

KWAN LEE – KULY JOINT VENTURE

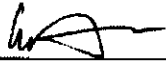
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Submission of Review Note No. 2

for

Environmental Monitoring and Audit (EM&A) Manual

(Revision 3)

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1. INTRODUCTION

Project Description

- 1.1 The Sha Tin and Tai Po Drainage Master Plan (DMP) Study, completed in October 1999, indicated that certain stormwater drains and natural rivers/streamcourses in the Sha Tin and Tai Po areas did not have the required hydraulic capacity to meet the flow requirements. To minimize the risks of flooding and to cope with future developments as identified in the DMP Study, construction of river channels, upgrading of existing stormwater drains, construction of flood pumping stations in the low-lying areas and other minor drainage facilities were recommended.
- 1.2 Upon completion of the DMP Study, Drainage Services Department (DSD) of Hong Kong SAR Government commissioned Maunsell Consultants Asia Ltd. (MCAL) to undertake Agreement No. CE50/2001 (DS) Drainage Improvement in Sha Tin and Tai Po – Design and Construction (hereinafter referred to as “the Assignment”), for implementing the drainage improvement works at various locations as recommended by the DMP study to alleviate the potential flooding problems in Sha Tin and Tai Po districts.
- 1.3 This manual presents the environmental monitoring and auditing requirements associated with the proposed drainage improvement works in Shuen Wan (the Project), which comprises the following five works items:
 - Construction of a 1000m long 3m x 2.5m twin-cell box culvert along Tung Tsz Road
 - Replacement of existing gates by automatic mechanical gates at the mouth of Wai Ha River
 - Construction of a 280m long 1200dia. drainage pipe near Wai Ha Village
 - Construction of a 260m long 2100dia. flood relief drain along Ting Kok Road
 - Construction of a floodwater pumping station at Shuen Wan
- 1.4 An Environmental Impact Assessment (EIA) study was conducted to provide information on the nature and extent of potential environmental impacts pertinent to the construction and operation of the Project. The findings are presented in a separate EIA report.
- 1.5 **Figure 1.1** shows the location of the Project.

Purpose of this Manual

- 1.6 As part of the EIA study, the purpose of this Environmental Monitoring and Audit (EM&A) Manual is to provide guidelines for the setting up of an EM&A programme to check on compliance with the environmental protection conditions, EIA Report recommendations, assess the effectiveness of the recommended mitigation measures, and identify any need for additional mitigation measures or remedial action. This Manual also outlines the monitoring and audit programme for the construction and operation phases of the works proposed under the Project.
- 1.7 The EM&A Manual has been prepared in accordance with the requirements stipulated in Annex 21 of the Technical Memorandum on the EIA Process (EIAO TM).
- 1.8 This Manual contains the following information:
 - Responsibilities of the Contractor, the Engineer or Engineer’s Representative (ER), Environmental Team (ET) and Independent Environmental Checker (IEC) with respect to the EM&A requirements during the implementation of the Project.
 - Information on the project organization and programming of construction activities.

- Project construction schedule and necessary environmental monitoring and audit programme to track environmental impacts.
- Requirements for the review of pollution sources and working procedures in the event of non-compliance of the project's environmental performance criteria.
- Environmental monitoring protocols and their technical requirements.
- Environmental auditing procedures.
- Requirements for the documentation of environmental monitoring and audit data, and appropriate reporting procedures.
- Complaint resolution procedures.

1.9 For the purpose of this Manual, the ET leader, who should be responsible for and in charge of the ET, should refer to the person or party delegated the role of executing the respective EM&A requirements.

Project Implementation

1.10 The project will be implemented under two works contracts, which comprises the following works:-

Contract 1

- Construction of a floodwater pumping station
- Construction of a flood relief drain along Ting Kok Road
- Construction of a twin-cell box culvert from the pumping station passing underneath Ting Kok Road and Tung Tsz Nursery and connect to twin cell box culvert (to be constructed under Contract 2)
- Installation of Auto mechanical gates at the mouth of Wai Ha River

Contract 2

- Construction of a twin-cell box culvert along Tung Tsz Road
- Construction of a drainage pipe near Wai Ha Village

The project programme for this Project is presented in **Table 1.1**.

Table 1.1 Project Programme

Task Description	Tentative/Actual Completion Date
Selection of the Scheme	May 2005
Detailed Design of Works	February 2007
Commencement of Contract 1	February 2010 (Construction in January 2011)
Commencement of Contract 2	May 2011
Completion of the Contract 1 & 2	August 2013

Environmental Monitoring and Audit Requirements

1.11 The construction and operational phase environmental impacts of the Project were assessed, and are presented in the EIA report on Drainage Improvement in Sha Tin and Tai Po – Design and Construction. The EIA report has identified the recommended environmental mitigation measures to minimize the potential adverse environmental impacts identified. An implementation schedule of the recommended mitigation measures is also prepared as part of the EIA study and is provided in **Appendix A** of this Manual.

Project Organisation

- 1.12 The proposed project organisation and lines of communication with respect to environmental protection works are shown in **Figure 1.2**.
- 1.13 The general duties/responsibilities of various parties comprise the following:

Engineer or Engineer's Representative (ER)

- 1.14 The term ER, refers to the organisation responsible for overseeing the construction works or operation of the Project undertaken by various Contractors, and for ensuring that the construction works are undertaken by the Contractors in accordance with the specification and requirements in the Contract. The ER should:
- Monitor the Contractors' compliance with contract specifications, including Environmental Permit (EP) conditions, and the implementation and operation of the environmental mitigation measures.
 - Follow the requirements in the agreed Event / Action Plan in the event of any exceedance.
 - Provide assistance to the ET as necessary in the implementation of the EM&A programme.
 - Engage IEC services to audit EM&A works carried out by the ET.
 - Require the Contractor to follow the agreed protocols or those in the contract specifications in the event of exceedance or complaints.

The Contractor

- 1.15 The term "Contractor" should be taken to mean all construction contractors and sub-contractors, working on site at any one time. Besides reporting to the ER, the Contractor should:
- Work within the scope of the relevant requirements in the contract and EP.
 - Participate in site inspections undertaken by the ET and undertake any corrective actions as necessary.
 - Provide information / advice to the ET regarding works activities which may contribute to the generation of adverse environmental conditions.
 - Implement measures to reduce impact where Action and Limit levels are exceeded.
 - Submit proposals on mitigation measures in case of exceedances of Action and Limit levels in accordance with the Event / Action Plans.
 - Follow the procedures for carrying out complaint investigation.

Independent Environmental Checker (IEC)

- 1.16 The IEC should advise the ER on environmental issues related to the Project, and should be empowered to audit the environmental performance of construction.
- 1.17 The IEC should have at least 7 years' local experience in EM&A and ecology, and one year of which should be relevant to recent ecological survey / monitoring work in the Shuen Wan area. The IEC should also have relevant professional qualifications, which should include being an Accredited Monitoring Professional of the Hong Kong Institute of Environmental Impact Assessment (HKIEIA), and have relevant project management experience. The appointment of the IEC is subject to the approval of the ER. The IEC should be employed prior to the commencement of the construction of the Project.
- 1.18 The main duty of the IEC is to carry out environmental audit of the project; this should include, inter alia, the following:

- Review and audit all aspects of the EM&A programme.
- Validate and confirm the accuracy of monitoring results, monitoring equipment, monitoring locations, monitoring procedures and locations of sensitive receivers.
- Carry out random sample check and audit on monitoring data and sampling procedures.
- Conduct random site inspection.
- Audit the EIA recommendations and requirements against the status of implementation of environmental protection measures on site.
- Review the effectiveness of environmental mitigation measures and project environmental performance.
- On a need basis, verify and certify the environmental acceptability of the Contractor's construction methodology (both temporary and permanent works), relevant design plans and submissions under the EP. Where necessary, the IEC should seek the least impact alternative in consultation with ET leader and the Contractor.
- Verify the investigation results of complaint cases and the effectiveness of corrective measures.
- Verify EM&A report that has been certified by the ET leader.
- Feedback audit results to ET according to Event and Action Plan in the manual.
- Verify the results of the ecological monitoring of the compensatory ecological habitats. Details of the monitoring requirements are set out in **Section 6.16** of this Manual.

Environmental Team (ET)

- 1.19 The ET leader and the ET should be employed to conduct the EM&A programme and check the Contractor's compliance with the Project's environmental performance requirements during construction. The ET should be led and managed by the ET leader.
- 1.20 The ET leader should be an independent party from the Contractor and should possess at least 7 years' local experience of EM&A and have relevant professional qualifications, which should include being an Accredited Monitoring Professional of the Hong Kong Institute of Environmental Impact Assessment (HKIEIA). The ET leader should have at least 3 years of experience in ecological monitoring given ecological impact would be the key environmental issue of this Project. The appointment of the ET is subject to the approval of the ER and the Director of Environmental Protection.
- 1.21 Suitably qualified staff should be included in the ET, and resources for the implementation of the EM&A programme should be allocated in time under the Contract, to enable fulfilment of the requirements as specified in the EM&A Manual during construction and operation of the Project.
- 1.22 Duties of the ET are:
- Conduct sampling, analysis and statistical evaluation of monitoring parameters with reference to the EIA study recommendations and requirements.
 - Conduct environmental site surveillance.
 - Audit of compliance with environmental protection, and pollution prevention and control regulations.
 - Monitor the implementation of environmental mitigation measures.
 - Monitor compliance with the environmental protection clauses/specifications in the Contract.
 - Review construction programme and comment as necessary.

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- Review construction methodology and comment as necessary.
- Conduct complaint investigation, evaluation and identification of corrective measures.
- Liaise with IEC on all environmental performance matters, and timely submit all relevant EM&A proforma for IEC's approval.
- Provide advice to the Contractor on environmental improvement, awareness, enhancement matters, etc. on site.
- Submit EM&A report timely to the Project Proponent and the Director of Environmental Protection.

1.23 Sufficient and suitably qualified professional and technical staff should be employed by the respective parties to confirm full compliance with their duties and responsibilities, as required under the EM&A programme for the duration of the Project.

2. CONSTRUCTION NOISE

Introduction

- 2.1 In this section, the requirements, methodology, equipment, monitoring locations, criteria and protocols for the monitoring and audit of noise impacts during the construction phase of the Project are presented.

Methodology and Criteria

- 2.2 The construction noise level should be measured in terms of the A-weighted equivalent continuous sound pressure level (L_{eq}). L_{eq} (30 minutes) should be used as the monitoring parameter for the time period between 0700 and 1900 hours on normal weekdays. For all other time periods, L_{eq} (5 minutes) should be employed for comparison with the Noise Control Ordinance (NCO) criteria.
- 2.3 Supplementary information for data auditing, statistical results such as L_{10} and L_{90} should also be obtained for reference. A sample data record sheet is shown in **Appendix B** for reference.
- 2.4 Whilst the Noise Control Ordinance (NCO) does not provide for the statutory control of construction activities occurring on weekdays during normal working hours (i.e. Monday to Saturday inclusive 0700-1900 hours), a daytime standard of $L_{Aeq}(30 \text{ minute})$ 75dB stipulated in *Annex 5 of the Technical Memorandum on Environmental Impact Assessment Process* is used as the appropriate criterion for all residential dwellings; while a daytime standard of $L_{Aeq}(30 \text{ minute})$ 70dB was adopted for all educational institutions during normal school days and L_{Aeq} (30 minute) 65dB during examination periods.
- 2.5 The NCO provides statutory controls on general construction works during restricted hours (i.e. 1900-0700 hours Monday to Saturday and at any time on Sundays and public holidays). The ANLs for evenings and holidays and for night-time are dependent on the Area Sensitivity Rating at the NSR. The relevant ANLs are provided in Table 2.1.

Table 2.1 Acceptable Noise Levels (ANLs)

Time Period	Area Sensitivity Rating		
	A	B	C
All days during the evening (1900-2300 hours) and general holidays (including Sundays) during the day and evening (0700-2300 hours)	60	65	70
All days during the night-time (2300-0700)	45	50	55

Monitoring Equipment

- 2.6 As referred to in the Technical Memorandum (TM) issued under the NCO, sound level meters in compliance with the International Electrotechnical Commission Publications 651: 1979 (Type 1) and 804: 1985 (Type 1) specifications should be used for carrying out the noise monitoring. Immediately prior to and following each noise measurement the accuracy of the sound level meter should be checked using an acoustic calibrator generating a known sound pressure level at a known frequency. Measurements may be accepted as valid only if the calibration level from before and after the noise measurement agree to within 1.0 dB.
- 2.7 Noise measurements should not be made in the presence of fog, rain, wind with a steady speed exceeding 5ms^{-1} or wind with gusts exceeding 10ms^{-1} . The wind speed should be checked with a portable wind speed meter capable of measuring the wind speed in m/s.
- 2.8 The ET is responsible for the provision of the monitoring equipment. He should confirm 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 should be clearly labelled.

Monitoring Locations

2.9 Based on the EIA study, four worst affected locations are designated for construction noise monitoring as listed in Table 2.2 and illustrated in **Figure 2.1**. The status and location of noise sensitive receivers may change after issuing this manual. If such cases exist, the ET Leader should propose updated monitoring locations and seek approval from ER and agreement from the IEC and EPD on the proposal.

Table 2.2 Noise Monitoring Stations during Construction Phase

Noise Monitoring Station	Noise Monitoring Location
M1	14, Shuen Wan Chim Uk
M2	150, San Tau Kok
M3	31, Wai Ha
M4	Block 15, Treasure Spot Garden

2.10 When alternative monitoring locations are proposed, the monitoring locations should be chosen based on the following criteria:

- Monitoring at sensitive receivers close to the major site activities which are likely to have noise impacts;
- Monitoring at the noise sensitive receivers as defined in the Technical Memorandum;
- Assurance of minimal disturbance to the occupants during monitoring.

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

Alternative Noise Monitoring Locations for Contract 1

2.12 Although the Contractor has taken the possession of Area L, no construction activities will be carried out in Area L under Contract 1. Therefore, the Environmental Team Leader propose to omit noise monitoring station M4 from Contract 1. Furthermore, Noise Monitoring station M3 is more than 300 meters away from any major activities of Contract 1, so they will not be monitored in Contract 1.

2.13 Due to a domestic development on Tung Tze Road potentially affecting the reliability of noise monitoring data collected at M2, alternative noise monitoring location, AL1 is proposed by the ET Leader. The monitoring station AL1, which is situated at the Joint Village Office for Villages in Shuen Wan, Tai Po, can capture construction noise produced from Areas A and B. Many populated village houses are located adjacent to the Joint Village Office, hence the ET Leader sees this location as a suitable replacement for M2. The proposed locations are listed in Table 2.3.

Table 2.3 Alternative Noise Monitoring Stations during Construction Phase

Noise Monitoring Station	Noise Monitoring Location
M1	14, Shuen Wan Chim Uk
AL1	Joint Village Office for Villages in Shuen Wan, Tai Po

Noise Monitoring Locations for Contract 2

- 2.14 Due to the change of monitoring locations for Contract 1, the monitoring locations for Contract 2 are also changed and they are listed in Table 2.4. In the case of the domestic development completes before the completion of Contract 2, monitoring station M2 will be resumed.

Table 2.4 Noise Monitoring Stations during Construction Phase for Contract 2

Noise Monitoring Station	Noise Monitoring Location
M1	14, Shuen Wan Chim Uk
AL1	Joint Village Office for Villages in Shuen Wan, Tai Po
M2*	150, San Tau Kok
M3	31, Wai Ha
M4	Block 15, Treasure Spot Garden

*Monitoring station M2 will be resumed when the construction works of the nearby domestic development, affecting the noise measurement, has completed.

Baseline Monitoring

- 2.15 The ET should carry out baseline noise monitoring prior to the commencement of the construction works. The baseline monitoring should be measured for a continuous period of at least 14 consecutive days at a minimum logging interval of 30 minutes (as six consecutive $L_{Aeq, 5min}$ readings) for daytime and 15 minutes (as three consecutive $L_{Aeq, 5min}$ readings) for evening time and night time. The L_{eq} , L_{10} and L_{90} should be recorded at the specified interval. A schedule on the baseline monitoring should be submitted to the IEC and EPD for approval before the monitoring starts.
- 2.16 There should not be any construction activities in the vicinity of the stations during the baseline monitoring. Any non-project related construction activities in the vicinity of the stations during the baseline monitoring should be noted and the source and location recorded.
- 2.16 In exceptional cases, when insufficient baseline monitoring data or questionable results are obtained, the ET should liaise with the EPD to agree on an appropriate set of data to be used as a baseline reference and submit to the ER for approval.

Impact Monitoring

- 2.18 Noise monitoring should be carried out at all the designated monitoring stations. The monitoring frequency should depend on the scale of the construction activities. The following is an initial guide on the regular monitoring frequency for each station on a weekly basis when noise-generating activities are underway:
- one set of measurements between 0700 and 1900 hours on normal weekdays.
- 2.19 In case of non-compliance with the construction noise criteria, more frequent monitoring, as specified in the Action Plan in **Table 2.5**, should be carried out. This additional monitoring should be continued until the recorded noise levels are rectified or proved to be irrelevant to the construction activities.

Event and Action Plan

- 2.20 The Action and Limit levels for construction noise are defined in **Table 2.5**. Should non-compliance of the criteria occur, action in accordance with the Action Plan in **Table 2.6** should be carried out.

Table 2.5 Action and Limit Levels for Construction Noise

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Time Period	Action Level	Limit Level
0700 – 1900 hours on normal weekdays	When one documented complaint is received	75 dB(A)

*Acceptable Noise Levels for Area Sensitivity Rating of A/B/C.

Table 2.6 Event / Action Plan for Construction Noise

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

Mitigation Measures

Good Site Practice

2.21 The following good site practices were recommended in the EIA study:

- Only well-maintained plant should be operated on-site and plant should be serviced regularly during the construction program;
- Silencers or mufflers on construction equipment should be utilized and should be properly maintained during the construction program;
- Mobile plant, if any, should be sited as far from NSRs as possible;
- Machines and plant (such as trucks) that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum;
- Plant known to emit noise strongly in one direction should, wherever possible, be orientated so that the noise is directed away from the nearby NSRs; and
- Material stockpiles and other structures should be effectively utilized, wherever practicable, in screening noise from on-site construction activities.

Adoption of Quieter PME

2.22 The EIA study recommended the use of quieter plants for the construction tasks proposed for the Project. The quieter plants recommended are listed in the table below.

Table 2.7 Quieter PME Recommended for Adoption during Construction Phase

PME	Reference	SWL
Excavator / Loader	BS C3/97	105
Dump Truck	BS C9/39	103
Concrete Lorry Mixer	BS C6/23	100
Vibratory Poker	BS C6/32	100
Breaker, Excavator Mounted (Hydraulic)	BS C8/12	106
Vibratory Roller	Noise data of Quality PME from EPD Website	101

Use of Temporary Noise Barrier

2.23 Temporary noise barriers of about 3.5m high have been recommended in the EIA study for screening of noise from the PMEs used for the construction of box culvert and site clearance. This can achieve a 5 dB(A) reduction for movable plants and 10dB(A) for stationary plant, depending on the line of sight that could be blocked by the barriers when viewed from the NSR.

2.24 **Figure 2.2** shows the typical section of the proposed temporary noise barriers. The barriers should be made of material of surface mass in excess of 7kg/m² to achieve the predicted screening effect.

Use of Quieter Alternative Construction Method

2.25 Quieter alternative construction method (hereinafter referred to as “the Low Impact Method”) has been proposed in the EIA study. This method involves using PMEs with lower impact and generally smaller in size, making it possible to be enclosed by noise enclosure which can further reduce the noise emission levels. **Table 2.8** presents the proposed PME for the Low Impact Method.

Table 2.8 Plant Inventory for the Low Impact Method

Construction Sub-task	PME	Reference	SWL
Pipe laying at Wai Ha			
Excavation	Hand-held breaker	CNP024	108
	Air compressor	CNP002	102
	Mini backhoe	CNP082	94
Pipe Laying	Mini backhoe	CNP082	94
	Vibratory poker	BSC6/32	100
Backfilling	Vibratory poker	BSC6/32	100
	Vibratory roller	EPD Website: Quality PME	101

Noise Enclosures and Temporary Noise Barriers

- 2.26 Noise enclosure has been proposed in the EIA study to alleviate the construction noise impact. It can be used for enclosing the PMEs (except mini backhoe) as listed in **Table 2.8**. For mini backhoe, the roof panels of the noise enclosure should be removed when it is in use and the side panels would form a temporary noise barrier (as illustrated in **Figure 2.2**) along the periphery of the works area. The conceptual design of the noise enclosure is shown in **Figures 2.3**.
- 2.27 The noise enclosure should be made of materials with a surface mass of not less than 10kg/m² to achieve the maximum screening effect. Openings should be provided at the side of the noise enclosure facing towards the natural hillside and away from the NSRs for ventilation. The noise enclosure should be designed to achieve at least 15dB(A) noise reduction for PME.
- 2.28 The implementation schedule for the recommended mitigation measures is presented in **Appendix A**.

3. AIR QUALITY

Introduction

- 3.1 This section presents the requirements, methodology, equipment, monitoring locations, criteria and protocols for the audit of air quality impacts during the construction phase of the Project.
- 3.2 According to the EIA study, significant dust emission arising from the construction activities would not be expected. With the implementation of mitigation measures as stipulated in the *Air Pollution Control (Construction Dust) Regulation*, it would be unlikely that the Project would result in adverse air quality impact on the representative ASRs.
- 3.3 Therefore, no air quality monitoring would be required during construction of the drainage improvement works. It is recommended that auditing works during construction phase be carried out to check that the Contractor has implemented the recommended mitigation measures to minimize the construction dust impact.

Site Inspection

- 3.4 Weekly site audits should be carried out to inspect the construction activities and works areas in order to confirm the recommended dust control mitigation measures are implemented and are working effectively. The Contractor should be responsible for the implementation of the *Air Pollution Control (Construction Dust) Regulation* and good site practices

Air Quality Mitigation Measures

- 3.5 Mitigation measures have been proposed in the EIA study, including the implementation of the *Air Pollution Control (Construction Dust) Regulation* and good site practices. The practical measures are summarized as below:
- Use of regular watering to reduce dust emissions from exposed site surfaces and unpaved road, with complete coverage, particularly during dry weather;
 - Use of frequent watering for particularly dusty static construction areas and areas close to ASRs;
 - Tarpaulin covering of all dusty vehicle loads transported to, from and between site location;
 - Establishment and use of vehicle wheel and body washing facilities at the exit points of the site;
 - Routing of vehicles and positioning of construction plant should be at the maximum possible distance from ASRs;
 - Stockpiled excavated materials should be covered with tarpaulin, and should be removed off-site within 24 hours to avoid any odour nuisance arising.
- 3.6 Upon receipt of an environmental complaint, or as part of the environmental audit, the Contractor should liaise with the ET on some other mitigation measures, propose to ER for approval, and implement the mitigation measures.

4. WATER QUALITY

Introduction

- 4.1 The water quality assessment in the EIA study identified that no adverse impact would occur during the construction and operation of the Project provided the recommended mitigation measures were properly implemented. It is recommended that regular site inspections (at least weekly) be undertaken to audit the construction activities and works areas in order to check the recommended mitigation measures are properly implemented.

Site Inspection

- 4.2 Site inspection should be conducted at least weekly to inspect the construction activities and works areas in order to check the recommended mitigation measures are properly implemented

Water Quality Mitigation Measures

- 4.3 Mitigation measures recommended for the construction and operation phases of the Project are summarized below. The implementation schedule of the recommended water quality mitigation measures is presented in **Appendix A**.

Construction Phase

Construction Run-off and Drainage

- 4.4 Mitigation measures should be implemented to control construction site runoff and drainage from the works areas, and to prevent runoff and drainage water with high levels of suspended solids from entering the Wai Ha River, fishponds and the receiving water body of Tolo Harbour. The construction phase discharges should comply with the WPCO requirements.
- 4.5 The site practices outlined in ProPECC PN 1/94 "Construction Site Drainage" should be followed during the drainage improvement works in order to minimise surface runoff and to control erosion, and also to retain and reduce any suspended solids prior to discharge. These practices include the following items and should be implemented as an erosion control plan during the construction phase:
- Before commencing any site formation work, all sewer and drainage connections should be sealed to prevent debris, soil, sand etc. from entering public sewers/drains.
 - Temporary ditches should be provided to facilitate run-off discharge into appropriate watercourses, via a silt retention pond. No site run-off should enter the fishponds at Shuen Wan.
 - Sand/silt removal facilities such as sand traps, silt traps and sediment basins should be provided to remove sand/silt particles from runoff to meet the requirements of the Technical Memorandum standard under the Water Pollution Control Ordinance. The design of silt removal facilities should be based on the guidelines provided in ProPECC PN 1/94. All drainage facilities and erosion and sediment control structures should be inspected monthly and maintained to attain proper and efficient operation at all times and particularly during rainstorms.
 - Water pumped out from excavated pits should be discharged into silt removal facilities.
 - During rainstorms, exposed slope/soil surfaces should be covered by a tarpaulin or other means. Other measures that need to be implemented before, during, and after rainstorms are summarized in ProPECC PN 1/94.
 - Exposed soil areas should be minimized to reduce potential for increased siltation and contamination of runoff.

- Earthwork final surfaces should be well compacted and subsequent permanent work or surface protection should be immediately performed to reduce the potential of soil erosion.
- Open stockpiles of construction materials or construction wastes on-site should be covered with tarpaulin or similar fabric during rainstorms.

4.6 With standard water pollution control measures set out in ProPECC PN1/94 in place, it is anticipated that the construction phase discharges would comply with the WPCO requirements.

4.7 In addition, precautionary measures for controlling potential water quality impact due to the proposed works close to the Conservation Area should be required in order to safeguard the known sites of high ecological value during the construction phase, particularly during the rainy season as there is a risk that intense rainfall events may result in discharge of turbid drainage water. The contractor should implement the following mitigation measures:

- For the construction of the box culvert next to the existing channel of the Wai Ha River, sand bags should be deployed around the boundary of the works trench to prevent muddy water ingress into the adjacent CA or Wai Ha River. As an effective measure, sand bags should be used to surround the excavated trench. Generally, the sand bags will be placed up to a height of 300mm to provide adequate allowance for the built-up water level during rainstorm event. With sand bags in place, unpolluted surface runoff will be intercepted and flow to Wai Ha River or collected by the existing drainage system as usual.
- For the construction of the box culvert in the extreme northeast corner of Shuen Wan Marsh Conservation Area sand bags should be deployed along the limit of the works area to prevent muddy water ingress into the CA. Sand bags should be placed to a height of at least 300mm from ground level and +2.5 mPD (whichever is greater) to provide adequate allowance for the built-up water level during rainstorm events. Unpolluted surface runoff within the works area should then be collected and directed into the existing drainage system.
- Sheet-piles, which would be installed around the works trench near the Conservation Area, would be extended above ground level for about 2m to serve as hoardings to isolate the works site.
- Tarpaulin sheets would be used to cover the excavation areas during heavy rainstorms. This would prevent the ingress of rainwater into the trench minimising the risk of muddy water getting into Wai Ha River and the adjacent Conservation Area.
- Any concrete washing water would be contained inside the works site surrounded by the extended sheet piles. A pump sump at the bottom of the trench would be provided to pump any excess water during concrete washing.
- Stockpiling the excavated materials adjacent to the Conservation Area would not be allowed. The excavated materials would be either removed off site immediately after excavation, or stockpile at location(s) away from the Conservation Area. The stockpile locations should be approved by the site engineer.

General Construction Activities

4.8 Debris and refuse generated on-site should be collected, handled and disposed of properly to avoid entering the Wai Ha River and fish ponds at Shuen Wan. Stockpiles of cement and other construction materials should be kept covered when not being used.

4.9 Oils and fuels should only be used and stored in designated areas which have pollution prevention facilities. To prevent spillage of fuels and solvents to nearby water bodies, all fuel tanks and storage areas should be provided with locks and be sited on sealed areas, within bunds of a capacity equal to 110% of the storage capacity of the largest tank. The bund should be drained of rainwater after a rain event.

Sewage from Construction Workforce

- 4.10 Temporary sanitary facilities, such as portable chemical toilets, should be employed on-site. A licensed contractor would be responsible for appropriate disposal and maintenance of these facilities.

River Channel Excavation Works

- 4.11 The excavation works within the upstream end of the existing river channel of the Wai Ha River for the construction of the proposed box culvert should be carried out in a dry condition. Containment measures such as bunds and barriers should be used within the affected length of the river channel and the excavation works restricted to within an enclosed dry section of the channel. The excavation works should be restricted to the period from October to April.
- 4.12 Creation of the Ecological Compensatory Area (ECA) as shown in Figure 7.2 of the EIA Report and as detailed in the Habitat Compensatory Plan (HCP) will involve the formation of a channel link to the Wai Ha River in order to divert water into (ECA). The formation of the channel link should be undertaken during the period from October to April and all excavation work should be carried out from the landward (ECA) side. Prior to actually establishing the connection a temporary sandbag barrier should be placed in the channel during low tide (tide height less than +1.5 mPD) to isolate the section of bank which is to be removed to form the channel. Once the bank has been lowered to the required height and the required works to stabilize the channel floor and sides have been undertaken, the temporary sandbag barrier will be removed. The removal of temporary sandbag barrier will effect water quality and water flow of Wai Ha River. The water quality and water flow will be monitored by the respective water quality and hydrological characteristics monitoring stated out in the following sections. Water pollution control measures set out in ProPECC PN1/94 shall be strictly followed, such that construction phase discharges would comply with the WPCO requirements.
- 4.13 The location of the channel link is shown in Figure 4.0. For details on the formation of channel link, please refer to the Figure 5 and Section 5.5.4 of the HCP in **Appendix E**.

Water Quality Monitoring in Shuen Wan Marsh and Wai Ha River

- 4.14 The EIA study, Section 5.16, indicates the construction of penstock and ECA shall not significantly affect the water quality of the water sensitive receivers within Tolo Harbour, namely the fish ponds at Shuen Wan, Wai Ha River. However, the construction of ECA for Contract 1 and box culvert for Contract 2 include excavation at sections adjacent to the Wai Ha River, so a water quality monitoring scheme for construction phase was determined to be necessary.
- 4.15 The water quality parameters which need to be monitored include dissolved oxygen (DO), dissolved oxygen saturation, temperature, turbidity, suspended solids (SS) and pH. In association to the water quality parameters, relevant data including location/position, time, weather conditions, and any other special phenomena and work underway at the construction site shall also be recorded. A sample of data collection sheet is presented in **Appendix D**.

Monitoring Equipment

- 4.16 Monitoring equipment such as the DO and temperature measuring equipment, turbidity measurement instrument, water sampler and pH indicator shall be supplied by the ET and approved by the IEC and the Engineer for water quality monitoring.
- 4.17 Dissolved Oxygen, Dissolved Oxygen Saturation, Temperature, Turbidity and pH Measurement
- 4.17.1 The instrument shall a portable and weatherproof multimeter complete with cable and use a DC power source. The instrument is capable of measuring:
- A turbidity between 0-800NTU;
 - A dissolved Oxygen level in the range of 0-20mg/L and 0-200% saturation;
 - A temperature of 0-45°C;
 - pH in the range of 0-14.

- 4.17.2 Should any of the measuring parameters not be built-in in the multimeter, ET shall supply specifications of monitoring equipments to IEC and Engineer for approval.
- 4.18 Water Sampler
- 4.18.1 A water sampler is required. It shall comprise a transparent PVC cylinder, with a capacity of not less than 2 litres, which can be effectively sealed with latex cups at both ends. The sampler 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.
- 4.18.2 In case the water depth is less than 500mm, a water bucket can be used as a water sampler to minimize the possibility of the latching system disturbing sediment during water sampling.
- 4.19 Water Depth Detector
- 4.19.1 A portable, battery-operated echo sounder shall be used for the determination of water depth at each designated monitoring station.
- 4.20 Suspended Solids
- 4.20.1 A water sample of at least 2.5L in capacity shall be collected. Samples should be submitted to HOKLAS accredited laboratory as soon as possible for gravimetric analysis for suspended solids determination.
- 4.21 Positioning Device
- 4.21.1 The locations of water monitoring points should be located using a hand-held or boat fixed digital Global Positioning System (GPS) or other equivalent instrument of similar accuracy. This is to ensure that the water sampling locations are correct during the water quality monitoring work.
- 4.22 Laboratory Analysis
- 4.22.1 All laboratory work shall be carried out in a HOKLAS accredited laboratory. Water samples of about 1,000 ml shall be collected at the monitoring and control stations for carrying out the laboratory determinations. The determination work shall start within 24 hours after collection of the water samples. The analyses shall follow the standard methods according to APHA Standard Methods for the Examination of Water and Wastewater, 20th Edition, or an equivalent method approved by EPD. The method and detection limit are listed in Table 4.1.

Table 4.1 Methods and Detection Limits for Laboratory Analysis

Parameter	Recommended Method	Detection Limit
Suspended Solids	APHA 2540D	2 mg/L

- 4.22.2 For each of the testing methods, details shall be submitted to the Director of Environmental Protection (DEP) or his representatives for approval prior to the commencement of the monitoring programme. The submitted information should include 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. The QA/QC details shall be in accordance with requirements of HOKLAS or another internationally accredited scheme. The QA/QC results shall be reported. EPD may request the laboratory to carry out analysis of known standards provided 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 method verification should, if required, be submitted to the EPD. In any case, sample testing shall have comprehensive quality assurance and quality control programmes. The laboratory shall be prepared to demonstrate the quality control programmes to the EPD or their representative if and when required.

- 4.23 All *in-situ* monitoring instruments should be checked, calibrated and certified by a laboratory accredited under HOKLAS or any other international accreditation scheme before use, and subsequently re-calibrated at 3 monthly intervals throughout all stages of the water quality monitoring. Responses of sensors and electrodes should be checked with certified standard solutions before each use. Wet bulb calibration for a DO meter should be carried out before measurement at each monitoring.
- 4.24 The monitoring locations (**Figure 4.1**) are summarized in **Table 4.2** and **4.3**. Water quality monitoring station W1 will act as a control point for Contract 1 and W3 for Contract 2 to compare the water quality from potentially impacted sites with the ambient water quality. When alternative monitoring locations are proposed, they shall be chosen based on the following criteria:
- at locations close to and preferably at the boundary of the mixing zone of the major site activities as indicated in the EIA final report, which are likely to have water quality impacts;
 - close to the sensitive receptors which are directly or likely to be affected;
 - for monitoring locations located in the vicinity of the sensitive receptors, care shall be taken to cause minimal disturbance during monitoring;
 - one upstream control station is selected for Contract 1 (Station Number W1), and one upstream control station is selected for Contract 2 (Station Number W3) and they are at locations representative of the project site in its undisturbed condition. These control stations will act as control stations for their respective works area for the entire project period. Control stations shall be located, as far as if practicable, both upstream and down stream of the works area.

Table 4.2 Construction Phase Water Quality Monitoring Locations for Contract 1

Station Number	Location	Coordinates
W1	Between the Shuen Wan Marsh and ECA (<u>Control Station</u>)	E: 839301 N: 836386
W2	Between Tolo Harbour and Proposed Penstock	E: 839542 N: 836184

Table 4.3 Construction Phase Water Quality Monitoring Locations after commencement of Contract 2

Station Number	Location	Coordinates
W1	Between the Shuen Wan Marsh and ECA (Control Station for works under Contract 1)	E: 839301 N: 836386
W2	Between Tolo Harbour and Proposed Penstock	E: 839542 N: 836184
W3	Upstream of Tung Tze Shan Road (<u>Control Station</u> for works under Contract 2)	E: 838760 N: 836714
W4	Wai Ha Village 29D	E: 838865 N: 836621

- 4.25 Measurements shall be taken at 3 water depths, namely, 1m below water surface, mid-depth and 1m above river 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.
- 4.26 Baseline monitoring shall be performed and baseline conditions shall be established prior to commencement of works on the ECA. Measurements shall be taken at all designated monitoring locations, 3 days per week, for a period of 4 weeks prior to commencement of works of the channel link between the Wai Ha River and ECA for Contract 1 and the box culvert for Contract 2. The interval between 2 sets monitoring shall not be less than 36 hours.
- 4.27 During the construction phase, impact monitoring shall be undertaken on all designated monitoring locations 3 times per week as listed in Table 4.4.

Table 4.4 Water Quality Monitoring Frequency in Construction Phase

Monitoring Phase	Frequency
Baseline monitoring	Three times per week
Impact monitoring	Three times per week

4.28 Event and Action Plan

4.28.1 The water quality criteria, namely Action and Limit levels, are shown in **Table 4.5**. Should the water quality parameters monitoring results at any designated monitoring station exceed the water quality criteria, actions in accordance with the Event and Action Plan in **Table 4.6** shall be carried out.

Table 4.5 Action and Limit Levels for Water Quality Monitoring

Parameters	Action	Limit
DO in mg L ⁻¹	5 percentile of baseline data	4 mg/L
pH	N/A	6.0 – 9.0
SS in mg L ⁻¹	95 percentile of baseline data or 120% of upstream control station's SS	99 percentile of baseline data or 130% of upstream control station's SS
Turbidity in NTU	95 percentile of baseline data or 120% of upstream control station's Turbidity	99 percentile of baseline data or 130% of upstream control station's Turbidity

Notes:

- For DO, non-compliance of water quality limits occurs when monitoring result is lower than the limits.
- For SS and Turbidity, non-compliance of water quality limits occurs when monitoring result is higher than the limits.

4.28.2 Should the water quality parameters monitoring results at the monitoring station W2 exceed the water quality criteria, the water quality monitoring data of two reference points (C1 and C2) will be used as the supplementary information. The monitoring data of C1 should be used for comparison with the monitoring data of W2 that taken at flood tide; and the monitoring data of C2 should be used for comparison with the monitoring data of W2 that taken at ebb tide. The comparison of water quality between W2 and C1 at flood tide and between W2 and C2 at ebb tide is to prove whether influence of water quality is caused by the construction activities. The details of C1 and C2 are presented in **Appendix G**.

Table 4.6 Event and Action Plan for Water Quality

Event	ET Leader	IEC	ER	Contractor
ACTION LEVEL				
Action level being exceeded by one sampling day	<ol style="list-style-type: none"> 1. Repeat in-situ measurements to confirm findings; 2. Identify reasons for non-compliance and source(s) of impact; 3. Inform IEC, Contractor and Engineer; 4. Check monitoring data, all plant, equipment and Contractor's working methods; 5. Discuss mitigation measures with IEC, Engineer and Contractor; 6. Ensure mitigation measures are implemented. 7. Repeat measurement on next day of exceedance. 	<ol style="list-style-type: none"> 1. Discuss mitigation measures with ET, Engineer and Contractor; 2. Review proposals on mitigation measures submitted by Contractor and advise the Engineer accordingly; 3. Assess effectiveness of implemented mitigation measures. 	<ol style="list-style-type: none"> 1. Discuss proposed mitigation measures with IEC, ET and Contractor; 2. Make agreement on mitigation measures to be implemented; 3. Assess effectiveness of implemented mitigation measures. 	<ol style="list-style-type: none"> 1. Inform Engineer and confirm in writing notification of the non-compliance; 2. Rectify unacceptable practice; 3. Check all plant and equipment; 4. Consider changes in working methods; 5. Discuss with ET, IEC and Engineer and propose mitigation measures to IEC and Engineer within three working days; 6. Implement agreed mitigation measures.
Action level being exceeded by more than two consecutive sampling days	<ol style="list-style-type: none"> 1. Repeat in-situ measurements to confirm findings; 2. Identify reasons for non-compliance and source(s) of impact; 3. Inform IEC, Contractor and Engineer; 4. Check monitoring data, all plant, equipment and Contractor's working methods; 5. Discuss mitigation measures with IEC, Engineer and Contractor; 	<ol style="list-style-type: none"> 1. Discuss mitigation measures with ET, Engineer and Contractor; 2. Review proposals on mitigation measures submitted by Contractor and advise the Engineer accordingly; 3. Assess effectiveness of implemented mitigation measures. 	<ol style="list-style-type: none"> 1. Discuss proposed mitigation measures with IEC, ET and Contractor; 2. Make agreement on mitigation measures to be implemented; 3. Assess effectiveness of implemented mitigation measures. 	<ol style="list-style-type: none"> 1. Inform Engineer and confirm in writing notification of the non-compliance; 2. Rectify unacceptable practice; 3. Check all plant and equipment; 4. Consider changes in working methods; 5. Discuss with ET, IEC and Engineer and propose

	<ol style="list-style-type: none"> 6. Ensure mitigation measures are implemented. 7. Prepare to increase the monitoring frequency to daily; 8. Repeat measurement on next day of exceedance. 			<p>mitigation measures to IEC and Engineer within three working days;</p> <p>6. Implement agreed mitigation measures.</p>
LIMIT LEVEL				
Limit level being exceeded by one sampling day	<ol style="list-style-type: none"> 1. Repeat in-situ measurements to confirm findings; 2. Identify reasons for non-compliance and source(s) of impact; 3. Inform EPD, IEC, Contractor and Engineer; 4. Check monitoring data, all plant, equipment and Contractor's working methods; 5. Discuss mitigation measures with IEC, Engineer and Contractor; 6. Ensure mitigation measures are implemented; 7. Increase the monitoring frequency to daily until no exceedance of Limit level. 	<ol style="list-style-type: none"> 1. Discuss mitigation measures with ET, Engineer and Contractor; 2. Review proposals on mitigation measures submitted by Contractor and advise the Engineer accordingly; 3. Assess effectiveness of implemented mitigation measures. 	<ol style="list-style-type: none"> 1. Discuss proposed mitigation measures with IEC, ET and Contractor; 2. Request Contractor to critically review the working methods; 3. Make agreement on mitigation measures to be implemented; 4. Assess effectiveness of implemented mitigation measures. 	<ol style="list-style-type: none"> 1. Inform Engineer and confirm in writing notification of the non-compliance; 2. Rectify unacceptable practice; 3. Check all plant and equipment; 4. Consider changes in working methods; 5. Discuss with ET, IEC and Engineer and propose mitigation measures to IEC and Engineer within three working days; 6. Implement agreed mitigation measures.
Limit level being exceeded by more than two consecutive sampling days	<ol style="list-style-type: none"> 1. Repeat in-situ measurements to confirm findings; 2. Identify reasons for non-compliance and source(s) of impact; 3. Inform EPD, IEC, Contractor and Engineer; 4. Check monitoring data, all plant, 	<ol style="list-style-type: none"> 1. Discuss mitigation measures with ET, Engineer and Contractor; 2. Review proposals on mitigation measures submitted by Contractor and advise the Engineer 	<ol style="list-style-type: none"> 1. Discuss proposed mitigation measures with IEC, ET and Contractor; 2. Request Contractor to critically review the working methods; 	<ol style="list-style-type: none"> 1. Inform Engineer and confirm in writing notification of the non-compliance; 2. Rectify unacceptable practice; 3. Check all plant and equipment; 4. Consider

	<p>equipment and Contractor's working methods;</p> <p>5. Discuss mitigation measures with IEC, Engineer and Contractor;</p> <p>6. Ensure mitigation measures are implemented.</p> <p>7. Increase the monitoring frequency to daily until no exceedance of Limit level for two consecutive days.</p>	<p>accordingly;</p> <p>3. Assess effectiveness of implemented mitigation measures.</p>	<p>3. Make agreement on mitigation measures to be implemented;</p> <p>4. Assess effectiveness of implemented mitigation measures;</p> <p>5. Consider and if necessary instruct Contractor to slow down or to stop all or part of the construction activities until no exceedance of Limit Level.</p>	<p>changes in working methods;</p> <p>5. Discuss with ET, IEC and Engineer and propose mitigation measures to IEC and Engineer within three working days;</p> <p>6. Implement agreed mitigation measures;</p> <p>7. As directed by the Engineer, slow down or stop all or part of the construction activities until no exceedance of Limit level.</p>
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Monitoring of Hydrological Characteristics of Shuen Wan Marsh

- 4.29 A specific monitoring programme of Wai Ha River through the Shuen Wan Marsh is recommended. The hydrological monitoring is to ensure the works along Wai Ha River will not affect the water flow into the Shuen Wan Marsh. A sample template for the Hydrological Characteristics Monitoring Data Record Sheet is presented in Appendix F.
- 4.30 Monitoring locations should be situated on the upper and lower stream of Shuen Wan Marsh. **Figure 4.2** and **Table 4.7 & 4.8** summarized the locations of monitoring stations. H3 and H4 are proposed to monitor if there is any change in the hydrological characteristics of Wai Ha River that may subsequently affect the Shuen Wan Marsh caused by the works involved in Contract 2.

Table 4.7 Construction and Operation Phase Hydrological Characteristics Monitoring Locations for Contract 1

Station Number	Location	Coordinates
H1	Between the Shuen Wan Marsh and ECA	E: 839306 N: 836379
H2	Route to Sam Kung Temple	E: 839163 N: 836433

Table 4.8 Construction and Operation Phase Hydrological Characteristics Monitoring Locations after commencement of Contract 2

Station Number	Location	Coordinates
H1	Between the Shuen Wan Marsh and ECA	E: 839306 N: 836379
H2	Route to Sam Kung Temple	E: 839163 N: 836433

H3	Upstream of Tung Tze Shan Road	E: 838760 N: 836714
H4	Wai Ha Village 29D	E: 838865 N: 836621

- 4.31 Baseline data should be collected on a consecutive of 4 weeks, at mid-flood and mid-ebb tides, for once a week before commencement of any major site activities involving the Wai Ha River, namely the construction of channel link between the Wai Ha River and ECA for Contract 1 and the box culvert for Contract 2.
- 4.32 Construction and operation phase monitoring shall be conducted on a weekly basis, at mid-flood and mid-ebb tides. The hydrological monitoring will be carried out for 1 year after the construction is complete as operation phase monitoring. After this monitoring period, DSD will review the need for extending the operation phase monitoring. The review results will be submitted to the EPD and AFCD for agreement.
- 4.33 The monitoring parameters shall include:
- Water flow rate
 - Water depth
- 4.34 The action/limit level for the hydrological monitoring shall be determined after the baseline data is collected.

Monitoring Equipment

- 4.35 Water Depth Detector
- 4.35.1 A portable, battery-operated echo sounder shall be used for the determination of water depth at each designated monitoring station.
- 4.36 Flow Rate Meter
- 4.36.1 A portable, battery-operated flow meter should be used for the determination of water depth at each designated monitoring location and record in m³/s.
- 4.37 The water quality criteria, namely Action and Limit levels shall be determined once the baseline monitoring is complete. Should the water quality parameters monitoring results at any designated monitoring station exceed the water quality criteria, actions in accordance with the Event and Action Plan in **Table 4.9** shall be carried out.

Table 4.9 Event and Action Plan for Monitoring of Hydrological Characteristics

Event	ET Leader	IEC	ER	Contractor
ACTION LEVEL				
Action level being exceeded by one sampling day	1. Repeat in-situ measurements to confirm findings; 2. Identify reasons for non-compliance and source(s) of impact; 3. Inform IEC, Contractor	1. Discuss mitigation measures with ET, Engineer and Contractor; 2. Review proposals on mitigation measures submitted by Contractor and	1. Discuss proposed mitigation measures with IEC, ET and Contractor; 2. Make agreement on mitigation	1. Inform Engineer and confirm in writing notification of the non-compliance; 2. Rectify unacceptable practice;

	<p>and Engineer;</p> <ol style="list-style-type: none"> 4. Check monitoring data, Contractor's working methods and any excavation works or dewatering processes; 5. Discuss mitigation measures with IEC, Engineer and Contractor; 6. Ensure mitigation measures are implemented. 7. Repeat measurement on next day of exceedance. 	<p>advise the Engineer accordingly;</p> <ol style="list-style-type: none"> 3. Assess effectiveness of implemented mitigation measures. 	<p>measures to be implemented;</p> <ol style="list-style-type: none"> 3. Assess effectiveness of implemented mitigation measures. 	<ol style="list-style-type: none"> 3. Check working methods and any excavation works or dewatering processes; 4. Consider changes in working methods and plans; 5. Discuss with ET, IEC and Engineer and propose mitigation measures to IEC and Engineer within three working days; 6. Implement agreed mitigation measures.
<p>Action level being exceeded by more than two consecutive sampling days</p>	<ol style="list-style-type: none"> 1. Repeat in-situ measurements to confirm findings; 2. Identify reasons for non-compliance and source(s) of impact; 3. Inform IEC, Contractor and Engineer; 4. Check monitoring data, Contractor's working methods and any excavation works or dewatering processes; 5. Discuss mitigation measures with IEC, Engineer and Contractor; 6. Ensure mitigation measures are implemented. 7. Prepare to increase the monitoring frequency to daily; 8. Repeat measurement on next day of exceedance. 	<ol style="list-style-type: none"> 1. Discuss mitigation measures with ET, Engineer and Contractor; 2. Review proposals on mitigation measures submitted by Contractor and advise the Engineer accordingly; 3. Assess effectiveness of implemented mitigation measures. 	<ol style="list-style-type: none"> 1. Discuss proposed mitigation measures with IEC, ET and Contractor; 2. Make agreement on mitigation measures to be implemented; 3. Assess effectiveness of implemented mitigation measures. 	<ol style="list-style-type: none"> 1. Inform Engineer and confirm in writing notification of the non-compliance; 2. Rectify unacceptable practice; 3. Check working methods and any excavation works or dewatering processes; 4. Consider changes in working methods and plans; 5. Discuss with ET, IEC and Engineer and propose mitigation measures to IEC and Engineer within three working days; 6. Implement agreed mitigation measures.
LIMIT LEVEL				

<p>Limit level being exceeded by one sampling day</p>	<ol style="list-style-type: none"> 1. Repeat in-situ measurements to confirm findings; 2. Identify reasons for non-compliance and source(s) of impact; 3. Inform AFCD, IEC, Contractor and Engineer; 4. Check monitoring data, and Contractor's working methods and any excavation works or dewatering processes; 5. Discuss mitigation measures with IEC, Engineer and Contractor; 6. Ensure mitigation measures are implemented; 7. Increase the monitoring frequency to daily until no exceedance of Limit level. 	<ol style="list-style-type: none"> 1. Discuss mitigation measures with ET, Engineer and Contractor; 2. Review proposals on mitigation measures submitted by Contractor and advise the Engineer accordingly; 3. Assess effectiveness of implemented mitigation measures. 	<ol style="list-style-type: none"> 1. Discuss proposed mitigation measures with IEC, ET and Contractor; 2. Request Contractor to critically review the working methods; 3. Make agreement on mitigation measures to be implemented; 4. Assess effectiveness of implemented mitigation measures. 	<ol style="list-style-type: none"> 1. Inform Engineer and confirm in writing notification of the non-compliance; 2. Rectify unacceptable practice; 3. Check working methods and any excavation works or dewatering processes; 4. Consider changes in working methods and plans; 5. Discuss with ET, IEC and Engineer and propose mitigation measures to IEC and Engineer within three working days; 6. Implement agreed mitigation measures.
<p>Limit level being exceeded by more than two consecutive sampling days</p>	<ol style="list-style-type: none"> 1. Repeat in-situ measurements to confirm findings; 2. Identify reasons for non-compliance and source(s) of impact; 3. Inform AFCD, IEC, Contractor and Engineer; 4. Check monitoring data, and Contractor's working methods and any excavation works or dewatering processes; 5. Discuss mitigation measures with IEC, Engineer and Contractor; 6. Ensure mitigation measures are 	<ol style="list-style-type: none"> 1. Discuss mitigation measures with ET, Engineer and Contractor; 2. Review proposals on mitigation measures submitted by Contractor and advise the Engineer accordingly; 3. Assess effectiveness of implemented mitigation measures. 	<ol style="list-style-type: none"> 1. Discuss proposed mitigation measures with IEC, ET and Contractor; 2. Request Contractor to critically review the working methods; 3. Make agreement on mitigation measures to be implemented; 4. Assess effectiveness of implemented mitigation measures; 5. Consider and if 	<ol style="list-style-type: none"> 1. Inform Engineer and confirm in writing notification of the non-compliance; 2. Rectify unacceptable practice; 3. Check working methods and any excavation works or dewatering processes; 4. Consider changes in working methods and plans; 5. Discuss with ET, IEC and Engineer and propose mitigation measures to IEC

	<p>implemented.</p> <p>7. Increase the monitoring frequency to daily until no exceedance of Limit level for two consecutive days.</p>		<p>necessary instruct Contractor to slow down or to stop all or part of the construction activities until no exceedance of Limit Level.</p>	<p>and Engineer within three working days;</p> <p>6. Implement agreed mitigation measures;</p> <p>7. As directed by the Engineer, slow down or stop all or part of the construction activities until no exceedance of Limit level.</p>
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5. WASTE MANAGEMENT IMPLICATIONS

Introduction

- 5.1 Waste management should be the contractor's responsibility to confirm that all wastes produced during the construction phase for the drainage improvement works are handled, stored and disposed of in accordance with good waste management practices and EPD's regulations and requirements. The recommended mitigation measures should form the basis of the Waste Management Plan to be developed by the Contractor.
- 5.2 Waste materials generated during construction activities, such as construction and demolition (C&D) material, chemical wastes and general refuse, are recommended to be audited at regular intervals (at least quarterly) to check that proper storage, transportation and disposal practices are being implemented. The Contractor should be responsible for the implementation of any mitigation measures to minimise waste or redress problems arising from the waste materials.

Waste Control and Mitigation Measures

- 5.3 Mitigation measures for waste management are summarised below. With the appropriate handling, storage and removal of waste arisings during the construction works as defined below, the potential to cause adverse environmental impacts would be minimised. The implementation schedule of the recommended mitigation measures is presented in **Appendix A**. During the site inspections, the ET should pay special attention to the issues relating to waste management and check whether the Contractor has implemented the recommended good site practices and other mitigation measures.

Good Site Practices

- 5.4 Appropriate waste handling, transportation and disposal methods for all waste generated during the construction works should be implemented such that construction wastes do not enter the river channels and coastal waters of Inner Tolo Harbour, and to minimize potential impacts where works areas are located close to ecological sensitive receivers.
- 5.5 It is not anticipated that adverse waste management related impacts would arise, provided that good site practices are strictly followed. Recommendations for good site practices during the construction activities include:
- Nomination of approved personnel, such as a site manager, to be responsible for good site practices and making arrangements for collection of all wastes generated at the site and effective disposal to an appropriate facility.
 - Training of site personnel in proper waste management and chemical waste handling procedures.
 - Provision of sufficient waste disposal points and regular collection for disposal.
 - Appropriate measures to minimise windblown litter and dust during transportation of waste by either covering trucks or by transporting wastes in enclosed containers.
 - Separation of chemical wastes for special handling and appropriate treatment at the Chemical Waste Treatment Facility.
 - Regular cleaning and maintenance programme for drainage systems, sumps and oil interceptors.
 - A recording system for the amount of waste generated, recycled and disposal (including the disposal sites) should be proposed.
 - A Waste Management Plan should be prepared and submitted to the Engineer for approval. One may make reference to ETWB TCW No. 19/2005 for details.

- 5.6 In order to monitor the disposal of C&D material at landfills and public filling areas, as appropriate, and to control fly tipping, a trip-ticket system should be included as one of the contractual requirements. One may make reference to ETWB TCW No. 31/2004 for details. The use of a trip-ticket system should be required to avoid any illegal or unplanned dumping of waste generated by the Project, particularly at works areas close to ecologically sensitive receivers.

Waste Reduction Measures

- 5.7 Good management and control can prevent the generation of significant amounts of waste. Waste reduction is best achieved at the planning and design stage, as well as by ensuring the implementation of good site practices. Recommendations to achieve waste reduction include:
- Segregation and storage of different types of waste in different containers, skips or stockpiles to enhance reuse or recycling of materials and their proper disposal.
 - To encourage collection of aluminium cans by individual collectors, separate labelled bins should be provided to segregate this waste from other general refuse generated by the work force.
 - Any unused chemicals or those with remaining functional capacity should be recycled.
 - Maximising the use of reusable steel formwork to reduce the amount of C&D material.
 - Prior to disposal of C&D waste, it is recommended that wood, steel and other metals should be separated for re-use and / or recycling to minimise the quantity of waste to be disposed of to landfill.
 - Proper storage and site practices to minimise the potential for damage or contamination of construction materials.
 - Plan and stock construction materials carefully to minimise amount of waste generated and avoid unnecessary generation of waste.
- 5.8 In addition to the above good site practices and waste reduction measures, specific mitigation measures are recommended below for the identified waste arisings to minimise environmental impacts during handling, transportation and disposal of these wastes.

Construction and Demolition Material

- 5.9 To minimize the environmental impacts during the collection and transportation of C&D material, the following mitigation measures are recommended:
- The excavated material with suitable characteristics/size should be reused on-site as fill material as far as practicable, such as for backfilling of the box culvert and drainage pipe works, to minimise off-site disposal of C&D material.
 - Suitable areas should be designated within the works site boundaries for temporary stockpiling of C&D material.
 - Within stockpile areas, the following measures should be taken to control potential environmental impacts or nuisance:
 - covering material during heavy rainfall;
 - locating stockpiles to minimise potential visual impacts; and
 - minimizing land intake of stockpile areas as far as possible
 - When disposing C&D material at a public filling area, the material should only consist of soil,

rock, concrete, brick, cement plaster/mortar, inert building debris, aggregates and asphalt. The material should be free from marine mud, household refuse, plastic, metals, industrial and chemical waste, animal and vegetable matter, and other material considered to be unsuitable by the Filling Supervisor.

Chemical Wastes

- 5.10 If chemical wastes are produced at the construction site, the following mitigation measures should be implemented to minimize the environmental impacts associated with the handling, transportation and disposal of chemical waste:
- Contractor should be required to register with the EPD as a Chemical Waste Producer and to follow the guidelines stated in the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes.
 - Good quality containers compatible with the chemical wastes should be used, and incompatible chemicals should be stored separately.
 - Appropriate labels should be securely attached on each chemical waste container indicating the corresponding chemical characteristics of the chemical waste, such as explosives, flammable, oxidizing, irritant, toxic, harmful, corrosive, etc.
 - The Contractor should use a licensed collector to transport and dispose of the chemical wastes generated at the Chemical Waste Treatment Centre at Tsing Yi, or other licensed facility, in accordance with the Waste Disposal (Chemical Waste) (General) Regulation.

General Refuse

- 5.11 The recommended mitigation measures for the handling of general refuse are as below:
- General refuse should be stored in enclosed bins or compaction units separate from C&D material.
 - A reputable waste collector should be employed by the contractor to remove general refuse from the site, separately from C&D material.
 - An enclosed and covered area is preferred to reduce the occurrence of 'wind blown' light material.

6. ECOLOGICAL IMPACT

Introduction

- 6.1 The ecological impact assessment in the EIA Report identified that ecological impacts resulting from the proposed drainage improvement works are anticipated to be very minor in scale. Nevertheless, measures were identified in the EIA Report that would minimise any potential ecological impact. Ecological mitigation measures are detailed in the following sections.

Ecological Mitigation Measures

- 6.2 Following *EIAOTM Annex 16* guidelines, mitigation measures are proposed in this section to avoid, minimise and compensate for identified ecological impacts.

Avoidance/ Minimisation

- 6.3 Wherever possible, proposed drainage improvement works have been designed to avoid or minimise direct impacts to areas of recognised conservation importance in the Assessment Area including Conservation Area (CA), Coastal Protection Area (CPA), and Site of Special Scientific Interest (SSSI).
- 6.4 The following measures should be implemented to minimise identified ecological impacts during the construction and operation phase.

Construction Phase

- 6.5 The proposed twin cell box-culvert constructed partially underneath Tung Tsz Road has been designed to reduce the footprint of the proposed works from 0.35ha to 0.3ha, thereby minimising direct impacts to marsh habitat and the CA.
- 6.6 During the construction of the proposed twin cell box-culvert, the following measures are recommended to be implemented:
- Sheet-pilings, which will be installed around the trench of excavation, should be extended above ground level for ~2m to act as hoarding to isolate the works site.
 - The trenching works for the construction of the proposed box culvert should be carried out in phases, with a trench length of not more than 120m in each phase. The trench should be backfilled and compacted with suitable materials upon completion of each phase of the construction works.
 - The construction of intercept point of twin cell box culvert at the upstream of Wai Ha River should be confined to only one side of the river bank.
 - Construction works of box culvert should be conducted in the existing artificially modified channel as far as practicable which lined with masonry wall in order to minimised impact to natural stream section.
 - To restore and enhance the ecological value of the stream, any affected river bank should be reinstated to its original condition or lined with rock-filled gabion.
 - Planting pits will be provided in any gabion bank to allow the re-establishment of riparian vegetation.
 - The existing natural riverbed and substrates should be retained and the natural pool-riffle sequence should be re-created in the new channel bed.

6.7 Concerning the excavation works, the following measures should be implemented:

- All works conducted within or close to water bodies should be carried out from October to April, with construction making use of land-based plant.
- Works within river/stream channels should be restricted to an enclosed dry section of the river, with containment measures such as bunds and barriers used within the river to minimize the impacts upon the downstream water body.
- Site runoff should be directed towards regularly cleaned and maintained silt traps and oil/grease separators to minimise the risk of sedimentation and pollution of river water. The silt and oil/grease separators should be appropriately designed for the local drainage and ground conditions.
- To minimize leakage and loss of sediments during excavation in narrow channels, tightly sealed closed grab excavators should be deployed where material to be handled is wet.
- For the construction of the box culvert along the north side of Shuen Wan Marsh Conservation Area, sand bags should be deployed along the limit of the works area to prevent muddy water ingress into the CA. Sand bags should be placed to a height of at least 300mm from ground level and +2.5 mPD (whichever is greater) to provide adequate allowance for the built-up water level during rainstorm events. Surface within the works area runoff should then be collected and directed into the existing drainage system

6.8 During the construction of the ecological compensatory area (ECA), the following monitoring should be implemented:

- Monthly check of planted, retained and transplanted trees and shrubs, and other planted vegetation (including wetland vegetation, shrubs and trees once planting of these has commenced).
- Monthly monitoring *in situ* of water quality of the ECA once connection to the river has been made.
- Weekly inspection of the construction and planting of the ECA.

6.9 Since the identified ecological impacts resulting from the proposed drainage improvement work are very minor in scale, ecological monitoring is conducted to ensure that the proposed construction would produce no adverse ecological impacts on the floral and faunal characteristics on-site and in the adjacent habitats. During the pre-construction and construction phases of the stormwater pumping station and twin-cell box-culvert under Contract 1, the following monitoring should be implemented:

- During the pre-construction phase, ecological baseline monitoring updating the habitat map, floristic and faunal characteristics (including bird, mammal, herpetofauna, butterfly, dragonfly) within the works boundary and areas within 100m of the works boundary under Contract 1. Since the proposed construction area under Contract 1 is adjacent to the downstream of Wai Ha River, aquatic stream survey (including fish and macroinvertebrates) in this downstream portion will be conducted.
- Monthly monitoring of the faunal groups (same faunal groups as for the pre-construction phase monitoring) during the construction.
- Monthly check of retained and transplanted trees and shrubs within the work boundary and riparian vegetation adjacent to construction site and wetland vegetation (mainly mangrove and mangrove-associated vegetation) during the construction.

- Monthly monitoring *in situ* of water quality of Wai Ha River during the construction.

No ecological monitoring on the marine habitat is required as no ecological impacts on marine ecosystem resulting from the proposed construction of stormwater pumping station under Contract 1 was identified by the approved EIA report.

6.10 During the pre-construction and construction phases of the twin-cell box-culvert under Contract 2, the following monitoring should be implemented:

- During the pre-construction phase, ecological baseline monitoring updating the habitat map, floristic and faunal characteristics (including bird, mammal, herpetofauna, butterfly, dragonfly, and fish and macroinvertebrates in Wai Ha River) within the works boundary and areas within 100m of the works boundary under Contract 2.
- Monthly monitoring of the faunal groups (same faunal groups as for the pre-construction phase monitoring) during the construction.
- Monthly check of retained and transplanted trees and shrubs within the work boundary, riparian vegetation adjacent to construction site and wetland vegetation (mainly mangrove and mangrove-associated vegetation) during the construction.
- Monthly monitoring *in situ* of water quality of Wai Ha River during the construction.
- Weekly inspection of the construction and planting for the box-culvert construction

6.11 It has been identified in the EIA report that a plant species of conservation interest (Hong Kong Pavetta, *Pavetta hongkongensis*) would be potentially affected by the construction of the proposed box-culvert. In view of this, specific mitigation measures have been recommended for this species:

- The affected individuals are to be transplanted to a suitable wooded habitat in the ECA prior to the construction phase of the second contract of the Project.
- A detailed vegetation survey of the affected species of conservation interest should be conducted by a suitably qualified botanist/ecologist to identify the number and location of the affected individuals. A detailed transplantation methodology should be formulated before the commencement of transplantation.
- Transplantation should be supervised by a suitably qualified botanist/horticulturalist/arborist.

6.12 To minimise disturbance to habitats adjacent to the works areas, noise mitigation measures as listed below should be implemented:

- Quieter construction plant should be used during the construction phase.
- Temporary noise barriers should be used during the construction of the box-culvert along Tung Tsz Road, the floodwater pumping station, the mechanical gate, and drainage pipe to minimise potential construction phase disturbance to ardeids that may breed in Shuen Wan Egretty SSSI, and avifauna foraging in marsh habitat.
- Noise generating construction works within 100m of any nests in the Shuen Wan Egretty SSSI should be avoided as far as practicable during the breeding season (March to June) of the ardeids. Works near the SSSI (i.e. installation of mechanical gate) could be restricted to be executed outside the breeding season by provision of special conditions in the contract document.
- To further minimise construction noise impact to the marshland and prevent tipping, storage of

construction material and encroachment of personnel into the marshland area, hoardings with minimum height of 2m should be set up along the south side of the proposed box culvert works area adjacent to the marsh, extending at least 20m at both ends, throughout the construction period.

- 6.13 Standard good site practice measures should be implemented throughout the construction phase. The measures should include:
- Placement of equipment or stockpile in designated works areas and access routes selected on existing disturbed land to minimise disturbance to natural or moderate-high ecological value habitats.
 - Construction activities should be restricted to work areas that should be clearly demarcated. The work areas should be reinstated after completion of the works.
 - Waste skips should be provided to collect general refuse and construction wastes. The wastes should be disposed of timely and properly off-site.
 - General drainage arrangements should include sediment and oil traps to collect and control construction site run-off.
 - Open burning on works sites is illegal, and should be strictly prohibited.

Operation Phase

- 6.14 Potential operational phase activities in newly box-culvert would be limited to regular maintenance such as de-silting. Impacts to aquatic communities in the nearby water channel resulting from these activities are expected to be minor. Nevertheless, the following measures are recommended to minimise potential impacts resulting from operational phase activities:
- To minimise sedimentation, de-silting should be limited to the dry season.
 - Waste material produced during de-silting should be disposed of in a timely and appropriate manner.

Compensation

- 6.15 Compensatory planting as listed below would be required due to the unavoidable loss of trees and vegetations.
- Planting of trees should be provided within the ECA to compensate for the unavoidable loss of approximately 0.08ha of secondary woodland habitat that would be affected by the drainage improvement works.
 - Planting of trees and other vegetation within project area along the banks of Wai Ha River and Tung Tsz Road should also provide compensation for unavoidable tree-felling and loss of riparian vegetation resulting from the proposed works.
 - Planting of trees and shrubs of appropriate separation and density should be provided in area falling within the Shuen Wan Conservation Area to compensate for the loss of tree and other wetland vegetation (such as mangrove and mangrove-associated vegetation).
 - The compensatory planting should make use of native plant species with flowers/fruits attractive to wildlife.
- 6.16 As there will be loss of a small area of marsh habitat (about 0.30ha) within the CA resulting from the construction of the box-culvert along Tung Tsz Road, a total of about 1.12 ha of area is proposed as ECA to compensate the loss of marsh and secondary habitats. Wetland habitats, including open water, intertidal mudflat, mangrove and brackish marsh, of approximately 0.75 ha will be proposed,

while about 0.37 ha of land will be planted with trees and shrubs or as a receptor site for any transplanted trees under the Project. The compensation should includes the following:

- The ECA will make use of an existing low ecological value recreational fishpond on government land adjacent to the marsh.
- The above-mentioned pond should be enhanced by removing boardwalks around the existing pond, and restoring vegetation along the pond bunds. It should also be re-profiled to provide areas of shallow water (approximately 15-50cm deep), creating a suitable foraging habitat for wildlife.
- Screen planting of shrubs and trees along the south-eastern bund of the pond should be implemented to minimise disturbance to avifauna and other wildlife from the adjacent recreational fishpond.

Ecological Monitoring and Audit Requirements

6.17 The proper implementation of mitigation measures during construction and operation phase recommended in Section 6.3 to 6.15 should be monitored and audited. Ecological monitoring (including flora establishment and fauna utilization) of the ECA will be carried out by qualified ecologists employed by the Contractor during the 1-year wetland establishment period of the ECA. During the post establishment period, ecological monitoring and maintenance of the ECA will be undertaken by Agriculture, Fisheries and Conservation Department (AFCD) for the first 5 years upon completion of the wetland habitat. Monitoring during the post-establishment phase will only involve measures to monitor the vegetation health, fauna utilization of the ECA and maintain the engineering stability of the bunds and created wetland of the ECA. The need for extension of the maintenance of the ECA would be subject to further review.

6.18 A specific monitoring programme of the compensatory habitats of the ECA is required. The programme should provide data on the establishment of marsh communities, and allow an assessment of the relative success of mitigation measures to be made. The ecological monitoring will be conducted by qualified ecologists employed by the Contractor in accordance with the approved ecological monitoring programme and requirements detailed in the Habitat Compensatory Plan (HCP) pursuant to Condition 2.5 of the Environmental Permit No. EP-303/2008 and approved by EPD on 24 September 2010. Ecological monitoring of the ECA during its construction and establishment phases is recommended in Table 6.1. Table 6.2 describes the action and limit levels and the action plan for the ecological monitoring of the ECA during establishment phase. Methodology is also applicable as a management plan after the establishment phase monitoring. Ecological monitoring results of the ECA should be submitted to the Environmental Team Leader for inclusion in the Monthly EM&A Reports and verified by IEC before submission to EPD.

Table 6.1 Construction and Establishment Phase Ecological Monitoring by the Contractor’s ecologist for the ECA

	Construction Phase Ecological Monitoring	Establishment Phase Ecological Monitoring
Habitat types	Not required.	At six monthly intervals at the end of the wet season (i.e. September 2011) and the end of the dry season (i.e. March 2012) when tide height is <1.5 mPD.

	Construction Phase Ecological Monitoring	Establishment Phase Ecological Monitoring
Vegetation cover	Not required.	At six monthly intervals at the end of the wet season (i.e. September 2011) and the end of the dry season (i.e. March 2012) when tide height is <1.5 mPD.
Vegetation health	Monthly check of planted, retained and transplanted trees and shrubs, and planting (once planting has commenced).	Monthly check of planted, retained and transplanted trees and shrubs.
Water Quality	Following filling with water monthly for <i>in situ</i> water quality.	Monthly for <i>in situ</i> water quality.
Intertidal fauna	Not required.	At six monthly intervals in wet season (August 2011) and dry season (February 2012).
Other fauna (include avifauna, herpetofauna, fish, odonate and butterfly)	Not required.	At six monthly intervals in wet season (August 2011) and dry season (February 2010).
Site Inspections	Weekly.	Twice per month.

Table 6.2 Proposed Contingency Plan for Monitoring and Maintaining the ECA

Parameters	Action Level	Limit Level	Action
Flooding/storm damage	N.A.	N.A.	Review damage in conjunction with short-term weather forecast. Review damage (e.g. vegetation condition) and determine severity and undertake repairs/modifications to the design.
Area of water in the open water pond at tide height of < 1.5 mPD	< 70%	< 60 %	Action level exceedance: double the monitoring frequency, identify and review the problem. If the problem persists, the action plan for limit level exceedance should be implemented. Limit level exceedance: re-profiling as required.
Emergent or floating vegetation in the open water pond at tide height of < 1.5 mPD(although it	> 10 %	> 20 %	Action level exceedance: double the monitoring frequency, identify and review the problem. If the problem persists, the action plan for limit level exceedance should be implemented. Limit level exceedance: manual or

Parameters	Action Level	Limit Level	Action
is not proposed to plant emergent or floating vegetation as part of the restoration process, it is to be expected that these will colonise the wetland over time)			mechanical vegetation clearance.
Woodland area with a mixture of planted trees and shrubs; wooded area with retained and/or (trans)planted trees	< 80%	< 70%	Action level exceedance: review tree status and growth. If the problem (such as dead trees, shrubs or >50% diseased leaves in tree canopy) persists, the action plan for limit level exceedance should be implemented. Limit level exceedance: undertake supplemental tree and/or shrub planting.
Emergent, mangrove propagules or unwanted vegetation in the intertidal mudflat (it is expected that such vegetation will colonize the wetland over time)	> 20%	> 30%	Action level exceedance: double the monitoring frequency, identify and review the problem. If the problem persists, the action plan for limit level exceedance should be implemented. Limit level exceedance: manual or mechanical vegetation clearance.
Brackish marsh vegetation cover	< 80%	< 70%	Action level exceedance: double the monitoring frequency, identify and review the problem. If the problem (such as dead plants or invasion of undesirable plant species) persists, the action plan for limit level exceedance should be implemented. Limit level exceedance: carry out weeding or planting.
Undesirable plant species (all wetland) including unwanted terrestrial	> 10% of vegetation in the ECA	> 20% of vegetation in ECA	Action level exceedance: removal by weeding. Limit level exceedance: removal by weeding, if problem persists or further deterioration occurs, review design

Parameters	Action Level	Limit Level	Action
species and exotics (including but not limited to exotic, invasive climbers <i>Mikania micrantha</i> , <i>Ipomoea aquatica</i> , <i>Ipomoea cairica</i> , <i>Eichhornia crassipes</i> and <i>Typha angustilia</i>).			and management regime.
Undesirable fauna including invasive/exotic aquatic invertebrates (including but not limited to Red Imported Fire Ant)	Presence	Negatively impacting wetland function	Action level exceedance: treatment or removal (or other method if suitable). Limit level exceedance: increase frequency of treatment or removal (or other method if suitable), review management protocols and design.

6.19 Ecological monitoring during post-establishment phase should be undertaken by AFCD to maintain the wetland health and engineering stability of the created wetland (**Table 6.3**). Monitoring results should be reported to Environmental Protection Department (EPD) on a quarterly basis.

Table 6.3 Maintenance and Management Schedule for the ECA during the Post-establishment Phase

Action	Frequency	Notes
Structural maintenance		
Inspect condition of bunds and repair / maintain as necessary	Annual inspection.	Also after any flood events/ typhoons. Repair/maintenance of bunds will only be carried out if necessary.
Vegetation management		
Supplemental planting	Requirement to be assessed annually.	Depending upon health status of the wetland vegetation, trees and shrubs during the bi-annual monitoring. Planting to be restricted to the wet season; monthly inspection on any newly planted vegetation should be conducted in the first three months to monitor their survival

Action	Frequency	Notes
		and establishment rates in early planting period.
Monitoring the health of trees and shrubs, vegetation cover, pruning and removal	Bi-annual monitoring of vegetation cover and health; Annual pruning of trees and shrubs if necessary in the whole ECA.	Annual pruning of trees and shrubs will be conducted only if necessary.
Removal of exotic / undesirable invasive plants (including algae, unwanted terrestrial species and exotics) (weeding)	Quarterly checking of unwanted vegetation in particular wetland habitats (i.e. open water, intertidal mudflat, brackish marsh and mangrove) with removal to be scheduled in subsequent 30 days.	Aggressive exotics such as floating herb <i>Eichhornia crassipes</i> and emergent herb <i>Typha angustifolia</i> to be removed immediately. Any significant number of established mangrove seedlings in intertidal mudflat and open water to be removed immediately.
Control of excessive colonization of brackish marsh in the adjacent intertidal mudflat	Quarterly checking of any excessive colonization of brackish marsh vegetation with removal to be scheduled for subsequent 30 days.	Removal of excessive colonization of brackish marsh will be conducted on a case-by-case basis.
Monitoring of intertidal fauna, avifauna, herpetofauna, fish, odonate and butterfly	Bi-annually.	
Pest control	Quarterly check for presence of pests.	Review and consider appropriate treatment on a case-by-case basis.

6.20 For other areas of ecological importance, baseline ecological survey should be conducted in pre-construction phases of Contracts 1 and 2 to update the floristic composition and faunal characteristics of the adjacent ecologically sensitive habitats (such as Wai Ha River and marsh in Shuen Wan Conservation Area) (**Figure 6.1**). The baseline survey should cover areas within the works boundaries (Contracts 1 and 2) and areas within 100m from the boundaries of Contracts 1 and 2. Bi-monthly and quarterly ecological monitoring should be carried out during the construction and operation phases (12 months) of the stormwater pumping station, twin-cell box-culvert and drainage pipe (**Table 6.4**). The construction and operation phases ecological monitoring should be conducted by qualified local ecologist(s) of the Independent Environmental Checker (IEC) for the Project with at least 7 years relevant ecology and EM&A experience. The IEC should submit reports on the findings of each monitoring trip, and a final report summarising the monitoring results over the entire monitoring period to AFCD and Environmental Protection Department (EPD).

Table 6.4 Pre-construction, Construction and Operation Phase Ecological Monitoring for areas under Contracts 1 and 2

	Pre-construction Phase Ecological	Construction Phase Ecological	Establishment Phase Ecological
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	Monitoring	Monitoring	Monitoring
Habitat map	Once before the commencement of construction of Contracts 1 and 2	Not required.	Not required.
Vegetation	Once before the commencement of construction of Contracts 1 and 2	Bi-monthly check on the retained and transplanted trees and shrubs within and in proximity to the works boundary.	Quarterly check on the retained, transplanted and planted trees and shrubs within and in proximity to the works boundary.
Fauna (includes avifauna, herpetofauna, odonate and butterfly)	Once before the commencement of construction of Contracts 1 and 2	Bi-monthly monitoring on faunal groups in any ecologically sensitive area within 100m of the works boundary.	Quarterly monitoring on faunal groups in any ecologically sensitive area within 100m of the works boundary.
Stream (includes fish and macroinvertebrates)	Once before the commencement of construction of Contracts 1 and 2	Bi-monthly monitoring on stream fauna along Wai Ha River.	Quarterly monitoring on stream fauna along Wai Ha River.

- 6.21 Following transplantation, the health and condition of individuals of the plant species of conservation interest, *Pavetta hongkongensis*, affected by the proposed works should be monitored by a qualified botanist/ecologist. Monitoring should cover 12-month period following transplantation, and be conducted once a week in the first 3 months and at least once per month in the remaining of monitoring period. Health and growth condition of trees planted for compensating the tree loss of the Project (for both Contracts 1 and 2) should be monitored by a qualified botanist/ecologist during the 1-year establishment period. Monitoring results of these transplanted saplings of *Pavetta hongkongensis* and trees should be included in the EM&A reports of the Project for updating the conditions of these plants after transplantation.

7. LANDSCAPE AND VISUAL

Introduction

- 7.1 Landscape and Visual Impact Assessment in the EIA Report has identified the key issues and the possible impacts due to the proposed work. It has also recommended mitigation measures for minimizing the impacts and for improving overall landscape and visual quality. The Contractor of the Project should be responsible for the implementation of mitigation measures.

Monitoring Requirement

- 7.2 A Registered Landscape Architect (RLA) as a member of the ET, with local construction site experience should be responsible for conducting the baseline review and monitoring the design, implementation and maintenance of landscape and visual mitigation measures during construction and operational phases in accordance with the EIA Report.

Construction Phase

Baseline Review

- 7.3 A baseline review should be undertaken at the commencement of the construction contracts. The purpose of the review is:
- to check the status of the landscape resources within, and immediately adjacent to, the construction sites and works areas.
 - to determine whether any change has occurred to the status of the landscape resources since the EIA.
 - to determine whether amendments in the design of the landscape and visual mitigation measures are required for those changes.
 - to recommend any necessary amendments to the design of the landscape and visual mitigation measures.

Landscape and Visual Monitoring

- 7.4 The design, implementation and maintenance of landscape and visual mitigation measures should be checked bi-weekly to check that they are fully realised. Any potential conflicts between the proposed landscape measures and any other project works or operational requirements should also be recorded for the Contractor to resolve in early stage, without compromising the intention of the mitigation measures.

Operational Phase

Landscape and Visual Monitoring

- 7.5 All landscape and visual mitigation measures should be monitored quarterly during the first year of the Operational Phase to check on the effectiveness of the mitigations.

Mitigation Measures

Construction Phase

- 7.6 A number of landscape and visual mitigation measures during the construction phase have been proposed in the EIA report, and are summarized as below:

- Use of hoardings as visual screens for the construction in the works areas.
- Use of temporary barriers, covers and drainage provision around the construction works as contaminant / sediment control to prevent the contaminants and sediments from entering the sensitive water-based habitats.
- Implementation of pollution control measures to minimise any adverse environmental impacts to the surrounding habitats.
- Liaison with the nursery operator as necessary to minimise any adverse impact to the daily operation and plant holding capacity of the nursery.
- Maintenance and protection of the existing trees, especially their crowns, trunks and roots, within work sites.
- Provision of construction light should be controlled at night to avoid excessive glare to the surrounding villages and to Plover Cove.

Operation Phase

- 7.7 Landscape and visual mitigation measures during the operation phase as listed below should be implemented to minimize the potential impacts:
- Viewing area formation by planting with shrubs, grasses and benches along the area.
 - Architectural design of the pump house will help it fit into the existing suburban, natural to semi-natural surroundings.
 - Landscape design of pump house by providing sufficient planting around its boundary fence,
 - Enhancement planting along Tung Tsz Road with shrubs / trees of suitable species to help protect the stream and marshes.
 - Construction of box culvert should be with at least 1.0m soil depth for enhancement planting.
 - Transplanting of existing affected trees to adjacent locations should be carried out.
 - Preparation for transplanting is needed to allow sufficient time for root pruning and rootball preparation prior to transplanting.
 - Reinstatement of affected area should be carried out to check that the works areas are properly reinstated.
- 7.8 The implementation for the recommended landscape and visual impact mitigation measures is presented in **Appendix A**.

8. ENVIRONMENTAL AUDIT

Site Inspection

- 8.1 Site inspection provides a direct means to assess and check the project's environmental protection and pollution control measures are in compliance with relevant statutory requirements. Site inspection should be undertaken regularly and routinely by the ET to inspect construction activities in order to check that appropriate environmental protection and pollution control mitigation measures are implemented in accordance with EIA recommendations. With well defined pollution control and impact mitigation specifications and an established efficient and remedial action reporting system, site inspection is an effective tool to verify the acceptable environmental performance on the construction site.
- 8.2 The ET leader should be responsible for formulation of the environmental site inspection, deficiency and remedial action reporting system, and for carrying out site inspection works. He should in consultation with the IEC, prepare a procedure for the site inspection, deficiency and remedial action reporting requirements, and submit to the Contractor for agreement, and to the ER for approval, within 21 days of commencement of the construction contract.
- 8.3 Regular site inspections should be carried out at least once per week for all works areas. The inspections should cover the environmental situation, pollution control and mitigation measures within the works areas; they should also review the environmental situation outside the works areas which is likely to be affected, directly or indirectly, by the site activities. The ET leader should make reference to the following information in conducting the inspection:
- i. The EIA recommendations and requirements on environmental protection and pollution control mitigation measures.
 - ii. Works progress, programme, site/aerial photos and site plans.
 - iii. Individual works methodology proposals (which should include proposal on associated pollution control measures).
 - iv. Contract specifications on environmental protection and pollution prevent control.
 - v. Relevant environmental protection and pollution control laws, ProPECC Notes.
 - vi. Previous site inspection results.
- 8.4 The Contractor should update the ET leader with all relevant information of the construction contract necessary for him to carry out site inspections. Inspection results and associated recommendations for improvements in the Project's environmental performance should be submitted to the IEC and the Contractor within 24 hours for reference and for taking immediate remedial action. The Contractor should follow the procedures and time-frame as stipulated in the environmental site inspection, deficiency and remedial action reporting system (formulated by the ET leader), to report on any remedial measures subsequent to the site inspections.
- 8.5 The ET and/or IEC should also carry out ad hoc site inspections if major unacceptable or unforeseen 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.

Compliance with Legal and Contractual Requirements

- 8.6 There are contractual environmental protection and pollution control requirements as well as environmental protection and pollution control laws in Hong Kong with which construction activities should comply.
- 8.7 The ET leader should also review the progress and programme of the works to check that relevant environmental laws have not been violated, and that any foreseeable potential for violating laws can be prevented.
- 8.8 The Contractor should regularly copy relevant documents to the ET leader so that the checking of

the Project's environmental performance can be carried out effectively. Documents to be submitted by the Contractor should include at least the updated Works Progress Reports, Works Programme, application for any necessary licence / permits under relevant environmental protection laws, and all the valid licence / permits received to date. The site diary should also be available for the ET leader's inspection upon his request.

- 8.9 After reviewing the documents, the ET leader should advise the Contractor and inform the IEC of any non-compliance with the project contractual and legislative requirements on environmental protection and pollution control. The Contractor should take follow-up and appropriate remedial actions. If the ET leader's review concludes that the current status of licence / permit application and any planned environmental protection and pollution control works may not cope with the works programme, or potential violation of environmental protection and pollution control requirements may arise, he should advise the Contractor and ER accordingly. The review should be copied to IEC for any follow-up action.
- 8.10 Upon receipt of the advice, the Contractor should undertake immediate action to remedy the situation. The ER should follow up to check that appropriate action has been taken by the Contractor to satisfy Project's environmental protection and pollution control requirements

Environmental Complaints

- 8.11 Complaints should be referred to the ET leader for carrying out complaint investigation procedures. The ET leader should undertake the following procedures upon receipt of any complaint:
- (i) Log complaint and date of receipt onto the complaint database and inform the IEC immediately.
 - (ii) Investigate the complaint to determine its validity, and assess whether the source of the problem is due to works activities.
 - (iii) Identify mitigation measures in consultation with the IEC if a complaint is valid and due to works.
 - (iv) Advise the Contractor accordingly if mitigation measures are required.
 - (v) Review the Contractor's response to identified and required mitigation measures, and the current situation.
 - (vi) If the complaint is transferred from the EPD, submit interim report to the EPD on the status of the complaint investigation and follow-up action within the time frame assigned by the EPD.
 - (vii) Undertake additional monitoring and audit to verify the situation if necessary, and check that any valid reason for complaint does not recur through the proposed amendments to work methods, procedures, machines and/or equipment, etc.
 - (viii) Report investigation results and subsequent actions to complainant (if the source of complaint is EPD, the results should be reported within the timeframe assigned by the EPD).
 - (ix) Log a record of the complaint, investigation, the subsequent actions and the results in the monthly EM&A reports.
- 8.12 During the complaint investigation work, the Contractor and ER should cooperate with the ET leader in providing all necessary information and assistance for completion of the investigation. If mitigation measures (in consultation with the IEC) are required following the investigation, the Contractor should promptly carry out the measures. The ER should check that the measures have been carried out by the Contractor.

9. REPORTING

General

- 9.1 Reports can be provided in an electronic medium upon agreeing the format with EPD. This would enable a transition from a paper / historic and reactive approach to an electronic / real time proactive approach. All the monitoring data (baseline and impact) should also be submitted on diskettes. The format for noise monitoring data to be submitted on diskette is shown in **Appendix B**.
- 9.2 Types of reports that the ET leader should prepare and submit include baseline monitoring report, monthly EM&A report, quarterly EM&A summary report and final EM&A review report. In accordance with Annex 21 of the EIAO-TM, a copy of the monthly, quarterly summary and final review EM&A reports should be made available to the Director of Environmental Protection.

Baseline Monitoring Report

- 9.3 The ET leader should 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 should be submitted to the Contractor, the IEC, the ER and the EPD. The ET leader should liaise with the relevant parties on the exact number of copies they require. The report format and baseline monitoring data format should be agreed with the EPD prior to submission.
- 9.4 The baseline monitoring report should include at least the following:
- (i) Up to half a page executive summary.
 - (ii) Brief project background information.
 - (iii) Drawings showing locations of the baseline monitoring stations.
 - (iv) Monitoring results (in both hard and diskette copies) together with the following information:
 - Monitoring methodology.
 - Types of equipment used and calibration details.
 - Parameters monitored.
 - Monitoring locations.
 - Monitoring date, time, frequency and duration.
 - Quality assurance (QA) / quality control (QC) results and detection limits.
 - (v) Details of 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 results.
 - (vi) Determination of the Action and Limit Levels for each monitoring parameter and statistical analysis of the baseline data, the analysis should conclude if there is any significant difference between control and impact stations for the parameters monitored.
 - (vii) Revisions for inclusion in the EM&A Manual.

- (viii) Comments, recommendations and conclusions.

Monthly EM&A Reports

- 9.5 The results and findings of all EM&A work required in the Manual should be recorded in the monthly EM&A reports prepared by the ET leader. The EM&A report should be prepared and submitted within 10 working days of the end of each reporting month, with the first report due the month after construction commences. Each monthly EM&A report should be submitted to the following parties: the Contractor, the IEC, the ER and the EPD. Before submission of the first EM&A report, the ET leader should liaise with the parties on the required number of copies and format of the monthly reports in both hard copy and electronic medium.
- 9.6 The ET leader should review the number and location of monitoring stations and parameters every six months, or on as needed basis, in order to cater for any changes in the surrounding environment and the nature of works in progress.

First Monthly EM&A Report

- 9.7 The first monthly EM&A report should include at least the following:
- (i) Executive summary (1-2 pages):
- Breaches of Action and Limit levels.
 - Complaint log.
 - Notifications of any summons and successful prosecutions.
 - Reporting changes.
 - Future key issues.
- (ii) Basic project information:
- Project organization including key personnel contact names and telephone numbers.
 - Construction programme.
 - Management structure, and
 - Works undertaken during the month.
- (iii) Environmental status:
- Works undertaken during the month with illustrations (such as location of works).
 - Drawings showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations (with co-ordinates of the monitoring locations).
- (iv) A brief summary of EM&A requirements including:
- All monitoring parameters.
 - Environmental quality performance limits (Action and Limit levels).
 - Event-Action Plans.

- Environmental mitigation measures, as recommended in the project EIA study final report.
 - Environmental requirements in contract documents.
- (v) Implementation status:
- Advice on the implementation status of environmental protection and pollution control / mitigation measures, as recommended in the project EIA.
- (vi) Monitoring results (in both hard and diskette copies) together with the following information:
- Monitoring methodology.
 - Name of types of equipment used and calibration details.
 - Parameters monitored.
 - Monitoring locations.
 - 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.
- (vii) Report on non-compliance, complaints, and notifications 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 investigation, liaison and consultation undertaken, actions and follow-up procedures taken, results and summary.
 - Record of all notification of summons and successful prosecutions for breaches of current environmental protection / pollution control legislation, 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.
 - Description of the actions taken in the event of non-compliance and deficiency reporting and any follow-up procedures related to earlier non-compliance.
- (viii) 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.
- Comments (for examples, effectiveness and efficiency of the mitigation measures), recommendations (for example, any improvement in the EM&A programme) and conclusions.

Subsequent Monthly EM&A Reports

9.8 Subsequent monthly EM&A reports should include the following:

- (i) Executive summary (1 - 2 pages):
 - Breaches of Action and Limit levels.
 - Complaints log.
 - Notifications of any summons and successful prosecutions.
 - Reporting changes.
 - Future key issues.
- (ii) Environmental status:
 - Works undertaken during the month with illustrations (such as location of works etc.).
 - Drawing showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations.
- (iii) Implementation status:
 - Advice on the implementation status of environmental protection and pollution control / mitigation measures, as recommended in the project EIA.
- (iv) Monitoring results (in both hard and diskette copies) together with the following information:
 - Monitoring methodology.
 - Name of types of equipment used and calibration details.
 - Parameters monitored.
 - Monitoring locations.
 - 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.
- (v) Report on non-compliance, complaints, and notifications 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 investigation, liaison and consultation undertaken, actions and follow-up procedures taken, results and summary.
 - Record of all notification of summons and successful prosecutions for breaches of current environmental protection / pollution control legislation, 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.
 - Description of the actions taken in the event of non-compliance and deficiency reporting and any follow-up procedures related to earlier non-compliance.
- (vi) 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.
 - Comments (for examples, effectiveness and efficiency of the mitigation measures), recommendations (for example, any improvement in the EM&A programme) and conclusions.
- (vii) 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:
 - major activities being carried out on site during the period.
 - weather conditions during the period.
 - any other factors that might affect the monitoring results.
 - Monitoring schedule for the present and next reporting period.
 - Cumulative statistics on complaints, notifications of summons and successful prosecutions.
 - Outstanding issues and deficiencies.

Quarterly EM&A Summary Reports

9.9 A quarterly EM&A summary report of around five pages should be produced and should contain at least the following information.

- (i) Up to half a page executive summary.
- (ii) Basic project information including a synopsis of the project organisation, programme, contacts of key management, and a synopsis of works undertaken during the quarter.
- (iii) A brief summary of EM&A requirements including:
 - Monitoring parameters.
 - Environmental quality performance limits (Action and Limit levels).
 - Environmental mitigation measures, as recommended in the project EIA Final Report.
- (iv) Advice on the implementation status of environmental protection and pollution control / mitigation measures, as recommended in the project EIA Final Report, summarised in the updated implementation schedule.
- (v) Drawings showing the project area, any environmental sensitive receivers and the locations of

the monitoring and control stations.

- (vi) Graphical plots of any trends in monitored parameters over the past four months (the last month of the previous quarter and the present quarter) for representative monitoring stations annotated against:
 - Major activities being carried out on site during the period.
 - Weather conditions during the period.
 - Any other factors which might affect the monitoring results.
- (vii) Advice on the solid and liquid waste management status.
- (viii) A summary of non-compliance (exceedances) of the environmental quality performance limits (Action and Limit levels).
- (ix) A brief review of the reasons for and the implications of any non-compliance, including a review of pollution sources and working procedures.
- (x) A summary description of actions taken in the event of non-compliance and any follow-up procedures related to any earlier non-compliance.
- (xi) A summarised record of all complaints received (written or verbal) for each media, liaison and consultation undertaken, actions and follow-up procedures taken.
- (xii) Comments (for examples, a review of the effectiveness and efficiency of the mitigation measures), recommendations (for example, any improvement in the EM&A programme) and conclusions for the quarter.
- (xiii) Proponents' contacts and any hotline telephone number for the public to make enquiries.

Final EM&A Review Report

9.10 The final EM&A report should include, inter alia, the following information:

- (i) An executive summary.
- (ii) Drawings showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations.
- (iii) Basic project information including a synopsis of the project organisation, contacts of key management, and a synopsis of work undertaken during the entire construction period.
- (iv) A brief summary of EM&A requirements including:
 - Monitoring parameters.
 - Environmental quality performance limits (Action and Limit levels).
 - Environmental mitigation measures, as recommended in the project EIA study final report.
 - Event-Action Plans.
- (v) A summary of the implementation status of environmental protection and pollution control/mitigation measures, as recommended in the project EIA Report, summarised in the updated implementation schedule.
- (vi) Graphical plots of the trends of monitored parameters over the construction period for representative monitoring stations, including the post-project monitoring annotated against:

- The major activities being carried out on site during the period.
 - Weather conditions during the period.
 - Any other factors which might affect the monitoring results.
- (vii) A summary of non-compliance (exceedances) of the environmental quality performance limits (Action and Limit levels).
- (xi) A brief review of the reasons for and the implications of non-compliance including review of pollution sources and working procedures as appropriate.
- (xii) A summary description of the actions taken in the event of non-compliance and any follow-up procedures related to earlier non-compliance.
- (xiii) A summary record of all complaints received (written or verbal) for each media, liaison and consultation undertaken, actions and follow-up procedures taken.
- (xiv) A summary record of notifications of summons and successful prosecutions for breaches of the current environmental protection/pollution control legislations, locations and nature of the breaches, investigation, follow-up actions taken and results.
- (xii) A review of the validity of EIA predictions and identification of shortcomings in EIA recommendations.
- (xiii) Comments (for examples, a review of the effectiveness and efficiency of the mitigation measures and of the performance of the environmental management system, that is, of the overall EM&A programme).
- (xiv) Recommendations and conclusions (for example, a review of success of the overall EM&A programme to cost-effectively identify deterioration and to initiate prompt effective mitigatory action when necessary).

Data Keeping

- 9.11 No site-based documents (such as monitoring field records, laboratory analysis records, site inspection forms, etc.) are required to be included in the monthly EM&A reports. However, any such document should be well kept by the ET leader and be ready for inspection upon request. All relevant information should be clearly and systematically recorded in the document. Monitoring data should also be recorded in magnetic media form, and the software copy must be available upon request. Data format should be agreed with EPD. All documents and data should be kept for at least one year following completion of the construction contract.

Interim Notifications of Environmental Quality Limit Exceedances

- 9.12 With reference to the Event and Action Plan, when the environmental quality performance limits are exceeded, the ET leader should immediately notify the IEC and EPD, as appropriate. The notification should be followed up with advice to IEC and EPD on the results of the investigation, proposed actions and success of the actions taken, with any necessary follow-up proposals. A sample template for the interim notifications is presented in Appendix C.

Appendix A Implementation Schedule of Mitigation Measures

EIA Ref.	EM&A Ref.	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concern to Address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
A Noise Impact							
S 3.30	2.18	<p>Good Site Practice:</p> <ul style="list-style-type: none"> ▪ Only well-maintained plant shall be operated on-site and plant shall be serviced regularly during the construction program ▪ Silencers or mufflers on construction equipment shall be utilized and shall be properly maintained during the construction program ▪ Mobile plant, if any, shall be sited as far from NSRs as possible ▪ Machines and plant (such as 	To minimize construction noise impacts	Contractor	Works areas	Construction phase	EIAO-TM NCO

EIA Ref.	EM&A Ref.	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concern to Address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
		<p>trucks) that may be in intermittent use shall be shut down between work periods or shall be throttled down to a minimum</p> <ul style="list-style-type: none"> ▪ Plant known to emit noise strongly in one direction shall, wherever possible, be orientated so that the noise is directed away from the nearby NSRs ▪ Material stockpiles and other structures shall be effectively utilized, wherever practicable, in screening noise from on-site construction activities. 					
S 3.31 - 3.32	2.19	Use of quieter PME	To minimize construction noise impacts	Contractor	Works areas	Construction phase	EIAO-TM NCO
S 3.33 – 3.34	2.20-2.21	Use of temporary noise barrier	To minimize construction noise impacts	Contractor	Works areas as shown in Figure	Construction phase	EIAO-TM NCO

EIA Ref.	EM&A Ref.	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concern to Address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
3.36-3.38	2.23-2.24				3.5		
S 3.35 and Table 3.6	2.22	Use of alternative quieter construction method (the Low Impact Method)	To minimize construction noise impacts	Contractor	Part of the works area for pipe laying in Wai Ha (refer to Figure 3.5)	Construction phase	EIAO-TM NCO
3.36-3.38	2.23-2.24	Use of noise enclosure	To minimize construction noise impacts	Contractor	Part of the works area for pipe laying in Wai Ha (refer to Figure 3.5)	Construction phase	EIAO-TM NCO
B Air Quality Impact							
S4.16	3.5	Implementation of mitigation measures stipulated in the Air Pollution Control (Construction Dust) Regulation and good site practices including but not limited to the following:	To minimize construction dust impacts	Contractor	Construction Sites	Construction Phase	EIAO-TM

EIA Ref.	EM&A Ref.	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concern to Address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
		<ul style="list-style-type: none"> ▪ Use of regular watering to reduce dust emissions from exposed site surfaces and unpaved road, with complete coverage, particularly during dry weather; ▪ Use of frequent watering for particularly dusty static construction areas and areas close to ASRs; ▪ Tarpaulin covering of all dusty vehicle loads transported to, from and between site location; ▪ Establishment and use of vehicle wheel and body washing facilities at the exit points of the site; ▪ Routing of vehicles and 					

EIA Ref.	EM&A Ref.	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concern to Address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
		<p>positioning of construction plant should be at the maximum possible distance from ASRs.</p> <ul style="list-style-type: none"> ▪ Stockpiled excavated materials should be covered with tarpaulin, and should be removed off-site within 24 hours to avoid any odour nuisance arising. 					
C Water Quality Impact							
S5.29	4.5	<p>Construction Site Run-off and Drainage:</p> <ul style="list-style-type: none"> ▪ Before commencing any site formation work, all sewer and drainage connections shall be sealed to prevent debris, soil, sand etc. from entering public 	To minimize water quality impacts	Contractor	Works sites	Construction phase	ProPECC PN 1/94 Construction Site Drainage

EIA Ref.	EM&A Ref.	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concern to Address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
		<p>sewers/drains.</p> <ul style="list-style-type: none"> ▪ Temporary ditches shall be provided to facilitate run-off discharge into appropriate watercourses, via a silt retention pond. No site run-off shall enter the fishponds at Shuen Wan. ▪ Sand/silt removal facilities such as sand traps, silt traps and sediment basins shall be provided to remove sand/silt particles from runoff to meet the requirements of the Technical Memorandum standard under the Water Pollution Control Ordinance. The design of silt removal facilities shall be based on the guidelines provided in ProPECC PN 1/94. All drainage 					

EIA Ref.	EM&A Ref.	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concern to Address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
		<p>facilities and erosion and sediment control structures shall be inspected monthly and maintained to ensure proper and efficient operation at all times and particularly during rainstorms.</p> <ul style="list-style-type: none"> ▪ Water pumped out from excavated pits shall be discharged into silt removal facilities. ▪ During rainstorms, exposed slope/soil surfaces shall be covered by a tarpaulin or other means. <p>Other measures that need to be implemented before, during, and after rainstorms as summarized in ProPECC PN 1/94 shall be followed.</p>					

EIA Ref.	EM&A Ref.	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concern to Address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
		<ul style="list-style-type: none"> ▪ Exposed soil areas shall be minimized to reduce potential for increased siltation and contamination of runoff. ▪ Earthwork final surfaces shall be well compacted and subsequent permanent work or surface protection shall be immediately performed to reduce the potential of soil erosion. ▪ Open stockpiles of construction materials or construction wastes on-site shall be covered with tarpaulin or similar fabric during rainstorms. 					
S5.30	4.7	Further precautionary measures during rainy season:	To minimize water quality impacts to the designated Conservation Area	Contractor	Works areas near the Conservation Area	Rainy seasons during construction	EIAO-TM Water Pollution Control Ordinance

EIA Ref.	EM&A Ref.	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concern to Address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
		<ul style="list-style-type: none"> <li data-bbox="414 443 840 1262">▪ For the construction of the box culvert next to the existing channel of the Wai Ha River, sand bags should be deployed around the boundary of the works trench to prevent muddy water ingress into the adjacent CA or Wai Ha River. Sand bags should also be used to surround the excavated trench. Generally, the sand bags will be placed up to a height of 300mm to provide adequate allowance for the built-up water level during rainstorm event. With sand bags in place, surface runoff will be intercepted and flow to Wai Ha River or collected by the existing drainage system as usual. <li data-bbox="414 1294 840 1321">▪ For the construction of the box 				phase	(WPCO)

EIA Ref.	EM&A Ref.	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concern to Address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
		<p>culvert in the extreme northeast corner of Shuen Wan Marsh Conservation Area sand bags should be deployed along the limit of the works area to prevent muddy water ingress into the CA. Sand bags should be placed to a height of at least 300mm from ground level and +2.5 mPD (whichever is greater) to provide adequate allowance for the built-up water level during rainstorm events. Unpolluted surface runoff within the works area should then be collected and directed into the existing drainage system.</p> <ul style="list-style-type: none"> ▪ Sheet-piles, which would be installed around the works trench near the Conservation Area, would 					

EIA Ref.	EM&A Ref.	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concern to Address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
		<p>be extended above ground level for about 2m to serve as hoardings to isolate the works site.</p> <ul style="list-style-type: none"> ▪ Tarpulin sheets would be used to cover the excavation areas during heavy rainstorms. This would prevent the ingress of rainwater into the trench minimising the risk of muddy water getting into Wai Ha River and the adjacent Conservation Area. ▪ Any concrete washing water would be contained inside the works site surrounded by the extended sheet piles. A pump sump at the bottom of the trench would be provided to pump any excess water during concrete washing. 					

EIA Ref.	EM&A Ref.	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concern to Address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
		<ul style="list-style-type: none"> ▪ Stockpiling the excavated materials adjacent to the Conservation Area would not be allowed. The excavated materials would be either removed off site immediately after excavation, or stockpile at location(s) away from the Conservation Area. The stockpile locations shall be approved by the site engineer. 					
S5.31-S 5.32	4.8-4.9	<p>General Construction Activities:</p> <ul style="list-style-type: none"> ▪ Debris and refuse generated on-site should be collected, handled and disposed of properly to avoid entering the Wa Ha River and fish ponds at Shuen Wan. Stockpiles of cement and other construction materials should be kept covered 	To minimize water quality impacts	Contractor	Works sites	Construction phase	EIAO-TM WPCO

EIA Ref.	EM&A Ref.	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concern to Address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
		<p>when not being used.</p> <ul style="list-style-type: none"> ▪ Oils and fuels should only be used and stored in designated areas which have pollution prevention facilities. To prevent spillage of fuels and solvents to nearby water bodies, all fuel tanks and storage areas should be provided with locks and be sited on sealed areas, within bunds of a capacity equal to 110% of the storage capacity of the largest tank. The bund should be drained of rainwater after a rain event. 					
S5.33	4.10	<p>Sewage from Construction workforce:</p> <ul style="list-style-type: none"> ▪ Temporary sanitary facilities, such as portable chemical toilets, should be employed on-site. A 	To minimize water quality impacts	Contractor	Works sites	Construction phase	EIAO-TM WPCO

EIA Ref.	EM&A Ref.	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concern to Address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
		licensed contractor would be responsible for appropriate disposal and maintenance of these facilities.					
S5.34	4.11	<p>River Channel Excavation Works:</p> <ul style="list-style-type: none"> ▪ The excavation works within the upstream end of the existing river channel of the Wai Ha River for the construction of the proposed box culvert shall be carried out in dry condition. Containment measures such as bunds and barriers shall be used within the affected length of the river channel and the excavation works restricted to within an enclosed dry section of the channel. The excavation works within Wai Ha River shall be restricted to the period from October 	To minimize water quality impacts	Contractor	Works sites	Construction phase	EIAO-TM WPCO

EIA Ref.	EM&A Ref.	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concern to Address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
		to April.					
D Waste Management Implications							
S6.20 – 6.22	5.5	<p>Good site practices:</p> <ul style="list-style-type: none"> ▪ Nomination of approved personnel, such as a site manager, to be responsible for good site practices and making arrangements for collection of all wastes generated at the site and effective disposal to an appropriate facility. ▪ Training of site personnel in proper waste management and chemical waste handling procedures. ▪ Provision of sufficient waste disposal points and regular 	To reduce waste management impacts	Contractor	Works sites	Construction phase	ETWB TCW No.19/2005 ETWB TCW No.31/2004

EIA Ref.	EM&A Ref.	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concern to Address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
		<p>collection for disposal.</p> <ul style="list-style-type: none"> ▪ Appropriate measures to minimise windblown litter and dust during transportation of waste by either covering trucks or by transporting wastes in enclosed containers. ▪ Separation of chemical waste for special handling and appropriate treatment at the Chemical Waste Treatment Facility. ▪ Regular cleaning and maintenance programme for drainage systems, sumps and oil interceptors. ▪ A Waste Management Plan 					

EIA Ref.	EM&A Ref.	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concern to Address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
		<p>should be prepared and submitted to the Engineer for approval. One may make reference to ETWB TCW No. 15/2003 for details.</p> <ul style="list-style-type: none"> ▪ A recording system for the amount of wastes generated, recycled and disposed (including the disposal sites) should be proposed. 					
S6.23-6.24	5.7	<p>Waste reduction measures:</p> <ul style="list-style-type: none"> ▪ Segregation and storage of different types of waste in different containers, skips or stockpiles to enhance reuse or recycling of materials and their proper disposal. ▪ To encourage collection of aluminium cans by individual collectors, separate labelled bins 	To achieve waste reduction	Contractor	Works sites	Construction phase	EIAO-TM

EIA Ref.	EM&A Ref.	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concern to Address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
		<p>shall be provided to segregate this waste from other general refuse generated by the work force.</p> <ul style="list-style-type: none"> ▪ Any unused chemicals or those with remaining functional capacity shall be recycled. ▪ Maximising the use of reusable steel formwork to reduce the amount of C&D material. ▪ Proper storage and site practices to minimise the potential for damage or contamination of construction materials. ▪ Plan and stock construction materials carefully to minimise amount of waste generated and 					

EIA Ref.	EM&A Ref.	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concern to Address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
		avoid unnecessary generation of waste.					
S6.25-6.26		<p>Construction & Demolition (C&D) Material:</p> <ul style="list-style-type: none"> ▪ Excavated material with suitable characteristics/size should be reused on-site as fill material as far as practicable, such as for backfilling of the box culvert and drainage pipe works. ▪ Suitable areas should be designated within the works site boundaries for temporary stockpiling of C&D material. ▪ Within stockpile areas, the following measures should be taken to control potential environmental 	<p>To minimize off-site disposal of C&D material</p> <p>To minimize environmental impacts during the handling of C&D material</p>	Contractor	Works sites	Construction phase	EIAO-TM

EIA Ref.	EM&A Ref.	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concern to Address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
		<p>impacts or nuisance:</p> <ul style="list-style-type: none"> - covering material during heavy rainfall; - locating stockpiles to minimize potential visual impacts; and - minimizing land intake of stockpile areas as far as possible. <ul style="list-style-type: none"> ▪ When disposing C&D material at a public filling area, the material shall only consist of soil, rock, concrete, brick, cement plaster/mortar, inert building debris, aggregates and asphalt. The material shall be free from marine mud, household refuse, plastic, metals, industrial and chemical waste, animal and vegetable matter, and other material considered to be 					

EIA Ref.	EM&A Ref.	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concern to Address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
		unsuitable by the Filling Supervisor.					
S6.27		<p>Chemical waste:</p> <ul style="list-style-type: none"> ▪ Contractor should register with the EPD as a Chemical Waste Producer and to follow the guidelines stated in the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes. ▪ Good quality containers compatible with the chemical wastes should be used, and incompatible chemicals should be stored separately. ▪ Appropriate labels should be securely attached on each chemical waste container indicating the 	To minimize environmental impacts during the handling, transportation and disposal of chemical waste	Contractor	Works sites	Construction phase	EIAO-TM Waste Disposal (Chemical Waste) (General) Regulation

EIA Ref.	EM&A Ref.	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concern to Address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
		<p>corresponding chemical characteristics of the chemical waste, such as explosives, flammable, oxidizing, irritant, toxic, harmful, corrosive, etc.</p> <ul style="list-style-type: none"> ▪ The Contractor should use a licensed collector to transport and dispose of the chemical wastes generated at the Chemical Waste Treatment Centre at Tsing Yi, or other licenced facility, in accordance with the Waste Disposal (Chemical Waste) (General) Regulation. 					
S6.28		<p>General refuse:</p> <ul style="list-style-type: none"> ▪ It should be stored in enclosed bins or compaction units separate from C&D material. ▪ A reputable waste collector 	To minimize environmental impacts during the handling and transportation of general refuse	Contractor	Works sites	Construction phase	EIAO-TM

EIA Ref.	EM&A Ref.	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concern to Address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
		<p>should be employed by the contractor to remove general refuse from the site, separately from C&D material.</p> <ul style="list-style-type: none"> ▪ An enclosed and covered area is preferred to reduce the occurrence of 'wind blown' light material. 					
E Ecological Impact							
S. 7.95	6.6	<ul style="list-style-type: none"> ▪ Sheet-pilings, which will be installed around the trench of excavation, should be extended above ground level for ~2m to act as hoarding to isolate the works site. ▪ The trenching works for the construction of the proposed box culvert should be carried out in phases, with a trench length of not 	To minimize the impacts on the stream and natural river bank	Contractor	Whole site	Construction Phase	EIAO-TM

EIA Ref.	EM&A Ref.	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concern to Address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
		<p>more than 120m in each phase.</p> <p>The trench should be backfilled and compacted with suitable materials upon completion of each phase of the construction works.</p>					
S7.117	6.6	<ul style="list-style-type: none"> ▪ The construction of intercept point of twin cell box culvert at the upstream of Wai Ha River should be confined to only one side of the river bank. ▪ To restore and enhance the ecological value of the stream, the affected river bank should be reinstated to its original condition or lined with rock-filled gabion. ▪ Planting pits should be provided in the gabion bank to allow the re-establishment of riparian vegetation. 	To minimize the impacts on the stream and natural river bank	Contractor	Whole site	Construction Phase	EIAO-TM

EIA Ref.	EM&A Ref.	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concern to Address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
		<ul style="list-style-type: none"> ▪ The existing natural riverbed and substrates should be retained and the natural pool-riffle sequence should be re-created in the new channel bed. 					
S 7.118	6.7	<ul style="list-style-type: none"> ▪ All works carried out within the the river channel of Wai Ha River should be carried out from October to April, with construction carried out by land-based plant. ▪ Works within river/stream channels should be restricted to an enclosed dry section of the river, with containment measures such as bunds and barriers used within the river to minimize the impacts upon the downstream water body. 	To minimise sedimentation/ water quality impacts	Contractor	Whole Site	Construction Phase	EIAO-TM

EIA Ref.	EM&A Ref.	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concern to Address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
		<ul style="list-style-type: none"> ▪ Site runoff should be directed towards regularly cleaned and maintained silt traps and oil/grease separators to minimize the risk of sedimentation and pollution of river water. ▪ The silt and oil/grease separators should be appropriately designed for the local drainage and ground conditions. ▪ To minimize leakage and loss of sediments during excavation in narrow channels, tightly sealed closed grab excavators should be deployed where material to be handled is wet. 					
S 7.119	6.8	<ul style="list-style-type: none"> ▪ The construction of the proposed box-culvert would have the potential to directly impact a few 	To protect plant species of conservation interest	Contractor/qualified botanist/horticulturist	Whole site	Construction Phase	EIAO-TM

EIA Ref.	EM&A Ref.	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concern to Address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
		<p>individual of a plant species of conservation interest (Hong Kong Pavetta, <i>Pavetta hongkongensis</i>). The affected individuals should be transplanted to a suitable nearby habitats prior to the construction phase.</p> <ul style="list-style-type: none"> ▪ A detailed vegetation survey of the affected species of conservation interest should be conducted by a suitably qualified botanist/ecologist to identify the affected individuals in order to provide details for transplantation scheme. ▪ Transplantation should be supervised by a suitably qualified botanist/horticulturalist. A detailed transplantation methodology should be formulated during the detailed design stage of this Project. 		Horticulturalist			

EIA Ref.	EM&A Ref.	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concern to Address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
S 7.120	6.9	<ul style="list-style-type: none"> ▪ Noise mitigation measures such as the use of quieter construction plant and temporary noise barriers should be implemented to minimize disturbance to habitats adjacent to the works areas. ▪ Temporary noise barriers should be used during the construction of the box-culvert along Tung Tsz Road, the floodwater pumping station, the mechanical gate, and drainage pipe to minimize potential construction phase disturbance to ardeids and avifauna foraging in marsh habitat. ▪ Noise generating construction works near the Shuen Wan Egrettry SSSI should be avoided as far as practicable during the breeding season (March to June) of the 	To minimise disturbance impacts.	Contractor	Whole site	Construction Phase	EIAO-TM

EIA Ref.	EM&A Ref.	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concern to Address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
		<p>ardeids.</p> <ul style="list-style-type: none"> ▪ Works near the SSSI (i.e. installation of mechanical gate) should be restricted to be executed outside the breeding season by provision of special conditions in the contract document. ▪ Hoardings with minimum height of 2m should be set up along the south side of the proposed box culvert works area adjacent to the marsh, extending at least 20m at both ends, throughout the construction period. 					
S 7.121	6.10	<ul style="list-style-type: none"> ▪ Placement of equipment or stockpile in designated works areas and access routes selected on existing disturbed land to minimise disturbance to natural or 	To minimise disturbance to habitats.	Contractor	Whole site	Construction Phase	EIAO-TM

EIA Ref.	EM&A Ref.	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concern to Address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
		moderate-high ecological value habitats.					
S 7.121	6.10	<ul style="list-style-type: none"> ▪ Construction activities should be restricted to work areas that would be clearly demarcated. The work areas should be reinstated after completion of the works. 	To minimise disturbance to natural habitats outside works area.	Contractor	Whole site	Construction Phase	EIAO-TM
S 7.121	6.10	<ul style="list-style-type: none"> ▪ Waste skips should be provided to collect general refuse and construction wastes. The wastes would be disposed of timely and properly off-site. 	To minimise disturbance to habitats.	Contractor	Whole site	Construction Phase	EIAO-TM
S 7.121	6.10	<ul style="list-style-type: none"> ▪ General drainage arrangements should include sediment and oil traps to collect and control construction site run-off. 	To minimise sedimentation/ water quality impacts	Contractor	Whole site	Construction Phase	EIAO-TM
S 7.121	6.10	<ul style="list-style-type: none"> ▪ Open burning on works sites is illegal, and should be strictly prohibited. 	To prevent accidental hill-fires.	Contractor	Whole site	Construction Phase	EIAO-TM

EIA Ref.	EM&A Ref.	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concern to Address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
S 7.122	6.11	<ul style="list-style-type: none"> ▪ De-silting should be limited to the dry season. 	To minimise sedimentation/ water quality impacts	Maintenance parties of the channel	Whole site	Operation Phase	EIAO-TM
S 7.122	6.11	<ul style="list-style-type: none"> ▪ Waste material produced during de-silting should be disposed of in a timely and appropriate manner. 	To minimise sedimentation/ water quality impacts	Maintenance parties of the channel	Whole site	Operation Phase	EIAO-TM
S 7.123	6.12	<ul style="list-style-type: none"> ▪ Planting of trees should be provided within the project area to compensate for the unavoidable loss of approximately 0.08ha secondary woodland habitat due to the Project. ▪ Planting of trees and other vegetation within project area along the banks of Wai Ha River and Tung Tsz Road should be carried out to provide compensation for unavoidable tree-felling and loss of riparian vegetation resulting from the 	To compensate the loss of vegetation	Contractor	Whole site	Construction Phase	EIAO-TM

EIA Ref.	EM&A Ref.	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concern to Address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
		<p>Project.</p> <ul style="list-style-type: none"> ▪ The compensatory planting should make use of native plant species with flowers/fruits attractive to wildlife. 					
S 7.124	6.13	<ul style="list-style-type: none"> ▪ Compensation would be required for the loss of a small area of marsh habitat (about 0.30ha) within the CA resulting from the construction of the box-culvert. ▪ An existing low ecological value recreational fishpond on government land adjacent to the marsh would be used as a proposed area (about 0.8ha) for the compensation for the marsh as well as secondary woodland habitats loss (0.08ha). ▪ The pond should be enhanced by removing boardwalks around the 	To compensate the loss of marsh habitat and enhance the quality compensatory habitat	Contractor / qualified ecologist	The recreational fish pond located to the southwest of the existing Tung Tsz Nursery	Construction Phase	EIAO-TM

EIA Ref.	EM&A Ref.	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concern to Address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
		<p>existing pond, and restoring vegetation along the pond bunds, and it would be re-profiled to provide areas of shallow water (approximately 15-50cm deep), creating a suitable foraging habitat for avifauna, particularly ardeids and other waders.</p> <ul style="list-style-type: none"> ▪ Screen planting of shrubs and trees along the south-eastern bund of the pond should be implemented to minimise disturbance to avifauna and other wildlife from the adjacent recreational fishpond. The enhanced pond is expected to provide a moderate-high ecological value wetland habitat. 					
F <i>Landscape and Visual</i>							
Table	7.6	Visual screen, contaminant/	To mitigate the landscape	Contractor	Whole site	Construction	EIAO-TM

EIA Ref.	EM&A Ref.	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concern to Address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
8.4		sediment control, pollution control, liaison with nursery, protection of existing trees with works area and construction light are used or practiced to mitigate the impacts during construction phase.	and visual impacts during construction phase.			Phase	
Table 8.4	7.7	Viewing area formation, architectural design for pump house, landscape design for pump house, enhancement planting along Tung Tsz Road, sufficient soil depth for enhancement planting, transplanting of trees to adjacent locations, preparation for transplanting and reinstatement of affected area are practiced to mitigate the impacts during operational phase.	To mitigate the landscape and visual impacts during the operational phase.	Contractor	Whole site	Detail Design / Operational Phase	EIAO-TM

Appendix B
Construction Stage Noise Monitoring Field Record Sheet

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

Name & Designation

Signature

Date

Recorded by:

Checked by:

Appendix C
Incident Report on Action Level or Limit Level Non-compliance

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

Prepared by: _____

Designation: _____

Signature: _____

Date: _____

Appendix D
Water Quality Monitoring Data Record Sheet

Monitoring Location		
Date (dd/mm/yy)		
Start Time (hh:mm)		
Weather		
Water Depth (m)		
Temperature (°C)		
DO Saturation (%)		
DO (mg/L)		
Turbidity (NTU)		
Suspended Solids (SS)		
Sample ID		
SS Laboratory Results (mg/L)		
Observed Construction Activities	<100 m from location	
	>100 m from location	
Other Observations		

Recorded by: _____

Date: _____

Appendix E

Figure 5 & Section 5.5.4 of HCP

filling with stockpiled wetland soils (Soil Mix 2);

- Where proposed levels are > 0.5 m above existing levels and final levels are to be < +2.0 mPD, required levels should be achieved by filling with subsoil to 0.5 m below required levels covered with 0.5 m depth of stockpiled wetland soils (Soil Mix 3);
- Where proposed levels are < 0.5 m above existing level and final levels are to be > +2.0 mPD (i.e. high water mark), existing material should be removed to a depth of 0.5 m below final levels and final levels should be achieved by filling with topsoil 0.5 m in depth (Soil Mix 4);
- Where proposed levels are > 0.5 m above existing level and final levels are to be > +2.0 mPD (i.e. high water mark), required levels should be achieved by filling with subsoil to 0.5 m below required levels covered with topsoil 0.5 m in depth (Soil Mix 5).

5.5.4 For the connection to the Wai Ha River desired levels will be achieved by excavating from the landward side and finishing as follows:

- Where proposed final levels are < +2.0 mPD excavate to 0.3 m below desired final levels and line with rubble stone (granite) irregular in shape with all dimensions not less than 100 mm and not more than 300 mm (Soil Mix 6);
- Where proposed levels are > +2.0 mPD excavate to 0.5 m below desired levels and final levels should be achieved by filling with topsoil 0.5 m in depth (Soil Mix 4).

Excavated material may be re-used on site so long as it meets the specifications for subsoil and is re-used as sub-soil.

5.5.5 Areas for each Soil Mix and specifications are detailed in **Figure 4** and **Annex 1**.

5.4.6 Once connection has been made with the Wai Ha River a water level marker should be erected in the deepest point of the pool to check that water levels are as predicted. Similarly, water levels should be measured at least three high and three low spring and neap tides to check that the intertidal area is flooding to the desired depths. If necessary, levels will be adjusted to accord with the desired habitat design concept. If such adjustment requires a departure from the contour plan the achievement of the desired habitat concept (i.e. permanently flooded, intertidal and terrestrial zones) will take precedence.

5.6 Planting

5.6.1 Terrestrial and wetland planting to create the required habitats will be undertaken as detailed in **Annex 2**. Some of these plants will be stored in the temporary site nursery area prior to planting. Specifications concerning the preparatory and planting work are given in **Annex 1**.



- Legend
- Site Boundary
 - Existing Tree Removed
 - Existing Tree Retained (Tree Position Indicative Outside Site Boundary)
 - Natural Rubble Stone to Reinforce Bank and Prevent Scour
 - High Tide approx. 2m
 - Intertidal Zone
 - Permanent Pond
- Scheduled trees to be removed
 C4 *Mangifera indica* on slope
 C5 *Citrus maxima* on slope
 C6 *Macaranga tanarius* on slope
 C8 *Mangifera indica*
 C9 *Clausena lansium* (undersized)

Wai Ha River

7.6 m

22.3 m

Job Title		
Contract No. DC/2009/22 - Drainage Improvement Works in Shuen Wan, Tai Po, Contract 1- Design & Construction of Ecological Compensatory Area		
Drawing Title		
Proposed Linkage of Wetland to Wai Ha River		
Drawing No.	Project No.	
Figure 5	09/317/161	
Scale	Date	Rev
1:300 @ A3	May 2010	A
Drawn by	Checked by	
EW	MRL	
群利 - 豐利聯營 Kwan Lee - Kuly Joint Venture		
Asia Ecological Consultants Ltd		

Appendix F

Hydrological Characteristics Monitoring Data Record Sheet

Monitoring Location	
Date (dd/mm/yy)	
Time	
Weather	
Water Depth (m)	
Flow Rate (m/s)	
Other Observations	

Recorded by: _____

Date: _____

Appendix G

Approved Proposal of Revision for Action/Limit Level

Criteria of Water Quality Monitoring

本署檢號
OUR REF:
來函編號
YOUR REF:
電話
TEL. NO.:
圖文傳真
FAX NO.:
電子郵件
E-MAIL:
網址
HOMEPAGE:

(2) in Ax (1) to EP2/G/1/117 Pt.4

**Environmental Protection Department
Branch Office**

28th Floor, Southorn Centre,
130 Hennessy Road,
Wan Chai, Hong Kong.



環境保護署分處
香港灣仔
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By Post & Fax : 2827 8700

31 May 2012

Drainage Projects Division,
Drainage Services Department,
40/F, 44/F & 45/F, Revenue Tower,
5 Gloucester Road, Wan Chai, Hong Kong
(Attn: Mr. SO Chi Ho)

Dear Mr. So,

Drainage Improvement Works in Sha Tin and Tai Po
Environmental Permit No. EP-303/2008
Revised Water Quality Monitoring

I refer to the letter from Environmental Pioneers & Solution Ltd (ET Leader) of 17 May 2012 proposing changes to water quality monitoring under the EM&A Programme for the captioned project.

Based on the justifications provided and pursuant to Condition 5.1 of the Environmental Permit No. EP-303/2008, I hereby approve the proposed changes to water quality monitoring.

Yours faithfully,


(Maurice YENN)
Principal Environmental Protection Officer
for Director of Environmental Protection

c.c.

Internal (w/cncl. proposal enclosed in the letter from Environmental Pioneers & Solutions Ltd. of 17.5.2012)
S(RN)1
EIAO Register Office

EP-303/2008

Enquiry of Revision for Action/Limit Level Criteria of Water Quality Monitoring

	Prepared By:	Verified By:	Submitted By:
Parties:	Environmental Team Leader (Environmental Pioneers & Solutions Limited)	IEC (Environ Hong Kong Limited)	Contractor (Kwan Lee – Kuly Joint Venture)
Name:	Ms. Goldie Fung	Mr. Tony Cheng	Mr. C.L. Wong
Signature:			
Date:	16-5-2012	16 May 2012	16/5/2012

Rev. 6

Submitted by: 16-May-2012

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Appendix A

Appendix B

Appendix C

Appendix D

Appendix E

Appendix F

Appendix G

Appendix H

Appendix I

1. Introduction

Environmental Pioneers and Solutions Limited (EPSL) has been appointed to work as the Environmental Team (ET) for the Contract No. DC/2009/22 Drainage Improvement Works in Shuen Wan, Tai Po (Contract no. 1) to implement the Environmental Monitoring and Audit (EM&A) programme.

The scope of the Project includes the following works:-

- (1) Construction of a 1000m long, 3m x 2.5m twin-cell box culvert along Tung Tsz Road;
- (2) Replacement of existing gates by automatic mechanical gates at the mouth of Wai Ha River;
- (3) Construction of a 280m long, 1200 dia. Drainage pipe near Wai Ha Village;
- (4) Construction of a 260m long, 2100 dia. Flood relief drain along Ting Kok Road; and
- (5) Construction of a floodwater pumping station at Shuen Wan.

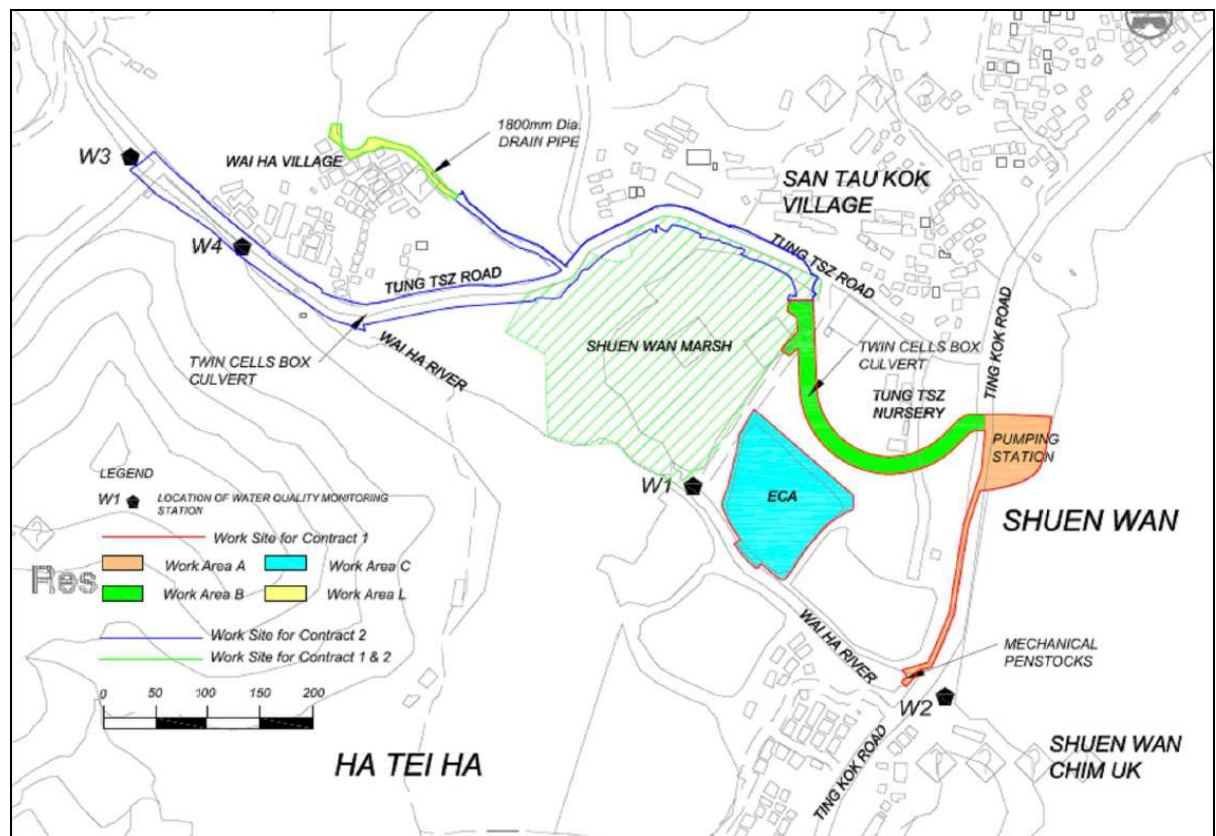
The construction period of the project was commenced on February 26th, 2010 and anticipated to complete in August 2013.

2. Water Quality Monitoring

2.1 Monitoring Locations

There are two separate contracts covered by the Environmental Permit EP-303/2008, including contract no. DC/2009/22 (contract no. 1) and contract no. DC/2010/02 (contract no. 2). There are totally 4 monitoring stations (W1, W2 and W4 for impact monitoring station and W3 for control station) selected for the water quality monitoring. With reference to the Clause 4.25 of EM&A Manual (Rev. 3), the water samples are collected at mid-depth of each proposed monitoring stations for measuring due to the water depth is less than 3m. The Location Plan is shown in Figure 2.1 for reference.

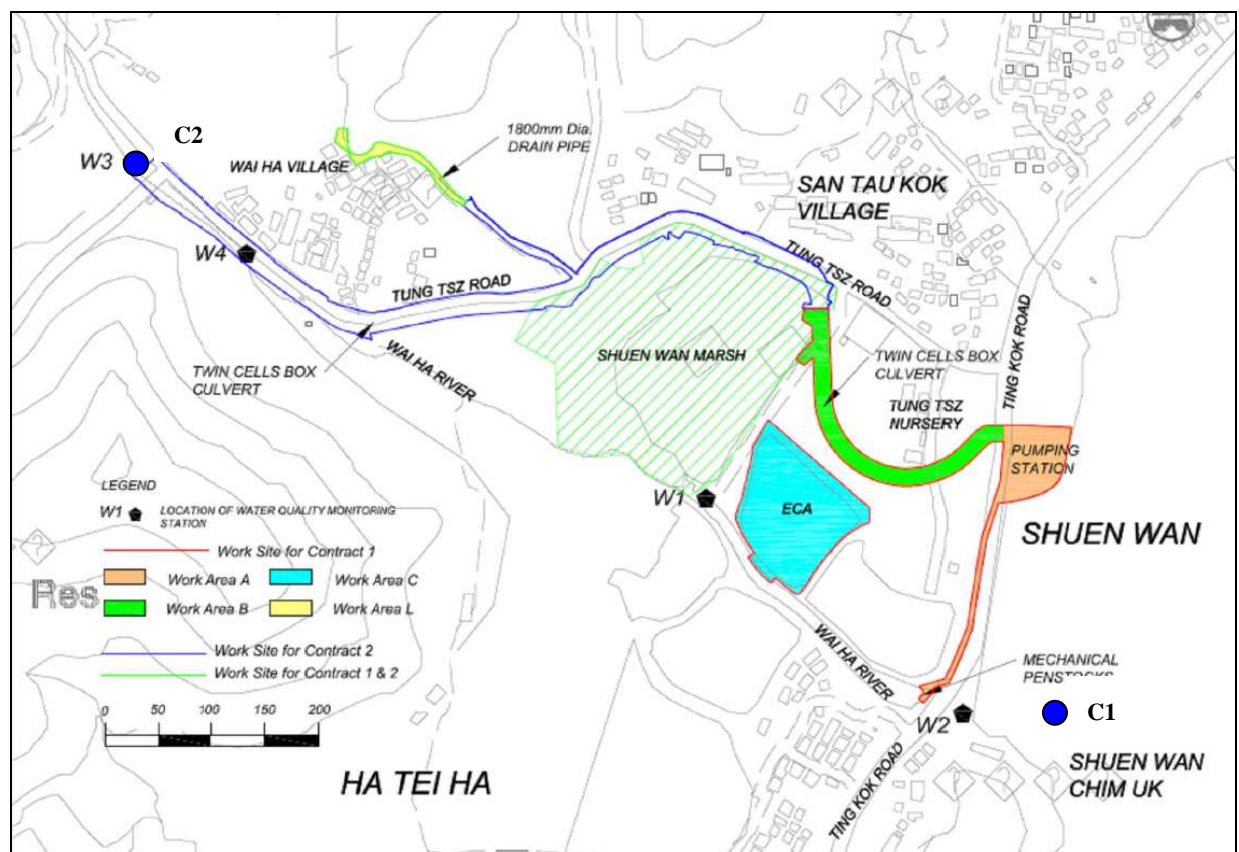
Figure 2.1 Water Quality Monitoring Locations



2.2 Reference Points for Contract No. 1

The construction activities of contract no. 1 were commenced on 9 March 2011 and anticipated to be completed in February 2013 and those of contract no. 2 were commenced on 29 April 2011 and anticipated to be completed on 27 October 2013. According to the current site situation of the project, there are construction activities carrying out for contract no. 1 and no. 2. The water quality of control station W1 may be affected by the construction activities of contract no. 2. Under this circumstance, 2 additional reference points (C1 and C2) are proposed for the water quality monitoring of contract no. 1. The water quality of both C1 and C2 will not be affected by any construction activities of this project. The location of C1 and C2 can refer to the Fig. 2.2. Reference point C1 is located at 20m apart from the estuary of Wai Ha River. The water quality of C1 will not be affected by the construction activities at flood tide and is free from contamination. The water quality parameter of C1; W1 and W2 are listed in Appendix A for reference. Reference point C2 is the same monitoring location of W3 which is approximate 70m apart from the site boundary and will not be affected by the construction activities.

Figure 2.2 Reference Points C1 and C2 Locations



The monitoring parameters of C1 and C2 are same as those of W1, and the monitoring data of C1 and C2 will be reported as the supplementary information. When the water quality of W2 exceed the Action/Limit levels criteria, the monitoring data of C1 will be used for comparison when the monitoring of W2 is taken at flood tide; and the monitoring data of C2 will be used for comparison when the monitoring of W2 is taken at ebb tide. The comparison of water quality between W2 and C1 at flood tide and between W2 and C2 at ebb tide can help to prove whether influence of water quality is caused by the construction activities. The water quality monitoring of W1 will continuously be carried out and the collected data will be submitted for reference as well.

2.3 Data Analysis

With reference to the Location Plan shown in Figure 2.1, control station W3 is at the upstream location of the Wai Ha River for this project. According to the location, the water quality of W3 can be considered to be not affected by any construction activities of the project. Besides, the level of W3 should be +5.08mPD and its water quality can be considered to be not undergone any tidal influence. Based on these criteria, the Dissolved Oxygen (DO) of control station W3 were used for the analysis in the following sections. In order to indicate the current situation of DO level of the river, the DO level of W3 measured from August 2011 to January 2012 were selected to compare with baseline data.

a. Baseline Monitoring Data

The baseline data of DO of W3 are shown in Appendix B. The baseline monitoring data were collected before the commencement of any construction activities in dry season from 7th January, 2011 to 2nd February 2011. According to the submitted Baseline Environmental Monitoring Report, the Action/Limit level for monitoring station W3 are indicated in Table 2.1.

Table 2.1 Action and Limit Levels for Water Quality at Monitoring Stations W3

Parameters	Monitoring Stations (Flood Tide)		Monitoring Stations (Ebb Tide)	
	Action Level	Limit Level	Action Level	Limit Level
DO (mg/L)	8.66	8.00	8.71	8.61

b. Impact Monitoring Data

Water quality monitoring (WQM) for control station W3 was carried out 13 times in August 2011; 14 times in September 2011; 12 times in October 2011; 13 times in November 2011; 13 times in December 2011; 12 times in January 2012. The collected DO data of W3 in these 77 times monitoring are shown in Appendix C. Average DO monitoring result of each month at W3 are summarized in Table 2.2.

Table 2.2 Water quality monitoring results of Dissolved Oxygen at W3

Month	Average Dissolved Oxygen (DO) in mg/L (Range)
August 2011	6.44 (7.31 – 4.44)
September 2011	6.08 (7.32 – 4.49)
October 2011	5.91 (6.86 – 5.09)
November 2011	5.79 (6.72 – 4.62)
December 2011	6.50 (7.91 – 5.09)
January 2012	7.14 (8.89 – 5.10)

By comparing the WQM results from August 2011 to January 2012 and Action/Limit level (Ebb Tide) of W3 in Table 2.1, it is observed that only one WQM result has not exceeded the Action/Limit level and all other WQM results have exceeded the Limit Level. The result is highlighted in Appendix D for reference. As mentioned before, the water quality of W3 will not be affected by any construction activities of the project, so that the cause of exceedance may due to the natural fluctuation such as temperature and seasonal change.

c. Variation between Dry and Wet Seasons

As the cause of exceedance may due to the seasonal change, the variation between dry and wet season is calculated as below for the compensation of seasonal change. As the water quality in the Wai Ha River (also referred to as Tung Tze Stream) is monitored under the Environmental Protection Department (EPD) routine river water quality monitoring programme. Ten years (Year 2001 to 2010) of river water quality data at station TR6 Tung Tze Stream are extracted from EPD database for the calculation of DO variation between Dry and Wet seasons. TR6 is located near the estuary of Tung

Tze Stream and the location can refer to the map in Appendix E. The raw data are listed in Appendix F for reference. After analyzed the distribution of the ten years data (refer to Appendix G), median of DO for dry and wet seasons are used to calculated the DO variation to eliminate the effect of the lowest and the highest values. The DO variation between Dry and Wet seasons variation is calculated by equation (eqt. 2-1).

$$\text{Variation} = (\text{Dry Season}_{\text{median}} - \text{Wet Season}_{\text{median}}) / \text{Dry Season}_{\text{median}} \quad (\text{eqt. 2-1})$$

According to the condition 3.7 of the Environmental Permit EP-303/2008, dry season should be defined from October to April; and the wet season should be defined from May to September. The data from October to April are used for the calculation of Dry Season; the data from April to October are used for the calculation of Wet Season. Total 6 sets of result for 3 different time period are calculated for comparison. Both median and mean of the DO have been calculated for time periods including 1) Recent year - Year 2010; 2) Four years data – from Year 2007 to 2010; and 3) Ten years data – from Year 2001 to 2010. The results can refer to Table 2.3.

Table 2.3 DO variation between dry and wet season from 2007 to 2010 at station TR6, Tung Tze Stream

Collected Data	DO(mg/l)	Wet season	Dry season	Variation
Year 2010	Median	6.50	6.50	0%
Year 2007-2010	Median	5.65	6.55	13.74%
Year 2001-2010	Median	5.80	6.40	9.37%
Year 2010	Mean	6.16	6.36	3.14%
Year 2007-2010	Mean	5.81	6.28	7.48%
Year 2001-2010	Mean	5.85	6.38	8.31%

From the results in Table 2.3, the highest variation value 13.74% is used to enhance the effect of applying the variation. By applying the variation (13.74%) to the baseline data, a new set of Action/Limit level is calculated by equation (eqt. 2-2) and the result are shown in Table 2.4.

$$\text{Revised Level} = \text{Original Level} \times (1 - 13.74\%) \quad (\text{eqt. 2-2})$$

Table 2.4 New set of Action/Limit Level, using the calculated variation (13.74%)

Parameters		Monitoring Stations (Flood Tide)		Monitoring Stations (Ebb Tide)	
		Action Level	Limit Level	Action Level	Limit Level
Original Level	DO (mg/L)	8.66	8.00	8.71	8.61
Revised level	DO (mg/L)	7.47	6.90	7.51	7.43

With reference to the new set of Action/Limit level in Table 2.4, the higher DO level (Ebb tide) were used to compare with the WQM results from August 2011 to January 2012, it is observed that there were only five times of WQM results have not exceeded the Action/Limit level and all other 72 times of WQM results have exceeded the Limit Level. The result is highlighted in Appendix H for reference. Since W3 functions as the control station of this project, its water quality should not be affected by the construction works of this project. From the comparison results with the original and revised Action/Limit level, it was observed that both sets of Action/Limit level cannot reflect the actual river condition.

3. Conclusion

After the consideration of seasonal change which may affect the DO of W3 in section 2.3, the DO of W3 will also exceed the Limit level in almost all the measurement day in both dry and wet seasons. After the consideration of seasonal change and applied the DO variation between wet and dry season to amend the Action/Limit level, the DO of W3 will also exceed the Limit level in both dry and wet seasons. Both the original and revised Action/Limit level could not reflect the actual condition of Wai Ha River. The Action/Limit level criteria should be revised so as to reflect the actual condition of Wai Ha River and to monitor the water quality.

With reference to other EM&A projects of river work in Hong Kong (refer to Appendix I), the limit level for DO is 4 mg/L and without the comparison of the percentile of baseline data. Suggest that the Action Level criteria remain unchanged which is DO exceedance occur when impact monitoring data is lower than 5

percentile of baseline data; and the Limit Level criteria should be revised to DO exceedance occur when impact monitoring data is lower than 4 mg/L.

Parameter	Original Limit Level	Revised Limit Level
DO in mg/L	4 mg/L or 1%-ile of baseline data	4 mg/L

Appendix A

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Water Quality Baseline Monitoring of Reference Point C1 - Flood

Position	Tide	Weather	Date	Time	Location	pH value	Salinity (ppt)	Temperature (°C)	Turbidity (NTU)	DO (mg/L)
Mid	Flood	Cloudy	2/3/2012	8:45	C1	8.5	28.1	18	0.1	9.21
				8:57	W2	7.16	4	18.1	11.7	7.16
				9:23	W1	7.12	0.1	19.3	6	7.47
Mid	Flood	Cloudy	5/3/2012	15:35	C1	8.59	28.3	20.8	0.1	9.5
				15:18	W2	7.14	6.6	21	7.2	6.97
				15:00	W1	7.1	0.4	21.4	3.4	6.91
Mid	Flood	Cloudy	7/3/2012	16:45	C1	8.51	29	20.5	0.1	9.32
				16:30	W2	7.78	16.4	20.8	14.4	7.51
				16:00	W1	7.3	3.8	20.4	27.3	7.39
Mid	Flood	Rainy	12/3/2012	9:40	C1	8.55	28.2	16.7	0.1	9.53
				9:55	W2	8.18	26.3	16.9	1.2	7.86
				10:25	W1	7.94	21.5	16.9	5.3	8.27

Appendix B

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Water Quality Baseline Monitoring of Control Point W3 - Flood

Location	Position	Tide	Date	Time	Weather	DO (mg/L)		Average	DO (%)		Average
						Data 1	Data 2		Data 1	Data 2	
W3	Mid	Flood	7/1/2011	9:20	Cloudy	9.55	9.46	9.51	88	89	89
W3	Mid	Flood	10/1/2011	12:00	Cloudy	10.12	10.13	10.13	113	110	112
W3	Mid	Flood	12/1/2011	12:50	Cloudy	7.83	7.86	7.85	95	96	96
W3	Mid	Flood	14/1/2011	13:00	Cloudy	9.67	9.52	9.60	98	96	97
W3	Mid	Flood	17/1/2011	15:40	Cloudy	9.92	9.81	9.87	105	104	105
W3	Mid	Flood	19/1/2011	17:45	Sunny	9.25	9.41	9.33	98	101	100
W3	Mid	Flood	21/1/2011	7:40	Sunny	10.86	10.52	10.69	103	104	104
W3	Mid	Flood	24/1/2011	9:15	Cloudy	9.56	9.71	9.64	101	106	104
W3	Mid	Flood	26/1/2011	11:00	Sunny	11.10	10.69	10.90	111	108	110
W3	Mid	Flood	28/1/2011	13:05	Sunny	10.21	9.89	10.05	103	99	101
W3	Mid	Flood	31/1/2011	16:10	Sunny	10.54	10.72	10.63	116	112	114
W3	Mid	Flood	2/2/2011	7:00	Cloudy	10.78	10.66	10.72	109	103	106
5 percentile	DO Action					8.07	8.66				
1 percentile	DO Limit					7.84	8.00				

Appendix B

EP-303/2008

Water Quality Baseline Monitoring of Control Point W3 - Ebb

Location	Position	Tide	Date	Time	Weather	DO (mg/L)		Average	DO (%)		Average
						Data 1	Data 2		Data 1	Data 2	
W3	Mid	Ebb	7/1/2011	14:10	Cloudy	8.91	9.00	8.96	97	99	98
W3	Mid	Ebb	10/1/2011	17:10	Cloudy	9.00	8.85	8.93	94	91	93
W3	Mid	Ebb	12/1/2011	18:40	Cloudy	9.84	9.61	9.73	96	95	96
W3	Mid	Ebb	14/1/2011	7:50	Cloudy	9.98	9.77	9.88	101	95	98
W3	Mid	Ebb	17/1/2011	10:30	Cloudy	10.92	10.63	10.78	104	104	104
W3	Mid	Ebb	19/1/2011	11:25	Sunny	8.77	8.41	8.59	96	97	97
W3	Mid	Ebb	21/1/2011	13:10	Sunny	10.08	9.97	10.03	106	101	104
W3	Mid	Ebb	24/1/2011	15:30	Cloudy	8.93	8.67	8.80	96	94	95
W3	Mid	Ebb	26/1/2011	17:35	Sunny	10.71	10.24	10.48	109	103	106
W3	Mid	Ebb	28/1/2011	7:50	Sunny	9.58	9.55	9.57	97	84	91
W3	Mid	Ebb	31/1/2011	10:45	Sunny	11.33	10.76	11.05	113	106	110
W3	Mid	Ebb	2/2/2011	12:15	Cloudy	9.96	9.59	9.78	102	96	99
5 percentile	DO Action					8.69	8.71				
1 percentile	DO Limit					8.47	8.61				

Appendix C – W3 Monitoring data of dissolved oxygen from August 2011 to January 2012

Monitoring Date	DO mg/L	Monitoring Date	DO mg/L	Monitoring Date	DO mg/L
1-Aug-2011	6.93	30-Sep-2011	5.52	1-Dec-2011	5.68
3-Aug-2011	7.31	4-Oct-2011	5.09	3-Dec-2011	5.09
6-Aug-2011	6.89	6-Oct-2011	5.12	6-Dec-2011	6.17
8-Aug-2011	7.26	8-Oct-2011	5.89	8-Dec-2011	5.59
11-Aug-2011	6.01	11-Oct-2011	6.09	10-Dec-2011	6.58
13-Aug-2011	6.76	13-Oct-2011	6.53	13-Dec-2011	6.44
15-Aug-2011	7.03	15-Oct-2011	5.19	15-Dec-2011	7.15
17-Aug-2011	6.40	18-Oct-2011	5.21	17-Dec-2011	6.60
19-Aug-2011	6.74	20-Oct-2011	6.04	20-Dec-2011	6.68
23-Aug-2011	6.21	22-Oct-2011	6.86	22-Dec-2011	7.14
25-Aug-2011	5.07	25-Oct-2011	6.58	24-Dec-2011	7.91
27-Aug-2011	4.44	27-Oct-2011	6.39	29-Dec-2011	6.90
30-Aug-2011	6.71	29-Oct-2011	5.92	31-Dec-2011	6.63
1-Sep-2011	7.18	1-Nov-2011	5.66	3-Jan-2012	6.22
3-Sep-2011	7.32	3-Nov-2011	6.64	5-Jan-2012	6.90
6-Sep-2011	5.86	5-Nov-2011	6.58	7-Jan-2012	5.10
8-Sep-2011	5.66	8-Nov-2011	5.47	10-Jan-2012	7.10
10-Sep-2011	6.88	10-Nov-2011	6.72	12-Jan-2012	7.25
12-Sep-2011	6.44	12-Nov-2011	6.53	14-Jan-2012	6.90
15-Sep-2011	6.09	15-Nov-2011	6.51	17-Jan-2012	7.60
17-Sep-2011	5.73	17-Nov-2011	4.74	19-Jan-2012	6.50
20-Sep-2011	6.26	19-Nov-2011	4.62	21-Jan-2012	8.41
22-Sep-2011	4.49	22-Nov-2011	5.09	26-Jan-2012	8.89
24-Sep-2011	6.43	24-Nov-2011	5.70	28-Jan-2012	7.62
26-Sep-2011	5.36	26-Nov-2011	5.69	31-Jan-2012	7.18
28-Sep-2011	5.91	29-Nov-2011	5.38		

Appendix D - Exceedance records from August 2011 to January 2012 for Existing Criteria

Monitoring Date	DO mg/L	Monitoring Date	DO mg/L	Monitoring Date	DO mg/L
1-Aug-2011	6.93	30-Sep-2011	5.52	1-Dec-2011	5.68
3-Aug-2011	7.31	4-Oct-2011	5.09	3-Dec-2011	5.09
6-Aug-2011	6.89	6-Oct-2011	5.12	6-Dec-2011	6.17
8-Aug-2011	7.26	8-Oct-2011	5.89	8-Dec-2011	5.59
11-Aug-2011	6.01	11-Oct-2011	6.09	10-Dec-2011	6.58
13-Aug-2011	6.76	13-Oct-2011	6.53	13-Dec-2011	6.44
15-Aug-2011	7.03	15-Oct-2011	5.19	15-Dec-2011	7.15
17-Aug-2011	6.40	18-Oct-2011	5.21	17-Dec-2011	6.60
19-Aug-2011	6.74	20-Oct-2011	6.04	20-Dec-2011	6.68
23-Aug-2011	6.21	22-Oct-2011	6.86	22-Dec-2011	7.14
25-Aug-2011	5.07	25-Oct-2011	6.58	24-Dec-2011	7.91
27-Aug-2011	4.44	27-Oct-2011	6.39	29-Dec-2011	6.90
30-Aug-2011	6.71	29-Oct-2011	5.92	31-Dec-2011	6.63
1-Sep-2011	7.18	1-Nov-2011	5.66	3-Jan-2012	6.22
3-Sep-2011	7.32	3-Nov-2011	6.64	5-Jan-2012	6.90
6-Sep-2011	5.86	5-Nov-2011	6.58	7-Jan-2012	5.10
8-Sep-2011	5.66	8-Nov-2011	5.47	10-Jan-2012	7.10
10-Sep-2011	6.88	10-Nov-2011	6.72	12-Jan-2012	7.25
12-Sep-2011	6.44	12-Nov-2011	6.53	14-Jan-2012	6.90
15-Sep-2011	6.09	15-Nov-2011	6.51	17-Jan-2012	7.60
17-Sep-2011	5.73	17-Nov-2011	4.74	19-Jan-2012	6.50
20-Sep-2011	6.26	19-Nov-2011	4.62	21-Jan-2012	8.41
22-Sep-2011	4.49	22-Nov-2011	5.09	26-Jan-2012	8.89
24-Sep-2011	6.43	24-Nov-2011	5.70	28-Jan-2012	7.62
26-Sep-2011	5.36	26-Nov-2011	5.69	31-Jan-2012	7.18
28-Sep-2011	5.91	29-Nov-2011	5.38		

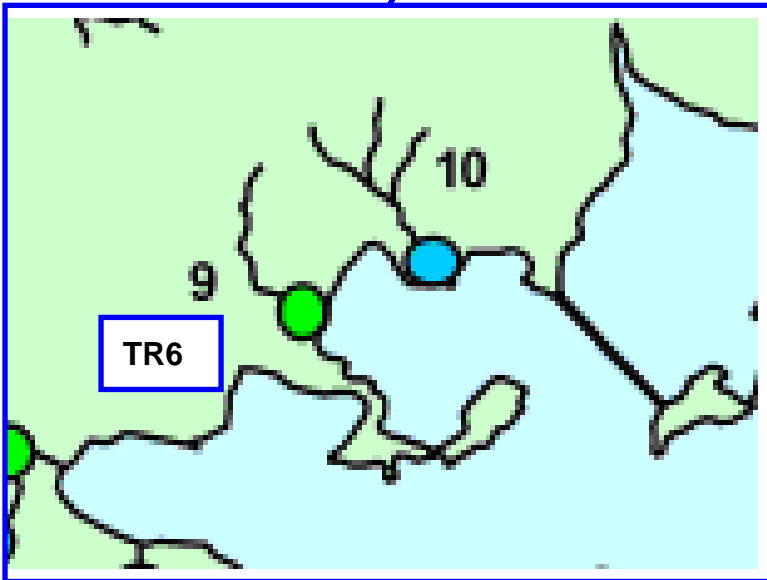
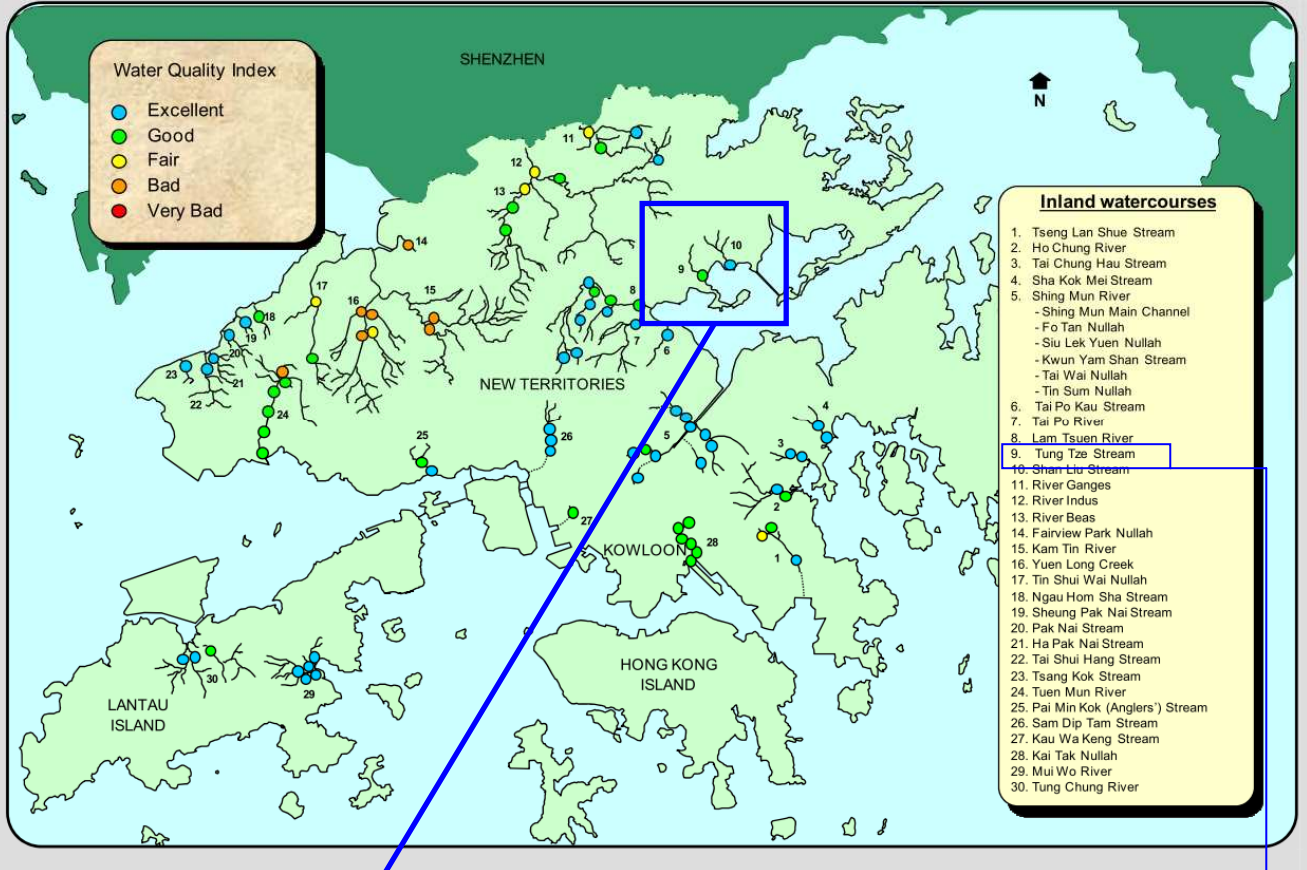
Remarks:

Red highlight: The value is exceeded Limit Level (<**8.61**)

Yellow highlight: The value is exceeded Action Level (<**8.71**)

Appendix E – Location of TR6 at Tung Tze Stream

Map of river monitoring stations and Water Quality Index gradings in 2010



9. Tung Tze Stream

Appendix F

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Dissolved Oxygen Level at Tung Tze Stream

Dry Season

				DO (mg/l)
Tolo Harbour And Channel	Tung Tze Stream	TR6	3/1/2001	8.1
Tolo Harbour And Channel	Tung Tze Stream	TR6	12/2/2001	10.2
Tolo Harbour And Channel	Tung Tze Stream	TR6	16/3/2001	5
Tolo Harbour And Channel	Tung Tze Stream	TR6	19/4/2001	6.6
Tolo Harbour And Channel	Tung Tze Stream	TR6	12/10/2001	6.1
Tolo Harbour And Channel	Tung Tze Stream	TR6	16/11/2001	7.2
Tolo Harbour And Channel	Tung Tze Stream	TR6	17/12/2001	6.2
Tolo Harbour And Channel	Tung Tze Stream	TR6	18/1/2002	6.2
Tolo Harbour And Channel	Tung Tze Stream	TR6	20/2/2002	7.3
Tolo Harbour And Channel	Tung Tze Stream	TR6	18/3/2002	6.6
Tolo Harbour And Channel	Tung Tze Stream	TR6	18/4/2002	6.8
Tolo Harbour And Channel	Tung Tze Stream	TR6	3/10/2002	4.9
Tolo Harbour And Channel	Tung Tze Stream	TR6	4/11/2002	6.9
Tolo Harbour And Channel	Tung Tze Stream	TR6	5/12/2002	5.4
Tolo Harbour And Channel	Tung Tze Stream	TR6	3/1/2003	7.3
Tolo Harbour And Channel	Tung Tze Stream	TR6	7/2/2003	7.4
Tolo Harbour And Channel	Tung Tze Stream	TR6	6/3/2003	6.4
Tolo Harbour And Channel	Tung Tze Stream	TR6	10/4/2003	7.1
Tolo Harbour And Channel	Tung Tze Stream	TR6	8/10/2003	4.8
Tolo Harbour And Channel	Tung Tze Stream	TR6	6/11/2003	5.9
Tolo Harbour And Channel	Tung Tze Stream	TR6	4/12/2003	7.5
Tolo Harbour And Channel	Tung Tze Stream	TR6	9/1/2004	6.1
Tolo Harbour And Channel	Tung Tze Stream	TR6	4/2/2004	8.3
Tolo Harbour And Channel	Tung Tze Stream	TR6	3/3/2004	6
Tolo Harbour And Channel	Tung Tze Stream	TR6	2/4/2004	7.2
Tolo Harbour And Channel	Tung Tze Stream	TR6	8/10/2004	4.9
Tolo Harbour And Channel	Tung Tze Stream	TR6	4/11/2004	5.9
Tolo Harbour And Channel	Tung Tze Stream	TR6	2/12/2004	5.1
Tolo Harbour And Channel	Tung Tze Stream	TR6	7/1/2005	7.8
Tolo Harbour And Channel	Tung Tze Stream	TR6	1/2/2005	5.2
Tolo Harbour And Channel	Tung Tze Stream	TR6	4/3/2005	8.2
Tolo Harbour And Channel	Tung Tze Stream	TR6	8/4/2005	5.1
Tolo Harbour And Channel	Tung Tze Stream	TR6	7/10/2005	5.4
Tolo Harbour And Channel	Tung Tze Stream	TR6	3/11/2005	5.7
Tolo Harbour And Channel	Tung Tze Stream	TR6	5/12/2005	5.1
Tolo Harbour And Channel	Tung Tze Stream	TR6	5/1/2006	5.3
Tolo Harbour And Channel	Tung Tze Stream	TR6	3/2/2006	6
Tolo Harbour And Channel	Tung Tze Stream	TR6	8/3/2006	5.5
Tolo Harbour And Channel	Tung Tze Stream	TR6	3/4/2006	8.4
Tolo Harbour And Channel	Tung Tze Stream	TR6	5/10/2006	6.6
Tolo Harbour And Channel	Tung Tze Stream	TR6	3/11/2006	5.5
Tolo Harbour And Channel	Tung Tze Stream	TR6	5/12/2006	7.4

Appendix F

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Dissolved Oxygen Level at Tung Tze Stream

Dry Season

				DO (mg/l)
Tolo Harbour And Channel	Tung Tze Stream	TR6	5/1/2007	5.9
Tolo Harbour And Channel	Tung Tze Stream	TR6	2/2/2007	7.3
Tolo Harbour And Channel	Tung Tze Stream	TR6	2/3/2007	5.2
Tolo Harbour And Channel	Tung Tze Stream	TR6	13/4/2007	5.3
Tolo Harbour And Channel	Tung Tze Stream	TR7	4/10/2007	5.5
Tolo Harbour And Channel	Tung Tze Stream	TR6	2/11/2007	5
Tolo Harbour And Channel	Tung Tze Stream	TR6	4/12/2007	7.3
Tolo Harbour And Channel	Tung Tze Stream	TR6	7/1/2008	6.7
Tolo Harbour And Channel	Tung Tze Stream	TR6	13/2/2008	6.9
Tolo Harbour And Channel	Tung Tze Stream	TR6	6/3/2008	6.1
Tolo Harbour And Channel	Tung Tze Stream	TR6	10/4/2008	6.6
Tolo Harbour And Channel	Tung Tze Stream	TR6	20/10/2008	5.6
Tolo Harbour And Channel	Tung Tze Stream	TR6	13/11/2008	6.3
Tolo Harbour And Channel	Tung Tze Stream	TR6	2/12/2008	7
Tolo Harbour And Channel	Tung Tze Stream	TR6	7/1/2009	7.3
Tolo Harbour And Channel	Tung Tze Stream	TR6	6/2/2009	6.9
Tolo Harbour And Channel	Tung Tze Stream	TR6	5/3/2009	6.7
Tolo Harbour And Channel	Tung Tze Stream	TR6	20/4/2009	5.2
Tolo Harbour And Channel	Tung Tze Stream	TR6	16/10/2009	4.7
Tolo Harbour And Channel	Tung Tze Stream	TR6	16/11/2009	6.9
Tolo Harbour And Channel	Tung Tze Stream	TR6	16/12/2009	7
Tolo Harbour And Channel	Tung Tze Stream	TR6	6/1/2010	6.6
Tolo Harbour And Channel	Tung Tze Stream	TR6	18/2/2010	7.4
Tolo Harbour And Channel	Tung Tze Stream	TR6	3/3/2010	5.4
Tolo Harbour And Channel	Tung Tze Stream	TR6	8/4/2010	6.5
Tolo Harbour And Channel	Tung Tze Stream	TR6	20/10/2010	6.4
Tolo Harbour And Channel	Tung Tze Stream	TR6	17/11/2010	6.6
Tolo Harbour And Channel	Tung Tze Stream	TR6	15/12/2010	5.6

Appendix F

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Dissolved Oxygen Level at Tung Tze Stream Wet Season

				DO (mg/l)
Tolo Harbour And Channel	Tung Tze Stream	TR6	24/5/2001	6.1
Tolo Harbour And Channel	Tung Tze Stream	TR6	15/6/2001	5.7
Tolo Harbour And Channel	Tung Tze Stream	TR6	11/7/2001	7.9
Tolo Harbour And Channel	Tung Tze Stream	TR6	3/8/2001	6.6
Tolo Harbour And Channel	Tung Tze Stream	TR6	19/9/2001	5.2
Tolo Harbour And Channel	Tung Tze Stream	TR6	22/5/2002	4.1
Tolo Harbour And Channel	Tung Tze Stream	TR6	7/6/2002	5
Tolo Harbour And Channel	Tung Tze Stream	TR6	4/7/2002	5.4
Tolo Harbour And Channel	Tung Tze Stream	TR6	2/8/2002	5.7
Tolo Harbour And Channel	Tung Tze Stream	TR6	4/9/2002	5.8
Tolo Harbour And Channel	Tung Tze Stream	TR6	14/5/2003	5.7
Tolo Harbour And Channel	Tung Tze Stream	TR6	9/6/2003	4.9
Tolo Harbour And Channel	Tung Tze Stream	TR6	11/7/2003	6.2
Tolo Harbour And Channel	Tung Tze Stream	TR6	8/8/2003	5.8
Tolo Harbour And Channel	Tung Tze Stream	TR6	5/9/2003	5.6
Tolo Harbour And Channel	Tung Tze Stream	TR6	7/5/2004	6.5
Tolo Harbour And Channel	Tung Tze Stream	TR6	4/6/2004	5.8
Tolo Harbour And Channel	Tung Tze Stream	TR6	7/7/2004	5.2
Tolo Harbour And Channel	Tung Tze Stream	TR6	9/8/2004	6.5
Tolo Harbour And Channel	Tung Tze Stream	TR6	2/9/2004	6.7
Tolo Harbour And Channel	Tung Tze Stream	TR6	6/5/2005	6
Tolo Harbour And Channel	Tung Tze Stream	TR6	3/6/2005	5.8
Tolo Harbour And Channel	Tung Tze Stream	TR6	8/7/2005	6.4
Tolo Harbour And Channel	Tung Tze Stream	TR6	3/8/2005	5.5
Tolo Harbour And Channel	Tung Tze Stream	TR6	2/9/2005	6.5
Tolo Harbour And Channel	Tung Tze Stream	TR6	11/5/2006	5.2
Tolo Harbour And Channel	Tung Tze Stream	TR6	16/6/2006	7
Tolo Harbour And Channel	Tung Tze Stream	TR6	5/7/2006	5.6
Tolo Harbour And Channel	Tung Tze Stream	TR6	2/8/2006	6.7
Tolo Harbour And Channel	Tung Tze Stream	TR6	6/9/2006	5

Appendix F

EP-303/2008

Dissolved Oxygen Level at Tung Tze Stream Wet Season

				DO (mg/l)
Tolo Harbour And Channel	Tung Tze Stream	TR6	3/5/2007	6.3
Tolo Harbour And Channel	Tung Tze Stream	TR6	1/6/2007	5.1
Tolo Harbour And Channel	Tung Tze Stream	TR6	5/7/2007	7.3
Tolo Harbour And Channel	Tung Tze Stream	TR6	2/8/2007	6.9
Tolo Harbour And Channel	Tung Tze Stream	TR6	10/9/2007	6.1
Tolo Harbour And Channel	Tung Tze Stream	TR6	16/5/2008	5.5
Tolo Harbour And Channel	Tung Tze Stream	TR6	18/6/2008	5.4
Tolo Harbour And Channel	Tung Tze Stream	TR6	18/7/2008	5.5
Tolo Harbour And Channel	Tung Tze Stream	TR6	25/8/2008	6.1
Tolo Harbour And Channel	Tung Tze Stream	TR6	18/9/2008	4.1
Tolo Harbour And Channel	Tung Tze Stream	TR6	7/5/2009	6
Tolo Harbour And Channel	Tung Tze Stream	TR6	3/6/2009	5.4
Tolo Harbour And Channel	Tung Tze Stream	TR6	17/7/2009	5.5
Tolo Harbour And Channel	Tung Tze Stream	TR6	7/8/2009	4.9
Tolo Harbour And Channel	Tung Tze Stream	TR6	17/9/2009	5.3
Tolo Harbour And Channel	Tung Tze Stream	TR6	27/5/2010	5.8
Tolo Harbour And Channel	Tung Tze Stream	TR6	30/6/2010	6.8
Tolo Harbour And Channel	Tung Tze Stream	TR6	19/7/2010	5
Tolo Harbour And Channel	Tung Tze Stream	TR6	13/8/2010	6.7
Tolo Harbour And Channel	Tung Tze Stream	TR6	9/9/2010	6.5

Appendix G

EP-303/2008

Dissolved Oxygen Level at Tung Tze Stream

Median of Dry Season

Date	DO(mg/l)
3/1/2001	8.1
12/2/2001	10.2
16/3/2001	5
19/4/2001	6.6
12/10/2001	6.1
16/11/2001	7.2
17/12/2001	6.2
18/1/2002	6.2
20/2/2002	7.3
18/3/2002	6.6
18/4/2002	6.8
3/10/2002	4.9
4/11/2002	6.9
5/12/2002	5.4
3/1/2003	7.3
7/2/2003	7.4
6/3/2003	6.4
10/4/2003	7.1
8/10/2003	4.8
6/11/2003	5.9
4/12/2003	7.5
9/1/2004	6.1
4/2/2004	8.3
3/3/2004	6
2/4/2004	7.2
8/10/2004	4.9
4/11/2004	5.9
2/12/2004	5.1
7/1/2005	7.8
1/2/2005	5.2
4/3/2005	8.2
8/4/2005	5.1
7/10/2005	5.4
3/11/2005	5.7
5/12/2005	5.1

For 2001 to 2010	
Minimum	4.7
Median	6.40
Maximum	10.2
Mean	6.38

Appendix G

EP-303/2008

Dissolved Oxygen Level at Tung Tze Stream Median of Dry Season

Date	DO(mg/l)
5/1/2006	5.3
3/2/2006	6
8/3/2006	5.5
3/4/2006	8.4
5/10/2006	6.6
3/11/2006	5.5
5/12/2006	7.4
5/1/2007	5.9
2/2/2007	7.3
2/3/2007	5.2
13/4/2007	5.3
4/10/2007	5.5
2/11/2007	5
4/12/2007	7.3
7/1/2008	6.7
13/2/2008	6.9
6/3/2008	6.1
10/4/2008	6.6
20/10/2008	5.6
13/11/2008	6.3
2/12/2008	7
7/1/2009	7.3
6/2/2009	6.9
5/3/2009	6.7
20/4/2009	5.2
16/10/2009	4.7
16/11/2009	6.9
16/12/2009	7
6/1/2010	6.6
18/2/2010	7.4
3/3/2010	5.4
8/4/2010	6.5
20/10/2010	6.4
17/11/2010	6.6
15/12/2010	5.6

For 2007 to 2010	
Minimum	4.7
Median	6.55
Maximum	7.4
Mean	6.28

For 2010	
Minimum	5.4
Median	6.50
Maximum	7.4
Mean	6.36

Appendix G

EP-303/2008

Dissolved Oxygen Level at Tung Tze Stream Median of Wet Season

Date	DO(mg/l)
24/5/2001	6.1
15/6/2001	5.7
11/7/2001	7.9
3/8/2001	6.6
19/9/2001	5.2
22/5/2002	4.1
7/6/2002	5
4/7/2002	5.4
2/8/2002	5.7
4/9/2002	5.8
14/5/2003	5.7
9/6/2003	4.9
11/7/2003	6.2
8/8/2003	5.8
5/9/2003	5.6
7/5/2004	6.5
4/6/2004	5.8
7/7/2004	5.2
9/8/2004	6.5
2/9/2004	6.7
6/5/2005	6
3/6/2005	5.8
8/7/2005	6.4
3/8/2005	5.5
2/9/2005	6.5
11/5/2006	5.2
16/6/2006	7
5/7/2006	5.6
2/8/2006	6.7
6/9/2006	5
3/5/2007	6.3
1/6/2007	5.1
5/7/2007	7.3
2/8/2007	6.9
10/9/2007	6.1
16/5/2008	5.5
18/6/2008	5.4
18/7/2008	5.5
25/8/2008	6.1
18/9/2008	4.1

For 2001 to 2010	
Minimum	4.1
Median	5.80
Maximum	7.9
Mean	5.85

For 2007 to 2010	
Minimum	4.1
Median	5.65
Maximum	7.3
Mean	5.81

Appendix G

EP-303/2008

Dissolved Oxygen Level at Tung Tze Stream Median of Wet Season

Date	DO(mg/l)
7/5/2009	6
3/6/2009	5.4
17/7/2009	5.5
7/8/2009	4.9
17/9/2009	5.3
27/5/2010	5.8
30/6/2010	6.8
19/7/2010	5
13/8/2010	6.7
9/9/2010	6.5

For 2010	
Minimum	5.0
Median	6.50
Maximum	6.8
Mean	6.16

Appendix H – W3 Monitoring data of dissolved oxygen from August 2011 to January 2012 with applying 13.74% variation

Monitoring Date	DO mg/L	Monitoring Date	DO mg/L	Monitoring Date	DO mg/L		
1-Aug-2011	6.93	30-Sep-2011	5.52	1-Dec-2011	5.68		
3-Aug-2011	7.31	4-Oct-2011	5.09	3-Dec-2011	5.09		
6-Aug-2011	6.89	6-Oct-2011	5.12	6-Dec-2011	6.17		
8-Aug-2011	7.26	8-Oct-2011	5.89	8-Dec-2011	5.59		
11-Aug-2011	6.01	11-Oct-2011	6.09	10-Dec-2011	6.58		
13-Aug-2011	6.76	13-Oct-2011	6.53	13-Dec-2011	6.44		
15-Aug-2011	7.03	15-Oct-2011	5.19	15-Dec-2011	7.15		
17-Aug-2011	6.40	18-Oct-2011	5.21	17-Dec-2011	6.60		
19-Aug-2011	6.74	20-Oct-2011	6.04	20-Dec-2011	6.68		
23-Aug-2011	6.21	22-Oct-2011	6.86	22-Dec-2011	7.14		
25-Aug-2011	5.07	25-Oct-2011	6.58	24-Dec-2011	7.91		
27-Aug-2011	4.44	27-Oct-2011	6.39	29-Dec-2011	6.90		
30-Aug-2011	6.71	29-Oct-2011	5.92	31-Dec-2011	6.63		
1-Sep-2011	7.18	1-Nov-2011	5.66	3-Jan-2012	6.22		
3-Sep-2011	7.32	3-Nov-2011	6.64	5-Jan-2012	6.90		
6-Sep-2011	5.86	5-Nov-2011	6.58	7-Jan-2012	5.10		
8-Sep-2011	5.66	8-Nov-2011	5.47	10-Jan-2012	7.10		
10-Sep-2011	6.88	10-Nov-2011	6.72	12-Jan-2012	7.25		
12-Sep-2011	6.44	12-Nov-2011	6.53	14-Jan-2012	6.90		
15-Sep-2011	6.09	15-Nov-2011	6.51	17-Jan-2012	7.60		
17-Sep-2011	5.73	17-Nov-2011	4.74	19-Jan-2012	6.50		
20-Sep-2011	6.26	19-Nov-2011	4.62	21-Jan-2012	8.41		
22-Sep-2011	4.49	22-Nov-2011	5.09	26-Jan-2012	8.89		
24-Sep-2011	6.43	24-Nov-2011	5.70	28-Jan-2012	7.62		
26-Sep-2011	5.36	26-Nov-2011	5.69	31-Jan-2012	7.18		
28-Sep-2011	5.91	29-Nov-2011	5.38				

Remarks:

Red highlight: The value is exceeded Limit Level (<**7.43**)

Yellow highlight: The value is exceeded Action Level (<**7.51**)

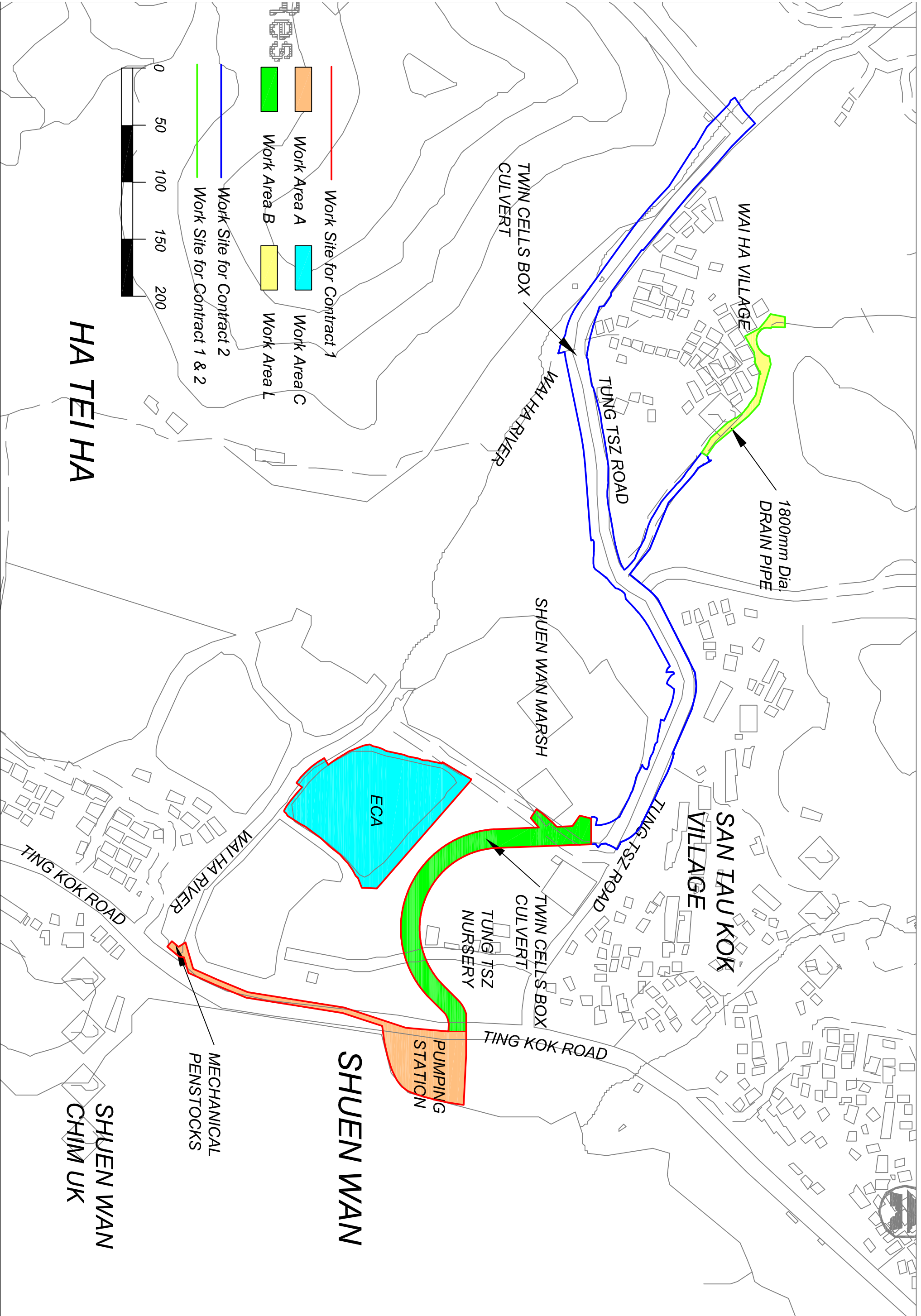
Appendix I

EP-303/2008

Enquiry of Revision for Action/Limit Level Criteria of Water Quality Monitoring

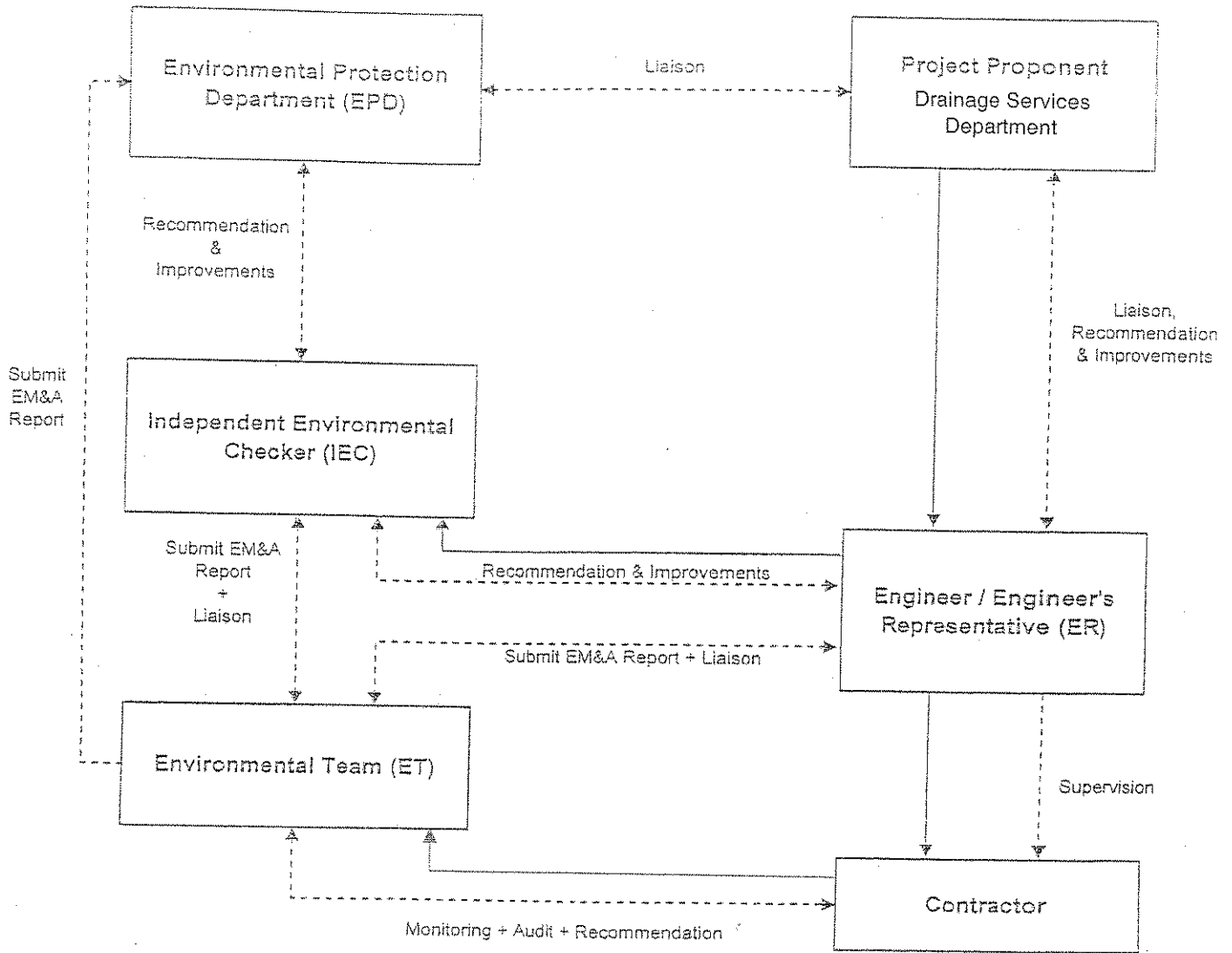
Reference Cases

Case	Environmental Permit No.	Project Title	EM&A Manual	EIA Report	Limit Level for Water Quality - DO
1.	EP-434/2012	Drainage Improvements in Southern Lantau	Section 4.8.1, Table 4.1		4mg/L
2.	EP-429/2012	Development of the Integrated Waste Management Facilities Phase 1	Section 4a.7.12, Table 4a.4		4mg/L
3.	EP-413/2011	Integration of Siu Ho Wan and Silver Mine Bay Water Treatment Works	Section 4.7.8, Table 4.2		4mg/L
4.	EP-334/2009	Sludge Treatment Facilities	Section 5.8.1.1, Table 5.3		4mg/L
5.	EP-224/2005	Proposed Extension of Public Golf Course at Kau Sai Chau, Sai Kung	Section 3.9.1, Table 3.8		4mg/L
6.	EP-217/2005	Drainage Improvements in Sai Kung		Section 4.7.3, Table 4.2	4mg/L
7.	EP-190/2004	Improvements to San Tin Interchange	Section 4.25, Table 4.1		4mg/L

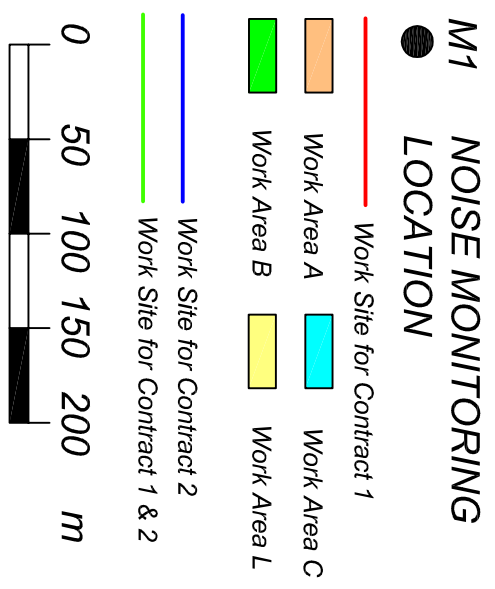
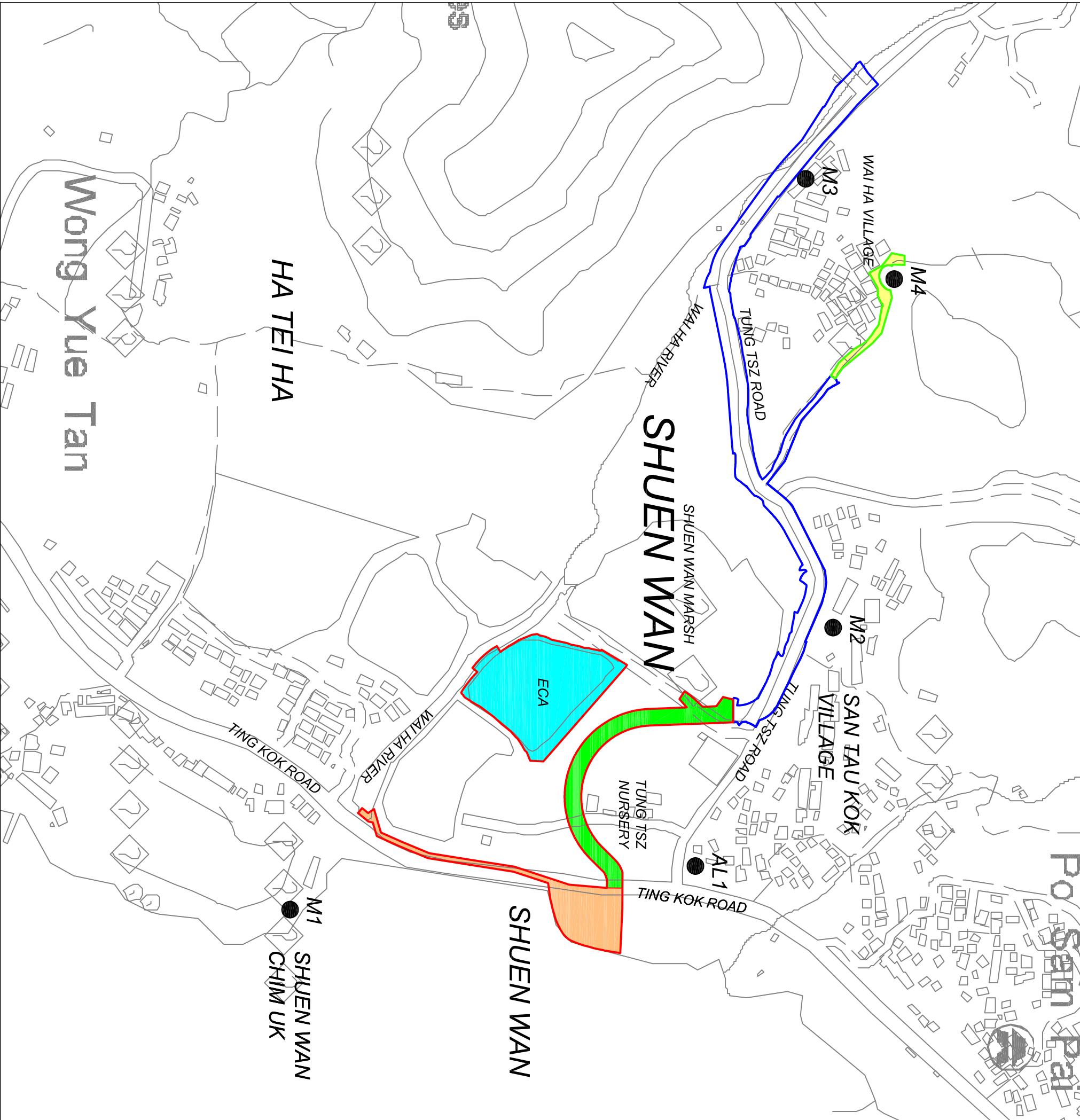


LOCATION OF THE PROJECT

FIGURE 1.1

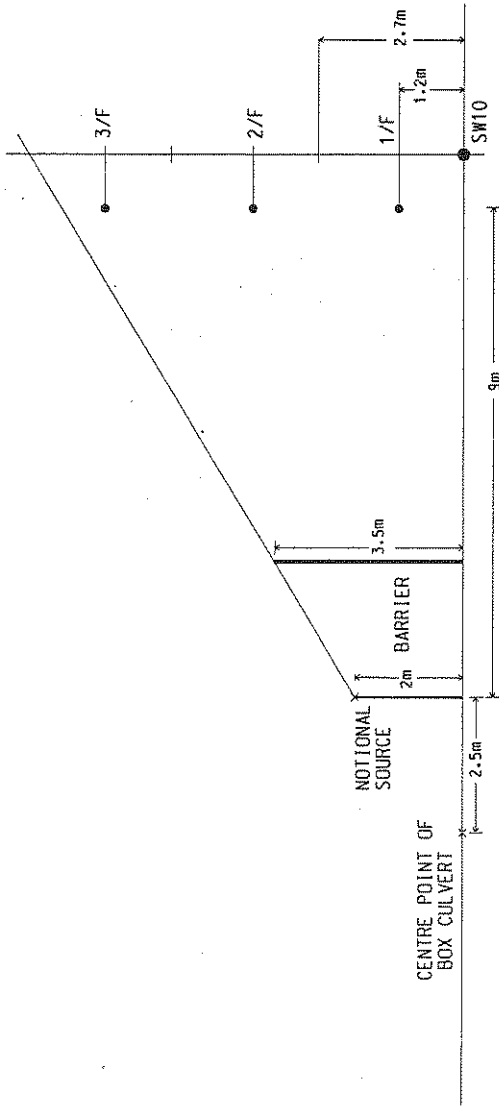


————— Employment Relationship
 - - - - - Working Relationship

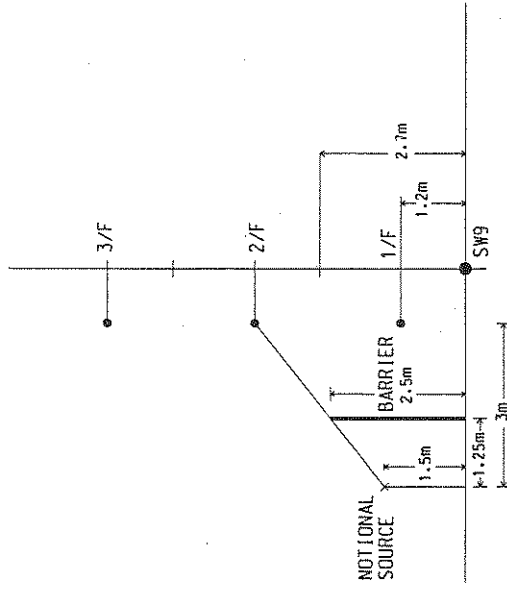


LOCATION OF CONSTRUCTION NOISE MONITORING STATION

FIGURE 2.1



FOR SITE CLEARANCE AND BOX CULVERT CONSTRUCTION



FOR PIPE LAYING AT WAI HA

MAUNSELL | AECOM

Maunsell Engineering
 50, Westgate Court, Auckland

AGREEMENT NO. CE 50/2001 (DS)
 DRAINAGE IMPROVEMENT IN SHA TIN AND TAI PO DESIGN AND CONSTRUCTION

TYPICAL SECTION OF PROPOSED TEMPORARY BARRIER

SCALE A3 1:100

CHECK TKT

JOB No. A01602(005)

DATE

JAN 07

DRAWN

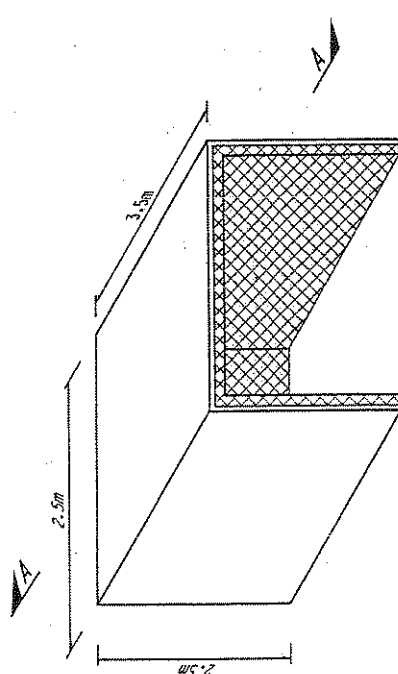
ILPY

DRAWING No.

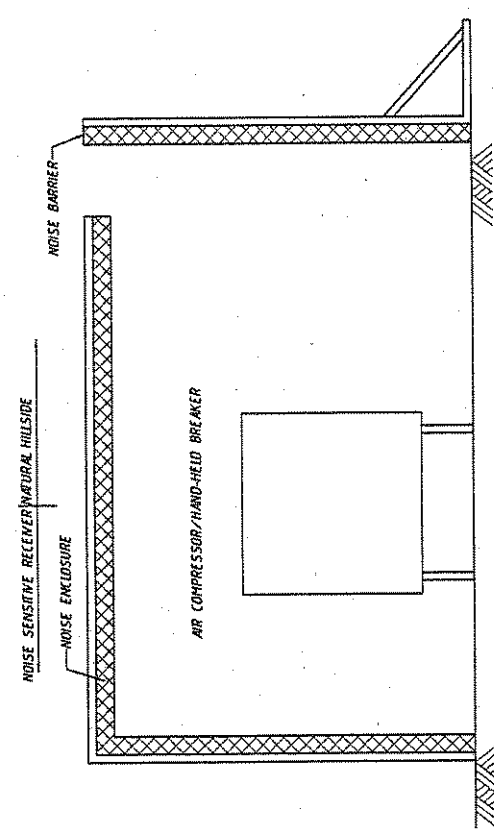
2.2

REV

-



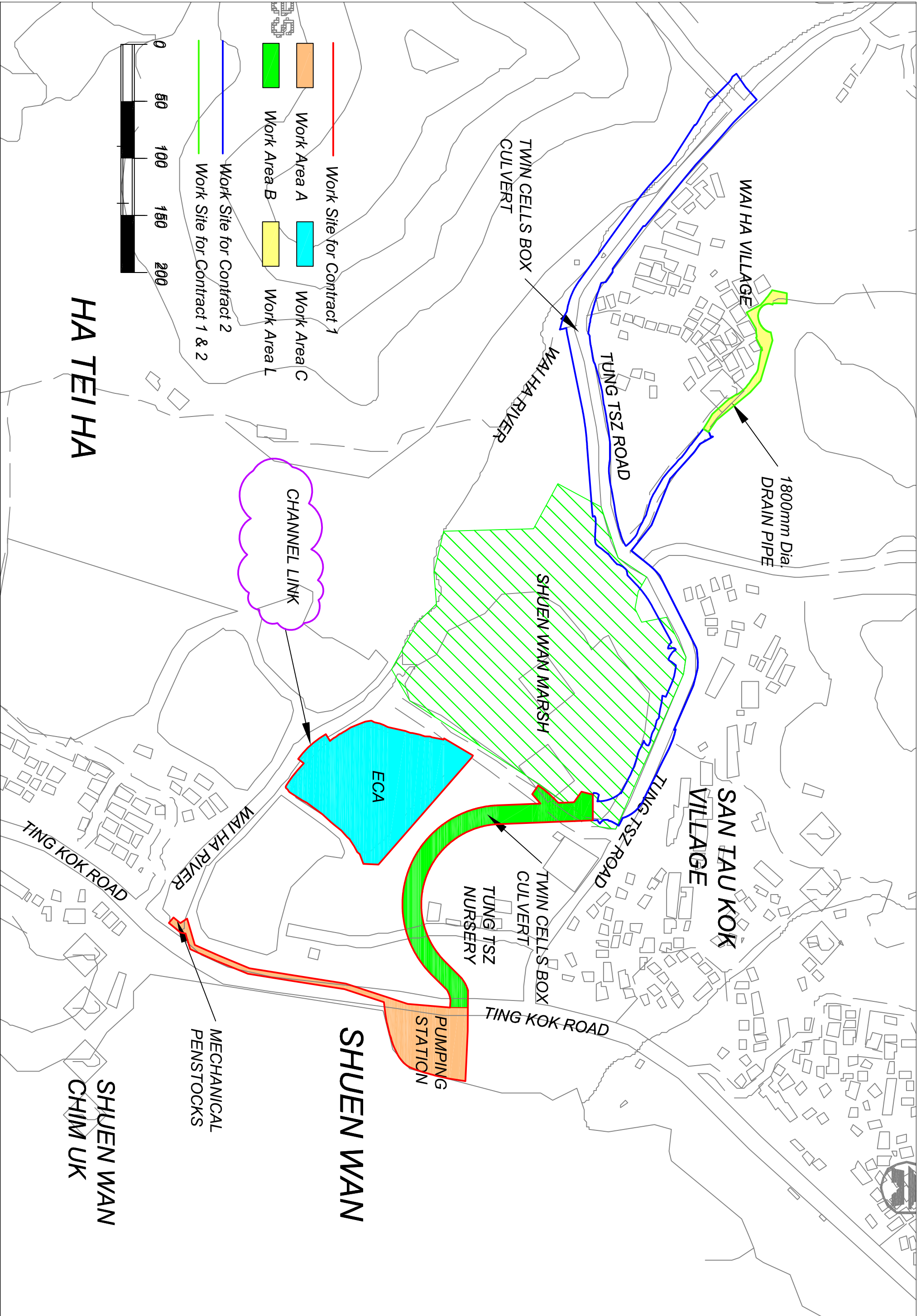
NOISE ENCLOSURE
 * NOISE BARRIER NOT SHOWN FOR CLARITY



SECTION A - A

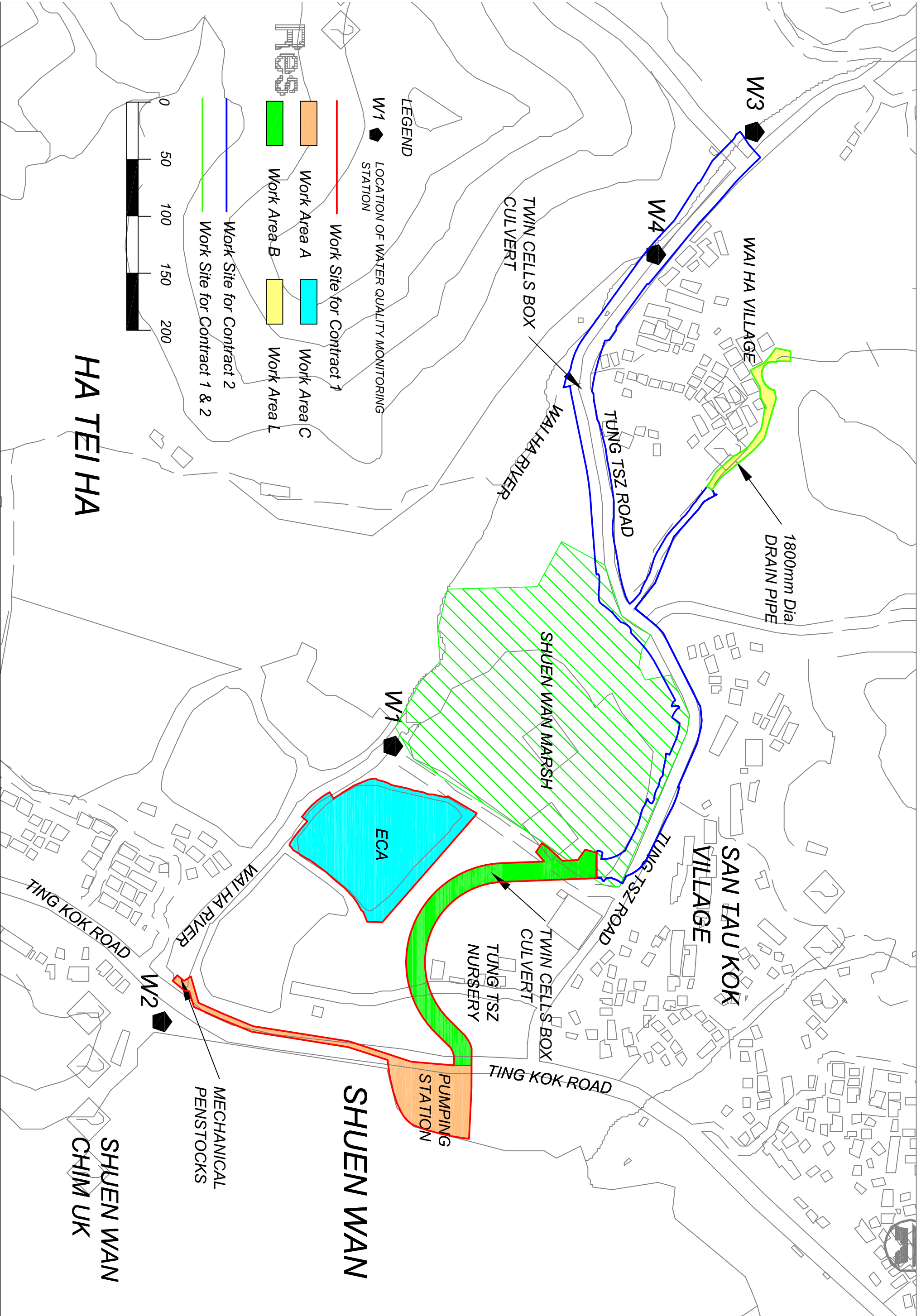
NOTE:
 1. DIMENSIONS OF THE NOISE ENCLOSURE ARE SUBJECT TO THE SITE CONDITION

MAUNSELL AECOM Mounsell Environmental Management Consultants Ltd <small>05201 P:\projects\70102\FIGURE NEW\FIGURE 3 3.dgn</small>	AGREEMENT No. CE 59/2001 (DS) DRAINAGE IMPROVEMENT IN SHA TIN AND TAI PO - DESIGN AND CONSTRUCTION		SCALE CHECK JOB No	N.T.S. TKT 70102	DATE DRAWN DRAWING No JUN. 2006 LDF FIGURE 2.3	REV
	TYPICAL DESIGN OF NOISE ENCLOSURE					



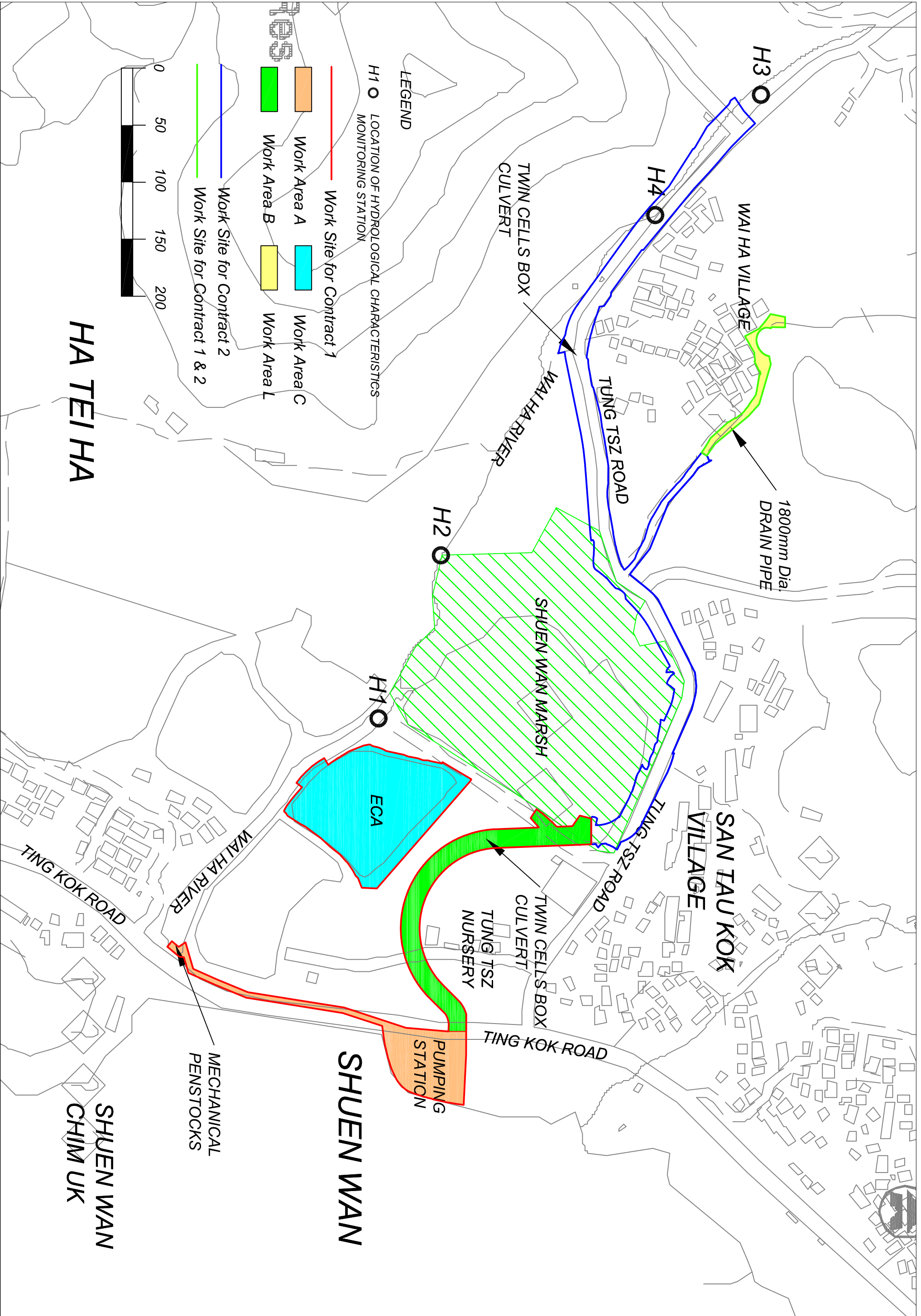
LOCATION OF CHANNEL LINK BETWEEN WAI HA RIVER & ECA

FIGURE 4.0



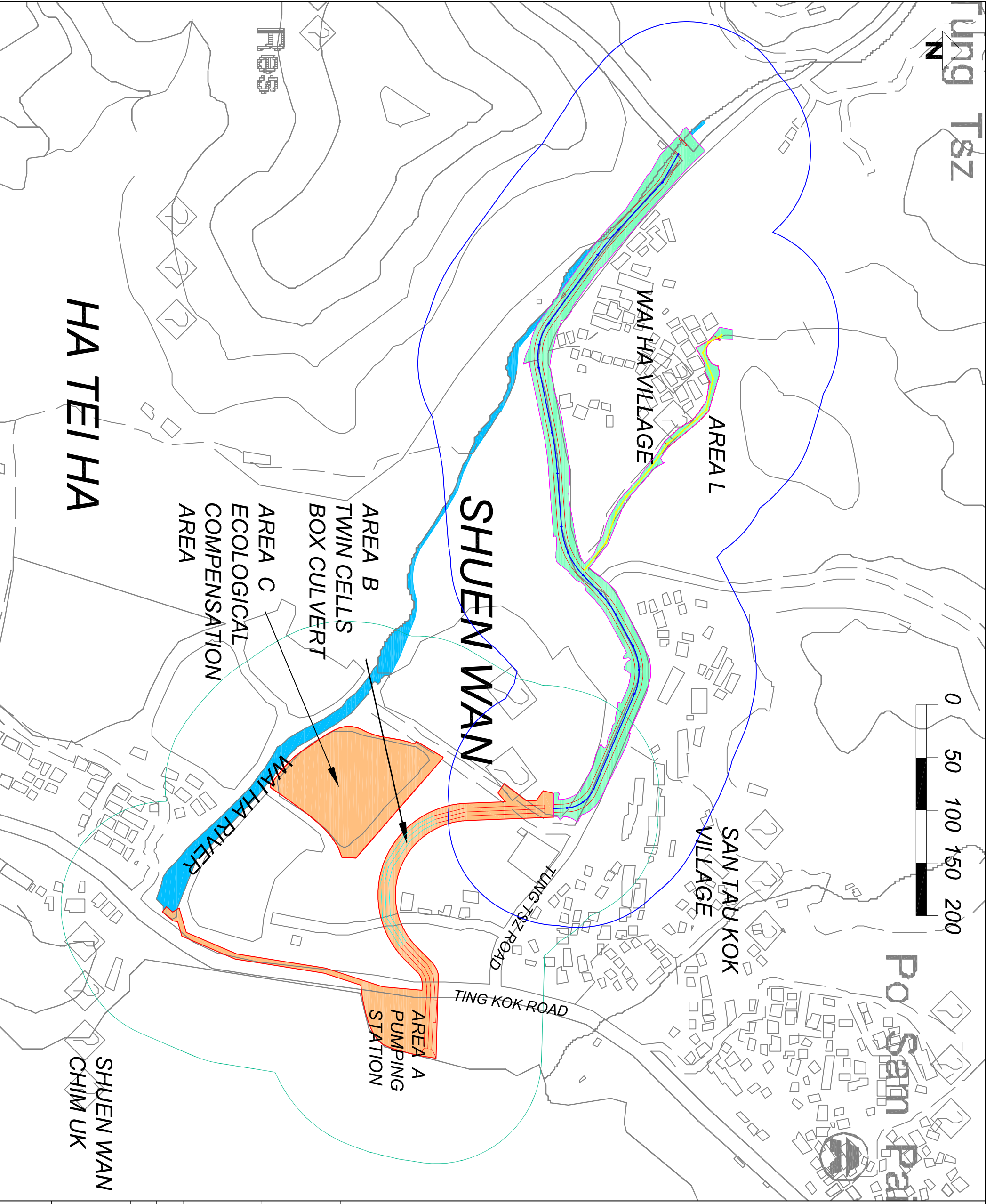
LOCATION OF WATER QUALITY MONITORING STATION

FIGURE 4.1




LOCATION OF HYDROLOGICAL CHARACTERISTICS MONITORING STATION

FIGURE 4.2



- Legend**
- Site Boundary (Contract 1)
 - Site Boundary (Contract 2)
 - Works Boundary under Contract 1
 - Works Boundary under Contract 2
 - Wai Ha River
 - 100m Buffer of Works Boundary under Contract 1
 - 100m Buffer of Works Boundary under Contract 2

Job Title Contract No. DC/2009/22 Drainage Improvement Works in Shuen Wan, Tai Po, Contract 1	
Drawing Title Ecological Monitoring Area for Contracts 1 and 2 of the Project	
Drawing No. Figure 6.1	Project No. 09/317/167
Scale As Shown	Date Nov 2010
Drawn by SK	Checked by IV
 Asia Ecological Consultants Ltd 群利 - 豐利聯營 Kwan Lee - Kully Joint Venture	