

# Environmental Monitoring and Audit Manual

May 2000

 土木工程署  
Civil Engineering Department

Agreement No CE 41/98

## Tai O Sheltered Boat Anchorage Environmental and Drainage Impact Assessment

prepared by

**Scott Wilson (Hong Kong) Limited**

**Environmental  
Monitoring  
and Audit Manual**

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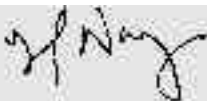
for

**Civil Engineering Department (CED)**

Agreement No CE 41/98

**Tai O Sheltered Boat Anchorage  
Environmental and Drainage Impact  
Assessment**

**CHECKED**



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ISO9001:1994  
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## 1. INTRODUCTION

### 1.1 Introduction

The Civil Engineering Department (CED) has commissioned **Scott Wilson (Hong Kong) Limited** in association with Ecosystems Ltd and Dredging Research Limited to undertake Environmental and Drainage Impact Assessments for the Tai O Sheltered Boat Anchorage Study (Agreement No CE 41/98).

This Assignment has entailed carrying out an EIA for the Tai O Sheltered Boat Anchorage in accordance with the Environmental Impact Assessment Ordinance (Cap.499, S.16) (EIAO) and the associated Technical Memorandum on the Environmental Impact Assessment Process (EIA-TM).

The scope and content of the following EM&A Manual is based upon the findings of the Tai O Sheltered Boat Anchorage EIA - Final Assessment Report (FAR).

### 1.2 Purpose of the Manual

The purpose of this Environmental Monitoring and Audit (EM&A) Manual is to guide the set up of an EM&A programme to ensure compliance with the Environmental Impact Assessment (EIA) study recommendations (Agreement No CE41/98 Tai O Sheltered Boat Anchorage), 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 Tai O Sheltered Boat Anchorage. It aims to provide systematic procedures for monitoring, auditing and minimising of the environmental impacts associated with the construction works.

Hong Kong environmental legislation, the Hong Kong Planning Standards and Guidelines, and the recommendations presented in the EIA FAR have served as environmental standards and guidelines for the preparation of this Manual.

This Manual contains the following:

- (a) duties of the Contractor, the Engineer's Representative (ER), the Independent Environmental Checker (IEC) and the Environmental Team (ET) with respect to the environmental monitoring and audit requirements during construction;
- (b) information on project organisation and programming of construction activities for the project;
- (c) requirements with respect to the construction schedule and the necessary environmental monitoring and audit programme to track the varying environmental impacts;
- (d) definition of Action and Limit levels;
- (e) establishment of event and action plans;

- (f) requirements for reviewing pollution sources and working procedures required in the event of non-compliance of the environmental criteria;
- (g) requirements of presentation of environmental monitoring and audit data and appropriate reporting procedures.

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 requirements. The IEC shall undertake the auditing role.

### 1.3 Background

Tai O was formerly one of the largest fishing villages in Hong Kong and was a historical base for fishing boats in the western approaches of Lantau Island and the Pearl River estuary. However, the importance of the fishing industry in Tai O has declined in recent decades, which has resulted in a degradation of its population base. The formation of the Tai O sheltered boat anchorage is fully supported by the Islands Provisional District Board members and is widely seen as a means of reviving the town's local fishing industry and contributing to the revitalisation of Tai O. The Tai O sheltered boat anchorage will also assist in meeting the shortfall of available typhoon shelter space in Hong Kong.

The Tai O sheltered boat anchorage scheme comprises an 8 hectare (ha) anchorage for 220 vessels and a 1 hectare (ha) reclamation for boat maintenance facilities, parking area, bus terminus and a loading/unloading bay. The scheme has been pending implementation for several years, however, Territory boundary issues have resulted in a project delay. Such boundary issues were resolved in July 1997 upon signing of the Memorandum of Understanding on setting the revised boundary between the Special Administrative Region (SAR) and Guangdong. The anchorage scheme is now scheduled for implementation in July 2001 and completion in December 2003. In addition, it has been decided to combine anchorage development with a mangrove restoration scheme. The construction of Chek Lap Kok airport and associated port and airport developments on the northern shore of Lantau may result in the loss of 7ha of mangroves. As part of the New Airport Master Plan Study (1991), recommendations were made to provide a new mangrove habitat – the area highlighted and subsequently investigated by the Agriculture and Fisheries Department (AFD), comprises the Tai O salt pans. The integration of these two schemes has the potential to generate significant economic, social and environmental benefits to the Tai O community.

### 1.4 Description of the Works

The general layout of the proposed Tai O sheltered boat anchorage development is shown in **Figure 1.1**. The works include the following key components:

- construction of a sheltered boat anchorage with an effective area of approximately 8ha for approximately 220 small boats/fishing vessels;

- construction of an approximately 700m long breakwater, marker dolphins, public landings and other marine facilities;
- reclamation of 1.0ha of land for boat maintenance facilities and a loading/unloading area;
- dredging and disposal of marine mud to lower the seabed within the sheltered boat anchorage, the associated fairways/access approaches, the breakwater foundation and reclamation;
- seawall protection measures involving the construction of a sheet piling wall alongside the existing salt pan outer seawall (subject to confirmation during the detailed design); and
- associated engineering works to prepare for subsequent planting works in the new mangrove habitat. The formation is proposed to be achieved by re-shaping some of the internal bunds in the salt pans and the addition of some marine mud dredged from the adjacent boat anchorage.

## 1.5 Environmental Monitoring and Audit Requirements

The EIA FAR identified the likely environmental impacts during construction and operational phases, including: noise (construction only), water quality and ecology. These impacts can be minimised to acceptable levels with the implementation of environmental mitigation measures. In order to ensure compliance with relevant environmental standards, baseline and compliance monitoring for noise and water quality is required and is described in detail in the subsequent sections. In addition, the area is known to be of cultural heritage interest and as such provisions are needed to ensure that the existing outer seawall is protected during the works. The proposed schedule for the implementation of recommended mitigation measures is shown in **Table 10.2** of the EIA FAR and reproduced in **Appendix E**.

## 1.6 Project Organisation

The project organisation and lines of communication with respect to environmental protection works is shown in **Figure 1.2**.

There shall be two elements of the environmental monitoring and audit team. The Environmental Team (ET) who shall be employed by the contractor and undertake the monitoring and the Independent Environmental Checker (IEC) who shall be engaged by the ER and audit the work of the ET. The IEC shall not be in any way an associated body of the Contractor. The ET and the IEC Team Leader shall have relevant professional qualifications, or have sufficient relevant EM&A experience subject to approval of the Environmental Protection Department (EPD).

Appropriate staff shall be included in the ET and IEC under the supervision of the ER/IEC Team Leader, to fulfil the EM&A duties specified in this manual.

The duties/responsibilities comprise the following:

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### ***The Contractor***

- Employ an Environmental Team (ET) to undertake monitoring, laboratory analysis and reporting of environmental monitoring and audit;
- provide assistance to the ET in carrying out monitoring;
- submit proposals on mitigation measures in case of exceedances of Action and Limit Levels in accordance with the Event and Action Plans;
- implement measures to reduce impact where Action and Limit Levels are exceeded; and
- adhere to the procedures for carrying out complaint investigation in accordance with Section 6.3 of this Manual.

### ***Engineer or Engineer's Representative***

- Supervise the Contractor' activities and ensure that the requirements in the EM&A Manual are fully complied with;
- inform the Contractor when action is required to reduce impacts in accordance with the Event and Action Plans;
- employ an Independent Checker (Environment) (IEC) to audit the results of the EM&A works carried out by the ET; and
- adhere to the procedures for carrying out complaint investigation in accordance with Section 6.3 of this Manual.

### ***Environmental Team***

- Monitor the various environmental parameters as required in this Manual;
- analyse the environmental monitoring and audit data and review the success of EM&A programme to confirm the adequacy of mitigatory measures implemented and the validity of the EIA predictions and to identify any adverse environmental impacts arising;
- carry out site inspection to investigate and audit the Contractor's site practice, equipment and work methodologies with respect to pollution control and environmental mitigation, and effect proactive action to pre-empt problems;
- audit and prepare audit reports on the environmental monitoring data and site environmental conditions;
- report on the environmental monitoring and audit results to the IEC, the Contractor, the ER and EPD or its delegated representative;



- recommend suitable mitigation measures to the Contractor in the case of exceedance of Action and Limit Levels in accordance with the Event and Action Plans; and
- adhere to the procedures for carrying out complaint investigation in accordance with Section 6.3 of this Manual.

#### *Independent Checker (Environment)*

- Review the EM&A works performed by the ET;
- audit the monitoring activities and results;
- report the audit results to the ER and EPD in parallel;
- review the EM&A reports submitted by the ET;
- review the proposal on mitigation measures submitted by the Contractor in accordance with the Event and Action Plans; and
- adhere to the procedures for carrying out complaint investigation in accordance with Section 6.3 of this Manual.

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

## 1.7 Construction Programme

The tentative works programme for the project is presented in **Figure 1.3**.

The project 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 stages to schedule the EM&A works, and the Contractor shall provide the respective information to the ET Leader for formulating the EM&A schedule.

## 2 NOISE

### 2.1 Noise Parameters

The construction noise levels shall be measured in terms of the A-weighted equivalent continuous sound pressure level (Leq). Leq(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, Leq(5 min) shall be employed for comparison with the Noise Control Ordinance (NCO) criteria.

Supplementary information for data auditing, statistical results such as L10 and L90 shall also be obtained for reference. A sample data record sheet is shown in **Appendix B1** for reference.

### 2.2 Monitoring Equipment

As referred to in the Technical Memorandum (TM) issued under the Noise Control Ordinance (NCO), sound level meters in compliance with the International Electrotechnical Commission Publications 651: 1979 (Type 1) and 804: 1985 (Type 1) specifications shall be used for carrying out the noise monitoring. Immediately prior to and following each noise measurement the accuracy of the sound level meter shall be checked using an acoustic calibrator generating a known sound pressure level at a known frequency. Measurements may be accepted as valid only if the calibration level from before and after the noise measurement agree to within 1.0dB.

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

The ET Leader is responsible for the provision of the monitoring equipment. The ET Leader 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.

### 2.3 Monitoring Locations

The EIA identified that unacceptable noise levels at identified sensitive receivers may occur during the construction works unless specific mitigation measures are implemented. As such, a programme of noise monitoring has been recommended at representative sensitive receivers to ensure that the works proceeds in manner that does not result in unacceptable noise levels. the

Proposed construction phase noise monitoring stations are shown in **Figure 2.1** and detailed in **Table 2.1**.

**Table 2.1: Proposed Noise Monitoring Stations during the Construction Phase.**

Identification No.	Locations
N1	Village House in Shek Tsai Po
N2	School
N3	Lung Tin Estate Phase 2 Area B
N4	Nam Chung Tsuen
N5	Village House

Owing to the nature of the works, construction activities will shift from one location to another from time to time. The ET shall select the monitoring locations from those in **Table 2.1** based on the locations of the construction activities and seek approval from ER and agreement from the IEC and EPD. When alternative monitoring locations are proposed, the monitoring locations should 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; and
- (c) for monitoring locations located in the vicinity of the sensitive receivers, care should be taken to cause minimal disturbance to the occupants during monitoring.

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 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 shall agree with the IEC 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.

## 2.4 Baseline Monitoring

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.

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

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

## 2.5 Impact Monitoring

Noise monitoring shall be carried out at all the designated monitoring stations. The monitoring frequency shall depend on the scale of the construction activities. An initial guide to the regular

monitoring frequency for each station on a per week basis when noise generating activities are underway is provided below:

- (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.

For the measurements (b), (c) and (d) above, one set of measurements shall at least include 3 consecutive Leq(5 min) results.

If a school exists near the construction activity, such as the noise monitoring station N2, 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.

In case of non-compliance with the construction noise criteria, more frequent monitoring as specified in the Action Plan in Section 2.6 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.

A schedule for the compliance monitoring shall be submitted to the ER and IEC for approval before the monitoring starts.

## 2.6 Event and Action Plan for Noise

The Action and Limit levels for construction noise are defined in **Table 2.2**. Should non-compliance with the criteria occur, action in accordance with the Action Plan in **Table 2.3**, shall be carried out.

**Table 2.2: 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)

**Notes:**

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

\*\* to be selected based on Area Sensitivity Rating.

If works are to be carried out during restricted hours, the conditions stipulated in the construction noise

**Table 2.3: Event/Action Plan for Construction Noise.**

Event	Action			
	ET	IEC	ER	CONTRACTOR
<b>Action Level</b>	<ol style="list-style-type: none"> <li>1. Identify source, investigate the causes of exceedance and propose remedial measures;</li> <li>2. Notify IEC and Contractor;</li> <li>3. Report the results of investigation to the ER and Contractor;</li> <li>4. Discuss with the Contractor and formulate remedial measures;</li> <li>5. Increase monitoring frequency to check mitigation effectiveness;</li> <li>6. Review the proposed remedial measures by Contractor and advise the ER accordingly.</li> </ol>	<ol style="list-style-type: none"> <li>1. Review the analysed results submitted by the ET;</li> <li>2. Review the proposed remedial measures by the Contractor and advise the ER accordingly;</li> <li>3. Supervise the implementation of remedial measures.</li> </ol>	<ol style="list-style-type: none"> <li>1. Confirm receipt of notification of failure in writing;</li> <li>2. Notify Contractor;</li> <li>3. Require Contractor to propose remedial measures for the analysed noise problem;</li> <li>4. Ensure remedial measures are properly implemented.</li> </ol>	<ol style="list-style-type: none"> <li>1. Submit noise mitigation proposals to IEC;</li> <li>2. Implement noise mitigation proposals.</li> </ol>
<b>Limit Level</b>	<ol style="list-style-type: none"> <li>1. Identify source;</li> <li>2. Inform IEC, ER EPD and Contractor;</li> <li>3. Advise the ER on the effectiveness of the proposed remedial measures;</li> <li>4. Repeat measurements to confirm findings;</li> <li>5. Increase monitoring frequency to daily;</li> <li>6. Carry out analysis of Contractor's working procedures to determine possible mitigation to be implemented;</li> <li>7. Assess effectiveness of Contractor's remedial actions and keep IEC, EPD, ER informed the results;</li> <li>8. If exceedance stops, cease additional monitoring;</li> <li>9. Review Contractor's remedial actions whenever necessary to assure their effectiveness and advise the ER accordingly</li> </ol>	<ol style="list-style-type: none"> <li>1. Discuss amongst ER, ET and Contractor on the potential remedial actions;</li> <li>2. Review Contractor's remedial actions whenever necessary to assure their effectiveness and advise the ER accordingly;</li> <li>3. Supervise the implementation of remedial measures.</li> </ol>	<ol style="list-style-type: none"> <li>1. Confirm receipt of notification of failure in writing;</li> <li>2. Notify Contractor;</li> <li>3. Require Contractor to propose remedial measures for the analysed noise problem</li> <li>4. Ensure remedial measures properly implemented;</li> <li>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.</li> </ol>	<ol style="list-style-type: none"> <li>1. Take immediate action to avoid further exceedance;</li> <li>2. Submit proposals for remediation to IEC within 3 working days of notification;</li> <li>3. Implement the agreed proposals;</li> <li>4. Resubmit proposals if problem still not under control;</li> <li>5. Stop the relevant portion of works as determined by the ER until the exceedance is abated.</li> </ol>

## 2.7 Noise Mitigation Measures

**Figure 1.2** shows the locations of construction work-site areas. The proposed schedule for construction is shown in **Appendix A1** and the PME groups (Groups 1 to 13) are described in **Appendix A2**. The implementation schedule for recommended mitigation measures is presented in **Appendix E**.

The EIA FAR has recommended construction noise control and mitigation measures during different construction phases. The key measures are shown below :

- quiet plant and barriers for Group 2 PME;
- barriers for Group 3 PME;
- quiet plant and barriers for Group 4 PME;
- quiet plant for Group 12 PME;
- quiet plant for Group 13 PME; and
- quiet plant and barriers for Group 14 PME.

In particular, for the school at NSR 9, during the examination period, there should be:

- no Group 1 works at work site A8 during Q4 of 2001;
- no Group 2 and Group 3 works undertaken concurrently at work site A9 during Q1 and Q2 of 2002 (i.e. either Group 2 or Group 3 works should be carried out at any one time); and
- no Group 5 to Group 9 works (inclusive) at work-sites A4 and A5 during Q1 and Q2 of 2002.

If the above measures are not sufficient to restore construction noise quality to acceptable levels, the Contractor shall liaise with the ET on other mitigation measures, propose these measures to the ER for approval, and carry out the mitigation measures as necessary.

### 3 WATER QUALITY

#### 3.1 Water Quality Parameters

In order to ensure that any deterioration in water quality can be readily detected and timely action taken to rectify the situation, a water quality monitoring programme is required. The following water quality parameters should be included in the monitoring programme during construction and operational phases.

**Table 3.1: Water Quality Parameters during Construction and Operational Phase Monitoring.**

Phase	Water Quality Parameters
Construction	<ul style="list-style-type: none"> <li>• temperature (°C)</li> <li>• pH (pH unit)</li> <li>• turbidity (NTU)</li> <li>• water depth (m)</li> <li>• salinity (mg/L)</li> <li>• dissolved oxygen (mg/L and % of saturation)</li> <li>• suspended solids (mg/L)</li> </ul>
Operation	<ul style="list-style-type: none"> <li>• dissolved oxygen (mg/L and % of saturation)</li> <li>• pH (pH unit)</li> <li>• suspended solids (mg/L)</li> <li>• BOD<sub>5</sub> (mg/L)</li> <li>• ammoniacal nitrogen (NH<sub>3</sub>-N) (mg/L)</li> <li>• total Inorganic nitrogen (mg/L)</li> <li>• oil and grease</li> <li>• <i>E.coli</i> (cfu/100mL)</li> <li>• Faecal coliform (cfu/100mL)</li> </ul>

#### 3.2 Monitoring Equipment

For water quality monitoring, the following equipment shall be supplied by the ET and approved by the ER.

##### 3.2.1 Dissolved Oxygen and Temperature Measuring Equipment

The instrument for measuring dissolved oxygen and temperature shall be portable and weatherproof complete with cable, sensor, comprehensive operation manuals and use 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.

It shall have a membrane electrode with automatic 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).

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.

### 3.2.2 Turbidity

Turbidity shall be measured *in situ* by the nephelometric method. The instrument shall be portable and weatherproof using an DC power source complete with cable, sensor and comprehensive operation manuals. The equipment shall be capable of measuring turbidity between 0-1000 NTU. The probe cable should not be less than 25m in length. The meter should be calibrated in order to establish the relationship between NTU units and the levels of SS.

### 3.2.3 Suspended Solids

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

Water samples for SS should be collected in high density polythene bottles, packed in ice (cooled to 4°C without being frozen) and delivered to HOKLAS accredited laboratory for analysis as soon as possible after collection.

### 3.2.4 Water Depth Detector

A portable, battery-operated echo sounder (Seafarer 700 or a similar approved instrument) should be used for the determination of water depth at each designated monitoring station. This unit can either be hand held or affixed to the underside of the survey boat, if the same vessel is to be used throughout the monitoring programme.

### 3.2.5 Salinity

A portable salinometer capable of recording within the range of 0-40 ppt should be used for salinity measurements.

### 3.2.6 Water Sampling for Laboratory Analysis

A water sampler as detailed in Section 3.2.3 should be used to collect samples for laboratory analysis.

### 3.2.7 Position System

A hand held or boat fixed type digital Global Positioning System (GPS) should be used to ensure that the correct location has been selected prior to sample collection.



### 3.2.8 Sample Container and Storage

Following collection, water samples for SS, BOD, NH<sub>3</sub>-N, TIN, *E.coli* and faecal coliform analysis should be stored in high density polythene bottles with no preservative added, packed in ice (cooled to 4°C without being frozen), delivered to the laboratory and analysed as soon as possible.

### 3.2.9 Calibration of *In Situ* Instruments

All *in situ* monitoring instrument shall be checked, calibrated and certified by a laboratory accredited under HOKLAS or other international accreditation scheme before use, and subsequently re-calibrated at 3 monthly intervals throughout all stages of the water quality monitoring.

For the on site calibration of field equipment, the BS 1427:1993, "Guide to Field and on-site test methods for the analysis of waters" should be observed.

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 is under maintenance, calibration, etc.

### 3.2.10 Laboratory Analytical Methods

Analysis, including SS, BOD, NH<sub>3</sub>-N, TIN, *E.coli* and faecal coliform, shall be carried out in a HOKLAS or other international accredited laboratory. The following table shows the standard test methods of the proposed determinants for laboratory analysis.

**Table 3.2: Methods for Laboratory Analysis for Water Samples.**

Parameters (Unit)	Suggested Method
SS (mg/L)	APHA 2540 D
BOD (mg/L)	APHA 5210 B
NH <sub>3</sub> -N (mg/L)	APHA 4500-NH <sub>3</sub>
TIN	APHA 4500-N
Oil and grease	APHA 5520C
<i>E.coli</i> (count/1000mL)	DoE 7.8 & 7.9
Faecal coliform	DoE 7.8 & 7.9

**Notes:**

APHA = American Public Health Association : Standard Methods for the Examination of Water and Wastewater Ed 19  
 DoE = The Bacteriological Examination of Drinking Water Supplies 1982

The testing laboratory should be HOKLAS accredited (or if not, approved by the ER) and comprehensive quality assurance and control procedures in place in order to ensure quality and consistency in results.

If a site laboratory is set up or a non-HOKLAS and non-international accredited laboratory is hired for carrying out the laboratory analysis, the laboratory equipment, analytical procedures, and quality control shall be approved by EPD. All the analysis shall be witnessed by the ER.

The ET 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.

For the testing methods of other parameters as recommended 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 know 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 for submission to EPD. In any circumstance, the sample testing shall have comprehensive quality assurance and quality control programmes. The laboratory should prepare to demonstrate the programmes to EPD.

### 3.3 Monitoring Locations

The water quality monitoring locations are shown in **Figure 3.1** - these locations are summarised in **Table 3.3**.

**Table 3.3: Water Quality Monitoring Locations.**

Phase	No	Location	Category	Co-ordinates	
				Easting	Northing
Construction Phase	1	Outer Bay	Control Station (on ebb tide) Impact Station (on flood tide)	802250	813200
	2	Outer Bay	Impact Station	801900	812710
	3	Outer Bay	Impact Station	801850	812060
	4	Outer Bay	Control Station (on flood tide) Impact Station (on ebb tide)	802050	811530
	5	Mouth of Tai O Creek	Impact Station	803844	812839
Operational Phase	6	Inner Bay	Impact Station	803571	812362
	7	Inner Bay	Control Station	802894	812601
	8	Inner Bay	Control Station	803110	811906

During the construction phase it is not considered appropriate to monitor water quality inside Tai O Bay close to the dredging activities (although monitoring at station 5 will be undertaken at

the mouth of Tai O Bay in order to protect sensitive receivers upstream). A total of 4 stations have been located outside Tai O Bay - stations 2 and 3 are impact stations, whilst station 1 acts as a control station during the ebb tide and as an impact station during the flood tide, similarly station 4 acts as a control station during the flood tide and as a impact station during the ebb tide. This reflects the movement of any sediment plume with the tides as illustrated by the water quality modelling exercise as detailed in the EIA FAR (i.e. the sediment plume moves north during a flood tide and south during an ebb tide - stations 1 and 4 thus alternate between control stations and impact stations).

During the operational phase, station 6 will monitor the impact of the sheltered boat anchorage operation on water quality, whilst stations 7 and 8 will act as controls and aim to confirm the EIA FAR water quality modelling results which indicate that the anchorage operation will not impact upon water quality in the outer bay areas.

Prior to the commencement of the EM&A programme, the proposed water quality monitoring stations shall be discussed and agreed with the ET Leader and EPD.

### 3.4 Baseline Monitoring

Baseline conditions for water quality shall be established and agreed upon with EPD prior to the commencement of works. The purpose 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 all the water quality parameters specified in Section 3.1 and as illustrated in **Table 3.1**. The measurements shall be taken at all designated monitoring stations including control stations, 3 days per week, at mid-flood and mid-ebb tides, at three depth locations (i.e. 1m below surface, mid-depth and 1m from bed), for a period of 4 weeks prior to the commencement of marine works. The interval between two sets of monitoring shall not be less than 36 hours and the baseline monitoring schedule shall be submitted to EPD at least 1 week prior to the commencement of the baseline monitoring. Flow rates and sample depth should be also recorded, where appropriate. Also, all seasonal variations such as rainfall, tidal flow, typhoons, shipping activities should be assessed.

Measurements shall be taken at 3 water depths, namely, 1m below water surface, mid-depth and 1m above sea bed, except where the water depth less than 6m, the mid-depth station may be omitted. Should the water depth be less than 3m, only the mid-depth station will be monitored. The ET Leader shall seek approval from EPD on all the monitoring stations.

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

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

### 3.5 Impact Monitoring

During the course of the marine works, 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.

Measurements shall be taken at 3 water depths, namely, 1m below water surface, mid-depth and 1m above sea bed, except where the water depth less than 6m, the mid-depth station may be omitted. Should the water depth be less than 3m, only the mid-depth station will be monitored.

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.

The Action/Limit levels shall be derived with agreement from EPD following the completion of the baseline monitoring. The Action/Limit levels should be calculated as outlined in **Table 3.4**.

**Table 3.4: Action/Limit Levels for Water Quality.**

Parameter (unit)	Action	Limit
Dissolved Oxygen (mg/L) (surface, middle, bottom)	<i>Surface and middle</i> 5%-ile of baseline for surface and middle layers  <i>Bottom</i> 5%-ile of baseline for bottom layer	<i>Surface and middle</i> 4 mg/L or 1%-ile of baseline data for surface and middle layers  <i>Bottom</i> 2 mg/L or 1%-ile of baseline data for bottom layer
SS (mg/L) (depth average)	95%-ile of baseline data or 120% of upstream control station's SS at the same tide of the same day	99%-ile of baseline or 130% of SS readings at the upstream control station at the same tide of same day and specific sensitive receiver water quality requirements
Turbidity (NTU) (depth average)	95%-ile of baseline data or 120% of upstream control station's turbidity at the same tide of the same day	99%-ile of baseline or 130% of turbidity at the upstream control station at the same tide of same day

**Notes :**

1. For DO, non-compliance of the water quality limit occurs when monitoring result is lower than the limit.
2. For SS and turbidity non-compliance of the water quality limits occur when monitoring result is higher than the limits.
3. All the figures given in the table are used for reference only and the EPD may amend the figures whenever it is considered as necessary

### 3.6 Event and Action Plan for Water Quality

When the monitoring results of the water quality parameters at any designated monitoring stations exceed the water quality criteria, the actions in accordance with the Action Plan in **Table 3.5** shall be carried out.

**Table 3.5: Event and Action Plan for Water Quality during the Construction Phase.**

Event	Action			
	ET	IEC	ER	CONTRACTOR
Action Level being exceeded by one sampling day	<ol style="list-style-type: none"> <li>Repeat in-situ measurement to confirm findings;</li> <li>Identify source(s) of impact;</li> <li>Inform IC(E) and Contractor;</li> <li>Check monitoring data, all plant, equipment and Contractor's working methods;</li> <li>Discuss mitigation measures with IC(E) and Contractor; and</li> <li>Repeat measurement on next day of exceedance.</li> </ol>	<ol style="list-style-type: none"> <li>Discuss with ET and Contractor on the mitigation measures Review proposals on mitigation measures submitted by Contractor and advise the ER accordingly; and</li> <li>Assess the effectiveness of the implemented mitigation measures.</li> </ol>	<ol style="list-style-type: none"> <li>Discuss with IC(E) on the proposed mitigation measures; and</li> <li>Make agreement on the mitigation measures to be implemented</li> </ol>	<ol style="list-style-type: none"> <li>Inform the ER and confirm notification of the non-compliance in writing;</li> <li>Rectify unacceptable;</li> <li>Check all plant and equipment;</li> <li>consider changes of working methods;</li> <li>Discuss with ET and IC(E) and propose mitigation measures to IC(E) and ER; and</li> <li>Implement the agreed mitigation measures.</li> </ol>
Action level being exceeded by more than one consecutive sampling days	<ol style="list-style-type: none"> <li>Repeat in-situ measurement to confirm findings;</li> <li>Identify sources(s) of impact;</li> <li>Inform IC(E) and Contractor;</li> <li>Check monitoring data, all plant, equipment and Contractor's working methods;</li> <li>Discuss mitigation measures with IC(E) and Contractor;</li> <li>Ensure mitigation measures are implemented;</li> <li>Prepare to increase the monitoring frequency to daily;</li> <li>Repeat measurement on next day of exceedance.</li> </ol>	<ol style="list-style-type: none"> <li>Discuss with ET and Contractor on the mitigation measures Review proposals on mitigation measures submitted by Contractor and advise the ER accordingly</li> <li>Assess the effectiveness of the implemented mitigation measures.</li> </ol>	<ol style="list-style-type: none"> <li>Discuss with IC(E) on the proposed mitigation measures;</li> <li>Make agreement on the mitigation measure to be implemented;</li> <li>Assess the effectiveness of the implemented mitigation measures.</li> </ol>	<ol style="list-style-type: none"> <li>Inform the Engineer and confirm notification of the non-compliance in writing;</li> <li>Rectify unacceptable practice;</li> <li>Check all plant and equipment;</li> <li>consider changes of working methods;</li> <li>Discuss with ET and IC(E) and propose mitigation measures to IC(E) and ER within 3 working days;</li> <li>Implement the agreed mitigation measures.</li> </ol>

Event	Action			
	ET	IEC	ER	CONTRACTOR
Limit level being exceeded by one sampling day	<ol style="list-style-type: none"> <li>Repeat measurement on next day of exceedance to confirm findings;</li> <li>Identify source(s) of impact;</li> <li>Inform IC(E), Contractor, ER &amp; EPD;</li> <li>Check monitoring data, all plant equipment &amp; Contractor's working methods; and</li> <li>Discuss mitigation measures with IC(E), Contractor &amp; ER.</li> </ol>	<ol style="list-style-type: none"> <li>Checking monitoring data submitted by ET &amp; Contractor's working method;</li> <li>Discuss with ET &amp; Contractor on the possible mitigation measures; and</li> <li>Review the proposed mitigation measures submitted by Contractor &amp; advise the ER accordingly.</li> </ol>	<ol style="list-style-type: none"> <li>Confirm receipt of notification of failure in writing;</li> <li>Discuss with IC(E), ET &amp; Contractor on the proposed mitigation measures;</li> <li>Require Contractor to review the working methods; and</li> <li>Ensure mitigation measures are properly implemented.</li> </ol>	<ol style="list-style-type: none"> <li>Inform the ER &amp; confirm notification of the non-compliance in writing;</li> <li>Rectify unacceptable practice;</li> <li>Check all plant &amp; equipment &amp; consider changes of working methods;</li> <li>Discuss with ET, IC(E) and ER and propose mitigation measures to ER and IC(E) within 3 working days; and</li> <li>Implement the agreed mitigation measures</li> </ol>
Limit level being exceeded by two or more consecutive sampling days	<ol style="list-style-type: none"> <li>Repeat measurement on next day of exceedance to confirm findings;</li> <li>Identify source(s) of impact;</li> <li>Inform IC(E), Contractor, ER &amp; EPD;</li> <li>Check monitoring data, all plant equipment &amp; Contractor's working methods;</li> <li>Discuss mitigation measures with IC(E), Contractor &amp; ER;</li> <li>Ensure mitigation are implemented; and</li> <li>Increase the monitoring frequency to daily until no exceedance of Limit level for two consecutive days.</li> </ol>	<ol style="list-style-type: none"> <li>Checking monitoring data submitted by ET &amp; Contractor's working method;</li> <li>Discuss with ET &amp; Contractor on the possible mitigation measures;</li> <li>Review the proposed mitigation measures submitted by Contractor &amp; advise the ER accordingly; and</li> <li>Supervise the implementation of mitigation measures.</li> </ol>	<ol style="list-style-type: none"> <li>Discuss with IC(E), ET &amp; Contractor on the proposed mitigation measures;</li> <li>Request Contractor to critically review the working methods;</li> <li>Make agreement on the mitigation measures to be implemented;</li> <li>Ensure mitigation measures are properly implemented; and</li> <li>Consider &amp; instruct, if necessary, the contractor to slow down or to stop all or part of the construction activities until no exceedance of Limit level.</li> </ol>	<ol style="list-style-type: none"> <li>Take immediate action to avoid further exceedance;</li> <li>Discuss with ET, IC(E) and ER and propose mitigation measures to ER and IC(E) within 3 working days;</li> <li>Implement the agreed mitigation measures;</li> <li>Resubmit proposals of mitigation measures if problem still not under control; and</li> <li>As directed by the engineer to slow down or to stop all or part of construction activities until no exceedance of Limit level.</li> </ol>

### 3.7 Operational Phase Monitoring

Following completion of the sheltered boat anchorage construction phase monitoring locations 5 and 6 should be monitored on a monthly basis for the parameters detailed in **Table 3.1**. Water quality samples should be collected from the mid-water depth. Monitoring should be undertaken for 1 year following anchorage operation, thereafter the requirement for additional monitoring shall be discussed and agreed with EPD.

### 3.8 Water Quality Mitigation Measures

The EIA report has recommended mitigation measures during construction and operational phases of the proposed development. The implementation schedule for recommended mitigation measures is presented in **Appendix E**.

#### 3.8.1 Construction Phase

The Contractor shall be responsible for the design and implementation of these mitigation measures. These include :

##### *Dredging Best Practice*

- Unnecessary disturbance to the sediments should be minimised by exerting care when lowering and lifting the grab;
- all vessels used should be sized such that adequate clearance of the seabed is maintained at all stages of the tidal cycle and undue turbidity should not be generated by turbulence from vessel movement or propeller wash;
- use of silt curtains where and when considered appropriate;
- barges should be used which are fitted with tight fitting seals to their bottom openings to prevent leakage of material;
- barge loading should be ensured accurately to avoid splashing of dredged material to the surrounding water;
- grabs should be closed tightly and that hoist speeds should be suitably low;
- barges or hoppers should not be filled to a level which will cause the overflow of materials or polluted water during loading or transportation. Adequate freeboard should be maintained to ensure that the decks are not washed by wave action;
- large objects and debris should be removed manually prior to mechanical dredging to minimise losses from partially closed grabs;
- dredging should be undertaken taking into account tidal conditions;
- no visible foam, oil, grease, scum, litter or other objectionable matter should be present in the water within the site or dumping grounds; and
- appropriate monitoring of water quality should be undertaken to allow the implementation of appropriation action plans to prevent unacceptable water quality impacts.

During dredging of contaminated sediments, additional mitigation measures are required as follows:

- contaminated sediments should be dredged, transported and placed in approved special

dumping grounds in accordance with EPD Technical Circular 1-1-92, WB Technical Circulars 22/92 and 6/92;

- contaminated sediments should be dredged by using grabs of no more than 8m<sup>3</sup>;
- specialised water tight grabs should be used to control sediment loss;
- contaminated mud to marine disposal sites should, wherever possible, be transported by split barges of not less than 750m<sup>3</sup> capacity, well maintained and capable of rapid opening and discharge at the disposal site;
- the barge loading should be monitored to ensure that loss of material does not take place during transportation; and
- on-site auditing of the equipment and plant should be required to ensure that it is used in the appropriate manner.

### ***Reclamation***

In order to ensure that silt-laden runoff from these areas does not occur during the works phase, the mitigation measures described in the "Practice Note for Professional Persons on Construction Site Drainage", Professional Persons Environmental Consultative Committee, 1994 (ProPECC PN 1/94) should be followed as far as practicable. These practices include the following:

- the capacity of sediment tanks should be sufficient for settling wastewaters prior to disposal. The system capacity should be flexible and able to handle multiple inputs from a variety of sources and particularly suited to applications where the influent is pumped. Various physical and chemical filters can be added should refinement of the sedimentation process be required;
- the detailed design should be formulated such that construction works are programmed to minimise surface excavations during the rainy season (April to September). If excavation of soil cannot be avoided during the rainy season, or at any time of year when rainstorms are likely, exposed slope surfaces should be covered by a tarpaulin or other means. Other measures that need to be implemented before, during and after rainstorms are summarised in ProPECC PN 1/94;
- earthworks final surfaces should be well compacted and subsequent permanent work or surface protection works should be carried out immediately after final surfaces have been formed in order to prevent rainstorm erosion;
- all drainage facilities and erosion and sediment control structures should be regularly inspected and maintained to ensure proper and efficient operation at all times and particularly following rainstorms. Deposited silt and grit should be removed regularly and disposed of to the salt pan area during periods of low-tide;
- measures should be taken to minimise the ingress of site drainage into excavations. If the excavation of trenches in wet periods is necessary, they should be dug and backfilled in short sections wherever practicable. Water pumped out from trenches or foundation excavations should be discharged via the silt removal facilities;
- both during and following construction of the reclamation areas, open stockpiles of inert construction materials (e.g. aggregates, sand and fill material) of more than 50m<sup>3</sup> should be covered with a tarpaulin or similar fabric during rainstorms;
- stockpiles of cement and other construction material should be kept covered when not being used;
- manholes (including newly constructed ones) should always be adequately covered and temporarily sealed. Discharge of surface run-off into foul sewers must always be prevented



- to avoid overloading the foul sewerage system;
- all vehicles and plant should be cleaned before leaving the construction. An adequately designed and sited wheel washing bay should be provided at every site exit (if any) and wash-water should have sand and silt settled out and removed at least on a weekly basis. The section of access road leading to and exiting from the wheel-wash bay to the public road should be paved with sufficient backfill toward the wheel-wash;
  - water used for construction purposes on site should, as far as practical, be recycled for use;
  - information detailing storm run-off and wastewater discharge points and the corresponding maximum (or range of) volumes of discharges expected from the construction sites on a dry day should be provided in the WPCO licence application. The licence application to EPD should be submitted as early as possible before the commencement of any discharge;
  - entry points into the surface drainage system should be fitted with oil interceptors;
  - waste oils and other chemical waste as defined in the Waste Disposal (Chemical Waste) (General) Regulation will require disposal by an appropriate means and could require pre-notification to EPD prior to disposal. An appropriate disposal facility could be the Chemical Waste Treatment Centre (CWTC) at Tsing Yi. If chemical wastes are to be generated, the Contractor will need to register with EPD as a chemical waste producer and observe the requirements for chemical waste storage, labelling, transportation and disposal; and
  - the existing drainage system and sewerage system should be avoided from general construction site activities required for reclamation formation.

### ***Salt Pan Infilling/Reworking***

Many of the general construction site mitigation activities as detailed above are also applicable to activities occurring within the salt pan area. In order to further minimise the potential for the loss of material from the salt pans, the following mitigation measures should also be employed:

- material placement and reworking should only occur during low tidal conditions;
- material should be dredged using grab dredgers to minimise moisture content and allow rapid material consolidation;
- a low rate of sediment reworking should be practised in order to minimise sediment disturbance (e.g. placement of approximately 100m<sup>3</sup> of dredged material in the salt pans per day and reworking of approximately 230m<sup>3</sup> of material a day);
- placed mud should be mixed with the relatively coarser salt pan bed material to reduce erosion potential and enhance consolidation;
- all material placed in the salt pans should be spread and mixed with existing bed material before completion of the day's work such that there is no material stockpiling; and
- the outer seawall should be breached in order to reduce the velocity of water entering and leaving the salt pans and thus reduce the risk of erosion of newly placed or moved materials. Material from around the breached areas should be removed prior to reworking.

### ***Worker Generated Waste***

- The construction work force should use the existing toilet facilities next to the bus depot. Alternatively, portable toilets could be used.

### 3.8.2 Operational Phase

The project proponent or the developer should be responsible to the following measures :

#### *Boat Effluents – Sewage and Bilge Discharges*

- Provision of notices and educational leaflets to prevent sewage and bilge discharges within the anchorage and to encourage segregation of wastes in any boat maintenance yards.

#### *Litter*

- Collection of floating refuse within anchorage by private contractor; and
- collection of littoral refuse along the seawall edge of the outer seawall.

#### *Urban Runoff*

- The surface water from the eastern reclamation should be directed towards the mangrove planting area; and
- the surface runoff from the western reclamation should be directed to Tai O Bay through a dry weather interceptor.

#### *Sewage Effluents*

- Any sewage discharges from either of the new reclamation areas is connected to the existing trunk sewerage system.

#### *Process Wastes*

- A centralised wastewater collection and treatment facility should be included in the design.

The implementation schedules of mitigation measures for water quality control during construction and operational phases are presented in **Appendix E**.

If the above measures are not sufficient to restore the water quality to an acceptable level, the Contractor (during construction) or the project proponent (during operational phase) shall liaise with the ET Leader on other mitigation measures, propose to ER and IEC for approval, carry out the mitigation measures.

## 4 ECOLOGY

### 4.1 Introduction

The purpose of ecological monitoring is to verify the predictions of the impact assessment, detect unpredicted ecological impacts, monitor the effectiveness of mitigation measures, and recommend action plans in response to unpredicted impacts and/or failed mitigation. A programme of ecological monitoring to achieve these objectives is outlined below. A summary of impacts, receivers, severity of impacts, mitigation requirements, and residual impacts is shown in **Tables 4.1** and **4.2**. An implementation schedule of recommended mitigation measures is provided in **Appendix E**.

### 4.2 Monitoring Programme

#### 4.2.1 Construction Phase

##### *Dredging of Anchorage, Approach Channels, Breakwater Site*

Potential impacts of sedimentation on benthos and their habitats, and on dolphins will be controlled by the water quality monitoring programme outlined in Chapter 3 of this Manual. That programme should ensure that no unforeseen sedimentation impacts occur to these marine ecological receivers. No additional water quality monitoring measures are proposed specifically for ecological receivers.

Potential for vessel collisions with dolphins will be mitigated through best practice. Dredging supervisors will be advised of the possible occurrence of dolphins, the need to avoid them with dredging vessels, and the legal vessel speed limits in Tai O Bay. Similarly, the dredging supervisors shall be advised of the potential occurrence of horseshoe crabs. In the event that horseshoe crabs are encountered during dredging, these shall be released to an area remote from the dredging operations. The ETL will be responsible for advising dredging supervisors of best practice measures.

##### *Modification of Bunds Within Salt Pans*

Mitigation of impacts on flora will be achieved by providing mangrove layout maps to fill supervisors, demarcating the areas to be protected, and monitoring operator compliance. These actions will be carried out by the ETL during preparation of the salt pans for filling. Compliance monitoring will be carried out on a daily basis during filling to ensure minimal impacts to existing vegetation (see below).

##### *Placement of Dredged Material Into Salt Pans*

The objective of this task is to monitor filling of dredged mud into the filled salt pans to minimise destruction of existing mangroves. This will be accomplished by daily monitoring of the filling process by the Environmental Team Leader or an on-site ecologist authorised by the ETL. The responsible individual is to be on-site during all hours of operation, and is to have authority to stop or re-direct filling as needed. Monitoring will take place throughout the salt pans and will continue through to the end of the fill placement process. Specific tasks are:

- provide proposed layout plans to construction supervisors to ensure they understand the priority on mangrove protection;
- stake, flag or otherwise mark mangroves to be preserved;
- check to monitor whether marked mangroves are encroached; and
- if encroached, notify filling supervisor, and correct operator methods.

### ***Breakwater Construction***

Potential for vessel collisions with dolphins will be mitigated through best practice. Dredging supervisors will be advised of the possible occurrence of dolphins, the need to avoid them with dredging vessels, and the legal vessel speed limits in Tai O Bay.

Design of the slopes of the breakwater is to include rip-rap facing according to the specifications listed in the EIA FAR. The ETL is to monitor the design and implementation process to ensure that the proper rip-rap design and construction methods are used.

## **4.2.2 Operational Phase**

### ***Discharge of Sewage, Bilge and Other Wastes from Vessels***

Potential impacts of water quality degradation on marine fauna will be controlled by the water quality monitoring programme outlined in Chapter 3 of this Manual. That programme should ensure that no unforeseen water quality impacts occur to marine ecological receivers. No additional water quality monitoring measures are proposed specifically for ecological receivers.

### ***Maintenance Dredging of Approach Channels***

Potential impacts of sedimentation on benthos and their habitats, and on the ecology of the filled salt pans will be controlled by the water quality monitoring programme outlined in Chapter 3 of this Manual. That programme should ensure that no unforeseen sedimentation impacts occur to these receivers. No sediment monitoring measures are proposed specifically for ecological receivers.

### ***Facilities Operation at Boatyard***

Any boatyards that are developed on the reclamation areas will need to treat any wastewater generated prior to its discharge. Given this requirement, no specific ecological monitoring programme is proposed.

**Table 4.1: Summary of Construction Stage Impacts and Mitigation Measures.**

Impact Source	Receiver	Potential Impact	Severity	Mitigation Measure	Residual Impact
Dredging of anchorage, approach channels and breakwater site	Benthic fauna (including horseshoe crabs) and subtidal habitats at and near dredging site	± 1.3 ha of permanent habitat loss and ±22 ha of temporary degradation. Mortality of benthos and temporary reduction in habitat area for dolphins due to sedimentation Vessel collisions with dolphins	Minor	1. Control sedimentation per Section 3 of this Manual. 2. Release horseshoe crabs in unaffected areas of Tai O Bay. 3. Advise dredging supervisors to avoid dolphins when operating dredging vessels. 4. Advise dredging supervisors of the legal speed limit for vessels in Tai O Bay.	Acceptable
	Dolphins in and around Tai O Bay		Minor		
			Minor		
Modification of bunds within salt pans	Mangroves	Mortality and short-term habitat loss of ±0.1 ha	Minor	5. Provide mangrove layout map to fill supervisors. 6. Demarcate portions of bunds to be protected during filling. 7. Monitor operator compliance in protecting demarcated zones.	Acceptable
Placement of dredged material into salt pans	Salt pan flora		Minor		
	Intertidal and benthic fauna of salt pans	Insignificant			
	Birds using salt pans	Insignificant			
Breakwater construction	Benthic organisms and dolphins in Tai O Bay	Sedimentation, noise and disturbance	Minor	10. Ensure design includes rip-rap meeting guidelines listed in the EIA. Mitigate dolphin impacts using best current practice. Advise dredging supervisors of the possible occurrence of dolphins, the need to avoid them with dredging vessels, and the legal vessel speed limits in Tai O Bay.	Acceptable

**Table 4.2: Summary of Operation Phase Impacts and Mitigation Measures.**

Activity	Receiver	Potential Impact	Severity	Requirement for Mitigation	Residual Impact
Discharge of sewage, bilge and other wastes from boats	Subtidal and intertidal fauna of Tai O Bay and its shores, including the salt pans	Degradation of water quality, physiological stress on biota	Minor	11. Implement water quality control measures listed in Section 3 of this Manual.	Acceptable
Maintenance dredging of approach channels	Benthic fauna along channels	Smothering	Minor	12. Implement water quality control measures listed in Section 3 of this Manual.	Acceptable
	Salt pan ecology	Sedimentation	Insignificant	13. Implement water quality control measures listed in Section 3 of this Manual.	Acceptable
Operation of boat maintenance facilities on new reclamations	Subtidal fauna of Tai O Bay	Pollution, leading to reduced reproduction or survivorship	Would depend on type/scale of activities	14. Implement water quality control measures listed in Section 3 of this Manual. Any process wastes must be treated prior to discharge.	Acceptable

## 5 CULTURAL HERITAGE

### 5.1 Introduction

The cultural heritage impact assessment has shown that of the historical features associated with the Tai O salt pan area, the portion of the outer seawall located in front of Fan Kwai Tong remains in good repair and exhibits many of the original features of its design. In addition, whilst breaches to the outer seawall are required to facilitate development of a mangrove habitat, such breaches should be kept to the absolute minimum and should only be considered in areas of the outer seawall that are already degraded. The areas of the seawall to be breached will be identified during the detailed design. The key features of the salt pan outer seawall are shown in **Figure 5.1**.

The EIA – FAR has indicated that in order to ensure that any marine archaeological material is protected during the dredging works, a watching brief should be considered. However, it is noted that the Antiquities and Monuments Office (AMO) of the Home Affairs Bureau will undertake a geophysical marine archaeological investigation survey, after which the requirement for a watching brief will be re-evaluated.

### 5.2 Protection Measures for the Outer Seawall

It has been recommended in the EIA – FAR that measures are incorporated into the construction contract to ensure that the portion of the outer seawall in areas that are not being breached to facilitate salt pan area tidal flushing are not damaged.

Prior to the commencement of the Works, the ET and the Contractor shall set out the areas of the seawall to be protected and shall restrict access thereto (using high visibility reflective tape or similar).

The Contractor shall ensure that all staff (including any sub-Contractors) working on the Site shall be aware of the significance of the outer seawall and the need to prevent unnecessary damage when working in the area.

In accordance with the requirements of Section 6.1, the ET Leader is responsible for the formulation of the environmental reporting plan for site inspections. For the avoidance of doubt, this shall include regular checking of the outer seawall to ensure that the contract specifications have been maintained.

### 5.3 Watching Brief

In order to protect many marine archaeological material in Tai O Bay, unless indicated to be unnecessary by the AMO geophysical survey, a watching brief should be maintained during the proposed dredging works. A watching brief is a standard archaeological practice and is defined as follows:

*"a formal programme of observation and investigation conducted during any operation carried out for non-archaeological reasons within a specified area or site on land or underwater, where there is a possibility that archaeological deposits may be disturbed or destroyed"* (Institute of Field Archaeologists (1997) Standard Guidance for Archaeological Watching Briefs).

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The watching brief should be maintained throughout the dredging period by a suitably qualified person. If archaeological material are found, AMO should be contacted immediately to seek guidance on its significance and appropriate mitigation measures should be prepared thereafter.



## 6 ENVIRONMENTAL AUDIT

### 6.1 Site Inspection

Site Inspections provide a direct means to trigger and enforce the specified environmental protection and pollution control measures. They shall be undertaken routinely 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.

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.

Regular site inspections shall be carried out at least once per week. The areas of inspection shall not be limited to the environmental situation, 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.

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 ER 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.

*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.

A mitigation implementation status proforma and a site inspection proforma are provided in **Appendices C1** and **C2** respectively.

## 6.2 Compliance with Legal and Contractual Requirements

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.

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 be sent to the ET Leader for vetting to see whether sufficient environmental protection and pollution control measures have been included.

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.

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.

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 also advise the Contractor and the ER accordingly.

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.

A regulatory compliance proforma is presented in **Appendix C3**.

## 6.3 Environmental Complaints

Complaints shall be referred to the ET Leader for carrying out complaint investigation procedures. The ET Leader shall undertake the following procedures upon receipt of the complaints:

- (a) log complaint and date of receipt onto the complaint database;
- (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) undertake additional monitoring and audit to verify the situation if necessary, and review that any valid reason for complaint does not recur;
- (h) report the investigation results and the subsequent actions to the source of complaint for responding to complainant (If the source of complaint is EPD, the results should be reported within the time frame assigned by EPD); and
- (i) record the complaint, investigation, the subsequent actions and the results in the monthly EM&A reports.

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.

A flow chart of the complaint response procedures is shown in **Figure 6.1**.

A complaint log sheet is provided in **Appendix C4**.

## 7 REPORTING

### 7.1 General

The following reporting requirements based upon a paper documented approach. However, the same information can be provided in 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 agreed by ER and EPD.

### 7.2 Baseline Monitoring Report

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 each of the four parties: the Contractor, the IEC, the ER and the EPD. The ET Leader shall liaise with the relevant parties on the exact number of copies they want. 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;
  - equipment used and calibration details;
  - parameters monitored;
  - monitoring locations (and depth);
  - monitoring date, time, frequency and duration;
- (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 Action and Limit Levels for each monitoring parameter and statistical analysis of the baseline data;
- (g) revisions for inclusion in the EM&A Manual; and
- (h) comments and conclusions.

### 7.3 EM&A Reports

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 and

submitted within 10 working days of the end of each reporting month, with the first report due in the month after construction commences. A maximum of 4 copies of each monthly EM&A report shall be submitted to each of the four parties: the Contractor, the IEC, the ER and the EPD. 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.

### 7.3.1 First Monthly EM&A Report

The first monthly EM&A report shall include at least the following :

- (a) executive summary (1-2 pages)
  - breaches of Action and Limit levels;
  - complaint log;
  - notifications of any summons and successful prosecutions;
  - reporting changes; and
  - future key issues.
- (b) basic project information
  - project organisation including key personnel, contact names and telephone numbers;
  - construction programme with fine turning of construction activities showing the interrelationship with environmental mitigation measures for the month;
  - management structure; and
  - works undertaken during the month.
- (c) environmental status
  - works undertaken during the month with illustrations such as location of works; and
  - drawing showing the project area, any environmental sensitive receivers and the locations of the monitoring stations.
- (d) a brief summary of EM&A requirements including:
  - all monitoring parameters;
  - environmental quality performance limits (Action and Limit levels);
  - Event-Action Plans;
  - environmental mitigation measures, as recommended in the project EIA study final report; and
  - environmental requirements in contract documents;
- (e) implementation status
  - 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.
- (f) monitoring results (in both hard and diskette copies)

- 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;
  - any other factors which might affect the monitoring results;
  - QA/QC results and detection limits; and
  - all monitoring results should be tabulated with exceedances highlighted for ease of referencing.
- (g) report on non-compliance, complaints, notification of summons and successful prosecutions
- record of all non-compliance (exceedances) of the environmental quality performance limits (Action and Limit levels);
  - record of all complaints received (written or verbal) for each media, including locations and nature of complaints, liaison and consultation undertaken, actions and follow-up procedures taken and summary of complaints;
  - 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 non-compliance and deficiency reporting and nay follow-up procedures related to earlier non-compliance.
- (h) others
- an account of the future key issues as reviewed from the works programme and work method statements;
  - advice on the solid and liquid waste management status; and
  - submission of implementation status proforma, environmental protection proforma regular compliance proforma, site inspection proforma and complaint log, etc, summarising EM&A of the period.

### 7.3.2 Subsequent 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;
  - notification of any summons and successful prosecutions;
  - future key issues
- (b) environmental status
- construction programme with fine tuning of construction activities showing the

- interrelationship with environmental protection/mitigation measures for the month;
  - works undertaken during the month with illustrations including key personnel contact names and telephone numbers; and
  - drawing showing the project area, any environmental sensitive receivers and the locations of the monitoring stations.
- (c) implementation status
- 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.
- (d) monitoring results (in both hard and diskette copies)
- 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;
  - any other factors which might affect the monitoring results;
  - QA/QC results and detection limits; and
  - all monitoring results should be tabulated with exceedances highlighted for ease of referencing.
- (e) report on non-compliance, complaints, notification of summons and successful prosecutions
- record of all non-compliance (exceedances) of the environmental quality performance limits (Action and Limit levels);
  - record of all complaints received (written or verbal) for each media, including locations and nature of complaints, liaison and consultation undertaken, actions and follow-up procedures taken and summary of complaints;
  - 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 non-compliance and deficiency reporting and nay follow-up procedures related to earlier non-compliance.
- (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
- Action and Limit levels;
  - graphical plots of trends of monitored parameters at key stations over the past four

reporting periods for representative monitoring stations annotated against the following :

- 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; and
  - outstanding issues and deficiencies.

### 7.3.3 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 monitoring work is proving effective and that is generating data with 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;
  - environmental quality performance limits (Action and Limit levels); and
  - environmental mitigation measures, as recommended in the project EIA study final 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 non-compliance (exceedances) of the environmental quality performance limits (Action and Limit levels);



- (i) a brief review of the reasons for and the implications of non-compliance including review of pollution sources and working procedures;
- (j) a summary description of the actions taken in the event of non-compliance and any follow-up procedures related to earlier non-compliance;
- (k) a summary record of all complaints received (written or verbal) for each media, liaison and consultation undertaken, actions and follow-up procedures taken;
- (l) 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-action taken and results;
- (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.

#### 7.4 Final EM&A Reports

The termination of EM&A programme shall be determined on the following basis:

- (a) completion of construction activities and insignificant environmental impacts of the remaining outstanding construction works;
- (b) Trends analysis to demonstrate the narrow down of monitoring exceedances due to construction activities and the return of ambient environmental conditions in comparison with baseline data; and
- (c) no environmental complaints and prosecution involved.

The final EM&A report should contain at least the following information:

- (a) an executive summary (1-2 pages);
- (b) basic project information including a synopsis of the project organisation, contacts of key management, and a synopsis of work undertaken during the entire construction period;
- (c) a brief summary of EM&A requirements including:
- (d) advice on the implementation status of environmental protection and pollution control/mitigation measures, as recommended in the project EIA study final report, summarised in the updated implementation proformas;
- (e) drawings showing the project area, any environmental sensitive receivers and the locations of the monitoring stations;
- (f) graphical plots and the statistical analysis of the trends of monitored parameters over the

construction project for representative monitoring stations annotated against:

- (g) compare and contrast the EM&A data with the EIA predictions and annotate with explanation for any discrepancies;
- (h) provide clear-cut decisions on the environmental acceptability of the project with reference to the specific impact hypothesis;
- (i) advice on the solid and liquid waste management status;
- (j) a summary of non-compliance (exceedances) of the environmental quality performance limits (Action and Limit levels);
- (k) a brief review of the reasons for and the implications of non-compliance including review of pollution sources and working procedures as appropriate;
- (l) a summary description of the actions taken in the event of non-compliance and any follow-up procedures related to earlier non-compliance;
- (m) a summary record of all complaints received (written or verbal) for each media, liaison and consultation undertaken, actions and follow-up procedures taken;
- (n) review the monitoring methodology adopted and with the benefit of hindsight; comment on its effectiveness (including cost effectiveness);
- (o) 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-action taken and results;
- (p) review the practicality and effectiveness of the EIA process and EM&A programme (e.g. effectiveness and efficiency of the mitigation measures), recommend any improvement in the EM&A programme; and
- (q) a conclusion to state the return of ambient and/or the predicted scenario as per EIA findings.

## 7.5 Data Keeping

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 and be ready for inspection upon request. All relevant information shall be clearly and systematically recorded in the document. The monitoring data shall also recorded in magnetic media form, and the software copy can be available upon request. All the document and data shall be kept for at least one year after completion of the construction contract.

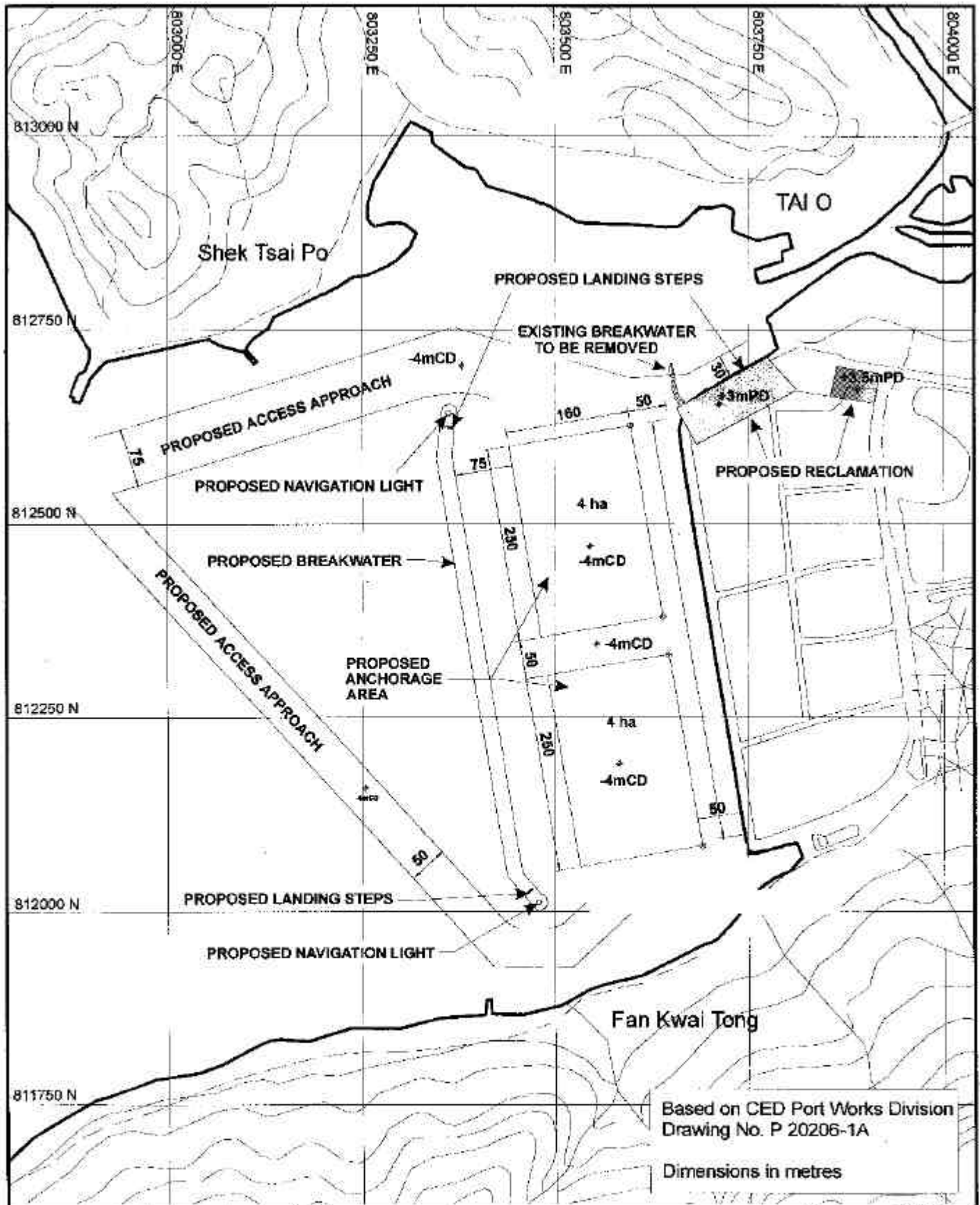
A software copy of the monitoring data (including baseline data) should be submitted to EPD along with the EM&A reports.

## 7.6 Interim Notifications of Environmental Quality Limit Exceedances

With reference to Event/Action Plans in **Tables 2.3** and **3.4**, when the environmental quality limits are exceeded, the ET shall immediately notify the ER, IEC and EPD, as appropriate. The notification shall be followed up with advice to IEC and EPD on the results of the investigation, proposed action and success of the action taken, with any necessary follow-up proposals. An interim notification form is shown in **Appendix D** for reference.



## FIGURES



Based on CED Port Works Division Drawing No. P 20206-1A

Dimensions in metres

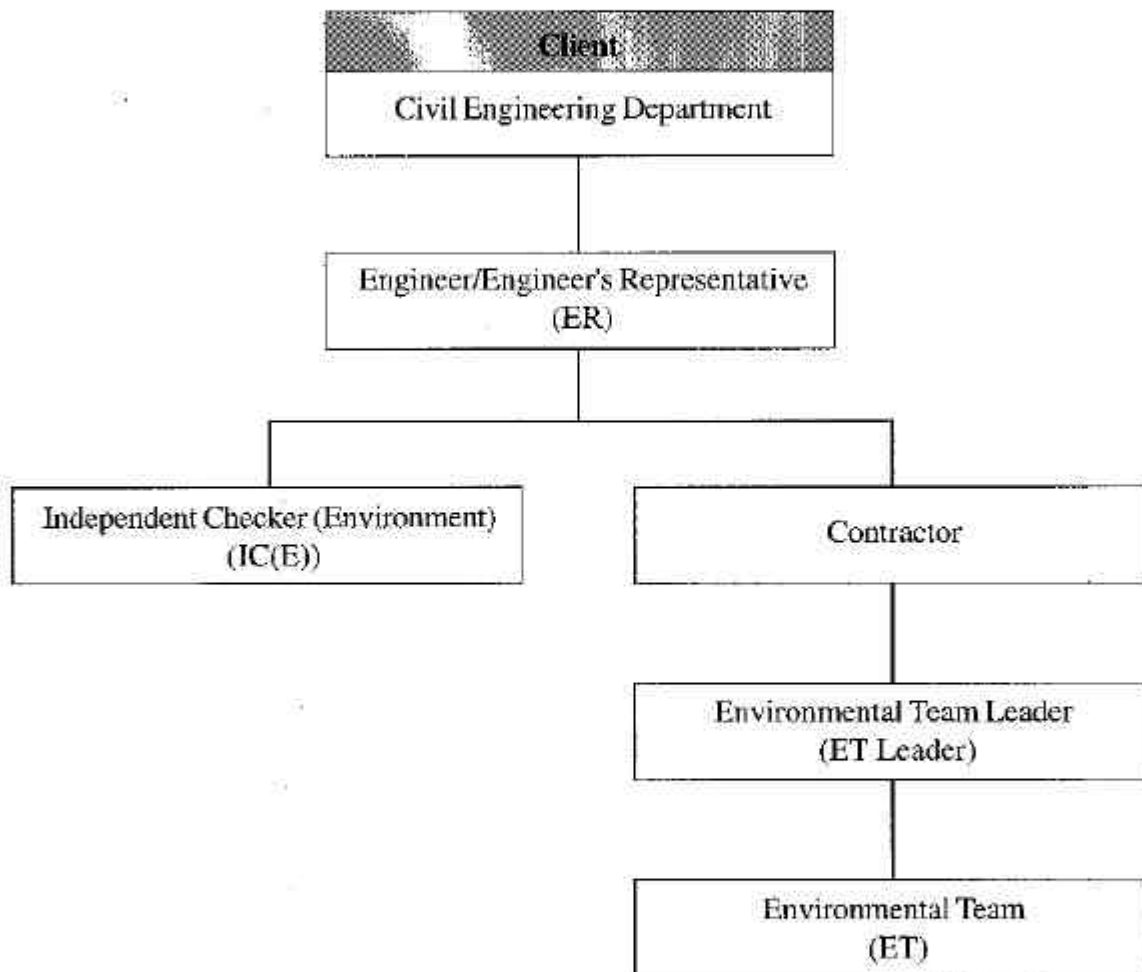


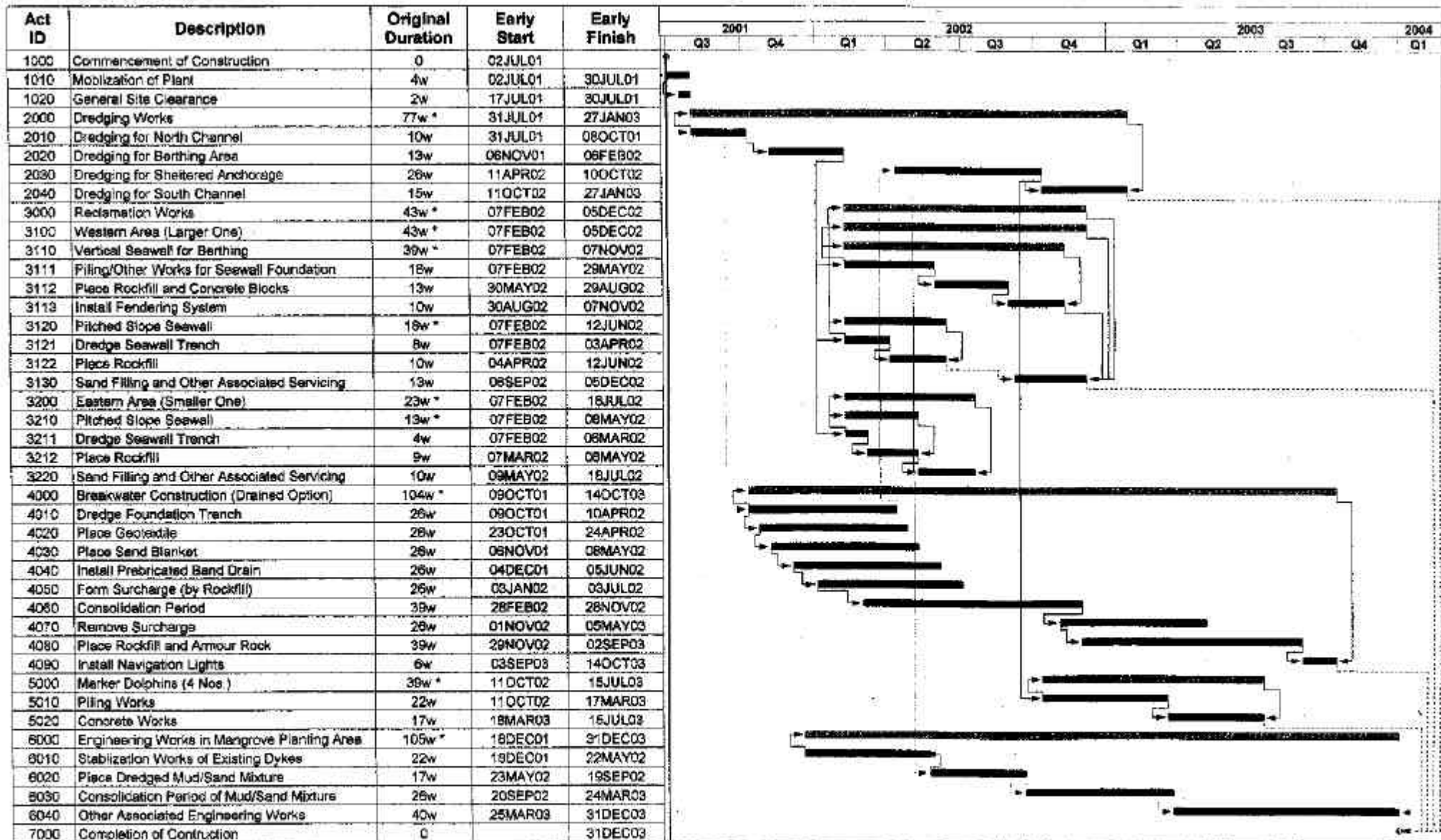
**GENERAL LAYOUT OF PROPOSED WORKS**

AGREEMENT No. CE 41/98  
 ENVIRONMENTAL AND DRAINAGE  
 IMPACT ASSESSMENT FOR  
 TAI O SHELTERED BOAT ANCHORAGE

Figure No.	1.1	
Scale	N.T.S.	
Drawn	Approved	Revised
JML		
Checked	Date	Date
JML		

Figure 1.2 Project Organisation Chart





Start date 01JUL01  
 Finish date 31DEC03  
 Data date 01JUL01  
 Run date 23MAR99  
 Page number 1A

Primavera Systems, Inc.

PWP Item No. 236CL  
 Tai O Development Package 4 Stage II  
 Sheltered Boat Anchorage - Construction Programme

Figure 1.3

- Early bar
- Progress bar
- Critical bar
- Summary bar
- ⊕ Start milestone point
- ⊖ Finish milestone point

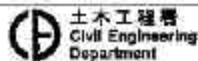
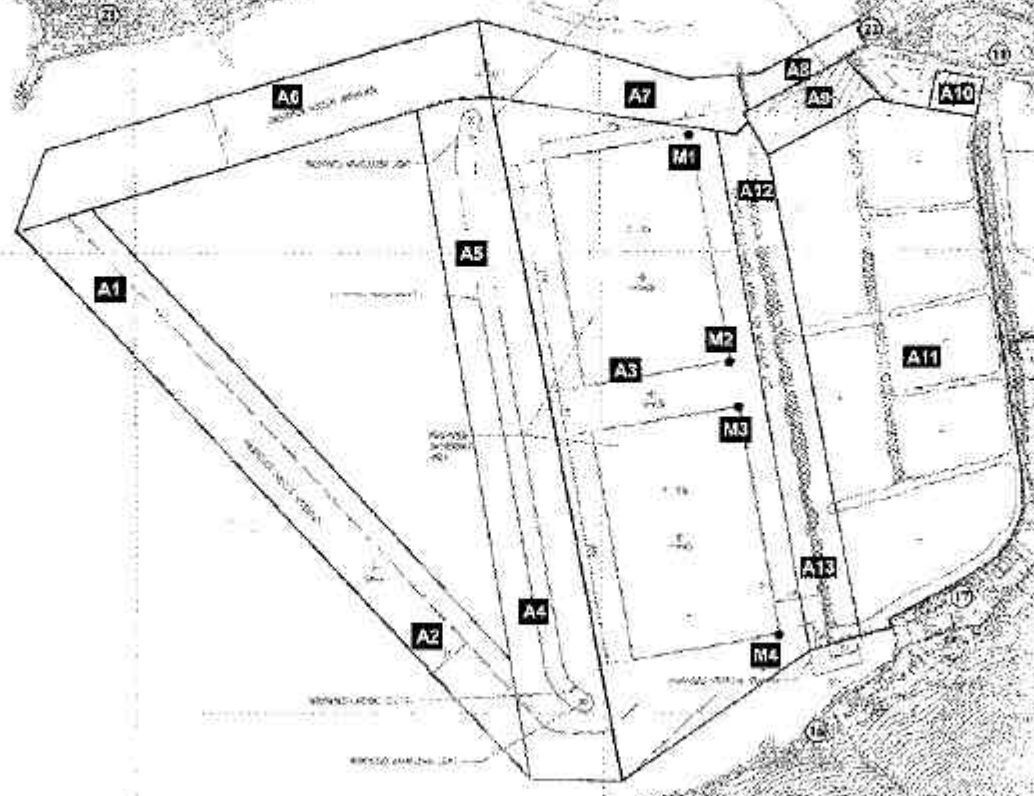


**Noise Sensitive Receivers**

- \* ① Village House in Shek Tsai Po
- ② Village House in Shek Tsai Po
- ③ Village House along Shek Tsai Po Street
- ④ School near Shek Tsai Po
- ⑤ Temple in Shek Tsai Po
- ⑥ Clinic
- ⑦ Community Centre
- ⑧ Village House
- \* ⑨ School
- ⑩ Church
- \* ⑪ Lung Tin Estate Phase 2 Area B
- ⑫ Lung Tin Estate Phase 1
- ⑬ Buddhist Pui Hoi Members College near Tai O Road
- ⑭ Temple at Sau Tsuen
- ⑮ Chung Uk/Sau Tsuen
- ⑯ Leung Uk Tsuen
- \* ⑰ Nam Chung Tsuen
- ⑱ Nam Chung
- ⑲ Fai Kwai Tong
- \* ⑳ Village House
- ㉑ Police Quarters
- ㉒ Village House
- ㉓ Village Housing

\* Proposed Baseline Noise Monitoring Locations

- A** Proposed Work Sites
- M** Marker Dolphins



AGREEMENT NO. CE 41-00  
ENVIRONMENTAL AND DRAINAGE (EM/ED)  
ASSESSMENT REPORT FOR DEVELOPMENT  
SCAFFOLDING

Drawn 設計	Scale 比例	Checked 校核	Approved 批准
Scale 比例	Scale 比例	Date 日期	Date 日期
Scale 比例	Scale 比例	Scale 比例	Scale 比例

Locations of Proposed Work Sites,  
Representative Noise Sensitive Receivers  
and Noise Monitoring Stations

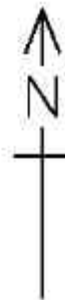
Scott Wilson (Hong Kong) Ltd  
信信顧問(香港)有限公司





	EASTING	NORTHING	NOTES
1	802250	813200	● - CONTROL (EBB)/IMPACT (FLOOD)
2	801900	812710	● - IMPACT
3	801850	812060	● - IMPACT
4	802050	811530	● - CONTROL (FLOOD)/IMPACT (EBB)
5	803844	812839	● - IMPACT
6	803571	812362	⊙ - IMPACT
7	802894	812601	⊙ - CONTROL
8	803110	811906	⊙ - CONTROL

- CONSTRUCTION PHASE
- ⊙ OPERATIONAL PHASE



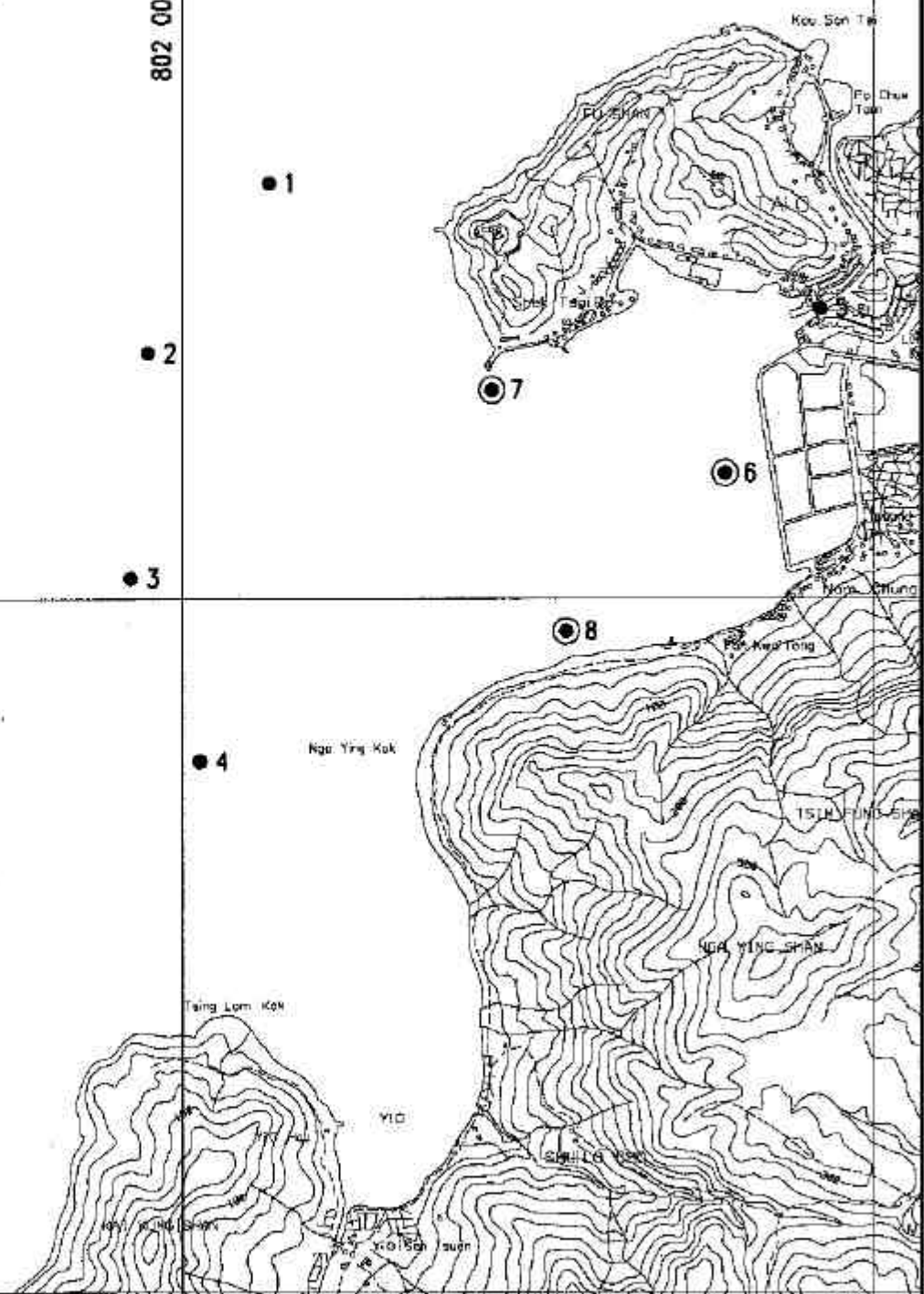
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Title <b>WATER QUALITY MONITORING LOCATIONS</b>		Figure No. 圖則編號 <b>3.1</b>		
		Drawn 設計 NYH	Checked 核校 SRW	
<b>TAI O SHELTERED BOAT ANCHORAGE (AGREEMENT CE 4/98)</b>	Scale 比例 1 : 20000		Status 現況	

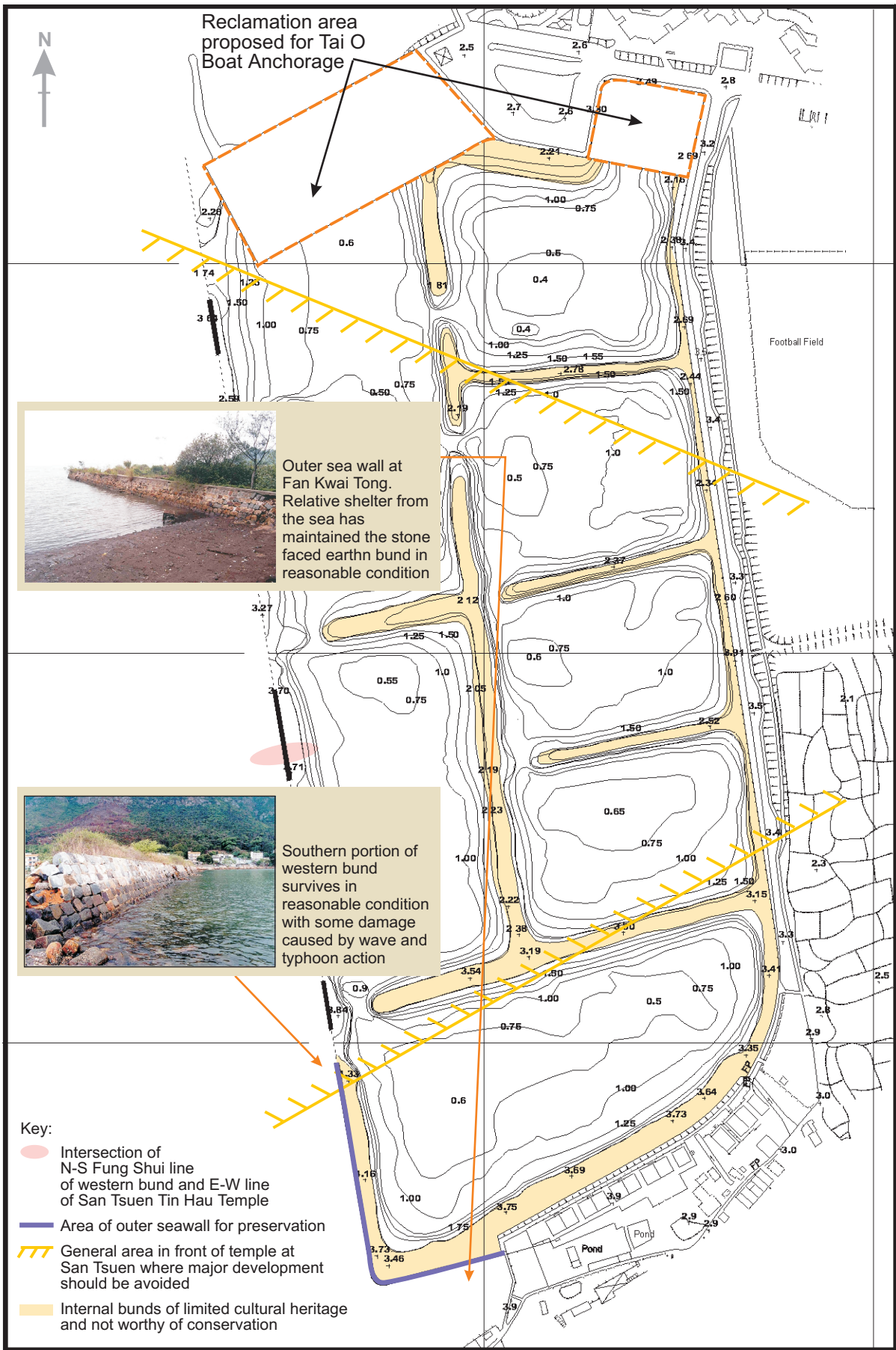
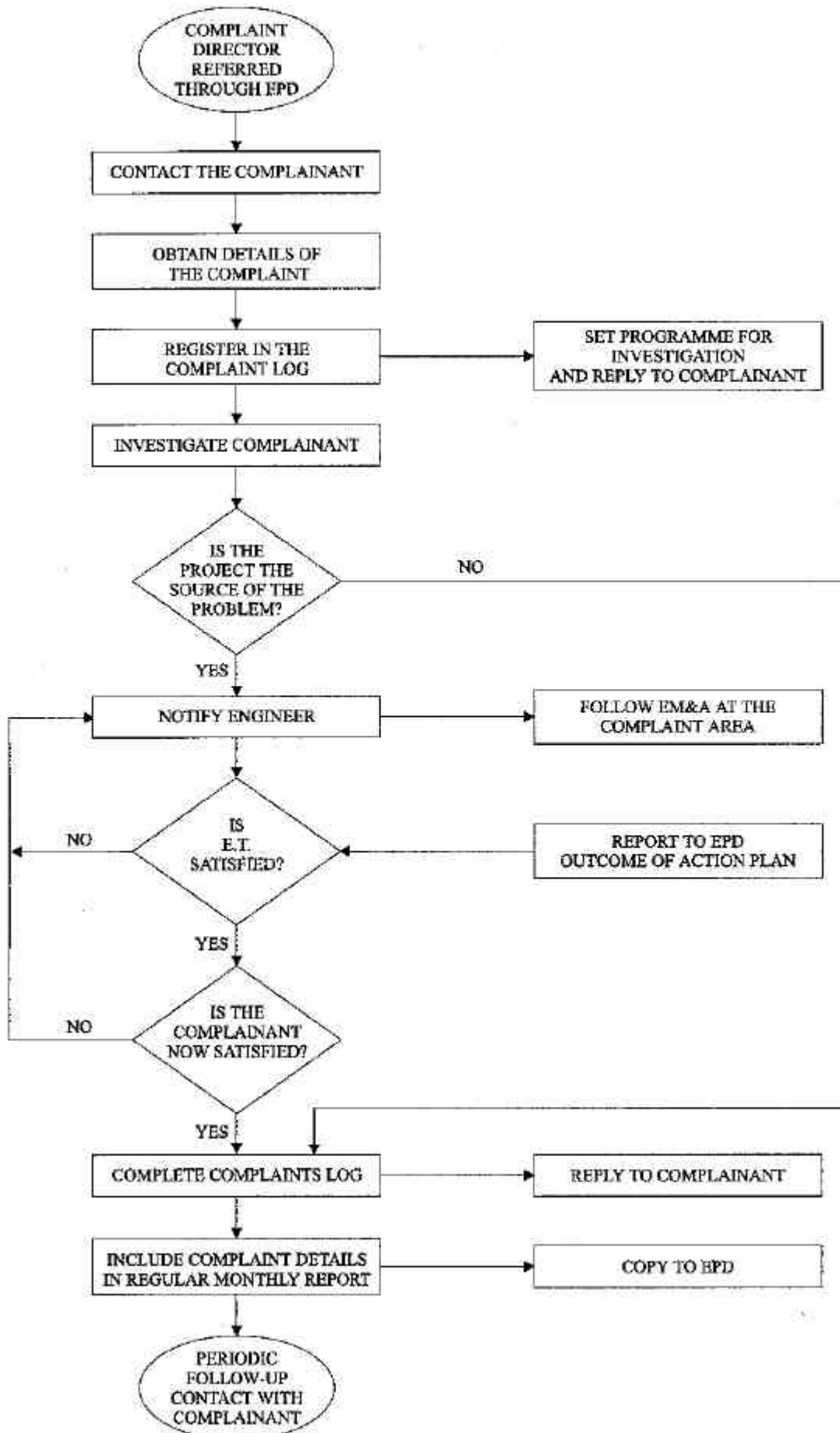


Figure 5.1 Existing Cultural Heritage Interest of the Salt Pans

Figure 6.1 Complaint Response Procedures - Action Flow Chart





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## APPENDICES

## Appendix A

### PROPOSED SCHEDULE FOR CONSTRUCTION AND PLANT GROUPS

**Appendix A1: Proposed Schedule for Construction and PME Development.**

Year	2001		2002				2003				2004	
	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	
Work Site												
Area 1 & Area 2						G1	G1					
Area 3				G1	G1							
Area 4 & Area 5		G5-8	G5-9	G5-9		G9, G10	G9, G10	G9, G10	G10			
Area 6	G1											
Area 7	G1											
Area 8		G1										
Area 9			G2, G3	G2, G3	G10	G4						
Area 10			G3	G4	G4							
Area 11				G14	G14							
Area 12 & Area13		G13	G13									
Marker Dolphins 1						G11, G12	G11, G12	G11, G12	G11, G12			
Marker Dolphins 2						G11, G12	G11, G12	G11, G12	G11, G12			
Marker Dolphins 3						G11, G12	G11, G12	G11, G12	G11, G12			
Marker Dolphins 4						G11, G12	G11, G12	G11, G12	G11, G12			

**Notes :**

Work Site Refers to the Work Site Shown in **Figure 2.1**

G(x) Refers to the Plant Group Described in **Appendix A2**

## Appendix A2: Plant Groups.

Groups	Construction Activities
G1	Dredging Works
G2	Reclamation Works – Vertical Seawall
G3	Reclamation Works – Pitched Slope Seawall
G4	Reclamation Works – Sand Filing and Other Services
G5	Breakwater Construction – Dredging Trench
G6	Breakwater Construction – Geotextile
G7	Breakwater Construction – Sand Blanket
G8	Breakwater Construction – Prefabricated Band Drains
G9	Breakwater Construction – Surcharge
G10	Breakwater Construction – Rock Fill and Armour Rock
G11	Marker Dolphins – Piling Works
G12	Marker Dolphins – Concrete Works
G13	Engineering Works in Mangrove Planting Area – Stabilisation Works of Existing Dykes
G14	Engineering Works in Mangrove Planting Area – Placement of Dredged Mud

## Appendix B

### ENVIRONMENTAL MONITORING DATA RECORDING SHEETS





**Appendix B1: 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 <sub>90</sub> (dB(A))	
	L <sub>10</sub> (dB(A))	
	Leq(dB(A))	
Major Construction Noise Source(s) During Monitoring		
Other Noise Source(s) During Monitoring		
Remarks		

Name & Designation

Signature

Date

Field Operator : \_\_\_\_\_

Checked by : \_\_\_\_\_

**Appendix B2: Water Quality Monitoring Field Record Sheet.**

Location		
Date		
Start Time (hh:mm)		
Weather		
Water Depth (m)		
Temperature (C)		
Turbidity (NTU)		
Sample Identification		
SS (mg/l)		
DO (mg/l)		
Observed Construction Activities	< 100m from location	
	> 100m from location	
Other Observations		

Name & Designation

Signature

Date

Checked by : \_\_\_\_\_

Recorded by : \_\_\_\_\_

Note: The SS results are to be entered once they are available from the laboratory.



## Appendix C

### ENVIRONMENTAL PROFORMAS



**APPENDIX C1: IMPLEMENTATIONS STATUS PROFORMA.**

Ref : \_\_\_\_\_

Ref**	Environmental Protection Measures*	Implementation Status

\* All recommendations and requirements resulted during the Course of EIA/EA Process, including ACE and for 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: \_\_\_\_\_



**APPENDIX C2: 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, process, 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)



**APPENDIX C3: 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 license/permittee

Recorded by Environmental Team Leader: \_\_\_\_\_

Date: \_\_\_\_\_

Signed by Independent Checker (Environment): \_\_\_\_\_

Date: \_\_\_\_\_



**APPENDIX C4: 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: \_\_\_\_\_

## Appendix D

### INTERIM NOTIFICATIONS OF ENVIRONMENTAL QUALITY LIMITS EXCEEDANCES





**Appendix D: Sample Template for Interim Notifications of Environmental Quality Limit Exceedances.**

Incident Report on Action Level or Limit Level Non-compliance

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

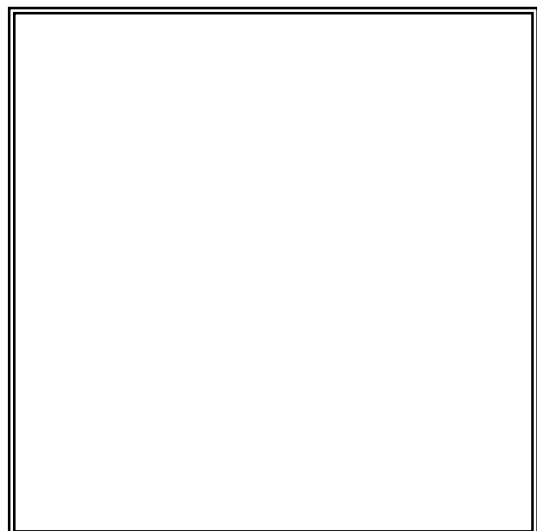
**Location Plan**

Prepared by : \_\_\_\_\_

Designation : \_\_\_\_\_

Signature : \_\_\_\_\_

Date : \_\_\_\_\_



## Appendix E

### IMPLEMENTATION SCHEDULE OF MITIGATION MEASURES

**Appendix E: Implementation Schedule of Recommended Mitigation Measures - Tai O Sheltered Boat Anchorage (Agreement No. CE/41/98).**

EIA FAR Ref.	Environmental Protection Measures	Location/Timing	Funding Agent	Implementation Agent	Maintenance Agent	Implementation Stages		
						D	C	O
<b>NOISE MITIGATION MEASURES</b>								
3.8.5	Good Site Practice as follows*: <ul style="list-style-type: none"> <li>• use of well-maintained and regularly-serviced plant during the works</li> <li>• plant operating on an intermittent basis should be turned off or throttled down when not in active use</li> <li>• plant that is known to emit noise strongly in one direction should be orientated to face away from the NSRs</li> <li>• silencers, mufflers and enclosures for plant should be used where possible and maintained adequately throughout the works</li> <li>• where possible mobile plant should be sited away from NSRs</li> <li>• stockpiles of excavated materials and other structures such as site buildings should be used effectively to screen noise from the works</li> </ul>	All work sites/CP	CED	Contractor	N/A		✓	
3.9	Quiet plant (refer to Table 3.11 in the FAR) and barriers for Group 2 PME	All work sites/CP		Contractor	N/A		✓	
	Barriers for Group 3 PME	All work sites/CP		Contractor	N/A		✓	
	Quiet plant (refer to Table 3.11 in the FAR) and barriers for Group 4 PME	All work sites/CP		Contractor	N/A		✓	
	Quiet plant (refer to Table 3.11 in the FAR) for Group 12 PME	All work sites/CP		Contractor	N/A		✓	
	Quiet plant (refer to Table 3.11 in the FAR) for Group 13 PME	All work sites/CP		Contractor	N/A		✓	
	Quiet plant (refer to Table 3.11 in the FAR) and barriers for Group 14 PME	All work sites/CP		Contractor	N/A		✓	
	No Group 1 works at work site A8 during Q4 of year 2001	School NSR 9/CP during examinations		Contractor	N/A		✓	

EIA FAR Ref.	Environmental Protection Measures	Location/ Timing	Funding Agent	Implementation Agent	Maintenance Agent	Implementation Stages		
						D	C	O
	No Group 2 and Group 3 works undertaken concurrently at work site A9 during Q1 and Q2 of 2002 (i.e. either Group 2 or Group 3 works should be carried out at any one time)	School NSR 9/ CP during examinations	CED	Contractor	N/A		✓	
	No Group 5 to Group 9 works (inclusive) at work-sites A4 and A5 during Q1 and Q2 of 2002	School NSR 9/ CP during examinations		Contractor	N/A		✓	
<b>WATER QUALITY MITIGATION</b>								
5.10.1	Dredging Best Practice – includes the following*: <ul style="list-style-type: none"> <li>• minimisation of unnecessary disturbance to the sediments by exerting care when lowering and lifting the grab</li> <li>• all vessels used should be sized such that adequate clearance of the seabed is maintained at all stages of the tidal cycle and ensure that undue turbidity is not generated by turbulence from vessel movement or propeller wash</li> <li>• the Contractor should use barges that are fitted with tight fitting seals to their bottom openings to prevent leakage of material</li> <li>• the Contractor should ensure accurate barge loading to avoid splashing of dredged material to the surrounding water</li> <li>• the Contractor should ensure that grabs close tightly and that hoist speeds are suitably low</li> <li>• barges or hoppers should not be filled to a level which will cause the overflow of materials or polluted water during loading or transportation. Adequate freeboard should be maintained to ensure that the decks are not washed by wave action</li> </ul>	Dredging sites/CP+AO	CED	Contractor	N/A		✓	✓

EIA FAR Ref.	Environmental Protection Measures	Location/ Timing	Funding Agent	Implementation Agent	Maintenance Agent	Implementation Stages		
						D	C	O
	<ul style="list-style-type: none"> <li>the Contractor should manually remove large objects and debris prior to mechanical dredging to minimise losses from partially closed grabs</li> <li>dredging should be undertaken taking into account tidal conditions;</li> <li>construction works should cause no visible foam, oil, grease, scum, litter or other objectionable matter to be present in the water within the site or dumping grounds</li> <li>appropriate monitoring of water quality during dredging works should be undertaken to allow the implementation of appropriate action plans to prevent any unacceptable water quality impacts (refer to Section 5.12 in the FAR). Through this approach, water quality impacts during dredging can be controlled and limited</li> </ul>	Dredging sites/CP+AO	CED	Contractor	N/A		✓	✓
	Where contaminated sediments as defined by EPD Technical Circular 1-1-92 are being dredged the Best Dredging Practices defined above should be implemented together with the following: <ul style="list-style-type: none"> <li>contaminated sediments should be dredging using grabs of no more than 8m<sup>3</sup></li> <li>transport of contaminated mud to marine disposal sites should, wherever possible, be by split barges of not less than 750m<sup>3</sup> capacity, well maintained and capable of rapid opening and discharge at the disposal site</li> <li>monitoring of the barge loading to ensure that loss of material does not take place during transportation</li> <li>on-site auditing of the equipment and plant is essential to ensure that it is used in the appropriate manner</li> </ul>	Dredging sites/CP+AO		Contractor	N/A		✓	✓
	The number of grab dredgers operating simultaneously in Tai O Bay should be restricted to two	Dredging sites/CP		Contractor	N/A		✓	
	Silt curtain should be used at mouth of Tai O Creek to prevent excess sedimentation of the creek	Mouth of Tai O Creek		Contractor	N/A		✓	
5.10.2	Reduce silt laden runoff through implementation of ProPECC Note PN 1/94 "Construction Site Drainage"	Reclamation areas/CP	CED	Contractor	N/A		✓	

EIA FAR Ref.	Environmental Protection Measures	Location/ Timing	Funding Agent	Implementation Agent	Maintenance Agent	Implementation Stages		
						D	C	O
5.10.3	Reduce silt laden runoff through implementation of ProPECC Note PN 1/94 "Construction Site Drainage"	Salt pans/ During filling		Contractor	N/A		✓	
	Material placement and reworking should only occur during low tidal conditions	Salt pans/ During filling		Contractor	N/A		✓	
	Material should be dredged using grab dredged to minimise moisture content and allow rapid material consolidation	Salt pans/ During filling		Contractor	N/A		✓	
	Low rate of sediment reworking in order to minimise sediment disturbance (i.e. placement of approximately 100m <sup>3</sup> of dredged material in the salt pans per day and reworking of approximately 230m <sup>3</sup> of material a day)	Salt pans/ During filling		Contractor	N/A		✓	
	Placed mud should be mixed with the relatively coarser salt pan bed material to reduce erosion potential	Salt pans/ During filling		Contractor	N/A		✓	
	All material should be spread and mixed with existing bed material before completion of the day's work such that there is no material stockpiling	Salt pans/ During filling		Contractor	N/A		✓	
	The outer seawall should be breached in order to reduce velocity of water entering and leaving the salt pans and thus reduce the risk of erosion of newly placed or moved materials. Material from around the breached areas should be removed prior to reworking	Salt pans/ During filling		Contractor	N/A		✓	
5.10.4	Provide temporary toilet facilities/use existing municipal toilet facilities	Contractors works compound/CP		Contractor	N/A		✓	
5.11.1	Provision of notices and leaflets to prevent sewage and bilge discharges within the anchorage	Waterfront locations of reclamations/ AO		TDD / DO	TDD / DO			✓
5.11.3	Surface water from the eastern reclamation should be directed towards the mangrove planting area	Eastern reclamation/ During design		CED	N/A	✓		
	Surface water from the western reclamation should be directed to a dry weather interceptor prior to discharge to Tai O Bay/Creek	Western reclamation/ During design	CED	CED	N/A	✓		
5.11.4	Sewerage systems at the reclamation areas should connect to existing trunk sewerage system	Reclamations		CED	DSD	✓		

EIA FAR Ref.	Environmental Protection Measures	Location/ Timing	Funding Agent	Implementation Agent	Maintenance Agent	Implementation Stages		
						D	C	O
5.11.5	Centralised wastewater collection and treatment facility should be used at the boat maintenance facilities	Western reclamation/ During design		CED	System operators	✓		
<b>ECOLOGICAL MITIGATION</b>								
6.6.1	Dredging Best Practice methods specified in Section 5.10.1 of the FAR*	Breakwater, anchorage, approach channel dredging sites/CP	CED	Contractor	N/A		✓	
6.6.4	Grab dredge placement of sediments in salt pans; do not completely embay salt pans during filling (also refer to water quality mitigation measures)	Salt pans/ CP		Contractor	N/A		✓	
	Distribute sediments within salt pans using low-ground-pressure track equipment	Salt pans/ CP		Contractor	N/A		✓	
	Demarcate existing mangroves to be preserved using flagging. Inform equipment operators to protect mangroves on salt pans	Salt pans/ Prior to filling		Environmental Team Leader	N/A		✓	
	Monitor equipment operators to ensure mangroves are protected	Salt pans/ During filling		Environmental Team	N/A		✓	
	Rework salt pans principally between August and March*	Salt pans/ During filling		CED (design) Contractor (construction)	N/A	✓	✓	
6.6.5	Design rock facing of breakwater to simulate rocky shore to simulate natural boulder or rock shore	Breakwater/ During design		CED (design)	N/A	✓		
6.6.5	Advise dredging supervisors to avoid dolphins when operating dredging vessels	Dredging Sites/CP	CED	Contract	N/A		✓	
6.6.6	Implement control measures to minimise erosion and escape of sediments from the reclamation sites in accordance with ProPECC PN 1/94	Reclamation/ CP		Contractor	N/A		✓	
6.6.7	Implement control measures specified in Section 5.10 of the FAR	Works sites/CP		Contractor	N/A		✓	

EIA FAR Ref.	Environmental Protection Measures	Location/ Timing	Funding Agent	Implementation Agent	Maintenance Agent	Implementation Stages		
						D	C	O
6.7.1	Water quality mitigation measures defined in Section 5.11 of the FAR	Anchorage/ AO		CED (design) Contractor (construction)	DSD	✓	✓	
	Plant mangroves in salt pans to mitigate impacts of sewage/bilge discharged into the anchorage	Salt pans/ Post- construction stage		AFD	N/A			✓
6.7.3 7.8.1	Dredging Best Practice methods specified in Section 5.10.1 of the FAR*	Approach channels/ AO		Contractor	N/A			✓
6.7.3	Water quality mitigation measures defined in Section 5.11 of the FAR	Reclamation areas/AO		Boat maintenance facilities operators	Boatyard operators			✓
	Control measures for control of maintenance dredging sediment during operation specified in Section 5.10.1 of the FAR	Approach channels/AO		Contractor	N/A			✓
6.7.5	Implement water quality controls as specified in Section 5.11 of the FAR	Reclamation areas/AO		Boat maintenance facilities operators	Boatyard operators			✓
<b>FISHERIES MITIGATION</b>								
7.7.1	Avoid dredging in April-August where possible	All dredging sites/CP	CED	Contractor	N/A		✓	
7.7.2	Grab dredge placement of sediments in salt pans	Salt pans/CP		Contractor	N/A		✓	
	Do not embay salt pans during filling	Salt pans/CP		Contractor	N/A		✓	
7.7.3	Provide temporary toilet facilities/use existing municipal toilet facilities	Contractors works compound/CP		Contractor	N/A		✓	
7.8.1	Avoid maintenance dredging in April-August	Approach channels/AO		Contractor	CED			✓
7.8.2	Implement water quality controls as specified in Section 5.11.5 of the FAR	Reclamation areas/AO	CED	Boat maintenance facilities operators	Boatyard operators			✓
<b>CULTURAL HERITAGE MITIGATION</b>								
8.7	Design should ensure that breaches of the outer seawall for water circulation are minimised - the southern portion of the outer seawall in front of Fan Kwai Tong should be avoided and left in tact	Outer seawall/ During design	CED	CED	N/A	✓	✓	



EIA FAR Ref.	Environmental Protection Measures	Location/ Timing	Funding Agent	Implementation Agent	Maintenance Agent	Implementation Stages		
						D	C	O
	All parts of the outer seawall that are not to be breached should be "flagged" during construction activities to ensure that they are not damaged	All dredging sites/CP		Contractor	N/A		✓	
	Maintain a watching brief during the anchorage dredging operations (to be reviewed during detailed design following completion of AMO geophysical survey)	All dredging sites/CP		Contractor	N/A		✓	
	Outer seawall protection measures to prevent damage by boat-generated wake	Outer seawall/ During design		CED	N/A	✓		
<b>WASTE MANAGEMENT MITIGATION</b>								
9.1	Disposal of construction waste to be monitored by issue of receipt for delivery of waste	CP	CED	Contractor	N/A	✓	✓	
	Contract to include provisions for construction waste materials to be segregated to aid waste reuse/recycling	CP		CED	CED	✓		
9.4	Design of western reclamation area to include area for collection of boat generated municipal wastes	Western reclamation/ During design		CED	N/A	✓		
9.5.2	Collection of floating refuse within anchorage by private contractor	Anchorage/ AO	MD	MD	MD			✓
	Collection of littoral refuse along the seaward edge of the outer seawall	Outer seawall/AO	RSD/DO	RSD/DO	RSD/DO			✓
9.5.3	Monitoring of marine generated refuse*	Anchorage/ AO	MD	MD	MD			✓
	Monitoring of land generated refuse*	RCP/AO	RSD	RSD	RSD			✓

**Notes:**  
 CP - Construction phase      AO - Anchorage operation      \* - mitigation measures not to be included in the Environmental Permit conditions