed design/ during construction	Design Consultant/ Contractor	TMEIA	Y	Y		n/a
10.9	7.6	Ensure no run-off into water body adjacent to the Project Area (CM7)	All areas/detailed design/ during construction	Design Consultant/ Contractor	TMEIA	Y	Y		n/a
10.9	7.6	Avoidance of excessive height and bulk of buildings and structures (CM8)	All areas/detailed design/ during construction	Design Consultant/ Contractor	TMEIA	Y	Y		n/a

EIA Reference	EM&A Manual Reference	Environmental Protection Measures	Location/ Timing	Implementation Agent	Relevant Standard or Requirement	Implementation Stages			Maintenance Agency
						D	C	O	
10.9	7.6	Recycle/Reuse all felled trees and vegetation, e.g. mulching (CM9)	All areas/detailed design/ during construction	Design Consultant/ Contractor	TMEIA	Y	Y		n/a
10.9	7.6	Compensatory tree planting shall be provided to the satisfaction of relevant Government departments. Required numbers and locations of compensatory trees shall be determined and agreed separately with Government during the Tree Felling Application process under ETWBTC 3/2006 (CM10).	All areas/detailed design/ during construction	Design Consultant/ Contractor	TMEIA	Y	Y		n/a
10.9	7.6	Re-vegetation of affected woodland/shrubland with native species (OM1)	All areas/detailed design/ during construction/ during operation	Design Consultant/ Contractor	TMEIA	Y	Y	Y	AFCD/HyD/ L CSD
10.9	7.6	Tall buffer screen tree / shrub / climber planting should be incorporated to soften hard engineering structures and facilities (OM2)	All areas/detailed design/ during construction/ during operation	Design Consultant/ Contractor	TMEIA	Y	Y	Y	HyD/LCSD
10.9	7.6	Streetscape elements (e.g. paving, signage, street furniture, lighting etc.) shall be sensitively designed in a manner that responds to the local context, and minimises potential negative landscape and visual impacts. Lighting units should be directional and minimise unnecessary light spill (OM3)	All areas/detailed design/ during construction / during operation	Design Consultant/ Contractor	TMEIA	Y	Y	Y	HyD/LCSD
10.9	7.6	Structure, ornamental tree / shrub / climber planting should be provided along roadside amenity strips, central dividers and newly formed slopes to enhance the townscape quality and further greenery enhancement (OM4)	All areas/detailed design/ during construction / during operation	Design Consultant/ Contractor	TMEIA	Y	Y	Y	HyD/LCSD
10.9	7.6	Aesthetically pleasing design (visually unobtrusive and non-reflective) as regard to the form, material and finishes	All areas/detailed design/ during construction / during operation	Design Consultant/ Contractor	TMEIA	Y	Y	Y	HyD
WASTE									

EIA Reference	EM&A Manual Reference	Environmental Protection Measures	Location/ Timing	Implementation Agent	Relevant Standard or Requirement	Implementation Stages			Maintenance Agency
						D	C	O	
12.6		The Contractor shall identify a coordinator for the management of waste.	Contract mobilisation	Contractor	TMEIA		Y		n/a
12.6		The Contractor shall prepare and implement a Waste Management Plan which specifies procedures such as a ticketing system, to facilitate tracking of loads and to ensure that illegal disposal of wastes does not occur, and protocols for the maintenance of records of the quantities of wastes generated, recycled and disposed. A recording system for the amount of waste generated, recycled and disposed (locations) should be established.	Contract mobilisation	Contractor	TMEIA, Works Branch Technical Circular No. 5/99 for the Trip-ticket System for Disposal of Construction and Demolition Material		Y		n/a
12.6		The Contractor shall apply for and obtain the appropriate licenses for the disposal of public fill, chemical waste and effluent discharges.	Contract mobilisation	Contractor	TMEIA, Land (Miscellaneous Provisions) Ordinance (Cap 28); Waste Disposal Ordinance (Cap 354); Dumping at Sea Ordinance (Cap 466); Water Pollution Control Ordinance.		Y		n/a
12.6	8.1	Training shall be provided to workers about the concepts of site cleanliness and appropriate waste management procedures including waste reduction, reuse and recycling.	Contract Mobilisation	Contractor	TMEIA		Y		n/a
12.6	8.1	The extent of cutting operation should be optimised where possible. Earth retaining structures and bored pile walls should be proposed to minimise the extent of cutting.	All areas / throughout construction period	Contractor	TMEIA		Y		n/a
12.6	8.1	Rock armour from the existing seawall should be reused on the new sloping seawall as far as possible	All areas / throughout construction period	Contractor	TMEIA		Y		n/a
12.6	8.1	The site and surroundings shall be kept tidy and litter free.	All areas / throughout	Contractor	TMEIA		Y		n/a

EIA Reference	EM&A Manual Reference	Environmental Protection Measures	Location/ Timing	Implementation Agent	Relevant Standard or Requirement	Implementation Stages			Maintenance Agency
						D	C	O	
			construction period						
12.6	8.1	No waste shall be burnt on site.	All areas / throughout construction period	Contractor	TMEIA		Y		n/a
12.6	8.1	Provisions to be made in contract documents to allow and promote the use of recycled aggregates where appropriate.	Detailed Design	Design Consultant	TMEIA	Y			n/a
12.6	8.1	The Contractor shall be prohibited from disposing of C&D materials at any sensitive locations. The Contractor should propose the final disposal sites in the EMP and WMP for approval before implementation.	All areas / throughout construction period	Contractor	TMEIA		Y		n/a
12.6	8.1	Stockpiled material shall be covered by tarpaulin and /or watered as appropriate to prevent windblown dust/ surface run off.	All areas / throughout construction period	Contractor	TMEIA		Y		n/a
12.6	8.1	Excavated material in trucks shall be covered by tarpaulins to reduce the potential for spillage and dust generation.	All areas / throughout construction period	Contractor	TMEIA		Y		n/a
12.6	8.1	Wheel washing facilities shall be used by all trucks leaving the site to prevent transfer of mud onto public roads.	All areas / throughout construction period	Contractor	TMEIA		Y		n/a
12.6	8.1	Standard formwork or pre-fabrication should be used as far as practicable so as to minimise the C&D materials arising. The use of more durable formwork/plastic facing for construction works should be considered. The use of wooden hoardings should be avoided and metal hoarding should be used to facilitate recycling. Purchasing of construction materials should avoid over-ordering and wastage.	All areas / throughout construction period	Contractor	TMEIA		Y		n/a
12.6	8.1	The Contractor should recycle as many C&D materials (this is a waste section) as possible on-site. The public fill and C&D waste should be segregated and stored in separate containers or skips to facilitate the reuse or recycling of materials and proper	All areas / throughout construction period	Contractor	TMEIA		Y		n/a

EIA Reference	EM&A Manual Reference	Environmental Protection Measures	Location/ Timing	Implementation Agent	Relevant Standard or Requirement	Implementation Stages			Maintenance Agency
						D	C	O	
		disposal. Where practicable, the concrete and masonry should be crushed and used as fill materials. Steel reinforcement bar should be collected for use by scrap steel mills. Different areas of the sites should be considered for segregation and storage activities.							
12.6	8.1	All falsework will be steel instead of wood.	All areas / throughout construction period	Contractor	TMEIA		Y		n/a
12.6	8.1	Chemical waste producers should register with the EPD. Chemical waste should be handled in accordance with the Code of Practice on the Packaging, Handling and Storage of Chemical Wastes as follows: - suitable for the substance to be held, resistant to corrosion, maintained in good conditions and securely closed; - Having a capacity of <450L unless the specifications have been approved by the EPD; and - Displaying a label in English and Chinese according to the instructions prescribed in Schedule 2 of the Regulations. Clearly labelled and used solely for the storage of chemical wastes; - Enclosed with at least 3 sides; - Impermeable floor and bund with capacity to accommodate 110% of the volume of the largest container or 20% by volume of the chemical waste stored in the area, whichever is greatest; - Adequate ventilation; - Sufficiently covered to prevent rainfall entering (water collected within the bund must be tested and disposed of as chemical waste, if necessary); and - Incompatible materials are adequately	All areas / throughout construction period	Contractor	TMEIA		Y		n/a

EIA Reference	EM&A Manual Reference	Environmental Protection Measures	Location/ Timing	Implementation Agent	Relevant Standard or Requirement	Implementation Stages			Maintenance Agency
						D	C	O	
		separated.							
12.6	8.1	Waste oils, chemicals or solvents shall not be disposed of to drain,	All areas / throughout construction period	Contractor	TMEIA		Y		n/a
12.6	8.1	Adequate numbers of portable toilets should be provided for on-site workers. Portable toilets should be maintained in reasonable states, which will not deter the workers from utilising them.	All areas / throughout construction period	Contractor	TMEIA		Y		n/a
12.6	8.1	Night soil should be regularly collected by licensed collectors.	All areas / throughout construction period	Contractor	TMEIA		Y		n/a
12.6	8.1	General refuse arising on-site should be stored in enclosed bins or compaction units separately from C&D and chemical wastes. Sufficient dustbins shall be provided for storage of waste as required under the Public Cleansing and Prevention of Nuisances By-laws. In addition, general refuse shall be cleared daily and shall be disposed of to the nearest licensed landfill or refuse transfer station. Burning of refuse on construction sites is prohibited.	All areas / throughout construction period	Contractor	TMEIA		Y		n/a
12.6	8.1	All waste containers shall be in a secure area on hardstanding;	All areas / throughout construction period	Contractor	TMEIA		Y		n/a
12.6	8.1	Training shall be provided to workers about the concepts of site cleanliness and appropriate waste management procedure, including waste reduction, reuse and recycling.	All areas / throughout construction period	Contractor	TMEIA		Y		n/a
12.6	8.1	Office wastes can be reduced by recycling of paper if such volume is sufficiently large to warrant collection. Participation in a local collection scheme by the Contractor should be advocated. Waste separation facilities for paper, aluminium cans, plastic bottles, etc should be provided on-site.	Site Offices/ throughout construction period	Contractor	TMEIA		Y		n/a

EIA Reference	EM&A Manual Reference	Environmental Protection Measures	Location/ Timing	Implementation Agent	Relevant Standard or Requirement	Implementation Stages			Maintenance Agency
						D	C	O	
12.6	Section 8	EM&A of waste handling, storage, transportation, disposal procedures and documentation through the site audit programme shall be undertaken.	All areas / throughout construction period	Contractor	EM&A Manual		Y		n/a
CULTURAL HERITAGE									
11.8	Section 9	EM&A in the form of audit of the mitigation measures	All areas / throughout construction period	Highways Department	EIAO-TM		Y		n/a

Notes:

Legend: D=Design, C=Construction, O=Operation

Note: Funding Agent for all mitigation measures will be the Highways Department of the Hong Kong SAR Government

Appendix B

Environmental Proformas

(Adopted from: CINOTECH (2011) Agreement No. CE35/2011 EP Baseline Environmental Monitoring for Hong Kong-Zhuhai-Macao Bridge
Tuen Mun-Chep Lap Kok Link – Investigation. Updated EM&A Manual for Tuen Mun-Chek Lap Kok Link)

Proforma for Construction Phase EM&A Programme

COMPLAINT LOG Ref: _____

Log Ref.	Date / Location	Complainant/ Date of Contract	Details of Complaint	Investigation / Mitigation Action	File Closed

Filed by Environmental Team Leader _____ Date: _____

0 IMPLEMENTATION SCHEDULE Ref: _____

EIA Ref*	EM&A Log Ref	Environmental Protection Measures*	Location/ Timing	Implementation Agent	Implementation Stages**			
					Des	C	O	Dec

* All recommendations and requirements resulted during the Course of EIA/EA Process, including ACE and / or accepted public comment to the proposed project

** Des- Design, C-Construction,O-Operation, Dec- Decommissioning

Signed by Project Proponent: _____ Date: _____

IMPLEMENTATION STATUS PROFORMA Ref: _____

Ref**	Environmental Protection Measures*	Implementation Status

* All recommendations and requirements resulted during the Course of EIA/EA Process, including ACE and / or accepted public comment to the proposed project

** EIA Ref / EM&A Log Ref / Design Document Ref

Signed by Environmental Team Leader _____ Date: _____

Audited by Independent Environment Checker _____ Date: _____

DATA RECOVERY SCHEDULE

Ref: _____

Date	Air Quality Monitoring									Noise Monitoring						
	Monitoring Station*									Monitoring Station*						
	A02	A06	A07	A21	A24	A34	A36	A40	A42	R2	R5	R7	R14	R16	R21	R24
1																
2																
3																
4																
5																
6																
7																
8																
9																
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24																
25																
26																
27																
28																
29																
30																
31																
% of R																

* Research type of parameters

% of R The percentage of Data Recovery is the natural monitoring over the scheduled monitoring

Signed by Environmental Team Leader _____ Date: _____

SITE INSPECTION PROFORMA Ref: _____

Date	Location	Req ≠ Ref.*	Observation / Deficiency	Mitigation Action** (Responsible Agency)	Date*** of Confirmation

* EIA Ref / EM&A Log Ref / Design Document Ref / Environmental Protection Contract Clause

** Specific Environmental Mitigation Measures should be stated, such as, equipment, processes, systems, practices or technologies

*** The required completion date to confirm the specified Environmental Protection Action

This Proforma is an:
Environmental Protection Instruction for _____ Date: _____

Signed by Environmental Team Leader _____ Date: _____

Copy to Independent Environmental Checker

PROACTIVE ENVIRONMENTAL PROTECTION PROFORMA Ref: _____

Ref*	Proposed Construction Method*	Location/ Working Period	Anticipated Impacts	Recommended Mitigation Measures

* EIA Ref / EM&A Log Ref / Design Ref

** Details of equipment, vehicles, plants, processes, technologies for the option of construction method

Signed by Environmental Team Leader _____ Date: _____

Audited by Independent Environment Checker _____ Date: _____

REGULATORY COMPLIANCE PROFORMA Ref: _____

Ref*	Environmental License / Permit*	Control Area / Facility / Location	Effective Date

* Name of Applicant, Business Corporation, relevant regulation and remark of license / permit conditions

** File reference of the licensee / permittee

Signed by Environmental Team Leader _____ Date: _____

Audited by Independent Environment Checker _____ Date: _____

Proforma for Construction Phase EM&A Programme

COMPLAINT LOG **Ref:** _____

Log Ref.	Date / Location	Complainant/ Date of Contract	Details of Complaint	Investigation / Mitigation Action	File Closed

Filed by Environmental Team Leader _____ Date: _____

0

IMPLEMENTATION SCHEDULE

Ref: _____

EIA Ref*	EM&A Log Ref	Environmental Protection Measures*	Location/ Timing	Implementation Agent	Implementation Stages**			
					Des	C	O	Dec

* *All recommendations and requirements resulted during the Course of EIA/EA Process, including ACE and / or accepted public comment to the proposed project*

** *Des- Design, C-Construction,O-Operation, Dec- Decommissioning*

Signed by Project Proponent: _____ Date: _____

IMPLEMENTATION STATUS PROFORMA

Ref: _____

Ref**	Environmental Protection Measures*	Implementation Status

* *All recommendations and requirements resulted during the Course of EIA/EA Process, including ACE and / or accepted public comment to the proposed project*

** *EIA Ref / EM&A Log Ref / Design Document Ref*

Signed by Environmental Team Leader _____ Date: _____

Audited by Independent Environment Checker _____ Date: _____

DATA RECOVERY SCHEDULE

Ref: _____

Date	Air Quality Monitoring									Noise Monitoring						
	Monitoring Station*									Monitoring Station*						
	A02	A06	A07	A21	A24	A34	A36	A40	A42	R2	R5	R7	R14	R16	R21	R24
1																
2																
3																
4																
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31																
% of R																

* *Research type of parameters*

% of R *The percentage of Data Recovery is the natural monitoring over the scheduled monitoring*

Signed by Environmental Team Leader _____ Date: _____

SITE INSPECTION PROFORMA **Ref:** _____

Date	Location	Req=t Ref.*	Observation / Deficiency	Mitigation Action** (Responsible Agency)	Date*** of Confirmation

* *EIA Ref / EM&A Log Ref / Design Document Ref / Environmental Protection Contract Clause*
** *Specific Environmental Mitigation Measures should be stated, such as, equipment, processes, systems, practices or technologies*
*** *The required completion date to confirm the specified Environmental Protection Action*

This Proforma is an:
Environmental Protection Instruction for _____ Date: _____

Signed by Environmental Team Leader _____ Date: _____

Copy to Independent Environmental Checker

PROACTIVE ENVIRONMENTAL PROTECTION PROFORMA **Ref:** _____

Ref*	Proposed Construction Method*	Location/ Working Period	Anticipated Impacts	Recommended Mitigation Measures

* *EIA Ref / EM&A Log Ref / Design Ref*

** *Details of equipment, vehicles, plants, processes, technologies for the option of construction method*

Signed by Environmental Team Leader _____ Date: _____

Audited by Independent Environment Checker _____ Date: _____

REGULATORY COMPLIANCE PROFORMA

Ref: _____

Ref*	Environmental License / Permit*	Control Area / Facility / Location	Effective Date

* *Name of Applicant, Business Corporation, relevant regulation and remark of license / permit conditions*

** *File reference of the licensee / permittee*

Signed by Environmental Team Leader _____ Date: _____

Audited by Independent Environment Checker _____ Date: _____

Proforma for Operational Phase EM&A Programme

IMPLEMENTATION STATUS PROFORMA

Ref:_____

EIA Ref*	EM&A Log Ref	Environmental Protection Measures*	Location/ Timing	Implementation Agent	Implementation Stages**			
					Des	C	O	Dec

* *All recommendations and requirements resulted during the Course of EIA/EA Process, including ACE and / or accepted public comment to the proposed project*

** *Des- Design, C-Construction,O-Operation, Dec- Decommissioning*

Signed by Project Proponet _____ Date: _____

REGULATORY COMPLIANCE PROFORMA

Ref: _____

Ref*	Environmental License / Permit*	Control Area / Facility / Location	Effective Date

* *Name of Applicant, Business Corporation, relevant regulation and remark of license / permit conditions*

** *File reference of the licensee / permittee*

Signed by Environmental Team Leader _____ Date: _____

Audited by Independent Environment Checker _____ Date: _____

IMPLEMENTATION STATUS PROFORMA

Ref: _____

Ref**	Environmental Protection Measures*	Implementation Status

* *All recommendations and requirements resulted during the Course of EIA/EA Process, including ACE and / or accepted public comment to the proposed project*

** *EIA Ref / EM&A Log Ref / Design Document Ref*

Signed by Environmental Team Leader _____ Date: _____

Audited by Independent Environment Checker _____ Date: _____

Sample Template for Interim Notifications of Environmental Quality Limits Exceedances

Incident Report on Action Level or Limit Level Non-compliance

Project	
Date	
Time	
Monitoring Location	
Parameter	
Action & Limit Levels	
Measured Level	
Possible reason for Action or Limit Level Non-compliance	
Actions taken / to be taken	
Remarks	

Prepared by: _____

Designation: _____

Signature: _____

Date: _____

Annex A

Temporary Staging
Preliminary Layout

Preliminary Layout of Temporary Staging for TM-CLKL Southern Connection Viaduct Section

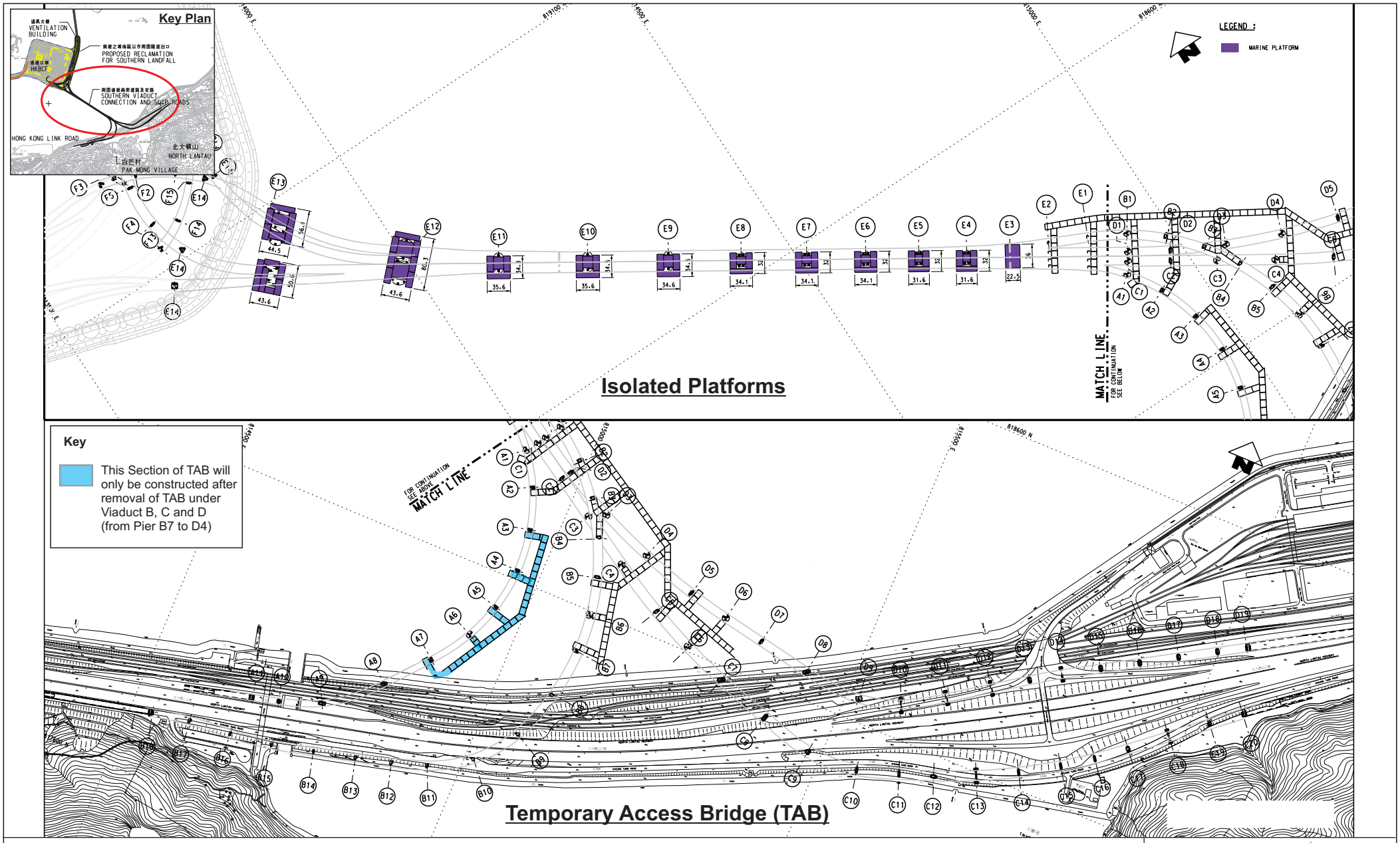


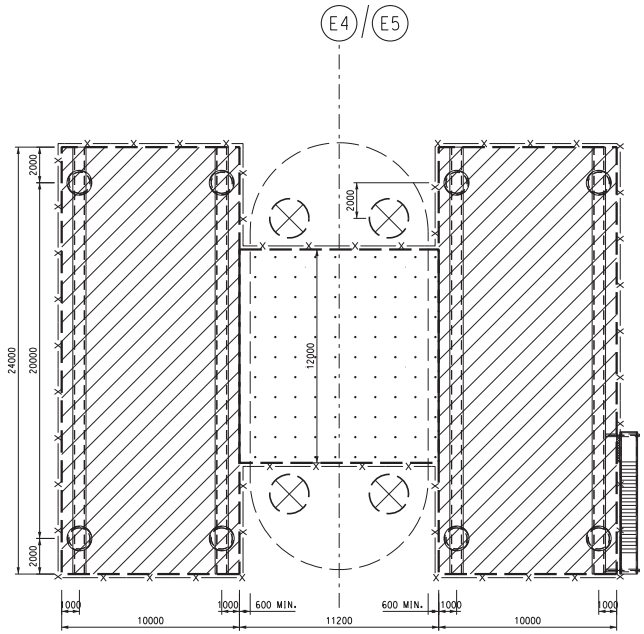
Figure 2.1A

Preliminary Layout of Temporary Staging

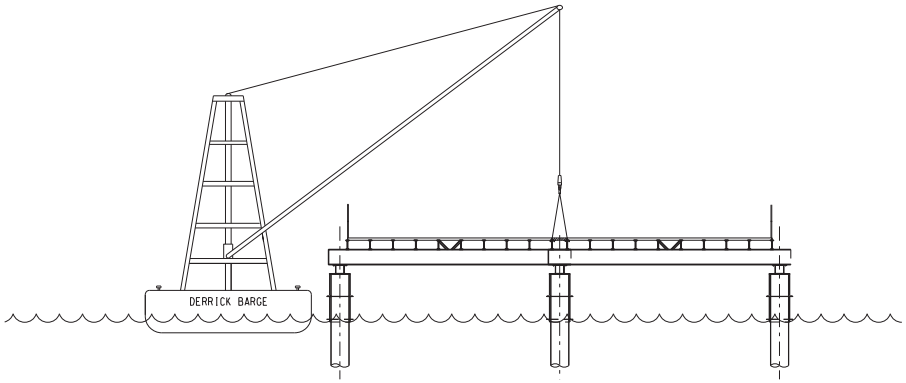
FILE: 0215660e
DATE: 26/09/2013

Environmental Resources Management

ERM



PLAN



CROSS SECTION

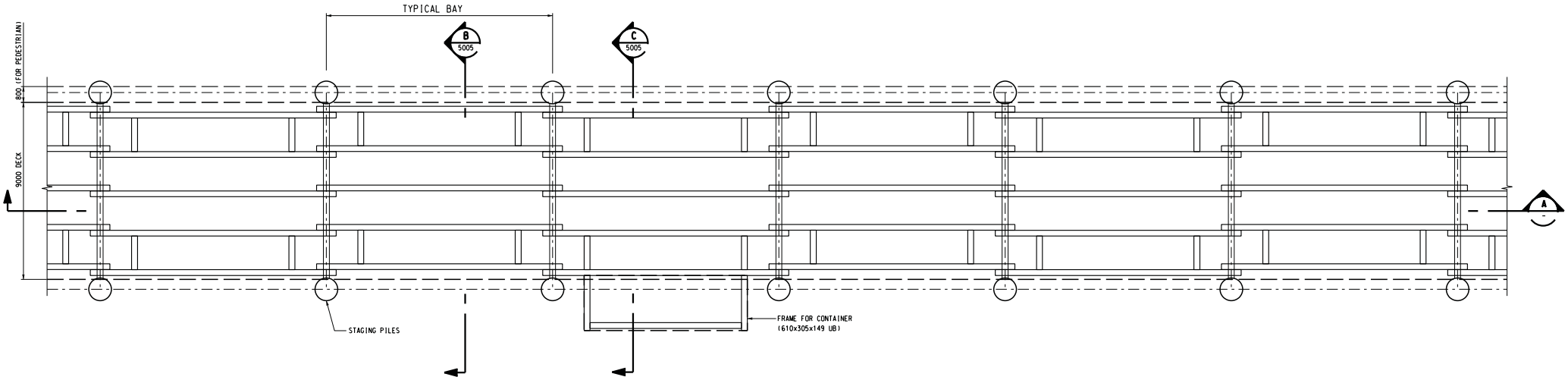
Figure 2.2A

Typical Pile Configuration of an Isolated Platform

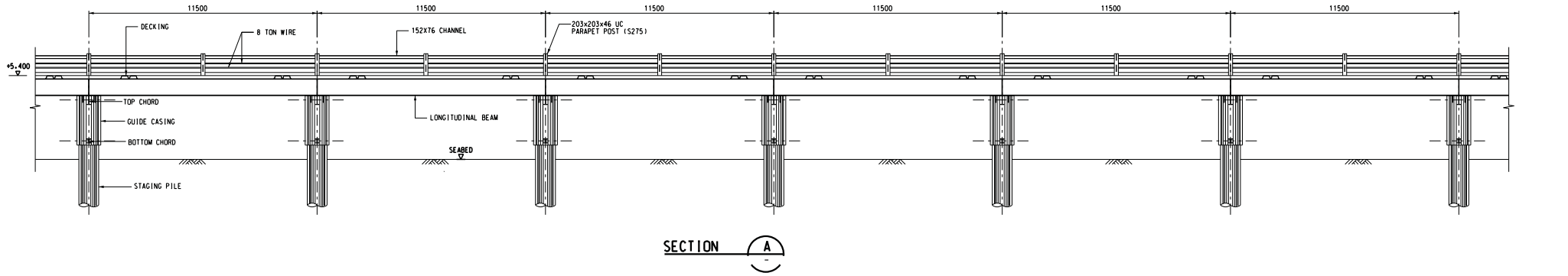
FILE: 0215660d
DATE: 21/10/2013

Environmental Resources Management

ERM



TYPICAL FRAMING PLAN



SECTION A

Figure 2.3A

Typical Pile Configuration of the TAB

FaILE: 0215660c
DATE: 26/09/2013

Environmental Resources Management

ERM

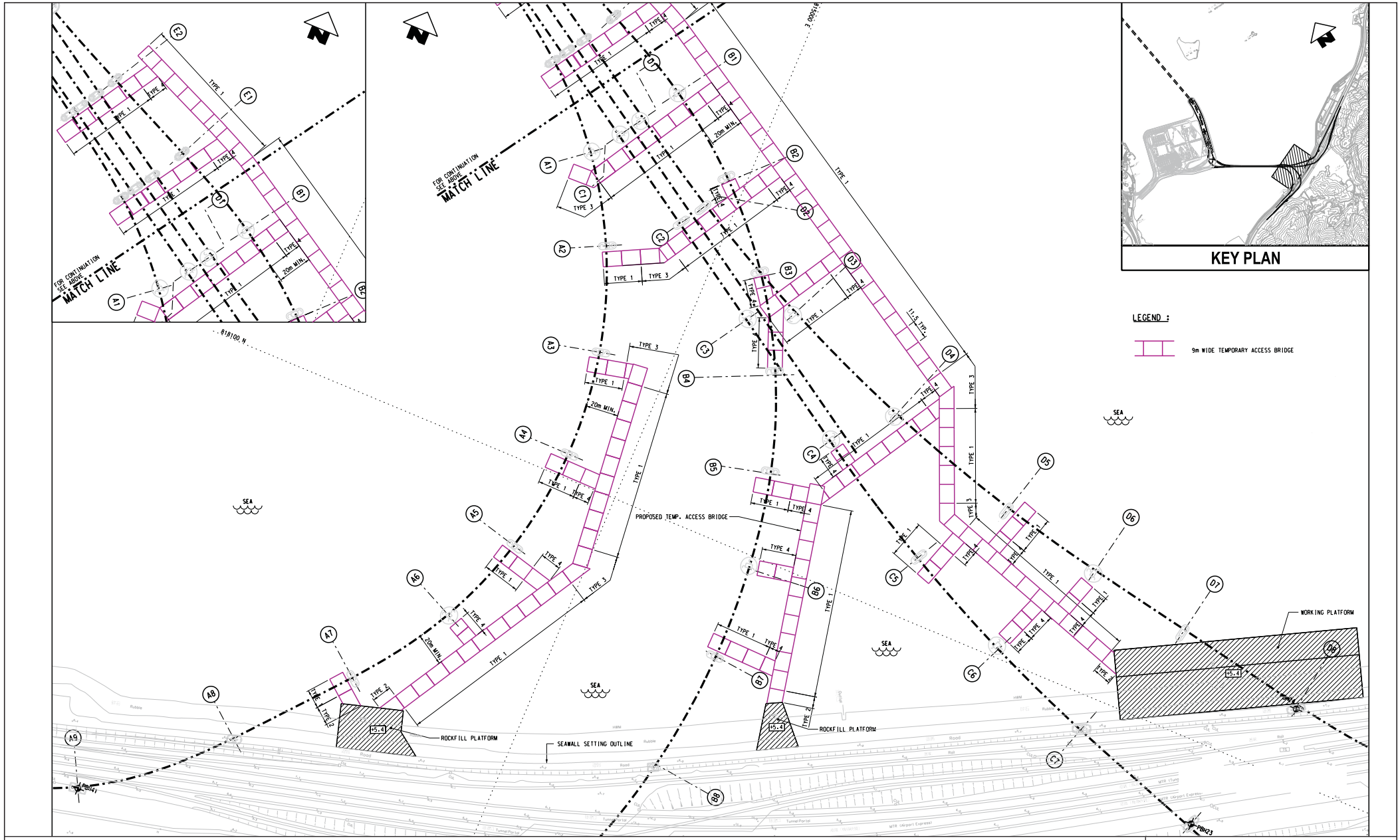


Figure 2.4A

Location of TAB Landing Platforms

FILE: 0215660b
DATE: 26/09/2013

Environmental Resources Management

ERM

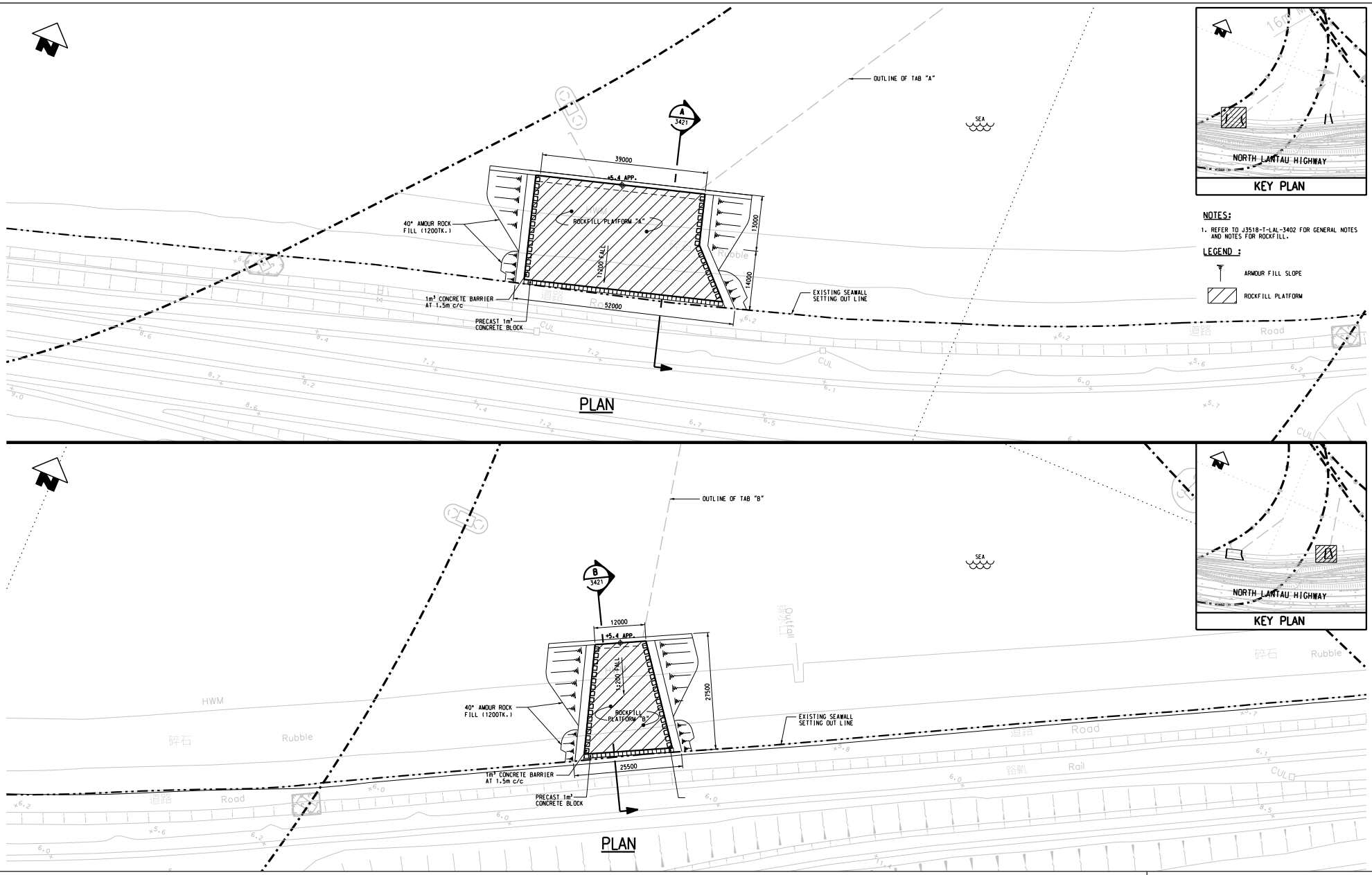


Figure 2.5A

Design of Landing Platforms at TAB ”A” and TAB “B” - Plan View

FILE: 0215660e2
DATE: 04/10/2013

Environmental Resources Management

ERM

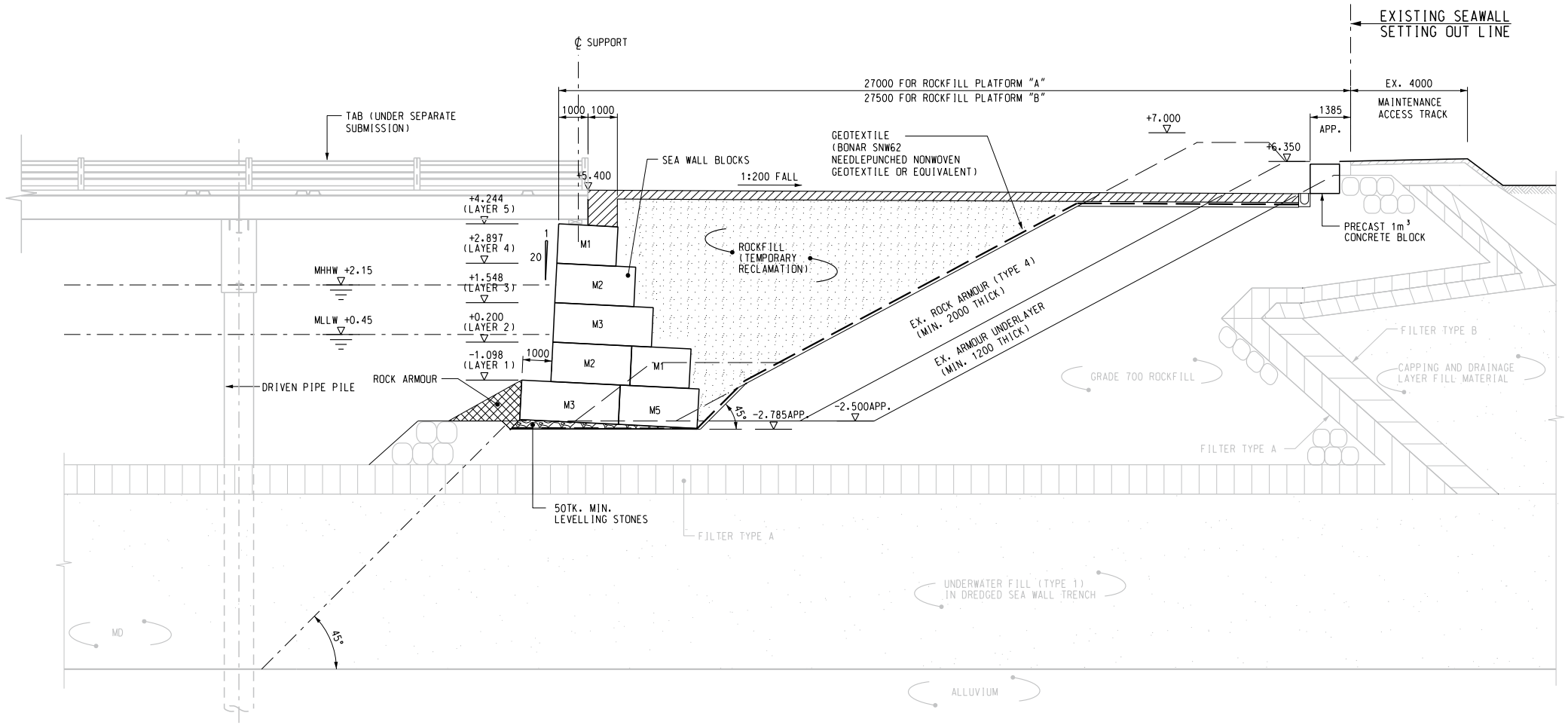


Figure 2.6A

Design of Landing Platforms at TAB "A" and TAB "B" - Section View

FILE: 0215660e4
DATE: 04/10/2013

Environmental
Resources
Management

ERM

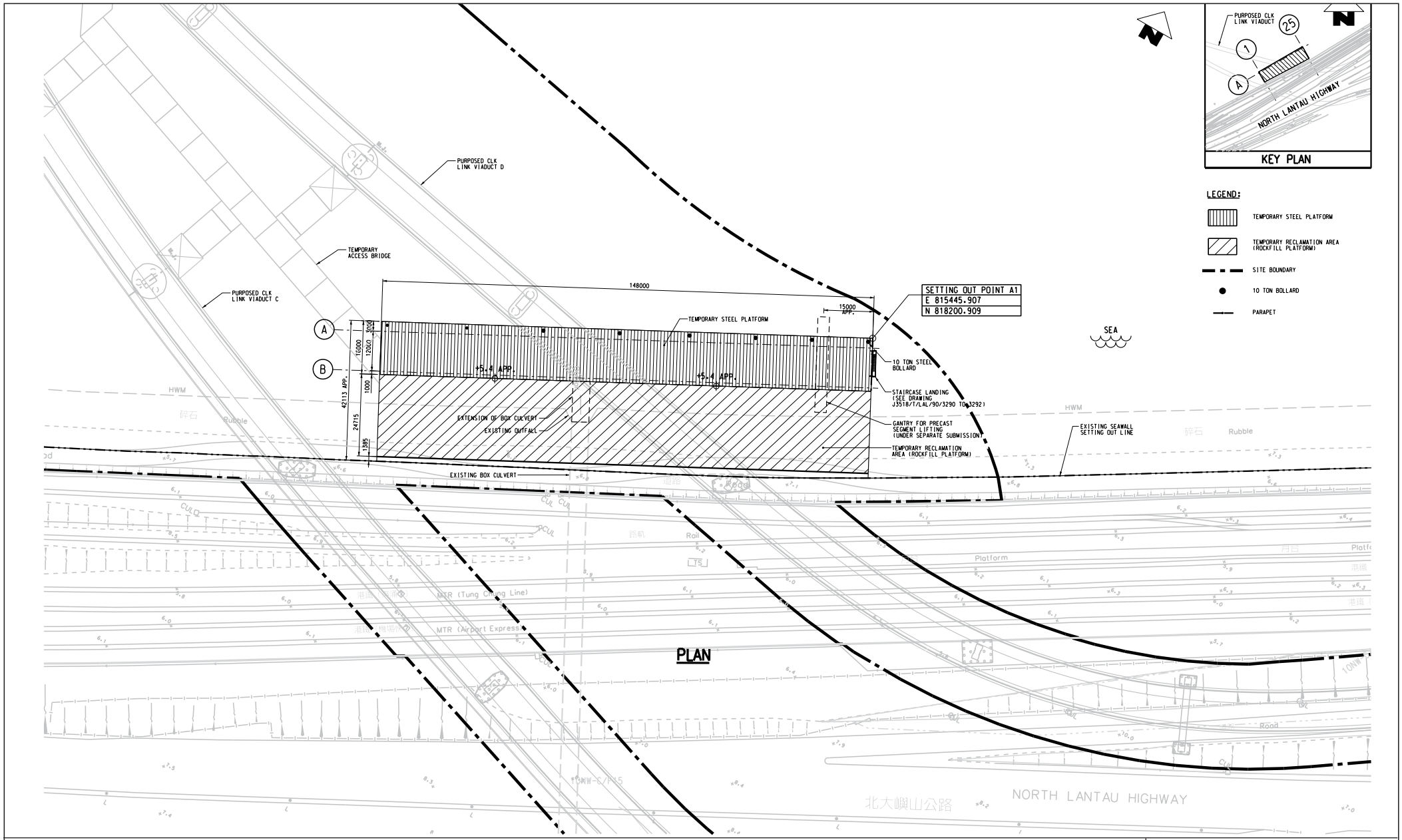


Figure 2.7A

Design of Landing Platform at TAB "D" - Plan View

FILE: 0215660e3
DATE: 04/10/2013

Environmental Resources Management

ERM

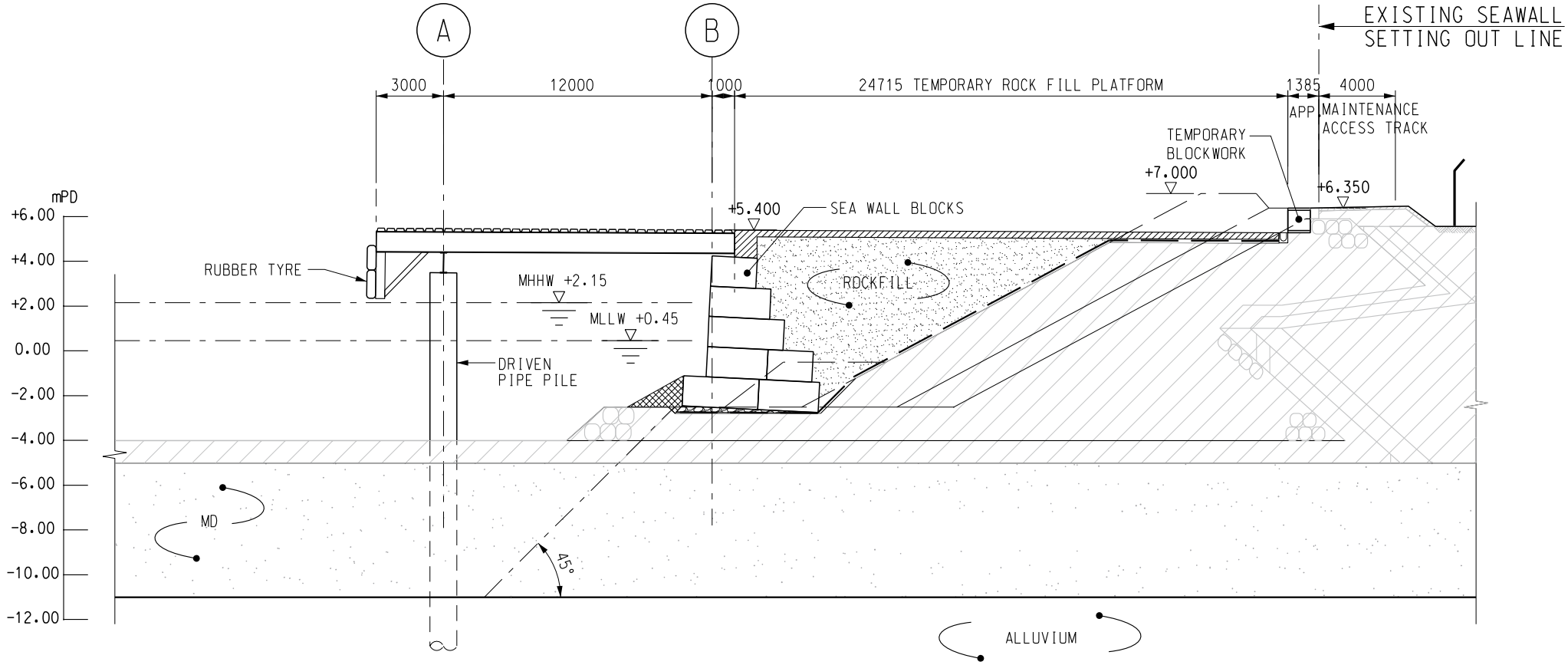


Figure 2.8A

Design of Landing Platform at TAB "D" - Section View

FILE: 0215660e5
DATE: 04/10/2013

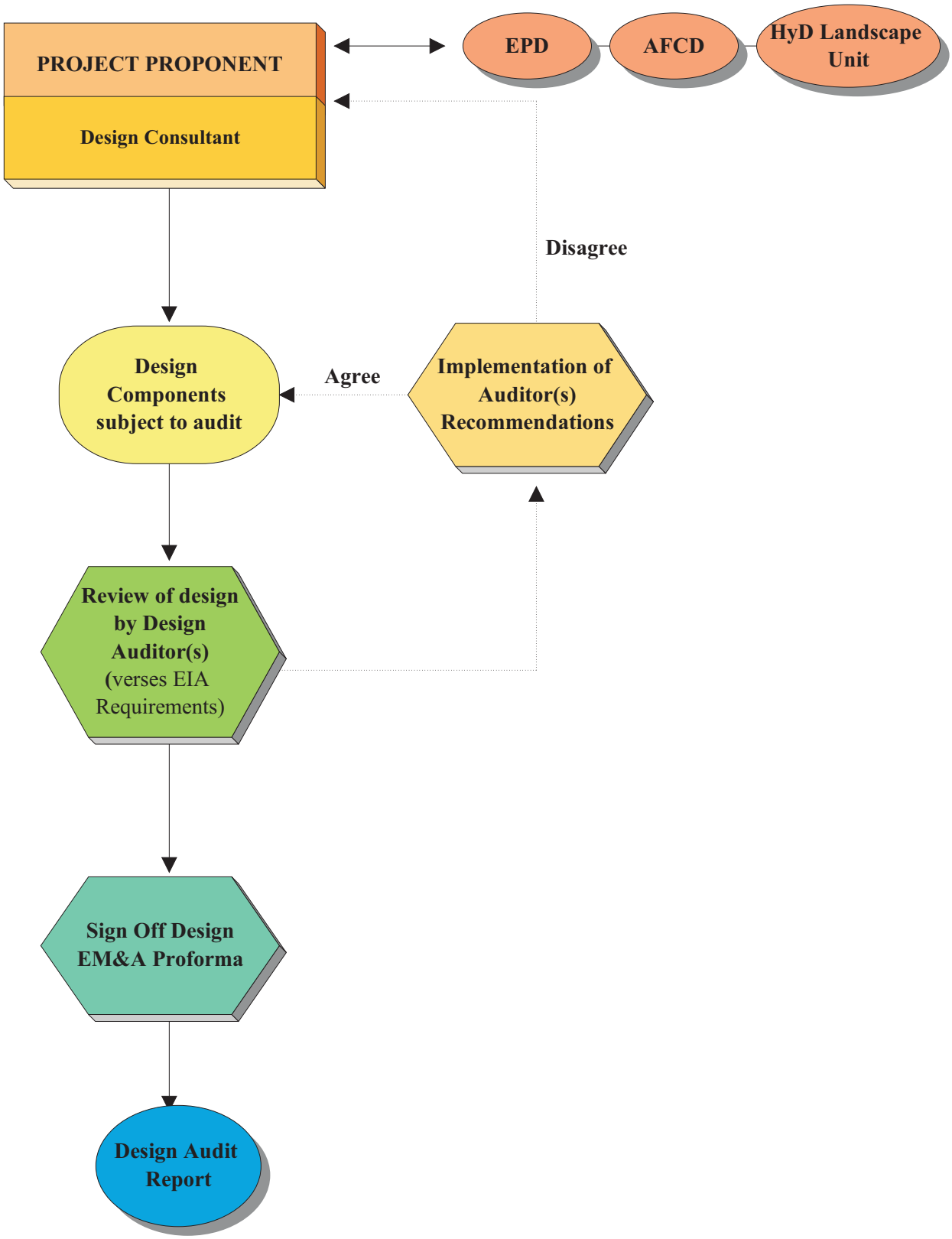
Environmental Resources Management

ERM

Annex B

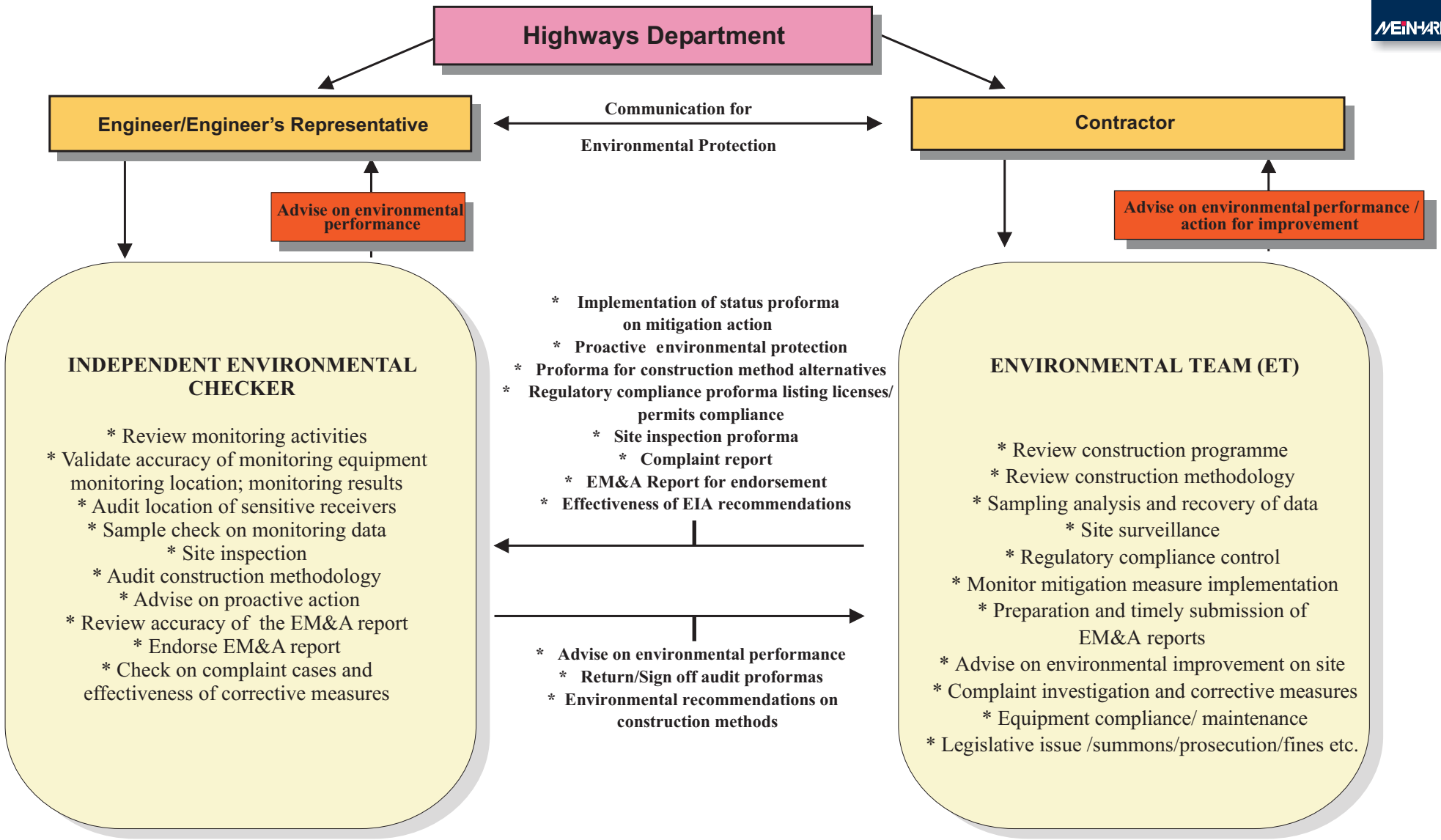
Figures

(Adopted from: CINOTECH (2011) Agreement No. CE35/2011 EP Baseline Environmental Monitoring for Hong Kong-Zhuhai-Macao Bridge
Tuen Mun-Chep Lap Kok Link – Investigation.
Updated EM&A Manual for Tuen Mun-Chek Lap Kok Link)

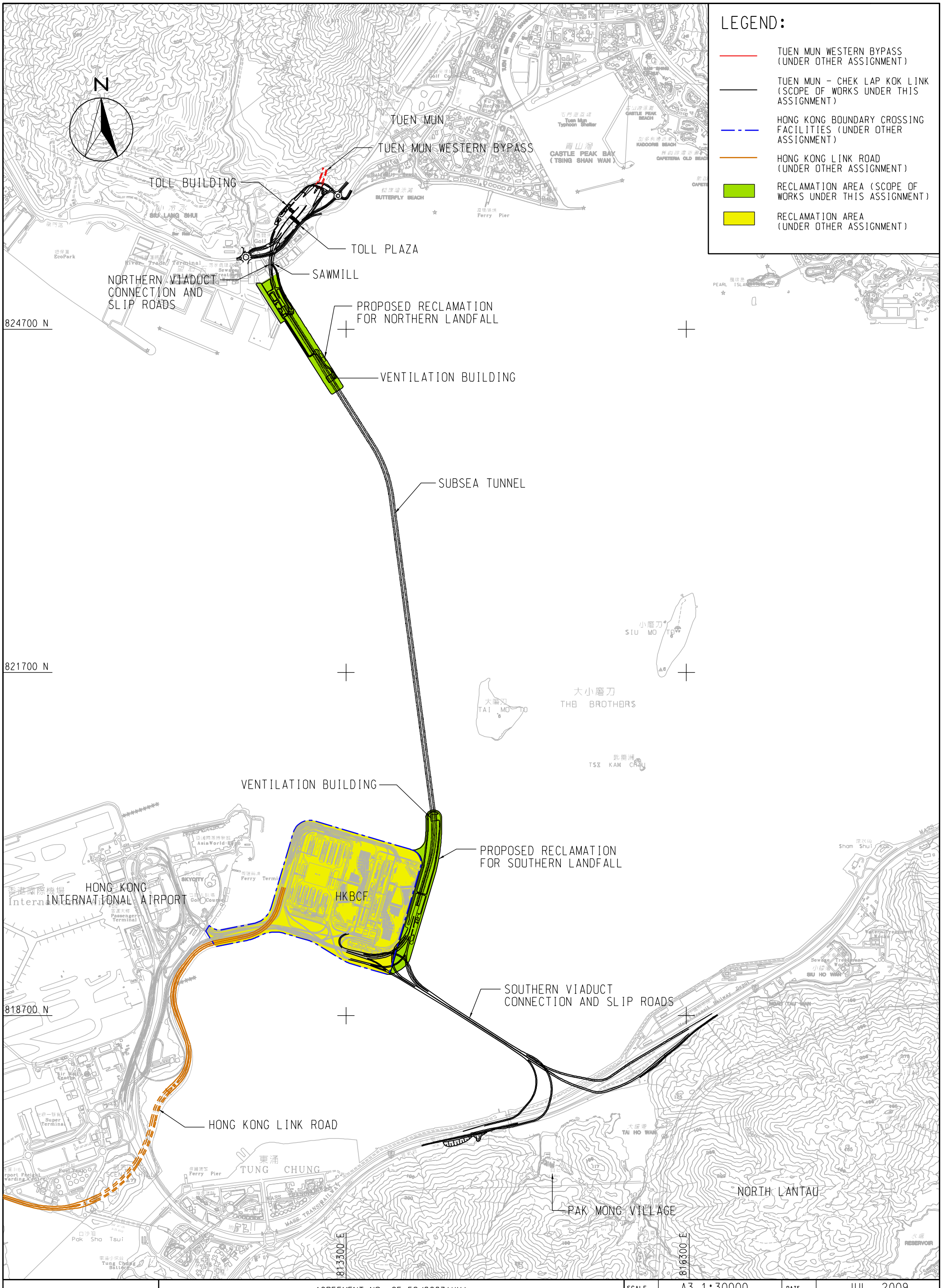


Design Phase EM&A
Procedure and Organisation

Figure No. 1.1



Construction and Operational Phase Procedure and Organisation **Figure No. 1.2**



AECOM

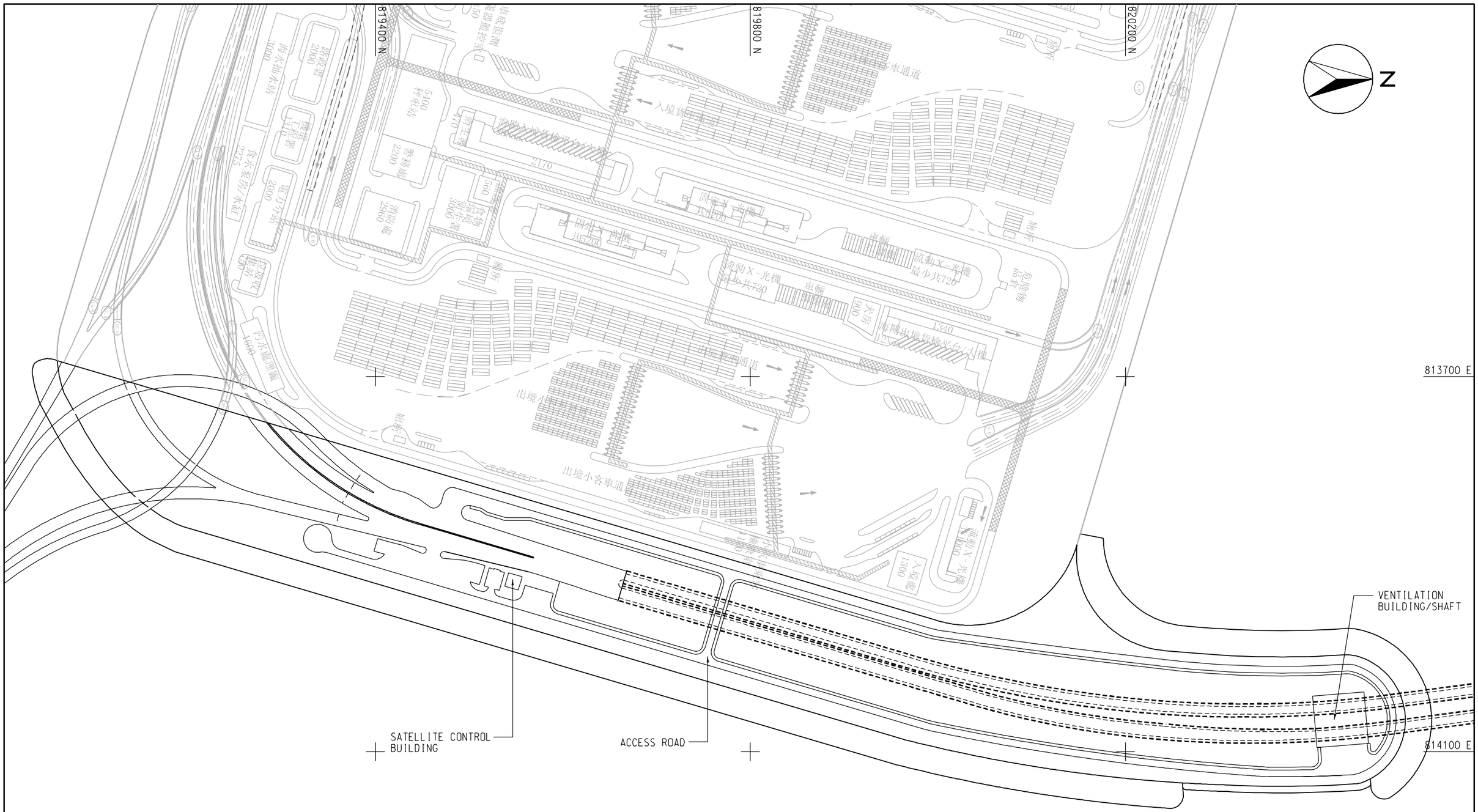
AGREEMENT NO. CE 52/2007(HY)
TUEN MUN - CHEK LAP KOK LINK - INVESTIGATION

GENERAL LAYOUT OF TM-CLKL

SCALE	A3 1:30000	DATE	JUL. 2009
CHECK	--	DRAWN	WYP
JOB No.	60044963	DRAWING No. Fig 2.1	REV A

Plotting By: 2009-8-6 CHENCA
PLOT SCALE: 1.762

p:\PROJECTS\60044963\DRAWING\FIGURE\EIA REPORT\CH3\FIGURE 3-1.dgn



AECOM

AGREEMENT NO. CE 52/2007(HY)
TUEN MUN - CHEK LAP KOK LINK - INVESTIGATION

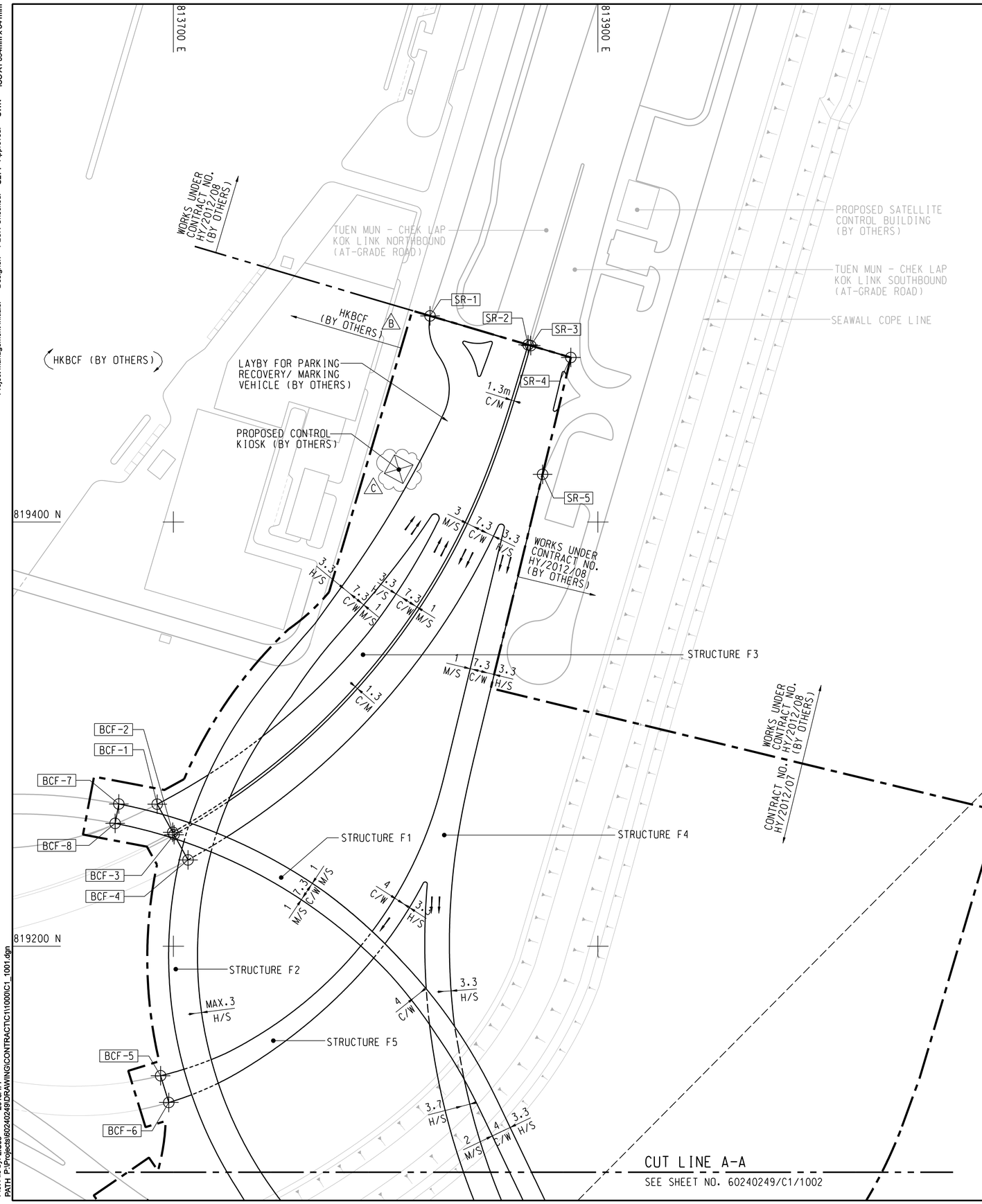
LAYOUT PLAN OF SOUTHERN LANDFALL

SCALE	A3 1:4000	DATE	JUL. 2009
CHECK	--	DRAWN	GXS
JOB No.	60044963	DRAWING No.	Fig 2.2b
		REV	A

Plotting By 2009-8-3
PLOT SCALE 1.4.00001

P:\PROJECTS\60044963\DRAWING\FIGURE\EIA REPORT\CH3\FIGURE 3-2b.dgn

Project Management Initials: Designer: PLCK Checked: SLYY Approved: CWN Drawn: CWN ISO A1 594mm x 841mm



NOTES:

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH SHEET NOS. 60240249/C1/1002 TO 1008.
2. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.
3. ALL LEVELS ARE IN METRES AND REFER TO PRINCIPAL DATUM.
4. ALL LEVELS ARE INDICATIVE ONLY.
5. DETAILS INCLUDING DIMENSIONS, LEVELS, DESCRIPTIONS, LOCATIONS, ETC GIVEN FOR EXISTING ROADS, FOOTPATHS, BOX CULVERTS, CHAIN LINK FENCE, ETC. ARE INDICATIVE ONLY. THE CONTRACTOR SHALL VERIFY THE ACTUAL EXISTING DETAILS ON SITE.
6. REFER TO SHEET NO. 60240249/C1/1021 FOR TYPICAL CROSS SECTION OF THE ROAD LAYOUT.
7. THE DEMARCATION LINE BETWEEN THIS CONTRACT AND CONTRACT NO. HY/2012/08 AS SHOWN IS APPROXIMATE ONLY. THE EXACT LOCATION OF WHICH SHALL BE SUBJECT TO THE DETAILED DESIGN OF THIS CONTRACT. THE CONTRACTOR SHALL LIAISE WITH THE CONTRACTOR OF CONTRACT NO. HY/2012/08 TO DETERMINE THE EXACT POSITION OF THE LINE.
8. NUMBER OF TRAFFIC LANES AT THE LOCATION SHOWN ON SHEET NOS. 60240249/C1/1001 TO 1008 SHALL BE STRICITY FOLLOWED.
9. THE DIMENSIONS, CO-ORDINATES AND LEVELS OF PROPOSED ROADS SHOWN ON SHEET NOS. 60240249/C1/1001 TO 1008 SHALL BE STRICTLY FOLLOWED.

LEGEND:

- SITE BOUNDARY
- 22.5 EXISTING SPOT LEVEL
- CUT SLOPE
- EXISTING SLOPE
- TRAFFIC LANE
- MTR RAILWAY PROTECTION BOUNDARY
- RETAINING WALL
- BOUNDARY OF LOT MTRL 2 RP
- 4 ROAD WIDTH WITH METRE SHOWN THUS

M/S	MARGINAL STRIP	C/M	CENTRAL MEDIAN
C/W	CARRIAGEWAY	M.J.	MOVEMENT JOINT
H/S	HARD SHOULDER		

SETTING OUT CO-ORDINATES AND LEVELS OF ROAD AT THE INTERFACES WITH OTHER CONTRACTS

SETTING OUT POINT	CO-ORDINATES		LEVELS
	EASTING	NORTHING	
SR-1	813820.934	819497.173	5.6
SR-2	813867.116	819483.530	6.9
SR-3	813868.363	819483.162	6.9
SR-4	813887.267	819477.577	6.5
SR-5	813873.947	819422.480	10.8
BCF-1	813692.388	819266.975	11.3
BCF-2	813699.700	819253.742	12.0
BCF-3	813700.329	819252.604	12.1
BCF-4	813706.906	819240.701	13.0
BCF-5	813693.985	819138.965	17.3
BCF-6	813697.850	819126.360	17.9
BCF-7	813674.316	819267.077	30.8
BCF-8	813672.576	819257.941	30.4

AECOM

PROJECT 項目

TUEN MUN - CHEK LAP KOK LINK

CONTRACT TITLE

TUEN MUN - CHEK LAP KOK LINK - SOUTHERN CONNECTION VIADUCT SECTION

CLIENT 業主

路政署 HIGHWAYS DEPARTMENT
港珠澳大橋香港工程管理處 Hong Kong - Zhuhai - Macao Bridge Hong Kong Project Management Office

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Figure 2.4c

ISSUE/REVISION 修訂

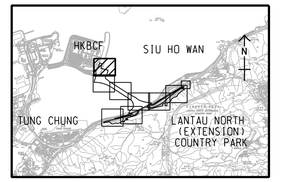
I/R 修訂	DATE 日期	DESCRIPTION 內容摘要	CHK. 複核
			C/W
C	DEC. 12	TENDER ADDENDUM NO.5	CWN
B	DEC. 12	TENDER ADDENDUM NO.4	CWN
A	DEC. 12	TENDER ADDENDUM NO.3	CWN
-	OCT. 12	TENDER DRAWING	CWN

STATUS 階段

SCALE 比例 A1 1:1000

DIMENSION UNIT 尺寸單位 METRES

KEY PLAN 索引圖 1 : 100000



PROJECT NO. 項目編號 60240249

CONTRACT NO. 合約編號 HY/2012/07

SHEET TITLE 圖紙名稱

GENERAL LAYOUT for Southern Viaduct (1)

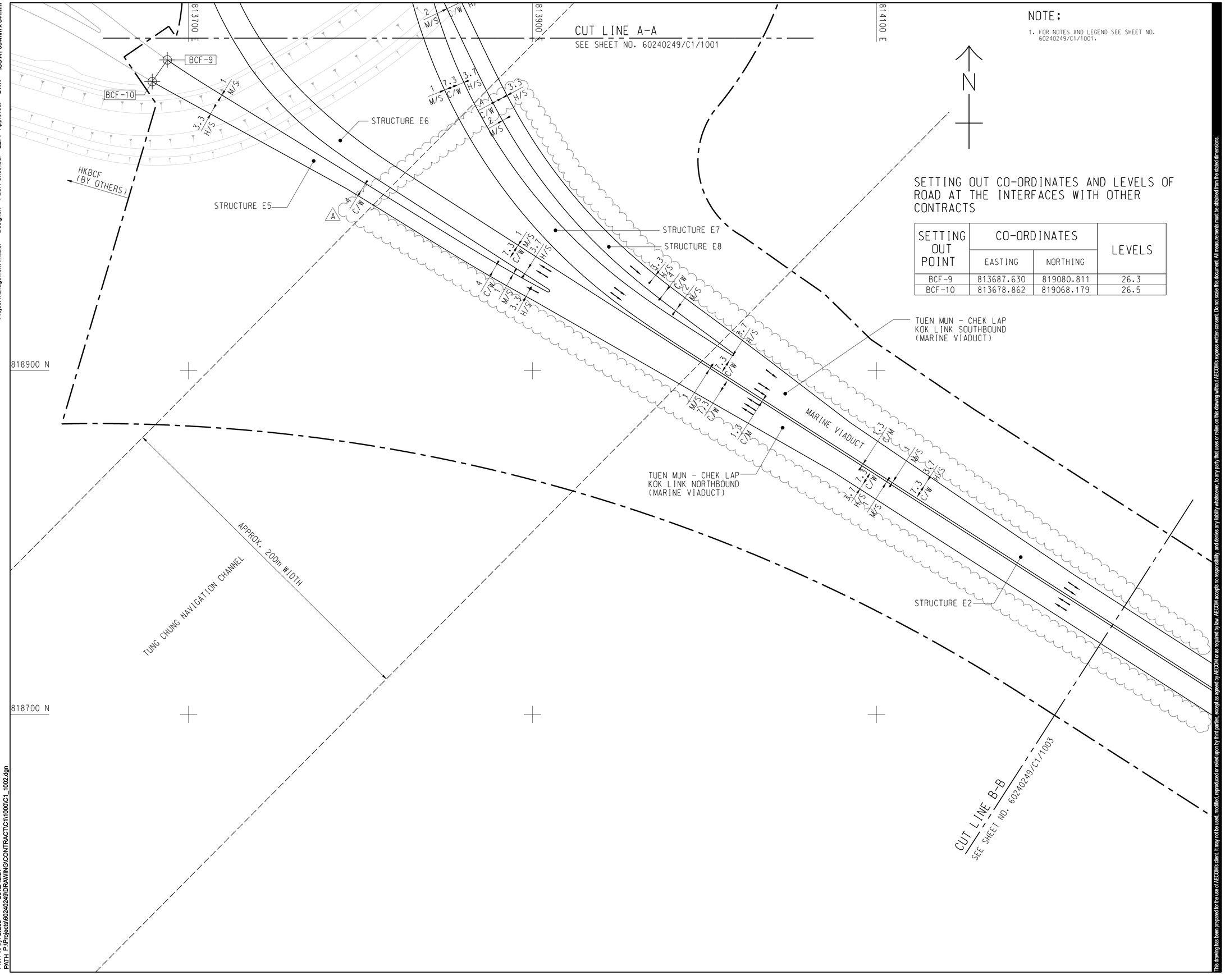
SHEET 1 OF 8

SHEET NUMBER 圖紙編號

60240249/C1/1001C

Plot File by: LIUJ3 2013/1/4
PATH: P:\Projects\60240249\DRAWING\CONTRACT\C1\1000\C1_1001.dgn

Project Management Initials: Designer: PLCK Checked: SLYY Approved: CWN C/Vy ISO A1 594mm x 841mm



NOTE:

1. FOR NOTES AND LEGEND SEE SHEET NO. 60240249/C1/1001.

SETTING OUT CO-ORDINATES AND LEVELS OF ROAD AT THE INTERFACES WITH OTHER CONTRACTS

SETTING OUT POINT	CO-ORDINATES		LEVELS
	EASTING	NORTHING	
BCF-9	813687.630	819080.811	26.3
BCF-10	813678.862	819068.179	26.5

AECOM

PROJECT 項目

TUEN MUN - CHEK LAP KOK LINK

CONTRACT TITLE

TUEN MUN - CHEK LAP KOK LINK - SOUTHERN CONNECTION VIADUCT SECTION

CLIENT 業主

路政署 HIGHWAYS DEPARTMENT
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Figure 2.4d

ISSUE/REVISION 修訂

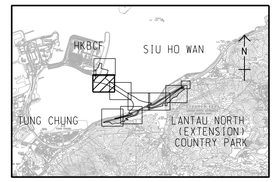
I/R 修訂	DATE 日期	DESCRIPTION 內容摘要	CHK. 複核
			C/Vy
A	DEC. 12	TENDER ADDENDUM NO.4	CWN
-	OCT. 12	TENDER DRAWING	CWN

STATUS 階段

SCALE 比例
A1 1:1000

DIMENSION UNIT 尺寸單位
METRES

KEY PLAN 索引圖 1 : 100000



PROJECT NO. 項目編號
60240249

CONTRACT NO. 合約編號
HY/2012/07

SHEET TITLE 圖紙名稱

GENERAL LAYOUT for Southern Viaduct (2)

SHEET 2 OF 8

SHEET NUMBER 圖紙編號

60240249/C1/1002A

Plot File by: LIUJ3 2012/12/21
PATH: P:\Projects\60240249\DRAWING\CONTRACT\C111000\C1_1002.dgn

Project Management Initials: Designer: PLCK Checked: SLYY Approved: CWN ISO A1 594mm x 841mm

814200 E

814400 E

814600 E

NOTE:

1. FOR NOTES AND LEGEND SEE SHEET NO. 60240249/C1/1001.

N

818700 N

CUT LINE B-B
SEE SHEET NO. 60240249/C1/1002

1 M/S 3.7 H/S 7.3 C/W 7.3 C/W 3.7 H/S 1 M/S

MARINE VIADUCT

A

TUEN MUN - CHEK LAP KOK LINK SOUTHBOUND (MARINE VIADUCT)

818500 N

TUEN MUN - CHEK LAP KOK LINK NORTHBOUND (MARINE VIADUCT)

STRUCTURE E2

1 M/S 3.7 H/S 7.3 C/W 7.3 C/W 3.7 H/S 1 M/S

CUT LINE C-C
SEE SHEET NO. 60240249/C1/1003

Plot File by: LIUJ3 2012/12/21
PATH: P:\Projects\60240249\DRAWING\CONTRACT\C1\1000\C1_1003.dgn

AECOM

PROJECT 項目

TUEN MUN - CHEK LAP KOK LINK

CONTRACT TITLE

TUEN MUN - CHEK LAP KOK LINK - SOUTHERN CONNECTION VIADUCT SECTION

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Figure 2.4e

ISSUE/REVISION 修訂

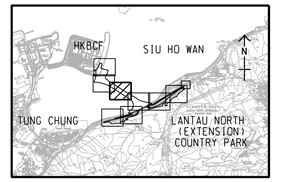
I/R 修訂	DATE 日期	DESCRIPTION 內容摘要	CHK. 複核
			C.W.Y.
A	DEC. 12	TENDER ADDENDUM NO.4	CWN
-	OCT. 12	TENDER DRAWING	CWN

STATUS 階段

SCALE 比例
A1 1:1000

DIMENSION UNIT 尺寸單位
METRES

KEY PLAN 索引圖 1 : 100000



PROJECT NO. 項目編號
60240249

CONTRACT NO. 合約編號
HY/2012/07

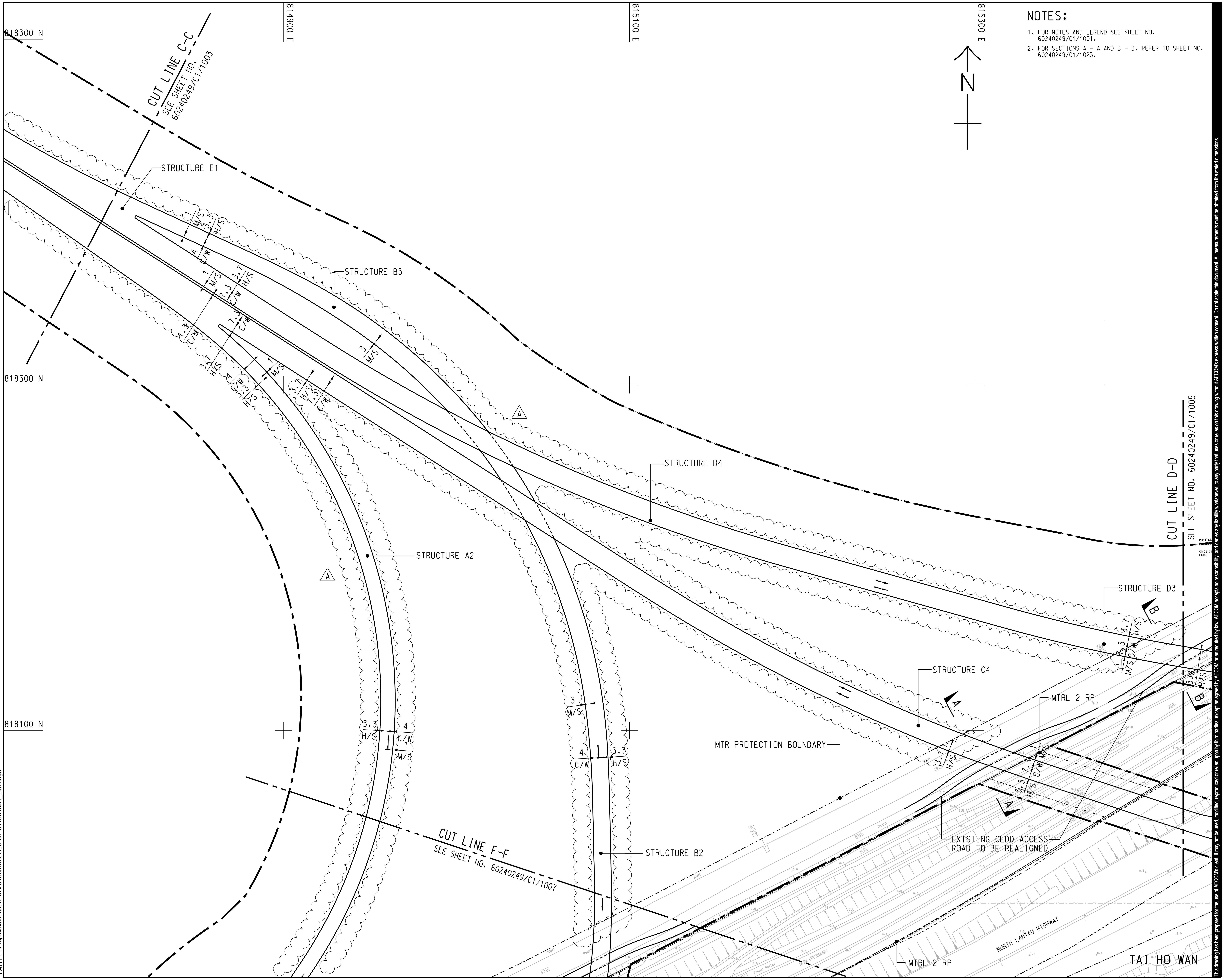
SHEET TITLE 圖紙名稱

GENERAL LAYOUT for Southern Viaduct (3)

SHEET 3 OF 8

SHEET NUMBER 圖紙編號

60240249/C1/1003A



Project Management Initials: Designer: PLCK Checked: SLYY Approved: CWN ISO A1 594mm x 841mm

Plot File by: LIUJ3 2012/12/21
PATH P:\Projects\60240249\DRAWING\CONTRACT\C1\1000\C1_1004.dgn

AECOM

PROJECT 項目

TUEN MUN - CHEK LAP KOK LINK

CONTRACT TITLE

TUEN MUN - CHEK LAP KOK LINK - SOUTHERN CONNECTION VIADUCT SECTION

CLIENT 業主

路政署
HIGHWAYS DEPARTMENT
港珠澳大橋香港工程管理處
Hong Kong - Zhuhai - Macao Bridge
Hong Kong Project Management Office

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Figure 2.4f

ISSUE/REVISION 修訂

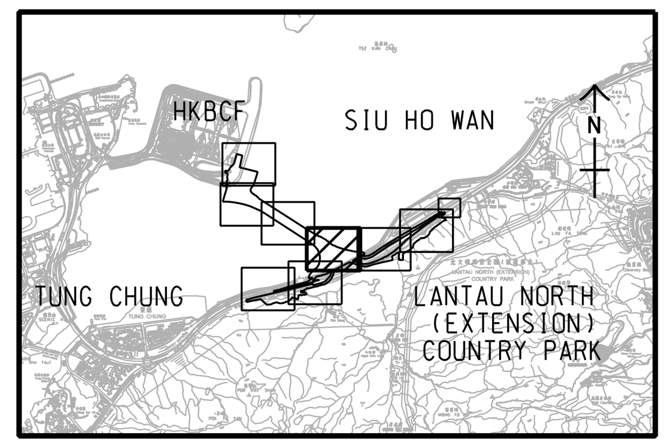
I/R 修訂	DATE 日期	DESCRIPTION 內容摘要	CHK. 複核
A	DEC. 12	TENDER ADDENDUM NO.4	CWN
-	OCT. 12	TENDER DRAWING	CWN

STATUS 階段

SCALE 比例 A1 1:1000

DIMENSION UNIT 尺寸單位 METRES

KEY PLAN 索引圖 1 : 100000



PROJECT NO. 項目編號 60240249

CONTRACT NO. 合約編號 HY/2012/07

SHEET TITLE 圖紙名稱

GENERAL LAYOUT for Southern Viaduct (4)

SHEET 4 OF 8

SHEET NUMBER 圖紙編號

60240249/C1/1004A

Project Management Initials: | Designer: PLCK | Checked: SLYY | Approved: CWN | CWy | ISO A1 594mm x 841mm

815500 E | 815700 E | 815900 E

NOTE:

1. FOR NOTES AND LEGEND SEE SHEET NO. 60240249/C1/1001.

CUT LINE D-D
SEE SHEET NO. 60240249/C1/1004

CUT LINE E-E
SEE SHEET NO. 60240249/C1/1006

818300 N

818100 N

MTR PROTECTION BOUNDARY

STRUCTURE D2

MTRL 2 RP

RE-ALIGNED CHEUNG TUNG ROAD

NORTH LANTAU HIGHWAY

CHEUNG TUNG ROAD

北大嶼山公路

MTR PROTECTION BOUNDARY

MTRL 2 RP

STRUCTURE C2

STRUCTURE C3

大嶼灣

TAI HO WAN

Plot File by: ZENGSB 2012-10-24
PATH P:\Projects\60240249\DRAWING\CONTRACT\C1\1000\C1_1005.dgn

AECOM

PROJECT 項目

TUEN MUN - CHEK LAP KOK LINK

CONTRACT TITLE

TUEN MUN - CHEK LAP KOK LINK - SOUTHERN CONNECTION VIADUCT SECTION

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Figure 2.4g

ISSUE/REVISION 修訂

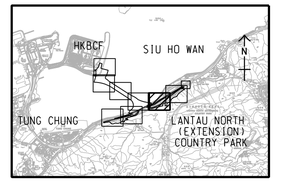
I/R 修訂	DATE 日期	DESCRIPTION 內容摘要	CHK. 複核
			CWy
-	OCT. 12	TENDER DRAWING	CWN

STATUS 階段

SCALE 比例 A1 1:1000

DIMENSION UNIT 尺寸單位 METRES

KEY PLAN 索引圖 1 : 100000



PROJECT NO. 項目編號 60240249

CONTRACT NO. 合約編號 HY/2012/07

SHEET TITLE 圖紙名稱

GENERAL LAYOUT for Southern Viaduct (5)

SHEET 5 OF 8

SHEET NUMBER 圖紙編號

60240249/C1/1005

Project Management Initials: Designer: PLCK Checked: SLYY Approved: CWN ISO A1 594mm x 841mm

MASS TRANSIT RAILWAY
SIU HO WAN DEPOT

816300 E
816500 E
816600 E
816700 E
818600 N
818400 N
818800 N
818700 N

MTRL 2 RP

NORTH LANTAU HIGHWAY

CHEUNG TUNG ROAD

MTR PROTECTION BOUNDARY

RE-ALIGNED CHEUNG TUNG ROAD

BOUNDARY OF COUNTRY PARK

STRUCTURE D1

STRUCTURE C1

SOUTHERN CONNECTION LINK ROAD

CUT LINE E-E
SEE SHEET NO. 60240249/C1/1005

CUT LINE H-H
SEE INSET 'Z'

INSET 'Z'
SCALE 1 : 1000

NOTE:

1. FOR NOTES AND LEGEND SEE SHEET NO. 60240249/C1/1001.
2. FOR SECTIONS K-K AND N-N REFER TO SHEET NO. 60240249/C1/1025.

Plot File by: ZENGSB 2012-10-24
PATH: F:\Projects\60240249\DRAWING\CONTRACT\C1\1000\C1_1006.dgn

AECOM

PROJECT 項目

TUEN MUN -
CHEK LAP KOK LINK

CONTRACT TITLE

TUEN MUN - CHEK LAP KOK LINK
- SOUTHERN CONNECTION
VIADUCT SECTION

CLIENT 業主

路政署
HIGHWAYS DEPARTMENT
港珠澳大橋香港工程管理處
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Figure 2.4h

ISSUE/REVISION 修訂

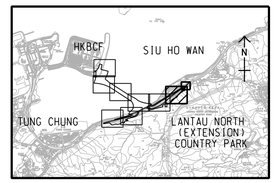
I/R 修訂	DATE 日期	DESCRIPTION 內容摘要	CHK. 核核
			CWN
-	OCT. 12	TENDER DRAWING	CWN

STATUS 階段

SCALE 比例
A1 1:1000

DIMENSION UNIT 尺寸單位
METRES

KEY PLAN 索引圖 1 : 100000



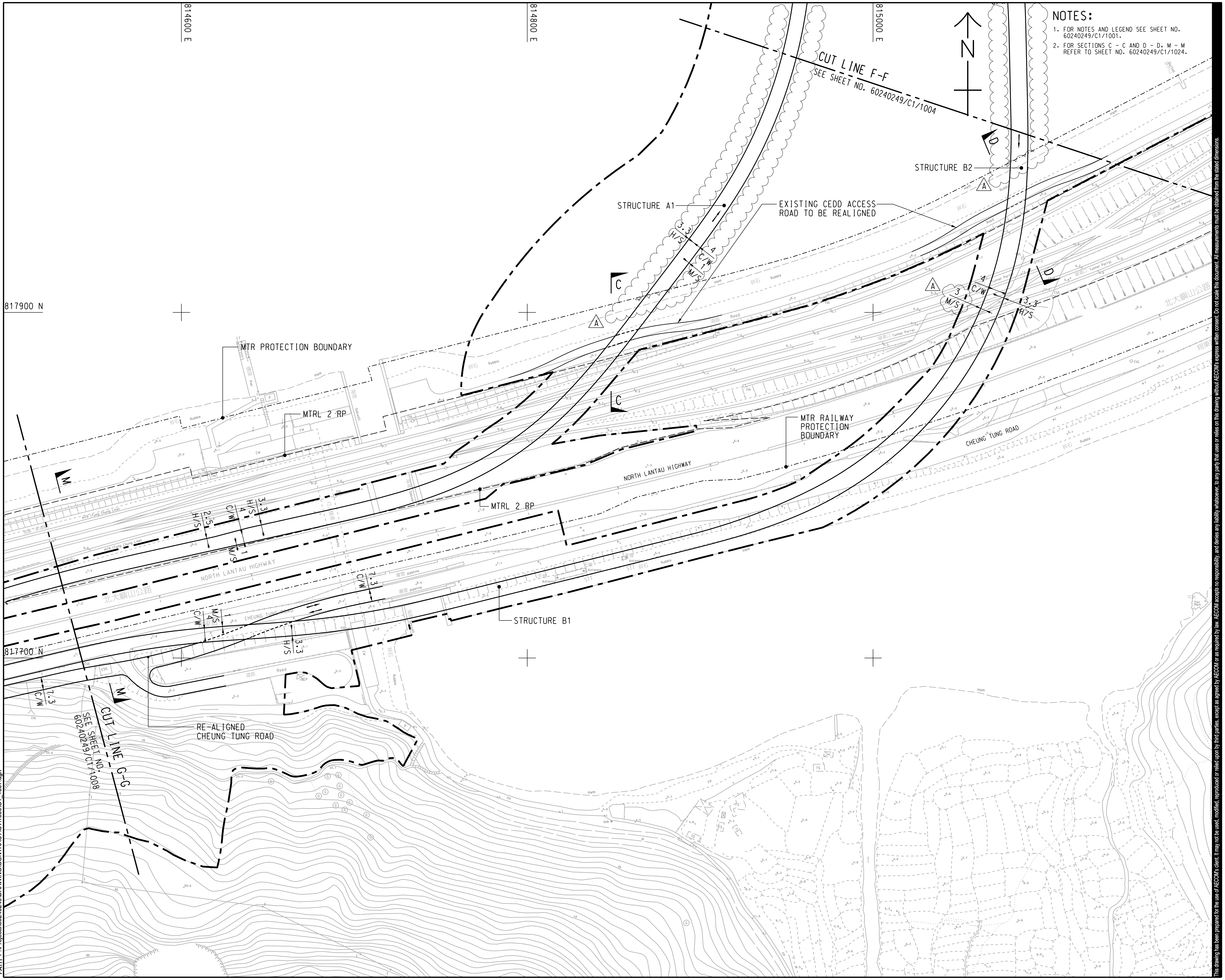
PROJECT NO. 項目編號
60240249

CONTRACT NO. 合約編號
HY/2012/07

SHEET TITLE 圖紙名稱
GENERAL LAYOUT for Southern Viaduct (6)

SHEET 6 OF 8

SHEET NUMBER 圖紙編號
60240249/C1/1006



Project Management Initials: Designer: PLCK Checked: SLYY Approved: CWN ISO A1 594mm x 841mm

Plot File by: LIUJ3 2012/12/21
PATH P:\Projects\60240249\DRAWING\CONTRACT\C11000\C1_1007.dgn

AECOM

PROJECT 項目

TUEN MUN - CHEK LAP KOK LINK

CONTRACT TITLE

TUEN MUN - CHEK LAP KOK LINK - SOUTHERN CONNECTION VIADUCT SECTION

CLIENT 業主

路政署 HIGHWAYS DEPARTMENT
港珠澳大橋香港工程管理處
Hong Kong - Zhuhai - Macao Bridge Hong Kong Project Management Office

CONSULTANT 工程顧問公司

AECOM Asia Company Ltd.
www.aecom.com

SUB-CONSULTANTS 分判工程顧問公司

Figure 2.4i

ISSUE/REVISION 修訂

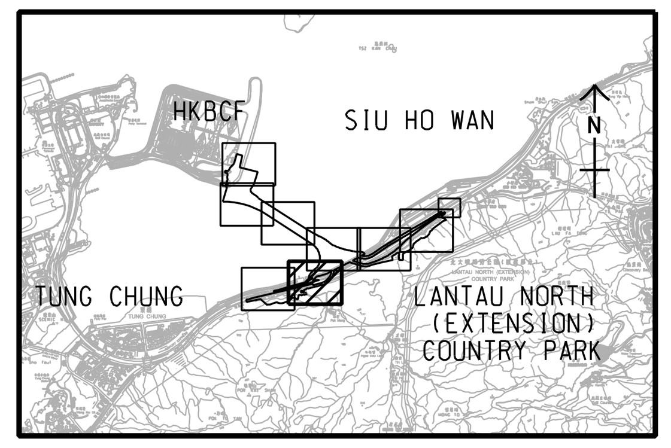
I/R 修訂	DATE 日期	DESCRIPTION 內容摘要	CHK. 複核
A	DEC. 12	TENDER ADDENDUM NO.4	CWN
-	OCT. 12	TENDER DRAWING	CWN

STATUS 階段

SCALE 比例: A1 1:1000

DIMENSION UNIT 尺寸單位: METRES

KEY PLAN 索引圖 1 : 100000



PROJECT NO. 項目編號: 60240249

CONTRACT NO. 合約編號: HY/2012/07

SHEET TITLE 圖紙名稱

GENERAL LAYOUT for Southern Viaduct (7)

SHEET 7 OF 8

SHEET NUMBER 圖紙編號

60240249/C1/1007A

Project Management Initials: Designer: PLCK Checked: SLYY Approved: CWN ISO A1 594mm x 841mm

NOTE:

1. FOR NOTES AND LEGEND SEE SHEET NO. 60240249/C1/1001.

814000 E | 814200 E | 814400 E

N

817800 N | 817600 N

CUT LINE G-G
SEE SHEET NO. 60240249/C1/1007

MTR PROTECTION BOUNDARY

MTRL 2 RP

STRUCTURE A1

STRUCTURE B1

RE-ALIGNED CHEUNG TUNG ROAD

NORTH LANTAU HIGHWAY

CHEUNG TUNG ROAD

REPROVISIONED TRAIL

BOUNDARY OF COUNTRY PARK

2.5 H/S C/W

3.3 H/S C/W

7.3 C/W

北大嶼山公路

翔東路

Plot File by: ZENGSB 2012-10-24
PATH: P:\Projects\60240249\DRAWING\CONTRACT\C11000\C1_1008.dgn

AECOM

PROJECT 項目

TUEN MUN - CHEK LAP KOK LINK

CONTRACT TITLE

TUEN MUN - CHEK LAP KOK LINK - SOUTHERN CONNECTION VIADUCT SECTION

CLIENT 業主

路政署 HIGHWAYS DEPARTMENT
港珠澳大橋香港工程管理處 Hong Kong - Zhuhai - Macao Bridge Hong Kong Project Management Office

CONSULTANT 工程顧問公司

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Figure 2.4j

ISSUE/REVISION 修訂

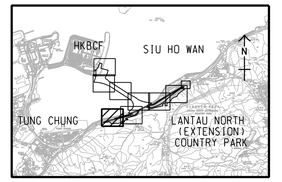
I/R 修訂	DATE 日期	DESCRIPTION 內容摘要	CHK. 複核
			CWN
-	OCT. 12	TENDER DRAWING	CWN

STATUS 階段

SCALE 比例: A1 1:1000

DIMENSION UNIT 尺寸單位: METRES

KEY PLAN 索引圖 1 : 100000



PROJECT NO. 項目編號: 60240249

CONTRACT NO. 合約編號: HY/2012/07

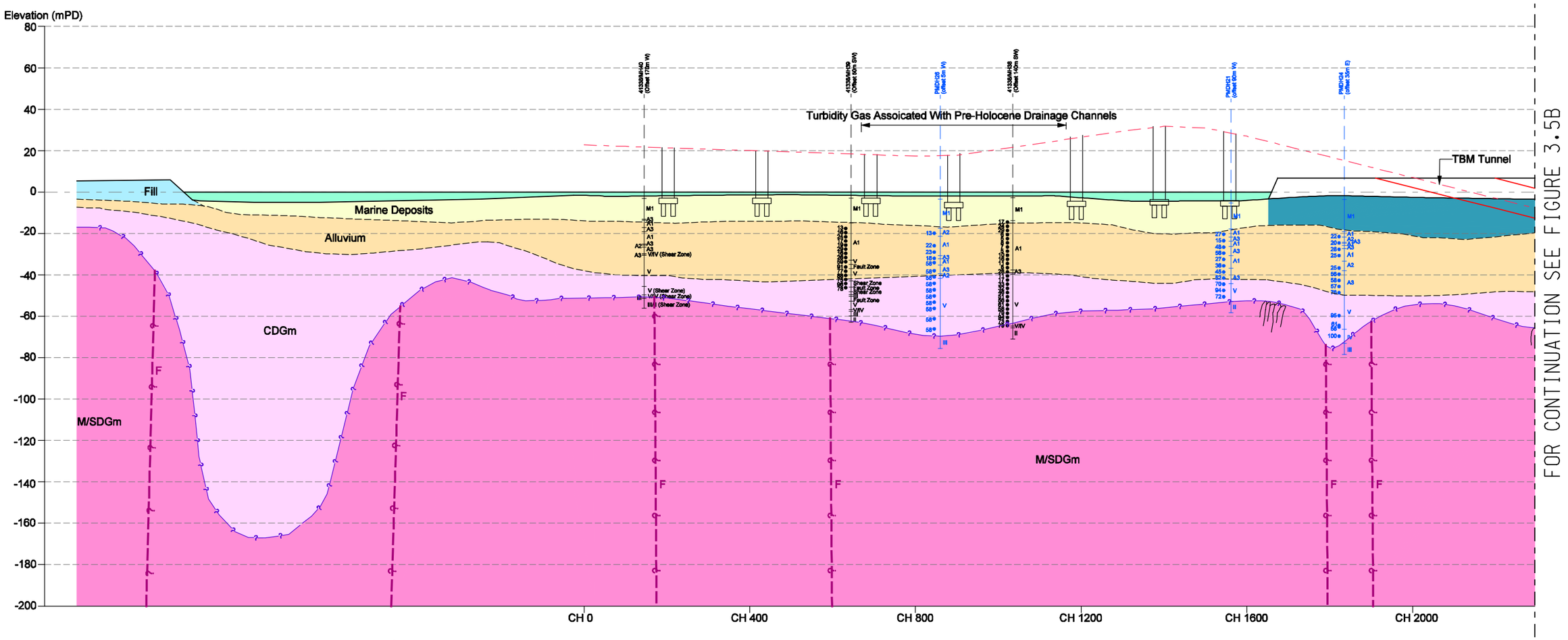
SHEET TITLE 圖紙名稱

GENERAL LAYOUT for Southern Viaduct (8)

SHEET 8 OF 8

SHEET NUMBER 圖紙編號

60240249/C1/1008



Legend:

- Fill
- Marine Deposits
- Estuarine Deposits
- Alluvium
- Colluvium
- Completely To Highly Decomposed Rock
- Grade III Or Better Rock (Refer To Granite,Otherwise Indicated On Section)
- Inferred Fault From Geophysical Data/Borehole Information
- Inferred Rockhead Along Original Alignment
- Inferred Rockhead Along Recommended Alignment

M2/A1 ← Current Drillhole

M2/A1 ← Existing Drillhole

M - Marine Deposit (1 Clay, 2 Silt)

A - Alluvial Deposit (3 Sand)

V - Completely Decomposed Rocks

IV - Highly Decomposed Rocks

III - Moderately Decomposed Rocks

II - Slightly Decomposed Rocks

•20 - SPT N Value

SCALE:

V: 1 : 2000 @ A3

H: 1 : 10000 @ A3

Note:

Rockhead Level & Material Profiles Are Referred From Adjacent Drillholes & Geophysical Survey Results

MAUNSELL | AECOM

Maunsell Consultants Asia Ltd

AGREEMENT NO. CE 52/2007(HY)

TUEN MUN - CHEK LAP KOK LINK - INVESTIGATION

GEOLOGICAL SECTION

SHEET 1 OF 3

SCALE	AS SHOWN	DATE	APR.2009
CHECK	--	DRAWN	CL
JOB No.	60044963	DRAWING No.	Fig 2.5a
		REV	--

Plotting By:2009-4-30
PLOT SCALE=$SCALESHORT$

p:\projects\60045854\DRAWING\WP31\090427\FIGURE 3.5A.dgn

N

813900 E

814900 E

815900 E

819300 N

818300 N

EXISTING TUNG CHUNG

NAVIGATION CHANNEL

NORTH LANTAU HIGHWAY

TAI HO WAN

大嶼灣

TAI HO WAN

Mass Transit Railway Depot

125

100

200

100

117

AECOM

AGREEMENT NO. CE 52/2007(HY)
TUEN MUN - CHEK LAP KOK LINK - INVESTIGATION

SOUTHERN VIADUCT CONNECTION AND SLIP ROADS

SCALE	A3 1:10000	DATE	JUL. 2009
CHECK	--	DRAWN	HBF
JOB No.	60044963	DRAWING No. **Fig 2.7**	REV A

Plotting By 8/06/2009
PLOT SCALE 1:10

p:\PROJECTS\60044963\DRAWING\FIGURE\EIA REPORT\CH3\FIGURE 3-7.dgn

817200 E

821200 E

825200 E

824800 N

820800 N

CASTLE PEAK BAY
(TSING SHAN WAN)

INSET A

WA4

INSET B

WA5

INSET A

WA4 - CLOSE TO TAI HO
OFFTAKE AND PIGGING STATION

WA5 - NORTH LANTAU HIGHWAY

INSET C

WA6 - NORTH LANTAU HIGHWAY

INSET B

MA WAN CHANNEL

INSET D

WA23 - WOK TAI WAN

INSET C

WA6

INSET D

WA23

DISCOVERY BAY
(TAI PAK WAN)

N

LEGEND:

PROPOSED WORKS AREA

AECOM

AGREEMENT NO. CE 52/2007(HY)
TUEN MUN - CHEK LAP KOK LINK - INVESTIGATION

PROPOSED WORKS AREAS FOR TMCLKL (LANTAU SIDE)

SCALE	A3 1:40000	DATE	JUN. 2009
CHECK	--	DRAWN	GXS
JOB No.	60044963	DRAWING No.	Fig 2.8b
		REV	--

Plotting By: 2009-6-12
PLOT SCALE: $SCALE$HORTS

p:\PROJECTS\60044963\DRAWING\FIGURE\EIA REPORT\CH3\FIGURE 3-8b.dgn

Activity ID	Activity Name	Original Duration	Start	Finish
HY/2012/07 - Tuen Mun - Chek Lap Kok Southern Connection				
Contract Dates				
Construction Programme				
CP100	Contract Award	0	13-Jun-13	
CP200	Commencement of the Works	0	22-Jun-13	
Key Dates				
Possession and Vacate Works Areas				
Preliminaries				
Procurement				
Sub-Contract Procurement				
Design				
General Requirements				
GR1000	General Mobilization	24	22-Jun-13	20-Jul-13
PR020	Site Survey/Ground Investigation/Install Geotechnical Instrumention	120	22-Jun-13	13-Nov-13
PR030	Application of EPD Permits	96	22-Jun-13	16-Oct-13
PR040	Application and obtaining marine dumping permits (incl. cross boundary)	96	22-Jun-13	16-Oct-13
PR050	Spot-check to locate corals/Undertake REA Survey & Prepare Report	36	22-Jun-13	03-Aug-13
PR060	Set-up MMLG	72	22-Jun-13	14-Sep-13
PR070	Notice to Mariner's	90	22-Jun-13	08-Oct-13
PR080	Temporary Working Platform (North Lantau)	72	09-Oct-13	07-Jan-14
PR090	Construction of Unloading Jetty (HKBCF)	72	01-Aug-15*	03-Nov-15
PR100	Initial Mobilization of Plant and Equipment for Piling Works	140	14-Nov-13	12-May-14
Precast Production				
Construction				
Approach from Lantau				
Structure A1				
A100010	TTM Implementation	0	01-Apr-15*	
A100012	Hoarding and Site Clearance	48	01-Apr-15	08-Jun-15
A100030	MTR Protection Barrier	30	21-Apr-15	30-May-15
A100040	New Sea wall retaining wall	48	21-Apr-15	29-Jun-15
A100050	Move MTR Fences	12	21-Apr-15	06-May-15
A100060	Divert Access Road	12	07-May-15	22-May-15
A101000	Land Piling Works (A1a)	41	10-Jun-15	05-Aug-15
A102000	Construct Abutment A	72	06-Aug-15	07-Nov-15
A103000	Land Piling Work (Pier A1b - Pier A1d)	54	06-Aug-15	15-Oct-15
A104000	Construction of Pile Caps (Pier A1b - Pier A1d)	63	14-Nov-15	29-Jan-16
A105000	Construction of Pier and Pier Heads (Pier A1b - Pier A1d)	76	29-Dec-15	02-Apr-16
A107000	Marine Bored Piling Work (Pier A1e - Pier A1f)	117	08-Jun-15	11-Nov-15
A107100	Construction of Marine Pile Caps (Pier A1e - Pier A1f)	44	08-Dec-15	30-Jan-16
A107200	Construction of Marine Pier and Pier Heads (Pier A1e - Pier A1f)	78	21-Jan-16	30-Apr-16
A108000	Install Precast Segments	106	13-May-16	05-Oct-16
A109000	Construction of Parapets	60	31-Aug-16	16-Nov-16
Structure A2				
A201000	Marine Bored Piling Works (Pier A2a - Pier A2e)	179	14-Mar-15	11-Nov-15
A201010	Construction of Marine Pile Caps (Pier A2a - Pier A2e)	144	07-Jul-15	06-Jan-16
A201020	Construction of Marine Pier and Pier Heads (Pier A2a - Pier A2e)	171	17-Aug-15	18-Mar-16
A201030	Install Precast Segments	48	10-Mar-16	12-May-16
A201040	Construction of Parapets	72	13-May-16	20-Aug-16
Structure A Others				
A109010	Structure A - Drainage/Fire Mains & Hydrants	60	15-Sep-16	30-Nov-16
A109050	Structure A - Flexible Paving Works	54	07-Nov-16	11-Jan-17
A109060	Structure A - Street Furniture Works	36	12-Jan-17	25-Feb-17
Structure B1				
B000000	TTM Implementation	0	01-Nov-13	
B000010	Hoarding and Fencing	24	01-Nov-13	28-Nov-13
B000020	Tree Survey, Tree Felling & Transplanting	101	01-Nov-13	05-Mar-14
B000040	Temporary Piling Platforms at slopes	72	15-Nov-13	13-Feb-14
B000050	Divert Roads & Utilities (IPA400/IPB500/HKBN/WTT/NWT/PCCW) for piling/cap	72	04-Feb-14	07-May-14

Planned Bar
Critical Bar
Milestone

Date	Revision	Checked	Approved
21-Jun-13	IWP - 1st Issue	RT	
12-Jul-13	Amended-SO Comment	RT	

Tuen Mun - Chek Lap Kok Southern Connection

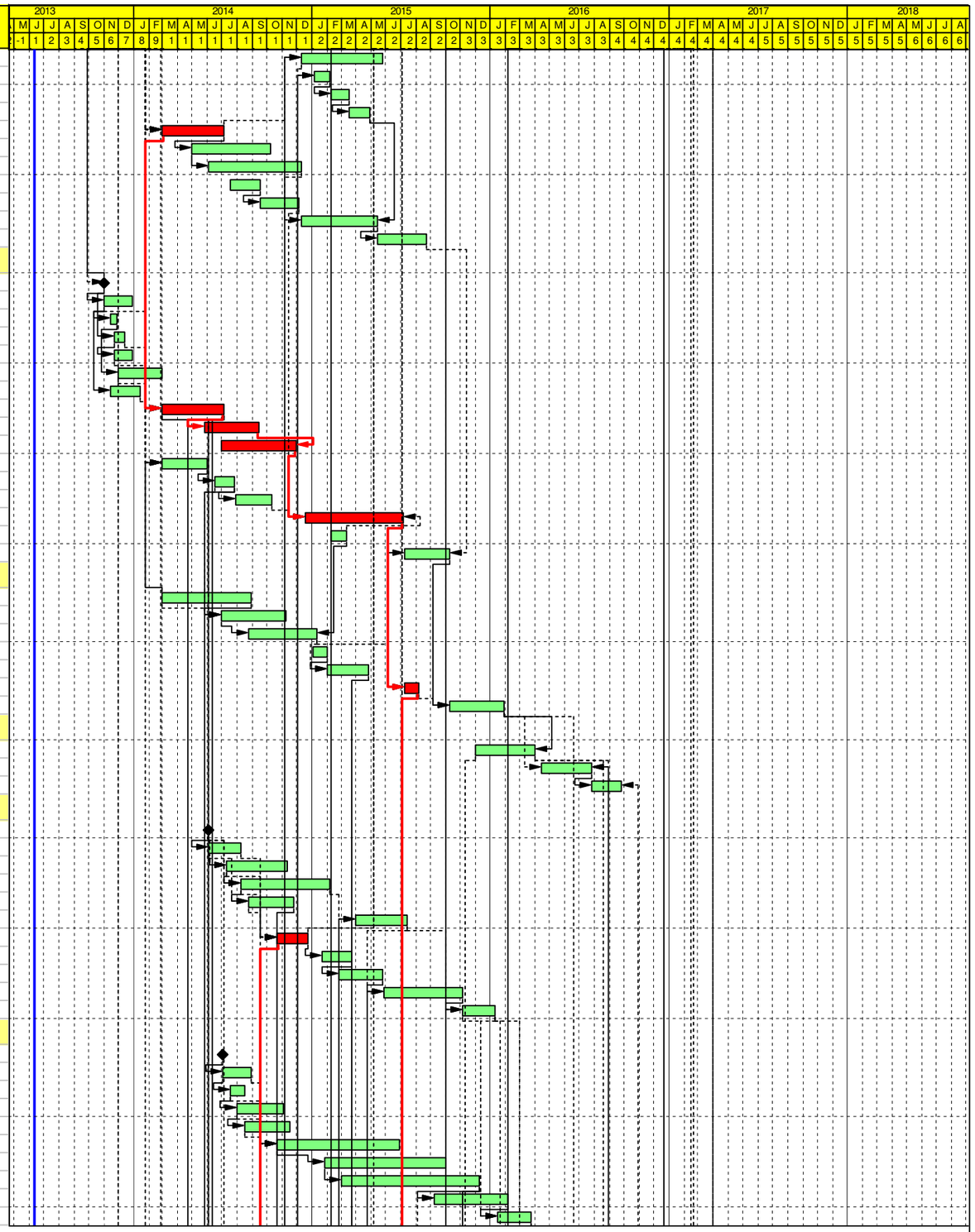
Initial Works Programme (Page 1 of 8 Pages)

Gammon ARUP LAMBETH

DWG. No.: Figure 2.9b

J3518/GCL/PGM/001 Rev. B

Activity ID	Activity Name	Original Duration	Start	Finish
B103000	Construct Abutment B	127	11-Dec-14	26-May-15
B103010	Land Piling Works (B1b/Pier B1c)	30	05-Jan-15	07-Feb-15
B103020	Construction of Pile Caps (B1b/Pier B1c)	30	09-Feb-15	18-Mar-15
B103030	Construction of Pier and Pier Heads (B1b/Pier B1c)	30	19-Mar-15	29-Apr-15
B104000	Land Piling Works (B1d - Pier B1g)	91	01-Mar-14*	05-Jul-14
B105000	Construction of Pile Caps (Pier B1d - Pier B1g)	117	30-Apr-14	07-Oct-14
B106000	Construction of Pier and Pier Heads (Pier B1d - Pier B1g)	145	03-Jun-14	09-Dec-14
B106010	Temporary Props and Platform	48	17-Jul-14	15-Sep-14
B107000	Assembly of Launching Girder	64	16-Sep-14*	05-Dec-14
B108000	Install Precast Segments	120	11-Dec-14	15-May-15
B109000	Construction of Parapets/Utilities Trough/Railings	72	16-May-15	24-Aug-15
Structure B2				
B200010	TTM Implementation	0	01-Nov-13*	
B200020	Hoarding and Fencing	48	01-Nov-13	28-Dec-13
B200022	Tree Felling	12	15-Nov-13	28-Nov-13
B200030	MTR Protection Barrier	18	22-Nov-13	12-Dec-13
B200040	Utilities Diversion (WTT/NWT/etc.) for piling/cap	30	22-Nov-13	28-Dec-13
B200050	Temporary Piling Platforms at slopes	72	29-Nov-13	27-Feb-14
B200060	New Sea wall retaining wall	48	15-Nov-13	13-Jan-14
B201000	Land Piling Work (Pier B2a - Pier B2e)	91	01-Mar-14	05-Jul-14
B202000	Construction of Pile Caps (Pier B2a - Pier B2e)	82	26-May-14	13-Sep-14
B203000	Construction of Pier and Pier Heads (Pier B2a - Pier B2e)	120	30-Jun-14	29-Nov-14
B204000	Marine Bored Piling Work (Pier B2f)	69	01-Mar-14	31-May-14
B205000	Construction of Marine Pile Caps (Pier B2f)	31	16-Jun-14	26-Jul-14
B206000	Construction of Marine Pier and Pier Heads (Pier B2f)	58	28-Jul-14	11-Oct-14
B208000	Install Precast Segments	148	19-Dec-14	07-Jul-15
B208010	Erection of Unloading Gantry at end Span B3a	24	09-Feb-15	11-Mar-15
B209000	Construction of Parapets/Utilities Trough/Railings	72	08-Jul-15	08-Oct-15
Structure B3				
B301000	Marine Bored Piling Work (Pier B3a - Pier B3f)	135	01-Mar-14*	30-Aug-14
B302000	Construction of Marine Pile Caps (Pier B3a - Pier B3f)	102	30-Jun-14	08-Nov-14
B303000	Construction of Marine Pier and Pier Heads (Pier B3a - Pier B3f)	110	25-Aug-14	10-Jan-15
B304000	Assembly of Lifting Frame	25	03-Jan-15	31-Jan-15
B304005	Install Precast Segments (B3b-B3e)	63	02-Feb-15*	25-Apr-15
B304010	Install Precast Segments (B3f)	25	08-Jul-15	07-Aug-15
B305000	Construction of Parapets/Utilities Trough/Railings	90	09-Oct-15	28-Jan-16
Structure B Others				
B309010	Structure B - Drainage/Fire Mains & Hydrants/Utilities	96	01-Dec-15	31-Mar-16
B309050	Structure B - Flexible Paving Works	72	15-Apr-16	25-Jul-16
B309060	Structure B - Street Furniture Works	48	26-Jul-16	23-Sep-16
Structure C1				
C100010	TTM Implementation	0	03-Jun-14*	
C100020	Hoarding and Fencing	48	03-Jun-14	08-Aug-14
C100030	Tree Survey, Tree Felling & Transplanting	96	09-Jul-14	10-Nov-14
C100040	Road Diversion & Utilities Diversion (NWT/PCCW/CTV/etc.) for piling/cap & abutment	144	09-Aug-14	05-Feb-15
C100060	Temporary Piling Platforms at slopes	72	25-Aug-14	24-Nov-14
C103000	Construct Abutment C	72	31-Mar-15	13-Jul-15
C104000	Land Piling Works (C1c - Pier C1e)	53	21-Oct-14*	22-Dec-14
C105000	Construction of Pile Caps (Pier C1d - Pier C1e)	51	20-Jan-15	23-Mar-15
C106000	Construction of Pier and Pier Heads (Pier C1d - Pier C1e)	69	24-Feb-15	26-May-15
C107000	Install Precast Segments	120	27-May-15	04-Nov-15
C109000	Construction of Parapets/Utilities Trough/Railings	54	05-Nov-15	09-Jan-16
Structure C2				
C200000	TTM Implementation	0	02-Jul-14*	
C200010	Hoarding and Fencing	48	02-Jul-14	30-Aug-14
C200020	Tree felling	24	17-Jul-14	15-Aug-14
C200030	Utilities Diversion (WTT/NWT/PCCW/CTV/etc.) for piling/cap	72	01-Aug-14	03-Nov-14
C200040	Temporary Piling Platforms at slopes	72	16-Aug-14	17-Nov-14
C201000	Land Piling Work (Pier C2a - Pier C2f)	192	21-Oct-14	29-Jun-15
C202000	Construction of Pile Caps (Pier C2a - Pier C2f)	185	27-Jan-15	02-Oct-15
C203000	Construction of Pier and Pier Heads (Pier C2a - Pier C2f)	213	03-Mar-15	09-Dec-15
C204000	Install Precast Segments	120	08-Sep-15	06-Feb-16
C205000	Construction of Parapets)/Utilities Trough/Railings	54	16-Jan-16	23-Mar-16



Planned Bar
Critical Bar
Milestone

Date	Revision	Checked	Approved
21-Jun-13	IWP - 1st Issue	RT	
12-Jul-13	Amended-SO Comment	RT	

Tuen Mun - Chek Lap Kok Southern Connection

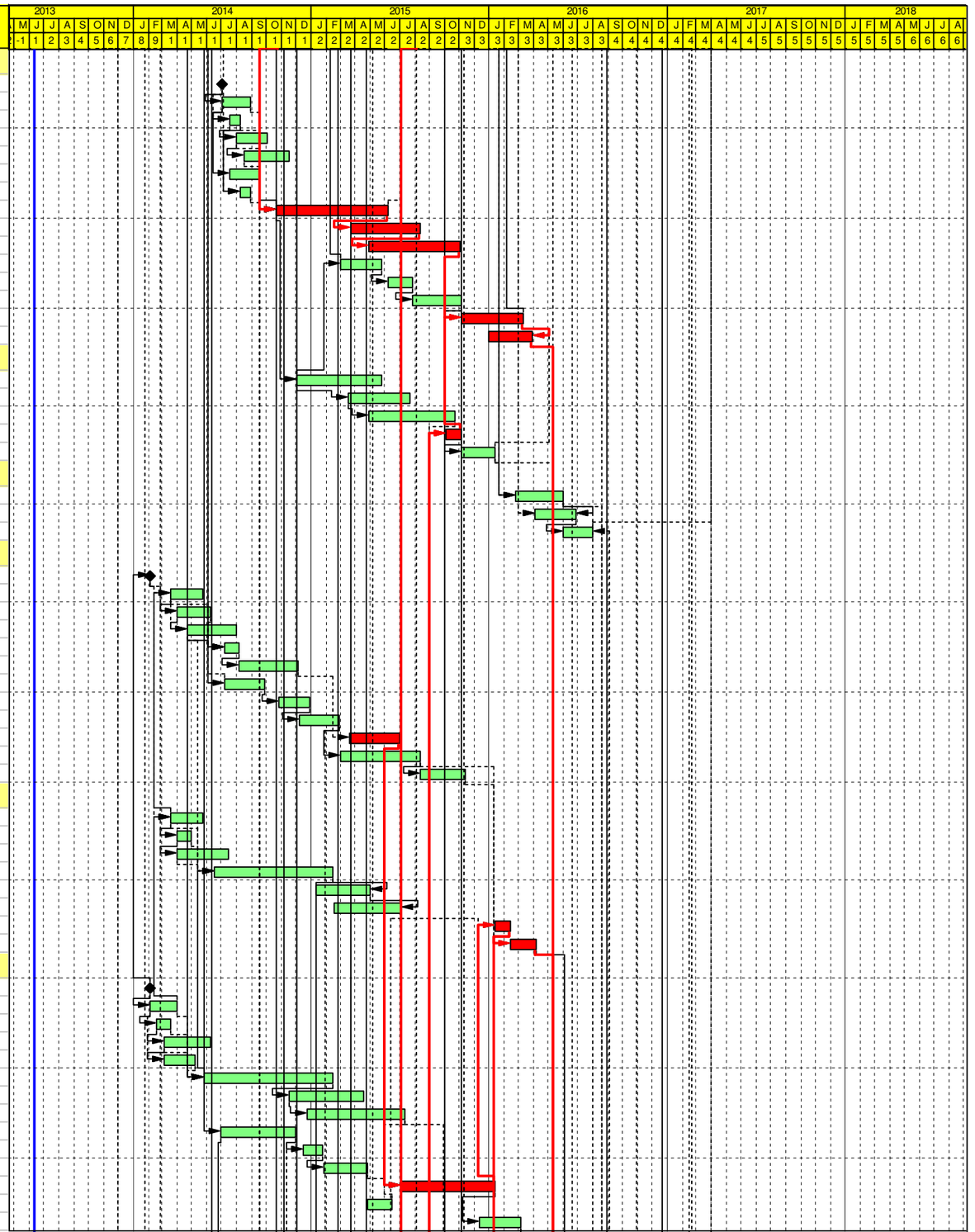
Initial Works Programme (Page 2 of 8 Pages)

Gammon ARUP LAMBETH

DWG. No.: Figure 2.9b

J3518/GCL/PGM/001 Rev. B

Activity ID	Activity Name	Original Duration	Start	Finish
Structure C3				
C300010	TTM Implementation	0	02-Jul-14*	
C300020	Hoarding and Fencing	48	02-Jul-14	30-Aug-14
C300030	Tree felling	18	17-Jul-14	08-Aug-14
C300040	Minor Utilities Diversion (WTT/NWT/etc.) for piling/cap	48	01-Aug-14	03-Oct-14
C300050	Temporary Piling Platforms at slopes	72	16-Aug-14	17-Nov-14
C300060	New Sea wall retaining wall	48	17-Jul-14	15-Sep-14
C300070	MTR Protection Barrier	18	09-Aug-14	30-Aug-14
C301000	Land Piling Work (Pier C3a - Pier C3e)	180	21-Oct-14*	08-Jun-15
C302000	Construction of Pile Caps (Pier C3a - Pier C3e)	102	24-Mar-15	13-Aug-15
C303000	Construction of Pier and Pier Heads (Pier C3a - Pier C3e)	140	28-Apr-15	03-Nov-15
C304000	Marine Bored Piling Work (Pier C3f)	63	03-Mar-15	26-May-15
C305000	Construction of Marine Pile Caps (Pier C3f)	35	08-Jun-15	27-Jul-15
C306000	Construction of Marine Pier and Pier Heads (Pier C3f)	76	28-Jul-15	04-Nov-15
C307000	Install Precast Segments	101	06-Nov-15	09-Mar-16
C308000	Construction of Parapets/Utilities Trough/Railings	72	30-Dec-15	30-Mar-16
Structure C4				
C401000	Marine Bored Piling Work (Pier C4a - Pier C4e)	135	02-Dec-14	26-May-15
C402000	Construction of Marine Pile Caps (Pier C4a - Pier C4e)	90	17-Mar-15	21-Jul-15
C403000	Construction of Marine Pier and Pier Heads (Pier C4a - Pier C4e)	131	28-Apr-15	22-Oct-15
C404000	Install Precast Segments	25	05-Oct-15	05-Nov-15
C405000	Construction of Parapets/Utilities Trough/Railings	54	06-Nov-15	11-Jan-16
Structure C Others				
C109010	Structure C - Drainage/Fire Mains & Hydrants/Utilities	72	24-Feb-16	30-May-16
C109050	Structure C - Flexible Paving Works	60	02-Apr-16	27-Jun-16
C109060	Structure C - Street Furniture Works	42	01-Jun-16	01-Aug-16
Structure D1				
D100010	TTM Implementation	0	04-Feb-14*	
D100020	Hoarding and Fencing	48	18-Mar-14	22-May-14
D100030	MTR Protection Barrier	48	01-Apr-14	09-Jun-14
D100050	Temporary Piling Platforms at slopes	72	22-Apr-14	30-Jul-14
D102000	Land Piling Works (D1b)	22	08-Jul-14	04-Aug-14
D103000	Construct Abutment D	96	05-Aug-14	04-Dec-14
D104000	Land Piling Work (Pier D1c - Pier D1d)	65	07-Jul-14	27-Sep-14
D105000	Construction of Pile Caps (Pier D1c - Pier D1d)	51	27-Oct-14	27-Dec-14
D106000	Construction of Pier and Pier Heads (Pier D1c - Pier D1d)	66	08-Dec-14	28-Feb-15
D107000	Assembly of Launching Girder	71	21-Mar-15*	02-Jul-15
D108000	Install Precast Segments	120	02-Mar-15	12-Aug-15
D109000	Construction of Parapets	72	13-Aug-15	13-Nov-15
Structure D2				
D200010	Hoarding and Fencing	48	18-Mar-14	22-May-14
D200020	MTR Protection Barrier	18	01-Apr-14	28-Apr-14
D200030	Temporary Piling Platforms at slopes	72	01-Apr-14	14-Jul-14
D201000	Land Piling Work (Pier D2a - Pier D2e)	192	16-Jun-14	14-Feb-15
D202000	Construction of Pile Caps (Pier D2a - Pier D2e)	86	12-Jan-15	02-May-15
D203000	Construction of Pier and Pier Heads (Pier D2a - Pier D2e)	99	16-Feb-15	04-Jul-15
D204000	Install Precast Segments	24	13-Jan-16	12-Feb-16
D205000	Construction of Parapets	42	13-Feb-16	06-Apr-16
Structure D3				
D100040	TTM Implementation	0	04-Feb-14*	
D300010	Hoarding and Fencing	48	04-Feb-14	31-Mar-14
D300020	MTR Protection Barrier	24	18-Feb-14	17-Mar-14
D300040	Temporary Piling Platforms at slopes	72	04-Mar-14	09-Jun-14
D300050	New Sea wall retaining wall	48	04-Mar-14	07-May-14
D301000	Land Piling Work (Pier D3a - Pier D3d)	205	26-May-14	14-Feb-15
D302000	Construction of Pile Caps (Pier D3a - Pier D3d)	121	17-Nov-14	18-Apr-15
D303000	Construction of Pier and Pier Heads (Pier D3a - Pier D3d)	150	22-Dec-14	11-Jul-15
D304000	Marine Bored Piling Work (Pier D3e)	120	30-Jun-14	29-Nov-14
D305000	Construction of Marine Pile Caps (Pier D3e)	33	15-Dec-14	24-Jan-15
D306000	Construction of Marine Pier and Pier Heads (Pier D3e)	69	26-Jan-15	25-Apr-15
D307000	Install Precast Segments	152	03-Jul-15	12-Jan-16
D307010	Erection of Unloading Gantry at end Span D4a	36	27-Apr-15*	15-Jun-15
D308000	Construction of Parapets	66	12-Dec-15	04-Mar-16



Planned Bar
Critical Bar
Milestone

Date	Revision	Checked	Approved
21-Jun-13	IWP - 1st Issue	RT	
12-Jul-13	Amended-SO Comment	RT	

Tuen Mun - Chek Lap Kok Southern Connection

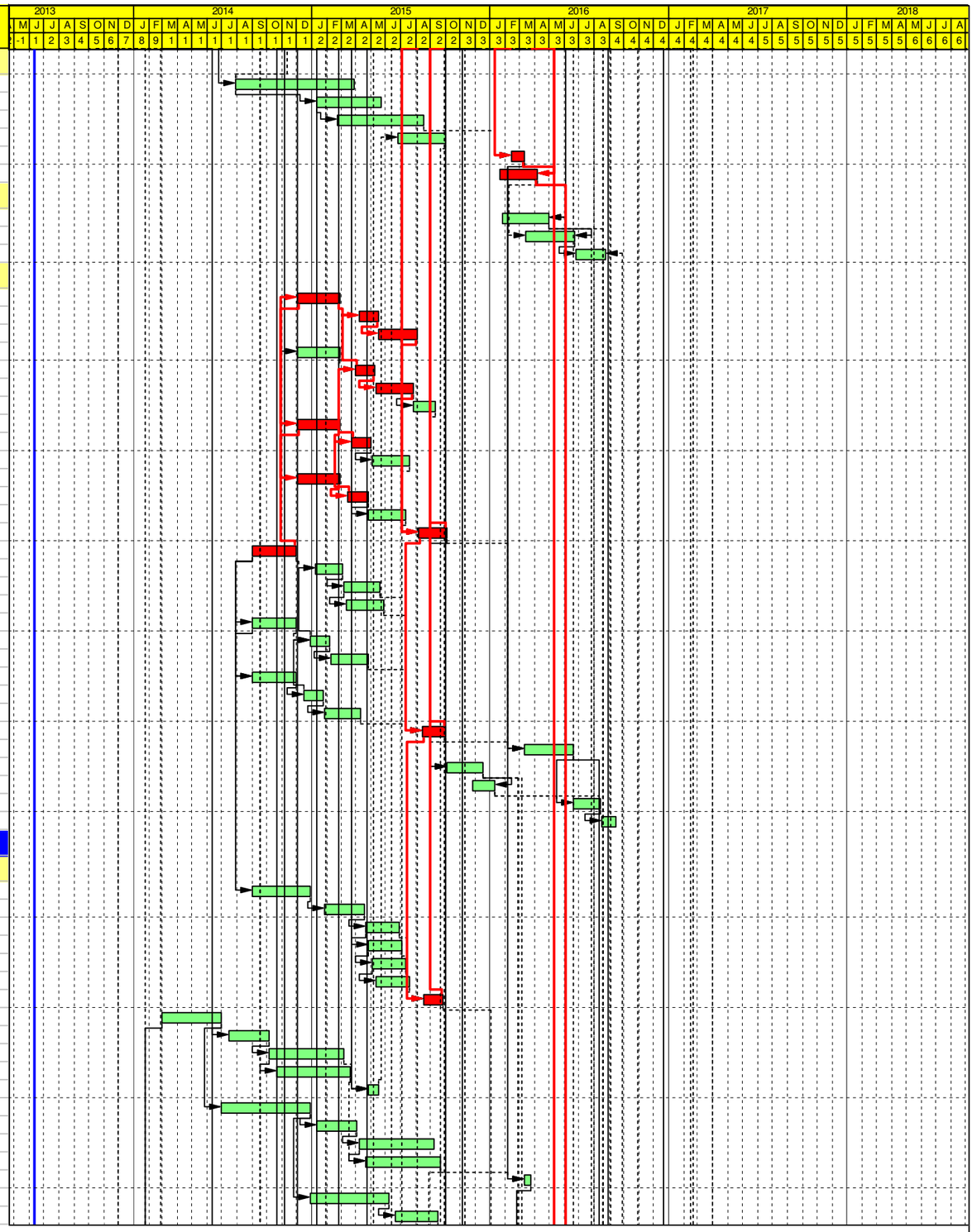
Initial Works Programme (Page 3 of 8 Pages)

Gammon ARUP LAMBETH

DWG. No.: Figure 2.9b

J3518/GCL/PGM/001 Rev. B

Activity ID	Activity Name	Original Duration	Start	Finish
Structure D4				
D401000	Marine Bored Piling Work (Pier D4a - Pier D4f)	194	28-Jul-14	28-Mar-15
D402000	Construction of Marine Pile Caps (Pier D4a - Pier D4f)	102	12-Jan-15	23-May-15
D403000	Construction of Marine Pier and Pier Heads (Pier D4a - Pier D4f)	131	23-Feb-15	18-Aug-15
D40400	Install Precast Segments (D4b-D4e)	74	27-Jun-15*	30-Sep-15
D404020	Install Precast Segments	22	13-Feb-16	09-Mar-16
D409000	Construction of Parapets	60	20-Jan-16	06-Apr-16
Structure D Others				
D409010	Structure D - Drainage/Fire Mains & Hydrants	72	27-Jan-16	29-Apr-16
D409050	Structure D - Flexible Paving Works	72	12-Mar-16	22-Jun-16
D409060	Structure D - Street Furniture Works	48	23-Jun-16	23-Aug-16
Structure E1				
E101000	Marine Bored Piling Work (E1a1)	72	01-Dec-14	28-Feb-15
E101010	Construction of Marine Pile Cap (E1a1)	30	08-Apr-15	16-May-15
E101020	Construction of Marine Pier and Pier Head (E1a1)	56	18-May-15	04-Aug-15
E102000	Marine Bored Piling Work (E1a2)	72	01-Dec-14	28-Feb-15
E102010	Construction of Marine Pile Cap (E1a2)	29	30-Mar-15	09-May-15
E102020	Construction of Marine Pier and Pier Head (E1a2)	55	11-May-15	27-Jul-15
E102040	Erection of Unloading Gantry at Structure E1	36	28-Jul-15	11-Sep-15
E103000	Marine Bored Piling Work (E1a3)	72	01-Dec-14	28-Feb-15
E103010	Construction of Marine Pile Cap (E1a3)	29	23-Mar-15	02-May-15
E103020	Construction of Marine Pier and Pier Head (E1a3)	55	04-May-15	20-Jul-15
E104000	Marine Bored Piling Work (E1a4)	72	01-Dec-14	28-Feb-15
E104010	Construction of Marine Pile Cap (E1a4)	30	16-Mar-15	25-Apr-15
E104020	Construction of Marine Pier and Pier Head (E1a4)	54	27-Apr-15	11-Jul-15
E104030	Install Precast Segments (E1a1-E1a4)	43	08-Aug-15	03-Oct-15
E105000	Marine Bored Piling Work (E1b1/E1b2)	71	01-Sep-14*	29-Nov-14
E105010	Construction of Marine Pile Cap (E1b1/E1b2)	45	09-Jan-15	05-Mar-15
E105020	Construction of Marine Pier and Pier Head (E1b1)	57	06-Mar-15	20-May-15
E105022	Construction of Marine Pier and Pier Head (E1b2)	56	13-Mar-15	28-May-15
E106010	Marine Bored Piling Work (E1b3)	71	01-Sep-14	29-Nov-14
E106020	Construction of Marine Pile Caps (E1b3)	35	29-Dec-14	07-Feb-15
E106030	Construction of Marine Pier and Pier Heads (E1b3)	57	09-Feb-15	25-Apr-15
E107000	Marine Bored Piling Work (E1b4)	71	01-Sep-14	29-Nov-14
E107010	Construction of Marine Pile Caps (E1b4)	33	15-Dec-14	24-Jan-15
E107020	Construction of Marine Pier and Pier Heads (E1b4)	59	26-Jan-15	11-Apr-15
E107030	Install Precast Segments (E1b1-E1b4)	37	14-Aug-15	30-Sep-15
E108000	Construction of Parapets/Utilities Trough/Center Divider/Railings	72	10-Mar-16	18-Jun-16
E108010	Construction of Utilities Cross-over structures	60	05-Oct-15	16-Dec-15
E108030	Drainages/Fire Mains & Hydrants/Utilities	36	26-Nov-15	09-Jan-16
E108040	Sub-base/Flexible Paving Works	42	20-Jun-16	13-Aug-16
E108050	Street Furniture Works	24	15-Aug-16	13-Sep-16
Main Marine Crossing				
Structure E2				
E201000	Marine Bored Piling Work (E2a1/E2a2/E2a3/E2a4)	93	01-Sep-14	27-Dec-14
E201010	Construction of Marine Pile Cap (E2a1/E2a2/E2a3/E2a4)	64	26-Jan-15	18-Apr-15
E201020	Construction of Marine Pier and Pier Head (E2a1)	48	20-Apr-15	27-Jun-15
E201022	Construction of Marine Pier and Pier Head (E2a2)	48	27-Apr-15	04-Jul-15
E201024	Construction of Marine Pier and Pier Head (E2a3)	49	04-May-15	11-Jul-15
E201026	Construction of Marine Pier and Pier Head (E2a4)	49	11-May-15	20-Jul-15
E201030	Install Precast Segments (E2a1/E2a2/E2a3/E2a4)	30	19-Aug-15	25-Sep-15
E202000	Marine Bored Piling Work (E2b1- E2b2)	86	01-Mar-14*	28-Jun-14
E202010	Construction of Marine Pile Cap (E2b1- E2b2)	63	14-Jul-14	04-Oct-14
E202020	Construction of Marine Seagull Pier (E2b1) (incl. Precast Segment Pier Head)	124	06-Oct-14	07-Mar-15
E202022	Construction of Marine Seagull Pier (E2b2) (incl. Precast Segment Pier Head)	125	20-Oct-14	21-Mar-15
E202030	Install Precast Segments (E2b1- E2b2)	16	27-Apr-15	16-May-15
E203000	Marine Bored Piling Work (E2c1- E2c2)	142	30-Jun-14	27-Dec-14
E203010	Construction of Marine Pile Cap (E2c1- E2c2)	67	12-Jan-15	02-Apr-15
E203020	Construction of Marine Seagull Pier (E2c1) (incl. Precast Segment Pier Head)	114	08-Apr-15	08-Sep-15
E203022	Construction of Marine Seagull Pier (E2c2) (incl. Precast Segment Pier Head)	115	20-Apr-15	22-Sep-15
E203030	Install Precast Segments	13	10-Mar-16	24-Mar-16
E204000	Marine Bored Piling Work (E2d1- E2d2)	123	29-Dec-14	06-Jun-15
E204010	Construction of Marine Pile Cap (E2d1- E2d2)	66	22-Jun-15	15-Sep-15



Planned Bar
Critical Bar
Milestone

Date	Revision	Checked	Approved
21-Jun-13	IWP - 1st Issue	RT	
12-Jul-13	Amended-SO Comment	RT	

Tuen Mun - Chek Lap Kok Southern Connection

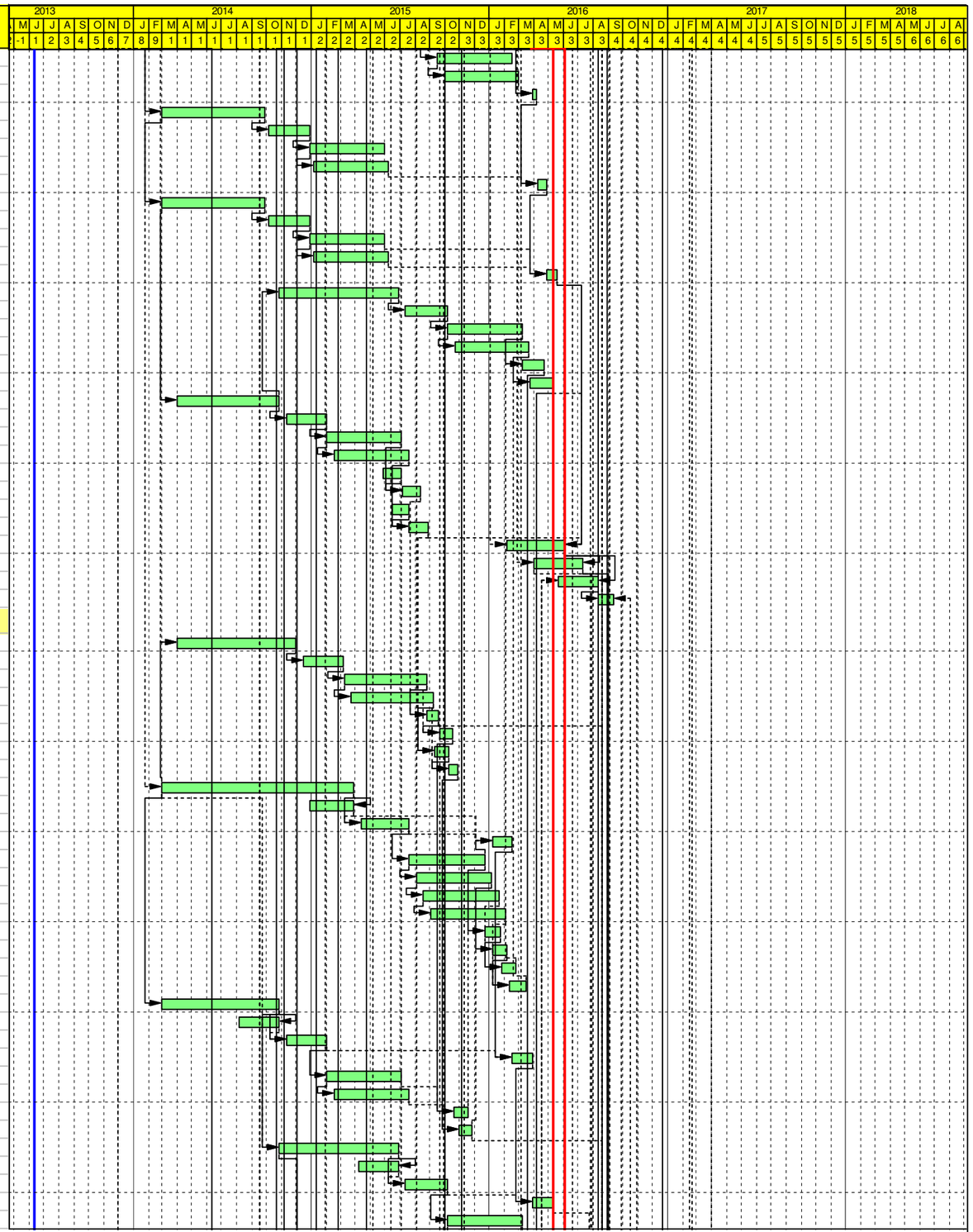
Initial Works Programme (Page 4 of 8 Pages)

Gammon ARUP LAMBETH

DWG. No.: Figure 2.9b

J3518/GCL/PGM/001 Rev. B

Activity ID	Activity Name	Original Duration	Start	Finish
E204020	Construction of Marine Seagull Pier (E2d1) (incl. Precast Segment Pier Head)	120	16-Sep-15	16-Feb-16
E204022	Construction of Marine Seagull Pier (E2d2) (incl. Precast Segment Pier Head)	121	02-Oct-15	01-Mar-16
E204030	Install Precast Segments	8	29-Mar-16	07-Apr-16
E205000	Marine Bored Piling Work (E2e1- E2e2)	156	01-Mar-14	27-Sep-14
E205010	Construction of Marine Pile Cap (E2e1- E2e2)	68	06-Oct-14	27-Dec-14
E205020	Construction of Marine Seagull Pier (E2e1) (incl. Precast Segment Pier Head)	118	29-Dec-14	30-May-15
E205022	Construction of Marine Seagull Pier (E2e2) (incl. Precast Segment Pier Head)	118	05-Jan-15	06-Jun-15
E205030	Install Precast Segments	15	08-Apr-16	27-Apr-16
E206000	Marine Bored Piling Work (E2f1- E2f2)	156	01-Mar-14	27-Sep-14
E206010	Construction of Marine Pile Cap (E2f1- E2f2)	68	06-Oct-14	27-Dec-14
E206020	Construction of Marine Seagull Pier (E2f1) (incl. Precast Segment Pier Head)	118	29-Dec-14	30-May-15
E206022	Construction of Marine Seagull Pier (E2f2) (incl. Precast Segment Pier Head)	118	05-Jan-15	06-Jun-15
E206030	Install Precast Segments	16	28-Apr-16	19-May-16
E207000	Marine Bored Piling Work (E2g1- E2g2)	186	27-Oct-14	27-Jun-15
E207010	Construction of Marine Pile Cap (E2g1- E2g2)	66	13-Jul-15	06-Oct-15
E207020	Construction of Marine Seagull Pier (E2g1) (incl. Precast Segment Pier Head)	123	07-Oct-15	08-Mar-16
E207022	Construction of Marine Seagull Pier (E2g2) (incl. Precast Segment Pier Head)	124	22-Oct-15	22-Mar-16
E207025	Install Precast Segments (E2g1)	33	09-Mar-16	22-Apr-16
E207030	Install Precast Segments (E2g2)	34	23-Mar-16	09-May-16
E208000	Marine Bored Piling Work (E2h1- E2h2)	152	31-Mar-14	25-Oct-14
E208010	Construction of Marine Pile Cap (E2h1- E2h2)	69	10-Nov-14	31-Jan-15
E208020	Construction of Marine Seagull Pier (E2h1) (incl. Precast Segment Pier Head)	111	02-Feb-15	04-Jul-15
E208022	Construction of Marine Seagull Pier (E2h2) (incl. Precast Segment Pier Head)	111	16-Feb-15	20-Jul-15
E208023	Assembly of Lifting Frame	25	28-May-15	04-Jul-15
E208025	Install Precast Segments (E2h1)	30	06-Jul-15	12-Aug-15
E208028	Assembly of Lifting Frame	25	15-Jun-15	20-Jul-15
E208030	Install Precast Segments (E2h2)	30	21-Jul-15	27-Aug-15
E212000	Construction of Parapets/Utilities Trough/Center Divider/Railings	89	06-Feb-16	04-Jun-16
E212010	Drainages/Fire Mains & Hydrants/Utilities	72	01-Apr-16	11-Jul-16
E212050	Sub-base/Flexible Paving Works	60	20-May-16	11-Aug-16
E212060	Street Furniture Works	24	12-Aug-16	10-Sep-16
Structure E5, E6, E7 & E8				
E501000	Marine Bored Piling Work (E5E6a/E7E8a)	181	31-Mar-14	29-Nov-14
E501010	Construction of Marine Pile Cap (E5E6a/E7E8a)	66	15-Dec-14	07-Mar-15
E501020	Construction of Marine Seagull Pier (E5E6a) (incl. Precast Segment Pier Head)	124	09-Mar-15	25-Aug-15
E501022	Construction of Marine Seagull Pier (E7E8a) (incl. Precast Segment Pier Head)	124	23-Mar-15	08-Sep-15
E501030	Install Precast Segment (E5a)	20	26-Aug-15	19-Sep-15
E501032	Install Precast Segment (E6a)	21	21-Sep-15	17-Oct-15
E501034	Install Precast Segment (E8a)	22	10-Sep-15	08-Oct-15
E501036	Install Precast Segment (E7a)	15	09-Oct-15	28-Oct-15
E502000	Marine Bored Piling Work (E5b/E6b/E7b/E8b)	302	01-Mar-14*	28-Mar-15
E502002	Marine Bored Piling Work (Dolphin N/S)	74	29-Dec-14	28-Mar-15
E502010	Construction of Marine Pile Cap (E5b/E6b/E7b/E8b)	70	13-Apr-15	20-Jul-15
E502012	Construction of Marine Pile Cap (Dolphin N/S)	33	06-Jan-16	16-Feb-16
E502020	Construction of Marine Seagull Pier (E5b) (incl. Precast Segment Pier Head)	123	21-Jul-15	22-Dec-15
E502022	Construction of Marine Seagull Pier (E6b) (incl. Precast Segment Pier Head)	120	05-Aug-15	05-Jan-16
E502024	Construction of Marine Seagull Pier (E7b) (incl. Precast Segment Pier Head)	121	19-Aug-15	19-Jan-16
E502026	Construction of Marine Seagull Pier (E8b) (incl. Precast Segment Pier Head)	122	02-Sep-15	02-Feb-16
E502030	Install Precast Segment (E5b)	25	23-Dec-15	23-Jan-16
E502032	Install Precast Segment (E6b)	28	06-Jan-16	06-Feb-16
E502034	Install Precast Segment (E7b)	24	25-Jan-16	24-Feb-16
E502036	Install Precast Segment (E8b)	30	11-Feb-16	16-Mar-16
E503002	Marine Bored Piling Work (E5c/E6c)	177	01-Mar-14	25-Oct-14
E503004	Marine Bored Piling Work (E5c Dolphin)	64	04-Aug-14	25-Oct-14
E503006	Construction of Marine Pile Cap (E5c/E6c)	69	10-Nov-14	31-Jan-15
E503008	Construction of Marine Pile Cap (E5c Dolphin)	33	17-Feb-16	29-Mar-16
E503010	Construction of Marine Seagull Pier (E5c) (incl. Precast Segment Pier Head)	111	02-Feb-15	04-Jul-15
E503012	Construction of Marine Seagull Pier (E6c) (incl. Precast Segment Pier Head)	111	16-Feb-15	20-Jul-15
E503014	Install Precast Segment (E5c)	24	19-Oct-15	17-Nov-15
E503016	Install Precast Segment (E6c)	25	30-Oct-15	27-Nov-15
E503100	Marine Bored Piling Work (E7c/E8c)	186	27-Oct-14	27-Jun-15
E503102	Marine Bored Piling Work (E8c Dolphin)	57	08-Apr-15	27-Jun-15
E503104	Construction of Marine Pile Cap (E7c/E8c)	66	13-Jul-15	06-Oct-15
E503106	Construction of Marine Pile Cap (E8c Dolphin)	33	30-Mar-16	11-May-16
E503108	Construction of Marine Seagull Pier (E7c) (incl. Precast Segment Pier Head)	123	07-Oct-15	08-Mar-16



Planned Bar
Critical Bar
Milestone

Date	Revision	Checked	Approved
21-Jun-13	IWP - 1st Issue	RT	
12-Jul-13	Amended-SO Comment	RT	

Tuen Mun - Chek Lap Kok Southern Connection

Initial Works Programme (Page 5 of 8 Pages)

Gammon ARUP LAMBETH

DWG. No.: Figure 2.9b

J3518/GCL/PGM/001 Rev. B

Activity ID	Activity Name	Original Duration	Start	Finish
E503110	Construction of Marine Seagull Pier (E8c) (incl. Precast Segment Pier Head)	124	22-Oct-15	22-Mar-16
E503112	Install Precast Segment (E7c)	29	23-Apr-16	31-May-16
E503114	Install Precast Segment (E8c)	27	10-May-16	18-Jun-16
E503200	Land Bored Piling Work (E5d)	98	05-Jan-15	09-May-15
E503202	Construction of Pile Caps (E5d)	23	11-May-15	12-Jun-15
E503204	Construction of Pier (E5d)	72	13-Jun-15	16-Sep-15
E503205	Install End Span Temporary Falsework (E5d)	74	07-Sep-15	09-Dec-15
E503206	Install Precast Segment (E5d)	30	10-Dec-15	16-Jan-16
E503300	Land Bored Piling Work (E6d)	98	05-Jan-15	09-May-15
E503302	Construction of Pile Caps (E6d)	28	24-Jun-15	30-Jul-15
E503304	Construction of Pier and Pier Heads (E6d)	83	31-Jul-15	14-Nov-15
E503306	Install Precast Segment (E6d)	25	22-Jan-16	23-Feb-16
E503400	Land Bored Piling Work (E7d)	89	11-May-15	08-Sep-15
E503402	Construction of Pile Caps (E7d)	28	22-Oct-15	24-Nov-15
E503404	Construction of Pier and Pier Heads (E7d)	72	25-Nov-15	23-Feb-16
E503406	Install Precast Segment (E7d)	20	09-May-16	04-Jun-16
E503500	Land Bored Piling Work (E8d)	94	11-May-15	15-Sep-15
E503502	Construction of Pile Caps (E8d)	27	07-Oct-15	10-Nov-15
E503504	Construction of Pier and Pier Heads (E8d)	84	11-Nov-15	23-Feb-16
E503506	Install Precast Segment (E8d)	37	24-Feb-16	11-Apr-16
E509000	Construction of Parapets/Utilities Trough	150	24-Dec-15	14-Jul-16
E509010	Drainage/Fire Mains & Hydrants/Utilities	140	05-Feb-16	13-Aug-16
E509040	Flexible Paving Works	90	12-Apr-16	13-Aug-16
E509060	Street Furniture Works	24	15-Aug-16	13-Sep-16
HKBCF Section				
Structure F1				
F102000	Mobilization	6	03-Nov-14	08-Nov-14
F103000	Land Piling Work (Pier F1b - Pier F1d) (1 rigs)	73	05-Dec-14	06-Mar-15
F104000	Construction of Pile Caps (Pier F1b - Pier F1d)	34	30-Mar-15	16-May-15
F105000	Construction of Pier and Pier Heads (Pier F1b - Pier F1d)	85	07-May-15	31-Aug-15
F105010	Install End Span Temporary Falsework (F1d)	20	16-Sep-15	12-Oct-15
F106010	Install Precast Segment (Pier F1d)	16	04-Nov-15	21-Nov-15
F106020	Install Precast Segment (Pier F1b - Pier F1c)	35	26-Oct-15*	05-Dec-15
F109000	Construction of Parapets	60	07-Dec-15	20-Feb-16
F109010	Drainage/Fire Mains & Hydrants/Utilities	48	22-Feb-16	23-Apr-16
F109050	Sub-base/Flexible Paving Works	36	25-Apr-16	13-Jun-16
F109060	Street Furniture Works	18	14-Jun-16	09-Jul-16
Structure F2				
F201000	Mobilization	6	28-Feb-15	06-Mar-15
F202000	Land Piling Works (Pier F2b - Pier F2f) (1 rigs)	134	07-Mar-15	04-Sep-15
F205000	Construction of Pile Caps (Pier F2b - Pier F2f)	115	07-Jul-15	30-Nov-15
F206000	Construction of Pier and Pier Heads (Pier F2b - Pier F2f)	164	12-Aug-15	05-Mar-16
F206010	Install End Span Temporary Falsework (F2f)	15	25-Apr-16	12-May-16
F207010	Install Precast Segment (Pier F2f)	16	13-May-16	04-Jun-16
F207020	Install Precast Segment (Pier F2d & Pier F2c)	37	07-Dec-15	21-Jan-16
F207030	Install Precast Segment (Pier F2b & Pier F2e)	29	06-Jun-16	18-Jul-16
F209000	Construction of Parapets	72	06-Jun-16	10-Sep-16
F209010	Drainage/Fire Mains & Hydrants	72	28-Jul-16	29-Oct-16
F209050	Sub-base/Flexible Paving Works	60	28-Sep-16	10-Dec-16
F209060	Street Furniture Works	48	12-Dec-16	11-Feb-17
Structure F3				
F301000	Mobilization	6	23-Mar-15	28-Mar-15
F302000	Land Piling Works (Pier F3a - Pier F3d) (2 rigs)	95	30-Mar-15	10-Aug-15
F305000	Construction of Pile Caps (Pier F3a - Pier F3d)	63	05-Sep-15	25-Nov-15
F306000	Construction of Pier and Pier Heads (Pier F3a - Pier F3d)	121	20-Oct-15	17-Mar-16
F306010	Install Viaduct F3 Temporary Falsework	30	27-Jan-16	04-Mar-16
F307000	Install Precast Segment (Pier F3a - Pier F3d)	64	05-Mar-16	30-May-16
F309000	Construction of Parapets/Median Barrier	72	31-May-16	05-Sep-16
F309010	Drainage/Fire Mains & Hydrants	72	23-Jul-16	24-Oct-16
F309050	Sub-base/Flexible Paving Works	72	23-Sep-16	21-Dec-16
F309060	Street Furniture Works	48	22-Dec-16	22-Feb-17
Structure F4				
F401000	Mobilization	6	04-Aug-15	10-Aug-15

Planned Bar
Critical Bar
Milestone

Date	Revision	Checked	Approved
21-Jun-13	IWP - 1st Issue	RT	
12-Jul-13	Amended-SO Comment	RT	

Tuen Mun - Chek Lap Kok Southern Connection

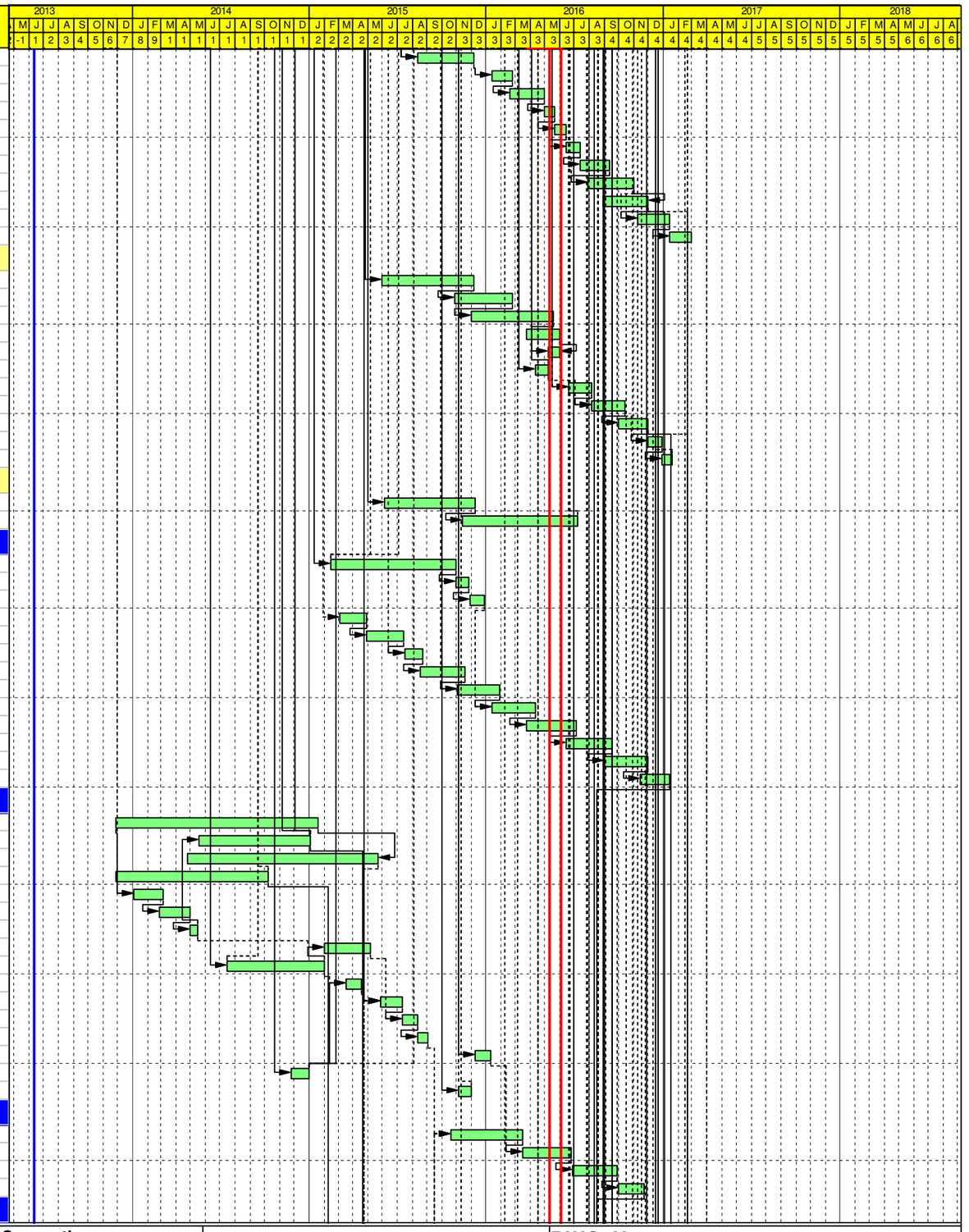
Initial Works Programme (Page 6 of 8 Pages)

Gammon ARUP LAMBETH

DWG. No.: Figure 2.9b

J3518/GCL/PGM/001 Rev. B

Activity ID	Activity Name	Original Duration	Start	Finish
F402000	Land Piling Works (Pier F4a - Pier F4c) (1 rig)	92	12-Aug-15	05-Dec-15
F405000	Construction of Pile Caps (Pier F4a - Pier F4c)	34	13-Jan-16	24-Feb-16
F406000	Construction of Pier and Pier Heads (Pier F4a - Pier F4c)	56	18-Feb-16	29-Apr-16
F406010	Install End Span Temporary Falsework (F4c)	15	30-Apr-16	20-May-16
F407010	Install Precast Segment (Pier F4c)	16	21-May-16	13-Jun-16
F407020	Install Precast Segment (Pier F4a)	20	14-Jun-16	13-Jul-16
F407030	Install Precast Segment (Pier F4b-1 & F4b-2)	48	14-Jul-16	12-Sep-16
F409000	Construction of Parapets	72	29-Jul-16	31-Oct-16
F409010	Drainage/Fire Mains & Hydrants	72	29-Aug-16	28-Nov-16
F409050	Sub-base/Flexible Paving Works	54	08-Nov-16	12-Jan-17
F409060	Street Furniture Works	36	13-Jan-17	27-Feb-17
Structure F5				
F501000	Land Piling Work (Pier F5b - Pier F5d) (1 rig)	144	30-May-15	05-Dec-15
F502000	Construction of Pile Caps (Pier F5b - Pier F5d)	96	28-Oct-15	24-Feb-16
F503000	Construction of Pier and Pier Heads (Pier F5b - Pier F5d)	131	01-Dec-15	18-May-16
F503010	Install End Span Temporary Falsework (F5d)	48	24-Mar-16	30-May-16
F504010	Install Precast Segment (Pier F5d)	16	09-May-16	30-May-16
F504020	Install Precast Segment (Pier F5c)	20	12-Apr-16	07-May-16
F504030	Install Precast Segment (Pier F5b & F5a)	35	20-Jun-16	04-Aug-16
F509000	Construction of Parapets	54	05-Aug-16	14-Oct-16
F509010	Drainage/Fire Mains & Hydrants	48	29-Sep-16	28-Nov-16
F509050	Sub-base/Flexible Paving Works	24	29-Nov-16	28-Dec-16
F509060	Street Furniture Works	18	29-Dec-16	19-Jan-17
Structure F Abutment				
F303000	Piling Works for Abutment (F3a-F2f-F4c)	144	05-Jun-15	10-Dec-15
F403000	Construct Abutment (F3a-F2f-F4c)	180	13-Nov-15	07-Jul-16
At grade Roadworks & Other Works along NLH				
M201000	9SE-B/FR8 - Slope Modification Works (incl. Pre-Bored H-Piles Walls)	190	14-Feb-15	30-Oct-15
M201010	9SE-B/R2 - Slope Modification Works	24	31-Oct-15	27-Nov-15
M201020	9SE-B/R1 - Slope Modification Works	24	28-Nov-15	28-Dec-15
M201150	10NW-C/F50 - Slope Modification Works	42	05-Mar-15	29-Apr-15
M201160	10NW-C/F10 - Slope Modification Works (incl. L-Shape Retaining Walls)	54	30-Apr-15	15-Jul-15
M201170	10NW-C/R4 - Slope Modification Works	30	17-Jul-15	24-Aug-15
M201180	10NW-C/F11 - Slope Modification Works (incl. Concrete Toe Walls)	72	17-Aug-15	17-Nov-15
M201190	10NW-C/F17 - Slope Modification Works (incl. Conc. Toe Walls & L-Shape Ret. Walls)	72	02-Nov-15	27-Jan-16
M201200	10NW-C/F9 - Slope Modification Works (incl. L-Shape Retaining Walls)	72	12-Jan-16	12-Apr-16
RW10100	Drainage/Watermain Works	72	23-Mar-16	05-Jul-16
RW10300	Sub-base Works for tie-ins	72	14-Jun-16	17-Sep-16
RW10400	Paving Works for tie-ins	72	31-Aug-16	30-Nov-16
RW10500	Street Furnitures Works for tie-ins	48	15-Nov-16	12-Jan-17
At grade Roadworks and Other Works along Cheung Tung Road				
B000100	West Natural Terrain Hazard Mitigation Measures (incl. Piling Works for Check Dams)	320	27-Nov-13	17-Jan-15
C100050	West Cheung Tung Rd Re-align (Drainage/Sewer/Divert Utilities/Paving Wrks /St. Furnitures)	176	17-May-14	03-Jan-15
C100100	East Natural Terrain Hazard Mitigation Measures (incl. Piling Works for Check Dams)	300	25-Apr-14	23-May-15
C100102	East Cheung Tung Rd Re-align (Drainage/Sewer/Divert Utilities/Paving Wrks /St. Furnitures)	238	27-Nov-13	08-Oct-14
M201030	9SE-B/C9 - Slope Modification Works	48	04-Jan-14	04-Mar-14
M201040	9SE-B/C8 - Slope Modification Works (incl. extension of Box Culvert)	48	26-Feb-14	29-Apr-14
M201050	9SE-B/F9 - Slope Modification Works	12	30-Apr-14	16-May-14
M201060	9SE-B/F85 - Slope Modification Works (Incl. Retaining Wall)	72	02-Feb-15	07-May-15
M201070	10SW-A/F52 - Slope Modification Works (incl. Pre-Bored H-Piles Walls)	160	14-Jul-14	31-Jan-15
M201080	10SW-A/F53 - Slope Modification Works	24	17-Mar-15	18-Apr-15
M201090	10NW-C/C26 - Slope Modification Works	32	27-May-15	11-Jul-15
M201100	10NW-C/C27 - Slope Modification Works	24	13-Jul-15	12-Aug-15
M201110	10NW-C/C22 - Slope Modification Works	18	13-Aug-15	03-Sep-15
M201120	10NW-C/F13 - Slope Modification Works	24	09-Dec-15	09-Jan-16
M201130	10NW-C/F14 - Slope Modification Works	30	25-Nov-14	31-Dec-14
M201140	10NW-C/F15 - Slope Modification Works	24	05-Nov-15	02-Dec-15
At grade Roadworks and Other Works at Southern Landfall				
RW30200	Drainage/Watermain Works	120	19-Oct-15	15-Mar-16
RW30400	Sub-base Works	72	16-Mar-16	25-Jun-16
RW30500	Paving Works	72	27-Jun-16	28-Sep-16
RW30600	Street Furnitures Works	42	29-Sep-16	21-Nov-16
Watermains & All Assoc Works from Tung Chung to Southern Landfall				



Planned Bar
Critical Bar
Milestone

Date	Revision	Checked	Approved
21-Jun-13	IWP - 1st Issue	RT	
12-Jul-13	Amended-SO Comment	RT	

Tuen Mun - Chek Lap Kok Southern Connection

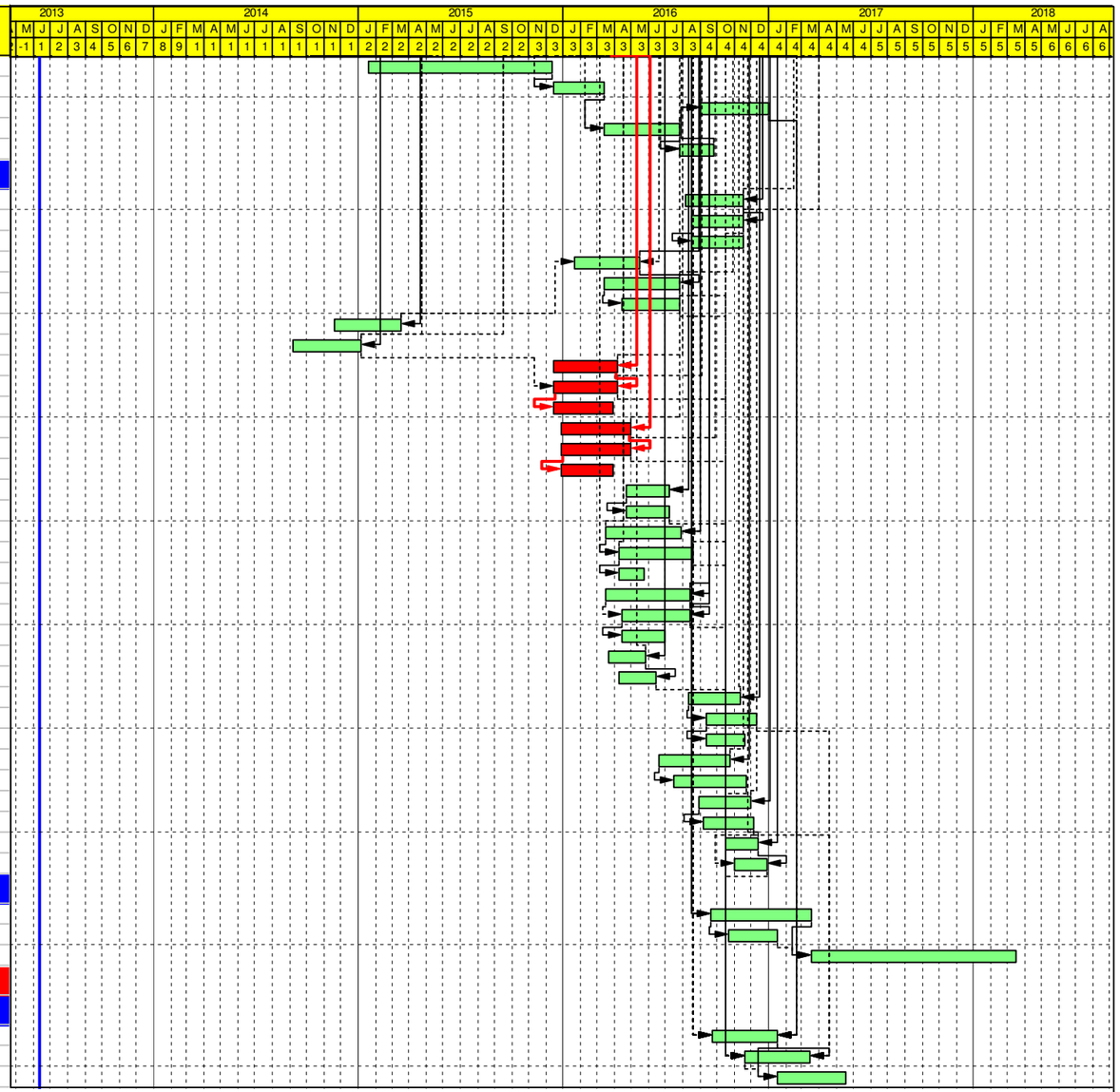
Initial Works Programme (Page 7 of 8 Pages)

Gammon ARUP LAMBETH

DWG. No.: Figure 2.9b

J3518/GCL/PGM/001 Rev. B

Activity ID	Activity Name	Original Duration	Start	Finish
A10000	From Tung Chung to Structure B1 - DN450 Fresh Watermains	250	19-Jan-15	12-Dec-15
B309020	Structure B - DN450 Fresh Watermains	72	14-Dec-15	12-Mar-16
E212030	Structure E1/E2 - DN450 Fresh Watermains	96	01-Sep-16	31-Dec-16
E509050	Structure E8 - DN450 Fresh Watermains	96	14-Mar-16	26-Jul-16
F109070	Structure F1 - DN450 Fresh Watermains & to Northern Landfall	48	27-Jul-16	24-Sep-16
Facilities Provision for E&M Works and Facilities Provision for TCSS				
A109030	Structure A - Street Lighting Poles/Traffic Signs/Sign Gantry	80	05-Aug-16	16-Nov-16
A109040	Structure A - E&M Works	72	16-Aug-16	16-Nov-16
A201050	Structure A - Facilities Provision for TCSS	72	16-Aug-16	16-Nov-16
B309030	Structure B - Street Lighting Poles/Traffic Signs/Sign Gantry	90	20-Jan-16	16-May-16
B309040	Structure B - E&M Works	96	12-Mar-16	25-Jul-16
B309070	Structure B - Facilities Provision for TCSS	72	15-Apr-16	25-Jul-16
C100070	West Cheung Tung Road Re-alignment (E&M Works)	96	20-Nov-14	18-Mar-15
C100112	East Cheung Tung Road Re-alignment (E&M Works)	96	05-Sep-14	06-Jan-15
C109030	Structure C - Street Lighting Poles/Traffic Signs/Sign Gantry	90	14-Dec-15	07-Apr-16
C109040	Structure C - E&M Works	90	14-Dec-15	07-Apr-16
C109070	Structure C - Facilities Provision for TCSS	84	14-Dec-15	30-Mar-16
D409030	Structure D - Street Lighting Poles/Traffic Signs/Sign Gantry	96	29-Dec-15	29-Apr-16
D409040	Structure D - E&M Works	96	29-Dec-15	29-Apr-16
D409070	Structure D - Facilities Provision for TCSS	72	29-Dec-15	29-Mar-16
E212016	Structure E1 - Street Lighting Poles/Traffic Signs/Sign Gantry	54	21-Apr-16	06-Jul-16
E212018	Structure E1 - E&M Works (Incl. Facilities Provision for TCSS & Navigation Lights)	54	21-Apr-16	06-Jul-16
E212020	Structure E2 - Street Lighting Poles/Traffic Signs/Sign Gantry	96	15-Mar-16	27-Jul-16
E212040	Structure E2 - E&M Works (Incl. Navigation Lights)	96	09-Apr-16	18-Aug-16
E212070	Structure E2 - Facilities Provision for TCSS	34	09-Apr-16	24-May-16
E509020	Structure E5/E6/E7/E8 - Street Lighting Poles/Traffic Signs/Sign Gantry	109	16-Mar-16	13-Aug-16
E509030	Structure E5/E6/E7/E8 - E&M Works (Incl. Navigation Lights)	89	13-Apr-16	13-Aug-16
E509035	Structure E5/E6/E7/E8 - Facilities Provision for TCSS	54	13-Apr-16	28-Jun-16
F109030	Structure F1 - Street Lighting Poles/Traffic Signs/Sign Gantry	48	21-Mar-16	25-May-16
F109040	Structure F1 - E&M Works (Incl. Facilities Provision for TCSS)	48	08-Apr-16	13-Jun-16
F209030	Structure F2 - Street Lighting Poles/Traffic Signs/Sign Gantry	72	12-Aug-16	12-Nov-16
F209040	Structure F2 - E&M Works	72	12-Sep-16	10-Dec-16
F209070	Structure F2 - Facilities Provision for TCSS	54	12-Sep-16	19-Nov-16
F309030	Structure F3 - Street Lighting Poles/Traffic Signs/Sign Gantry	96	20-Jun-16	24-Oct-16
F309040	Structure F3 - E&M Works (Incl. Facilities Provision for TCSS)	100	16-Jul-16	21-Nov-16
F409030	Structure F4 - Street Lighting Poles/Traffic Signs/Sign Gantry	72	29-Aug-16	28-Nov-16
F409040	Structure F4 - E&M Works (Incl. Facilities Provision for TCSS)	72	05-Sep-16	05-Dec-16
F509030	Structure F5 - Street Lighting Poles/Traffic Signs/Sign Gantry	48	15-Oct-16	12-Dec-16
F509040	Structure F5 - E&M Works (Incl. Facilities Provision for TCSS)	48	01-Nov-16	28-Dec-16
Landscape Works and Establishment Works				
A109080	Landscaping Works	144	19-Sep-16	17-Mar-17
A109082	Irrigation System for Soft Landscape Works	72	21-Oct-16	17-Jan-17
A109090	Establishment Works	365	18-Mar-17	17-Mar-18
T&C Works and Statutory Inspections				
Testing and Commissioning Works				
TC01000	WSD Inspection/Final connections Watermains/Sewer/Stormwater Drains	96	21-Sep-16	16-Jan-17
TC02000	Testing & Commissioning Works	96	18-Nov-16	16-Mar-17
TC03000	Statutory Submission/FSD & SCCU Inspection/Approval	96	17-Jan-17	18-May-17



Planned Bar
Critical Bar
Milestone

Date	Revision	Checked	Approved
21-Jun-13	IWP - 1st Issue	RT	
12-Jul-13	Amended-SO Comment	RT	

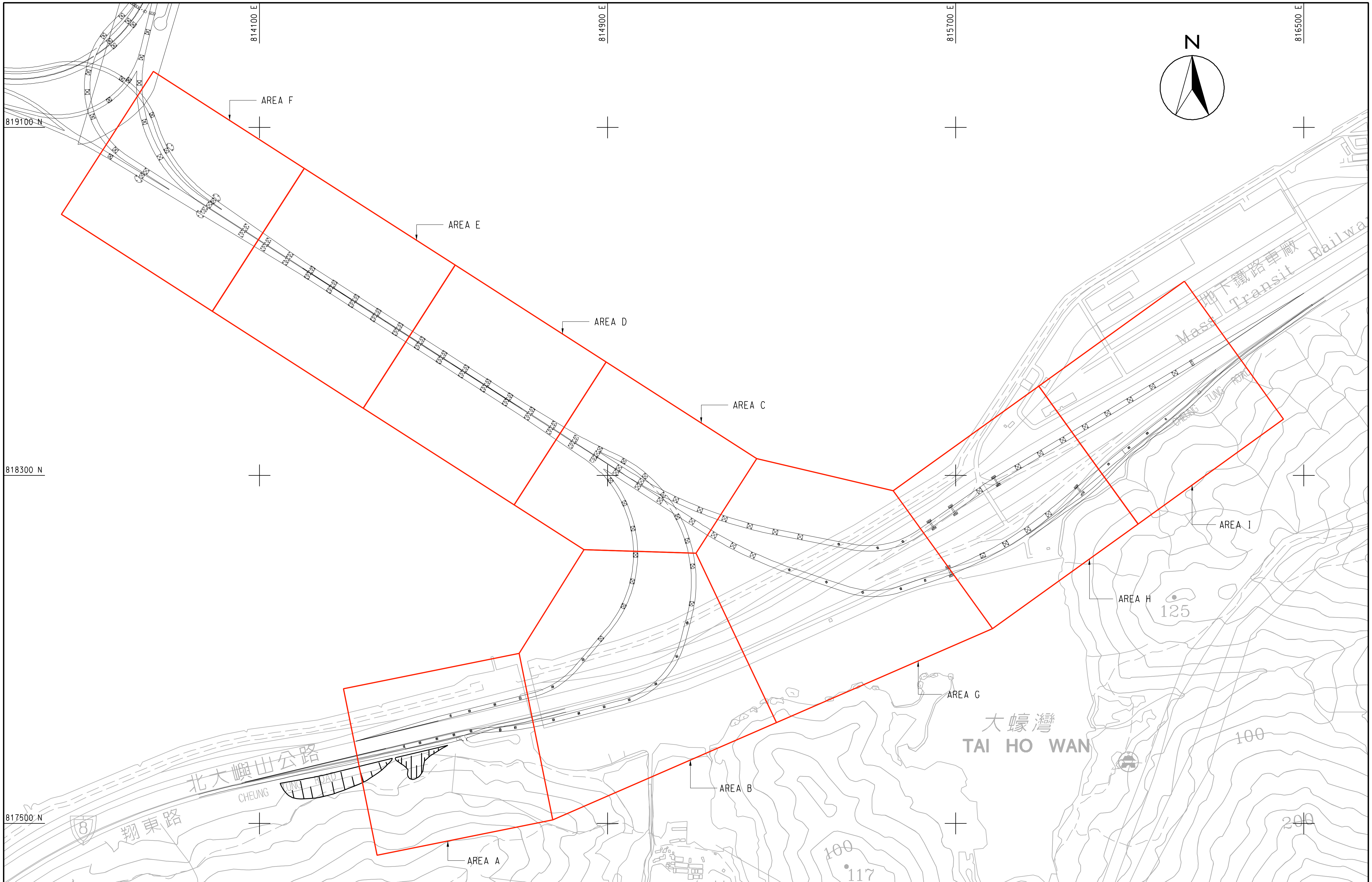
Tuen Mun - Chek Lap Kok Southern Connection

Initial Works Programme (Page 8 of 8 Pages)

Gammon ARUP LAMBETH

DWG. No.: Figure 2.9b

J3518/GCL/PGM/001 Rev. B



AECOM

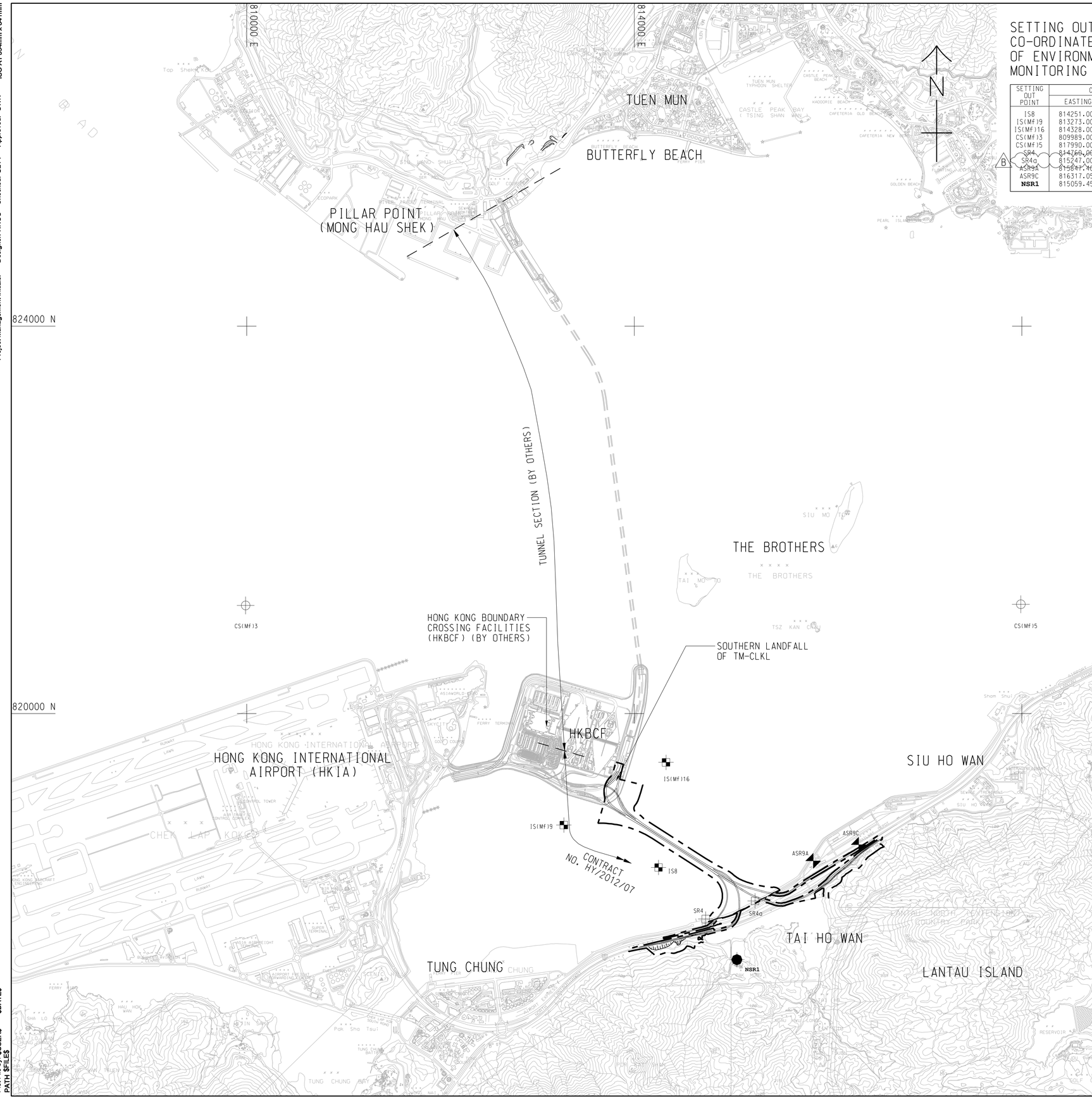
AGREEMENT NO. CE 52/2007(HY)
TUEN MUN - CHEK LAP KOK LINK - INVESTIGATION

PORTIONS OF WORKS IN NORTH LANTAU

SCALE	A3 1:8000	DATE	JUL. 2009
CHECK	--	DRAWN	MZG
JOB No.	60044963	DRAWING No.	Fig 2.9d
		REV	A

p.\PROJECTS\60044963\DRAWING\FIGURE\EIA REPORT\CH3\FIGURE 3-9d dgn

Project Management Initials: Designer: NNCC Checked: SLYY Approved: CWN ISO A1 594mm x 841mm



SETTING OUT CO-ORDINATES OF ENVIRONMENTAL MONITORING STATIONS

SETTING OUT POINT	COORDINATES	
	EASTING	NORTHING
IS8	814251.00	818412.00
IS(Mf)9	813273.00	818850.00
IS(Mf)16	814328.00	819497.00
CS(Mf)3	809989.00	821117.00
CS(Mf)5	817990.00	821129.00
SR4	814769.00	817867.00
SR4a	815247.00	818067.00
ASR9A	815847.10	819508.64
ASR9C	816317.05	818676.02
NSR1	815059.45	817488.99

LEGEND:

- SITE BOUNDARY
- IMPACT STATIONS (WATER QUALITY)
- CONTROL/FAR FIELD STATIONS (WATER QUALITY)
- SENSITIVE RECEIVERS STATIONS (WATER QUALITY)
- MONITORING STATION (AIR QUALITY)
- MONITORING STATION (NOISE)

NOTES:

1. ALL COORDINATES ARE IN HONG KONG (1980) GRID SYSTEM UNLESS OTHERWISE SPECIFIED.
2. EXACT LOCATIONS OF MONITORING STATIONS ARE TO BE DETERMINED ON SITE. THE CONTRACTOR AND ENVIRONMENTAL TEAM (ET) SHALL AGREE WITH THE INDEPENDENT ENVIRONMENTAL CHECKER (IEC) AND THE ENVIRONMENTAL PROJECT OFFICE (ENPO) AND APPROVED BY THE SUPERVISING OFFICER FOR THE PROPOSED LOCATIONS OF THE MONITORING STATIONS.
3. THE CONTRACTOR SHALL COMPLY WITH THE REQUIREMENTS STIPULATED IN THE EM&A MANUAL TO CONDUCT THE ENVIRONMENTAL MONITORING AND AUDIT WORKS.
4. THE CONTRACTOR SHALL CONDUCT WATER QUALITY MONITORING (INCLUDING BASELINE, CONSTRUCTION AND POST-CONSTRUCTION MONITORING) AT STATION SR4a IF THE USE OF TEMPORARY STRUCTURE AS STATED IN ER PART 8 CLAUSE 8.1.5A IS REQUIRED.

AECOM

PROJECT 項目

TUEN MUN - CHEK LAP KOK LINK

CONTRACT TITLE

TUEN MUN - CHEK LAP KOK LINK - SOUTHERN CONNECTION VIADUCT SECTION

CLIENT 業主

路政署 HIGHWAYS DEPARTMENT
港珠澳大橋香港工程管理處 Hong Kong - Zhuhai - Macao Bridge Hong Kong Project Management Office

CONSULTANT 工程顧問公司

AECOM Asia Company Ltd.
www.aecom.com

SUB-CONSULTANTS 分判工程顧問公司

Figure 3.2

ISSUE/REVISION 修訂

I/R 修訂	DATE 日期	DESCRIPTION 內容摘要	CHK. 複核
B	DEC12	TENDER ADDENDUM No. 3	CWN
A	NOV12	TENDER ADDENDUM No. 2	CWN
-	OCT12	TENDER DRAWING	CWN

STATUS 階段

SCALE 比例: A1 1:20000

DIMENSION UNIT 尺寸單位: METERS

KEY PLAN 索引圖

PROJECT NO. 項目編號: 60240249

CONTRACT NO. 合約編號: HY/2012/07

SHEET TITLE 圖紙名稱

ENVIRONMENTAL MONITORING STATIONS

SHEET NUMBER 圖紙編號

60240249/C1/6501B

Plot File by: $USER$ $DATE$
PATH: $FILE$

Figure 5.7 Water Quality Monitoring Data Record Sheet

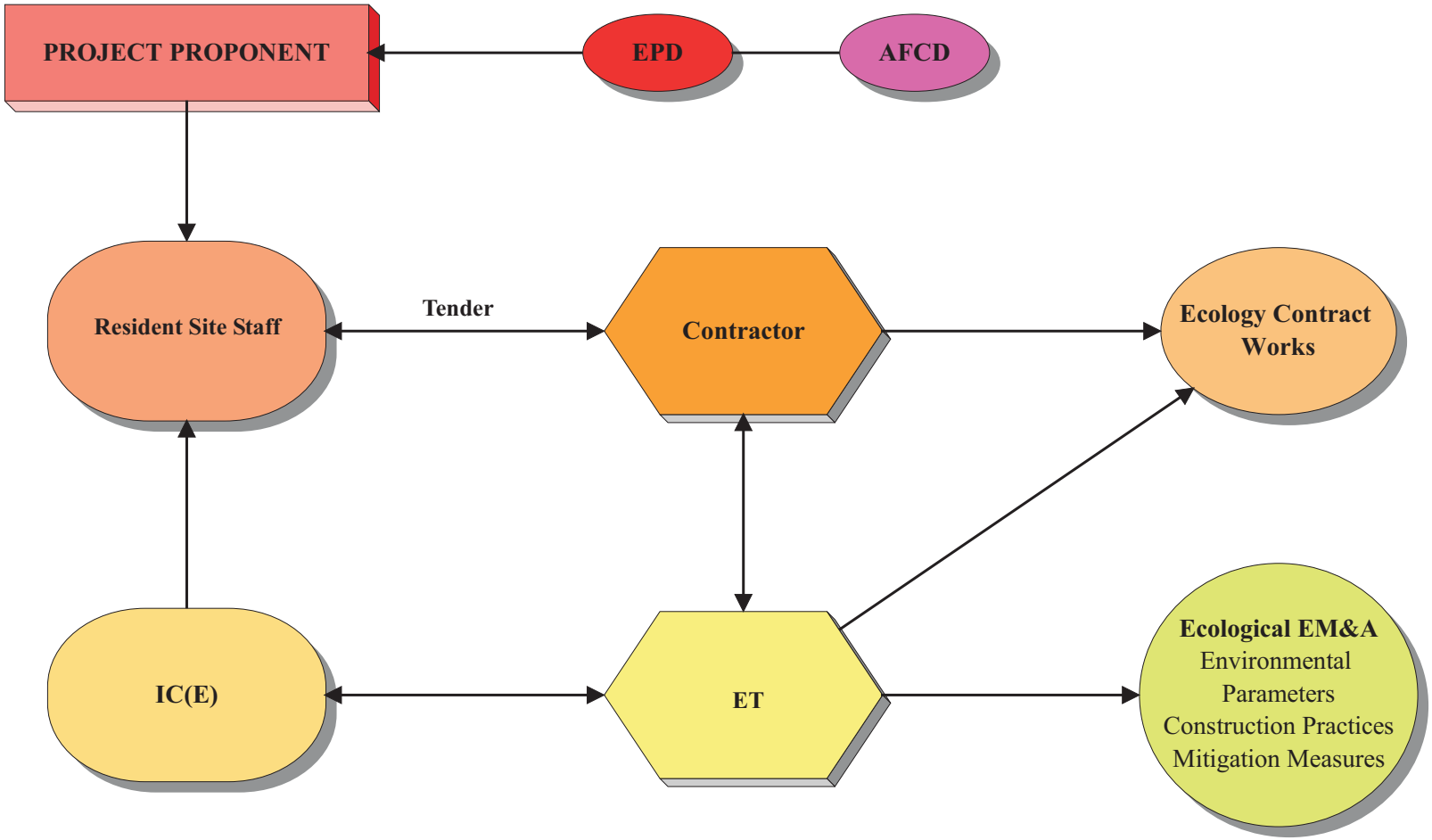
Location				
Date				
Start Time (hh:mm)				
Weather				
Sea Conditions				
Tidal Mode				
Water Depth (m)				
Monitoring Depth		Surface	Middle	Bottom
Current Speed (predominant) (m/s)				
Current Direction (predominant)				
Salinity				
Temperature (^{0}C)				
DO Saturation (%)				
DO (mg/L)				
Turbidity (NTU)				
SS Sample Identification				
SS (mg/L)				
Observed Construction Activities	<100m from location			
	>100m from location			
Other Observations				

Name & Designation Signature Date

Recorded By :

Checked By :

Note: The SS results are to be filled in once they are available from the laboratory



Construction Phase Ecological EM&A Procedure

Figure No. 6.1

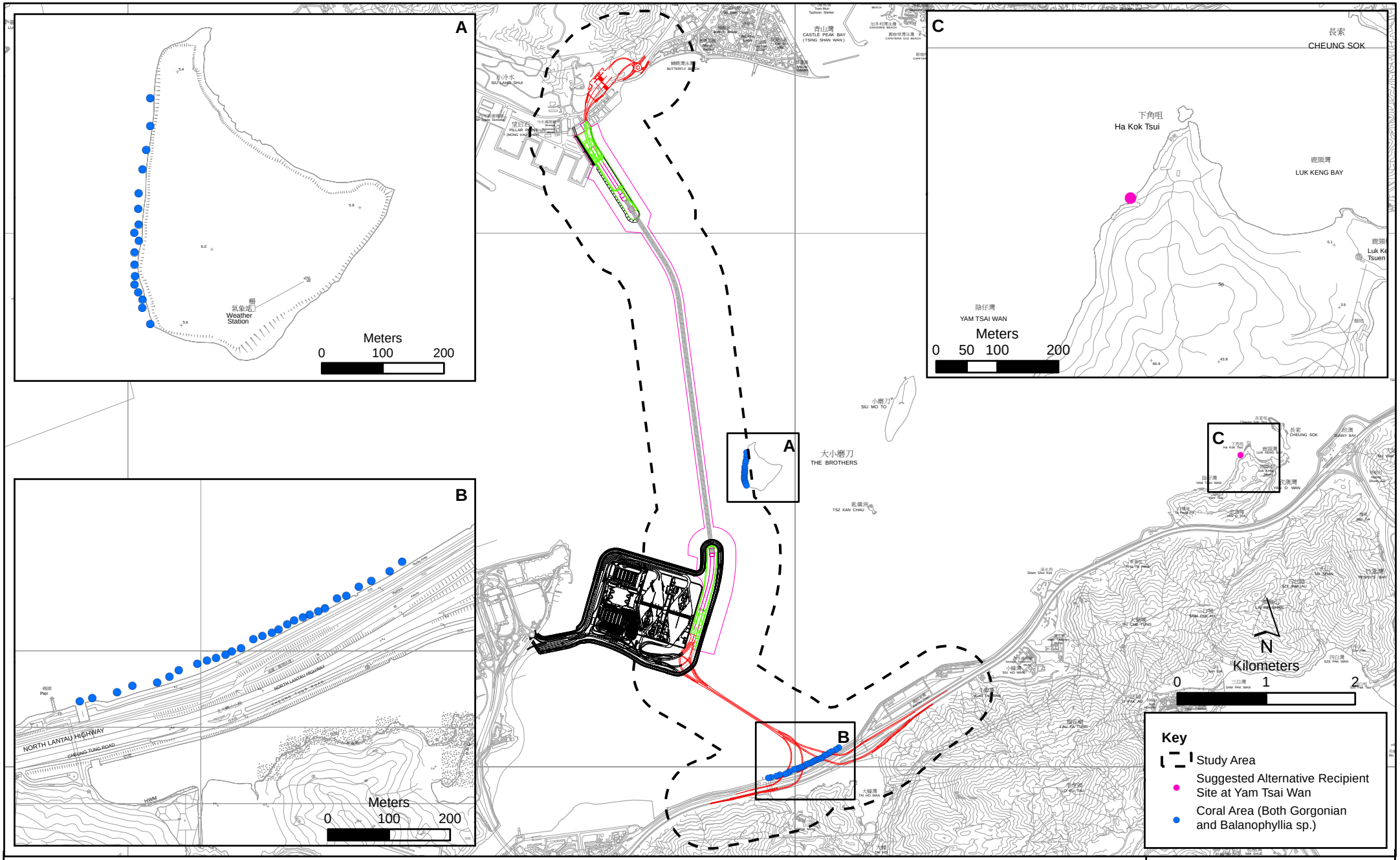


Figure 6.2

Locations of Coral Colonies identified at Tai Ho Wan and Tai Mo To and Location of Alternative Receptor Site

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Date: 12/11/2013

Environmental Resources Management

ERM

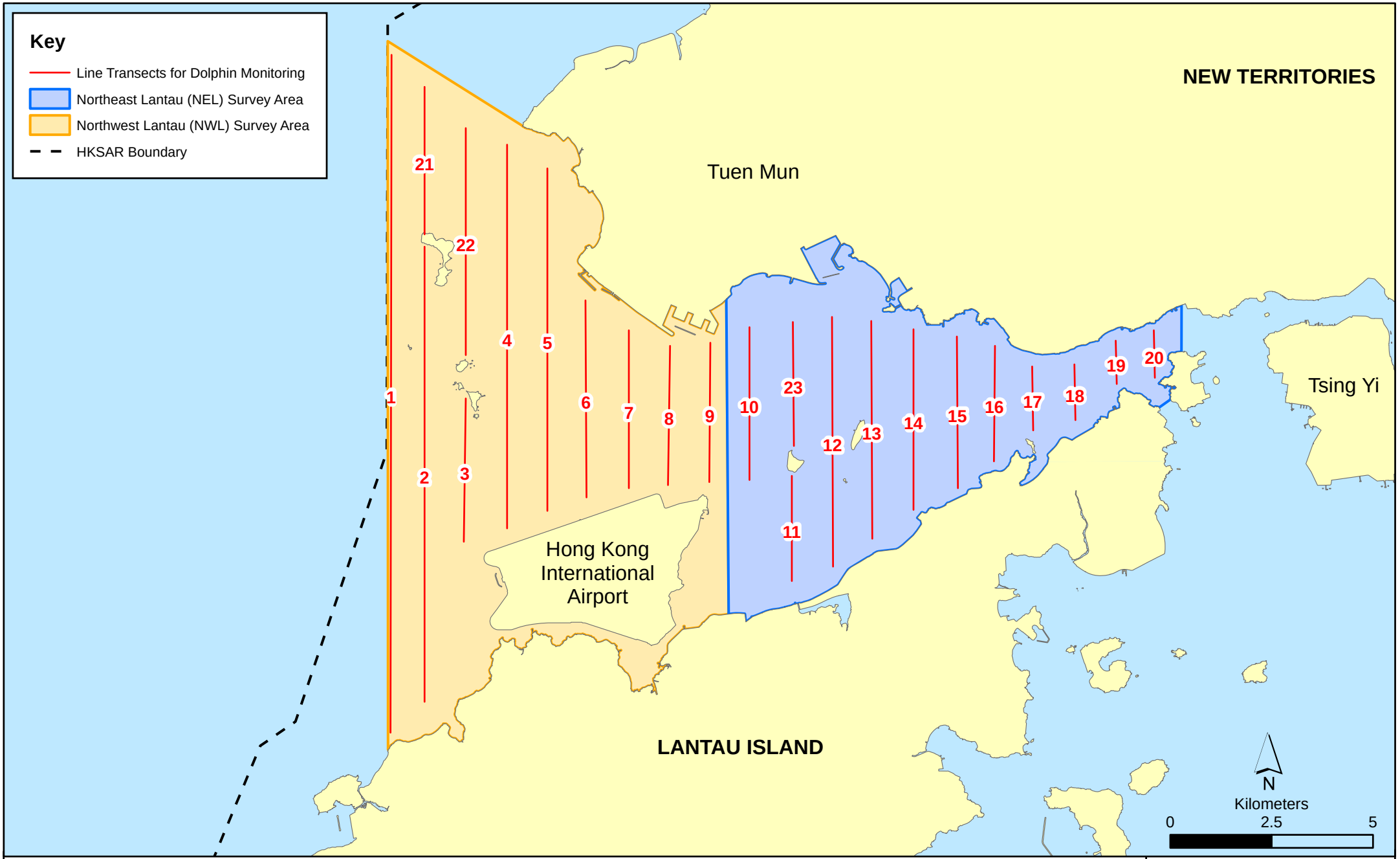

Figure 6.3

Layout of Transect Lines of Dolphin Monitoring in Northwest and Northeast Lantau Areas

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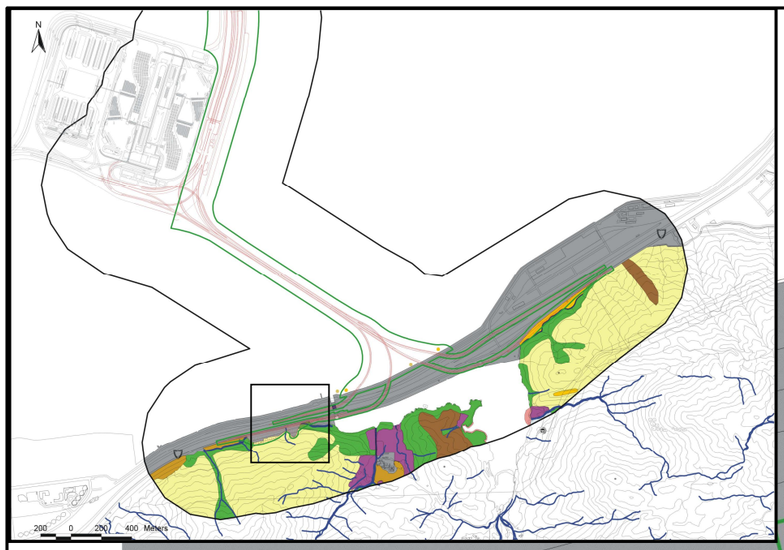
Date: 10/12/2013

Environmental Resources Management

ERM



Stream NL1

50 0 50 Meters

LEGEND

- Proposed Alignment
- Proposed 500m Study Area
- Site Boundary
- Country Park
- Secondary Woodland
- Cultivated Land
- Developed Area
- Tall Shrubland
- Mangrove
- Shrubby Grassland
- Stream
- Plantation
- Salt Marsh
- Wasteland

Plotting By: $DATE$
PLOT SCALE: $SCALE$HORT$

$file$

MAUNSELL AECOM
Maunsell Consultants Asia Ltd

AGREEMENT NO. CE 52/2007(HY)
TUEN MUN - CHEK LAP KOK LINK - INVESTIGATION

Location of Stream NL1

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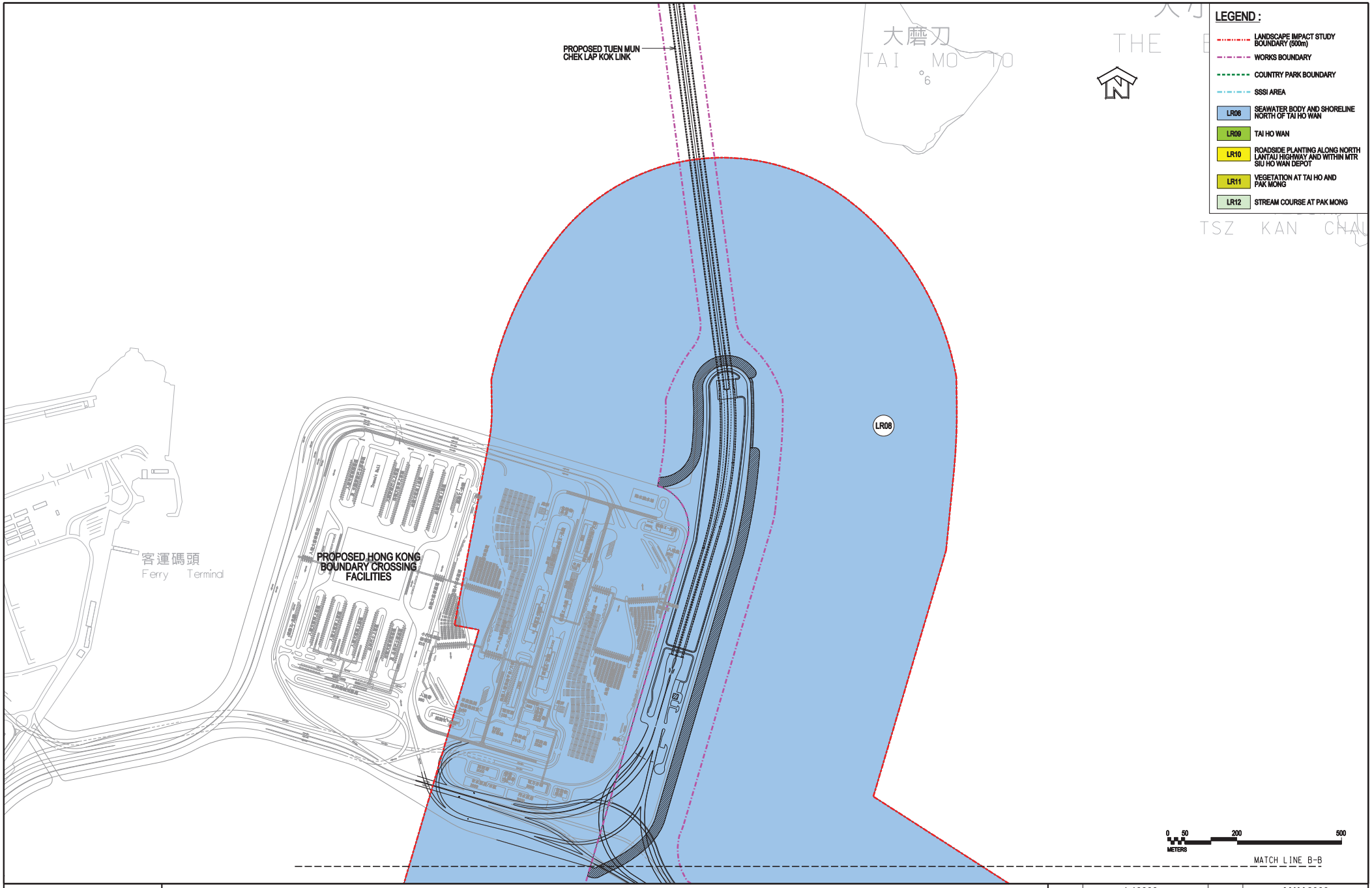
CHECK	--	DRAWN	--
JOB No.	08111511	DRAWING No.	6.4
		REV	--



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AGREEMENT NO. CE 52/2007(HY)
TUEN MUN - CHEK LAP KOK LINK - INVESTIGATION

BASELINE LANDSCAPE RESOURCES WITH DEVELOPMENT PROPOSAL OVERLAID

SHEET 3 OF 5

SCALE	1:10000	DATE	MAY 2009
CHECK	E.L.	DRAWN	F.L.
JOB No.	60044963	DRAWING No.	FIGURE 7.1.1.3
		REV	–

Plotting By: 2/17/2009
PLOT SCALE: 1=10

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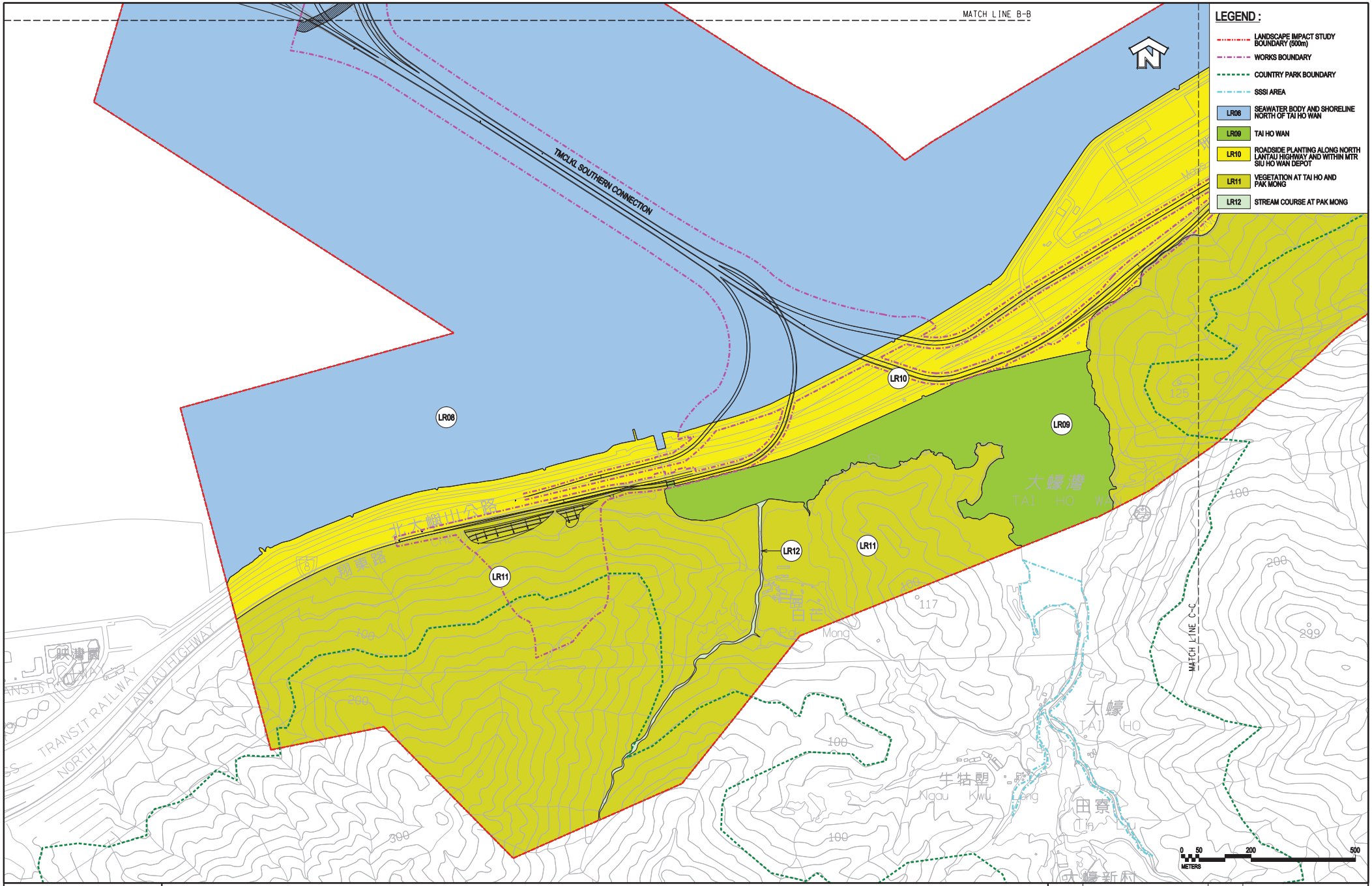

AECOM

AGREEMENT NO. CE 52/2007(HY)
TUEN MUN - CHEK LAP KOK LINK - INVESTIGATION

BASELINE LANDSCAPE RESOURCES WITH DEVELOPMENT PROPOSAL OVERLAID

SHEET 4 OF 5

SCALE	1:10000	DATE	MAY 2009
CHECK	E.L.	DRAWN	F.L.
JOB No.	60044963	DRAWING No.	FIGURE 7.1.1.4
		REV	–

Plotting By: 21/7/2009
PLOT SCALE: 1\10

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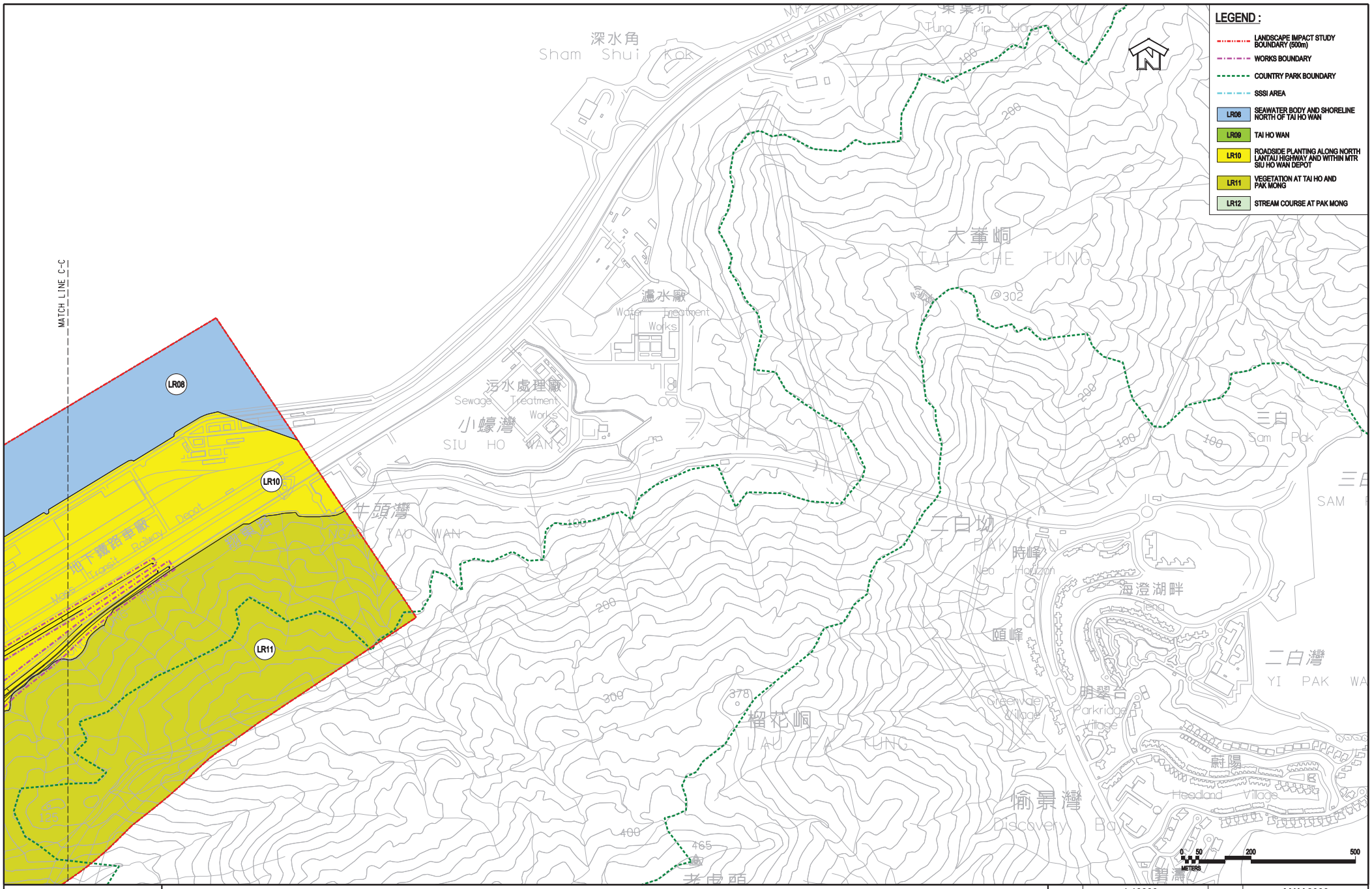


AECOM

AGREEMENT NO. CE 52/2007(HY)
TUEN MUN - CHEK LAP KOK LINK - INVESTIGATION

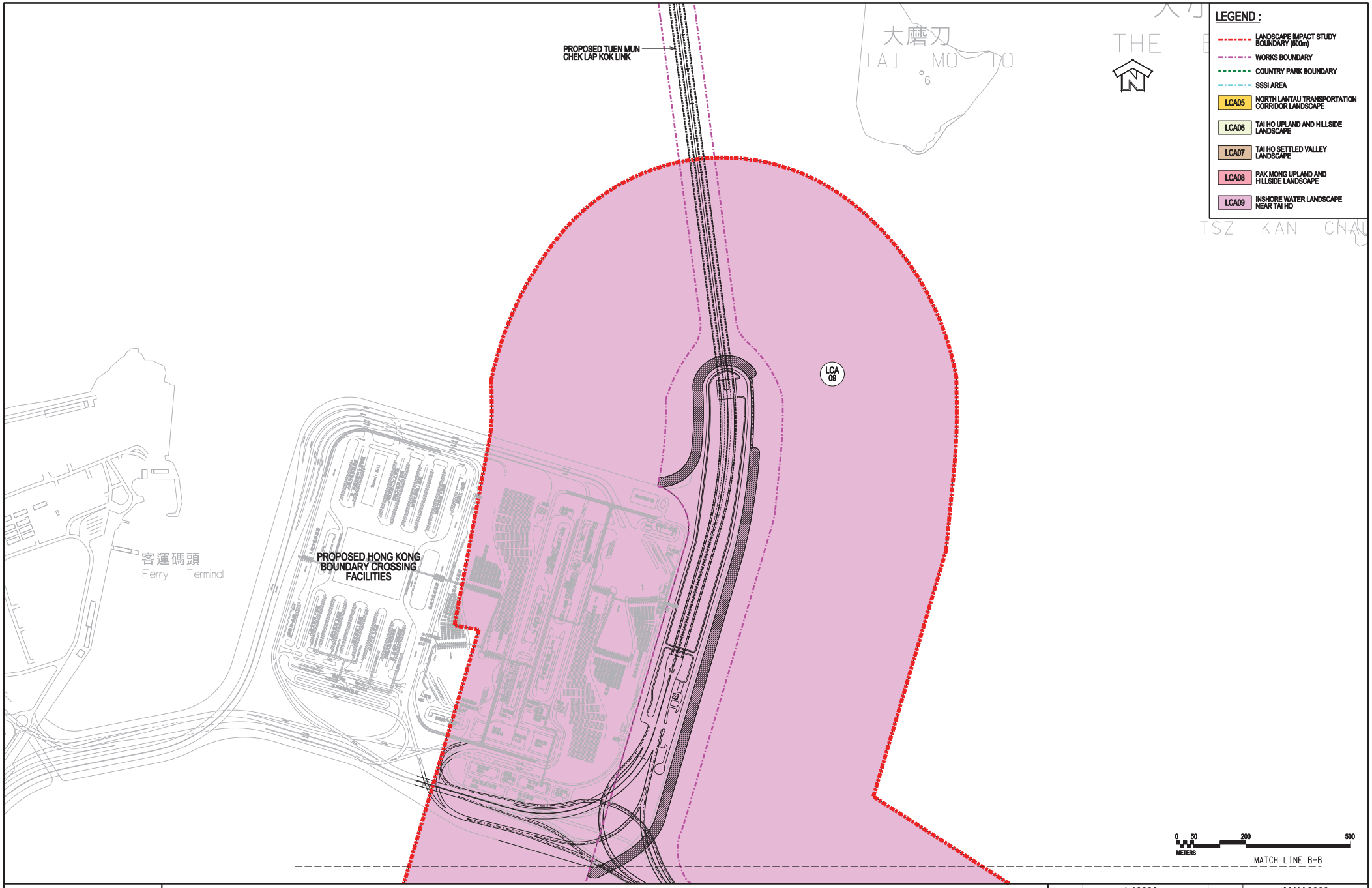
BASELINE LANDSCAPE RESOURCES WITH DEVELOPMENT PROPOSAL OVERLAID

SHEET 5 OF 5

SCALE	1:10000	DATE	MAY 2009
CHECK	E.L.	DRAWN	F.L.
JOB No.	60044963	DRAWING No.	FIGURE 7.1.1.5
		REV	–

Plotting By: 21/7/2009
PLOT SCALE: 1\10

D:\2008278 TM-CLK\03CAD\3.1Sheets\LVIA-EMA\FIG-07-01-01-5.dgn



AECOM

AGREEMENT NO. CE 52/2007(HY)
TUEN MUN - CHEK LAP KOK LINK - INVESTIGATION

BASELINE LANDSCAPE CHARACTER AREAS WITH DEVELOPMENT PROPOSAL OVERLAID

SHEET 3 OF 5

SCALE	1:10000	DATE	MAY 2009
CHECK	E.L.	DRAWN	F.L.
JOB No.	60044963	DRAWING No.	FIGURE 7.2.1.3
		REV	–

Plotting By: 2/17/2009
PLOT SCALE: 1=10

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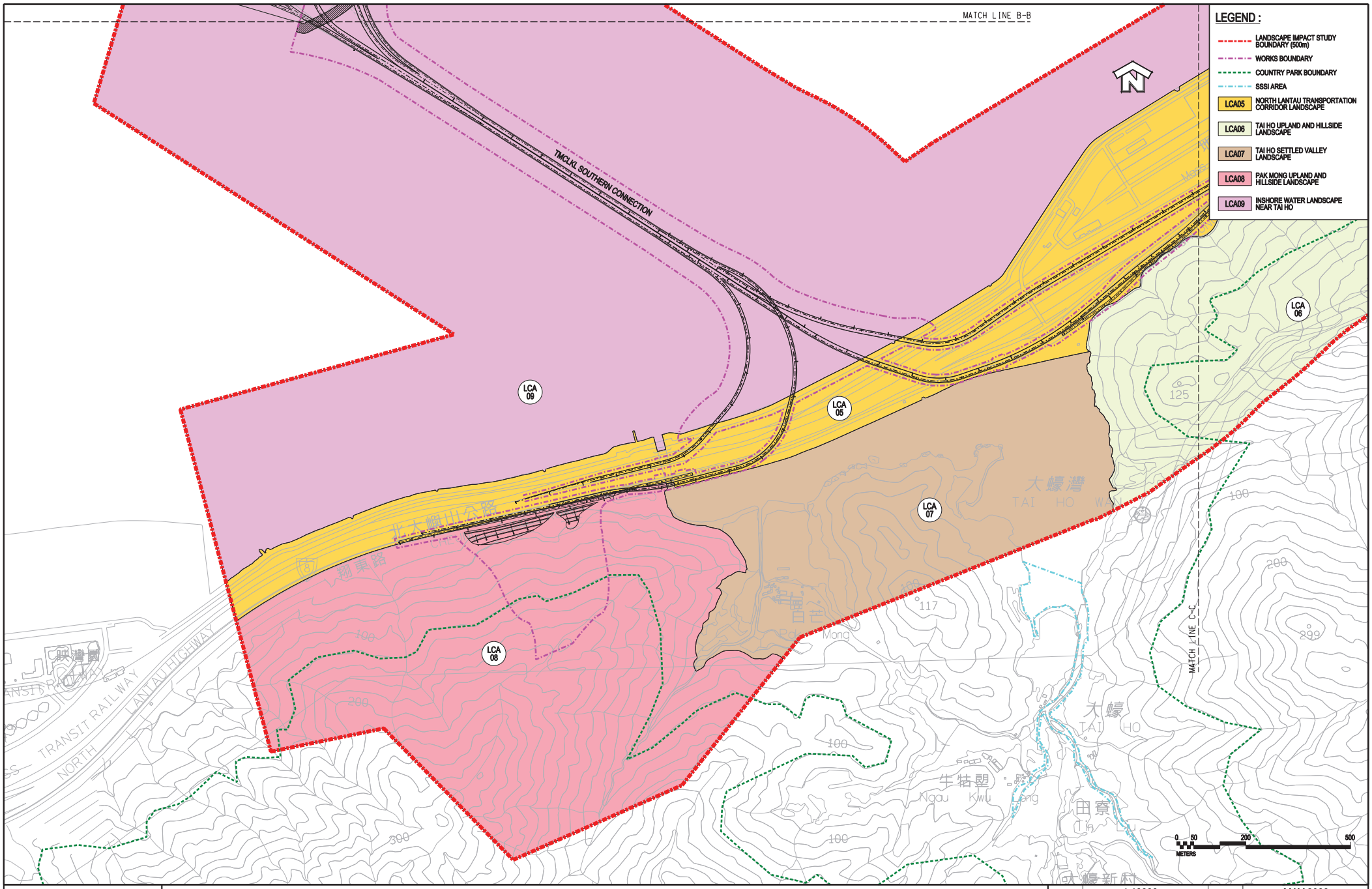

AECOM

AGREEMENT NO. CE 52/2007(HY)
TUEN MUN - CHEK LAP KOK LINK - INVESTIGATION

BASELINE LANDSCAPE CHARACTER AREAS WITH DEVELOPMENT PROPOSAL OVERLAID

SHEET 4 OF 5

SCALE	1:10000	DATE	MAY 2009
CHECK	E.L.	DRAWN	F.L.
JOB No.	60044963	DRAWING No.	FIGURE 7.2.1.4
		REV	–

Plotting By: 21/7/2009
PLOT SCALE: 1\10

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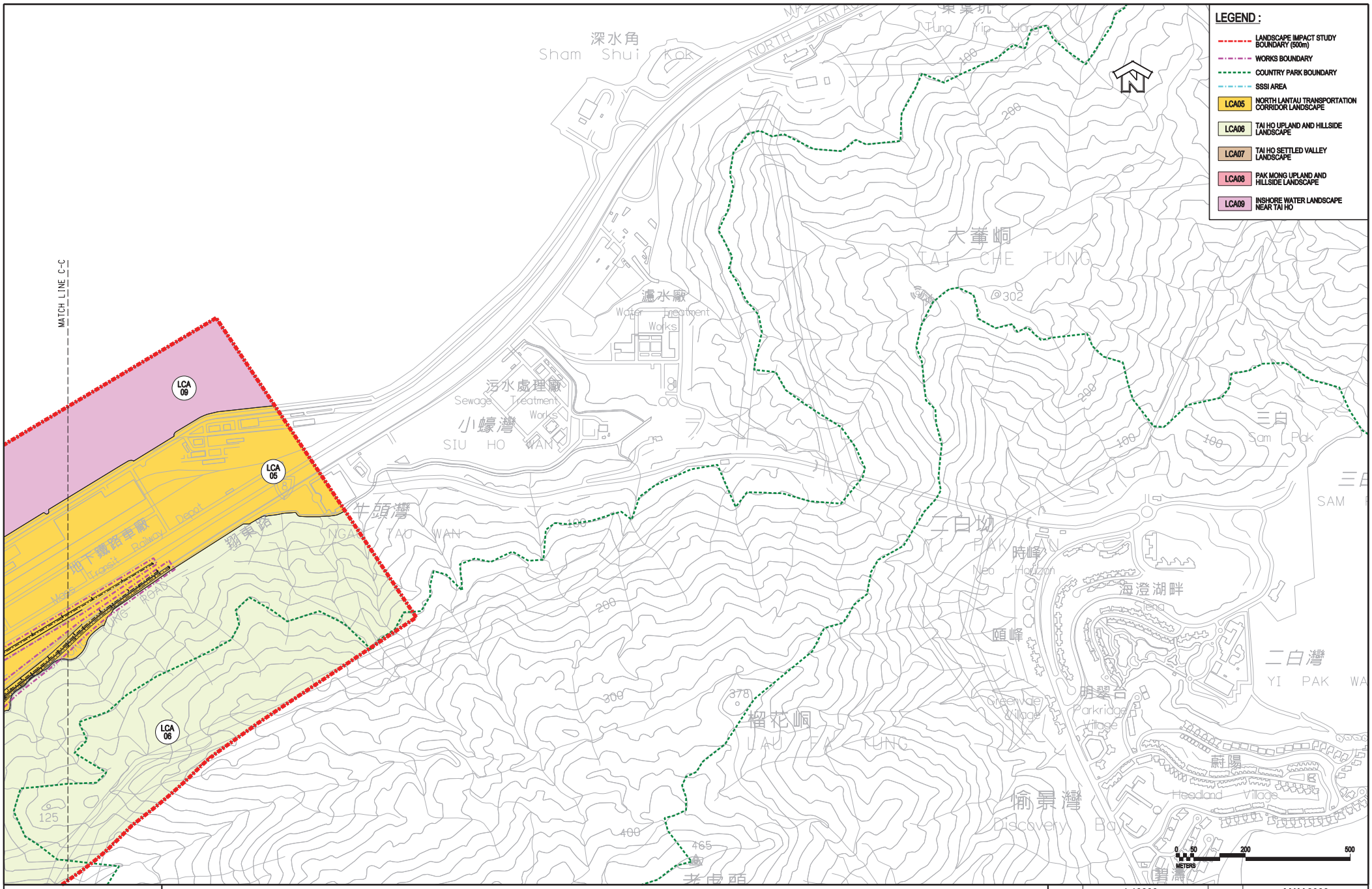

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AGREEMENT NO. CE 52/2007(HY)
TUEN MUN - CHEK LAP KOK LINK - INVESTIGATION

BASELINE LANDSCAPE CHARACTER AREAS WITH DEVELOPMENT PROPOSAL OVERLAID

SHEET 5 OF 5

SCALE	1:10000	DATE	MAY 2009
CHECK	E.L.	DRAWN	F.L.
JOB No.	60044963	DRAWING No.	FIGURE 7.2.1.5
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PLOT SCALE: 1\10

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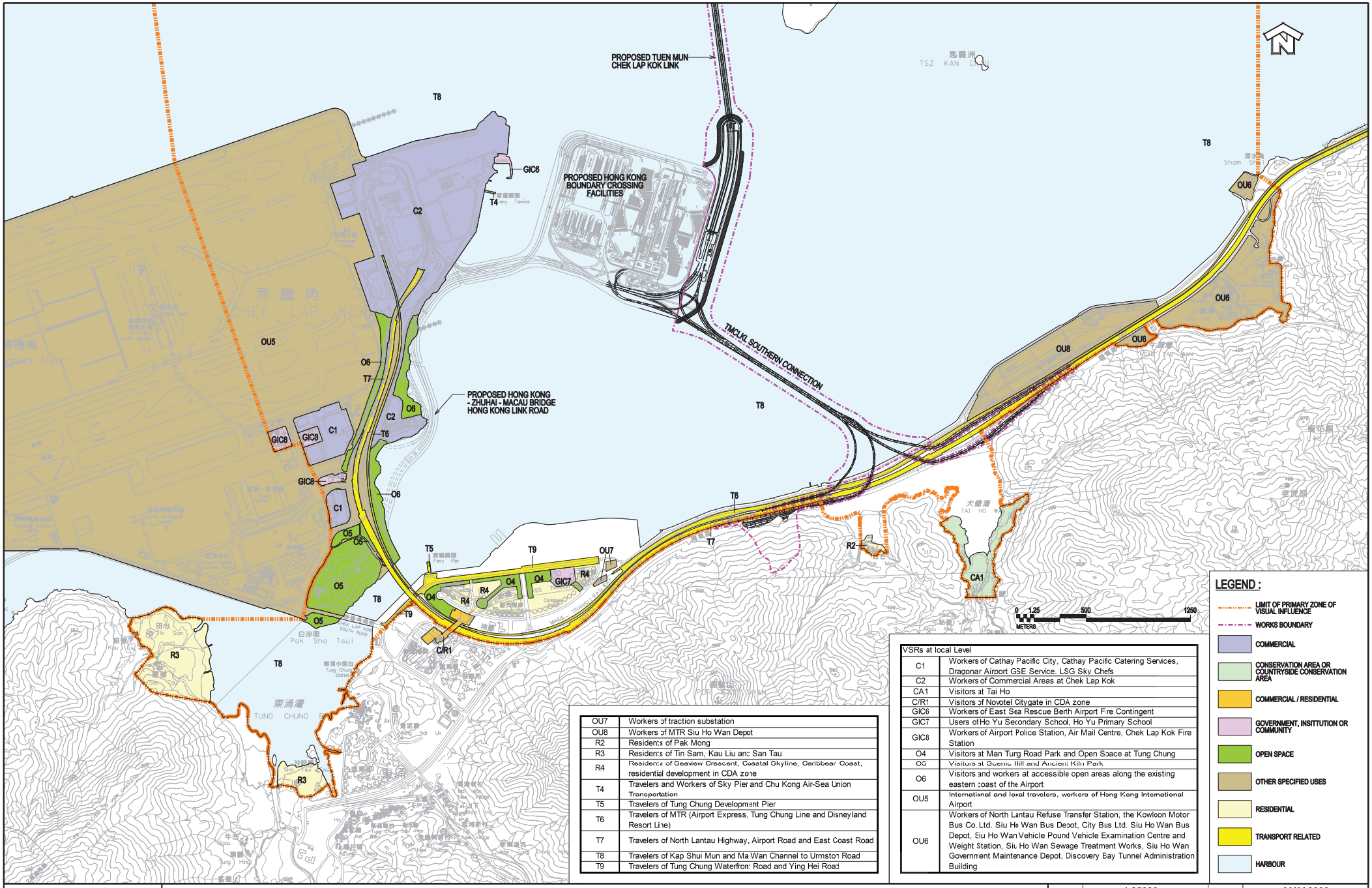


OU7	Workers of traction substation
OU8	Workers of MTR Siu Ho Wan Depot
R2	Residents of Pak Mong
R3	Residents of Tin Sam, Kau Liu and San Tau
R4	Residents of Seaview Crescent, Coastal Skyline, Caribbean Coast, residential development in CDA zone
T4	Travelers and Workers of Sky Pier and Chu Kong Air-Sea Union Transportation
T5	Travelers of Tung Chung Development Pier
T6	Travelers of MTR (Airport Express, Tung Chung Line and Disneyland Resort Line)
T7	Travelers of North Lantau Highway, Airport Road and East Coast Road
T8	Travelers of Kap Shui Mun and Ma Wan Channel to Urmston Road
T9	Travelers of Tung Chung Waterfron Road and Ying Hei Road

VSRs at local Level	
C1	Workers of Cathay Pacific City, Cathay Pacific Catering Services, Dragonair Airport GSE Service, LSG Sky Chefs
C2	Workers of Commercial Areas at Chek Lap Kok
CA1	Visitors at Tai Ho
C/R1	Visitors of Novotel Citygate in CDA zone
GIC6	Workers of East Sea Rescue Berth Airport Fire Contingent
GIC7	Users of Ho Yu Secondary School, Ho Yu Primary School
GIC8	Workers of Airport Police Station, Air Mail Centre, Chek Lap Kok Fire Station
O4	Visitors at Man Tung Road Park and Open Space at Tung Chung
O5	Visitors at Scenic Hill and Ancient Kiln Park
O6	Visitors and workers at accessible open areas along the existing eastern coast of the Airport
OU5	International and local travelers, workers of Hong Kong International Airport
OU6	Workers of North Lantau Refuse Transfer Station, the Kowloon Motor Bus Co. Ltd. Siu Ho Wan Bus Depot, City Bus Ltd. Siu Ho Wan Bus Depot, Siu Ho Wan Vehicle Pound Vehicle Examination Centre and Weight Station, Siu Ho Wan Sewage Treatment Works, Siu Ho Wan Government Maintenance Depot, Discovery Bay Tunnel Administration Building

LEGEND :

- LIMIT OF PRIMARY ZONE OF VISUAL INFLUENCE
- WORKS BOUNDARY
- COMMERCIAL
- CONSERVATION AREA OR COUNTRYSIDE CONSERVATION AREA
- COMMERCIAL / RESIDENTIAL
- GOVERNMENT, INSITTUTION OR COMMUNITY
- OPEN SPACE
- OTHER SPECIFIED USES
- RESIDENTIAL
- TRANSPORT RELATED
- HARBOUR

AECOM

AGREEMENT NO. CE 52/2007(HY)
TUEN MUN - CHEK LAP KOK LINK - INVESTIGATION

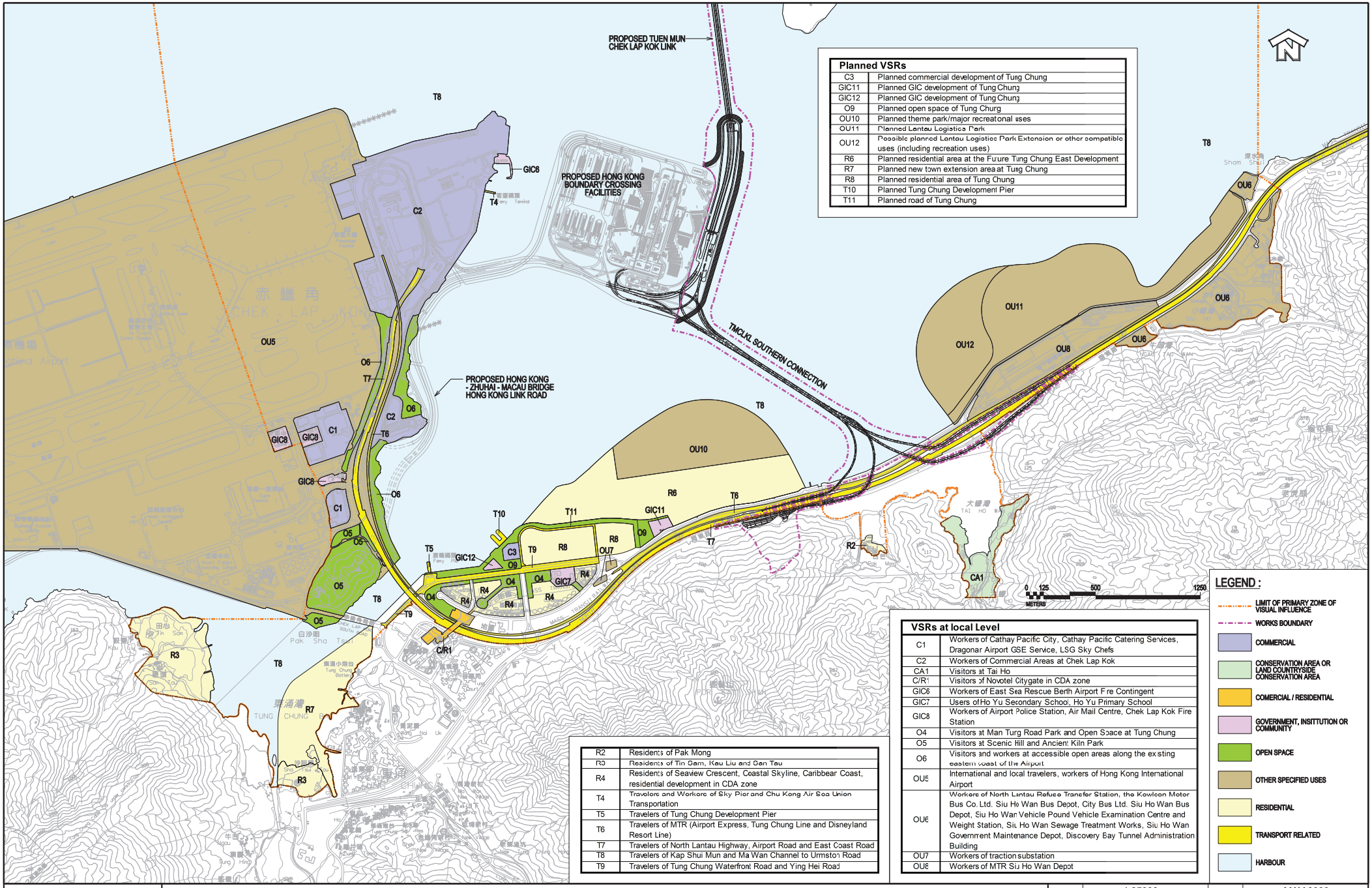
BASELINE KEY VSRs AND VIEWPOINTS AT LOCAL LEVEL WITH DEVELOPMENT PROPOSAL OVERLAID DURING CONSTRUCTION

SHEET 2 OF 2

SCALE	1:25000	DATE	MAY 2009
CHECK	E.L.	DRAWN	F.L.
JOB No.	60044963	DRAWING No.	FIGURE 7.3.1.2
		REV	--

Plotting By: 21/7/2009
PLOT SCALE: 1:25

D:\2008278 TM-CLK\03CAD\3.1Sheets\LVIA-EMA\FIG-07-03-01-2.dgn



Planned VSRs	
C3	Planned commercial development of Tung Chung
GIC11	Planned GIC development of Tung Chung
GIC12	Planned GIC development of Tung Chung
O9	Planned open space of Tung Churg
OU10	Planned theme park/major recreational uses
OU11	Planned Lantau Logistics Park
OU12	Possible planned Lantau Logistics Park Extension or other compatible uses (including recreation uses)
R6	Planned residential area at the Furure Tung Chung East Development
R7	Planned new town extension area at Tung Chung
R8	Planned residential area of Tung Chung
T10	Planned Tung Chung Development Pier
T11	Planned road of Tung Chung

VSRs at local Level	
C1	Workers of Cathay Pacific City, Cathay Pacific Catering Services, Dragonar Airport GSE Service, LSG Sky Chefs
C2	Workers of Commercial Areas at Chek Lap Kok
CA1	Visitors at Tai Ho
C/R1	Visitors of Novotel Citygate in CDA zone
GIC6	Workers of East Sea Rescue Berth Airport Fire Contingent
GIC7	Users of Ho Yu Secondary School, Ho Yu Primary School
GIC8	Workers of Airport Police Station, Air Mail Centre, Chek Lap Kok Fire Station
O4	Visitors at Man Tung Road Park and Open Space at Tung Chung
O5	Visitors at Scenic Hill and Ancient Kiln Park
O6	Visitors and workers at accessible open areas along the existing eastern coast of the Airport
OU5	International and local travelers, workers of Hong Kong International Airport
OU6	Workers of North Lantau Refuse Transfer Station, the Kowloon Motor Bus Co. Ltd. Siu Ho Wan Bus Depot, City Bus Ltd. Siu Ho Wan Bus Depot, Siu Ho Wan Vehicle Pound Vehicle Examination Centre and Weight Station, Siu Ho Wan Sewage Treatment Works, Siu Ho Wan Government Maintenance Depot, Discovery Bay Tunnel Administration Building
OU7	Workers of traction substation
OU8	Workers of MTR Siu Ho Wan Depot

R2	Residents of Pak Mong
R3	Residents of Tin Sam, Kau Liu and San Tau
R4	Residents of Seaview Crescent, Coastal Skyline, Caribbean Coast, residential development in CDA zone
T4	Travelers and Workers of Sky Pier and Chu Kong Air Sea Union Transportation
T5	Travelers of Tung Chung Development Pier
T6	Travelers of MTR (Airport Express, Tung Chung Line and Disneyland Resort Line)
T7	Travelers of North Lantau Highway, Airport Road and East Coast Road
T8	Travelers of Kap Shui Mun and Ma Wan Channel to Urmston Road
T9	Travelers of Tung Chung Waterfront Road and Ying Hei Road

LEGEND :

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AGREEMENT NO. CE 52/2007(HY)
TUEN MUN - CHEK LAP KOK LINK - INVESTIGATION

BASELINE KEY VSRs AND VIEWPOINTS AT LOCAL LEVEL WITH DEVELOPMENT PROPOSAL OVERLAID DURING OPERATION

SHEET 2 OF 2

SCALE	1:25000	DATE	MAY 2009
CHECK	E.L.	DRAWN	F.L.
JOB No.	60044963	DRAWING No.	FIGURE 7.3.1.4
		REV	--

Plotting By: 30/7/2009
PLOT SCALE: 1:25

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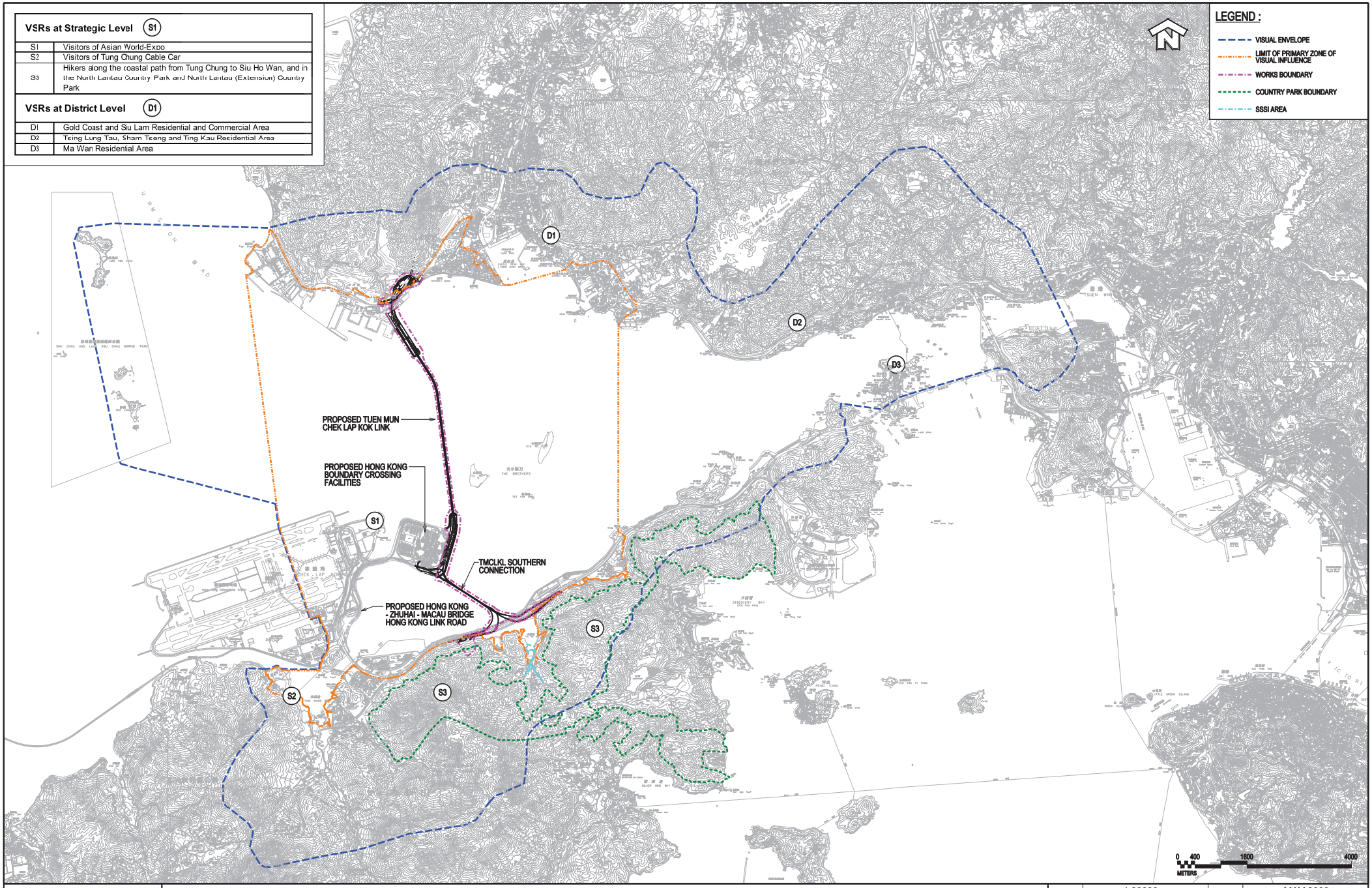

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AGREEMENT NO. CE 52/2007(HY)
TUEN MUN - CHEK LAP KOK LINK - INVESTIGATION

BASELINE KEY VSRs AND VIEWPOINTS AT STRATEGIC AND DISTRICT LEVEL WITH DEVELOPMENT PROPOSAL OVERLAID

SCALE	1:80000	DATE	MAY 2009
CHECK	E.L.	DRAWN	F.L.
JOB No.	60044963	DRAWING No.	FIGURE 7.3.2.1
		REV	--

Plotting By: 21/7/2009
PLOT SCALE: 1:80

D:\2008278 TM-CLK\03CAD\3.1Sheets\LVIA-EMA\FIG-07-03-02-1.dgn

Figure 12.1 Sample Template for Interim Notifications of Environmental Quality Limits Exceedances

Incident Report on Action Level or Limit Level Non-compliance

Project	
Date	
Time	
Monitoring Location	
Parameter	
Action & Limit Levels	
Measured Level	
Possible reason for Action or Limit Level Non-compliance	
Actions taken / to be taken	
Remarks	

Location Plan

Prepared by : _____

Designation : _____

Signature : _____

Date : _____

CONTRACT NO. HY/2012/07
TUEN MUN- CHEK LAP KOK LINK – SOUTHERN CONNECTION VIADUCT SECTION
SUMMARY OF CHANGE FOR CONTRACT SPECIFIC EM&A MANUAL

Section	Content
Section 1.2	ER has been revised to SOR
Section 1.3	Table 1.1 which listed EM&A requirement has been revised
Section 1.4	Revised according to the scope of the Contract HY/2012/07
Section 1.5	List of mitigation measures has been revised
Section 2.1	Scope of the Project has been revised
Section 2.2	Section not relevant to Contract HY/2012/07
Section 2.3	Section not relevant to Contract HY/2012/07
Section 2.4	Section has been revised. Text about temporary staging has been inserted.
Section 2.5	Details of TM-CLKL proposed works area has been revised for Contract HY/2012/07
Section 2.7	Some part of the section is not relevant to Contract HY/2012/07
Section 3.7	Table 3.1a and Table 3.1b are added to describe the derivation and value of the Action and Limit levels for TSP monitoring
Section 5.2	Mitigation measures regarding to water quality have been revised for Contract HY/2012/07
Section 5.6	Number of water quality monitoring stations have been revised in text and in Table 5.2a for Contract HY/2012/07
Section 5.7	Text about the additional water quality monitoring station (SR4a) and the period of which baseline water quality monitoring was done has been added into Section 5.7
Section 5.8	Section about the efficiency of silt curtain is not relevant to Contract HY/2012/07
Section 5.9	Sections about impact monitoring for water quality has been revised for Contract HY/2012/07
Section 5.10	Section about post-construction monitoring for northern and southern landfalls is not relevant to Contract HY/2012/07. Thus it has been removed
Section 5.12	Text has been revised as the relocation of Mf sediment is not relevant to Contract HY/2012/07
Section 6.3	Ecological Design Specifications have been revised according to Contract HY/2012/07, i.e. design of dredging and reclamation works acoustic decoupling method and artificial reef deployment being not relevant to Contract HY/2012/07
Section 6.4	Revised to clarify survey area to be covered by the Contract HY/2012/07 for dolphin monitoring and to incorporate details on coral translocation as specified in the Detailed Coral Translocation Methodology which was submitted to the EPD in accordance with Condition 2.6 of the EP-354/2009A.
Section 6.5	Sections about background and construction ecological audit have been revised for Contract HY/2012/07 that dolphin exclusion zone will be implemented for temporary staging construction; Table 6.9a describing Action and Limit Level for Dolphin Monitoring has been inserted for Contract HY/2012/07; ER is changed to SOR in Table 6.9b
Section 6.6	Mitigation and Enhancement Measures has been revised for Contract HY/2012/07
Section 7.4	ER is changed to SOR
Section 7.5	ER is changed to SOR in Table 7.2
Section 7.6	Mitigation Measures has been revised for Contract HY/2012/07
Section 8.1	The predicted amount of dredged material has been revised and remark has been added that the volume of C&D materials generated would be updated upon completion of the Design works of the Contract HY/2012/07. The predicted amount of C&D materials generated is also revised.

Section	Content
Section 9	EM&A requirements on cultural heritage is not relevant to Contract HY/2012/07 and Section 9 is thus revised.
Section 10	EM&A requirements on landfill gas hazard is not relevant to Contract HY/2012/07 and Section 10 is thus revised.
Section 11.1	ER is changed to SOR
Section 11.2	ER is changed to SOR
Section 11.3	ER is changed to SOR
Section 12	ER is changed to SOR
List of Figures	List of Figures has been revised accordingly
Appendix A	Environmental Mitigation and Enhancement Measure Implementation Scheme in Appendix A has been updated accordingly.
Annex A	Figures describing the arrangement of silt curtain systems under construction sequences A and B, and that of TM-CLKL Northern Landfall and HKLR Coastal Reclamation have been deleted Preliminary layout of Temporary Staging for TM-CLKL Southern Connection Viaduct Section has been inserted
Annex B	Figures 2.4a-b, 4.2, 5.8, 5.9, 5.10, 7.1.1.1, 7.1.1.2, 7.2.1.1, 7.2.1.2, 7.3.1.1, 7.3.1.3 and 9.1 have been deleted Figure 2.4c-j, 2.7 describing the general layout of Southern Connection Viaduct Section have been inserted Figure 3.2 showing the locations of water quality, air and noise monitoring has been updated accordingly. Figures 6.2 describing the locations of coral translocation donor and receptor site has been inserted Figure 6.3 showing the layout of dolphin monitoring transects has been revised.