TERRITORIAL DEVELOPMENT DEPARTMENT

AGREEMENT NO. CE 90\96

FEASIBILITY STUDY FOR PAK SHEK KOK DEVELOPMENT AREA

ENVIRONMENTAL IMPACT ASSESSMENT STUDY:

ENVIRONMENTAL MONITORING AND AUDIT MANUAL

MAY 1998

FEASIBILITY STUDY FOR PAK SHEK KOK DEVELOPMENT AREA
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Environmental Monitoring and Audit Manual

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1 INTRODUCTION

1.1 Purpose of the Manual

1.1.1 The purpose of this Environmental Monitoring and Audit (EM&A) Manual, hereafter referred to as the Manual, is to guide the setup of an EM&A programme to ensure compliance with the Environmental Impact Assessment (EIA) study recommendations, to assess the effectiveness of the recommended mitigation measures and to identify any further need for additional mitigation measures or remedial action. This Manual outlines the monitoring and audit programme to be undertaken for the construction of Pak Shek Kok Development Area (PSKDA). It aims to provide systematic procedures for monitoring, auditing and minimising of the environmental impacts associated with the construction works.

1.1.2 Hong Kong environmental regulations for air and water quality, noise and waste, the Hong Kong Planning Standards and Guidelines, and recommendations in the EIA study final report on Feasibility Study for PSKDA have served as environmental standards and guidelines in the preparation of this Manual.

1.1.3 This Manual contains the following:

(a) responsibilities of the Contractor, the Engineer or Engineer's Representative (ER) and Environmental Team (ET) with respect to the environmental monitoring and audit requirements during the course of the project;

(b) information on project organisation and programming of construction activities for the project;

(c) the hypotheses of potential impacts, the basis for and description of the broad approach underlying the environmental monitoring and audit programme;

(d) requirements with respect to the construction schedule and the necessary environmental monitoring and audit programme to track the varying environmental impact;

(e) the specific questions and testable hypotheses that the monitoring programme is designed to answer;

(f) full details of the methodologies to be adopted, including all field, laboratory and analytical procedures, and details on quality assurance and quality control programme;

(g) the rationale on which the environmental monitoring data will be evaluated and interpreted and the details of the statistical procedures that will be used to interpret the data;

(h) definition of Action and Limit levels (AL Levels);

(i) establishment of Event and Action Plans;

(j) requirements of reviewing pollution sources and working procedures required in the event of non-compliance of the environmental criteria and complaints;

(k) requirements of presentation of environmental monitoring and audit data and appropriate reporting procedures; and

(l) requirements for review of EIA predictions and effectiveness of the environmental monitoring and audit programme.

1.1.4 For the purpose of this Manual, the "Engineer" shall refer to the Engineer as defined in the Contract and the Engineer's Representative (ER), in cases where the Engineer's powers have been delegated to the ER, in accordance with the Contract. The ET leader, who shall be responsible for and in charge of the ET, shall refer to the person delegated the role of executing the environmental monitoring and audit requirements.

1.2 Background

1.2.1 On 10 April 1997, the Territory Development Department (TDD) of the Hong Kong Government commissioned Maunsell Consultants Asia Ltd (hereafter known as Maunsell) as the lead consultant for the Feasibility Study on the PSKDA (hereafter referred to as the Study) under Agreement No. CE 90/96. The purpose of this Study is to identify the alternative concept options for the PSKDA and then recommend the preferred development option for which Preliminary Design will be developed.

1.2.2 The project site and boundary is shown in *Figure 1.2a*.

1.2.3 The purpose of the EIA was to provide information on the nature and extent of environmental impacts arising from the construction and operation of the PSKDA and related activities which includes the dredging and public filling taking place concurrently for the Pak Shek Kok Reclamation - Public Dump (PSKRPD). The EIA will contribute to decisions on:

- the overall acceptability of any adverse environmental impacts arising from the proposed PSKDA;
- any conditions and requirements to be included into the detailed design, construction and operation of the PSKDA; and
- the acceptability of any residual impacts after the implementation of mitigation measures.

The EIA has produced various deliverables during the Assignment for consideration by the Environmental Study Management Group which include the following:

- **Environmental Demonstration Paper** The purpose of this Demonstration Paper was to comparatively assess the previous PSKRPD EIA and only assess the changes made in the reclamation phasing to determine that the impacts are no greater than that previously assessed;

- **EIA - Initial Assessment Report (EIA - IAR)** The purpose of this report was to review existing data and highlight key issues and constraints of the PSKDA proposals. The findings of this report have been used to provide input into the selection of a preferred development option;

- **EIA Report** The purpose of this report was to consolidate all the findings of the environmental impact assessment based on the preferred PSKDA option. The findings and recommendations of this report will be incorporated into the Preliminary Design of the PSKDA;

- **Environmental Monitoring and Audit (EM&A Manual)** The purpose of this Manual is to design and specify the EM&A requirements necessary to ensure the implementation and the effectiveness of the environmental protection and pollution control measures recommended in the EIA Report; and

- **Executive Summary** The purpose of the Executive Summary is to provide a non technical summary of all the findings in the EIA Study.

1.3 Environmental Monitoring and Audit Requirements

Noise

1.3.1 It was recommended that noise monitoring be carried out as part of the EM&A programme during the construction period of the PSKDA at the following locations:

- NSRs N1 (Chinese University Hong Kong (CUHK) Staff Accommodation);
- N2 (CUHK);
- N3 (Cheung Shue Tan Village);
- N4 (Tsiu Hang Village); and
- N8 (Tertiary Education Institution in Area 39).

1.3.2 Monitoring is required to ensure compliance with the Environmental Impact Assessment Ordinance (EIAO) in providing feedback to the Contractors for the management of their operations.

Air Quality

1.3.3 The cumulative construction work is likely to cause exceedance of the Total Suspended Particulates (TSP) dust criterion at ASRs A1 and A2 in 2001. Dust control measures are recommended to be incorporated in the Contract Specification of the PSKDA and PSK Reclamation to minimise dust nuisance arising from the works. It is expected that with the above measures, dust emission from infrastructure and development construction, materials handling and bulldozing could be reduced by 50%.

Water Quality

1.3.4 Based on the EIA Report of water quality impacts, it is recommended that during the construction of PSKDA, a water quality monitoring and auditing programme should be conducted before and during reclamation works to proactively detect any deterioration of water quality.

Waste Management

1.3.5 Auditing of different waste generation, storage, recycling, treatment, transport and disposal arrangements/procedures should be carried out periodically to determine if waste is being managed in accordance with approved procedures and the site water management plan and see if waste reduction targets are being achieved or could be improved.

1.3.6 Representative air, noise and water sensitive receivers, as defined in Environmental Impact Assessment Ordinance-Technical Memorandum, have been identified based on the EIA Report are listed in *Tables 1.2a-c*. The locations of these sensitive receivers are shown in *Figures 1.3a-c*.

Table 1.3a ***Air Sensitive Receivers***

ASR	Description
A1	Hong Kong Institute of Biotechnology (HKIB)
A2	HKIB Staff Accommodation
A3	CUHK Playing Fields
A4	CUHK: Residence No. 10
A5	Cheung Shue Tan Village
A6	Wong Nai Fai Village
A7	Tsiu Hang Village
A8	Deerhill Bay
A9	Villa Castell
A10	Hong Kong Institute of Education Playing Fields
A11	Education Facility
A12	Education Facility
A13	Open Space in Stage III Reclamation
A14	Residential Development (High Density)-R2 [1]
A15, A16	Residential Development-Site A (Medium Density)
A17	Residential Area in Stage III Reclamation
A18	Science Park
A19	CUHK Marine Science Laboratory (MSL)

Table 1.3b Noise Sensitive Receivers

NSR	Description
N1	HKIB Staff Accommodation
N2	CUHK: Residence No. 10
N3	Cheung Shue Tan Village
N4	Tsiu Hang Village
N5	Deerhill Bay
N6	Villa Castell
N7	Educational Uses in Area 12
N8	Possible Tertiary Education Institution in Area 39
N9	Residential Development-Site A (Medium Density)
N10	Residential Development (High Density)-R2

Table 1.3c Water Sensitive Receivers

WSR	Description
W1	CUHK Marine Science Laboratory (existing)
W2	Shatin WSD Seawater Pumping Station
W3	Tai Po WSD Seawater pumping Station
W4	Yim Tin Tsai Mariculture Zone
W5	CUHK Marine Science Laboratory (reprovisioned)

1.4 Project Organisation

1.4.1 The project organisation and lines of communication with respect to environmental protection works is shown in *Figure 1.4a*.

1.4.2 The Environmental Team (ET) shall not be in any way an associated body of the Contractor. The ET leader shall have relevant professional qualifications, or have sufficient relevant EM&A experience subject to approval of the Engineer's Representative (ER) and the Environmental Protection Department (EPD).

1.4.3 Appropriate staff shall be included in the ET, under the supervision of the ET Leader, to fulfil the EM&A duties of the ET Leader specified in this manual. Basically, the duties comprise the following:

(a) To monitor the various environmental parameters as required in EIA study final report;

(b) To investigate and audit the Contractors' equipment and work methodologies with respect to pollution control and environmental mitigation, and anticipate environmental issues for proactive action before problems arise;

(c) To audit and prepare audit reports on the environmental monitoring data and the site environmental conditions; and

(d) To report on the environmental monitoring and audit results to the Contractor, the ER, and the EPD or its delegate.

1.4.4 Appropriate resources shall also be allocated under the Contractor and the ER to fulfil their duties specified in this manual.

1.4.5 The Independent Checker (Environmental), IC(E), shall be an independent person or company with a minimum of 5 years EIA experience and proven track record in EM&A similar to the scope proposed in this Manual.

1.5 Construction Programme

PSKDA Construction Sequence

1.5.1 The formation of the sites and provision of infrastructure to be undertaken will in accordance with the construction programme as shown in *Figure 1.5a*. The construction programme forecasts the availability of land for various types of developments. The programme also incorporates other Government engineering and construction projects including roads and other infrastructure constructions, the provision of public housing estates and other government and community facilities. As shown in *Figure 1.5a*, the PSKDA will be implemented in stages, broadly following the completion of the reclamation which will be progressively completed from first commencement (late 1996) to 2004.

1.5.2 The construction of the proposed PSKDA is expected to proceed in three stages, with the development of the Science Park proceeding in the southern section first by the year 2001, followed by the development of residential development in the north in 2003 and recreation in the central area by the year 2006. A preliminary construction programme is shown in *Figure 1.5a*. At present, it is not known how the development on the existing Area 12 (Part) and 39 reclamation will proceed, apart from the area reserved for HKIE playing fields should be completed by the year 2000. Key programme dates can be summarised as follows:

- Civil Engineering Department (CED) reclamation programme is essentially fixed, with land for the Science Park Phase 1 being produced first (in portions from February 1998 to June 1999), followed by the northern portion (December 2000), then the remaining central section of land (July 2004).

- Substantial additional sewerage disposal capacity, beyond that needed for the Science Park Phase 1, is not expected to be available until 2003.

1.5.3 It should, however, be noted that the construction programme will be subject to ongoing change and refinement due to design development and Government review, as well as change and refinement as the design progresses. Any subsequent significant changes to the programme will necessitate an environmental review to confirm that impacts, including cumulative impacts, are no greater than those predicted in this PSKDA EIA.

Infrastructural Works

1.5.4 Infrastructural works to be conducted on the reclamation will include construction of the Science Park, residential development and recreational uses and the associated road works, infrastructural services and pipe laying.

1.5.5 The HKIE Sports Centre, as a committed use, can commence construction once the extension of Yau King Lane is completed, which is the only access to that site during its construction time.

1.5.6 The first phase of the Science Park is intended to open in mid 2001 on land nearest the Hong Kong Institute of Biotechnology. The advanced works which will include the Southern Access Road and will supply the necessary infrastructure to allow the Science Park to operate is expected to be open by mid 2001.

1.5.7 The residential areas north of the nullah will commence in 2001 and should be completed by mid 2003. The residential area south of the nullah will commence in 2004 and should be completed by the 2007.

Southern and Northern Access Roads

1.5.8 The Southern and Northern access roads have been proposed in the PSKDA Study *Access Road Options Working Paper (ET/03), Working Paper (ET/07)* and *PPFS*. Access options to the north and south have been proposed due to the implementation of the proposed developments and potential connections with the Tolo Highway. *Figures 1.5b-c* show the alignments of the proposed access roads. There will also be small reclamation requirements associated with these access roads as shown in *Figures 1.5d-e*.

KCRC Station

1.5.9 The options for rail access have been proposed in the PSKDA Study *Access Road Options Working Paper (ET/03)* and *KCRC Provisions Report (ET/06)* which would involve the option of the provision of a station along a straight section of rail in the middle of the site as shown in *Figure 1.5f*.

Other Projects

1.5.10 A summary of concurrent projects within the PSKDA is given in *Table 1.5a* and described in the following sections:

Table 1.5a Concurrent Projects

Development	Proposed/Likely Programme
Tolo Highway Widening	December 1998 - December 2001
Tai Po Development - Formation and Servicing of Area 12 (part) and 39, Phase I	March 1998 - March 2000
Tai Po Development - Formation and Servicing of Area 12 (part) and 39, Phase II	mid 1999 - end 2001

Tai Po Areas 12 (part) and 39

The proposed formation and servicing works have been divided into two phases. Phase I will include the following works:

- Site formation in the northern part of Area 39 (filling to approximately +6.0 m PD and associated drains);
- Widening of the existing Yau King Lane and construction and construction of Road L39/1 (north) to link Area 39 to Tai Po Road. Part of Road L39/1 will be constructed on the existing Kowloon Canton Railway embankment and track;
- Provision of pedestrian footways; and
- Provision of associated drains.

(i) Phase II Works will include completion of the site formation and servicing in the southern part of Area 39, completion of Road L39/1 and construction of Roads L39/2, L12/1, L12/2, culverting of the existing nullah, training of stream channels and other associated works. The duration of Phase II works is expected to be from mid 1999 until mid 2001.

PSK Reclamation

1.5.11 The construction of the Pak Shek Kok Reclamation is to be undertaken under a CED Public Dump Contract and has been environmentally assessed previously in the Pak Shek Kok Reclamation-Public Dump, EIA Study undertaken by Mouchel (April 1994). The proposed construction programme was expected to commence in the south and proceeding in three stages (Stages I to III) to the north.

1.5.12 Subsequent to the findings of the previous PSKRPD EIA, a revised staging programme was proposed in the PSKDA Study Reclamation Options Working Paper ET/02, Addendum No.1 in order to cater for the housing demand identified. An environmental Demonstration Paper was undertaken, as part of the PSKDA EIA Study, and submitted on 27 August 1997 to comparatively assess the proposed changes with previous PSKRPD EIA to determine that the impacts were no greater than that previously assessed.

1.5.13 *Figure 1.5a* is the tentative works programme for the project. This programme is for information of the ET Leader to get an initial idea of the projection of the works. The ET Leader shall make reference to the actual works progress and programme during the construction stage to schedule the EM&A works, and the Contractor shall provide the respective information to the ET Leader for formulating the EM&A schedule.

1.5.14 Due to the concurrent ongoing projects highlighted in this section, it is considered effective to have an integrated EM&A programme, if contractual arrangements allows. This integrated approach will facilitate the interaction of the various projects and thus avoid the potential duplication of environmental monitoring requirements.

2 AIR QUALITY

2.1 Introduction

2.1.1 In this section, the methodology, equipment, monitoring locations, criteria and protocols for the monitoring and audit of air quality impacts during the construction stage of PSKDA are explained. Dust is expected to be the key pollutant during construction of the PSKDA.

2.1.2 The impact of fugitive dust on ambient air pollution depends on the quantity, as well as the drift potential of the dust particles injected into the atmosphere. Large dust particles will settle out near the source and particles that are 30 - 100 μm in diameter are likely to undergo impended settling. These particles, depending on the extent of atmospheric turbulence, would settle within a distance of 100 m from the source. The main dust impact will arise from the fine particles of a diameter less than 30 μm, measured as TSP, dispersed over great distance from the sources. TSP levels shall, therefore, be monitored to evaluate the dust impact during impact during the construction. The objectives of TSP monitoring shall be:

- to identify the extent of construction dust impacts on sensitive receiver;
- to determine the effectiveness of mitigation measures to control dust from construction activities;
- to recommend further mitigation measures if found to be necessary; and
- to comply with AL Levels for air quality as defined in this Manual.

2.2 Air Quality Parameters

2.2.1 Monitoring and audit of the TSP levels shall be carried out by the ET to ensure that any deteriorating air quality could be readily detected and timely action taken to rectify the situation.

2.2.2 1-hour and 24-hour TSP levels should 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 of the ER, 1-hour TSP levels can be measured by direct reading methods which are capable of producing comparable results as that by the high volume sampling method, to indicate short event impacts.

2.2.3 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, and other special phenomena and work progress of the concerned site etc. shall be recorded down in details. A sample data sheet is shown in *Annex A*.

2.3 Monitoring Equipment

2.3.1 High volume sampler (HVS) in compliance with the following specifications shall be used for carrying out the 1-hr and 24-hr TSP monitoring:

(a) 0.6-1.7 m^3/min (20-60 SCFM) adjustable flow range;
(b) equipped with a timing/control device with +/- 5 minutes accuracy for 24 hours operation;
(c) installed with elapsed-time meter with +/- 2 minutes accuracy for 24 hours operation;
(d) capable of providing a minimum exposed area of 406 cm^2 (63 in^2);
(e) flow control accuracy: +/- 2.5% deviation over 24-hr sampling period;
(f) equipped with a shelter to protect the filter and sampler;
(g) incorporated with an electronic mass flow rate controller or other equivalent devices;
(h) equipped with a flow recorder for continuous monitoring;
(i) provided with a peaked roof inlet;
(j) incorporated with a manometer;
(k) able to hold and seal the filter paper to the sampler housing at horizontal position;
(l) easy to change the filter; and
(m) capable of operating continuously for 24-hr period.

2.3.2 The ET Leader is responsible for provision of the monitoring equipment. He shall ensure that sufficient number of HVSs with an appropriate calibration kit are available for carrying out the baseline monitoring, regular impact monitoring and ad hoc monitoring. The HVSs 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 labelled.

2.3.3 Initial calibration of dust monitoring equipment shall be conducted 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 the concerned parties such as the IC(E). All the data should be converted into standard temperature and pressure condition.

2.3.4 The flow-rate of the sampler before and after the sampling exercise with the filter in position shall be verified to be constant and be recorded down in the data sheet as mentioned in *Annex A*.

2.3.5 If the ET Leader proposes to use a direct reading dust meter to measure 1-hr TSP levels, he shall submit sufficient information to the IC(E) to prove that the instrument is capable of achieving a comparable result as that the HVS and may be used for the 1-hr sampling. The instrument should also be calibrated regularly, and the 1-hr sampling shall be determined periodically by HVS to check the validity and accuracy of the results measured by direct reading method.

2.3.6 Wind data monitoring equipment shall also be provided and set up at conspicuous locations for logging wind speed and wind direction near to the dust monitoring locations. The equipment installation location shall be proposed by the ET Leader and agreed with the ER in consultation with IC(E). For installation and operation of wind data monitoring equipment, the following points shall be observed:

(a) the wind sensors should be installed on masts at an elevated level 10m above ground so that they are clear of obstructions or turbulence caused by the buildings;
(b) the wind data should be captured by a data logger and to be downloaded for processing at least once a month;
(c) the wind data monitoring equipment should be re-calibrated at least once every six months; and
(d) wind direction should be divided into 16 sectors of 22.5 degrees each.

2.3.7 In exceptional situations, the ET Leader may propose alternative methods to obtain representative wind data upon approval from the ER and agreement from IC(E).

2.4 Laboratory Measurement / Analysis

2.4.1 A clean laboratory with constant temperature and humidity control, and equipped with necessary measuring and conditioning instruments, to handle the dust samples collected, shall be available for sample analysis, and equipment calibration and maintenance. The laboratory shall be HOKLAS accredited or other internationally accredited laboratory.

2.4.2 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 ER in consultation with the IC(E). Measurement performed by the laboratory shall be demonstrated to the satisfaction of the ER and the IC(E). IC(E) shall conduct regular audit to the measurement performed by the laboratory to ensure the accuracy of measurement results. The ET Leader shall provide the ER with one copy of the Title 40 of the Code of Federal Regulations, Chapter 1 (Part 50), Appendix B for his reference.

2.4.3 Filter paper of size 8"x 10" shall be labelled 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.

2.4.4 After sampling, the filter paper loaded with dust shall be kept in a clean and tightly sealed plastic bag. The filter paper is then 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.

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

2.5 Monitoring Locations

2.5.1 The dust monitoring locations are shown in *Figure 2.5a* and summarised in *Table 2.5a*. The status and locations of dust sensitive receivers may change after issuing this manual. If such cases exist, the ET Leader shall propose updated monitoring locations and seek approval from ER and agreement from the IC(E).

Table 2.5a Air Quality Monitoring Stations

Air Quality Monitoring Stations	Monitoring Location
AM1	HKIB Staff Accommodation
AM2	Cheung She Tan Village
AM3	Villa Castell
AM4*	SW edge of Stage II reclamation

Note: * AM4 monitoring will not commence until the formation of nullah is finished.

2.5.2 When alternative monitoring locations are proposed, the following criteria, as far as practicable, should be followed:

(a) at the site boundary or such locations close to the major dust emission source;

(b) close to the sensitive receptors; and

(c) take into account the prevailing meteorological conditions.

2.5.3 The ET Leader shall agree with the ER in consultation with the IC(E) the position of the HVS for installation of the monitoring equipment. When positioning the samplers, the following points shall be noted:

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

(b) no two samplers should be placed less than 2 meter apart;

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

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

(e) a minimum of 2 metre separation from any supporting structure, measured horizontally is required;

(f) no furnace or incinerator flue is nearby;

(g) airflow around the sampler is unrestricted;

(h) the sampler is more than 20 metres from the dripline;

(i) any wire fence and gate, to protect the sampler, should not cause any obstruction during monitoring;

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

(k) a secured supply of electricity is needed to operate the samplers.

2.6 Baseline Monitoring

2.6.1 The ET Leader shall carry out baseline monitoring at all of the designated monitoring locations for at least 14 consecutive days prior to the commissioning of the construction works to obtain daily 24-hr TSP samples. 1-hr sampling shall also be done at least 3 times per day while the highest dust impact is expected. Before commencing the baseline monitoring, the ET leader shall inform the IC(E) of the baseline monitoring programme such that the IC(E) can conduct on-site audit to ensure accuracy of the baseline monitoring results.

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

2.6.3 In case the baseline monitoring cannot be carried out at the designated monitoring locations during the baseline monitoring period, the ET Leader 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 ER and agreed with the IC(E).

2.6.4 In exceptional case, when insufficient baseline monitoring data or questionable results are obtained, the ET Leader shall liaise with the IC(E) and EPD to agree on an appropriate set of data to be used as a baseline reference and submit to ER for approval.

2.6.5 Ambient conditions may vary seasonally and shall be reviewed at three monthly intervals. If the ET Leader considers that the ambient conditions have been changed and a repeat of the baseline monitoring is required to be carried out for obtaining the updated baseline levels, the monitoring shall be at times when the contractor's activities are not generating dust, at least in the proximity of the monitoring stations. Should 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 IC(E) and EPD.

2.7 Impact Monitoring

2.7.1 The ET Leader 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 all the monitoring stations for 24-hr TSP monitoring. For 1-hr TSP monitoring, the sampling frequency of at least three times in every six-days shall be undertaken when the highest dust impact occurs. Before commencing the baseline monitoring, the ET leader shall inform the IC(E) of the impact monitoring programme such that the IC(E) can conduct on-site audit to ensure accuracy of the impact monitoring results.

2.7.2 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.

2.7.3 In case of non-compliance with the air quality criteria, more frequent monitoring exercise, as specified in the Action Plan in *Section 2.8*, 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.

2.8 Event and Action Plan for Air Quality

2.8.1 The baseline monitoring results form the basis for determining the air quality criteria for the impact monitoring. The ET Leader shall compare the impact monitoring results with air quality criteria set up for 24-hour TSP and 1-hour TSP. *Table 2.8a* shows the air quality criteria, namely Action and Limit (AL) Levels to be used. Should non-compliance of the air quality criteria occurs, actions in accordance with the Action Plan in *Table 2.8b* shall be carried out.

Table 2.8a Action and Limit Levels for Air Quality

Parameters	Action	Limit
24 Hour TSP Level in $\mu g/m^3$	For baseline level ≤ 200 $\mu g/m^3$, Action level = (Baseline level * 1.3 + Limit level)/2; For baseline level > 200 $\mu g/m^3$, Action level = Limit level	260
1 Hour TSP Level in $\mu g/m^3$	For baseline level ≤ 384 $\mu g/m^3$, Action level = (Baseline level *1.3 + Limit level)/2 For baseline level > 384 $\mu g/m^3$, Action level = Limit level	500

Table 2.8b *Event/Action Plan for Air Quality*

EVENT	ACTION			
	ET Leader	IC(E)	ER	CONTRACTOR
ACTION LEVEL				
1. Exceedance for one sample	1. Identify source 2. Inform IC(E) and ER 3. Repeat measurement to confirm finding 4. Increase monitoring frequency to daily	1. Check monitoring data submitted by 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 source 2. Inform IC(E) and ER 3. Repeat measurements to confirm findings 4. Increase monitoring frequency to daily 5. Discuss with IC(E) and Contractor on remedial actions required 6. If exceedance continues, arrange meeting with IC(E) and ER 7. If exceedance stops, cease additional monitoring	1. Checking monitoring data submitted by ET 2. Check Contractor's working method 3. Discuss with ET and Contractor on possible remedial measures 4. Advise the ER 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 Contractor 3. Ensure remedial measures properly implemented	1. Submit proposals for remedial actions to IC(E) within 3 working days of notification 2. Implement the agreed proposals 3. Amend proposal if appropriate
LIMIT LEVEL				
1. Exceedance for one sample	1. Identify source 2. Inform ER and EPD 3. Repeat measurement to confirm finding 4. Increase monitoring frequency to daily 5. Assess effectiveness of Contractor's remedial actions and keep IC(E), EPD and ER informed of the results	1. Checking monitoring data submitted by ET 2. Check Contractor's working method 3. Discuss with ET and Contractor on possible remedial measures 4. Advise the ER 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 Contractor 3. Ensure remedial measures properly implemented	1. Take immediate action to avoid further exceedance 2. Submit proposals for remedial actions to IC(E) 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 IC(E), ER, Contractor and EPD 2. Identify source 3. Repeat measurement to confirm findings 4. Increase monitoring frequency to daily 5. Carry out analysis of Contractor's working procedures to determine possible mitigation to be implemented 6. Arrange meeting with IC(E) and ER to discuss the remedial actions to be taken 7. Assess effectiveness of Contractor's remedial actions and keep IC(E), EPD and ER informed of the results 8. If exceedance stops, cease additional monitoring	1. Discuss amongst ER, ET, and Contractor on the potential remedial actions 2. Review Contractor's remedial actions whenever necessary to assure their effectiveness and advise the ER accordingly 3. Supervise the implementation of remedial measures	1. Confirm receipt of notification of failure in writing 2. Notify Contractor 3. In consultation with the IC(E), agree with the Contractor on the remedial measures to be implemented 4. Ensure remedial measures properly implemented 5. If exceedance continues, consider what portion of the work is responsible and instruct the Contractor to stop that portion of work until the exceedance is abated	1. Take immediate action to avoid further exceedance 2. Submit proposals for remedial actions to IC(E) within 3 working days of notification 3. Implement the agreed proposals 4. Resubmit proposals if problem still not under control 5. Stop the relevant portion of works as determined by the ER until the exceedance is abated

2.9 Dust Mitigation Measures

2.9.1 The EIA report has recommended dust control and mitigation measures. The Contractor shall be responsible for the design and implementation of these measures.

2.9.2 The cumulative construction work is likely to cause exceedance of the TSP dust criterion at ASRs A1 and A2 in 2001. The following dust control measures are recommended to be incorporated in the Contract Specification of the PSKDA and PSK Reclamation to minimise dust nuisance arising from the works:

- the heights from which fill materials are dropped should be controlled to a practical height to minimize the fugitive dust arising from unloading;
- during transportation by truck, materials should not be loaded to a level higher than the side and tail boards, and should be dampened or covered before transport;
- all stockpiles of aggregate or spoil should be enclosed or covered and water applied in dry or windy condition;
- effective water sprays should be used on the site at potential dust emission sources such as unpaved area;
- the haul road should be paved and vehicle speed should be limited to 20 kph;
- the haul road should be located away from the sensitive receivers, regular watering is recommended; and
- wheel washing facilities should be provided at the exit of work site.

2.9.3 If the above measures are not sufficient to restore the air quality to acceptable levels upon the advice of ET Leader, the Contractor shall liaise with the ET Leader on some other mitigation measures, propose to ER for approval, and implement the mitigation measures.

3 NOISE

3.1 Introduction

3.1.1 As the noise sensitive receivers (NSR)s near the PSKDA working area will be subjected to daytime, and possibly restricted-hour construction noise, a noise monitoring programme shall be developed by the ER to include daytime and restricted-hour (if necessary) noise measurement at the sensitive receivers. The programme shall be carried out by the ET to ensure that the noise level of construction works complies with the criteria of the Noise Control Ordinance (NCO) and other adopted noise criteria.

3.2 Noise Parameters

3.2.1 The construction noise level 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. For all other time periods, $L_{eq(3\ x\ 5\ min)}$ shall be employed for comparison with the NCO criteria.

3.2.2 As supplementary information for data auditing, statistical results such as L_{10} and L_{90} shall also be obtained for reference. A sample data record sheet is shown in *Annex A* for reference.

3.3 Monitoring Equipment

3.3.1 As referred to in the Technical Memorandum (TM) issued under the Noise Control Ordinance (NCO), sound level metres 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. Immediately prior to and following each noise measurement the accuracy of the sound level metre 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 1.0 dBA.

3.3.2 Noise measurements should not be made in accordance with standard acoustical principles and practices in relation to weather conditions.

3.3.3 The ET Leader is responsible for the provision and maintenance of the monitoring equipment. He shall ensure that sufficient noise measuring equipment and associated instrumentation are available for carrying out the baseline monitoring, regular impact monitoring and ad hoc monitoring. All the equipment and associated instrumentation shall be clearly labelled.

3.4 Monitoring Locations

3.4.1 The noise monitoring locations are shown in *Figure 3.4a* and summarised in *Table 3.4a*. The status and locations of noise sensitive receivers may change after issuing this manual. If such cases exist, the ET Leader shall propose updated monitoring locations and seek approval from ER, and agreement from the IC(E) and EPD of the proposal.

Table 3.4a *Noise Monitoring Stations*

Noise Monitoring Station	Noise Monitoring Location
NM1	CUHK Staff Accommodation
NM2	CUHK Residence No. 10
NM3	Cheung Shue Tan Village
NM4	Tsiu Hang Village
NM5	Deerhill Bay Development
NM6	Possible Tertiary Education Institution in Area 39
NM7	Residential Development (High Density) - R2

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

(a) at locations close to the major site activities which are likely to have noise impacts;

(b) close to the noise sensitive receivers (N.B. For the purposes of this section, any domestic premises, hotel, hostel, temporary housing accommodation, hospital, medical clinic, educational institution, place of public worship, library, court of law, performing art centre shall be considered as a noise sensitive receiver); and

(c) for monitoring locations located in the vicinity of the sensitive receivers, care shall be taken to cause minimal disturbance to the occupants during monitoring.

3.4.3 The monitoring station shall normally be at a point 1m from the exterior of the sensitive receivers building facade and be at a position 1.2m above the ground. If there is a problem with access to the normal monitoring position, an alternative position may be chosen, and a correction to the measurements shall be made. For reference, a correction of +3dB(A) shall be made to the free field measurements. The ET Leader shall agree with the IC(E) on the monitoring position and the corrections adopted. Once the positions for the monitoring stations are chosen, the baseline monitoring and the impact monitoring shall be carried out at the same positions.

3.5 Baseline Monitoring

3.5.1 The ET Leader shall carry out baseline noise monitoring prior to the commencement of the construction works. The baseline monitoring shall be carried out daily for a period of at least two weeks. A schedule on the baseline monitoring shall be submitted to the ER for approval before the monitoring starts.

3.5.2 There shall not be any construction activities in the vicinity of the stations during the baseline monitoring. Baseline monitoring measurements shall be evenly spread throughout the assessment period to be conducted at the some frequency and duration throughout all periods of the day for which works are anticipated to be constructed (eg. daytime, evening and nighttime).

3.5.3 In exceptional cases, when insufficient baseline monitoring data or questionable results are obtained, the ET Leader shall liaise with EPD to agree on an appropriate set of data to be used as a baseline reference and submit to the ER for approval.

3.6 Impact Monitoring

3.6.1 Noise monitoring shall be carried out at all the designated monitoring station. The monitoring frequency shall depend on the scale of the construction activities. The following is an initial guide on the regular monitoring frequency for each station on a per week basis when noise generating activities are underway:

(a) one set of measurements between 0700-1900 hours on normal weekdays;

(b) one set of measurements between 1900-2300 hours;

(c) one set of measurements between 2300-0700 hours of next day; and

(d) one set of measurements between 0700-1900 hours on holidays.

General construction work carrying out during restricted hours is controlled by CNP system under the NCO.

3.6.2 For the measurements (b), (c) and (d) above, one set of measurements shall at least include 3 consecutive $L_{eq(5\ min)}$ results.

3.6.3 If a school exists near the construction activity, noise monitoring shall be carried out at the monitoring stations for the schools during the school examination periods. The ET Leader shall liaise with the school's personnel and the Examination Authority to ascertain the exact dates and times of all examination periods during the course of the contract.

3.6.4 In case of non-compliance with the construction noise criteria, more frequent monitoring as specified in the Action Plan in *Section 3.7* shall be carried out. This additional monitoring shall be continued until the recorded noise levels are rectified or proved to be irrelevant to the construction activities.

3.7 Event and Action Plan for Noise

3.7.1 The AL Levels for construction noise are defined in *Table 3.7a*. Should non-compliance of the criteria occurs, action in accordance with the Action Plan in *Table 3.7b*, shall be carried out.

Table 3.7a *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)
0700-2300 hrs on holidays; and 1900-2300 hrs on all other days		60/65/70** dB(A)
2300-0700 hrs of next day		45/50/55** dB(A)

* Reduce to 70 dB(A) for schools and 65 dB(A) during school examination periods.
** To be selected based on Area Sensitivity Rating.

Table 3.7b *Event/Action Plan for Construction Noise*

EVENT	ACTION			
	ET Leader	IC(E)	ER	Contractor
Action Level	1. Notify IC(E) and Contractor 2. Carry out investigation 3. Report the results of investigation to the IC(E) and 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 ER accordingly 4. Supervise the implementation of remedial measures	1. Confirm receipt of notification of failure in writing 2. Notify Contractor 3. Require Contractor to propose remedial measures for the analysed noise problem 4. Ensure remedial measures are properly implemented	1. Submit noise miligation proposals to IC(E) 2. Implement noise mitigation proposals
Limit Level	1. Notify IC(E), ER, EPD and Contractor 2. Identify 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 IC(E), ER and EPD the causes & actions taken for the exceedances 7. Assess effectiveness of Contractor's remedial actions and keep IC(E), EPD and ER informed of the results 8. If exceedance stops, cease additional monitoring	1. Discuss amongst ER, ET, and Contractor on the potential remedial actions 2. Review Contractor's remedial actions whenever necessary to assure their effectiveness and advise the ER accordingly 3. Supervise the implementation of remedial measures	1. Confirm receipt of notification of failure in writing 2. Notify Contractor 3. Require Contractor to propose remedial measures for the analysed noise problem 4. Ensure remedial measures are properly implemented 5. If exceedance continues, consider what portion of the work is responsible and instruct the Contractor to stop that portion of work until the exceedance is abated	1. Take immediate action to avoid further exceedance 2. Submit proposals for remedial actions to IC(E) within 3 working days of notification 3. Implement the agreed proposals 4. Resubmit proposals if problem still not under control 5. Stop the relevant portion of works as determined by the ER until the exceedance is abated

3.8 Noise Mitigation Measures

3.8.1 The EIA Report has recommended construction noise control and mitigation measures. The Contractor shall be responsible for the design and implementation of these measures.

Recommended Mitigation Measures

3.8.2 Mitigation measures are detailed below, and the following forms of mitigation measures are recommended and should be incorporated into the Contract Specification:

- good site practice to limit noise emissions at source;
- selection of quieter plant and working methods; and
- reduction in number of plant operating in critical areas close to NSRs.

3.8.3 The Contractor may develop a different package of mitigation measures to meet the required noise standards, but the following illustrates suitable measures to demonstrate a feasible mitigation approach.

Good Site Practice

3.8.4 Good site practice and noise management can considerably reduce the impact of the construction sites' activities on nearby NSRs. The following package of measures should be followed during each phase of construction:

- only well maintained plant should be operated on-site and plant should be serviced regularly during the construction works;
- machines and plants (such as trucks, excavators) that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum;
- plant known to emit noise strongly in one direction, should, where possible, be orientated so that the noise is directed away from nearby NSRs;
- silencers or mufflers on construction equipment should be utilised and should be properly maintained during the construction works; and
- mobile plant should be sited as far away from NSRs as possible.

Selecting Quieter Plant and Working Methods

3.8.5 The Contractor may be able to obtain particular models of plant that are quieter than standard types given in *Technical Memorandum on Noise from Construction Work other than Percussive Piling* (GW-TM). The benefits achievable in this way will depend on the details of the Contractor's chosen methods of working, and it is considered too restrictive to specify that a Contractor has to use specific items of plant for the construction operations. It is therefore both preferable and practical to specify an overall plant noise performance specification to apply to the total sound power level of all plant on the site so that the Contractor is allowed some flexibility to select plant to suit his needs.

3.8.6 Quiet plant is defined as Power Mechanical Equipment (PME) whose actual Sound Power Level (SWL) is less than the value specified in GW-TM for the same piece of equipment. Examples of SWLs for specific silenced PME, which are known to be available in Hong Kong, are given below:

Bulldozer:	110 dB(A) max;
Breaker (Hand Held):	110 dB(A) max;
Compressors:	100 dB(A) max;
Concrete Pumps:	105 dB(A) max;
Dump Truck:	109 dB(A) max;
Excavator:	105 dB(A) max;
Generator:	100 dB(A) max;
Lorry:	105 dB(A) max;
Loader:	105 dB(A) max; and
Poker Vibrator:	110 dB(A) max.

Reducing the Number of Plant Operating in Critical Areas Close to NSRs

3.8.7 In general, the number of plant should be left to the choice of the Contractor. However, in cases of exceedances being identified by the noise monitoring, it may be appropriate to restrict the number of particularly noisy plant within certain parts of the site that are very close to the NSRs.

Constructing Temporary and Movable Noise Barriers

3.8.8 Movable barriers could be very effective in providing noise screening from a particular plant. It is anticipated that a 3 m high movable noise barrier with a skid footing and a small cantilevered upper portion can be located within a few metres of plant. It is estimated that movable noise barrier of this type, if carefully located, can produce at least 10 dB(A) screening for stationary plant and 5 dB(A) for mobile plant.

3.8.9 If there is any construction work during the restricted hours, it is the responsibility of the contractors to comply with the NCO and relevant TMs. The contractor should submit CNPs application and will be assessed by the Noise Control Authority, EPD. Conditions stipulated in CNPs might be strictly followed.

3.8.10 If the above measures are not sufficient to restore the construction noise quality to an acceptable levels upon the advice of ET Leader, the Contractor shall liaise with the ET Leader on some other mitigation measures, propose to ER for approval, and carry out the mitigation measures.

4 WATER QUALITY

4.1 Water Quality Parameters

4.1.1 During the PSKDA construction, operation of the seawater intakes could be directly impacted by Suspended Solids (SS), turbidity and pH values of seawater. SS concentration and turbidity should, therefore, be monitored to assess the background (ambient levels) and the extent of dredging impact during the construction. The pH value indicates the corrosive impact of seawater. The total hardness of water reflects the extent of the formation of insoluble precipitates that accumulate as adhering deposits on the surface of intake pipes and restrict the intake of seawater. Thus, these parameters are the most sensitive parameters of the seawater intakes that require close monitoring. Dissolved Oxygen (DO) concentration and % saturation will also be closely monitored as it is sensitive to reclamation activities.

4.1.2 Water quality monitoring shall be carried out by the ET to ensure that any deteriorating water quality could be readily detected and timely action taken to rectify the situation. Water quality monitoring parameters shall include:

• Dissolved oxygen (DO) (in mg l^{-1} and % saturation) • Temperature (°C) • pH value • Turbidity (NTU) • Water depth (m) • Salinity (mg l^{-1})	*In situ* measurement
• Suspended Solids (SS) (mg l^{-1}) • Ash-free dry weight of SS (mg l^{-1}) • Chlorophyll a (μg l^{-1}) • Total Lead (μg l^{-1}) • Ammoniacal nitrogen (mg l^{-1}) • Total phosphate (mg l^{-1})	Laboratory analysis

These parameters are selected for monitoring on the following basis:

- to reflect the background marine water quality near and within the working area; and
- the nature of the construction activities (dredging and filling).

4.1.3 As described in the EIA Report, the layout and construction phasing of the PSKDA has been designed to optimise tidal flushing of the temporary water body and avoid the formation of embayed water body.

4.1.4 The selection of water quality monitoring parameters shall be based on the recommendation in the EIA/EA report. The monitoring shall be carried out by the ET to ensure that any deteriorating water quality could be readily detected and action be taken in time to rectify the situation.

4.1.5 In association with the water quality parameters, some relevant data shall also be measured, such as monitoring location/position, time, water depth, water temperature, salinity, DO % saturation, weather conditions, sea conditions, tidal stage, and any special phenomena and work underway at the construction site etc.

4.1.6 A sample monitoring record sheet and data format are shown in *Annex A* for reference.

4.2 Monitoring Equipment

4.2.1 Water quality monitoring equipment with the following specifications shall be supplied by the ET Leader.

Dissolved Oxygen and Temperature Measuring Equipment

4.2.2 Dissolved oxygen and temperature measuring equipment

(a) The instrument shall be a portable, weatherproof dissolved oxygen measuring instrument complete with cable, sensor, comprehensive operation manuals, and use a DC power source. It shall be capable of measuring:-

- a dissolved oxygen level in the range of 0-20 mg/l and 0-200% saturation; and
- a temperature of 0-45 degree Celsius.

(b) It shall have a membrane electrode with automatic temperature compensation complete with a cable. Sufficient stocks of spare electrodes and cables shall be available for replacement where necessary. (e.g. YSI model 59 meter, YSI 5739 probe, YSI 5795A submersible stirrer with reel and cable or an approved similar instrument).

(c) Should salinity compensation not be built-in in the DO equipment, in-situ salinity shall be measured to calibrate the DO equipment prior to each DO measurement.

Turbidity Measurement Instrument

4.2.3 The instrument should be a portable, weatherproof turbidity-measuring instrument complete with comprehensive operation manual. The equipment should use a DC power source. It should have a photoelectric sensor capable of measuring turbidity between 0-1000 NTU and be complete with a cable (e.g. Hach model 2100P or an approved similar instrument).

4.2.4 The turbidity metre shall be calibrated to establish the relationship between turbidity readings (in NTU) and levels of SS (in mg l^{-1}). After calibration, turbidity measurements shall be taken as a true representation of levels of SS only before laboratory test results for SS are known.

Suspended Solids

4.2.5 A water sampler comprises a transparent PVC cylinder, with a capacity of not less than 2 litres, and 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 (e.g. Kahlsico Water Sampler or an approved similar instrument).

4.2.6 Water samples for suspended solids measurement should be collected in high density polythene bottles, packed in ice (cooled to 4°C without being frozen), and delivered to the laboratory as soon as possible after collection.

Water Depth Detector

4.2.7 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 handheld or affixed to the bottom of the work boat, if the same vessel is to be used throughout the monitoring programme.

Salinity

4.2.8 A portable salinometer capable of measuring salinity in the range of 0-40 mg l^{-1} shall be provided for measuring salinity of the water at each monitoring location.

Water Sampling Equipment

4.2.9 A water sampler, consisting of a transparent PVC or glass cylinder of not less than two litres which can be effectively sealed with cups at both ends, shall be used. The water sampler shall 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 (e.g. Kahlsico Water Sampler 13SWB203 or an approved similar instrument).

Location of the Monitoring Stations

4.2.10 A hand-held or boat-fixed type digital Global Positioning System (GPS) or other equivalent instrument of similar accuracy shall be provided and used during monitoring to ensure the monitoring vessel is at the correct location before taking measurements.

4.2.11 All in-situ monitoring instrument shall be checked, calibrated and certified by a laboratory accredited under HOKLAS or any other international accreditation scheme before use, 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 metre shall be carried out before measurement at each monitoring location.

4.2.12 For the on site calibration of field equipment, the BS 127:1993, "Guide to field and on-site test methods for the analysis of waters" should be observed.

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

4.3 Laboratory Measurement / Analysis

4.3.1 Analysis of suspended solids shall be carried out in a HOKLAS or other international accredited laboratory. Water samples of about 1000 ml shall be collected at the monitoring stations for carrying out the laboratory SS determination. The detection limit shall be 1 mg l^{-1} or better. The SS determination work shall start within 24 hours after collection of the water samples. The SS determination shall follow APHA 17ed 2540D or equivalent methods subject to approval of EPD.

4.3.2 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 the EPD. The ET Leader shall provide the ER with one copy of the relevant chapters of the "Standard Methods for the Examination of Water and Wastewater" updated edition and any other relevant document for his reference.

4.3.3 For the testing methods of other parameters as recommended by EIA or required by EPD, detailed testing methods, pre-treatment procedures, instrument use, Quality Assurance/Quality Control (QA/QC) details (such as blank, spike recovery, number of duplicate samples per batch, etc.), detection limits and accuracy shall be submitted to EPD for approval prior to the commencement of monitoring programme. The QA/QC shall be in accordance with the requirement of HOKLAS or international accredited scheme. The QA/QC results shall be reported. EPD may also request the laboratory to carry out analysis of known standards provided by EPD for quality assurance. Additional duplicate samples may be required by EPD for inter laboratory calibration. Remaining samples after analysis shall be kept by the laboratory for 3 months in case repeat analysis is required. If in-house or non-standard methods are proposed, details of the method verification may also be required to submit to EPD. In any circumstance, the sample testing shall have comprehensive quality assurance and quality control programmes. The laboratory shall prepare to demonstrate the programmes to EPD or his representatives when requested.

4.4 Monitoring Locations

4.4.1 The water quality monitoring locations are shown in *Figure 4.4a* (refer to *Table 4.4a*). The status and locations of water quality sensitive receivers and the marine activities may change after issuing this manual. If such cases exist, the ET Leader shall propose updated monitoring locations to IC (E) and seek approval from EPD.

Table 4.4a *Water Quality Monitoring Stations*

Station Description	HK Metric Grid E	HK Metric Grid N	Code
Southern Access Reclamation	831725	840250	WM1
Southern Access Reclamation	831350	840150	WM2
Sha Tin WSD Seawater Pumping Station	830300	840200	WM3
MSL (existing)	831120	840200	WM4
MSL (reprovisioned)	831413	840270	WM5
Control Station within Tolo Harbour	840700	833800	C2

4.4.2 When alternative monitoring locations are proposed, they should be selected based on the following guidelines:

(a) at the boundary of the mixing zone of the major site activities as indicated in the EIA final report, which are likely to cause water quality impacts;

(b) close to the sensitive receptors which are likely to be affected;

(c) for monitoring locations located in the vicinity of the sensitive receptors, care should be taken to cause minimal disturbance during monitoring;

(d) two or more control stations which shall be at locations representative of the project site in its undisturbed condition. Control stations should be located, as far as is practicable, both upstream and down stream of the works area.

4.4.3 Control station C2 is 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 station will thus serve as a means to check whether or not the marine water quality is impacted by other major adjacent development during PSKDA construction and in certain circumstances, may be of significant benefit for off-site impact attribution purposes.

4.4.4 Measurements 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 less than 6 m, the mid-depth station may be omitted. Should the water depth be less than 3 m, only the mid-depth station will be monitored. The ET Leader shall seek approval from IC(E) and EPD on all the monitoring stations.

4.5 Baseline Monitoring

4.5.1 Baseline conditions for water quality shall be established and agreed with EPD prior to the commencement of works. The purposes of the baseline monitoring are to establish ambient conditions prior to the commencement of the works and to demonstrate the suitability of the proposed impact, control and reference monitoring stations. The baseline conditions shall normally be established by measuring the water quality parameters specified in *Section 4.1*. The measurements shall be taken at all designated monitoring stations including control stations, 3 days per week, at mid-flood and mid-ebb tides, for four weeks prior to the commencement of marine works.

4.5.2 There shall not be any marine construction activities in the vicinity of the stations during the baseline monitoring.

4.5.3 In exceptional cases when insufficient baseline monitoring data or questionable results are obtained, the ET Leader shall seek approval from the IC(E) and EPD on an appropriate set of data to be used as baseline reference.

4.5.4 Baseline monitoring schedule shall be faxed to EPD 1 week prior to the commencement of baseline monitoring. The interval between 2 sets of monitoring shall not be less than 36 hours.

4.6 Impact Monitoring

4.6.1 During the course of the marine works for the Southern Access Road Reclamation, monitoring shall be undertaken three days per week, at mid-flood and mid-ebb tides, with sampling/measurement at the designated monitoring stations. The interval between two sets of monitoring shall not be less than 36 hours except where there are exceedances of Action and/or Limit levels, in which case the monitoring frequency will be increased.

4.6.2 Samples shall be taken at 1 m below the surface, mid-water depth and 1 m above the seabed at both mid-flood and mid-ebb tide. If the water depth is less than 6 m, the mid-depth measurement may be omitted subject to the approval of the Engineer. If the depth is less than 3 m, only the mid-depth measurement need to be taken subject to the approval of the Engineer.

4.6.3 Upon completion of all marine activities, a post project monitoring exercise on water quality shall be carried out for four weeks in the same manner as the impact monitoring.

4.6.4 Proposed water quality monitoring schedule shall be faxed to EPD on or before the first day of the monitoring month. EPD shall also be notified immediately for any changes in schedule by fax.

4.7 Event and Action Plan for Water Quality

4.7.1 Monitoring data collected during the period of the construction works shall be assessed for SS and DO with regard to the AL Levels criteria as shown in *Table 4.7a*. Should the monitoring results of the water quality parameters at any designated monitoring stations indicate that the water quality criteria are exceeded, the actions in accordance with the Action Plan in *Table 4.7b* shall be carried out.

4.7.2 There are two established ways to set the water quality assessment criteria for a monitoring programme. The consultants shall seek advice from the Director of Environmental Protection on setting the assessment criteria and the design of the project specific Action Plan.

4.7.3 Approach One:

The water quality assessment criteria, namely Action and Limit levels are based on the results of baseline monitoring and WQO of the relevant water control zone (Table 3.1). Should the monitoring results of the water quality parameters at any designated monitoring stations indicate that the water quality assessment criteria are exceeded, the actions in accordance with the Action Plan in Table 3.2 shall be carried out.

4.7.4 Approach Two:

The water quality assessment criteria shall be based on the results of statistical analysis on the different between impact monitoring results and 30% above control, and/or specific levels defined during the EIA stage for the sensitive receivers. Project specific Action Plan shall be designed according to the monitoring programme and seek approval from the Director of Environmental Protection.

Table 4.7a *Action and Limit Levels for Water Quality*

Parameters	*Action*	*Limit*
DO in mg/l (Surface, Middle & Bottom)	*Surface & Middle* *5%-ile of baseline data for surface and middle layer.* *Bottom* *5%-ile of baseline data for bottom layer.*	*Surface & Middle* *4 mg/l except 5 mg/l for FCZ* *or* *1%-ile of baseline data for surface and middle layer* *Bottom* *2 mg/l or* *1%-ile of baseline data for bottom layer*
SS in mg/l (depth-averaged)	*95%-ile of baseline data or120% of upstream control station's SS at the same tide of the same day*	*99%-ile of baseline or 130% of upstream control station's SS at the same tide of the same day and specific sensitive receiver water quality requirements (e.g. required suspended solids level for concerned sea water intakes)*
Turbidity (Tby) in NTU (depth-averaged)	*95%-ile of baseline data or 120% of upstream control station's Tby at the same tide of the same day*	*99%-ile of baseline or 130% of upstream control station's Tby at the same tide of the same day*

Table 4.7b *Event and Action Plan for Water Quality*

Event	ET Leader	IC(E)	ER	Contractor
Action level being exceeded by one sampling day	Repeat in-situ measurement to confirm findings; Identify source(s) of impact; Inform IC(E) and Contractor; Check monitoring data, all plant, equipment and Contractor's working methods; Discuss mitigation measures with IC(E) and Contractor; Repeat measurement on next day of exceedance.	Discuss with ET and Contractor on the mitigation measures Review proposals on mitigation measures submitted by Contractor and advise the ER accordingly Assess the effectiveness of the implemented mitigation measures.	Discuss with IC(E) on the proposed mitigation measures; Make agreement on the mitigation measures to be implemented;	Inform the ER and confirm notification of the non-compliance in writing; Rectify unacceptable practice; Check all plant and equipment; consider changes of working methods; Discuss with ET and IC(E) and propose mitigation measures to IC(E) and ER; Implement the agreed mitigation measures.
Action level being exceeded by more than one consecutive sampling days	Repeat in-situ measurement to confirm findings; Identify source(s) of impact; Inform IC(E) and Contractor; Check monitoring data, all plant, equipment and Contractor's working methods; Discuss mitigation measures with IC(E) and Contractor; Ensure mitigation measures are implemented; Prepare to increase the monitoring frequency to daily; Repeat measurement on next day of exceedance.	Discuss with ET and Contractor on the mitigation measures Review proposals on mitigation measures submitted by Contractor and advise the ER accordingly Assess the effectiveness of the implemented mitigation measures.	Discuss with IC(E) on the proposed mitigation measures; Make agreement on the mitigation measures to be implemented; Assess the effectiveness of the implemented mitigation measures.	Inform the Engineer and confirm notification of the non-compliance in writing; Rectify unacceptable practice; Check all plant and equipment; consider changes of working methods; Discuss with ET and IC(E) and propose mitigation measures to IC(E) and ER within 3 working days; Implement the agreed mitigation measures.
Limit level being exceeded by one sampling day	Repeat in-situ measurement to confirm findings; Identify source(s) of impact; Inform IC(E), contractor and EPD; Check monitoring data, all plant, equipment and Contractor's working methods; Discuss mitigation measures with IC(E), ER and Contractor; Ensure mitigation measures are implemented; Increase the monitoring frequency to daily until no exceedance of Limit level.	Discuss with ET and Contractor on the mitigation measures Review proposals on mitigation measures submitted by Contractor and advise the ER accordingly Assess the effectiveness of the implemented mitigation measures.	Discuss with IC(E), ET and Contractor on the proposed mitigation measures; Request Contractor to critically review the working methods; Make agreement on the mitigation measures to be implemented; Assess the effectiveness of the implemented mitigation measures.	Inform the Engineer and confirm notification of the non-compliance in writing; Rectify unacceptable practice; Check all plant and equipment; consider changes of working methods; Discuss with ET , IC(E) and ER and propose mitigation measures to IC(E) and ER within 3 working days; Implement the agreed mitigation measures
Limit level being exceeded by more than one consecutive sampling days	Repeat in-situ measurement to confirm findings; Identify source(s) of impact; Inform IC(E), contractor and EPD; Check monitoring data, all plant, equipment and Contractor's working methods; Discuss mitigation measures with IC(E), ER and Contractor; Ensure mitigation measures are implemented; Increase the monitoring frequency to daily until no exceedance of Limit level for two consecutive days.	Discuss with ET and Contractor on the mitigation measures Review proposals on mitigation measures submitted by Contractor and advise the ER accordingly Assess the effectiveness of the implemented mitigation measures.	Discuss with IC(E), ET and Contractor on the proposed mitigation measures; Request Contractor to critically review the working methods; Make agreement on the mitigation measures to be implemented; Assess the effectiveness of the implemented mitigation measures; Consider and instruct, if necessary, the Contractor to slow down or to stop all or part of the marine work until no exceedance of Limit level.	Inform the ER and confirm notification of the non-compliance in writing; Rectify unacceptable practice; Check all plant and equipment; Consider changes of working methods; Discuss with ET , IC(E) and ER and propose mitigation measures to IC(E) and ER within 3 working days; Implement the agreed mitigation measures; As directed by the Engineer, to slow down or to stop all or part of the marine work or construction activities..

4.8 Water Quality Mitigation Measures

4.8.1 The EIA report has recommended water quality control and mitigation measures. The Contractor shall be responsible for the design and implementation of these measures.

4.8.2 The results of the comparative assessment of the revised PSK Reclamation staging proposals, based on the same assumptions and methodology used in the previous PSKRPD EIA demonstrate that the potential water quality impacts will not be greater than previously assessed. Therefore, assumed that the mitigation measures proposed in the previous PSKRPD EIA will be adequate for the PSK Reclamation to be undertaken by the CED contractor (including Northern Access Road Reclamation to be undertaken by TDD contractor) mitigation measures are described below:

Southern Access Road Reclamation

Dredging Activities

- use of sealed grab and silt screen to contain sediment losses during dredging;
- the receiving barges must not be allowed to overflow; and
- in the event of an exceedance, the dredging rate could be reduced to further limit the impact on adjacent receivers.

Owing to the potential adverse water quality impact caused by the dredging of Southern Access Road Reclamation, in addition to the above mentioned mitigation measures, the following extra measures are also recommended:

- deploy silt screen at the at the Southern Access Road Reclamation face and at the Sha Tin WSD intake during the dredging of Southern Access Road Reclamation;
- the silt screens deployed will have efficient reduction in the SS concentration (a factor of 2.5 according the previous PSKRPD EIA). In addition the silt screen should be durable and easily maintainable. Regular surveillance and maintenance are also required;
- deploy silt screen at the reprovisioned MSL intake during the dredging of Southern Access Road reclamation; and
- reduction of the level of SS at reprovisioned MSL intake to comply with the 5 mg l^{-1} standard can be achieved by reduction of dredging rates of the Southern Access Road Reclamation, via extension of the Southern Access Road Reclamation dredging duration from 3 to 7.5 months.

Provided that the above two mitigation measures are implemented properly, the mitigated SS concentration at the Sha Tin WSD intake will comply with the WSD standards.

Filling Activities

- construction of a leading seawall of 100 m from the active dumping face;
- use of refuse boom around the public filling area to contain any floating refuses within the site area and the motorised sampans would be deployed to collect floating refuses if required;.
- use of silt screen around the public filling face would be expected to reduce the losses to the surrounding water;
- placement of a suitably protected surface boom supporting a hanging net or skirt around the tipping front to contain any floating debris;
- strict application of public filling licences and monitoring of material placed in the public fills should be implemented to control unauthorised material being placed in the public fills;
- use of a recirculation system to reduce SS and oil discharges from the vehicle wheel washing facility;
- fuel tanks on site should be housed within drainable trays and regularly drained of rain water. Vehicle maintenance should be carried out on paved areas, spillages controlled by absorbents and waste oils collected in designated tanks prior to disposal off site;
- permanent site offices and facilities should be connected to the most convenient sewer. Temporary chemical toilet facilities at distant locations on the reclamations should be serviced daily and the contents disposed of to the sewer; and
- at least a 200 m gap between seawalls will be maintained to assist adequate flushing during the filling of the Stage II Phase 2 formation period.

Contaminated Sediment

As it is anticipated that some of the dredged sediment is seriously contaminated. It should be noted that further additional mitigation measures may be needed in this instance and, therefore, the following mitigation measures may be appropriate.

Dredging Activities

- the prohibition of stockpiling of any moderately or seriously contaminated (Class B and C) material, and careful control of stockpiling of any uncontaminated (Class A) material to prevent run-off, resuspension and odour nuisance.
- all vessels should 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 dredgers should be fitted with tight fitting seals to their bottom openings to prevent leakage of material;

- the construction works should cause no visible foam, oil, grease, scum, litter or other objectionable matter to be present on the water within the site or public filling grounds;

- additional provisions will be required where sediments are contaminated. The locations and depths of any areas of contaminated sediments should be indicated int he construction contract following the completion of a detailed sediment quality survey which has been recommended by Full Management Committee (FMC), prior to construction. The Contractor should be required to ensure that contaminated sediments are dredged, transported and placed in approved special dumping grounds in accordance with the EPDTC 1-1-92, WBTC 22/92 and WBTC 6/92. Typical mitigation measures are list below:

- transport of contaminated mud to the marine disposal site should, wherever possible, be by split barge of not less than 750 m^3 capacity, well maintained and capable of rapid opening and discharge at the disposal site;

- the material should be placed in the pit by bottom dumping, at a location within the pit specified by the FMC;

- discharge should be undertaken rapidly and the hoppers should then immediately be closed, material adhering to the sides of the hopper should not be washed out of the hopper and the hopper should remain closed until the barge next returns to the disposal site;

- the dumping vessel should be stationary throughout the dumping operation;

- the Contractor must be able to position the dumping vessel to an accuracy of +/- 10 m;

- inspection of the barge loading to ensure that loss of material does not take place during transportation;

- transport barges or vessels shall be equipped with automatic self-monitoring devices; and

- on site audit of the equipment and plant is essential to ensure it is used in the correct manner.

Filling Activities

- all vessels should 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 grabs should be fitted with tight fitting seals to their bottom openings to prevent leakage of filling material;

- loading of barges should be controlled to prevent splashing of filling material to the surrounding water, and barges or hoppers should not be filled to a level which will cause the overflow of materials of polluted water during loading or transportation;

- the works should cause no visible foam, oil, grease, scum, litter or other objectionable matter to be present on the water within the Site or dumping grounds; and

- a maximum 5% fines contents of marine fill sand arriving at site is recommended as the upper limit of the fines content to minimize the SS impact upon the Sha Tin WSD intake located 200-300 m from the construction site.

General Construction Activities

All site construction run-off should be controlled and treated to prevent high levels of SS entering surrounding waters in accordance with ProPECC PN 1/94. The following measures, which constitute good site practices, may be considered where applicable:

- temporary ditches should be provided to facilitate run-off discharge into the appropriate watercourses, via a sediment trap/sediment retention basin, prior to discharge;

- permanent drainage channels should also incorporate sediment basins or traps, and baffles to enhance deposition rates;

- all traps (temporary or permanent) should also incorporate oil and grease removal facilities;

- sediment traps must be regularly cleaned and maintained by the contractor. Daily inspections of such facilities should be required of the contractor;

- concrete batching plants should be bunded to contain the surface water run-off;

- water from concrete batching plants must also pass through sediment traps and settlement tanks prior to run-off into watercourses. These must be regularly cleaned and maintained by the contractor;

- collection of spent bentonite/other grouts in a separate slurry collection system for either cleaning and reuse/disposal to landfill;

- maintenance and plant areas should be bunded and constructed on a hard standing with the provision of sediment traps and petrol interceptors;

- all drainage facilities must be adequate for the controlled release of storm flows;

- minimising of exposed soil areas to reduce the potential for increased siltation and contamination of run-off;

- all chemical stores shall be contained (bunded) such that spills are not allowed to gain access to water bodies; and
- chemical toilets will be required to handle the sewage from the on-site construction workforce.

4.8.3 If the above measures are not sufficient to restore the water quality to an acceptable levels upon the advice of the ET Leader, the Contractor shall liaise with the ET Leader on some other mitigation measures, propose to IC(E) and ER for approval, and carry out the mitigation measures.

5 WASTE MANAGEMENT

5.1 Introduction

5.1.1 The Contractor is responsible for waste control within the construction site, removal of waste material produced by the site and the implementation of any mitigation measures to minimise waste or redress problems arising from site waste. The waste material may include any sewage, waste water or effluent containing sand, cement, silt or any other suspended or dissolved material flowing from the site into any storm sewer, sanitary sewer, or any waste matter or refuse deposited anywhere within the site or onto any adjoining land.

5.1.2 When handling the waste material, the following measures shall be undertaken:

5.1.3 The proposed re-use, recycling, storage, collection, transport and disposal methods for various wastes which are recommended to avoid or minimise potential adverse impacts of the PSKDA are detailed below. Specifically, it is recommended that during the construction phase, the Contractor incorporate the recommendations into an on-site waste management plan.

5.1.4 The Contractor shall also pay attention to the Waste Disposal Ordinance, the Dumping at Sea Ordinance, the Public Health and Municipal Services Ordinance and the Water Pollution Control Ordinance, and carry out the appropriate waste management work. The relevant licence/permit, such as the effluent discharge licence, the chemical waste producer registration, etc. shall be obtained. The Contractor shall refer to the relevant booklets issued by EPD when applying for the licence/permit.

5.1.5 During the site inspections and the document review procedures as mentioned in Sections 6.1 and 6.2 of this manual, the ET Leader 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.

5.2 Waste Mitigation Measures

The various waste management options can be categorised in terms of preference from an environmental viewpoint. The options considered to be more preferable have the least impacts and are more sustainable in the long term. Hence, the hierarchy is as follows:

- Avoidance and minimisation, ie not generating waste through changing or improving practices and design;
- Re-use of materials, thus avoiding disposal (generally with only limited reprocessing);
- Recovery and recycling, thus avoiding disposal (although reprocessing may be required); and

- Treatment and disposal, according to relevant laws, guidelines and good practice.

The contractor should consult the Waste Disposal Authority, the EPD, on the final disposal of wastes.

The hierarchy should be used to evaluate waste management options, thus allowing maximum waste reduction and often reduction of disposal costs. Waste reduction measures should be introduced at the design stage and carried through the construction activities, wherever possible, by careful purchasing control, re-use of formwork and good site management. By reducing or eliminating over-ordering of construction materials, waste is avoided and costs are reduced both in terms of purchasing and in disposing of wastes.

Training and instruction of construction staff should be given at the site to increase awareness and draw attention to waste management issues and the need to minimise waste generation. The training requirements should be included in the site waste management plan.

5.2.1 Storage, Collection and Transport of Waste

Permitted waste hauliers should be used to collect and transport the wastes to the appropriate disposal points. The following measures to minimise adverse impacts including windblown litter and dust from the transportation of these wastes should be implemented:

- Handle and store wastes in a manner which ensures that they are held securely without loss or leakage, thereby minimising the potential for pollution;
- Use waste hauliers authorised or licensed to collect the specific category of waste;
- Remove wastes in a timely manner;
- Maintain and clean the waste storage areas regularly;
- Minimise windblown litter and dust during transportation by either covering trucks or transporting wastes in enclosed containers;
- Obtain the necessary waste disposal permits from the appropriate authorities, if they are required, in accordance with the *Waste Disposal Ordinance)(Cap 354)*, *Waste Disposal (Chemical Waste) (General) Regulation (Cap 354)*, the *Crown Land Ordinance (Cap 28)*, *Dumping At Sea Ordinance (Cap 466)* and *Works Branch Technical Circular No. 22/92, Marine Disposal of Dredged Mud*;
- Dispose of waste at licensed sites;

- Develop procedures such as a ticketing system to facilitate tracking of loads, particularly for chemical waste, and to ensure that illegal disposal of wastes does not occur; and

- Maintain records of the quantities of wastes generated, recycled and disposed.

5.2.2 Dredged Material

The volume of material dredged should be minimised by limiting dredging during reclamation to seawall formation. Suitable mitigation measures for handling of dredged material were dealt with, in *Section 4*.

5.2.3 Excavated Materials

Excavated materials are not considered likely to cause adverse impacts with respect to their disposal, since they will be reused on-site at the PSK Reclamation.

5.2.4 Construction and Demolition Waste

The likely generation rates of construction and demolition wastes from the CUHK facilities and Pak Shek Kok Public Pier is estimated to be approximately 2,800 m^3. In order to minimise waste arisings, the mitigation measures described below should be adopted.

Careful design, planning and good site management can minimise over ordering and generation of waste materials such as concrete, mortars and cement grouts. If feasible, the temporary noise barrier or enclosures should be designed in such a way that they could be reused, after they have been dismantled and removed, thereby not generating construction waste. The design of formwork should maximise the use of standard wooden panels so that high reuse levels can be achieved. Alternatives such as steel formwork or plastic facing should be considered to increase the potential for reuse.

The Contractor should recycle as much as possible of the construction waste on-site or the nearby Pak Shek Kok Public Filling Area. Proper segregation of wastes on site will increase the feasibility that certain components of the waste stream can be recycled by specialised contractors. Concrete and masonry, for example can be crushed and used as fill and steel reinforcing bar can be used by scrap steel mills. Different areas of the work sites can be designated for such segregation and storage depending on site specific conditions.

The handling and disposal of bentonite slurries should follow the *Practice Note For Professional Persons, Construction Site Drainage, Professional Persons Consultative Committee, 1994 (ProPECC PN 1/94)*.

In accordance with the *New Disposal Arrangements for Construction Waste, Environmental Protection Department and Civil Engineering Department, 1992*, disposal of construction waste can either be at a specified landfill, or at a public filling area, with the latter being the preferred option. Waste with inert material > 20% should be directed to the Pak Shek Kok Public Filling Area, where they have the added benefit of offsetting the need for removal of materials from terrestrial borrow areas for reclamation purposes. If landfill disposal has to be used, the wastes will most likely be delivered to the NENT Landfill.

At present, Government is developing a charging policy for the disposal of waste to landfill. When it is implemented, this will provide additional incentive to reduce the volume of waste generated and to ensure proper segregation to allow free disposal of inert material to public filling areas.

5.2.5 Chemical Waste

For those processes which generate chemical waste, it may be possible to find alternatives which generate reduced quantities or even no chemical waste, or less dangerous types of chemical waste. Chemical waste that is produced, as defined by *Schedule 1* of the *Waste Disposal (Chemical Waste) (General) Regulation*, should be handled in accordance with the *Code of Practice on the Packaging, Handling and Storage of Chemical Wastes* as follows.

Containers used for the storage of chemical wastes should:

- be suitable for the substance they are holding, resistant to corrosion, maintained in a good condition, and securely closed;
- have a capacity of less than 450 l unless the specifications have been approved by the EPD; and
- display a label in English and Chinese in accordance with instructions prescribed in Schedule 2 of the Chemical Waste (General) Regulations and Codes of Practise.

The storage area for chemical wastes should:

- be clearly labelled and used solely for the storage of chemical waste;
- be enclosed on at least 3 sides;
- have an impermeable floor and bunding, of capacity to accommodate 110% of the volume of the largest container or 20% by volume of the chemical waste stored in that area, whichever is the greatest;
- have adequate ventilation;
- be covered to prevent rainfall entering (water collected within the bund must be tested and disposed as chemical waste if necessary); and
- be arranged so that incompatible materials are adequately separated.

Disposal of chemical waste should:

- be via a licensed waste collector; and
- be to a facility licensed to receive chemical waste, such as the Chemical Waste Treatment Facility which also offers a chemical waste collection service and can supply the necessary storage containers; or
- be to a reuser of the waste, under approval from the EPD.

The Centre for Environmental Technology operates a Waste Exchange Scheme which can assist in finding receivers or buyers.

5.2.6 General Refuse

General refuse generated on-site should be stored in enclosed bins or compaction units separate from construction and chemical wastes. A reputable waste collector should be employed by the Contractor to remove general refuse from the site, separately from construction and chemical wastes, on a daily or every second day basis to minimise odour, pest and litter impacts. The burning of refuse on construction sites is prohibited by law.

General refuse is generated largely by food service activities on site, so reusable rather than disposable dishware should be used if feasible. Aluminium cans are often recovered from the waste stream by individual collectors if they are segregated or easily accessible, so separate, labelled bins for their deposit should be provided if feasible.

Office wastes can be reduced through recycling of paper if volumes are large enough to warrant collection. Participation in a local collection scheme should be considered if one is available.

6 SITE ENVIRONMENTAL AUDIT

6.1 Site Inspections

6.1.1 Site Inspections provide a direct means to trigger and enforce the specified environmental protection and pollution control measures. They shall be undertaken routinely by the ET Leader to inspect the construction activities in order to ensure that appropriate environmental protection and pollution control mitigation measures are properly implemented. With well defined pollution control and mitigation specifications and a well established site inspection, deficiency and action reporting system, the site inspection is one of the most effective tools to enforce the environmental protection requirements on the construction site.

6.1.2 The ET Leader is responsible for formulation of the environmental site inspection, deficiency and action reporting system, and for carrying out the site inspection works. He shall submit a proposal on the site inspection, deficiency and action reporting procedures within 21 days of the construction contract commencement to the Contractor for agreement and to the ER for approval.

6.1.3 Regular site inspections shall be carried out at least once per week. The areas of inspection shall not be limited to the pollution control and mitigation measures within the site; it should also review the environmental situation outside the site area which is likely to be affected, directly or indirectly, by the site activities. The ET Leader shall make reference to the following information in conducting the inspection:

(a) the EIA recommendations on environmental protection and pollution control mitigation measures;

(b) works progress and programme;

(c) individual works methodology proposals (which shall include proposal on associated pollution control measures);

(d) the contract specifications on environmental protection;

(e) the relevant environmental protection and pollution control laws; and

(f) previous site inspection results.

6.1.4 The Contractor shall update the ET Leader with all relevant information of the construction contract for him to carry out the site inspections. The inspection results and its associated recommendations on improvements to the environmental protection and pollution control works shall be submitted to the IC(E) 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 action reporting system formulated by the ET Leader to report on any remedial measures subsequent to the site inspections.

6.1.5 Ad hoc site inspections shall also be carried out if significant environmental problems are identified. Inspections may also be required subsequent to receipt of an environmental complaint, or as part of the investigation work, as specified in the Action Plan for environmental monitoring and audit.

6.2 Compliance with Legal and Contractual Requirements

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

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

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

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

6.2.5 After reviewing the document, the ET Leader shall advise the ER 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. If the ET Leader's review concludes that the current status on licence/permit application and any environmental protection and pollution control preparation works may not cope with the works programme or may result in potential violation of environmental protection and pollution control requirements by the works in due course, he shall advise the Contractor and the ER accordingly.

6.2.6 Upon receipt of the advice, the Contractor shall undertake immediate action to remedy the situation. The ER 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.

6.3 Environmental Complaints

6.3.1 Receipt of a complaint shall activate the actions required in the Event and Action Plans for air, noise and water quality by ET, Engineer, Contractor and IC(E). A flow chart of the formal procedure for handling complaints is given in *Figure 6.3a*. Complaints shall be referred to the ET Leader for carrying out complaint investigation procedures. The ET Leader shall liaise with the Contractor on the complaint investigation and undertake the following procedure:

(a) log complaint and date of receipt onto the complaint database and inform the IC(E) immediately;

(b) investigate the complaint to determine its validity, and to assess whether the source of the problem is due to works activities;

(c) if a complaint is valid and due to works, identify mitigation measures;

(d) if mitigation measures are required, advise the Contractor accordingly;

(e) review the Contractor's response on the identified mitigation measures, and the updated situation;

(f) if the complaint is transferred from EPD, submit interim report to EPD on status of the complaint investigation and follow-up action within the time frame assigned by EPD;

(g) review relevant environmental monitoring results and undertake additional monitoring if necessary to verify the situation;

(h) report the investigation results and the subsequent actions to the complainant; and

(i) record the complaint, investigation, the subsequent actions and the results in the monthly EM&A reports (refer to *Section 7*).

6.3.2 During the complaint investigation work, the Contractor and ER shall cooperate with the ET Leader in providing all the necessary information and assistance for completion of the investigation. If mitigation measures are identified in the investigation, the Contractor shall promptly carry out the mitigation. The ER shall ensure that the measures have been carried out by the Contractor.

6.3.3 Details of all complaints shall form a part of the regular monthly reports (refer to *Section 7*) and shall be accompanied by a review of the circumstances including any recommendations necessary to avoid future repetitions of complaints of a similar nature. The findings of all complaints shall be sent to the complainant in writing as soon as possible.

7 REPORTING

7.1 General

7.1.1 The reporting guidelines referred to in this section are based upon a paper based system, however, the same information can be provided by an electronic medium upon agreeing the format with the ER and EPD. All the monitoring data (baseline and impact) shall also be submitted in diskettes in a format shown in *Annex A*.

7.2 Baseline Monitoring Report

7.2.1 The ET Leader shall prepare and submit a Baseline Environmental Monitoring Report within 10 working days of completion of the baseline monitoring. Copies of the Baseline Environmental Monitoring Report shall be submitted to all parties; the Contractor, the IC(E), the ER and the EPD. The format and content of the report, and the representation of the baseline monitoring data shall be in a format to the satisfaction of EPD and include, but not be limited to the following:

(a) up to half a page executive summary;

(b) brief project background information;

(c) drawings showing locations of the baseline monitoring stations;

(d) monitoring results (in both hard and diskette copies) together with the following information:

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

(e) details on influencing factors, including:

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

(f) determination of the AL Levels for each monitoring parameter and statistical analysis of the baseline data; the analysis shall conclude if there is any significant difference between control and impact stations for the parameters monitored, and the following information should be recorded:

- graphical plots of monitored parameters in the month annotated against;

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

(g) revisions for inclusion in the EM&A Manual; and

(h) comments and conclusions, includes:

- submission of implementation status proforma, proactive environmental protection proforma, regulatory compliance proforma, site inspection proforma, data recovery schedule and complaint log summarising the EM&A period (see *Annex A*).

7.3 EM&A Reports

7.3.1 The results and findings of all EM&A work required in the Manual shall be recorded in the monthly EM&A reports prepared by the ET Leader. The EM&A report shall be prepared, endorsed by IC(E) and submitted within 10 working days of the end of each reporting month, with the first report due in the month after construction commences. Before submission of the first EM&A report, the ET Leader shall liaise with the parties on the exact number of copies and format of the monthly reports in both hard copy and electronic medium requirement. The ET Leader shall review the number and location of monitoring stations and parameters to monitor every 6 months or on as needed basis in order to cater for the changes in surrounding environment and nature of works in progress.

7.3.2 The report shall contain an executive summary of the project dumping activities including daily quantity and locations, exceedance of AL Levels, causes of exceedance and mitigation measures being taken; all monitoring data with the information indicating the sampling / measurement locations, and other factors which might affect the results and detailed description of the findings from auditing of monitoring data.

7.3.3 The raw data sheets of the monitoring data shall be maintained properly and readily and easily accessible upon request by other parties. The monitoring data shall be stored floppy disk with the format agreed with EPD. The disk shall be submitted to EPD together with the monthly report.

7.3.4 A report shall be made to EPD immediately by fax following exceedance of the Action Level by any parameter giving details of raw monitoring data, mitigation measures implemented and the proposed actions to ensure the reoccurrence shall be prevented.

7.3.5 First Monthly EM&A Report

The First Monthly EM&A Report shall include at least the following :

(a) 1-2 pages executive summary;

- Breaches of AL levels;
- Complaints Log;
- Notifications of any summons and successful prosecutions;
- Reporting Changes;
- Future key issues.

(b) Basic Project Information

- Project organisations including key personnel contact names and telephone numbers;
- Programme
- Management structure; and
- Works undertaken during the month;

(c) Environmental Status

- Work 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.

(d) Summary of EM&A requirements

- All monitoring parameters;
- AL Levels;
- Event-Action Plans;
- Environmental mitigation measures, as recommended in the project EIA Report;
- Environmental requirements in contract documents;

(e) Implementation Status

Advice on the implementation status of environmental protection and pollution control/mitigation measures, as recommended in the project EIA Report, summarised in the updated implementation schedule (in *Annex A*);

(f) Monitoring Results

To provide monitoring results (in both hard and diskette copies) together with the following information:

- Monitoring methodology
- Name of laboratory and types of equipment used and calibration details
- Parameters monitored
- Monitoring locations (and depth)
- Monitoring date, time, frequency, and duration;
- Weather conditions during the period; and
- Any other factors which might affect the monitoring results;
- QA/QC results and detection limits

(g) Report on Non-compliance, Complaints, Notifications of Summons and Successful Prosecutions

- Record of all noncompliance (exceedances) of the AL Levels;

- Record of all complaints received (written or verbal) for each media, including locations and nature of complaints investigation, liaison and consultation undertaken, actions and follow-up procedures taken, results and summary;

- Record of all notifications of summons and successful prosecutions for breaches of the current environmental protection/pollution control legislations, including locations and nature of the breaches, investigation, follow-up actions taken, results and summary;

- Review of the reasons for and the implications of non-compliance, complaints, summons and prosecutions including review of pollution sources and working procedures; and

- Description of the actions taken in the event of noncompliance and deficiency reporting and any follow-up procedures related to earlier noncompliance;

(h) Others

- An account of the future key issues as reviewed from the works programme and work method statements; and

- Advice on the solid and liquid waste management status.

7.3.6 Subsequent Monthly EM&A Reports

The subsequent Monthly EM&A Reports shall include the following :

(a) Executive Summary (1-2 pages)

- Breaches of AL levels
- Complaint Log
- Notifications of any summons and successful prosecutions;
- Reporting Changes
- Future key issues

(b) Environmental Status

- Construction programme with fine tuning of construction activities showing the inter-relationship with environmental protection/mitigation measures for the month;

- Works undertaken during the month with illustrations including key personnel contact names and telephone number; and

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

(c) Implementation Status

Advice on the implementation status of environmental protection and pollution control/mitigation measures including measures for ecological and visual impacts, as recommended in the EIA Report, summarised in the updated implementation schedule (see *Annex A*).

(d) Monitoring Results

To provide monitoring results (in both hard and diskette copies) together with the following information:

- Graphical plots of the monitored parameters in the month annotated against;
- The major activities being carried out on site during the period;
- Monitoring methodology
- Name of laboratory and types of equipment used and calibration details
- Parameters monitored
- Monitoring locations (and depth);
- Monitoring date, time, frequency, and duration;
- Weather conditions during the period; and
- Any other factors which might affect the monitoring results;
- QA/QC results and detection limits

(e) Report on Non-compliance, Complaints, Notifications of Summons and Successful Prosecutions

- Record of all noncompliance (exceedances) of the AL Levels;
- Record of all complaints received (written or verbal) for each media, including locations and nature of complaints investigation, liaison and consultation undertaken, actions and follow-up procedures taken, results and summary;
- Record of all notifications of summons and successful prosecutions for breaches of the current environmental protection/pollution control legislations, including locations and nature of the breaches, investigation, follow-up actions taken, results and summary;
- Review of the reasons for and the implications of non-compliance, complaints, summons and prosecutions including review of pollution sources and working procedures; and
- a description of the actions taken in the event of noncompliance and deficiency reporting and any follow-up procedures related to earlier noncompliance;

(f) Others

- An account of the future key issues as reviewed from the works programme and work method statements; and

- Advice on the solid and liquid waste management status.

(g) Appendix

- AL 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:

  i) major activities being carried out on site during the period;
  ii) weather conditions during the period; and
  iii) any other factors which might affect the monitoring results

- Monitoring schedule for the present and next reporting period
- Cumulative statistics on complaints, notifications of summons and successful prosecutions
- Outstanding issues and deficiencies

7.3.7 Quarterly EM&A Summary Reports

The Quarterly EM&A Summary Report which should generally be around 5 pages (including about 3 of text and tables and 2 of figures) should contain at least the following information. Apart from these, the first quarterly summary report should also confirm that the necessary statistical power to categorically identify or confirm the absence of impact attributable to the works.

(a) up to half a page executive summary;

(b) basic project information including a synopsis of the project organisation, programme, contacts of key management, and a synopsis of work undertaken during the quarter;

(c) a brief summary of EM&A requirements including:

- monitoring parameters;
- AL Levels; and
- environmental mitigation measures, as recommended in the EIA Report;

(d) advice on the implementation status of environmental protection and pollution control/mitigation measures, as recommended in the project EIA study report, summarised in the updated implementation schedule;

(e) drawings showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations;

(f) 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;

(g) advice on the solid and liquid waste management status;

(h) a summary of noncompliance (exceedances) of the AL Levels;

(i) an quarterly assessment of constructional impacts on water quality at the project site including but not limited to comparison of the difference between the quarterly mean and 1.3 times of the ambientment which is defined as 30% increase of the baseline data or EPD data of the related parameters by using appropriate statistical procedures. Suggestion of appropriate mitigation measures if the quarterly assessment analytical results demonstrate that the quarterly mean is significantly higher than the liaison water quality times of the ambient mean ($p < 0.05$);

(j) a brief review of the reasons for and the implications of non-compliance including review of pollution sources and working procedures;

(k) a summary description of the actions taken in the event of non-compliance and any follow-up procedures related to earlier non-compliance;

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

(m) 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; and

(n) proponents' contacts and any hotline telephone number for the public to make enquiries.

7.3.8 Annual/Final EM&A Review Reports

The Annual/Final EM&A Report should contain at least the following information:

(a) Executive Summary (1-2 pages);

(b) drawings showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations:

(c) basic project information including a synopsis of the project organization contacts of key management, and a synopsis of work undertaken during the course of the project or past twelve months;

(d) a brief summary of EM&A requirements including:

(i) environmental mitigation measures, as recommended in the project EIA Report;
(ii) environmental impact hypotheses tested;
(iii) AL Levels;
(iv) all monitoring parameters
(v) Event-Action Plans;

(e) a summary of the implementation status of environmental protection and pollution control/mitigation measures as recommended in the project EIA study report summarized in the updated implementation schedule;

(f) graphical plots and the statistical analysis of the trends of monitored parameters over the course of the project, including the post project monitoring (for the past twelve months for annual report) for all monitoring stations 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

(g) a summary of noncompliance (exceedances) of the AL Levels;

(h) a review of the reasons for and the implications of non-compliance including review of pollution sources and working procedures as appropriate;

(i) a description of the actions taken in the event of non-compliance;

(j) a summary record of all complaints received (written or verbal) for each media liaison and consultation undertaken, action and follow-up procedures taken;

(k) a summary record of notifications of summons 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;

(l) a review of the validity of EIA Report predictions and identification of shortcomings in EIA Report recommendations; and

(m) a review of the effectiveness and efficiency of the mitigation measures;

(n) a review of success of the EM&A programme to cost effectively identify deterioration and to initiate prompt effective mitigatory action when necessary.

7.4 Data Keeping

7.4.1 The site document such as the monitoring field records, laboratory analysis records, site inspection forms, etc. are not required to be included in the monthly EM&A reports for submission. However, the document shall be well kept by the ET Leader and be ready for inspection upon request. All relevant information shall be clearly and systematically recorded in the document. The monitoring data shall also be recorded in magnetic media form, and the software copy can be available upon request. The water quality data software format shall be agreed with EPD. All the documents and data shall be kept for at least one year after completion of the construction contract.

7.5 Interim Notifications of Environmental Quality Limit Exceedances

7.5.1 With reference to Event/Action Plans in *Tables 2.8b, 3.7b* and *4.7b*, when the environmental quality limits are exceeded, the ET Leader shall immediately notify the ER and EPD, as appropriate. The notification shall be followed up with advice to EPD 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 *Annex A*.

8 OPERATION PHASE EM&A

8.1 Introduction

According to the findings of EIA Report, only waste monitoring and audit are required during the operation phase (see *Section 1.3)*. The methodology, equipment, monitoring locations, criteria and protocols for the monitoring and audit of waste is explained below.

8.2 Waste Management

8.2.1 This Section sets out the recycling, treatment, storage, transportation and disposal options which may be implemented to avoid or minimise potential adverse impacts associated with waste arising from the operation of the PSKDA under the headings of each waste type. These options should be considered and the recommendations incorporated into a comprehensive on site waste management plan. Such waste management plans should incorporate site specific factors, such as the designation of areas for the segregation and temporary storage of reusable and recyclable materials.

8.2.2 Waste Management Hierarchy

The waste management strategy for the PSKDA operation should follow the waste management hierarchy as discussed below.

- *Waste Avoidance and Minimisation* To mitigate the potential adverse impacts due to the generation of solid waste, waste reduction measures should be used where feasible, particularly if this will lead to reduced costs.

- *Recycling and Reuse* For the remaining solid waste, recyclable and reusable portions should be separated out where practical. Recyclable wastes (eg paper and aluminium cans) should be separated and stored until collected by a recycling contractor or individual collectors. Segregated materials should be stored in tidy, dry conditions to prevent intermingling and contamination of materials.

- *Treatment and Disposal* All wastes which cannot feasibly be recycled or reused, should be disposed of to landfill, or if chemical or other dangerous wastes, to the Chemical Waste Treatment Facility (CWTF), as follows:

- general refuse should be transported by a reputable private waste collector and disposed of at the NENT Landfill; and

- chemical waste as defined by *Schedule 1* of the *Waste Disposal (Chemical Waste) (General) Regulation*, should be stored in accordance with approved methods defined in the Regulations and the chemical waste, transported by a party licensed to transport chemical wastes by the EPD and disposed of at a facility licensed to receive chemical wastes by EPD.

Based on the above principles, mitigation measures for the three operational waste types are given below.

General Refuse

Considerable scope exists to take waste reduction and management into account at the detailed design stage of the PSKDA, particularly at individual building and refuse collection points, by providing spaces or facilities for the segregation and storage of recyclable materials.

Public areas should be provided with bins and emptied frequently during each day, as necessary to prevent overspilling. The arisings of general refuse at the PSKDA may contain recyclable elements. Recycling bins for paper, bottles and aluminium cans may also be provided in public areas.

Waste collected from public areas should be taken to central refuse collection points. Hotels, retail areas and residential blocks should be provided with refuse collection points. Aluminium, paper and paperboard may be present in quantities large enough to warrant the provision of separate bins at the refuse collection points, the contents of which could be collected by, or sold to, recycling contractors. It may also be feasible to segregate organic materials, in particular food waste, for use as a composting medium. Organic materials have a high water content and may generate leachates and strong odours and therefore should be stored in sealed containers and collected daily.

Guidelines for the design of refuse collection points are given in the HKPSG. Drainage, storage and treatment facilities should be incorporated within the design of the refuse collection points for the collection of contaminated water and leachate arising from the compaction units.

General refuse from the PSKDA would most likely be taken directly to the NENT landfill by Regional Services Department (RSD) or by private contractors.

Chemical Waste

Under the Waste Disposal (Chemical Waste) (General) Regulation, chemical waste producers should register with EPD. Chemical wastes should be transported by a registered chemical waste collector to a facility licensed to receive chemical wastes.

Chemical waste should be stored in safe and suitably resistant containers, labelled, and in an appropriate storage area, in accordance with the Waste Disposal (Chemical Waste)(General) Regulation. Enviropace, the operator of the CWTF, supplies approved containers for chemical waste which can be replaced with each collection.

Oils and solvents can be recycled, or reused as fuel, depending upon their chemical nature and level of contamination. Transportation of used oils and other chemicals for reuse, recycling or disposal requires a chemical waste licence from the EPD. Other recycling options may be arranged, for instance through the Waste Exchange Scheme operated by the Centre for Environmental Technology.

Annex A

Proforma for Construction Phase EM&A Programme

IMPLEMENTATION SCHEDULE

Item No.	EIA* Ref	EM&A Log Ref	Environmental Protection Measures*	Location/Timing	Implementation Agent	Implementation Stages**			
						Des	C	O	Dec
Air Quality									
1	4.5.26-27	2.9	• the heights from which fill materials are dropped should be controlled to a practical height to minimize the fugitive dust arising from unloading; • during transportation by truck, materials should not be loaded to a level higher than the side and tail boards, and should be dampened or covered before transport; • all stockpiles of aggregate or spoil should be enclosed or covered and water applied in dry or windy condition; • effective water sprays should be used on the site at potential dust emission sources such as unpaved area; • the haul road should be paved and vehicle speed should be limited to 20 kph; • the haul road should be located away from the sensitive receivers, regular watering is recommended; and • wheel washing facilities should be provided at the exit of work site.	All Construction Activities within the PSKDA	The Contractor responsible for implementation Contractor to discuss the work methods with the ET and IC(E) and the proposed work methods should be agreed with ER		✓		
Noise									
2	3.5.16-34	3.8	**Good Site Practice** Good site practice and noise management can considerably reduce the impact of the construction sites' activities on nearby NSRs. The following package of measures should be followed during each phase of construction: • only well maintained plant should be operated on-site and plant should be serviced regularly during the construction works; • machines and plants (such as trucks, excavators) that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum; • plant known to emit noise strongly in one direction, should, where possible, be orientated so that the noise is directed away from nearby NSRs; • silencers or mufflers on construction equipment should be utilised and should be properly maintained during the construction works; and • mobile plant should be sited as far away from NSRs as possible.	All Construction Activities within the PSKDA	The Contractor responsible for implementation Contractor to discuss the work methods with the ET and IC(E) and the proposed work methods should be agreed with ER		✓		

Item No.	EIA* Ref	EM&A Log Ref	Environmental Protection Measures*	Location/Timing	Implementation Agent	Implementation Stages**			
						Des	C	O	Dec
3	3.5.16-34	3.8	**Selecting Quieter Plant and Working Methods** The Contractor may be able to obtain particular models of plant that are quieter than standard types given in *Technical Memorandum on Noise from Construction Work other than Percussive Piling* (GW-TM). The benefits achievable in this way will depend on the details of the Contractor's chosen methods of working, and it is considered too restrictive to specify that a Contractor has to use specific items of plant for the construction operations. It is therefore both preferable and practical to specify an overall plant noise performance specification to apply to the total sound power level of all plant on the site so that the Contractor is allowed some flexibility to select plant to suit his needs. Quiet plant is defined as Power Mechanical Equipment (PME) whose actual Sound Power Level (SWL) is less than the value specified in GW-TM for the same piece of equipment. Examples of SWLs for specific silenced PME, which are known to be available in Hong Kong, are given below: Bulldozer: 110 dB(A) max; Breaker (Hand Held): 110 dB(A) max; Compressors: 100 dB(A) max; Concrete Pumps: 105 dB(A) max; Dump Truck: 109 dB(A) max; Excavator: 105 dB(A) max; Generator: 100 dB(A) max; Lorry: 105 dB(A) max; Loader: 105 dB(A) max; and Poker Vibrator: 110 dB(A) max.	All Construction Activities within the PSKDA	The Contractor responsible for implementation Contractor to discuss the work methods with the ET and IC(E) and the proposed work methods should be agreed with ER		✓		

Item No.	EIA* Ref	EM&A Log Ref	Environmental Protection Measures*	Location/Timing	Implementation Agent	Implementation Stages**			
						Des	C	O	Dec
4	3.5.16-34	3.8	**Reducing the Number of Plant Operating in Critical Areas Close to NSRs** In general, the number of plant should be left to the choice of the Contractor. However, in cases of exceedances being identified by the noise monitoring, it may be appropriate to restrict the number of particularly noisy plant within certain parts of the site that are very close to the NSRs.	All Construction Activities within the PSKDA	The Contractor responsible for implementation Contractor to discuss the work methods with the ET and IC(E) and the proposed work methods should be agreed with ER		✓		
5	3.5.16-34	3.8	**Constructing Temporary and Movable Noise Barriers** Movable barriers could be very effective in providing noise screening from a particular plant. It is anticipated that a 3 m high movable noise barrier with a skid footing and a small cantilevered upper portion can be located within a few metres of plant. It is estimated that movable noise barrier of this type, if carefully located, can produce at least 10 dB(A) screening for stationary plant and 5 dB(A) for mobile plant. If there is any construction work during the restricted hours, it is the responsibility of the contractors to comply with the NCO and relevant TMs. The contractor should submit CNPs application and will be assessed by the Noise Control Authority, EPD. Conditions stipulated in CNPs might be strictly followed.	All Construction Activities within the PSKDA	The Contractor responsible for implementation Contractor to discuss the work methods with the ET and IC(E) and the proposed work methods should be agreed with ER		✓		

Item No.	EIA* Ref	EM&A Log Ref	Environmental Protection Measures*	Location/Timing	Implementation Agent	Implementation Stages**			
						Des	C	O	Dec
Water Quality									
6	5.5.40-45	4.8	*Dredging Activities* • use of sealed grab and silt screen to contain sediment losses during dredging; • the receiving barges must not be allowed to overflow; and • in the event of an exceedance, the dredging rate could be reduced to further limit the impact on adjacent receivers. Owing to the potential adverse water quality impact caused by the dredging of Southern Access Road Reclamation, in addition to the above mentioned mitigation measures, the following extra measures are also recommended: • deploy silt screen at the at the Southern Access Road Reclamation face and at the Sha Tin WSD intake during the dredging of Southern Access Road Reclamation; • the silt screens deployed will have efficient reduction in the SS concentration (a factor of 2.5 according the previous PSKRPD EIA). In addition the silt screen should be durable and easily maintainable. Regular surveillance and maintenance are also required; • deploy silt screen at the reprovisioned MSL intake during the dredging of Southern Access Road reclamation; • reduction of the level of SS at reprovisioned MSL intake to comply with the 5 mg l^{-1} standard can be achieved by reduction of dredging rates of the Southern Access Road Reclamation, via extension of the Southern Access Road Reclamation dredging duration from 3 to 7.5 months; and • maximum dredging rate shall be limited to 86 m^3/hr. Provided that the above two mitigation measures are implemented properly, the mitigated SS concentration at the Sha Tin WSD intake will comply with the WSD standards.	Southern and Northern Access Road Reclamation	The Contractor responsible for implementation Contractor to discuss the work methods with the ET and IC(E) and the proposed work methods should be agreed with ER		✓		

Item No.	EIA* Ref	EM&A Log Ref	Environmental Protection Measures*	Location/Timing	Implementation Agent	Implementation Stages**			
						Des	C	O	Dec
7	5.5.40-45	4.8	*Filling Activities* • construction of a leading seawall of 100 m from the active dumping face; • use of refuse boom around the public filling area to contain any floating refuses within the site area and the motorised sampans would be deployed to collect floating refuses if required;. • use of silt screen around the public filling face would be expected to reduce the losses to the surrounding water; • placement of a suitably protected surface boom supporting a hanging net or skirt around the tipping front to contain any floating debris; • strict application of public filling licences and monitoring of material placed in the public fills should be implemented to control unauthorised material being placed in the public fills; • use of a recirculation system to reduce SS and oil discharges from the vehicle wheel washing facility; • fuel tanks on site should be housed within drainable trays and regularly drained of rain water. Vehicle maintenance should be carried out on paved areas, spillages controlled by absorbents and waste oils collected in designated tanks prior to disposal off site; • permanent site offices and facilities should be connected to the most convenient sewer. Temporary chemical toilet facilities at distant locations on the reclamations should be serviced daily and the contents disposed of to the sewer; • at least a 200 m gap between seawalls will be maintained to assist adequate flushing during the filling of the Stage II Phase 2 formation period; and • grab filling method shall be employed and maximum filling rate shall be limited to 138 m^3/hr.	Southern and Northern Access Road Reclamation	The Contractor responsible for implementation Contractor to discuss the work methods with the ET and IC(E) and the proposed work methods should be agreed with ER		✓		

Item No.	EIA* Ref	EM&A Log Ref	Environmental Protection Measures*	Location/Timing	Implementation Agent	Implementation Stages**			
						Des	C	O	Dec
8	5.5.40-45	4.8	*Contaminated Sediment* As it is anticipated that some of the dredged sediment is seriously contaminated. It should be noted that further additional mitigation measures may be needed in this instance and, therefore, the following mitigation measures may be appropriate. *Dredging Activities* • the prohibition of stockpiling of any moderately or seriously contaminated (Class B and C) material, and careful control of stockpiling of any uncontaminated (Class A) material to prevent run-off, resuspension and odour nuisance. • all vessels should 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 dredgers should be fitted with tight fitting seals to their bottom openings to prevent leakage of material; • the construction works should cause no visible foam, oil, grease, scum, litter or other objectionable matter to be present on the water within the site or public filling grounds; • additional provisions will be required where sediments are contaminated. The locations and depths of any areas of contaminated sediments should be indicated int he construction contract following the completion of a detailed sediment quality survey which has been recommended by Full Management Committee (FMC), prior to construction. The Contractor should be required to ensure that contaminated sediments are dredged, transported and placed in approved special dumping grounds in accordance with the EPDTC 1-1-92, WBTC 22/92 and WBTC 6/92. Typical mitigation measures are list below:	Southern and Northern Access Road Reclamation	The Contractor responsible for implementation Contractor to discuss the work methods with the ET and IC(E) and the proposed work methods should be agreed with ER		✓		

Item No.	EIA* Ref	EM&A Log Ref	Environmental Protection Measures*	Location/Timing	Implementation Agent	Implementation Stages**			
						Des	C	O	Dec
			• transport of contaminated mud to the marine disposal site should, wherever possible, be by split barge of not less than 750 m^3 capacity, well maintained and capable of rapid opening and discharge at the disposal site; • the material should be placed in the pit by bottom dumping, at a location within the pit specified by the FMC; • discharge should be undertaken rapidly and the hoppers should then immediately be closed, material adhering to the sides of the hopper should not be washed out of the hopper and the hopper should remain closed until the barge next returns to the disposal site; • the dumping vessel should be stationary throughout the dumping operation; • the Contractor must be able to position the dumping vessel to an accuracy of +/- 10 m; • inspection of the barge loading to ensure that loss of material does not take place during transportation; • transport barges or vessels shall be equipped with automatic self-monitoring devices; • on site audit of the equipment and plant is essential to ensure it is used in the correct manner; and • maximum dredging rate shall be limited to 86 m^3/hr.						

Item No.	EIA* Ref	EM&A Log Ref	Environmental Protection Measures*	Location/Timing	Implementation Agent	Implementation Stages**			
						Des	C	O	Dec
9	5.5.40-45	4.8	*Contaminated Sediment* As it is anticipated that some of the dredged sediment is seriously contaminated. It should be noted that further additional mitigation measures may be needed in this instance and, therefore, the following mitigation measures may be appropriate. *Filling Activities* • all vessels should 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 grabs should be fitted with tight fitting seals to their bottom openings to prevent leakage of filling material; • loading of barges should be controlled to prevent splashing of filling material to the surrounding water, and barges or hoppers should not be filled to a level which will cause the overflow of materials of polluted water during loading or transportation; • the works should cause no visible foam, oil, grease, scum, litter or other objectionable matter to be present on the water within the Site or dumping grounds; • a maximum 5% fines contents of marine fill sand arriving at site is recommended as the upper limit of the fines content to minimize the SS impact upon the Sha Tin WSD intake located 200-300 m from the construction site; and • grab filling method shall be employed and maximum filling rate shall be limited to 138 m^3/hr.	Southern and Northern Access Road Reclamation	The Contractor responsible for implementation Contractor to discuss the work methods with the ET and IC(E) and the proposed work methods should be agreed with ER		✓		

Item No.	EIA* Ref	EM&A Log Ref	Environmental Protection Measures*	Location/Timing	Implementation Agent	Implementation Stages**			
						Des	C	O	Dec
10	5.5.40-45	4.8	*General Construction Activities* All site construction run-off should be controlled and treated to prevent high levels of SS entering surrounding waters in accordance with ProPECC PN 1/94. The following measures, which constitute good site practices, may be considered where applicable: • temporary ditches should be provided to facilitate run-off discharge into the appropriate watercourses, via a sediment trap/sediment retention basin, prior to discharge; • permanent drainage channels should also incorporate sediment basins or traps, and baffles to enhance deposition rates; • all traps (temporary or permanent) should also incorporate oil and grease removal facilities; • sediment traps must be regularly cleaned and maintained by the contractor. Daily inspections of such facilities should be required of the contractor; • concrete batching plants should be bunded to contain the surface water run-off; • water from concrete batching plants must also pass through sediment traps and settlement tanks prior to run-off into watercourses. These must be regularly cleaned and maintained by the contractor; • collection of spent bentonite/other grouts in a separate slurry collection system for either cleaning and reuse/disposal to landfill; • maintenance and plant areas should be bunded and constructed on a hard standing with the provision of sediment traps and petrol interceptors; • all drainage facilities must be adequate for the controlled release of storm flows; • minimising of exposed soil areas to reduce the potential for increased siltation and contamination of run-off; • all chemical stores shall be contained (bunded) such that spills are not allowed to gain access to water bodies; and • chemical toilets will be required to handle the sewage from the on-site construction workforce.	All Construction Activities within the PSKDA	The Contractor responsible for implementation Contractor to discuss the work methods with the ET and IC(E) and the proposed work methods should be agreed with ER		✓		

Item No.	EIA* Ref	EM&A Log Ref	Environmental Protection Measures*	Location/Timing	Implementation Agent	Implementation Stages**			
						Des	C	O	Dec
Waste									
11	6.4	5.2	• Avoidance and minimisation, ie not generating waste through changing or improving practices and design; • Re-use of materials, thus avoiding disposal (generally with only limited reprocessing); • Recovery and recycling, thus avoiding disposal (although reprocessing may be required); and • Treatment and disposal, according to relevant laws, guidelines and good practice. The contractor should consult the Waste Disposal Authority, the EPD, on the final disposal of wastes. The hierarchy should be used to evaluate waste management options, thus allowing maximum waste reduction and often reduction of disposal costs. Waste reduction measures should be introduced at the design stage and carried through the construction activities, wherever possible, by careful purchasing control, re-use of formwork and good site management. By reducing or eliminating over-ordering of construction materials, waste is avoided and costs are reduced both in terms of purchasing and in disposing of wastes. Training and instruction of construction staff should be given at the site to increase awareness and draw attention to waste management issues and the need to minimise waste generation. The training requirements should be included in the site waste management plan. Storage, Collection and Transport of Waste Permitted waste hauliers should be used to collect and transport the wastes to the appropriate disposal points. The following measures to minimise adverse impacts including windblown litter and dust from the transportation of these wastes should be implemented: • Handle and store wastes in a manner which ensures that they are held securely without loss or leakage, thereby minimising the potential for pollution; • Use waste hauliers authorised or licensed to collect the specific category of waste; • Remove wastes in a timely manner;	All Construction Activities within the PSKDA	The Contractor responsible for implementation Contractor to discuss the work methods with the ET and IC(E) and the proposed work methods should be agreed with ER		✓		

Item No.	EIA* Ref	EM&A Log Ref	Environmental Protection Measures*	Location/Timing	Implementation Agent	Implementation Stages**			
						Des	C	O	Dec
			• Maintain and clean the waste storage areas regularly; • Minimise windblown litter and dust during transportation by either covering trucks or transporting wastes in enclosed containers; • Obtain the necessary waste disposal permits from the appropriate authorities, if they are required, in accordance with the *Waste Disposal Ordinance)(Cap 354)*, *Waste Disposal (Chemical Waste) (General) Regulation (Cap 354)*, the *Crown Land Ordinance (Cap 28)*, *Dumping At Sea Ordinance (Cap 466)* and *Works Branch Technical Circular No. 22/92, Marine Disposal of Dredged Mud*; • Dispose of waste at licensed sites; • Develop procedures such as a ticketing system to facilitate tracking of loads, particularly for chemical waste, and to ensure that illegal disposal of wastes does not occur; and • Maintain records of the quantities of wastes generated, recycled and disposed.						

Item No.	EIA* Ref	EM&A Log Ref	Environmental Protection Measures*	Location/Timing	Implementation Agent	Implementation Stages**			
						Des	C	O	Dec
12	6.4	5.2	Construction and Demolition Waste In order to minimise waste arisings, the mitigation measures described below should be adopted. Careful design, planning and good site management can minimise over ordering and generation of waste materials such as concrete, mortars and cement grouts. If feasible, the temporary noise barrier or enclosures should be designed in such a way that they could be reused, after they have been dismantled and removed, thereby not generating construction waste. The design of formwork should maximise the use of standard wooden panels so that high reuse levels can be achieved. Alternatives such as steel formwork or plastic facing should be considered to increase the potential for reuse. The Contractor should recycle as much as possible of the construction waste on-site or the nearby Pak Shek Kok Public Filling Area. Proper segregation of wastes on site will increase the feasibility that certain components of the waste stream can be recycled by specialised contractors. Concrete and masonry, for example can be crushed and used as fill and steel reinforcing bar can be used by scrap steel mills. Different areas of the work sites can be designated for such segregation and storage depending on site specific conditions. The handling and disposal of bentonite slurries should follow the *Practice Note For Professional Persons, Construction Site Drainage, Professional Persons Consultative Committee, 1994 (ProPECC PN 1/94).* In accordance with the *New Disposal Arrangements for Construction Waste, Environmental Protection Department and Civil Engineering Department, 1992*, disposal of construction waste can either be at a specified landfill, or at a public filling area, with the latter being the preferred option. Waste with inert material > 20% should be directed to the Pak Shek Kok Public Filling Area, where they have the added benefit of offsetting the need for removal of materials from terrestrial borrow areas for reclamation purposes. If landfill disposal has to be used, the wastes will most likely be delivered to the NENT Landfill. At present, Government is developing a charging policy for the disposal of waste to landfill. When it is implemented, this will provide additional incentive to reduce the volume of waste generated and to ensure proper segregation to allow free disposal of inert material to public filling areas.	All Construction Activities within the PSKDA	The Contractor responsible for implementation Contractor to discuss the work methods with the ET and IC(E) and the proposed work methods should be agreed with ER		✓		

Item No.	EIA* Ref	EM&A Log Ref	Environmental Protection Measures*	Location/Timing	Implementation Agent	Implementation Stages**			
						Des	C	O	Dec
13	6.4	5.2	Chemical Waste For those processes which generate chemical waste, it may be possible to find alternatives which generate reduced quantities or even no chemical waste, or less dangerous types of chemical waste. Chemical waste that is produced, as defined by *Schedule 1* of the *Waste Disposal (Chemical Waste) (General) Regulation*, should be handled in accordance with the *Code of Practice on the Packaging, Handling and Storage of Chemical Wastes* as follows. Containers used for the storage of chemical wastes should: • be suitable for the substance they are holding, resistant to corrosion, maintained in a good condition, and securely closed; • have a capacity of less than 450 l unless the specifications have been approved by the EPD; and • display a label in English and Chinese in accordance with instructions prescribed in Schedule 2 of the Chemical Waste (General) Regulations and Codes of Practise. The storage area for chemical wastes should: • be clearly labelled and used solely for the storage of chemical waste; • be enclosed on at least 3 sides; • have an impermeable floor and bunding, of capacity to accommodate 110% of the volume of the largest container or 20% by volume of the chemical waste stored in that area, whichever is the greatest; • have adequate ventilation; • be covered to prevent rainfall entering (water collected within the bund must be tested and disposed as chemical waste if necessary); and • be arranged so that incompatible materials are adequately separated.	All Construction Activities within the PSKDA	The Contractor responsible for implementation Contractor to discuss the work methods with the ET and IC(E) and the proposed work methods should be agreed with ER		✓		

Item No.	EIA* Ref	EM&A Log Ref	Environmental Protection Measures*	Location/Timing	Implementation Agent	Implementation Stages**			
						Des	C	O	Dec
			Disposal of chemical waste should: • be via a licensed waste collector; and • be to a facility licensed to receive chemical waste, such as the Chemical Waste Treatment Facility which also offers a chemical waste collection service and can supply the necessary storage containers; or • be to a reuser of the waste, under approval from the EPD. The Centre for Environmental Technology operates a Waste Exchange Scheme which can assist in finding receivers or buyers.						
14	6.4	5.2	General Refuse General refuse generated on-site should be stored in enclosed bins or compaction units separate from construction and chemical wastes. A reputable waste collector should be employed by the Contractor to remove general refuse from the site, separately from construction and chemical wastes, on a daily or every second day basis to minimise odour, pest and litter impacts. The burning of refuse on construction sites is prohibited by law. General refuse is generated largely by food service activities on site, so reusable rather than disposable dishware should be used if feasible. Aluminium cans are often recovered from the waste stream by individual collectors if they are segregated or easily accessible, so separate, labelled bins for their deposit should be provided if feasible. Office wastes can be reduced through recycling of paper if volumes are large enough to warrant collection. Participation in a local collection scheme should be considered if one is available.	All Construction Activities within the PSKDA	The Contractor responsible for implementation Contractor to discuss the work methods with the ET and IC(E) and the proposed work methods should be agreed with ER		✓		

Item No.	EIA* Ref	EM&A Log Ref	Environmental Protection Measures*	Location/Timing	Implementation Agent	Implementation Stages**			
						Des	C	O	Dec
15	6.6	8.2	*General Refuse* Considerable scope exists to take waste reduction and management into account at the detailed design stage of the PSKDA, particularly at individual building and refuse collection points, by providing spaces or facilities for the segregation and storage of recyclable materials. Public areas should be provided with bins and emptied frequently during each day, as necessary to prevent overspilling. The arisings of general refuse at the PSKDA may contain recyclable elements. Recycling bins for paper, bottles and aluminium cans may also be provided in public areas. Waste collected from public areas should be taken to central refuse collection points. Hotels, retail areas and residential blocks should be provided with refuse collection points. Aluminium, paper and paperboard may be present in quantities large enough to warrant the provision of separate bins at the refuse collection points, the contents of which could be collected by, or sold to, recycling contractors. It may also be feasible to segregate organic materials, in particular food waste, for use as a composting medium. Organic materials have a high water content and may generate leachates and strong odours and therefore should be stored in sealed containers and collected daily. Guidelines for the design of refuse collection points are given in the HKPSG. Drainage, storage and treatment facilities should be incorporated within the design of the refuse collection points for the collection of contaminated water and leachate arising from the compaction units. General refuse from the PSKDA would most likely be taken directly to the NENT landfill by Regional Services Department (RSD) or by private contractors.	All Operational Activities within the PSKDA	Individual Developer responsible for implementation	—		✓	

Item No.	EIA* Ref	EM&A Log Ref	Environmental Protection Measures*	Location/Timing	Implementation Agent	Implementation Stages**			
						Des	C	O	Dec
16	6.6	8.2	*Chemical Waste* Under the Waste Disposal (Chemical Waste) (General) Regulation, chemical waste producers should register with EPD. Chemical wastes should be transported by a registered chemical waste collector to a facility licensed to receive chemical wastes. Chemical waste should be stored in safe and suitably resistant containers, labelled, and in an appropriate storage area, in accordance with the Waste Disposal (Chemical Waste)(General) Regulation. Enviropace, the operator of the CWTF, supplies approved containers for chemical waste which can be replaced with each collection. Oils and solvents can be recycled, or reused as fuel, depending upon their chemical nature and level of contamination. Transportation of used oils and other chemicals for reuse, recycling or disposal requires a chemical waste licence from the EPD. Other recycling options may be arranged, for instance through the Waste Exchange Scheme operated by the Centre for Environmental Technology.	All Operational Activities within the PSKDA	Individual Developer responsible for implementation			✓	

Item No.	EIA* Ref	EM&A Log Ref	Environmental Protection Measures*	Location/Timing	Implementation Agent	Implementation Stages**			
						Des	C	O	Dec
Ecology									
17	7.10	6.1	Tthe following mitigation measures in relation to protecting the two important plant species and good construction practice to minimise disturbance to the surrounding environment are recommended: • survey and collect individuals of the protected plant species *Spiranthes sinensis* and *Eulophia sinensis* prior to work commencement for transplanting to adjacent planting areas within the Open Space zone. • erect fences along the boundary of construction sites before the commencement of works to prevent tipping, vehicle movements, and encroachment of personnel into adjacent wooded areas; • regular checks to ensure that the work site boundaries are not exceeded and that no damage to surrounding areas; • avoid burning during construction, or such use if unavoidable should be carried out under close supervision; and • prohibit wild and uncontrolled open fires within the work site boundary, and install fire fighting equipment in the work area.	All Construction Activities within the PSKDA	The Contractor responsible for implementation Contractor to discuss the work methods with the ET and IC(E) and the proposed work methods should be agreed with ER		✓		

* 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 Checker (Environment): _____ Date: _____

DATA RECOVERY SCHEDULE

Ref: _____

Date	Air Quality Monitoring					Noise Monitoring									
	Monitoring Station*					Monitoring Location*					Monitoring Location*				
	A1	A2	A3	A4	A5	N1	N2	N3	N4	N5	W1	W2	W3	W4	W5
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															
11															
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22															
23															
24															
25															
26															
27															
28															
29															
30															
31															
% of R															

* *Remark type of parameters*

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

Signed by Environmental Team Leader: _____ Date: _____

Copy to Independent Checker (Environment)

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: _____ on _____

Signed by Environmental Team Leader: _____ Date: _____

Copy to Independent Checker (Environment)

Ref:_____

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

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

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

Reviewed by Environmental Team Leader: _____ Date: _____

Approved by Independent Checker (Environment): _____ 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*

Recorded by Environmental Team Leader: _____ Date: _____

Signed by Independent Checker (Environment): _____ Date: _____

COMPLAINT LOG

Ref:_____

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

Filed by Environmental Team Leader: _____ Date: _____

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 : _____

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 (°C)	
	Hi (in.)	
	Qsi (Std. m^3)	
Final Flow Rate, Qsf	Pf (mmHg)	
	Tf (°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 ($\mu g/m^3$)		

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

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 :	_____	_____	_____

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
Salinity				
Temperature (°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 up once they are available from the laboratory.

Data format for water quality monitoring

A. The data base structure for water quality monitoring is listed below. The ET shall select the related field names to create their own data recording sheet.

Field Name	Type	Width	Dec	Remark
Project/contract ID	C	3		Given by EPD
WorkArea ID	C	2		Given by EPD
SamStn	C	3		Sampling Station
Latitude	C	10		Latitude of Sampling Station
Longitude	C	10		Longitude of Sampling Station
Easting	C	6		HK Grid (Easting) of Sampling Station
Northing	C	6		HK Grid (Northing) of Sampling Station
Date	D	8		Sampling Date
Time	C	5		Sampling Time
Replicate	C	1		1 = first sample; 2 = duplicated sample; etc
StnPurpose	C	1		Purpose of Sampling Station (C = control; I = Impact; S = Sensitive receiver; etc)
SamPurpose	C	1		Purpose of Sample (B = baseline; I = Impact)
Weather	C	20		(sunshine, precipitation, humidity, air temperature)
TideStatus	C	10		Tidal Status (e.g mid_ebb; mid-flood)
WaterDepth	N	4	1	Depth of water column in meter
SamDepthM	N	4	1	Depth of sample taken in meter
SamDepth	C	1		Depth of sample taken (S=surface; M=middle; B=bottom)
WaterTemp	N	4	1	Water Temperature
Salinity	N	6	2	
DO	N	6	2	Dissolved Oxygen
DOS	N	6	2	Dissolved Oxygen in % saturation
Turbidity	N	6	2	
SS	N	6	2	Suspended solids
Metals_T ...	N	6	2	Total metals (approx. 7 parameters, and can be more)
Metals_D ...	N	6	2	Dissolved metals (approx. 7 parameters, and can be more)
Trace organic ...	N	6	2	Trace organic (e.g PAHs, PCBs etc.. can be a lot)
Nutrients	N	6	2	Nutrients (include several parameters such as NO_2_N, NO_3_N, NH_3_N, TP, OP etc)
BOD	N	6	2	
COD	N	6	2	
Chlorophyll_a	N	6	2	
Ecoli	N	10	0	
Fcoliform	N	10	0	Faecal coliform
PARA ...				Other parameters not listed above. (Confirm with EPD individually

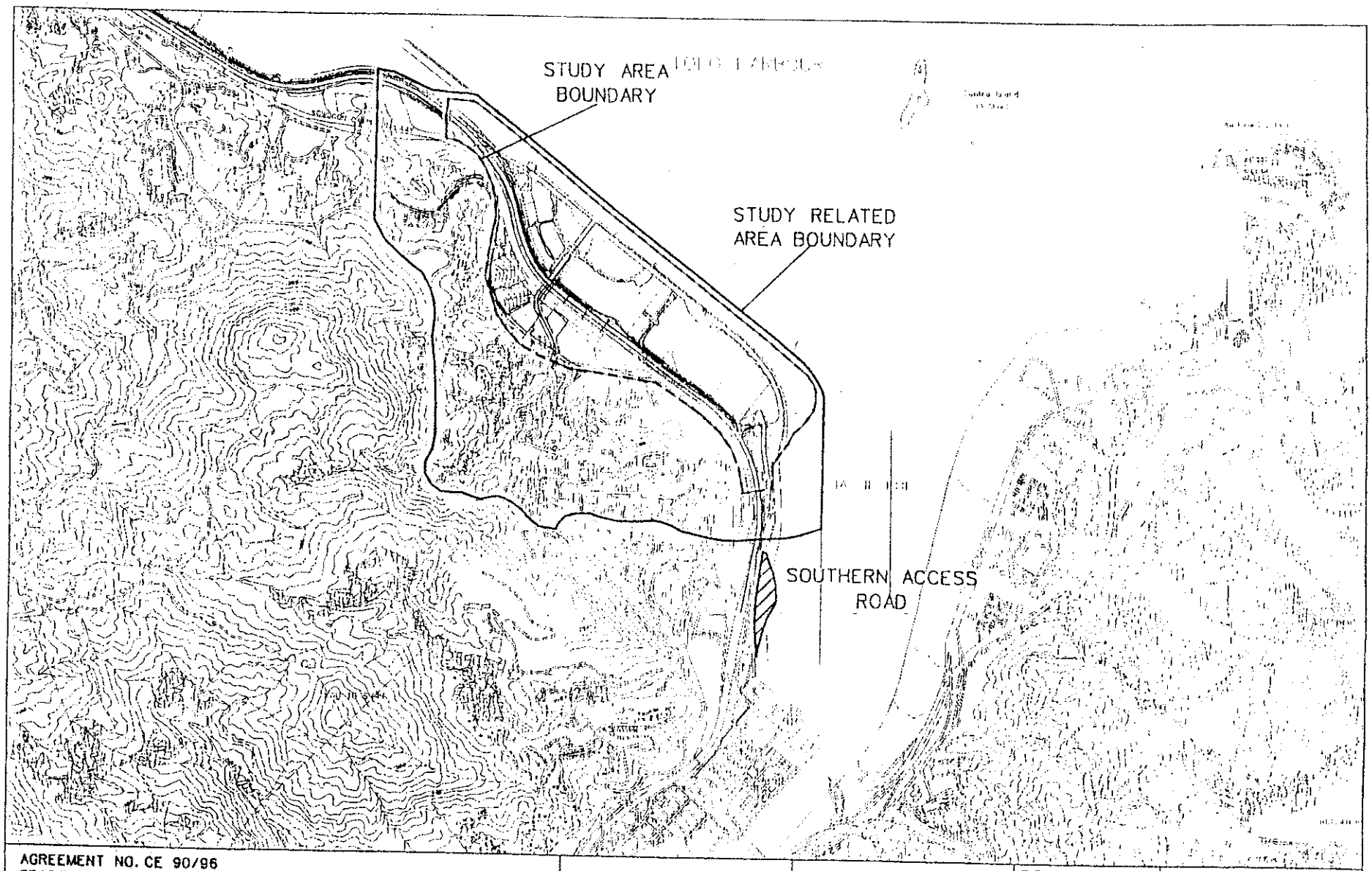
(Remark: enter 999.99 to any numeric field that have no reading. Please note that "zero" is also a valid data)

B. Details of water analytical methods and detection limits for different parameters.

Parameter	Limits of detection for WQ parameters	Units of measurement for WQ parameters	Analytical methods
e.g. DO			
e.g. Cd_T			
etc ...			

C. Apart from A and B, the following information shall also be provided:

1. Project name, contract number, consultant name and telephone, contractor name, contact person and telephone number, site staffs and telephone.
2. Project commencement date and the proposed completion date, frequency of sampling and project work nature, e.g. dumping, dredging or reclamation.
3. List of site instrument for water quality monitoring.



AGREEMENT NO. CE 90/96
FEASIBILITY STUDY FOR PAK SHEK KOK DEVELOPMENT AREA

PAK SHEK KOK STUDY AREA & RELATED AREA

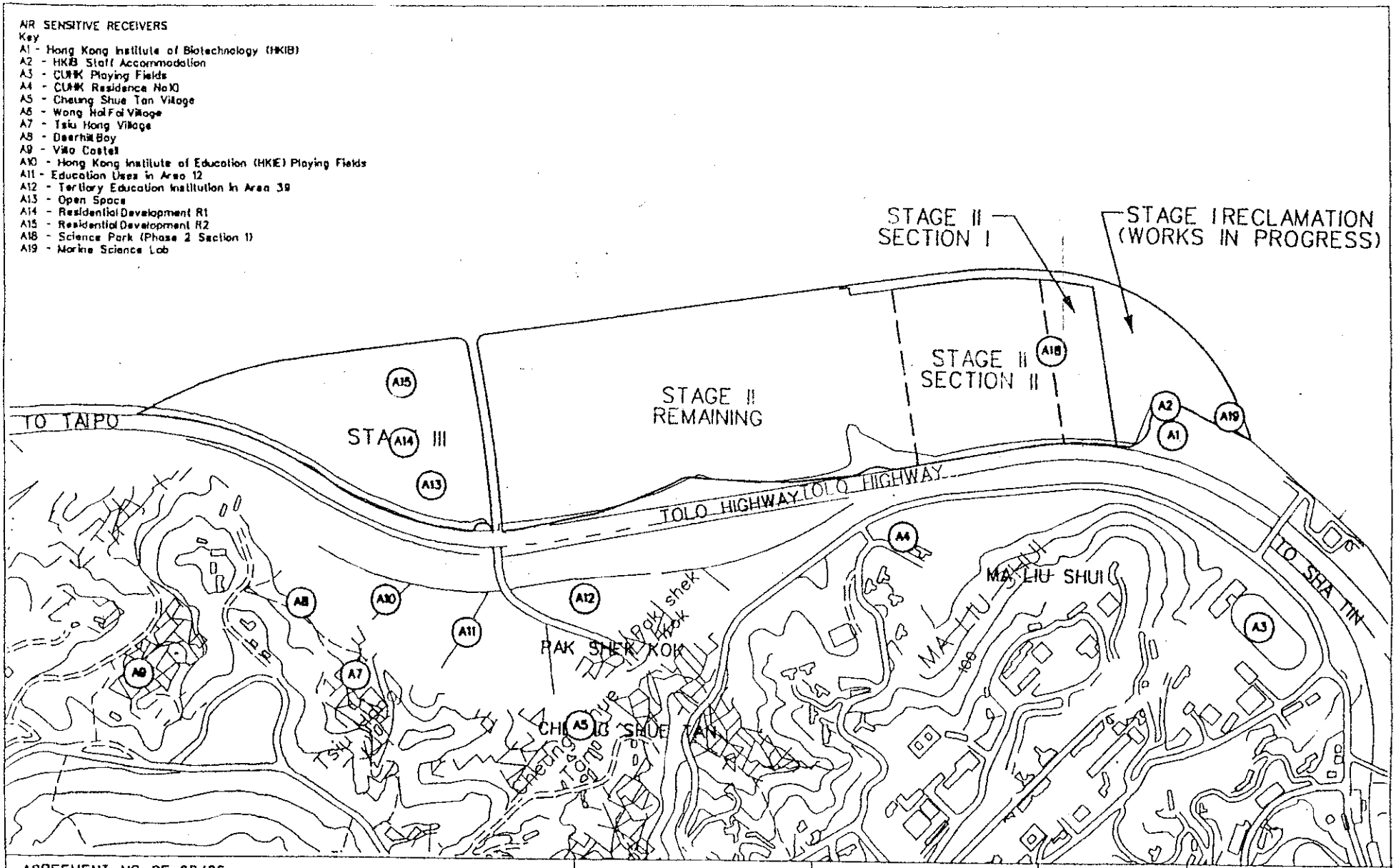
Maunsell
茂盛(亞洲)工程顧問有限公司

SCALE : N.T.S.

DATE : 07/05/98

FIGURE NO. : 1.2a

AR SENSITIVE RECEIVERS
Key
A1 - Hong Kong Institute of Biotechnology (HKIB)
A2 - HKIB Staff Accommodation
A3 - CUHK Playing Fields
A4 - CUHK Residence No10
A5 - Cheung Shue Tan Village
A6 - Wong Nai Fai Village
A7 - Tsiu Hang Village
A8 - Deerhill Bay
A9 - Villa Costel
A10 - Hong Kong Institute of Education (HKIE) Playing Fields
A11 - Education Uses in Area 12
A12 - Tertiary Education Institution in Area 39
A13 - Open Space
A14 - Residential Development R1
A15 - Residential Development R2
A16 - Science Park (Phase 2 Section 1)
A19 - Marine Science Lab



AGREEMENT NO. CE 90/96
FEASIBILITY STUDY FOR PAK SHEK KOK DEVELOPMENT AREA

LOCATION OF ASRs DURING CONSTRUCTION

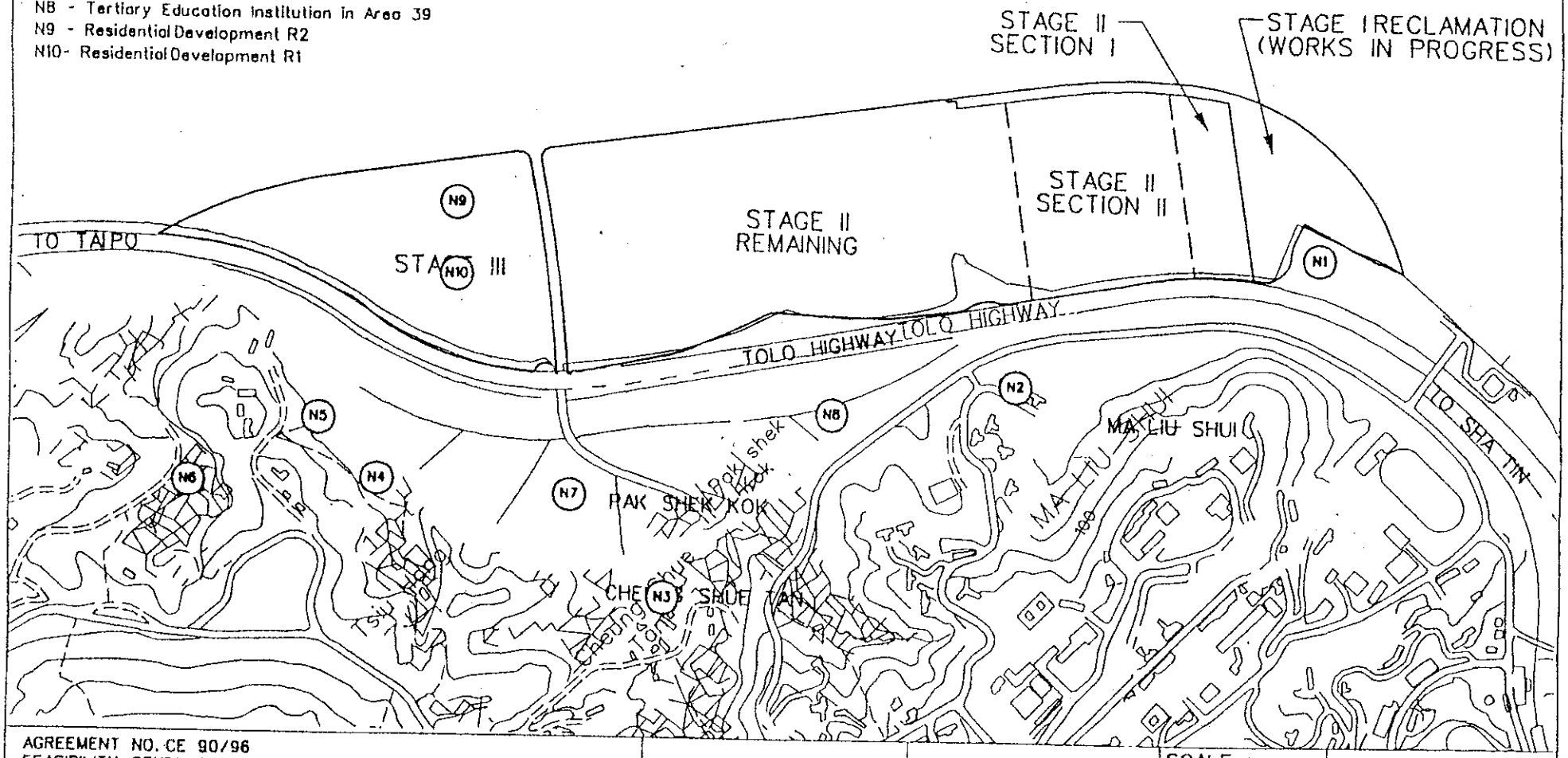
Maunsell
茂盛(亞洲)工程顧問有限公司

SCALE : N.T.S.

DATE : 11/05/98

FIGURE NO. : 1.3a

NOISE SENSITIVE RECEIVERS
Key
N1 - HKIB Staff Accommodation
N2 - CUHK: Residence No.10
N3 - Cheung Shue Tan Village
N4 - Tsiu Hang Village
N5 - Deerhill Bay
N6 - Villa Costell
N7 - Educational Uses in Area 12 (Part)
N8 - Tertiary Education Institution in Area 39
N9 - Residential Development R2
N10- Residential Development R1

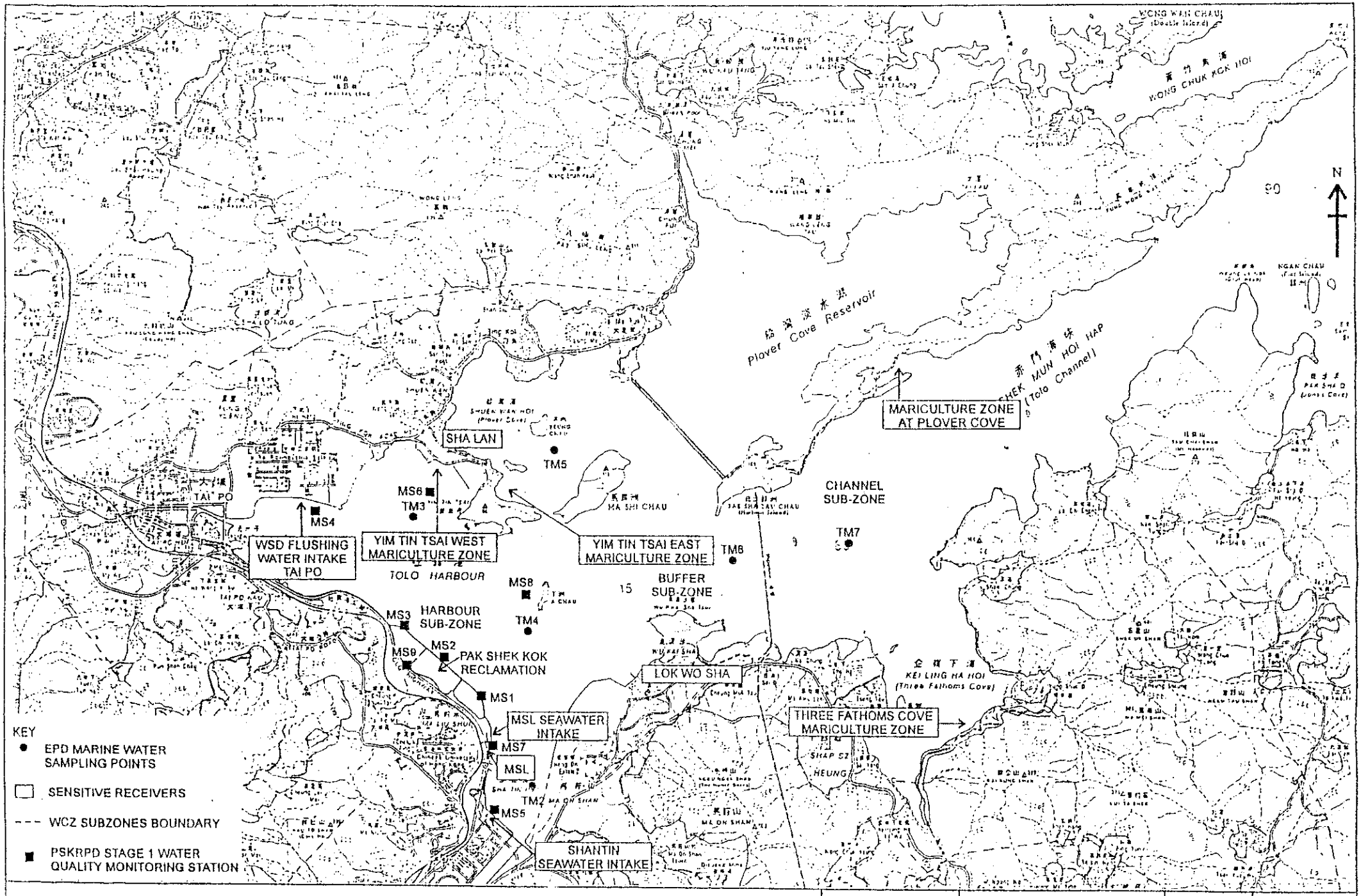


AGREEMENT NO. CE 90/96
FEASIBILITY STUDY FOR PAK SHEK KOK DEVELOPMENT AREA

LOCATION OF NSRs DURING CONSTRUCTION

Maunsell
茂盛(亞洲)工程顧問有限公司

SCALE : N.T.S.
DATE : 11/05/98
FIGURE NO. : 1.3b

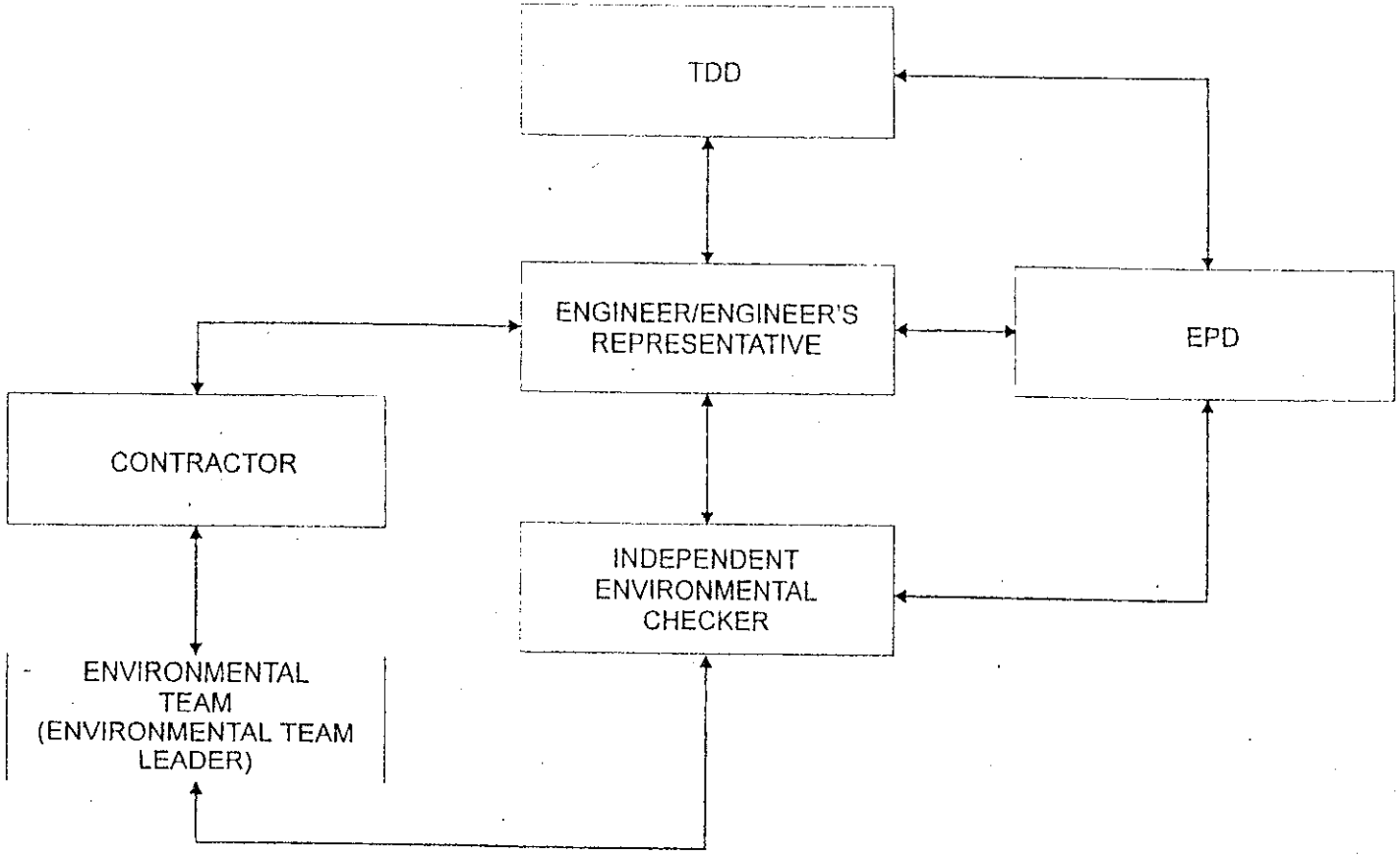


TOLO HARBOUR WCZ AND MARINE WATER QUALITY MONITORING LOCATIONS

Maunsell

DATE

FIGURE NO.



PROJECT ORAGANISATION AND LINES OF COMMUNICATION WITH RESPECT TO THE EM&A PROGRAMME	Maunsell 茂盛(亞洲)工程顧問有限公司	NOT TO SCALE	DATE :	FIGURE NO. 1.4a

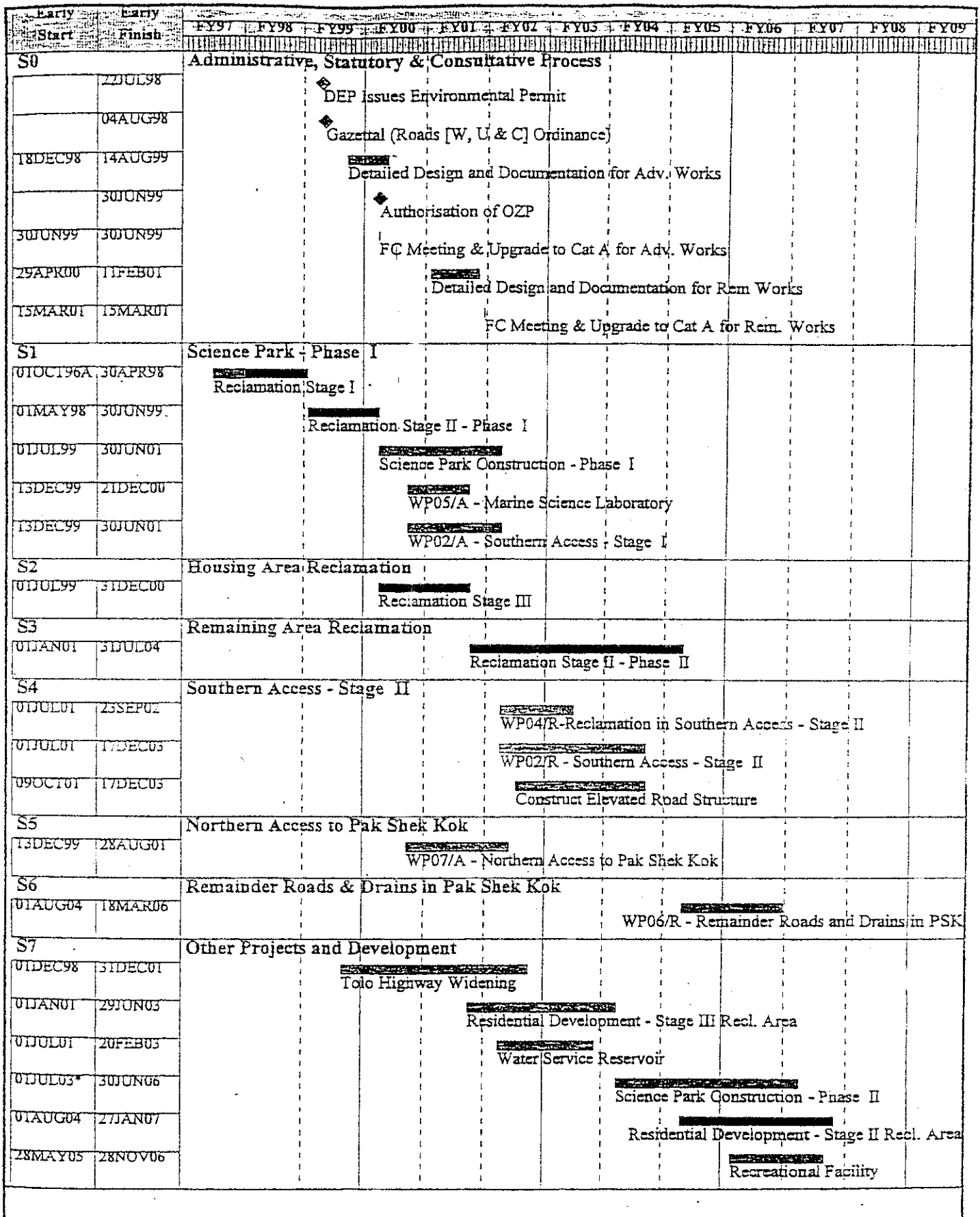
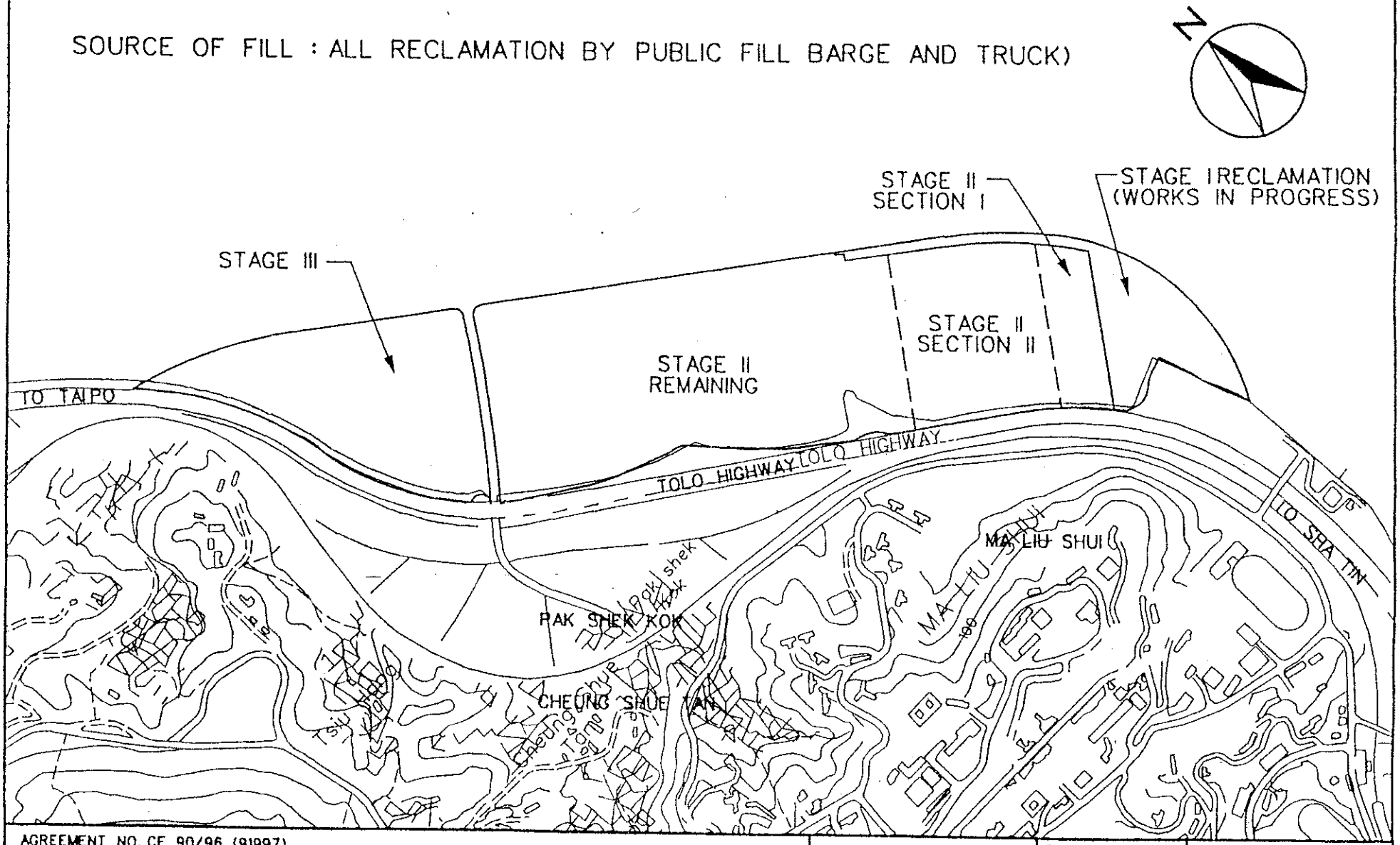

Early Start
Early Finish
FY97 FY98 FY99 FY00 FY01 FY02 FY03 FY04 FY05 FY06 FY07 FY08 FY09
S0
Administrative, Statutory & Consultative Process
22JUL98
DEP Issues Environmental Permit
04AUG98
Gazettal (Roads [W, U, & C] Ordinance)
18DEC98 14AUG99
Detailed Design and Documentation for Adv. Works
30JUN99
Authorisation of OZP
30JUN99 30JUN99
FC Meeting & Upgrade to Cat A for Adv. Works
29APR00 11FEB01
Detailed Design and Documentation for Rem Works
15MAR01 15MAR01
FC Meeting & Upgrade to Cat A for Rem. Works
S1
Science Park - Phase I
01OCT96A 30APR98
Reclamation Stage I
01MAY98 30JUN99
Reclamation Stage II - Phase I
01JUL99 30JUN01
Science Park Construction - Phase I
13DEC99 21DEC00
WP05/A - Marine Science Laboratory
13DEC99 30JUN01
WP02/A - Southern Access - Stage I
S2
Housing Area Reclamation
01JUL99 31DEC00
Reclamation Stage III
S3
Remaining Area Reclamation
01JAN01 31JUL04
Reclamation Stage II - Phase II
S4
Southern Access - Stage II
01JUL01 25SEP02
WP04/R-Reclamation in Southern Access - Stage II
01JUL01 17DEC03
WP02/R - Southern Access - Stage II
09OCT01 17DEC03
Construct Elevated Road Structure
S5
Northern Access to Pak Shek Kok
13DEC99 28AUG01
WP07/A - Northern Access to Pak Shek Kok
S6
Remainder Roads & Drains in Pak Shek Kok
01AUG04 18MAR06
WP06/R - Remainder Roads and Drains in PSK
S7
Other Projects and Development
01DEC98 31DEC01
Tolo Highway Widening
01JAN01 29JUN03
Residential Development - Stage III Recl. Area
01JUL01 20FEB03
Water Service Reservoir
01JUL03* 30JUN06
Science Park Construction - Phase II
01AUG04 27JAN07
Residential Development - Stage II Recl. Area
28MAY05 28NOV06
Recreational Facility
Project Start 01OCT96
Project Finish 29JUL07
Data Date 10APR97
Run Date 24MAR98
Current Bar
Progress Bar
Critical Activity
P106
Sheet 1 of 1
Territory Development Department
Pak Shek Kok Development
Summary Development Programme
FY03 Means 1 April 02 - 31 March 03
© Primavera Systems, Inc.

Figure 1.5 a

SOURCE OF FILL : ALL RECLAMATION BY PUBLIC FILL BARGE AND TRUCK)

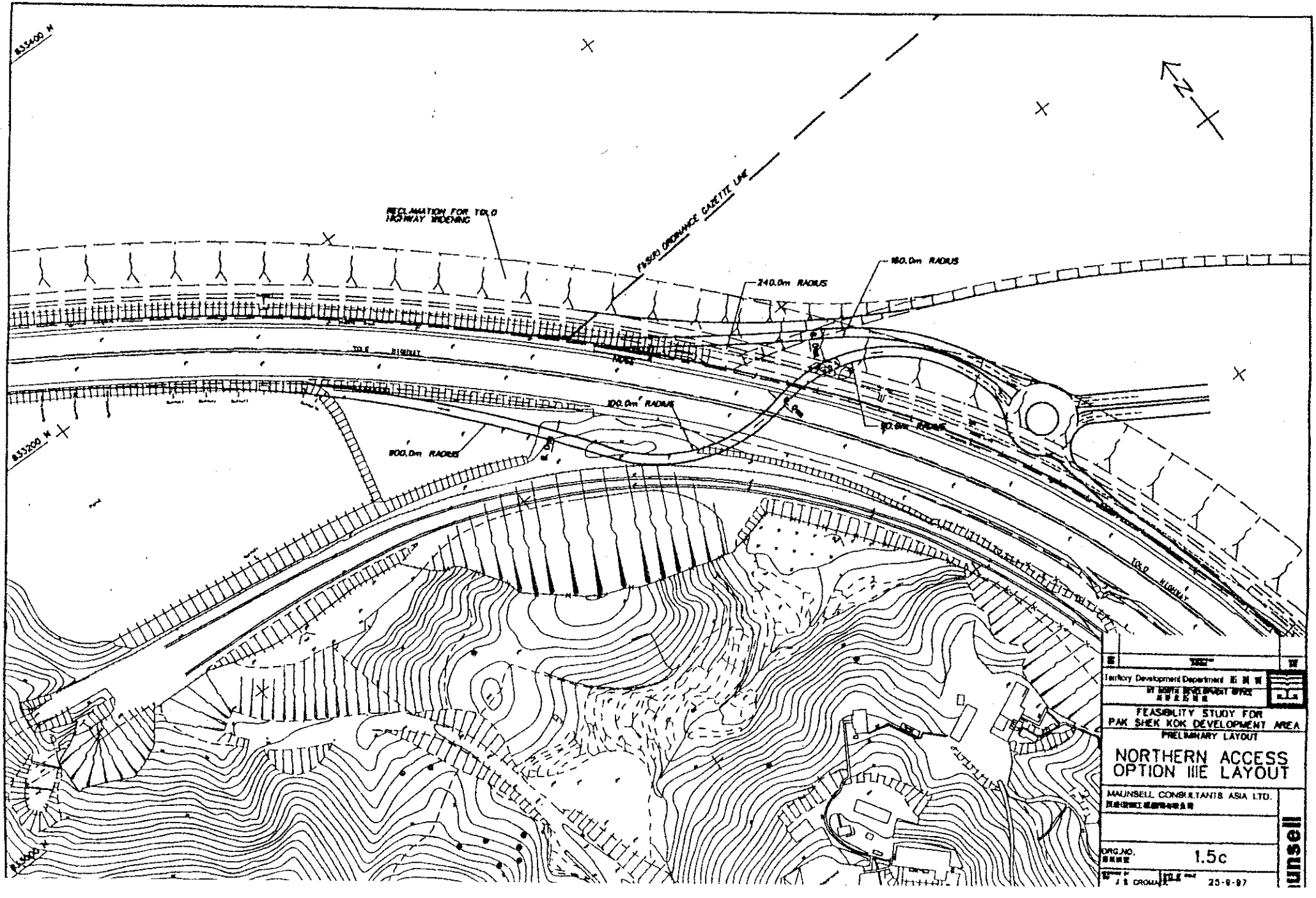


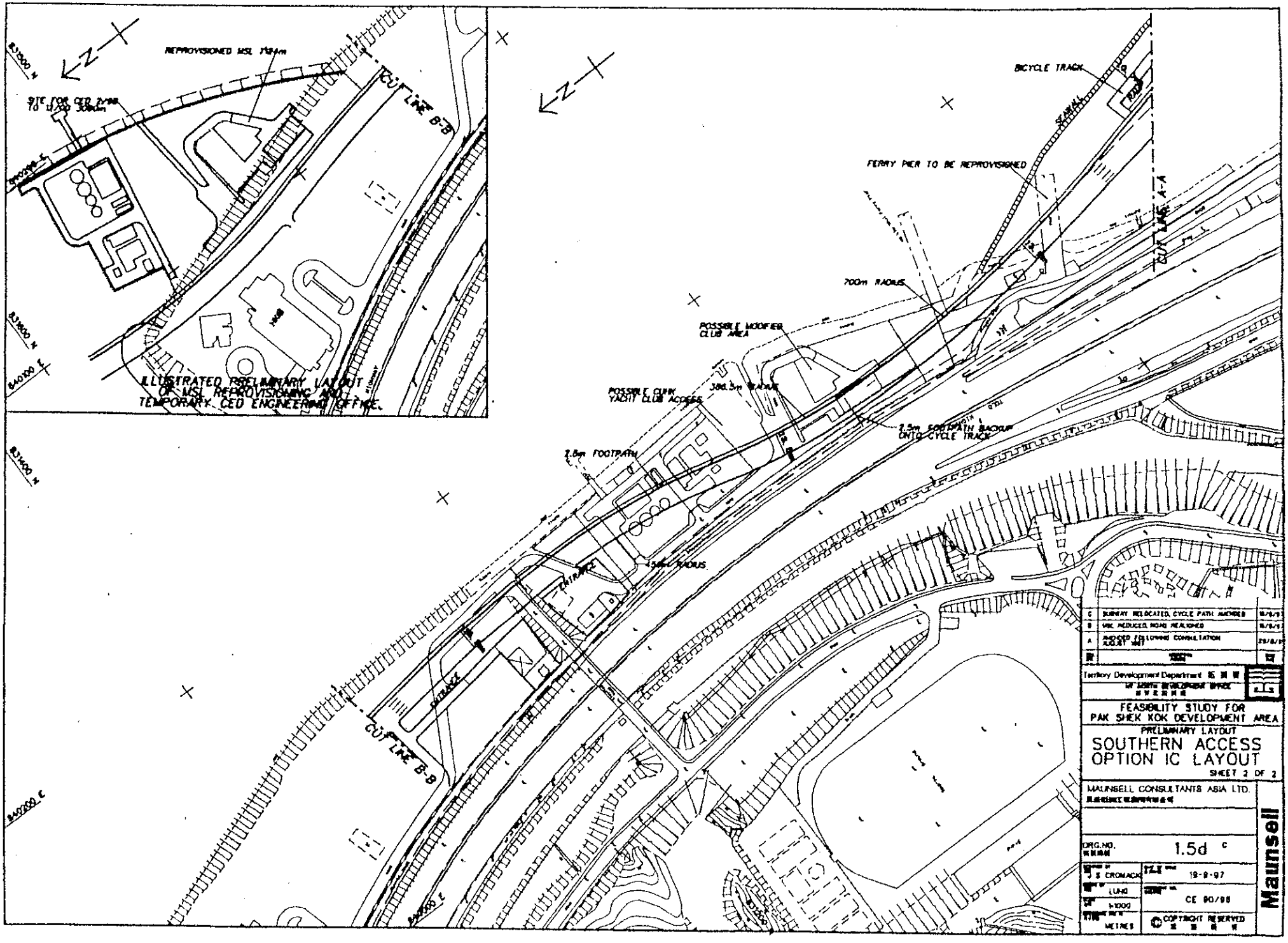
AGREEMENT NO. CE 90/96 (91997)
FEASIBILITY STUDY FOR PAK SHEK KOK DEVELOPMENT AREA

RECLAMATION - OPTION 2

Maunsell
茂盛(亞洲)工程顧問有限公司

SCALE : N.T.S.	FIGURE NO. : 1.5b
REVISED : 12/05/98	


RECLAMATION FOR TOLO HIGHWAY WIDENING
FINAL(S) ORDINANCE GAZETTE LINE
240.0m RADIUS
150.0m RADIUS
100.0m RADIUS
900.0m RADIUS
TOLO HIGHWAY
N
Territory Development Department
FEASIBILITY STUDY FOR
PAK SHEK KOK DEVELOPMENT AREA
PRELIMINARY LAYOUT
NORTHERN ACCESS
OPTION IIIE LAYOUT
MAUNSELL CONSULTANTS ASIA LTD.
ORG.NO.
1.5c
25-9-97
Maunsell


REPROVISIONED MSL
CUT LINE B-B
ILLUSTRATED PRELIMINARY LAYOUT OF MSL REPROVISIONING AND TEMPORARY CED ENGINEERING OFFICE
BICYCLE TRACK
FERRY PIER TO BE REPROVISIONED
CUT LINE A-A
700m RADIUS
POSSIBLE MOORING AREA
POSSIBLE CLUB ACCESS
2.5m FOOTPATH
2.5m FOOTPATH ON BACK OF CYCLE TRACK
CUT LINE B-B
Territory Development Department
FEASIBILITY STUDY FOR PAK SHEK KOK DEVELOPMENT AREA
PRELIMINARY LAYOUT
SOUTHERN ACCESS OPTION 1C LAYOUT
SHEET 2 OF 2
MAUNSELL CONSULTANTS ASIA LTD.
ORG.NO. 1.5d C
J S CROMACK
18-9-97
LUHO
CE 90/96
1:1000
METRES
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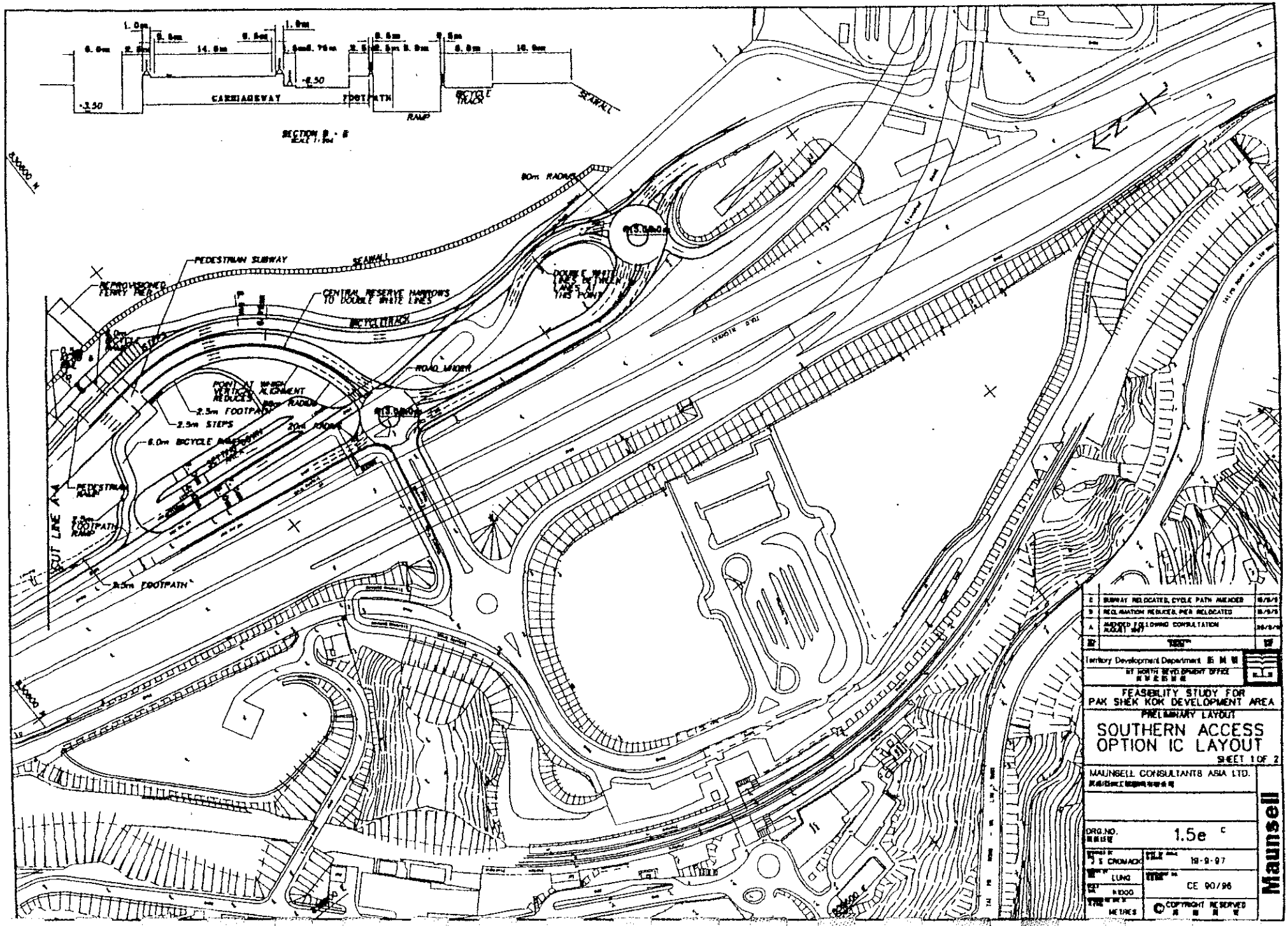
SECTION B - B
CARRIAGEWAY
FOOTPATH
RAMP
SEAWALL
80m RADIUS
PEDESTRIAN SUBWAY
SEAWALL
RETROFITTED FERRY PIER
CENTRAL RESERVE NARROWS TO DOUBLE WHITE LINES
BICYCLE TRACK
ROAD WIDEN
2.5m FOOTPATH
2.5m STEPS
6.0m BICYCLE
PEDESTRIAN WALK
2.5m FOOTPATH
8.5m FOOTPATH
CUT LINE A-A
5 SUBWAY RELOCATED, CYCLE PATH AMENDED
3 RECLAMATION REDUCED, PIER RELOCATED
A AMENDED FOLLOWING CONSULTATION
Territory Development Department
FEASIBILITY STUDY FOR PAK SHEK KOK DEVELOPMENT AREA
PRELIMINARY LAYOUT
SOUTHERN ACCESS OPTION IC LAYOUT
SHEET 1 OF 2
MAUNSELL CONSULTANTS ASIA LTD.
ORG.NO. 1.5e C
J S CROMACK
18-9-97
LUNG
CE 90/96
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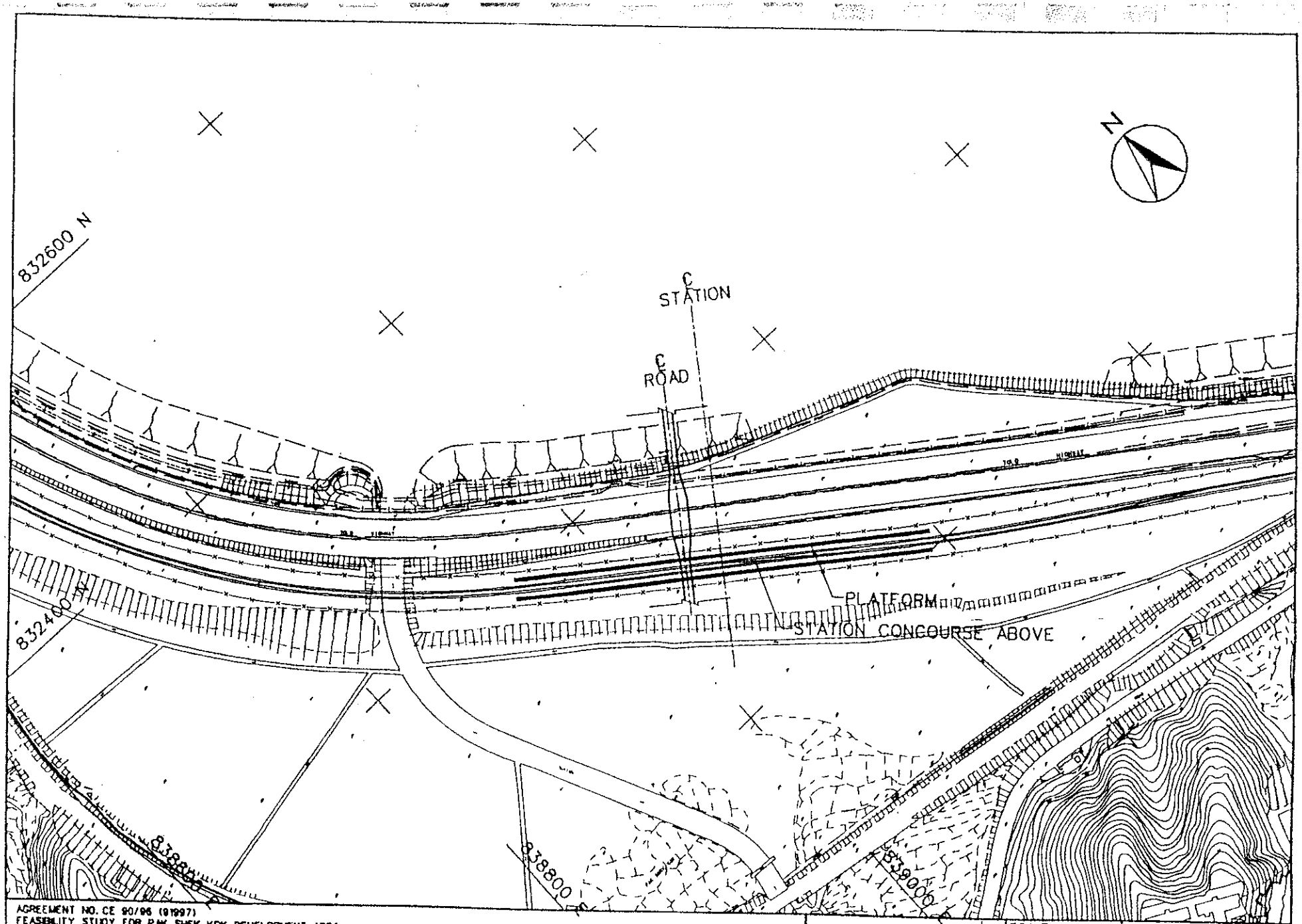


AGREEMENT NO. CE 90/96 (91997)
FEASIBILITY STUDY FOR PAK SHEK KOK DEVELOPMENT AREA

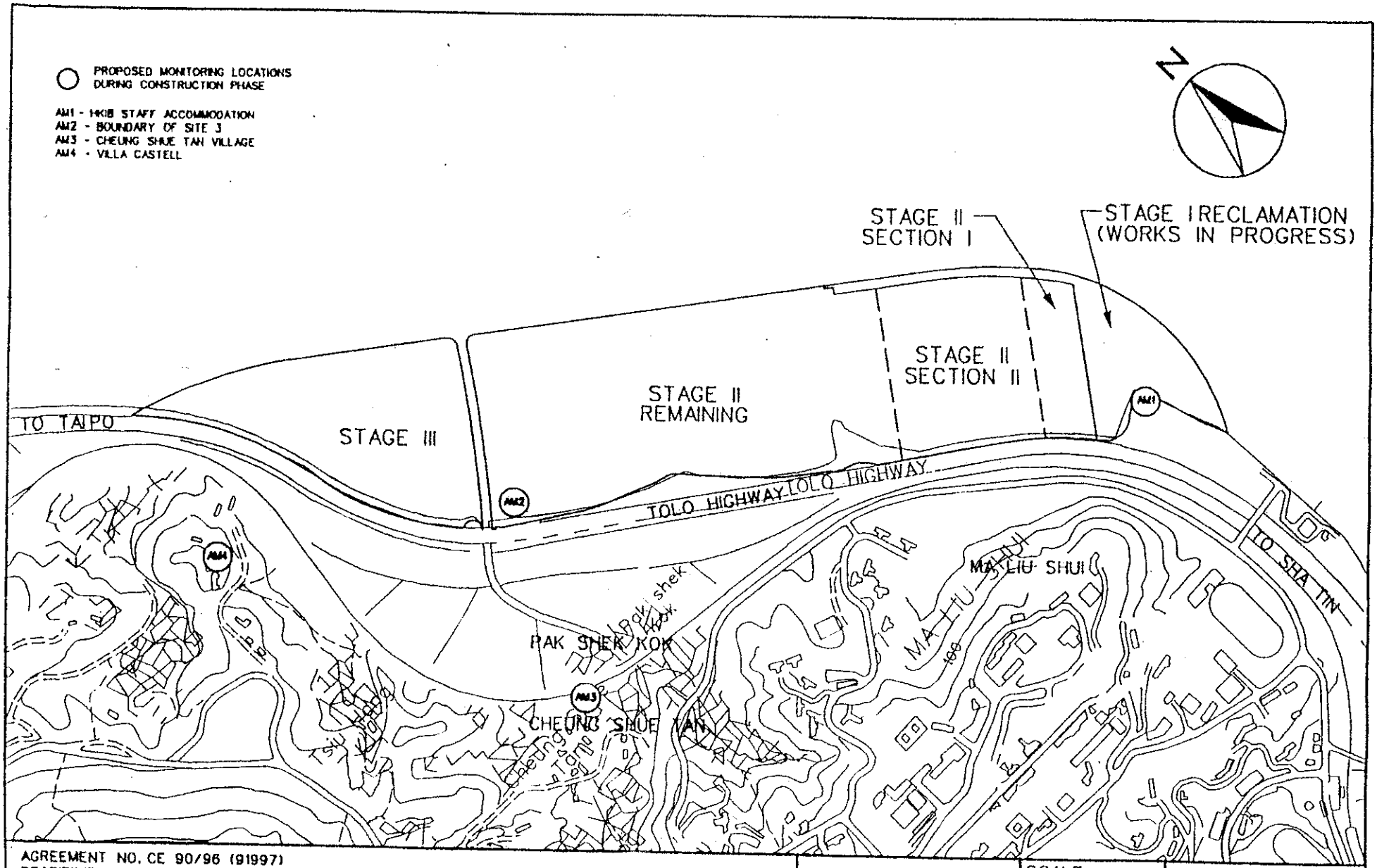
STATION LOCATION

Maunsell

SCALE : 1 : 2500

DATE : 18/9/97

FIGURE NO. : 1.5f



AGREEMENT NO. CE 90/96 (91997)
FEASIBILITY STUDY FOR PAK SHEK KOK DEVELOPMENT AREA

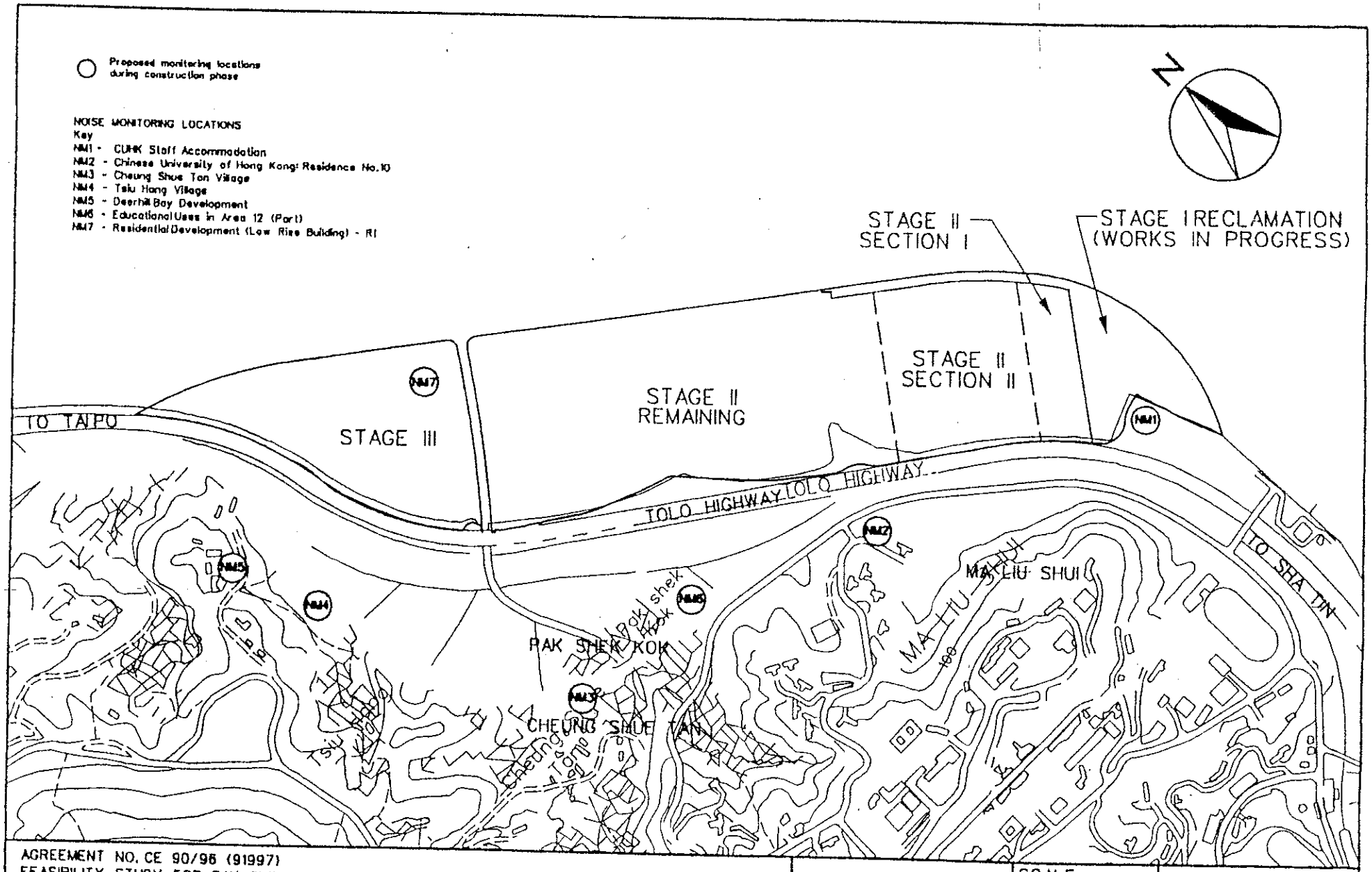
LOCATION OF PROPOSED MONITORING LOCATIONS

Maunsell
茂盛(亞洲)工程顧問有限公司

SCALE : N.T.S.

REVISED : 07/05/98

FIGURE NO. : 2.5a



AGREEMENT NO. CE 90/96 (91997)
FEASIBILITY STUDY FOR PAK SHEK KOK DEVELOPMENT AREA

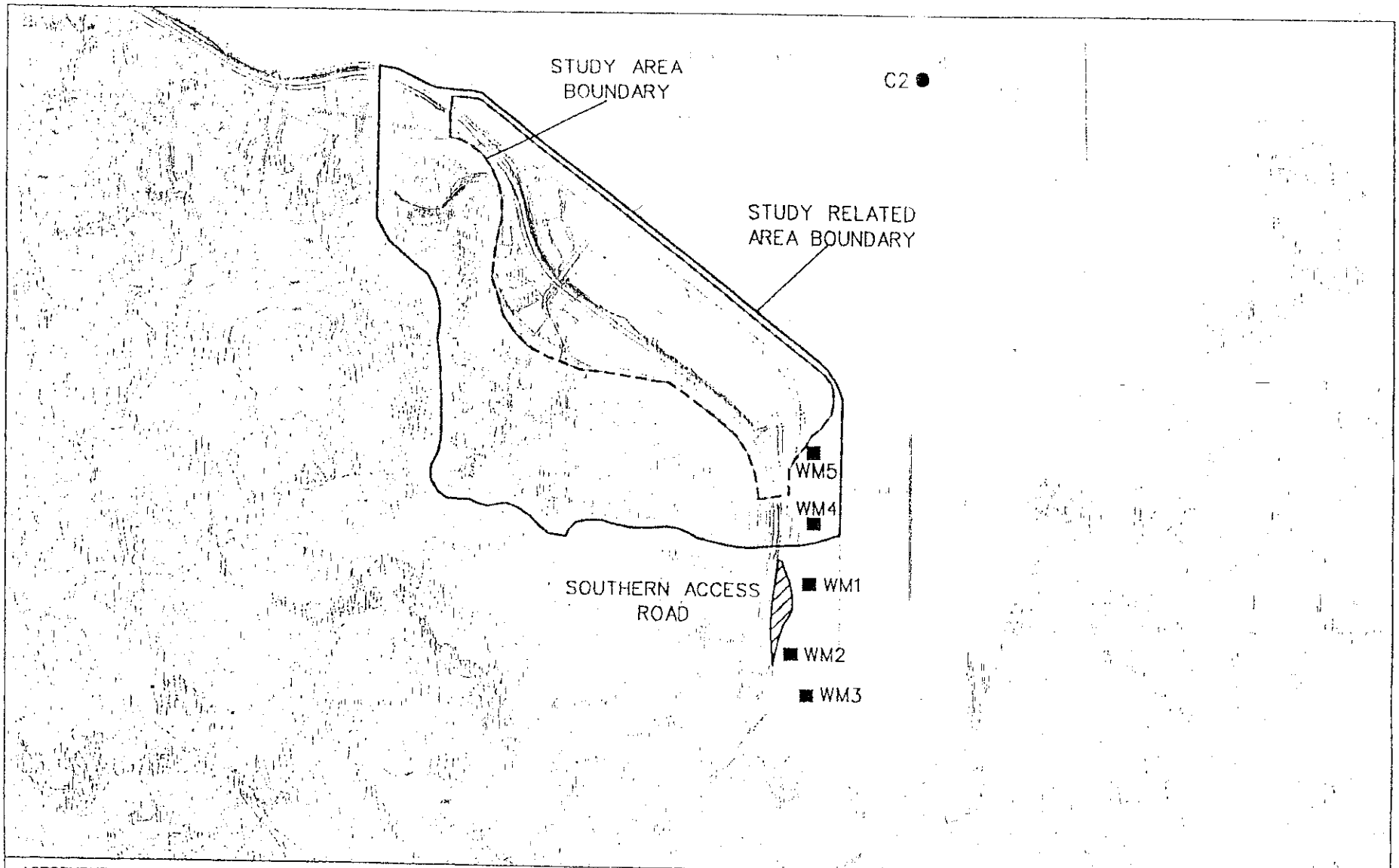
LOCATION OF PROPOSED MONITORING LOCATIONS

Maunsell
茂盛(亞洲)工程顧問有限公司

SCALE : N.T.S.

REVISED : 26/03/98

FIGURE NO. : 3.4a



AGREEMENT NO. CE 90/96
FEASIBILITY STUDY FOR PAK SHEK KOK DEVELOPMENT AREA

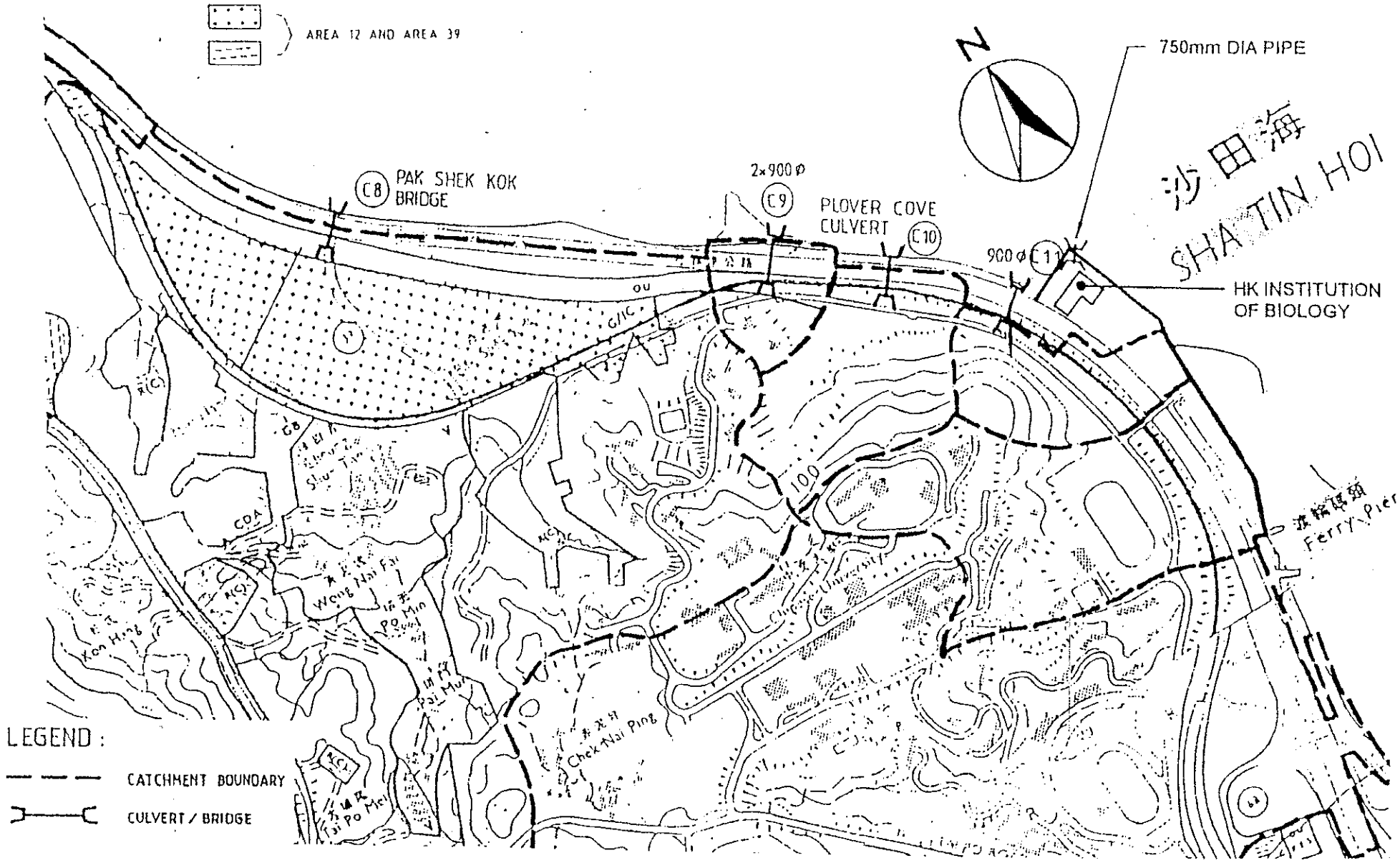
WATER QUALITY MONITORING LOCATIONS

Maunsell
茂盛(亞洲)工程顧問有限公司

SCALE : N.T.S.

DATE : 07/05/98

FIGURE NO. : 4.4a

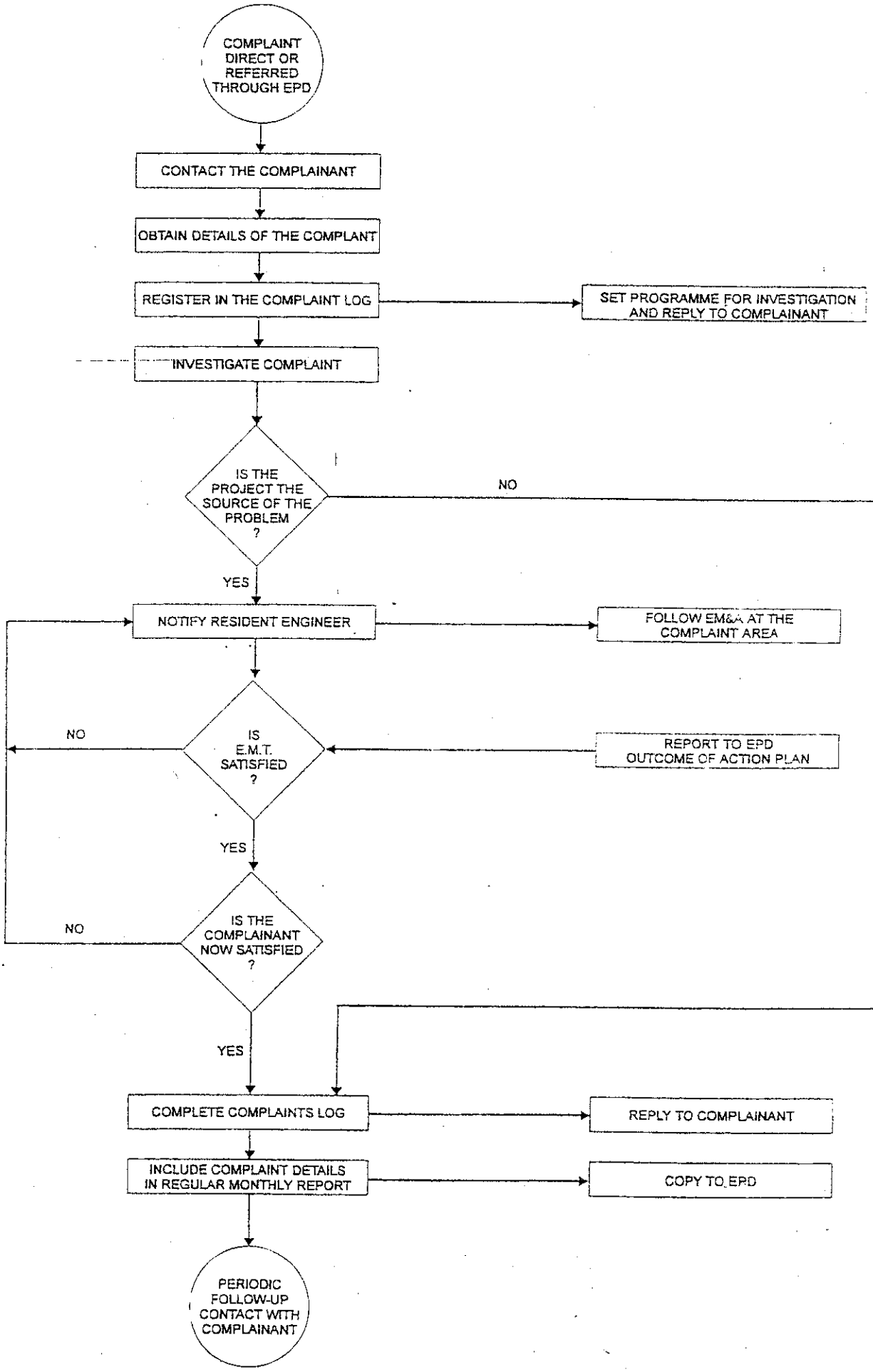


LOCATION OF MAJOR EXISTING OUTFALLS

Maunsell

DATE :

FIGURE NO.
5 5a



COMPLAINTS PROCEDURE - ACTION FLOW CHART	Maunsell	DATE :	FIGURE NO. 6.3a

Annex J

Detailed Road Traffic Noise Result for NSR 10D

HFANOISE v1.10 RESULTS FILE : FULL OUTPUT

File : 2011.DAT
Time : 16:50:28
Date : Tuesday, 02 June 1998

Receiver no 82:
X=838931.5 Y=832423.4 Z= 17.0 Height= 26.6

Road Name	Road Segment	Sub Segment	Flow	Speed	%Heavy	Gradient	Basic Noise Level	Corrections: Speed	Gradient	Surface	Distance	Angle of View	Barrier	Ground Cover	Facade	Reflection	Segment Total
TH-SB	1013 1014	1	5740.0	100.0	45.00	0.8	79.80	7.6	0.2	-3.5	-9.4	-12.1	-17.7	0.0	2.5	0.0	47.4
	1013 1014	2	5740.0	100.0	45.00	0.8	79.80	7.6	0.2	-3.5	-9.4	-13.5	-17.5	0.0	2.5	0.0	46.2
	1013 1014	3	5740.0	100.0	45.00	0.8	79.80	7.6	0.2	-3.5	-9.4	-15.1	-17.3	0.0	2.5	0.0	44.8
	1013 1014	4	5740.0	100.0	45.00	0.8	79.80	7.6	0.2	-3.5	-9.4	-10.4	-17.1	0.0	2.5	1.5	51.2
	1013 1014		Category: A	Noise Level:		54.1											
TH-SB	1012 1013	1	5740.0	100.0	45.00	0.9	79.80	7.6	0.3	-3.5	-9.4	-10.2	-17.6	0.0	2.5	1.5	51.0
	1012 1013	2	5740.0	100.0	45.00	0.9	79.80	7.6	0.3	-3.5	-9.4	-15.1	-17.3	0.0	2.5	1.5	46.4
	1012 1013	3	5740.0	100.0	45.00	0.9	79.80	7.6	0.3	-3.5	-9.4	-11.2	-17.0	0.0	2.5	1.5	50.6
	1012 1013	4	5740.0	100.0	45.00	0.9	79.80	7.6	0.3	-3.5	-9.4	-17.9	-16.7	0.0	2.5	1.5	44.2
	1012 1013		Category: A	Noise Level:		54.9											
TH-NB	1031 1032	1	5320.0	100.0	50.00	0.7	79.50	8.0	0.0	-3.5	-10.0	-13.8	-6.0	0.0	2.5	0.0	56.7
	1031 1032	2	5320.0	100.0	50.00	0.7	79.50	8.0	0.0	-3.5	-10.0	-13.5	-5.3	0.0	2.5	0.0	57.7
	1031 1032	3	5320.0	100.0	50.00	0.7	79.50	8.0	0.0	-3.5	-10.0	-15.1	-5.3	0.0	2.5	0.0	56.1
	1031 1032	4	5320.0	100.0	50.00	0.7	79.50	8.0	0.0	-3.5	-10.0	-10.3	-15.1	0.0	2.5	0.0	51.1
	1031 1032		Category: A	Noise Level:		62.0											
TH-NB	1030 1031	1	5320.0	100.0	50.00	0.8	79.50	8.0	0.0	-3.5	-10.0	-10.2	-16.5	0.0	2.5	0.0	49.8
	1030 1031	2	5320.0	100.0	50.00	0.8	79.50	8.0	0.0	-3.5	-10.0	-15.1	-16.2	0.0	2.5	0.0	45.2
	1030 1031	3	5320.0	100.0	50.00	0.8	79.50	8.0	0.0	-3.5	-10.0	-11.4	-15.9	0.0	2.5	0.0	49.2
	1030 1031		Category: A	Noise Level:		53.3											
TH-NB	1032 1033	1	5320.0	100.0	50.00	2.1	79.50	8.0	0.6	-3.5	-10.4	-12.8	-15.4	0.0	2.5	0.0	48.5
	1032 1033	2	5320.0	100.0	50.00	2.1	79.50	8.0	0.6	-3.5	-10.4	-12.7	-16.5	0.0	2.5	0.0	47.5
	1032 1033	3	5320.0	100.0	50.00	2.1	79.50	8.0	0.6	-3.5	-10.4	-17.4	-9.0	0.0	2.5	0.0	50.3
	1032 1033	4	5320.0	100.0	50.00	2.1	79.50	8.0	0.6	-3.5	-10.4	-18.0	-8.2	0.0	2.5	0.0	50.5
	1032 1033		Category: A	Noise Level:		55.4											
TH-SB	1014 1015	1	5740.0	100.0	45.00	1.6	79.80	7.6	0.0	-3.5	-9.9	-18.0	-16.9	0.0	2.5	1.5	43.1
	1014 1015	2	5740.0	100.0	45.00	1.6	79.80	7.6	0.0	-3.5	-9.9	-12.4	-17.6	0.0	2.5	1.5	48.0
	1014 1015	3	5740.0	100.0	45.00	1.6	79.80	7.6	0.0	-3.5	-9.9	-12.7	-18.4	0.0	2.5	1.5	46.9
	1014 1015	4	5740.0	100.0	45.00	1.6	79.80	7.6	0.0	-3.5	-9.9	-18.5	-18.8	0.0	2.5	0.0	39.2
	1014 1015		Category: A	Noise Level:		51.5											
TH-SB	1015 1016	1	5740.0	100.0	45.00	0.0	79.80	7.6	0.0	-3.5	-10.1	-18.1	0.0	0.0	2.5	1.5	59.7
	1015 1016	2	5740.0	100.0	45.00	0.0	79.80	7.6	0.0	-3.5	-10.1	-18.3	-17.9	0.0	2.5	1.5	41.6
	1015 1016	3	5740.0	100.0	45.00	0.0	79.80	7.6	0.0	-3.5	-10.1	-19.0	-17.9	0.0	2.5	1.5	40.9
	1015 1016	4	5740.0	100.0	45.00	0.0	79.80	7.6	0.0	-3.5	-10.1	-15.9	-17.9	0.0	2.5	1.5	44.0

Road Name	Road Segment		Sub Segment	Flow	Speed	%Heavy	Gradient	Basic Noise Level	Corrections: Speed	Gradient	Surface	Distance	Angle of View	Barrier	Ground Cover	Facade	Reflection	Segment Total
TH-SB	1015	1016	5	5740.0	100.0	45.00	0.0	79.80	7.6	0.0	-3.5	-10.1	-16.4	-17.9	0.0	2.5	1.5	43.5
	1015	1016	6	5740.0	100.0	45.00	0.0	79.80	7.6	0.0	-3.5	-10.1	-15.0	-17.9	0.0	2.5	1.5	44.9
	1015	1016	7	5740.0	100.0	45.00	0.0	79.80	7.6	0.0	-3.5	-10.1	-15.7	-17.9	0.0	2.5	1.5	44.2
	1015	1016		Category: A	Noise Level:	60.3												
TH-NB	1033	1034	1	5320.0	100.0	50.00	0.0	79.50	8.0	0.0	-3.5	-10.7	-19.2	-1.5	0.0	2.5	0.0	55.1
	1033	1034	2	5320.0	100.0	50.00	0.0	79.50	8.0	0.0	-3.5	-10.7	-16.4	-16.3	0.0	2.5	0.0	43.1
	1033	1034	3	5320.0	100.0	50.00	0.0	79.50	8.0	0.0	-3.5	-10.7	-15.9	-16.7	0.0	2.5	0.0	43.2
	1033	1034	4	5320.0	100.0	50.00	0.0	79.50	8.0	0.0	-3.5	-10.7	-16.4	-16.9	0.0	2.5	0.0	42.5
	1033	1034	5	5320.0	100.0	50.00	0.0	79.50	8.0	0.0	-3.5	-10.7	-15.0	-16.5	0.0	2.5	0.0	44.3
	1033	1034	6	5320.0	100.0	50.00	0.0	79.50	8.0	0.0	-3.5	-10.7	-16.8	-16.3	0.0	2.5	0.0	42.7
	1033	1034	7	5320.0	100.0	50.00	0.0	79.50	8.0	0.0	-3.5	-10.7	-15.8	-16.6	0.0	2.5	0.0	43.4
	1033	1034		Category: A	Noise Level:	56.5												
Rd L2	1116	1120	1	970.0	20.0	19.10	0.0	72.10	2.5	0.0	-1.0	-5.4	-13.2	-31.1	0.0	2.5	0.0	26.4
	1116	1120	2	970.0	20.0	19.10	0.0	72.10	2.5	0.0	-1.0	-5.4	-8.5	-31.4	0.0	2.5	0.0	30.8
	1116	1120	3	970.0	20.0	19.10	0.0	72.10	2.5	0.0	-1.0	-5.4	-9.6	-30.3	0.0	2.5	0.0	30.8
	1116	1120	4	970.0	20.0	19.10	0.0	72.10	2.5	0.0	-1.0	-5.4	-14.2	-30.2	0.0	2.5	0.0	26.3
	1116	1120	5	970.0	20.0	19.10	0.0	72.10	2.5	0.0	-1.0	-5.4	-15.4	0.0	0.0	2.5	0.0	55.3
	1116	1120	6	970.0	20.0	19.10	0.0	72.10	2.5	0.0	-1.0	-5.4	-12.6	0.0	0.0	2.5	0.0	58.1
	1116	1120	7	970.0	20.0	19.10	0.0	72.10	2.5	0.0	-1.0	-5.4	-12.5	0.0	0.0	2.5	0.0	58.2
	1116	1120		Category: N	Noise Level:	62.2												
TH-SB	1011	1012	1	5740.0	100.0	45.00	0.2	79.80	7.6	0.1	-3.5	-9.7	-16.3	-17.5	0.0	2.5	1.5	44.5
	1011	1012	2	5740.0	100.0	45.00	0.2	79.80	7.6	0.1	-3.5	-9.7	-12.7	-17.4	0.0	2.5	1.5	48.2
	1011	1012	3	5740.0	100.0	45.00	0.2	79.80	7.6	0.1	-3.5	-9.7	-16.8	-17.4	0.0	2.5	1.5	44.1
	1011	1012	4	5740.0	100.0	45.00	0.2	79.80	7.6	0.1	-3.5	-9.7	-17.8	-17.4	0.0	2.5	1.5	43.1
	1011	1012		Category: A	Noise Level:	51.5												
TH-SB	1009	1010	1	5740.0	100.0	45.00	0.2	79.80	7.6	0.0	-3.5	-10.4	-13.5	-17.9	0.0	2.5	1.5	46.1
	1009	1010	2	5740.0	100.0	45.00	0.2	79.80	7.6	0.0	-3.5	-10.4	-17.3	-17.9	0.0	2.5	1.5	42.3
	1009	1010	3	5740.0	100.0	45.00	0.2	79.80	7.6	0.0	-3.5	-10.4	-16.8	-17.9	0.0	2.5	1.5	42.8
	1009	1010	4	5740.0	100.0	45.00	0.2	79.80	7.6	0.0	-3.5	-10.4	-18.7	-17.8	0.0	2.5	1.5	41.0
	1009	1010	5	5740.0	100.0	45.00	0.2	79.80	7.6	0.0	-3.5	-10.4	-16.6	-30.2	0.0	2.5	1.5	30.7
	1009	1010	6	5740.0	100.0	45.00	0.2	79.80	7.6	0.0	-3.5	-10.4	-19.4	-30.1	0.0	2.5	1.5	28.0
	1009	1010		Category: A	Noise Level:	49.6												
TH-NB	1027	1028	1	5320.0	100.0	50.00	0.4	79.50	8.0	0.0	-3.5	-10.9	-18.2	-17.5	0.0	2.5	0.0	39.9
	1027	1028	2	5320.0	100.0	50.00	0.4	79.50	8.0	0.0	-3.5	-10.9	-13.1	-17.4	0.0	2.5	0.0	45.1
	1027	1028	3	5320.0	100.0	50.00	0.4	79.50	8.0	0.0	-3.5	-10.9	-17.3	-17.2	0.0	2.5	0.0	41.1
	1027	1028	4	5320.0	100.0	50.00	0.4	79.50	8.0	0.0	-3.5	-10.9	-16.8	-17.0	0.0	2.5	0.0	41.8
	1027	1028	5	5320.0	100.0	50.00	0.4	79.50	8.0	0.0	-3.5	-10.9	-18.7	-16.8	0.0	2.5	0.0	40.1
	1027	1028	6	5320.0	100.0	50.00	0.4	79.50	8.0	0.0	-3.5	-10.9	-17.5	-30.2	0.0	2.5	0.0	27.9
	1027	1028		Category: A	Noise Level:	49.1												
TH-NB	1029	1030	1	5320.0	100.0	50.00	0.2	79.50	8.0	0.0	-3.5	-10.3	-17.8	-16.6	0.0	2.5	0.0	41.8
	1029	1030	2	5320.0	100.0	50.00	0.2	79.50	8.0	0.0	-3.5	-10.3	-15.6	-16.6	0.0	2.5	0.0	44.0
	1029	1030	3	5320.0	100.0	50.00	0.2	79.50	8.0	0.0	-3.5	-10.3	-12.7	-16.6	0.0	2.5	0.0	46.9

Road Name	Road Segment	Sub Segment	Flow	Speed	%Heavy	Gradient	Basic Noise Level	Corrections: Speed	Gradient	Surface	Distance	Angle of View	Barrier	Ground Cover	Facade	Reflection	Segment Total
TH-NB	1029 1030	4	5320.0	100.0	50.00	0.2	79.50	8.0	0.0	-3.5	-10.3	-18.0	-16.5	0.0	2.5	0.0	41.7
	1029 1030		Category: A	Noise Level:		50.2											
Rd L3	1117 1118	1	560.0	50.0	30.30	8.0	69.70	3.3	2.4	-1.0	-8.1	-14.3	-30.4	0.0	2.5	0.0	24.1
	1117 1118	2	560.0	50.0	30.30	8.0	69.70	3.3	2.4	-1.0	-8.1	-9.4	-30.1	0.0	2.5	0.0	29.3
	1117 1118	3	560.0	50.0	30.30	8.0	69.70	3.3	2.4	-1.0	-8.1	-13.9	-30.1	0.0	2.5	0.0	24.8
	1117 1118	4	560.0	50.0	30.30	8.0	69.70	3.3	2.4	-1.0	-8.1	-15.1	0.0	0.0	2.5	0.0	53.7
	1117 1118	5	560.0	50.0	30.30	8.0	69.70	3.3	2.4	-1.0	-8.1	-12.3	0.0	0.0	2.5	0.0	56.5
	1117 1118	6	560.0	50.0	30.30	8.0	69.70	3.3	2.4	-1.0	-8.1	-12.9	0.0	0.0	2.5	0.0	55.9
	1117 1118	7	560.0	50.0	30.30	8.0	69.70	3.3	2.4	-1.0	-8.1	-11.7	0.0	0.0	2.5	0.0	57.1
	1117 1118	8	560.0	50.0	30.30	8.0	69.70	3.3	2.4	-1.0	-8.1	-10.9	0.0	0.0	2.5	1.5	59.4
	1117 1118		Category: N	Noise Level:		63.9											
Rd L2	1120 1121	1	970.0	20.0	19.10	0.0	72.10	2.5	0.0	-1.0	-5.4	-7.1	0.0	0.0	2.5	0.0	63.6
	1120 1121	2	970.0	20.0	19.10	0.0	72.10	2.5	0.0	-1.0	-5.4	-11.4	0.0	0.0	2.5	1.5	60.8
	1120 1121	3	970.0	20.0	19.10	0.0	72.10	2.5	0.0	-1.0	-5.4	-17.4	0.0	0.0	2.5	1.5	54.8
	1120 1121		Category: N	Noise Level:		65.8											
TH-SB	1010 1011	1	5740.0	100.0	45.00	0.4	79.80	7.6	0.1	-3.5	-10.0	-13.6	-17.8	0.0	2.5	1.5	46.6
	1010 1011	2	5740.0	100.0	45.00	0.4	79.80	7.6	0.1	-3.5	-10.0	-17.7	-17.7	0.0	2.5	1.5	42.6
	1010 1011		Category: A	Noise Level:		48.1											
TH-NB	1028 1029	1	5320.0	100.0	50.00	0.3	79.50	8.0	0.0	-3.5	-10.5	-17.7	-16.9	0.0	2.5	0.0	41.4
	1028 1029	2	5320.0	100.0	50.00	0.3	79.50	8.0	0.0	-3.5	-10.5	-19.4	-16.8	0.0	2.5	0.0	39.8
	1028 1029	3	5320.0	100.0	50.00	0.3	79.50	8.0	0.0	-3.5	-10.5	-14.6	-16.6	0.0	2.5	0.0	44.8
	1028 1029		Category: A	Noise Level:		47.3											
Rd D1	1121 1250	1	1500.0	50.0	23.50	0.0	74.00	2.5	0.0	-1.0	-8.5	-13.0	0.0	0.0	2.5	1.5	58.0
	1121 1250	2	1500.0	50.0	23.50	0.0	74.00	2.5	0.0	-1.0	-8.5	-10.9	0.0	0.0	2.5	1.5	60.1
	1121 1250		Category: N	Noise Level:		62.2											
Rd D1	1143 1144	1	540.0	50.0	35.00	0.0	69.50	3.7	0.0	-1.0	-8.6	-14.7	0.0	0.0	2.5	1.5	52.9
	1143 1144	2	540.0	50.0	35.00	0.0	69.50	3.7	0.0	-1.0	-8.6	-10.4	0.0	0.0	2.5	1.5	57.2
	1143 1144	3	540.0	50.0	35.00	0.0	69.50	3.7	0.0	-1.0	-8.6	-10.1	0.0	0.0	2.5	1.5	57.5
	1143 1144	4	540.0	50.0	35.00	0.0	69.50	3.7	0.0	-1.0	-8.6	-14.8	0.0	0.0	2.5	1.5	52.8
	1143 1144		Category: N	Noise Level:		61.7											
Rd L7	1118 1119	1	560.0	50.0	30.30	8.0	69.70	3.3	2.4	-1.0	-7.9	-12.9	0.0	0.0	2.5	0.0	56.1
	1118 1119	2	560.0	50.0	30.30	8.0	69.70	3.3	2.4	-1.0	-7.9	-17.3	0.0	0.0	2.5	0.0	51.7
	1118 1119	3	560.0	50.0	30.30	8.0	69.70	3.3	2.4	-1.0	-7.9	-17.1	0.0	0.0	2.5	0.0	51.9
	1118 1119	4	560.0	50.0	30.30	8.0	69.70	3.3	2.4	-1.0	-7.9	-15.1	0.0	0.0	2.5	0.0	53.9
	1118 1119		Category: N	Noise Level:		59.8											
Rd L6	1133 1134	1	80.0	50.0	50.00	0.0	61.20	5.0	0.0	-1.0	-4.6	-3.8	0.0	0.0	2.5	0.0	59.3
	1133 1134		Category: N	Noise Level:		59.3											
Rd D1	1251 1252	1	1500.0	50.0	23.50	0.0	74.00	2.5	0.0	-1.0	-9.2	-14.7	0.0	0.0	2.5	1.5	55.6
	1251 1252	2	1500.0	50.0	23.50	0.0	74.00	2.5	0.0	-1.0	-9.2	-10.9	0.0	0.0	2.5	1.5	59.4
	1251 1252		Category: N	Noise Level:		60.9											
Rd D1	1142 1143	1	540.0	50.0	35.00	0.0	69.50	3.7	0.0	-1.0	-8.8	-11.2	0.0	0.0	2.5	1.5	56.2
	1142 1143	2	540.0	50.0	35.00	0.0	69.50	3.7	0.0	-1.0	-8.8	-16.6	0.0	0.0	2.5	1.5	50.8

Road Name	Road Segment	Sub Segment	Flow	Speed	%Heavy	Gradient	Basic Noise Level	Corrections: Speed	Gradient	Surface	Distance	Angle of View	Barrier	Ground Cover	Facade	Reflection	Segment Total
YKL	1218 1219		Category: N	Noise Level:	39.5												
YKL	1214 1215	1	260.0	50.0	7.00	0.0	66.30	-0.5	0.0	-1.0	-14.8	-15.3	0.0	-2.0	2.5	0.0	35.2
	1214 1215	2	260.0	50.0	7.00	0.0	66.30	-0.5	0.0	-1.0	-14.8	-17.3	0.0	0.0	2.5	0.0	35.2
	1214 1215		Category: N	Noise Level:	38.2												
YKL	1210 1211	1	260.0	50.0	7.00	0.0	66.30	-0.5	0.0	-1.0	-15.2	-14.6	0.0	-2.1	2.5	0.0	35.4
	1210 1211	2	260.0	50.0	7.00	0.0	66.30	-0.5	0.0	-1.0	-15.2	-17.8	0.0	-2.1	2.5	0.0	32.2
	1210 1211		Category: N	Noise Level:	37.1												
YKL	1219 1220	1	260.0	50.0	7.00	0.0	66.30	-0.5	0.0	-1.0	-14.2	-14.3	0.0	0.0	2.5	0.0	38.8
	1219 1220		Category: N	Noise Level:	38.8												
YKL	1215 1216	1	260.0	50.0	7.00	0.0	66.30	-0.5	0.0	-1.0	-14.7	-18.1	0.0	0.0	2.5	0.0	34.5
	1215 1216	2	260.0	50.0	7.00	0.0	66.30	-0.5	0.0	-1.0	-14.7	-17.0	0.0	0.0	2.5	0.0	35.6
	1215 1216		Category: N	Noise Level:	38.1												
YKL	1217 1218	1	260.0	50.0	7.00	0.0	66.30	-0.5	0.0	-1.0	-14.5	-14.7	0.0	0.0	2.5	0.0	38.1
	1217 1218		Category: N	Noise Level:	38.1												
YKL	1216 1217	1	260.0	50.0	7.00	0.0	66.30	-0.5	0.0	-1.0	-14.6	-15.2	0.0	0.0	2.5	0.0	37.5
	1216 1217		Category: N	Noise Level:	37.5												
YKL	1222 1223	1	260.0	50.0	7.00	0.0	66.30	-0.5	0.0	-1.0	-13.7	-16.2	-0.3	0.0	2.5	0.0	37.1
	1222 1223		Category: N	Noise Level:	37.1												
YKL	1223 1224	1	260.0	50.0	7.00	0.0	66.30	-0.5	0.0	-1.0	-12.6	-18.2	-0.2	0.0	2.5	0.0	36.3
	1223 1224		Category: N	Noise Level:	36.3												
YKL	1229 1230	1	260.0	50.0	7.00	0.0	66.30	-0.5	0.0	-1.0	-15.0	-19.4	0.0	0.0	2.5	0.0	32.9
	1229 1230		Category: N	Noise Level:	32.9												
Rd L7	1119 1200	1	250.0	50.0	15.00	20.1	66.20	1.2	6.0	-1.0	-7.6	-22.3	0.0	0.0	2.5	0.0	45.0
	1119 1200		Category: N	Noise Level:	45.0		Warning: Segment angle less than 2°.										
TH-NB	1035 1307	1	5320.0	100.0	50.00	0.8	79.50	8.0	0.2	-3.5	-8.4	-28.5	-9.5	0.0	2.5	0.0	40.3
	1035 1307		Category: A	Noise Level:	40.3		Warning: Segment angle less than 2°.										
Rd L7	1200 1201	1	250.0	50.0	15.00	12.1	66.20	1.2	3.6	-1.0	-2.7	-27.8	0.0	0.0	2.5	0.0	42.0
	1200 1201		Category: N	Noise Level:	42.0		Warning: Segment angle less than 2°.										
Rd L7	1201 1202	1	250.0	50.0	15.00	12.2	66.20	1.2	3.7	-1.0	-5.2	-25.1	-9.5	0.0	2.5	0.0	32.8
	1201 1202		Category: N	Noise Level:	32.8		Warning: Segment angle less than 2°.										
TH-SB	1303 1304	1	5740.0	100.0	45.00	0.0	79.80	7.6	0.0	-3.5	-9.5	-28.0	0.0	0.0	2.5	1.5	50.4
	1303 1304		Category: A	Noise Level:	50.4		Warning: Segment angle less than 2°.										
TH-SB	1302 1303	1	5740.0	100.0	45.00	0.0	79.80	7.6	0.0	-3.5	-7.4	-30.6	0.0	0.0	2.5	0.0	48.4
	1302 1303		Category: A	Noise Level:	48.4		Warning: Segment angle less than 2°.										
Rd L7	1202 1203	1	250.0	50.0	15.00	10.3	66.20	1.2	3.1	-1.0	-9.2	-20.6	0.0	0.0	2.5	0.0	42.2
	1202 1203		Category: N	Noise Level:	42.2		Warning: Segment angle less than 2°.										
TH-NB	1307 1308	1	5320.0	100.0	50.00	0.0	79.50	8.0	0.0	-3.5	-6.1	-33.6	-7.2	0.0	2.5	0.0	39.6
	1307 1308		Category: A	Noise Level:	39.6		Warning: Segment angle less than 2°.										
TH-NB	1308 1309	1	5320.0	100.0	50.00	0.0	79.50	8.0	0.0	-3.5	-6.0	-33.6	-0.5	0.0	2.5	0.0	46.4

Road Name	Road Segment	Sub Segment	Flow	Speed	%Heavy	Gradient	Basic Noise Level	Corrections: Speed	Gradient	Surface	Distance	Angle of View	Barrier	Ground Cover	Facade	Reflection	Segment Total
TH-NB	1308 1309		Category: A	Noise Level:	46.4		Warning: Segment angle less than 2°.										
TH-SB	1301 1302	1	5740.0	100.0	45.00	0.0	79.80	7.6	0.0	-3.5	-5.1	-36.2	0.0	0.0	2.5	0.0	45.1
	1301 1302		Category: A	Noise Level:	45.1		Warning: Segment angle less than 2°.										
TH-SB	1304 1305	1	5740.0	100.0	45.00	0.0	79.80	7.6	0.0	-3.5	-13.2	-25.5	-0.8	0.0	2.5	1.5	48.4
	1304 1305		Category: A	Noise Level:	48.4		Warning: Segment angle less than 2°.										
TH-NB	1309 1310	1	5320.0	100.0	50.00	0.0	79.50	8.0	0.0	-3.5	-11.3	-27.7	-0.3	0.0	2.5	0.0	47.2
	1309 1310		Category: A	Noise Level:	47.2		Warning: Segment angle less than 2°.										
TH-NB	1310 1311	1	5320.0	100.0	50.00	0.0	79.50	8.0	0.0	-3.5	-12.8	-26.1	-0.2	0.0	2.5	0.0	47.4
	1310 1311		Category: A	Noise Level:	47.4		Warning: Segment angle less than 2°.										
TH-SB	1300 1301	1	5740.0	100.0	45.00	0.0	79.80	7.6	0.0	-3.5	-5.4	-36.9	0.0	0.0	2.5	0.0	44.1
	1300 1301		Category: A	Noise Level:	44.1		Warning: Segment angle less than 2°.										
Rd D1	1254 1255	1	2170.0	50.0	15.00	0.0	75.60	1.2	0.0	-1.0	-8.4	-25.3	0.0	0.0	2.5	0.0	44.6
	1254 1255		Category: N	Noise Level:	44.6		Warning: Segment angle less than 2°.										
TH-NB	1311 1312	1	5320.0	100.0	50.00	0.0	79.50	8.0	0.0	-3.5	-14.0	-26.7	-0.1	0.0	2.5	0.0	45.7
	1311 1312		Category: A	Noise Level:	45.7		Warning: Segment angle less than 2°.										
TH-SB	1305 1306	1	5740.0	100.0	45.00	0.0	79.80	7.6	0.0	-3.5	-14.6	-26.1	-1.7	0.0	2.5	0.0	44.0
	1305 1306		Category: A	Noise Level:	44.0		Warning: Segment angle less than 2°.										
TH-SB	1017 1300	1	5740.0	100.0	45.00	0.0	79.80	7.6	0.0	-3.5	-11.4	-31.6	0.0	0.0	2.5	0.0	43.4
	1017 1300		Category: A	Noise Level:	43.4		Warning: Segment angle less than 2°.										
Rd D1	1255 1256	1	2170.0	50.0	15.00	0.0	75.60	1.2	0.0	-1.0	-4.8	-33.5	0.0	0.0	2.5	0.0	40.0
	1255 1256		Category: N	Noise Level:	40.0		Warning: Segment angle less than 2°.										
Rd L7	1206 1207	1	250.0	50.0	15.00	7.0	66.20	1.2	2.1	-1.0	-11.0	-21.3	0.0	0.0	2.5	0.0	38.7
	1206 1207		Category: N	Noise Level:	38.7		Warning: Segment angle less than 2°.										

Total contribution from :

Unaltered	0.0
Altered	67.9
New	72.8
OVERALL	74.0

No angle of view selected: 360° used

TH-SB:Tolo Highway - Southbound
TH-NB:Tolo Highway - Northbound
YKL: Yau King Lane