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#### 1. INTRODUCTION

# 1.1 Project Background

- 1.1.1 In 2002, the Environmental Protection Department (EPD) carried out the Sewerage Master Plan Stage 2 Review (SMP Stage 2 Review), and completed the Preliminary Project Feasibility Study for Islands Sewerage Stage (hereinafter referred to as "PPFS").
- 1.1.2 In February 2008, Drainage Services Department (DSD) commenced the Investigation Stage of "Upgrading of Cheung Chau and Tai O Sewage Collection, Treatment and Disposal Facilities" under Agreement No. CE 31/2007 (DS) by commissioning a consultant to carry out review on the conclusions and recommendations of the PPFS report, surveys, investigations, impact assessments, preliminary environmental review and preliminary design of the recommended works (hereinafter referred to as "Investigation Consultancy").
- 1.1.3 During the implementation of Investigation Consultancy, DSD conducted various consultations activities, including attending the Islands District Council, meetings with Legislative Council member, Green Lantau Association and the Association for Tai O Environment and Development. DSD committed that extensive and in-depth consultation would be conducted during the design and construction stage of this Project.
- 1.1.4 In December 2010, Drainage Services Department (DSD) commissioned Atkins China Limited (ACL) to undertake Design and Construction of Upgrading of Cheung Chau and Tai O Sewage Collection, Treatment and Disposal Facilities under Agreement No. CE 15/2010 (DS).
- 1.1.5 The works for the Project as recommended in the Investigation Consultancy mainly comprises the upgrading for the sewage collection, treatment and disposal facilities in two outlying islands, Cheung Chau and Tai O in Lantau. In December 2009, DSD applied for two separate Environmental Impact Assessment (EIA) Study Briefs under Section 5(1) the Environmental Impact Assessment Ordinance (EIAO) for the works in Cheung Chau and Tai O, respectively.
- 1.1.6 An Environmental Impact Assessment (EIA) Study Brief No. ESB-212/2009 was issued to cover the upgrading of Cheung Chau Sewage Collection, Treatment and Disposal Facilities (hereinafter referred as the "Project").

## 1.2 Project Description

- 1.2.1 The works for this Project in Cheung Chau mainly comprises the following items and as shown in Layout Plan of **Figure 1.1**:
  - (a) Upgrading of the existing Cheung Chau Sewage Treatment Works (STW);
  - (b) Upgrading of the existing Pak She Sewage Pumping Station (SPS) by increasing the pumping capacity; and
  - (c) Sewers works in Cheung Chau including upgrading/rehabilitation of the existing sewers at Cheung Chau and provision of new sewers to unsewered areas/villages including Tai Kwai Wan San Tsuen, Pak She San Tsuen, Nam She Tong, Fa Peng, Chi Ma Hang, Round Table Villages, Tai Shek Hau and Sin Yan Tseng, Tai Tsoi Yuen Kui, Ko Shan Tsuen and Lung Tsai Tsuen.



- 1.2.2 Upgrading of the existing Cheung Chau STW to include upgrading of the sewage treatment level of Cheung Chau STW to provide secondary treatment with design capacity of 9,800 m³/day. Proposed general layout of the Cheung Chau STW is shown in **Figure 1.2**.
- 1.2.3 Under Part I, Schedule 2 of the EIAO, the Project consists of the following designated projects (DP):
  - (a) Upgrading of the existing Cheung Chau STW under Item F.2 which is Sewage Treatment Works with an installed capacity of more than 5,000 m³/d and a boundary less than 200 m from the boundary of a residential area;
  - (b) Upgrading of the existing Pak She SPS under Item F.3 which is Sewage Pumping Station with an installed capacity of more than 2,000 m³/d and a boundary less than 150 m from the boundary of a residential area; and
  - (c) Upgrading of the existing Cheung Chau STW under Item F.4 which includes an activity for the reuse of treated sewage effluent from a treatment plant.

# 1.3 Project Programme

- 1.3.1 The Project is divided into four phases, namely Review, Design, Tender and Construction. The Construction of the first works contract is tentatively scheduled to commence in late 2014 with a view to completing the works in 2019.
- 1.3.2 The tentative implementation schedule for different works packages is presented in **Table 1.1**.

Table 1.1 Tentative Implementation Schedule for Different Works Packages

	Package 1 Cheung Chau STW and Pak She SPS upgrading	Package 2 Cheung Chau Sewers Works
EIA Endorsed Oct 2013		2013
Scheme Gazette under WPC(S)R	-	May 2014
Scheme Authorization	-	Aug 2014
Tender Gazette	May 2014	Jun 2015
Contract Commencement	Sep 2014	Oct 2015
Contract Completion	Mar 2019	Mar 2019

# 1.4 Purpose of this Environmental Monitoring and Audit (EM&A) Manual

- 1.4.1 The purpose of this EM&A Manual (hereinafter refer to as the "Manual") is to guide the set up of an EM&A programme to ensure compliance with the recommendations in the EIA study covering the upgrading of Cheung Chau Sewage Collection, Treatment and Disposal Facilities, to assess the effectiveness of the recommended mitigation measures and to identify any further need for additional mitigation measures or remedial action. This Manual outlines the monitoring and audit programme for both the construction and operational phase of both the DP component (upgrading of Cheung Chau STW and Pak She SPS) and non-DP component (sewers works) of the Project. It aims to provide systematic procedures for monitoring, auditing and minimising environmental impacts associated with the construction and operational phases.
- 1.4.2 This Manual provides specific information, guidance and instruction to personnel in



charged with environmental responsibilities and undertaking environmental monitoring and auditing works for the upgrading of Cheung Chau STW and Pak She SPS (DP component of the Project). It also provides systematic procedures for monitoring, auditing, and minimising environmental impacts associated with the construction activities.

- 1.4.3 The EM&A programme contain the following information:
  - project organization for the Project;
  - responsibilities of the Contractor, the Engineer or Engineer's Representative (ER) and Environmental Team (ET) with respect to the environmental monitoring and audit requirements during the course of the Project;
  - the basis for, and description of the broad approach underlying the EM&A programme;
  - requirements with respect to the construction programme schedule and the necessary environmental monitoring and audit programme to track the varying environmental impact;
  - details of the methodologies to be adopted, including all field laboratories and analytical procedures, and details on quality assurance and quality control programme;
  - definition of Action and Limit levels;
  - establishment of Event and Action plans;
  - requirements for reviewing pollution sources and working procedures required in the event of non-compliance with the environmental criteria and complaints;
  - requirements for presentation of environmental monitoring and audit data and appropriate reporting procedures; and
  - requirements for review of EIA predictions and the effectiveness of the mitigation measures / environmental management systems and the EM&A programme.

## 1.5 Project Organisation

- 1.5.1 Involvement of relevant parties in a collaborative and interactive manner is essential for the implementation of the recommended EM&A programme. The following sections outline the primary responsibilities and duties of the key EM&A programme participants. The lines of communication with respect to EM&A works are shown in **Appendix A**.
- 1.5.2 **Drainage Services Department (DSD)** is the project proponent and works department and hence will assume overall responsibility for the project.
- 1.5.3 **Environmental Protection Department (EPD)** is the statutory enforcement body for environmental protection matters in Hong Kong
- 1.5.4 The **Engineer's Representative (ER)** shall appoint an appropriate member of the resident site staff, who shall:
  - (i) Monitor the Contractor's compliance with the contract specifications, including the EM&A programme, and the effective implementation and operation of environmental mitigation measures in a timely manner;
  - (ii) Ensure that impact monitoring is conducted at the correct locations at the correct frequency as identified in the EM&A programme;
  - (iii) Instruct the Contractor to follow the agreed protocols or those In the Contract Specifications in the event of exceedances or complaints;

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- (iv) Review the programme of works with a view to identifying any potential environmental impacts before they arise;
- (v) Check that mitigation measures that have been recommended in the EIA Report, this document and contract documents, or as required, are correctly implemented in a timely manner, when necessary;
- (vi) Report the findings of site audits and other environmental performance reviews to DSD;
- (vii) Verify the environmental acceptability of permanent and temporary works, relevant design plans and submissions, and
- (viii) Comply with the agreed Event Contingency Plan in the event of any exceedance.
- 1.5.5 The **Independent Environmental Checker (IEC)** shall advise the ER on environmental issues related to the project. The IEC shall not be in any way an associated body of the ER, the Contractor or the ET for the project. The IEC shall be empowered to audit from an independent viewpoint the environmental performance during the construction of the Project. The IEC shall be a person who has relevant professional qualifications in environmental control and at least 7 years experience in EM&A and environmental management.
- 1.5.6 The IEC shall be responsible for the duties defined in this Manual, and shall audit the overall EM&A programme, including the implementation of all environmental mitigation measures, submissions required in this Manual, as well as any other relevant submissions required under the Environmental Permit. The IEC shall be responsible for verifying the environmental acceptability of permanent and temporary works, relevant design plans and submissions under the EP. The IEC shall verify the logbook prepared and kept by the ET Leader. The IEC shall notify EPD by fax, within 24 hours of receipt of notification from the ET Leader of any such instance or circumstance or change of circumstances or non-compliance with the EIA Report or the EP, which might affect the monitoring or control of adverse environmental impact.
- 1.5.7 The main duties of the IEC are to carry out independent environmental audit of the project. This shall include, inter alias, the following:
  - (i) Review and audit in an independent, objective and professional manner in all aspects of the EM&A programme;
  - (ii) Validate and confirm the accuracy of monitoring results, appropriateness of monitoring equipment, monitoring locations with reference to the locations of the nearby sensitive receivers, and monitoring procedures;
  - (iii) Carry out random sample check and audit on monitoring data and sampling procedures, etc;
  - (iv) Conduct random site inspection (at least once a month);
  - (v) Audit the EIA recommendations and EP requirements against the status of implementation of environmental protection measures on site;
  - (vi) Review the effectiveness of environmental mitigation measures and Project environmental performance;
  - (vii) On an as needed basis, verify and certify the environmental acceptability of the construction methodology (both temporary and permanent works), relevant design plans and submissions under the environmental permit. Where necessary, the IEC shall agree in consultation with the ET Leader and the Contractor the least impact alternative;
  - (viii) Verify investigation results of complaint cases and the effectiveness of corrective measures:

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- (ix) Verify EM&A reports submitted and certified by the ET Leader; and
- (x) Feedback audit results to ER/ ET by signing according to the Event/ Action Plans specified in this Manual.
- 1.5.8 An Environmental Team (ET) headed by an ET Leader shall preferably be appointed by the Contractor to carry out the recommended EM&A programme for the Project. Neither ET Leader nor ET shall be in any way an associated body of ER, IEC or the Contractor. The ET Leader shall plan, organise and manage the implementation of the EM&A programme, and ensure that the EM&A works are undertaken to the required standards. The ET Leader shall have relevant professional qualifications in environmental control and possess at least 7 years experience in EM&A and/or environmental management subject to the approval of their employer.
- 1.5.9 The ET Leader shall be responsible for the implementation of the EM&A programme in accordance with the EM&A requirements specified in this Manual and the EP. The ET Leader shall keep a contemporaneous logbook for recording each and every instance or circumstance or change of circumstances that may affect the compliance with the recommendations of the EIA report. This logbook shall be kept readily available for inspection by the IEC, and Director of Environmental Protection (DEP) or his authorised officers.
- 1.5.10 Sufficient and suitably qualified professional and technical staff shall be employed by the respective parties to ensure full compliance with their duties and responsibility, as required under the EM&A programme for the duration of the project.
- 1.5.11 The broad categories of works of the ET comprise the following:
  - (i) To monitor the various environmental parameters as required by the EM&A programme;
  - (ii) To follow up and close out of the non-compliance actions;
  - (iii) To investigate and audit the Contractor's equipment and work methodologies with respect to pollution control and environmental mitigation, and to anticipate environmental issues that may require mitigation before the problem arises;
  - (iv) To audit and prepare audit reports on the environmental monitoring data and the site environmental conditions;
  - (v) To review the EM&A programme after the collection and analysis of the baseline data,
  - (vi) To modify the EM&A programme in terms of parameters, sites, sample sizes, frequency etc. if appropriate in consultation with the ER and EPD, and
  - (vii) To report the environmental monitoring and audit results to the IEC, Contractor and the ER.
- 1.5.12 The **Contractor** shall assign an on-site environmental coordinator to oversee Contractor's environmental performance and the implementation of the EM&A duties. The coordinator shall be a person who has relevant professional qualifications in environmental control and is subject to approval by the ER.
- 1.5.13 The broad categories of works of the Contractor comprise the following:
  - (i) Work within the scope of the construction contract and other tender conditions with respect to environmental requirements;
  - (ii) Operate and strictly adhere to the guidelines and requirements in this EM&A programme and contract specifications;



- (iii) Provide assistance to ET in carrying our monitoring;
- (iv) Participate in the site inspections undertaken by the ET as required, and undertake correction actions;
- (v) Provide information / advice to the ET regarding works activities which may contribute, or be continuing to the generation of adverse environmental conditions;
- (vi) Submit proposals on mitigation measures in case of exceedances of Action and Limit levels in accordance with the Event / Action Plans;
- (vii) Implement measures to reduce impact where Action and Limit levels are exceeded; and
- (viii) Adhere to the procedures for carrying out complaint investigation.
- 1.5.14 The Contractor should also participate in the environmental performance review undertaken by the ER and undertake any corrective actions as instructed by the ER.



### 2. AIR QUALITY

### 2.1 Introduction

- 2.1.1 In this section, the requirements, methodology, equipment, monitoring location, criteria and protocols for the monitoring and audit of air quality impacts during the construction and operation of upgrading of Cheung Chau STW and Pak She SPS (DP component) and sewers works (non-DP component) under the Project are presented.
- 2.1.2 With the implementation of dust suppression and control measures stipulated in the Air Pollution Control (Construction Dust) Regulation, the potential dust impacts due to the construction of sewers works would be minimal. Therefore, construction dust monitoring is only recommended for the construction works of upgrading of Cheung Chau STW.
- 2.1.3 During the operational phase of the Project, all the potential odour generating facilities would be enclosed by air-tight covers. Odourous gas generated from the Cheung Chau STW would be ventilated to the deodourisation facility for treatment before discharge. The deodourisation facility would be designed to achieve an odour removal efficiency of 99% for Cheung Chau STW and 99% for Pak She SPS. During sludge transportation, the sludge should be carried by enclosed container to avoid unacceptable odour nuisance. With the above mitigation measures incorporated into the design, no unacceptable odour impacts are anticipated. Odour monitoring and audit is proposed during the operation phase to ensure the continuing effectiveness of the odour control measures.

## 2.2 Air Quality Parameters

- 2.2.1 The air quality parameters to be monitored includes:
  - 24-hour TSP;
  - 1-hour TSP; and
  - odour units or equivalent Hydrogen Sulphide (H<sub>2</sub>S) concentration.

# 2.3 Monitoring Requirements and Equipment

### **Construction Phase**

- 2.3.1 1-hour and 24-hour TSP levels shall be measured to indicate the impacts of construction dust on air quality. The 24-hour TSP levels shall be measured by following the standard high volume sampling method as set out in the Title 40 of the United States Code of Federal Regulations, Chapter 1 (Part 50), Appendix B. Upon agreement from the ER and the IEC, 1-hour TSP levels can be measured by direct reading methods to indicate short event impacts.
- 2.3.2 All relevant data including temperature, pressure, weather conditions, elapsed-time meter reading for the start and stop of the sampler, identification and weight of the filter paper, other local atmospheric factors affecting or affected by site conditions and work progress of the concerned site etc. shall be recorded in detail. A sample data record sheet is shown in **Appendix B**. The ET Leader may modify the data record sheet for this EM&A programme, of which the format should be agreed by the ER and the IEC.
- 2.3.3 High volume samplers (HVSs) in compliance with the following specifications shall be



used for carrying out the 1-hour and 24-hour TSP monitoring:

- (i)  $0.6 1.7 \text{ m}^3$  per minute adjustable flow range;
- (ii) equipped with a timing / control device with +/- 5 minutes accuracy for 24 hours operation;
- (iii) installed with elapsed-time meter with +/- 2 minutes accuracy for 24 hours operation;
- (iv) capable of providing a minimum exposed area of 406 cm<sup>2</sup>;
- (v) flow control accuracy: +/- 2.5% deviation over 24-hour sampling period;
- (vi) equipped with a shelter to protect the filter and sampler;
- (vii) incorporated with an electronic mass flow rate controller or other equivalent devices;
- (viii) equipped with a flow recorder for continuous monitoring;
- (ix) provided with a peaked roof inlet;
- (x) incorporated with a manometer;
- (xi) able to hold and seal the filter paper to the sampler housing at horizontal position;
- (xii) easily changeable filter; and
- (xiii) capable of operating continuously for a 24-hour period.
- 2.3.4 The ET is responsible for provision of the monitoring equipment. They shall ensure that sufficient number of HVSs with an appropriate calibration kit is available for carrying out the baseline monitoring, and ad hoc monitoring. The HVSs shall be equipped with an electronic mass flow controller and be calibrated against a traceable standard at regular intervals. All the equipment, calibration kit, filter papers, etc., shall be clearly labelled.
- 2.3.5 Initial calibration of dust monitoring equipment shall be conducted upon installation and thereafter at bi-monthly intervals. The transfer standard shall be traceable to the internationally recognised primary standard and be calibrated annually. The concerned parties such as ER shall properly document the calibration data for future reference. All the data shall be converted into standard temperature and pressure condition.
- 2.3.6 The flow-rate of the sampler before and after the sampling exercise with the filter in position shall be verified to be constant and be recorded in the data sheet as mentioned in **Appendix B**.
- 2.3.7 If the ET proposes to use a direct reading dust meter to measure 1-hour TSP levels, he shall submit sufficient information to the ER to prove that the instrument is capable of achieving a comparable result to the HVS. The instrument shall also be calibrated regularly, and the 1-hour sampling shall be determined periodically by the HVS to check the validity and accuracy of the results measured by direct reading method.
- 2.3.8 Wind data monitoring equipment shall also be provided by the ET and set up at conspicuous locations for logging wind speed and wind direction near to the dust monitoring locations. The equipment installation location shall be proposed by the ET and agreed with the ER in consultation with the IEC. For installation and operation of wind data monitoring equipment, the following points shall be observed:
  - (i) The wind sensors shall be installed 10m above ground so that they are clear of obstructions or turbulence caused by the buildings;



- (ii) The wind data shall be captured by a data logger. The data shall be downloaded for analysis at least once a month;
- (iii) The wind data monitoring equipment shall be re-calibrated at least once every six months; and
- (iv) Wind direction should be divided into 16 sectors of 22.5 degrees each.
- 2.3.9 In exceptional situations, the ET may propose alternative methods to obtain representative wind data upon approval from the ER and agreement from the IEC.

## **Laboratory Measurement / Analysis**

- 2.3.10 A clean laboratory with constant temperature and humidity control, and equipped with necessary measuring and conditioning instruments to handle the dust samples collected, shall be available for sample analysis, and equipment calibration and maintenance. The laboratory shall be HOKLAS accredited.
- 2.3.11 If a site laboratory is set up or a non-HOKLAS accredited laboratory is hired for carrying out the laboratory analysis, the laboratory equipment shall be approved by the ER and the measurement procedures shall be witnessed by the ER. Any measurement performed by the laboratory shall be demonstrated to the satisfaction of the ER. The ER shall regularly audit the measurement performed by the laboratory to ensure the accuracy of measurement results. The ET Leader shall provide the ER with one copy of the Title 40 of the Code of Federal Regulations, Chapter 1 (Part 50), (Appendix B) for his reference.
- 2.3.12 Filter paper of size 8" x 10" shall be labelled before sampling. It shall be a clean filter paper with no pinholes, and shall be conditioned in a humidity-controlled chamber for over 24-hours and be pre-weighed before use for the sampling.
- 2.3.13 After sampling, the filter paper loaded with dust shall be kept in a clean and tightly sealed plastic bag. The filter paper shall then be returned to the laboratory for reconditioning in the humidity-controlled chamber followed by accurate weighing by an electronic balance with readout down to 0.1 mg. The balance shall be regularly calibrated against a traceable standard.
- 2.3.14 All the collected samples shall be kept in a good condition for 6 months before disposal.

## **Operation Phase**

## General

- 2.3.15 For baseline and commissioning monitoring, H<sub>2</sub>S measurements and odour sampling shall be carried out at the odour emission points and at sensitive receivers. The purpose is to determine the correlation between H<sub>2</sub>S concentrations and odour units obtained from the odour samplings. Once such correlation is established, H<sub>2</sub>S monitoring will be continued and it serves as a surrogate indicator for the odour for operation monitoring. H<sub>2</sub>S concentrations measured will be converted to equivalent odour units.
- 2.3.16 The following items should be recorded during odour sampling and H<sub>2</sub>S concentration measurement:
  - the prevailing weather condition;
  - wind direction;
  - any odour detected during sampling and the flavours of odour with detailed description of characteristics (e.g. sewage or rotten-egg smell, decayed



vegetables, ammonical, dischargeable odour, putrefaction, sharp, pungent, fish, irritating, fruit, vinegar, etc);

- downwind or upwind direction from the odour source;
- duration of odour (intermittent or continuous) during sampling; and
- photo showing the sampling locations relative to existing land features. The
  relevant meteorological data (e.g. ambient temperature, wind speed and
  direction, relative humidity, etc.) from the nearest Hong Kong Observatory
  station during the sampling period should also be recorded for reference.
- Measurement at each location shall be carried out at least three (3) times for each sampling event.

# **Odour Sampling**

- 2.3.17 Odour concentration sampling at designated sampling locations will be carried out. Each sampling at each location shall be carried out at least three (3) times in order to see if there would be any major fluctuation in the measured data.
- 2.3.18 During each odour sampling day, one blank sample is to be collected for quality control. The sample will be taken by purging pure nitrogen gas into odour sampling bag directly as a blank sample.
- 2.3.19 The odour concentration of the collected air samples should be determined by a forced-choice dynamic olfactometer with a panel of human assessors being the sensor in accordance with the European Standard Method: Air Quality Determination of Odour Concentration by Dynamic Olfactometry (EN13725) within 24 hours after collection.

### H<sub>2</sub>S Measurement

- 2.3.20 H<sub>2</sub>S concentrations shall be measured by portable H<sub>2</sub>S analyser, type Jerome 631-X H<sub>2</sub>S, or equivalent which utilises a gold film sensor for the detection of hydrogen sulphide. The instrument is controlled by microprocessor, ensuring rapid accurate analyses, and should be fitted with the following accessories:
  - Data logger (to allow the instrument to operate unattended);
  - Interface cable and interface software; and
  - Data download and graphics services.
- 2.3.21 The instrument is capable of measuring  $H_2S$  concentration in the range 1ppb to 50ppm, to an accuracy of  $\pm 6\%$ .

# Odour Complaint Registration

- 2.3.22 A complaint registration system should be in place to handle the odour complaint case. The operator of the Cheung Chau STW and Pak She SPS (i.e. DSD) in future can have their complaint registration system and would not be limited to the below proposed complaint registration system.
- 2.3.23 In the event when an odour complaint is received, the operator shall liaise with the complainant and a Complaint Registration Form shall be completed. The Complaint Registration Form is to record detailed information regarding the odour complaint and hence, facilitates efficient investigation work. The registration form shall contain, but not be limited to the following information:
  - (i) Location of where the odour nuisance occurred, including whether the odour was experienced indoors or outdoors;
  - (ii) Date and time of the complaint and the nuisance event;



- (iii) Description of the complaint, i.e. the type and characteristics of the odour; and an indication of the odour strength (highly offensive / offensive / slightly offensive / just continuously detectable /intermittently detectable); and
- (iv) Name and contact information of the complainant.
- 2.3.24 This information shall be obtained by the plant engineer or his representative(s) of the Cheung Chau STW and Pak She SPS when the complaint is received. The Odour Complaint Register is recommended to be kept at the Cheung Chau STW. The Complaint Registration Form is shown in **Appendix B** for reference.
- 2.3.25 In addition, it is recommended to obtain the following information:
  - (i) Meteorological conditions from the Hong Kong Observatory's Cheung Chau Weather Station (including temperature, wind speed, relative humidity) at the time of the complaint; and
  - (ii) Whether any abnormal operations are being carried out at the Cheung Chau STW and Pak She SPS at the time the nuisance occurred.

### 2.4 Air Quality Monitoring Locations

### **Construction Dust**

- 2.4.1 The status and location of the air quality sensitive receivers may change after issuing this Manual. The ET shall propose updated monitoring locations and seek approval from EPD, and agreement from the ER and the IEC before the baseline monitoring commences.
- 2.4.2 Should alternative monitoring locations be proposed, the proposed sites shall, as far as practicable:
  - (i) be at the site boundary or such locations close to the major dust emission source;
  - (ii) be close to the sensitive receptors; and
  - (iii) take into account the prevailing meteorological conditions.
- 2.4.3 The ET shall agree with the ER and the IEC on the position of the HVS for the installation of the monitoring equipment. When positioning the samplers, the following points shall be noted:
  - (i) a horizontal platform with appropriate support to secure the samplers against gusty wind shall be provided;
  - (ii) no two samplers shall be placed less than 2 meters apart;
  - (iii) the distance between the sampler and an obstacle, such as buildings, must be at least twice the height that the obstacle protrudes above the sampler;
  - (iv) a minimum of 2 meters of separation from walls, parapets and penthouses is required for rooftop samplers:
  - (v) a minimum of 2 meters separation from any supporting structure, measured horizontally is required;
  - (vi) no furnace or incinerator flue is nearby;
  - (vii) airflow around the sampler is unrestricted;
  - (viii) the sampler is more than 20 meters from the dripline;
  - (ix) any wire fence and gate, to protect the sampler, shall not cause any obstruction during monitoring;



- (x) permission must be obtained to set up the samplers and to obtain access to the monitoring stations; and
- (xi) a secured supply of electricity is needed to operate the samplers.
- 2.4.4 The proposed dust monitoring station is presented in **Table 2.1** and the respective locations are shown in **Figure 2.1**.

**Table 2.1 Proposed Dust Monitoring Stations** 

ID No.	Location	Nature of Use	
A1	Cheung King House, Cheung Kwai Estate	Residential	
A2	Cheung Chau Slaughter House	Slaughter house	

#### Odour

2.4.5 Four existing Air Sensitive Receivers (ASRs) have been identified for odour monitoring as shown in **Table 2.2** and illustrated in **Figure 2.1** and **Figure 2.2**. Monitoring shall be conducted at 1.5m above the ground surface.

**Table 2.2 Proposed Odour Monitoring Stations** 

ID No.	Location	Nature of Use	
A1	Cheung King House, Cheung Kwai Estate	Residential	
A2	Cheung Chau Slaughter House	Slaughter house	
A3	Cheung Chau Commercial Centre	Office	
A4	Cheung Chau Fire Station	Government Quarter	

### 2.5 Baseline Air Quality Monitoring

### **Construction Dust**

- 2.5.1 Baseline dust monitoring shall be carried out at the designated monitoring location shown in **Table 2.1** for at least 14 consecutive days prior to the commissioning of the construction works to obtain daily 24-hour TSP samples. One-hour TSP sampling shall also be done at least 3 times per day while the highest dust impact is expected.
- 2.5.2 During the baseline monitoring, there shall not be any construction or dust generation activities in the vicinity of the monitoring station. Before commencing baseline monitoring, the ET shall inform the ER and IEC of the baseline monitoring programme.
- 2.5.3 In case the baseline monitoring cannot be carried out at the designated monitoring location during the baseline monitoring period, the ET Leader shall carry out the monitoring at an alternative location that can effectively represent the baseline conditions at the impact monitoring location. The alternative baseline monitoring location shall be approved by the ER and IEC.
- 2.5.4 In exceptional cases, when insufficient baseline monitoring data or questionable results are obtained, the ET shall liaise with the ER and IEC to agree on an appropriate set of data to be used as a baseline reference and submit to ER and IEC for approval.
- 2.5.5 Ambient conditions may vary seasonally and shall be reviewed once every three months. When the ambient conditions have changed and a repeat of the baseline



monitoring is required to be carried out for obtaining the updated baseline levels, the monitoring shall be conducted at times when the Contractor's activities are not generating dust, at least in the proximity of the monitoring stations. Should change in ambient conditions be determined, the baseline levels and, in turn, the air quality criteria, shall be revised. The revised baseline levels and air quality criteria shall be agreed with the ER and IEC.

#### Odour

- 2.5.6 Prior to the demolition of the existing major odour emission sources in Cheung Chau STW or commissioning of the upgraded treatment facility of Cheung Chau STW, and prior to commissioning of the upgraded Pak She SPS, a programme to odour sampling with olfactometry analysis and H<sub>2</sub>S concentration measurement at the selected ASRs as shown in **Table 2.2**, A1 to A4, shall be undertaken by the ET to establish the prevailing odour condition for one year at a three months interval. The ET shall submit the baseline monitoring programme to the IEC for agreement prior to conducting the monitoring works. In case insufficient baseline monitoring results are obtained, the ET shall liaise with the ER and IEC to agree on an appropriate set of data to be used as a baseline reference and submit to ER and IEC for agreement.
- 2.5.7 Baseline odour monitoring should consist of both odour sampling and H<sub>2</sub>S concentration measurements. Sampling at the selected ASRs using olfactometry and H<sub>2</sub>S analyser should be carried out simultaneously. The results will be used for establishing the correlations between odour units and H<sub>2</sub>S concentration at ASRs. Since H<sub>2</sub>S is one of the key components of odour emissions from STW and SPS, it serves as a surrogate indicator for odours.

### 2.6 Impact Air Quality Monitoring

## **Construction Phase**

- 2.6.1 The ET shall carry out impact monitoring during construction phase of the Project. For regular impact monitoring, the sampling frequency of at least once in every six-days, shall be strictly observed at all the monitoring stations for 24-hour TSP monitoring. For 1-hour TSP monitoring, the sampling frequency of at least three times in every six-days shall be undertaken when the highest dust impact occurs. Before commencing the impact monitoring, the ET Leader shall inform the IEC of the impact monitoring programme such that the IEC can conduct on-site audit to ensure accuracy of the impact monitoring results.
- 2.6.2 In case of non-compliance with the air quality criteria, additional monitoring as specified in the Action Plan in **Table 2.4** shall be conducted within 24 hours after the result is obtained. This additional monitoring shall be continued until the excessive dust emission or the deterioration in air quality is rectified.

### **Operation Phase**

### Odour Monitoring during Commissioning Stage

2.6.3 The odour removal efficiency of deodorization units shall be audited at a monthly interval during the first year of commissioning stage. Odour sampling with olfactometry analysis and H<sub>2</sub>S measurements shall be conducted at the exhaust vent and inlet of the each deodorization unit. Correlation between odour level (in odour units) and H<sub>2</sub>S concentration will be established. Once such correlation is established, only H<sub>2</sub>S monitoring shall be carried out after the commissioning period, which serves as a surrogate indicator for odour. The H<sub>2</sub>S concentrations measured can be converted to equivalent odour units. Air flow rate at the exhaust vent shall



also be recorded.

- 2.6.4 In addition, odour sampling with olfactometry analysis and H<sub>2</sub>S measurements are to be conducted at a monthly interval during the first year of commissioning stage at the selected ASRs as shown in **Table 2.2**.
- 2.6.5 Upon completion of the first commissioning year monitoring, the ET shall summarise all the monitored results including analysis of the results to establish the correlation between H<sub>2</sub>S concentration and the odour units due to the operation of the upgraded Cheung Chau STW and Pak She SPS, and the trend of odour removal efficiency of the deodorization units, for the IEC agreement. The trend of the odour removal efficiency of the deodorization units will be used for reviewing their maintenance frequency.

#### Subsequent Monitoring

2.6.6 Based on the monitoring results obtained from the first year commissioning period the ET shall propose detailed monitoring requirements and programme for the Operation and Maintenance (O&M) period thereafter the first commissioning year for agreement by the IEC. As a basic approach, odour monitoring shall be conducted in the first five years of the Operation and Maintenance (O&M) period after the first commissioning year. The odour removal efficiency of deodorization units shall be monitored. H<sub>2</sub>S measurement shall be conducted at the exhaust vent and inlet of the each deodorization unit at a three month interval for the upgraded Cheung Chau STW and Pak She SPS. The measured H<sub>2</sub>S concentration shall be converted to the equivalent odour units based on the correlation established during the first year commissioning period. The odour removal efficiency of the deodorization units shall be calculated and reported. With reference to the monitoring results, the frequency of monitoring could be revised to fit the situation, subject to EPD's approval.

# 2.7 Environmental Quality Performance Limits

2.7.1 The baseline monitoring results form the basis for determining the air quality criteria for the impact monitoring. The ET shall compare the impact monitoring results with air quality criteria set up for 24-hour TSP and 1-hour TSP. **Table 2.3** shows the air quality criteria, namely Action and Limit levels to be used.

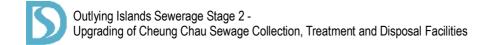
Table 2.3 Action / Limit Levels for Air Quality

Parameters	Action Level	Limit Level	
1-hour TSP Level in µg/m³	For baseline level $\leq$ 200 µg/m <sup>3</sup> AL = (BL * 1.3 + LL)/2 For baseline level $>$ 200 µg/m <sup>3</sup> AL = LL	260 μg/m³	
24-hour TSP Level in µg/m³	For baseline level $\leq 384 \mu g/m^3$ AL = (BL * 1.3 + LL)/2 For baseline level $> 384 \mu g/m^3$ AL = LL	500 μg/m³	
Odour Nuisance	Averaged baseline H <sub>2</sub> S concentration measured at ASRs (commissioning period only); or any incidence of odour complaint received through the Odour Complaint Register	Averaged baseline H <sub>2</sub> S concentration or the 5 OU equivalent, whichever is greater at ASRs (commissioning period only); or two or more complaints through the Odour Complaint Register within a three month period; or odour removal efficiency of deodorization units drops below 99%.	

Note: AL = Action level, LL = Limit level, BL = Baseline level



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# 2.8 Event and Action Plan

2.8.1 Should non-compliance of the air quality criteria occur, actions in accordance with the Action Plan in **Table 2.4** and **Table 2.5** shall be carried out.



Table 2.4 Event and Action Plan for Air Quality (Construction Dust)

EVENT	ACTION PLAN FOR CONSTRUCTION DUST			
EVENI	ET	IEC	ER	CONTRACTOR
		ACTION LEVEL		
Exceedance for one sample	Identify source, investigate the causes of exceedance and propose remedial measures;     Inform IEC and ER;     Repeat measurement to confirm finding; and     Increase monitoring frequency to daily.	Check monitoring data submitted by ET; and     Check Contractor's working method.	Notify Contractor.	Rectify any unacceptable practice; and     Amend working methods if appropriate.
Exceedance for two or more consecutive samples	<ol> <li>Identify source;</li> <li>Inform IEC and ER;</li> <li>Advise the ER on the effectiveness of the proposed remedial measures;</li> <li>Repeat measurements to confirm findings;</li> <li>Increase monitoring frequency to daily;</li> <li>Discuss with IEC and Contractor on remedial actions required;</li> <li>If exceedance continues, arrange meeting with IEC and ER; and</li> <li>If exceedance stops, cease additional monitoring.</li> </ol>	<ol> <li>Check monitoring data submitted by ET;</li> <li>Check Contractor's working method;</li> <li>Discuss with ET and Contractor on possible remedial measures;</li> <li>Advise the ET on the effectiveness of the proposed remedial measures; and</li> <li>Supervise implementation of remedial measures</li> </ol>	Confirm receipt of notification of failure in writing;     Notify Contractor; and     Ensure remedial measures properly implemented.	<ol> <li>Submit proposals for remedial to IEC within 3 working days of notification;</li> <li>Implement the agreed proposals; and</li> <li>Amend proposal if appropriate.</li> </ol>



ACTION PLAN FOR CONSTRUCTION DUST				
EVENI	ET	IEC	ER	CONTRACTOR
		LIMIT LEVEL		
Exceedance for one sample	<ol> <li>Identify source, investigate the causes of exceedance and propose remedial measures;</li> <li>Inform IEC, ER, and EPD;</li> <li>Repeat measurement to confirm finding;</li> <li>Increase monitoring frequency to daily; and</li> <li>Assess effectiveness of Contractor's remedial actions and keep EPD and ER informed of the results.</li> </ol>	<ol> <li>Check monitoring data submitted by ET;</li> <li>Check Contractor's working method;</li> <li>Discuss with ER and Contractor on possible remedial measures;</li> <li>Advise the ER on the effectiveness of the proposed remedial measures; and</li> <li>Supervise implementation of remedial measures.</li> </ol>	<ol> <li>Confirm receipt of notification of failure in writing;</li> <li>Notify Contractor; and</li> <li>Ensure remedial measures properly implemented.</li> </ol>	<ol> <li>Take immediate action to avoid further exceedance;</li> <li>Submit proposals for remedial actions to IEC within 3 working days of notification;</li> <li>Implement the agreed proposals; and</li> <li>Amend proposal if appropriate.</li> </ol>
Exceedance for two or more consecutive samples	<ol> <li>Notify ER, Contractor and EPD;</li> <li>Identify source;</li> <li>Repeat measurement to confirm findings;</li> <li>Increase monitoring frequency to daily;</li> <li>Carry out analysis of Contractor's working procedures to determine possible mitigation to be implemented;</li> <li>Arrange meeting with IEC and ER to discuss the remedial actions to be taken;</li> <li>Assess effectiveness of Contractor's remedial actions and keep IEC, EPD and ER informed of the results; and</li> <li>If exceedance stops, cease additional monitoring.</li> </ol>	Discuss amongst ER, ET and Contractor on potential remedial actions;     Review Contractor's remedial actions whenever necessary to assure their effectiveness and advise the ER accordingly; and     Supervise the implementation of remedial measures.	<ol> <li>Confirm receipt of notification of failure in writing;</li> <li>Notify Contractor;</li> <li>In consolidation with the IEC, agree with the Contractor on the remedial measures to be implemented;</li> <li>Ensure remedial measures properly implemented; and</li> <li>If exceedance continues, consider what portion of the work is responsible and instruct the Contractor to stop that portion of work until the exceedance is abated.</li> </ol>	<ol> <li>Take immediate action to avoid further exceedance;</li> <li>Submit proposals for remedial actions to IEC within 3 working days of notification;</li> <li>Implement the agreed proposals;</li> <li>Resubmit proposals if problem still not under control; and</li> <li>Stop the relevant portion of works as determined by the ER until the exceedance is abated.</li> </ol>



 Table 2.5
 Event and Action Plan for Air Quality (Operational Phase)

EVENT	ACTION PLAN FOR ODOUR					
CACIAI	PERSON IN CHARGE OF ODOUR MONITORING	DSD				
	ACTION LEVEL					
Exceedance of Action level (odour measurement)	<ol> <li>Identify source/ reason of exceedance;</li> <li>Repeat measurement to confirm findings.</li> </ol>	<ol> <li>Carry out investigation to identify the source/reason of exceedance. Investigation shall be completed within 2 weeks;</li> <li>Implement more mitigation measures if necessary;</li> <li>Inform EPD if the cause of exceedance is considered to be caused by the STW / SPS;</li> <li>Undertake maintenance of the deodourization facility if necessary.</li> </ol>				
Exceedance of Action level (odour complaint)	Identify source/ reason of complaint;     Carry out measurement to determine odour emissions from STW / SPS.	<ol> <li>Carry out investigation and verify the complaint whether it is related to potential odour emissions from the STW / SPS. Investigation should be completed within 2 weeks;</li> <li>Implement more mitigation measures if necessary;</li> <li>Inform EPD if the complaint is considered to be related to the STW / SPS;</li> <li>Undertake maintenance of the deodourization facility if necessary.</li> </ol>				
	LIMIT LEVEL					
Exceedance of Limit level	<ol> <li>Identify source/ reason of exceedance / complaint;</li> <li>Carry out measurement to determine odour emissions from STW / SPS;</li> <li>Carry out analysis of the operation and implementation of odour mitigation measures to determine if possible mitigation to be implemented;</li> <li>Carry out measurement to determine odour emissions from STW / SPS after implementation of abatement measures to confirm their effectiveness.</li> </ol>	<ol> <li>Carry out investigation to identify the source/reason of exceedance. Investigation shall be completed within 2 weeks;</li> <li>Inform EPD if the cause of exceedance / complaint is considered to be caused by the STW / SPS;</li> <li>Formulate abatement measures;</li> <li>Ensure abatement measures are properly implemented;</li> <li>If exceedance continues, consider what more / enhanced mitigation measures should be implemented, until the exceedance is abated;</li> <li>Undertake maintenance of the deodourization facility if necessary.</li> </ol>				



## 2.9 Mitigation Measures

#### **Construction Phase**

- 2.9.1 Mitigation measures for dust control have been recommended in the EIA report. The contractor shall be responsible for the design and implementation of these measures.
- 2.9.2 For the construction activities under the Project, the suitable requirements stipulated in the Air Pollution Control (Construction Dust) Regulation shall be implemented during the construction activities to minimise the dust impact. It is recommended that typical dust control methods including the following good site practices should also be incorporated during construction phase:
  - Watering eight times a day on active works areas and paved haul roads to reduce dust emissions by 90.9% (e.g. watering intensity at 0.5 litres/m². Actual application shall depend on the site condition and weather conditions).
  - Watering every hour on unpaved areas and stockpiles of dusty materials (if no tarpaulin is provided) to reduce dust emissions by 90% (e.g. watering intensity at 1.5 litre/m² during the first hour, subsequent application at 0.2 litre/m². Actual application shall depend on the site condition and weather conditions).
  - Use of regular watering, with complete coverage, to reduce dust emissions from exposed site surfaces and unpaved roads, particularly during dry weather
  - Use of frequent watering for particularly dusty construction areas and areas close to ASRs.
  - Vehicle washing facilities should be provided at every vehicle exit point.
  - Where a site boundary adjoins a road, streets or other areas accessible to the public, hoarding of not less than 2.4 m high from ground level should be provided along the entire length except for a site entrance or exit.
  - Stockpiles of imported material kept on site shall be contained within hoarding, dampened and/or covered during dry and windy weather.
  - Material stockpiled alongside trenches should be covered with tarpaulins.
  - Open stockpiles shall be avoided or covered. Where possible, prevent placing dusty material storage piles near ASRs.
  - Any excavated or stockpile of dusty material should be covered entirely by impervious sheeting or spayed with water to maintain the entire surface wet during the non-working hours.
  - All dusty materials shall be sprayed with water prior to any loading, unloading or transfer operation so as to keep the dusty materials wet.
  - Water sprays shall be used during the delivery and handling of sands aggregates and the like.
  - All demolished items that may emit dust particles should be covered entirely by impervious sheeting or placed in an area sheltered on the top and the 3 sides within a day of demolition.
  - Good site practices for concrete batching plant:
    - Every stock of more than 20 bags of cement or dry pulverized fuel ash (PFA) should be cover entirely by impervious sheeting or placed in an area sheltered on the top and the sides.



- Cement or dry PFA delivered in bulk should stored in a closed silo fitted with an audible high level alarm which is interlocked with the material filling line and no overfilling is allowed.
- Loading, unloading, transfer, handling or storage of bulk cement or dry PFA should be carried out in a totally enclosed system or facility, and any vent or exhaust should be fitted with effective fabric filter or equivalent air pollution control system (maximum TSP emission factor of silos and mixing tower: 50 mg/m³)

### **Operation Phase**

- 2.9.3 The design of enclosing the odour sources of the upgraded Cheung Chau STW and Pak She SPS and the installation of deodorization units would readily reduce the potential odour impacts. Adverse odour impact from the upgraded Cheung Chau STW and Pak She SPS is not anticipated.
- 2.9.4 In addition, good housekeeping practices listed below should be followed to control odour emissions from the plant and these standard practices should be included in the plant operator manual:
  - Screens should be cleaned regularly to remove accumulated organic debris;
  - Grit and screening transfer systems should be flushed regularly with water to remove organic debris and grit;
  - Grit and screened materials should be transferred to closed containers to minimize odour escape;
  - Sludge should be frequently withdrawn from tanks to prevent the production of gases;
  - Sludge should be transferred to closed containers; and
  - Sludge containers should be flushed with water regularly.



#### 3. NOISE

#### 3.1 Introduction

- 3.1.1 In this section, the requirements, methodology, equipment, monitoring locations, criteria and protocols for the monitoring and audit of noise impacts during the construction of upgrading of Cheung Chau STW and Pak She SPS (DP component) and sewers works (non-DP component) under the Project are presented.
- 3.1.2 No adverse operational noise impacts are expected if appropriate design and noise mitigation are adopted. Therefore, no EM&A programme is recommended for the operational phase of the Project.

## 3.2 Monitoring Requirements and Equipment

#### **Noise Parameters**

3.2.1 The construction noise level shall be measured in terms of equivalent A-weighted sound pressure level ( $L_{eq}$ ).  $L_{eq (30min)}$  shall be used as the monitoring parameter for the time period between 07:00-19:00 hours on normal weekdays. For all other time period,  $L_{eq (5min)}$  shall be employed for comparison with the Noise Control Ordinance criteria. The two statistical sound levels  $L_{10}$  and  $L_{90}$ , the level exceeded for 10% and 90% of the time respectively, shall also be recorded during monitoring. The  $L_{90}$  may be considered as the ambient level into which the  $L_{10}$  as an average peak level intrudes. A sample data record sheet is shown in **Appendix B**.

# **Noise Monitoring Equipment / Calibration**

- 3.2.2 Sound level meters and calibrators shall comply with the International Electrotechnical Commission (IEC) Publication 651:1979 (Type 1) and 804:1985 (Type 1) specification as referred to in the Technical Memorandum (TM) issued under the Noise Control Ordinance. The sound level meters shall be supplied and used with the manufacturer recommended weather shield as appropriate.
- 3.2.3 Sound level meters shall be calibrated using a portable calibrator prior to and following each noise measurement. The calibration levels shall be noted with the measurement results and where the difference between the calibration levels is greater than 1.0 dB(A), the measurement shall be repeated. Calibrated hand-held anemometers shall also be supplied for the measurement of wind speeds during noise monitoring periods.
- 3.2.4 The equipment shall be kept in a good state of repair in accordance with the manufacturer's recommendations and maintained in proper working order with sufficient spare equipment available in the event of breakdown to maintain the planned monitoring programme.
- 3.2.5 Noise measurements will not be made in the presence of fog, rain, wind with a steady speed exceeding 5m/s or wind with gusts exceeding 10m/s. The wind speed shall be checked with the hand-held anemometers capable of measuring the wind speed in m/s.
- 3.2.6 The ET is responsible for provision of the monitoring equipment. He shall ensure that sufficient noise measuring equipment and associated instrumentation are available for carrying out the baseline monitoring, regular impact monitoring and ad hoc monitoring. All the equipment and associated instrumentation shall be clearly labelled.



# 3.3 Noise Monitoring Methodology

- 3.3.1 Weatherproof logging sound level meters shall be installed at the monitoring locations during baseline monitoring. Continuous baseline noise for the A-weighted levels  $L_{eq}$ ,  $L_{10}$  and  $L_{90}$  shall be measured over a two week period, and sampling period of 5 minutes will be used throughout the monitoring. Average, by sound power, of six consecutive  $L_{eq~(5~min)}$  reading is used to provide  $L_{eq~(30~min)}$  for the non-restricted period and three consecutive  $L_{eq~(5~min)}$  reading is used to provide  $L_{eq~(15~min)}$  for the restricted period during the impact stage.
- 3.3.2 Regular visits, for a period of at least once every three to four days, shall be conducted by the ET to ensure the continuous operations of the sound level meter. Impact monitoring shall be conducted once a week. Information such as date of monitoring, weather condition, equipment used, measurement results and major noise sources will be recorded on the data record sheet. Examples of the record sheets are presented in **Appendix B**.

# 3.4 Noise Monitoring Locations

3.4.1 Ten monitoring locations as presented in **Table 3.1** have been identified for noise monitoring within the Study Area. Their locations are shown in **Figure 3.1 – 3.8**. The status and locations of noise sensitive receivers may change after the approval of the EIA Report. If such cases exist, the ET Leader shall propose updated monitoring locations and seek approval from ER.

**Table 3.1** Noise Monitoring Locations

ID No.	Location	Nature of Uses	Construction Works (1)
N1	No.4 Tai Kwai Wan San Tsuen	Residential	Non-DP
N2	Cheung King House, Cheung Kwai Estate	Residential	DP
N3	No. 1A Pak She Second Lane	Residential	DP
N4	3A Golden Lake Garden	Residential	Non-DP
N5	No.24 Tai Hing Tai Road	Residential	Non-DP
N6	Cheng Chau Fisheries Joint Association Public School	Educational	Non-DP
N7	No. 34 Praya Street	Residential	Non-DP
N8	No.41A Peak Road	Residential	Non-DP
N9	Block G-H Fu Yuen	Residential	Non-DP
N10	Caritas Ka Fai House	Residential	Non-DP

Note: (1) DP refers to the works of upgrading of Cheung Chau STW and Pak She SPS; Non-DP refers to the works of sewers works

- 3.4.2 When alternative monitoring locations are proposed, the monitoring locations shall be chosen based on the following criteria:
  - (i) The locations shall be close to the site activities which are likely to have significant noise impacts;
  - (ii) The locations shall be close to the noise sensitive receivers (NSRs) (NB. For the purpose of this section, any domestic premises, hotel, hostel, temporary housing accommodation, hospital, medical clinic, educational institution, place of public worship, library, court of law, performing art centre shall be considered as NSR); and



- (iii) Care shall be taken to cause minimal disturbance to the occupants of sensitive receivers.
- 3.4.3 The monitoring location shall normally be at a position from the exterior of the sensitive receivers building façade and 1.2m above the ground. If there is a problem with access to the normal monitoring position, an alternative position may be chosen, and a correction to the measurement made. For reference, a correction of +3dB(A) shall be made to free field measurements. The ET Leader shall agree with the IEC on the monitoring position and the corrections adopted. Once the positions for the monitoring stations are chosen, the baseline and impact monitoring shall be carried out at the same position.

# 3.5 Baseline Noise Monitoring

- 3.5.1 To obtain fully satisfactory baseline results, weatherproof logging sound level meter shall be used. Continuous baseline noise for the A-weighted levels L<sub>eq</sub>, L<sub>10</sub> and L<sub>90</sub> shall be measured over a period of two consecutive weeks and sampling period of 5 minutes will be used throughout the monitoring. Average, by sound power, of six consecutive L<sub>eq (5 min)</sub> reading is used to provide L<sub>eq (30 min)</sub> for the non-restricted period and three consecutive L<sub>eq (5 min)</sub> reading is used to provide L<sub>eq (15 min)</sub> for the restricted period. The monitoring period shall be selected prior to the commencement of any construction activities and so as to avoid other typical noise sources. Measurements shall be recorded to the nearest 0.1 dB. Major noise sources observed, both on-site and off-site, at each location will be recorded. A schedule on the baseline monitoring shall be submitted to the IEC for approval before the monitoring.
- 3.5.2 In exceptional cases, when insufficient baseline monitoring data or questionable results are obtained, the ET Leader and Contractor shall liaise with the IEC to agree on an appropriate set of data to be used as a baseline reference and submit to the IEC for approval.

## 3.6 Impact Noise Monitoring

- 3.6.1 Noise monitoring shall be undertaken at all designated monitoring stations when there are construction works nearby. The following is an initial guide on the regular monitoring frequency for each station on a per week basis when construction activities are undertaken:
  - (i) one set of  $L_{eq\ (30\ min)}$  noise level as six consecutive  $L_{eq\ (5\ min)}$  between 07:00-19:00 hours on normal weekdays;
  - (ii) one set of  $L_{eq (15 min)}$  noise level as three consecutive  $L_{eq (5 min)}$  for the restricted hours
- 3.6.2 Major noise sources observed, both on-site and off-site, at each location shall be recorded.
- 3.6.3 Where the designated noise monitoring station is a school, noise monitoring shall be scheduled during the school examination period. The ET Leader shall liaise with the school's personnel and the Examination Authority to ascertain the exact dates and times of all examination periods during the course of the contract.
- 3.6.4 In the case of non-compliance with the construction noise criteria, more frequent monitoring as specified in the Event and Action Plan in **Table 3.3** shall be carried out. This additional monitoring shall be continued until the exceedance is rectified or proved to be from a source other than the construction activities.



### 3.7 Event and Action Plan

3.7.1 The Action and Limit levels for construction noise are shown in **Table 3.2**. All NSRs identified in the Project are classified with an Area Sensitivity Rating (ASR) A in accordance with the Technical Memorandum on Noise from Construction Work Other Than Percussive Piling. Should non-compliance of the noise criteria occurs, action in accordance with the Event / Action Plans in **Table 3.3** shall be carried out.

Table 3.2 Action and Limit Levels for Construction Noise

Time Period	Action	Limit
07:00-19:00 hours on normal weekdays;	When one or more documented complaints are received	75dB(A)*
07:00-23:00 hours on holidays; and 19:00-23:00 hours on all other days		45 <sup>(1)</sup> dB(A) 60 <sup>(2)</sup> dB(A)
23:00-07:00 hours of the next day		30 <sup>(1)</sup> dB(A) 45 <sup>(2)</sup> dB(A)

Note: • Between 07:00-19:00 hours, construction noise limit for school during normal term time is 70dB(A) and 65dB(A) during examination period.

ASR = "A" which is a rural area that are not affected by the IF.



<sup>(1) -</sup> As stipulated In the Technical Memorandum on Noise from Construction Work in Designated Areas.

<sup>(2) -</sup> As stipulated in the Technical Memorandum on Noise from Construction Work other than Percussive Piling

Table 3.3 Event / Action Plan for Construction Noise

Event	ET	IEC	ER	CONTRACTOR
Action Level	<ol> <li>Notify ER, IEC and Contractor;</li> <li>Carry out investigation;</li> <li>Report the results of investigation to the IEC, ER and Contractor;</li> <li>Discuss with the IEC and contractor and formulate remedial measures; and</li> <li>Increase monitoring frequency to check the effectiveness of mitigation measures.</li> </ol>	<ol> <li>Review the investigation results submitted by the ET;</li> <li>Review the proposed remedial measures by the Contractor and advise the ER accordingly; and</li> <li>Advise the ER on the effectiveness of the proposed remedial measures.</li> </ol>	<ol> <li>Confirm receipt of notification of failure in writing;</li> <li>Notify Contractor;</li> <li>In consolidation with the IEC, agree with the Contractor on the remedial measures to be implemented; and</li> <li>Supervise the implementation of remedial measures.</li> </ol>	Submit noise mitigation proposals to IEC and ER; and     Implement noise mitigation proposals.
Limit Level	<ol> <li>Notify IEC, ER, EPD &amp; Contractor;</li> <li>Identify source and investigate the cause of exceedance;</li> <li>Repeat measurement to confirm findings;</li> <li>Increase monitoring frequency;</li> <li>Carry out analysis of Contractor's working procedures to determine possible mitigation to be implemented;</li> <li>Discuss with the IEC, Contractor and ER on remedial measures required;</li> <li>Assess the effectiveness of Contractor's remedial actions and keep IEC, EPD and ER informed of the results; and</li> <li>If exceedance stops, cease additional monitoring.</li> </ol>	Discuss amongst ER, ER and Contractor on the potential remedial actions; and     Review Contractor's remedial actions whenever necessary to assure their effectiveness and advise the ER accordingly.	Confirm receipt of notification of failure in writing;     Notify Contractor;     In consolidation with the EIC, agree with the Contractor on the remedial measures to be implemented;     Supervise the implementation of remedial measures; and     If exceedance continues, consider stopping the Contractor to continue working on that portion of work which causes the exceedance until the exceedance is abated.	Take immediate action to avoid further exceedance;     Submit proposals for remedial actions to IEC and ER within 3 working days of notification;     Implement the agreed proposals;     Submit further proposal if problem still not under control; and     Stop the relevant portion of works as determined by ER, until the exceedance is abated.



# 3.8 Mitigation Measures

3.8.1 The Contractor shall be responsible for the design and implementation of the measures recommended in **Appendix C**, **Table C2**.



#### 4. WATER QUALITY

#### 4.1 Introduction

- 4.1.1 Water quality impact arising from construction and operational activities would be minimised by implementing suitable mitigation measures and through good management practices. Water quality monitoring is recommended during the construction of upgrading of Cheung Chau STW and Pak She SPS (DP component) and sewers works (non-DP component) under the Project. While for the operation phase, water quality monitoring are recommended for the upgraded Cheung Chau STW (DP component).
- 4.1.2 Site audit shall be implemented to ensure that the mitigation measures recommended in the EIA Report are fully implemented during both construction and operational phases of the Project.

# 4.2 Water Quality Monitoring Equipment

### Dissolved Oxygen (DO) and Temperature Measuring Equipment

- 4.2.1 The instrument for DO and temperature measurement shall be a portable, weatherproof DO measuring instrument complete with cable, sensor, comprehensive operation manuals, and use a DC power source. It shall be capable of measuring:
  - a DO level in the range of 0 20 mg/L and 0 200% saturation; and
  - a temperature of 0 45 degree Celsius.
- 4.2.2 A membrane electrode with automatic temperature compensation shall be equipped with a cable. Sufficient stocks of spare electrodes and cables shall be available for replacement where necessary. (For example, YSI model 59 meter, YSI 5739 probe, YSI 5795A submersible stirrer with reel and cable or an approved similar instrument).
- 4.2.3 The salinity compensation shall not be built-in to the DO equipment. In-situ salinity shall be measured to calibrate the DO equipment prior to each DO measurement.

### **Turbidity Measurement Instrument**

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

# **Water Sampling Equipment**

- 4.2.5 A transparent PVC or glass cylinder, which has a volume of not less than 2 litres and can be sealed at both ends with cups, shall be used for collection of water samples at various depths. The water sampler shall be equipped with a positive latching system. During water sampling, a messenger is released to trigger the closure of the water sampler at designated water depths.
- 4.2.6 All in-situ monitoring equipments and instruments shall be checked, calibrated and certified by a laboratory accredited under HOKLAS or any other international accreditation scheme prior to filed application, and subsequently re-calibrated at 3 monthly intervals throughout all stages of the water quality monitoring. Responses of sensors and electrodes shall be checked with certified standard solutions before each use. Wet bulb calibration for a DO meter shall be carried out before



measurement at each monitoring location.

- 4.2.7 For the on-site calibration of field equipment, the BS 127:1993, Guide to Field and On-Site Test Methods for the Analysis of Water shall be observed.
- 4.2.8 Sufficient stocks of spare parts shall be maintained for replacement when needed. Backup monitoring equipment shall also be made available so that monitoring can proceed uninterruptedly even when some equipment is under maintenance, calibration, etc.

# **Water Depth Detector**

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

## **Salinity**

4.2.10 A portable salinometer capable of measuring salinity in the range of 0 – 40 parts per thousand (ppt) shall be provided for measuring salinity at each monitoring location.

#### pН

4.2.11 The instrument shall consist of a potentiometer, a glass electrode, a reference electrode and a temperature-compensating device. It shall be readable to pH 0.1 in a range of 0 to 14. Standard buffer solutions of at least pH 7 to pH 10 shall be used for calibration of the instrument before and after use. Details of the method shall comply with APHA, 19th ed. 4500-HTB.

### **Monitoring Positioning Equipment**

4.2.12 A hand-held or boat-fixed type digital Differential Global Positioning System (DGPS) with way point bearing indication or other equipment instrument of similar accuracy, shall be provided and used during marine water monitoring to ensure that the monitoring site is at the correct location before taking measurements.

# 4.3 Construction Phase Water Quality Monitoring

### **Construction Site Audit**

- 4.3.1 Regular site audit should be carried out to ensure that the recommended mitigation measures are properly implemented during the construction phase of upgrading of Cheung Chau STW and Pak She SPS (DP component) and sewers works (non-DP component) of the Project. It can also provide an effective control of any improper malpractices and therefore achieve continual improvement in environmental performance on site.
- 4.3.2 Site audit shall include site inspections and compliance audits.

### Site Inspection

- 4.3.3 Site inspection shall be carried out by the ET and attentions shall be paid to the mitigation measures recommended for water pollution control. In the event that the recommended mitigation measures are not fully or properly implemented, deficiencies shall be recorded and reported to the site management and suitable actions shall be taken, which may include:
  - Record the problems and investigate the cause;



- Issue action notes to the Contractor who is responsible for the works;
- Implement remedial and corrective actions immediately;
- Re-inspect the site condition upon completion of the remedial and corrective actions; and
- Record the event and discuss with the Contractor for preventive actions.

### **Compliance Audit**

- 4.3.4 Compliance audits are to be undertaken to ensure that a valid discharge license issued by EPD is in place prior to any effluent discharge from construction activities of the Project site. If monitoring of the treated effluent quality from the Works Areas is required during the construction phase of the Project, the monitoring shall be carried out in accordance with the Water Pollution Control Ordinance license that is under the ambit of a regional EPD office.
- 4.3.5 The auditing results reflect whether the effluent quality is in compliance with the discharge license requirements. In case of non-compliance, suitable actions by the ET shall be undertaken to:
  - Notify the Contractor, IEC and ER on the non-compliance;
  - Identify the sources of pollution;
  - Check the implementation status of recommended mitigation measures;
  - Investigate the operating conditions of on-site treatment systems;
  - Implement corrective and remedial actions to improve the effluent quality;
  - Increase the monitoring frequency until the effluent quality is in compliance with the discharge licence requirements; and
  - Record the non-compliance events and propose preventive measures.

## 4.4 Operational Phase Water Quality Monitoring

### **Water Quality Parameters**

- 4.4.1 Marine water quality monitoring during the operational phase of the Project is to quantify the variability of pollutant concentrations in the marine waters. Measured pollutant concentrations are to be compared to the relevant Water Quality Objectives and to the baseline data to identify any significant impact on water quality from the operation of upgraded Cheung Chau STW (DP component).
- 4.4.2 DO, turbidity, suspended solids (SS), *E.coli*, and nitrogen levels shall be monitored at designated marine water quality stations during the operation phase. DO and turbidity shall be measured in-situ whereas SS, *E.coli* and nitrogen concentrations shall be determined by laboratory. In addition, other relevant parameters including temperature, pH and salinity shall also be measured.
- 4.4.3 The ambient level of total inorganic nitrogen (TIN) near the Cheung Chau Project area is generally high, and even exceeds the WQO of 0.1 mg/L for TIN. Monitoring of TIN concentration is therefore considered necessary.
- 4.4.4 A sample of data record sheet for marine water quality monitoring is shown in **Appendix B** for reference.

# **Laboratory Analysis**

4.4.5 Analysis of marine water and the STW effluent quality parameters as listed in **Table 4.1** shall be carried out in a HOKLAS or other internationally accredited



laboratory. The Cheung Chau STW operator should be in charge of the laboratory analysis. The analysis shall commence within 24 hours after the collection of water samples. Details on the testing method, pre-treatment procedure, instrument to use, Quality Assurance/Quality Control (QA/QC) protocol (such as blank, spike recovery, number of duplicate samples per batch, etc.), detection limit and accuracy shall be submitted to DSD and the IEC for agreement, prior to the commencement of monitoring programmes.

4.4.6 If in-house or non-standard methods are proposed, details on the method verification shall be required to submit to EPD. Under any circumstances, testing of water sample shall have comprehensive quality assurance and quality control protocols. The laboratory shall prepare to demonstrate the quality assurance protocols to EPD when requested.

 Table 4.1
 Analytical Methods and Detection Limits for Marine Water Samples

Parameters	Standard Method	Detection Limit
Suspended Solid (SS)	APHA 20ed.2540 D	0.5 mg /L
5-day Biochemical Oxygen Demand (BOD <sub>5</sub> )	APHA 18ed. 5210B	0.1 mg /L
Ammonia Nitrogen (NH <sub>3</sub> -N)	ASTM D3590-89 B (FIA)	0.005 mg /L
Unionised Ammonia (NH <sub>4</sub> -N)	By Calculation	0.001 mg/L
Total Kjeldahl Nitrogen (TKN)	ASTM D3590-89 B (FIA) and APHA 20ed 4500-N A&D (FIA)	0.05 mg/L
Total Inorganic Nitrogen (TIN)	By Calculation	0.01 mg/L
Nitrite-nitrogen (NO <sub>2</sub> )	APHA 20ed. 4500-NO2- B (FIA)	0.002 mg/L
Nitrate-nitrogen (NO <sub>3</sub> )	APHA 20ed. 4500-NO3- F & I (FIA)	0.002 mg/L
Orthophosphorus (PO <sub>4</sub> )	ASTM D515-88 A (FIA)	0.002 mg/L
Total Phosphorus (TP)	ASTM D515-88 B (FIA) and APHA 20ed 4500-P G (FIA)	0.02 mg/L
E.coli	membrane filtration with CHROMagar Liquid E. coli – coliform culture (1)	1 cfu/100mL

#### Note:

(a) DoE, DHSS & PHLS (1983); The Bacteriological Examination of Drinking Water Supplies 1982, Sec.7.8 & 7.9; and (b) B.S.W. Ho and T.Y. Tam (1997), Enumeration of E. coli in environmental waters and wastewater using a chromogenic medium. Wat. Sci. Tech.Vol.35, No.11-12, pp.409-413; method adopted in 1997.

### **Monitoring Locations**

4.4.7 A total of six stations (W1, W2, W3, W4, W5 and W6) were proposed for marine water quality monitoring as shown in **Figure 4.1**. One station (W1) is located near the Project area; one (W2) is in Cheung Chau Wan; one (W3) is at Tung Wan; one (W4) is at Kun Yam Wan; one (W5) is at Tai Kwai Wan; and the other one (W6) is at Chi Ma Wan. Co-ordinates of the six monitoring stations are listed in **Table 4.2** 



Locations	Station	Easting	Northing
Cheung Chau STW	W1	820151.20	808236.90
Cheung Chau Wan	W2	820579.40	807761.65
Tung Wan	W3	821221.73	808130.84
Kwun Yam Wan	W4	821469.22	807804.01
Tai Kwai Wan	W5	820493.00	808822.31
Chi Ma Wan	W6	817649.00	811487.00

**Table 4.2 Marine Water Monitoring Locations** 

4.4.8 Water sampling shall be taken at three water depths, namely, 1m below the water surface, mid-depth and 1m above the seabed if water depth is 6m or more. If water depth is 4m to 5m, the mid-depth station may be skipped. If the water depth is less than 3m, sampling can only be taken at the surface.

# **Baseline Water Quality Monitoring**

- 4.4.9 Baseline water quality shall be established and agreed with EPD prior to the commencement of Project works. The purpose of the baseline monitoring is to establish a baseline ambient condition prior to the commencement of the Project and to demonstrate the suitability of the proposed water quality monitoring stations. The baseline condition shall be established by measuring the concentrations of selected water quality parameters at the proposed marine water quality monitoring stations shown in **Figure 4.1**. The sampling for baseline monitoring shall avoid peak hours of the existing flow discharge if the current STW is in operation during the time of baseline monitoring.
- 4.4.10 The baseline measurements shall be taken at all the monitoring stations prior to the operation of the upgraded Cheung Chau STW. There shall not be any marine construction activities in the vicinity of the stations during the baseline monitoring. A six-month baseline monitoring programme covering both dry and wet seasons is proposed at a frequency of twice per month to establish the baseline water quality condition. The measurements should be taken at all designated monitoring stations at least 2 times per month at mid-flood and mid-ebb tides, respectively during each survey.
- 4.4.11 A certain number of duplicate water samples shall be collected for each independent sampling event to ensure a robust, statistically interpretable database. Other relevant information such as monitoring location, sampling time, sampling depth, tidal stages, and weather conditions should also be recorded.
- 4.4.12 In case that insufficient baseline monitoring data or questionable results are obtained, the ET shall seek approval from EPD for an appropriate set of data to be used as baseline reference.

## **Operational Phase Marine Water Monitoring**

4.4.13 A Post-Project Monitoring (PPM) programme is recommended to confirm the water quality predictions presented in the EIA report. It is suggested to start the marine water quality monitoring for the operational phase three months after the commissioning of Cheung Chau STW.



- 4.4.14 Marine water samples and in-situ measurements shall be taken at a frequency of twice per month at mid-flood and mid-ebb tides, respectively to determine whether there is any deterioration in water quality compared to the baseline monitoring.
- 4.4.15 The monitoring programme can be discontinued after one year (12 months) of monitoring if there is no obvious deterioration in water quality.

## **Operational Phase STW Effluent Quality Monitoring**

- 4.4.16 To ensure the effectiveness of the proposed wastewater treatment process, monitoring of the STW effluent quality is recommended for water quality parameters including pH, BOD, SS, TIN, NH3-N and *E. coli.* Monitoring of residual chlorine, cadmium, copper, nickel, lead, mercury, chromium, zinc, PCBs and PAHs shall also be included.
- 4.4.17 A valid discharge licence shall be obtained from EPD prior to the effluent discharge from the upgraded STW. The monitoring frequency and parameters specified in the discharge licence shall be fully complied during the monitoring. The ET shall seek approval from EPD on all the monitoring requirements. The effluent results reflect whether the effluent quality is in compliance with the discharge licence requirements. In case of non-compliance, suitable actions shall be undertaken to notify the plant operator for the non-compliance and identify the cause for the non-compliance. Corrective and remedial actions shall be implemented to improve the effluent quality. The monitoring frequency should also be increased until the effluent quality is in compliance with the discharge licence requirements. The non-compliance events and preventive measures shall be documented.
- 4.4.18 In case of an emergency discharge, daily marine water monitoring should be conducted throughout the discharge period until the normal STW operation is resumed and the quality of receiving marine water resumes to its normal level.

#### 4.5 Event and Action Plan

- 4.5.1 Marine water quality thresholds for actions are shown in **Table 4.3**. These thresholds should be applied to ensure that any water quality deterioration can be readily detected.
- 4.5.2 In the event that the monitoring results of water quality parameters at designated monitoring stations exceed the water quality thresholds, appropriate actions in accordance with the Event and Action Plan in **Table 4.4** shall be carried out.

## 4.6 Mitigation Measures

4.6.1 Mitigation measures for water quality were recommended in the EIA Report and are listed in the implementation schedule given in **Appendix C, Table C3**.



## **Table 4.3 Thresholds for Marine Water Quality Parameters**

Parameters	Action Threshold	Limit Threshold
DO in mg/ L (Surface, Middle & Bottom)	Surface & Middle : 5 percentile of baseline data for surface and middle layer  Bottom: 5 percentile of baseline data for bottom layer.	Surface & Middle: 4 mg/L or 1 percentile of baseline data for surface and middle layer.  Bottom: 2 mg/L or 1 percentile of baseline data for bottom layer.
SS in mg/ L (depth-averaged)	95 percentile of baseline data or 120% of upstream control station's SS at the same tide of the same day.	99 percentile of baseline data or 130% of upstream control station's SS at the same tide of the same day.
Unionised Ammonia in mg /L (depth-averaged)	95 percentile of baseline data.	99 percentile of baseline data or 0.021 mg /L.
E.coli (depth- averaged)	95 percentile of baseline data.	<ul> <li>(i) 99 percentile of baseline or 610 cfu/100mL as geometric mean for secondary contact, recreation subzones and fish culture zones.</li> <li>(ii) 99 percentile of baseline or 180 cfu/100mL as geometric mean for bathing beach subzones.</li> </ul>
Turbidity in NTU (depth-averaged)	95 percentile of baseline data or 120% of upstream control station's turbidity at the same tide of the same day.	99 percentile of baseline or 130% of upstream control station's turbidity at the same tide of the same day.
TIN in mg/ L (depth- averaged)	95 percentile of baseline data.	99 percentile of baseline data.

Notes: 1. "Depth-averaged" value is calculated by taking the arithmetic means of reading of all three depths.

- 2. For DO, non-compliance of the water quality limits occurs when monitoring result is lower than the threshold.
- 3. For turbidity, SS and TIN, non-compliance occurs when monitoring result is higher than the threshold.
- 4. All the figures given in the table are used for reference only and could be amended by EPD.



Table 4.4 Event and Action Plan for Protection of Marine Water Quality

Frant		Actions to be T	aken	
Event	ET Leader	IEC	ER	Contractor
Action threshold exceeded by one sampling day	Repeat in-situ measurement on next day of exceedance to confirm findings;     Identify source(s) of impact;     Inform IEC, Contractor and ER; and     Check monitoring data, all plant, equipment and Contractor's working methods.	Check monitoring data submitted by ET and Contractor's working methods.	Confirm receipt     of notification of     noncompliance in     writing; and     Notify Contractor.	Inform the ER and confirm notification of the noncompliance in writing;     Rectify unacceptable practice; and     Amend working methods if appropriate.
Action threshold exceeded by two or more consecutive sampling days	<ol> <li>Repeat measurement on next day of exceedance to confirm findings;</li> <li>Identify source(s) of impact;</li> <li>Inform IEC, Contractor, ER, EPD, and AFCD;</li> <li>Check monitoring data, all plant, equipment and Contractor's working methods;</li> <li>Discuss mitigation measures with IEC, ER and Contractor;</li> <li>Ensure mitigation measures are implemented; and</li> <li>Increase the monitoring frequency to daily until no exceedance of Action level.</li> </ol>	1. Check monitoring data submitted by ET and Contractor's working method; 2. Discuss with ET and Contractor on possible remedial actions; 3. Review the proposed mitigation measures submitted by Contractor and advise the ER accordingly; and 4. Supervise the implementation of mitigation measures.	Discuss with IEC on the proposed mitigation measures;     Ensure mitigation measures are properly implemented; and     Assess the effectiveness of the implemented mitigation measures.	1. Inform the Engineer and confirm notification of the noncompliance in writing; 2. Rectify unacceptable practice; 3. Check all plant and equipment and consider changes of working methods; 4. Submit proposal of additional mitigation measures to ER within 3 working days of notification and discuss with ET, IEC and ER; and 5. Implement the agreed mitigation measures.
Limit threshold exceeded by one sampling day	Repeat measurement on next day of exceedance to confirm findings;     Identify source(s) of impact;     Inform IEC, Contractor, ER, EPD, and AFCD;     Check monitoring data, all plant, equipment and Contractor's working methods; and     Discuss mitigation measures with IEC, ER and Contractor.	1. Check monitoring data submitted by ET and Contractor's working method; 2. Discuss with ET and Contractor on possible remedial actions; and 3. Review the proposed mitigation measures submitted by Contractor and advise the ER accordingly.	1. Confirm receipt of notification of failure in writing; 2. Discuss with IEC, ET and Contractor on the proposed mitigation measures; and 3. Request Contractor to review the working methods.	1. Inform the ER and confirm notification of the noncompliance in writing; 2. Rectify unacceptable practice; 3. Check all plant and equipment and consider changes of working methods; and 4. Submit proposal of mitigation measures to ER within 3 working days of notification and discuss with ET, IEC and ER.



Event	Actions to be Taken							
Event	ET Leader	IEC	ER	Contractor				
Limit threshold exceeded by two or more consecutive sampling days	<ol> <li>Repeat measurement on next day of exceedance to confirm findings;</li> <li>Identify source(s) of impact;</li> <li>Inform IEC, Contractor, ER, EPD, AFCD;</li> <li>Check monitoring data, all plant, equipment and Contractor's working methods;</li> <li>Discuss mitigation measures with IEC, ER and Contractor;</li> <li>Ensure mitigation measures are implemented; and</li> <li>Increase the monitoring frequency to daily until no exceedance of Limit level for two consecutive days.</li> </ol>	1. Check monitoring data submitted by ET and Contractor's working method; 2. Discuss with ET and Contractor on possible remedial actions; 3. Review the Contractor's mitigation measures whenever necessary to assure their effectiveness and advise the ER accordingly; and 4. Supervise the implementation of mitigation measures.	1. Discuss with IEC, ET and Contractor on the proposed mitigation measures;  2. Request Contractor to critically review the working methods;  3. Make agreement on the mitigation measures to be implemented;  4. Ensure mitigation measures are properly implemented; and  5. Consider and instruct, if necessary, the Contractor to slow down or to stop all or part of the construction activities until no exceedance of Limit level.	1. Take immediate action to avoid further exceedance; 2. Submit proposal of mitigation measures to ER within 3 working days of notification and discuss with ET, IEC and ER; 3. Implement the agreed mitigation measures; 4. Resubmit proposals of mitigation measures if problem still not under control; and 5. As directed by the Engineer, to slow down or to stop all or part of the construction activities until no exceedance of Limit level.				



#### 5. WASTE MANAGEMENT

#### 5.1 Introduction

- 5.1.1 Based on the waste management implication assessed in the EIA Report, it has been identified that some construction wastes (including inert and non-inert wastes), chemical waste and general refuse will be generated from the construction activities. Construction and demolition (C&D) waste will be fully reused on site as far as practicable. EM&A requirements are recommended during the construction phase of upgrading of Cheung Chau STW and Pak She SPS (DP component) and sewers works (non-DP component) under the Project.
- 5.1.2 Through proper on-site handling and storage (covered containers), reuse (of inert construction wastes) and off-site disposal (via approved waste collectors to approved waste facilities and/or disposal grounds), the generation, handling and disposal of these wastes are not expected to give rise to any adverse environmental impacts. The ET shall check the Contractor's implementation of waste management practices during the regular site environmental audits to ensure wastes are being managed properly.

## 5.2 Construction Phase EM&A Requirements

#### Site Audit / Inspection

5.2.1 Site inspections and supervisions of waste management procedures and auditing of the effectiveness of implemented mitigation measures shall be undertaken by the ET on a regular basis (e.g. weekly as a minimum). These tasks shall be scheduled in the Waste Management Plan (WMP) to be prepared by the Contractor, and the site audits summary shall be presented in the EM&A reports.

#### **Waste Management Practices**

- 5.2.2 An on-site environmental co-ordinator shall be employed by the Contractor. Prior to commencement of Project works, the co-ordinator shall prepare a WMP in accordance with the requirements set out in the ETWB TCW No. 19/2005, Waste Management on Construction Sites, for the ER's approval. The WMP shall include monthly and yearly Waste Flow Tables (WFT) that indicate the amounts of waste generated, recycled and disposed of (including final disposal site), and which shall be regularly updated.
- 5.2.3 The overall principles of construction waste management are to reduce waste generation and to reuse and recycle construction waste. The arrangement for avoidance, reuse, recovery and recycling, storage, collection, treatment and disposal of different categories of waste to be generated from the construction activities and the recommended mitigation measures are to be described in a WMP.
- 5.2.4 The WMP will indicate the disposal location(s) of all surplus excavated materials and wastes. A trip ticket system in accordance with Development Bureau Technical Circular (Works) (TC(W)) No. 6/2010, Trip Ticket System for Disposal of Construction & Demolition Materials shall be included in the WMP. Surplus excavated materials and wastes shall only be disposed of at designated disposal locations unless otherwise approved by the Director. All measures recommended in the WMP shall be fully and properly implemented by the Contractor throughout the construction period.



#### **Mitigation Measures**

- 5.2.5 The implementation status of the following mitigation measures shall be monitored through the site audit programme by the ET:
  - To minimize the production of construction waste through careful design, planning, good site management, and control of ordering procedures, segregation and reuse of materials; To arrange for private contractors to collect used formwork materials for reuse;
  - To dispose of any chemical wastes such as lubricating oil or solvent in strict accordance with the Waste Disposal (Chemical Waste) (General) Regulation. Only licensed chemical waste collectors shall be employed to collect any chemical waste generated at site. The handling, storage, transportation and disposal of chemical wastes shall be conducted in accordance with the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes and A Guide to the Chemical Waste Control Scheme both published by EPD;
  - All chemical toilets, if any, shall be regularly cleaned and the night-soil collected and transported by a licensed contractor to a Government Sewage Treatment Works facility for disposal;
  - To assign a reliable waste collector to collect general refuse generated from the construction site on a daily basis to minimise the potential odour, pest and litter impacts;
  - To identify requirements on proper waste management for implementation during the operation of the project; and
  - Toolbox talks shall be provided to workers about the concepts of site cleanliness and appropriate waste management procedures, including waste reduction, reuse and recycling.
- 5.2.6 **Appendix C, Table C4** shows the implementation schedule of the mitigation measures for waste management.

#### **Good Site Practices**

- 5.2.7 In order to check that the waste control and mitigation measures have been implemented by the Contractor as good site practices, the following shall be included as part of the site inspections and audits:
  - The reuse/recycling of all materials on site shall be investigated prior to treatment/disposal off site;
  - Good site practices shall be adopted from the commencement of works to avoid the generation of waste, reduce cross contamination of waste and to promote waste minimisation practices;
  - All waste materials shall preferably be sorted on-site into inert and non-inert construction wastes, and where the materials will be recycled or reused these shall be further segregated. Inert material, or public fill will comprise stone, rock, masonry, brick, concrete and soil which is suitable for land reclamation and site formation whilst non-inert materials include all other wastes generated from the construction process such as plastic packaging and vegetation (from site clearance);
  - The Contractor shall be responsible for identifying what materials can be recycled/ reused, whether on-site or off-site. In the event of the latter, the Contractor shall make arrangements for the collection of the recyclable materials. Any remaining non-inert waste shall be collected and disposed of to the Public Filling Areas whilst any inert C&D materials shall be re-used on site as far as possible. Alternatively, if no use of the inert material can be



found on-site, the materials can be delivered to a Public Fill Area or Public Fill Bank after obtaining the appropriate licence;

- In order to monitor the disposal of C&D material and solid wastes at public filling facilities and landfills, and control fly-tipping, a trip-ticket system shall be implemented by the Contractor, in accordance with the contract and the requirements of Development Bureau Technical Circular (Works) (TC(W)) No. 6/2010, Trip Ticket System for Disposal of Construction & Demolition Materials;
- Under the Waste Disposal (Chemical Waste) (General) Regulation, the Contractor shall register with EPD as a Chemical Waste Producer if there is any use of chemicals on site including lubricants, paints, diesel fuel, etc. Only licensed chemical waste collectors shall be employed to collect any chemical waste generated at site. The handling, storage, transportation and disposal of chemical wastes shall be conducted in accordance with the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes and A Guide to the Chemical Waste Control Scheme both published by EPD;
- A sufficient number of covered bins shall be provided on site for the
  containment of general refuse to prevent visual impacts and nuisance to the
  sensitive surroundings. These bins shall be cleared daily and the collected
  waste disposed of to the refuse transfer station. Further to the issue of ETWB
  TCW No. 6/2002A, Enhanced Specification for Site Cleanliness and Tidiness,
  the Contractor is required to maintain a clean and hygienic site throughout
  the project works;
- All chemical toilets, if any, shall be regularly cleaned and the night-soil collected and transported by a licensed contractor to a Government Sewage Treatment Works facility for disposal; and
- The Contractor shall comply with all relevant statutory requirements and guidelines and their updated versions that may be issued during the course of project construction.

#### 5.3 Operational Phase EM&A Requirements

5.3.1 Given the nature of use of the Project, there is no EM&A requirement considered necessary during the operational phase. However, the Operator of the Cheung Chau STW and Pak She SPS shall ensure the general refuse to be disposed of at landfill site regularly by a reputable waste collector to reduce pest, odour and litter impacts.



#### 6. CULTURAL HERITAGE

#### 6.1 Introduction

- 6.1.1 Protective measures have been recommended in the EIA Report for the preservation and conservation of the potentially affected archaeological and built heritage sites from the proposed sewers works (non-DP component) under the Project.
- 6.1.2 Desk based research highlighted the potential for archaeology within the study areas on Cheung Chau. The majority of these areas are currently inaccessible as they are covered by paths and thus a programme of archaeological watching brief was recommended to be implemented during the construction phase. A methodology and scope have been recommended but will have to be confirmed with AMO prior to implementation.
- 6.1.3 In addition, the Contractor shall report to the ER, the Project Proponent and the AMO immediately if any discoveries of the antiquities or supposed antiquities occur during the course of the construction works.
- 6.1.4 The Built Heritage Impact Assessment has also identified a number of resources, in addition to the Cheung Chau Rock Carving, which require protective measures during the construction stage. The aim of these measures is to ensure that the heritage resource, buildings and structures are not damaged by the construction works. The measures will also ensure that the public will have safe access to cultural resource, buildings and structures, such as shrines, temples and graves during the construction phase.
- 6.1.5 No EM&A requirement is considered necessary during the construction and operational phase of upgrading of Cheung Chau STW and Pak She SPS (DP component).

#### 6.2 Construction Phase Protective Measures

### **Archaeology**

6.2.1 An Archaeological Watching Brief and protective measures for the Cheung Chau Rock Carving are required as part of the EM&A requirement to be implemented during the construction phase. During the Watching Brief, archaeological deposits and/or features, if appropriate, will be identified and recorded within the areas of archaeological interest highlighted in the EIA. **Table 6.1** includes the areas and the type of mitigation works required:



Table 6.1 Proposed Further Archaeological Works during Construction Phase

Areas of Impact	Archaeological Potential	Type of Archaeological Investigation / Protection	Scope
Tai San Street , Tai San Back Street, Chung Hing Street and Chung Hing Back Street	High archaeological potential	Archaeological Watching Brief (within boundary of Tung Wan Site of Archaeological Interest)	Archaeological Watching Brief area covers all marked alignments within Figures 6.6, 6.8, 6.9, 6.10.
			100% monitoring is required for the proposed sewer at Chung Hing Street (Figure 6.6) due to its known high archaeological potential.
			100% monitoring is proposed for the proposed sewer near the Cheung Chau Fisheries Joint Association Public School (Figure 6.8).
	Moderate archaeological potential		Due to the moderate archaeological potential which is based on previous findings and level of existing impacts, one visit per four sections monitoring frequency is proposed (Figures 6.6, 6.8, 6.9, 6.10).
Cheung Chau Rock Carving	Declared Monument	Archaeological Watching Brief	Archaeological Watching Brief area is marked on Figure 6.11.
			Due to its proximity to a Declared Monument, one visit per four sections monitoring frequency is proposed (Figure 6.11).
Cheung Chau Rock Carving	Declared Monument	Protective measures	A buffer zone including the rock carving and its immediate environs and Hak Pai Road and the nearby open space (see Figure 6.11). Within the buffer zone, construction works as well as storage of construction materials are not allowed. Erection of temporary fencing/barriers to demarcate the buffer zone is not required. The rock carving should be maintained and directional signage should be erected or installed at appropriate location(s) near the rock carving to facilitate visitors to access the rock carving during the construction phase. It has to be noted however that the access to the rock carving will not be blocked as the works area does not encroach upon the access or immediate environs of the rock carving. The directional signage can only be erected on the fencing at the edge of construction works area which is locate more than 10m from the entrance to the rock carving.
Tung Wan Road	Moderate to high archaeological potential	Archaeological Watching Brief of the manhole excavations	Archaeological Watching Brief area at Manhole nos. 24-28 is marked on Figure 6.8.
			Despite the moderate potential of the area a 100% monitoring of the manholes until sterile soils are reached is recommended. The manhole areas are relatively small and will be excavated by hand.



- 6.2.2 Each monitoring visit should nominally be of a day's duration and would typically involve observation, finds collection and recording as specified in **Appendix D**.
- 6.2.3 The archaeological watching brief must be undertaken by a qualified archaeologist who shall apply for and obtain a licence to conduct the watching brief for the project (as required under section 12 of the Antiquities and Monuments Ordinance Cap.53). It should be noted that processing of the licence application may take up to 8 weeks after submission. Final details of the scope and methodology including monitoring frequency will be submitted to the AMO for review and approval as part of the submission of the licence application.
- 6.2.4 For the declared monument Cheung Chau Rock Carving, mitigation in the form of a buffer zone is required to ensure that the Declared Monument and its environs are not infringed upon during the construction works. In order to better protect the Rock Carving and its environs the buffer zone will include Hak Pai Road and the nearby open space. Within the buffer zone, construction works as well as storage of construction materials are not allowed. Erection of temporary fencing/barriers to demarcate the buffer zone is not required.
- 6.2.5 In addition, access to the rock carving should be maintained and directional signage should be erected or installed at appropriate location(s) near the rock carving to facilitate visitors to access the rock carving during the construction phase.
- 6.2.6 In addition, periodic monitoring of the declared monument is recommended. It is recommended to conduct inspection of the site every 3 months during the construction phase. Inspection record supplemented with the site photos showing the condition of the overall declared monument should be submitted to AMO for record purposes.
- 6.2.7 Finally, an archaeological watching brief programme is proposed for the area at the foot of the rock carving to assess potential deposits associated with the rock carving.

#### **Built Heritage**

6.2.8 The mitigation recommendations as listed in **Table 6.2** and **6.3** will be presented for Built Heritage Resources as shown in **Figures 6.16 – 6.30**. The description below will provide the detailed requirements for each of the mitigation actions and will be abbreviated in the tables by the letters shown in brackets.

#### **Condition Survey**

- 6.2.9 A condition survey must be carried out by qualified building surveyor or engineer in advance of works for Graded Historic Buildings and structures and Nil Grade heritage structures that may be affected by ground borne vibration. The Condition Survey Report should contain descriptions of the structure, identification of fragile elements, an appraisal of the condition and working methods for any proposed monitoring and precautionary measures that are recommended.
- 6.2.10 The condition survey report for Graded Historic Buildings must be submitted to AMO before construction activities commence. The contractor must implement the approved monitoring and precautionary measures.

#### Vibration Monitoring

6.2.11 Vibration monitoring should be undertaken during the construction works to ensure that safe levels of vibration are not exceeded. A maximum level of 5mm/s for Grade 1, 7.5mm/s for Grades 2 and 3 Historic Buildings and 15 mm/s for Nil Grade heritage structures should be adopted. It should be noted that the condition survey report should highlight if the limit should be lowered after the detailed study of the condition



of the building. A monitoring schedule should be included in the condition survey report. The location of proposed monitoring point on the building should avoid damaging the historic fabric and approved by the owner.

#### Provision of Buffer Zones (BZ)

6.2.12 A buffer zone should be provided to separate the building from the construction works. The buffer zone should be clearly marked out by temporary fencing. The buffer zone should be at least 1 metre unless site restrictions make this unfeasible. In this case the buffer zone should be made as large as the site restrictions allow.

#### Provision of Protective Covering (PC)

6.2.13 Protective covering in the form of plastic sheeting placed on a movable fence should be provided for external walls and surfaces of historical buildings and structures in close proximity to works areas, i.e. areas where a buffer zone alone cannot provide protection from equipment and works activities.

#### Safe Public Access (SPA)

6.2.14 Any proposed works in close proximity to buildings or structures used by the public for religious, ritual or funerary purposes, such as shrines, ancestral halls, temples and graves have the potential to create an unsafe environment for members of the public. The contractor must ensure that safe public access, through provision of clearly marked paths separated from the construction works areas is provided for any such affected cultural heritage structure.

Table 6.2 Mitigation Recommendations for Graded Historical Buildings in Cheung Chau

Recorded Resource	Grade	Cat Ref	Mitigation <sup>(1)</sup>
Yuk Hui Temple	1	(CC14)	No mitigation required.
Cheung Chau Police Station	2	(CC37)	No mitigation required
No. 91 Lai Chi Yuen	2	(CC38A)	The Alert, Alarm and Action (AAA) vibration limit will be set at 5/6/7.5 mm/s. (CS, VM)
No. 92 Lai Chi Yuen	2	(CC38B)	The Alert, Alarm and Action (AAA) vibration limit will be set at 5/6/7.5 mm/s. (CS, VM)
No. 93 Lai Chi Yuen	2	(CC38C)	The Alert, Alarm and Action (AAA) vibration limit will be set at 5/6/7.5 mm/s. (CS, VM)
Hung Shing Temple	2	(CC29)	The Alert, Alarm and Action (AAA) vibration limit will be set at 5/6/7.5 mm/s. (CS, VM)
No. 18 Tai San Street	2	(CC32)	The Alert, Alarm and Action (AAA) vibration limit will be set at 5/6/7.5 mm/s.
			Any damage to exterior walls will be repaired with finishes which match with the existing finish. If matching material is not readily available, the closest possible substitute will be sourced by the contractor and AMO will be contacted for comment on the material. (CS, VM, BZ, PC)



Recorded Resource	Grade	Cat Ref	Mitigation <sup>(1)</sup>
Cheung Chau Government Secondary School, Caretakers Residence	2	(CC36)	The Alert, Alarm and Action (AAA) vibration limit will be set at 5/6/7.5 mm/s. (CS, VM)
Cheung Chau Government Secondary School, Old Block	2	(CC35)	No mitigation required
Tin Hau Temple, Chung Hing Street	2	(CC20)	The Alert, Alarm and Action (AAA) vibration limit will be set at 5/6/7.5 mm/s. (CS, VM)
Tin Hau Temple, Pak She Tsuen	2	(CC13)	The Alert, Alarm and Action (AAA) vibration limit will be set at 5/6/7.5 mm/s.
			Any damage to exterior walls will be repaired with finishes which match with the existing finish. If matching material is not readily available, the closest possible substitute will be sourced by the contractor and AMO will be contacted for comment on the material. (CS, VM, BZ, PC, SPA)
Cheung Chau Fong Pin Hospital	3	(CC30)	The Alert, Alarm and Action (AAA) vibration limit will be set at 5/6/7.5 mm/s. (CS, VM)
St. John Hospital	3	(CC51)	The Alert, Alarm and Action (AAA) vibration limit will be set at 5/6/7.5 mm/s. (CS, VM)
No. 233 Tai San Back Street	3	(CC39A)	The Alert, Alarm and Action (AAA) vibration limit will be set at 5/6/7.5 mm/s. (CS, VM)
No. 234 Tai San Back Street	3	(CC39B)	The Alert, Alarm and Action (AAA) vibration limit will be set at 5/6/7.5 mm/s. (CS, VM)
No. 242 Tai San Back Street	3	(CC39C)	No mitigation required.
Gate and Enclosing Walls of Nos. 233, 234 and 242 Tai San Back Street	3	(CC40)	The Alert, Alarm and Action (AAA) vibration limit will be set at 5/6/7.5 mm/s. (CS/VM)
Cheung Chau Theatre	3	(CC45)	No Mitigation required

Note: (1)
CS – Condition Survey
VM – Vibration Monitoring
BZ – Buffer Zone
PC – Provision of Protective Covering
SPA – Safe Public Access

**Table 6.3 Mitigation Recommendations for Non-Graded Historical Structures** in Cheung Chau

Recorded Resource	Туре	Cat Ref	Mitigation Recommendations (1)
Shrine beside Pak Kok Tsuen Road	Shrine	CC01	No mitigation required.
Grave near No. 21 Tai Kwai Wan San Tsuen	Grave	CC02	The vibration limit will be set at 15 mm/s. (CS, VM)
Grave beside No. 5A Tai Kwai San Tsuen	Grave	CC03	The vibration limit will be set at 15 mm/s. (CS, VM, BZ, PC, SPA)



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Recorded Resource	Туре	Cat Ref	Mitigation Recommendations (1)
Cheung Chau Christian Cemetery	Cemetery	CC04	No mitigation required.
Grave behind No. 108 Pak She San Tsuen	Grave	CC05	No mitigation required.
No. 107 Pak She San Tsuen	VH	CC06	The vibration limit will be set at 15 mm/s. (CS, VM, BZ, PC)
No. 103 Pak She San Tsuen	VH	CC07	The vibration limit will be set at 15 mm/s. (CS, VM, BZ, PC)
No. 57 Pak She San Tsuen	VH	CC08	The vibration limit will be set at 15 mm/s. (CS, VM, BZ, PC)
No. 56 Pak She San Tsuen	VH	CC09	The vibration limit will be set at 15 mm/s. (CS, VM, BZ, PC)
No. 48 Pak She San Tsuen	VH	CC10	The vibration limit will be set at 15 mm/s. (CS, VM, BZ, PC)
No. 30 Pak She San Tsuen	VH	CC11	The vibration limit will be set at 15 mm/s. (CS, VM, BZ, PC)
No. 24 Pak She San Tsuen	VH	CC12	The vibration limit will be set at 15 mm/s. (CS, VM, BZ, PC)
Shrine south of No.1, Block A, Round Table 2nd Village	Shrine	CC15	The vibration limit will be set at 15 mm/s. (CS, VM)
Shrine north of Block J of Tung Koon San Tsuen	Shrine	CC16	The vibration limit will be set at 15 mm/s. (CS, VM)
Shrine southwest of No.39 Lutheran Village	Shrine	CC17	The vibration limit will be set at 15 mm/s. (CS, VM, BZ, PC, SPA)
Grave south of Lutheran Village	Grave	CC18	The vibration limit will be set at 15 mm/s. (CS, VM)
Boundary stone next to a footpath at the end of the uphill stairs south of Golden Lake Garden	Boundary Stone	CC19	The vibration limit will be set at 15 mm/s. (CS, VM, BZ, PC)
Grave west of No.139B Middle Hill Road	Grave	CC21	The vibration limit will be set at 15 mm/s. (CS, VM)
Well south of No.5B Tai Shek Hau	Well	CC22	No mitigation required.
No.30A Ko Shan Tsuen	VH	CC23	The vibration limit will be set at 15 mm/s. (CS, VM, BZ, PC)
No.73B Chung Hing Back Street	VH	CC24	The vibration limit will be set at 15 mm/s. (CS, VM)
No.78 Chung Hing Back Street	VH	CC25	The vibration limit will be set at 15 mm/s. (CS, VM)
Fuk Tak Koon (near No.101 Chung Hing Back Street)	Shrine	CC26	The vibration limit will be set at 15 mm/s. (CS, VM)
No.94 Chung Hing Back Street	VH	CC27	No mitigation required.
Shrine east of No.125 Chung Hing Back Street	Shrine	CC28	The vibration limit will be set at 15 mm/s. (CS, VM, BZ, PC SPA)
East Section of No.15 Tai San Back Street	VH	CC31	The vibration limit will be set at 15 mm/s. (CS, VM, BZ, PC)



Recorded Resource	Туре	Cat Ref	Mitigation Recommendations (1)
Gate of the Fong Pin Yuen Hospital east of No.111C Tai San Back	Arch	CC33	The vibration limit will be set at 15 mm/s. (CS, VM)
Wong Chung Ying Tong at No.31 Tai San Back Street	Ancestral Hall	CC34	The vibration limit will be set at 15 mm/s. (CS, VM)
Nos. 1, 2 and 3 Tung Wan Road	VH	CC41	The vibration limit will be set at 15 mm/s. (CS, VM, BZ, PC)
Shrine east of No.157 San Hing Back Street	Shrine	CC42	The vibration limit will be set at 15 mm/s. (CS, VM)
No.157 San Hing Back Street	VH	CC43	The vibration limit will be set at 15 mm/s. (CS, VM, BZ, PC)
Shrine west of No.81 Hok Loo Lane	Shrine	CC44	The vibration limit will be set at 15 mm/s. (CS, VM, BZ, PC,SPA)
Shrine near the Sitting-out Area of Afternoon Beach	Shrine	CC46	The vibration limit will be set at 15 mm/s. (CS, VM, BZ, PC,SPA)
Shrine west of Shui Yuek Temple	Shrine	CC47	The vibration limit will be set at 15 mm/s. (CS, VM)
Gate west of Shui Yuek Temple	Gate	CC48	The vibration limit will be set at 15 mm/s. (CS, VM)
Shrine west of Shui Yuek Temple	Shrine	CC49	The vibration limit will be set at 15 mm/s. (CS, VM)
Shui Yuet Temple at Kwun Yam Wan	Temple	CC50	The vibration limit will be set at 15 mm/s. (CS, VM)
Boundary Stone Near the east wall of St John Hospital	Boundary Stone	CC52	No mitigation required.
Grave northwest of Cheung Chau Sports Ground	Grave	CC53	The vibration limit will be set at 15 mm/s. (CS, VM, BZ, PC, SPA)
Pavilion South of No. 14A Fa Peng Road)	Pavilion	CC54	The vibration limit will be set at 15 mm/s. (CS, VM)
Shrine next to the gate of No.15 Fa Peng Road	Shrine	CC55	The vibration limit will be set at 15 mm/s. (CS, VM, BZ, PC, SPA)
Gwai Yuen Jing She Nunnery at No.15 Fa Peng Road	Nunnery	CC56	The vibration limit will be set at 15 mm/s. (CS, VM)
Tao Yuen, Main House and Annex Block at No. 14 Fa Peng Road	VH	CC57	The vibration limit will be set at 15 mm/s. (CS, VM)
Christian Zheng Sheng School at No.4 Fa Peng Road	School	CC58	The vibration limit will be set at 15 mm/s. (CS, VM)
No.26 Ko Shan Tsuen	VH	CC59	The vibration limit will be set at 15 mm/s. (CS, VM)
No.27 Ko Shan Tsuen	VH	CC60	The vibration limit will be set at 15 mm/s. (CS, VM, BZ, PC)
No.38 Ko Shan Tsuen	VH	CC61	The vibration limit will be set at 15 mm/s. (CS, VM, BZ, PC)



Recorded Resource	Туре	Cat Ref	Mitigation Recommendations (1)
East of No.2 Hi Shi Road	VH	CC62	The vibration limit will be set at 15 mm/s. (CS, VM)
No. 27 Lung Tsai Tsuen	VH	CC63	The vibration limit will be set at 15 mm/s. (CS, VM)
No. 61 Lung Tsai Tsuen	VH	CC64	The vibration limit will be set at 15 mm/s. (CS, VM, BZ, PC)
No.50 Lung Tsai Tsuen	VH	CC65	The vibration limit will be set at 15 mm/s. (CS, VM)
No.54 Lung Tsai Tsuen	VH	CC66	The vibration limit will be set at 15 mm/s. (CS, VM)
No.61A Lung Tsai Tsuen	VH	CC67	The vibration limit will be set at 15 mm/s. (CS, VM, BZ, PC)
No.25D Lung Tsai Tsuen	VH	CC68	The vibration limit will be set at 15 mm/s. (CS, VM, BZ, PC)

Note: (1)

CS – Condition Survey VM – Vibration Monitoring

BZ - Buffer Zone

PC - Provision of Protective Covering

SPA - Safe Public Access

## 6.3 Operational Phase Protective Measures

#### **Archaeology**

6.3.1 No mitigation measures will be required during the operational phase.

## 6.4 Construction Phase EM&A Requirements

6.4.1 **Appendix C, Table C5** shows the implementation schedule of the mitigation measures. Also, relevant construction phase measures recommended in the EIA Report are shown in Section 6.2 above. All these measures shall be covered by the EM&A programme.

## **Archaeology**

- 6.4.2 Periodic monitoring is required for the Archaeological Watching Brief to ensure compliance with agreed methodology and scope.
- 6.4.3 In addition, periodic monitoring of the declared monument is required. During the construction phase at interval of 3 months, an inspection of the site is to be undertaken. An inspection record supplemented with the site photos showing the condition of the overall declared monument should be submitted to AMO for record purposes.

#### **Built Heritage**

6.4.4 The condition survey report shall finalise the EM&A requirements for vibration monitoring for the heritage structures requiring condition survey. This should include the type of monitoring equipment required, the location of monitoring equipment, the frequency of monitoring and reporting requirements and action plan. Protective covering, provision of buffer zone and safe public access are also EM&A requirements.



## 6.5 Operational Phase EM&A Requirements

## **Archaeology**

6.5.1 There are no requirements for EM&A during the operational phase.

## **Built Heritage**

6.5.2 There are no requirements for EM&A during the operational phase.



#### 7. LANDSCAPE AND VISUAL

#### 7.1 Introduction

7.1.1 The EIA Report has recommended landscape and visual mitigation measures to be undertaken during construction and operational phases of the upgrading of Cheung Chau STW (DP component) under this Project. The implementation and maintenance of landscape mitigation measures shall be checked to ensure that they are fully realised and that potential conflicts between the proposed landscape measures and any other project works and operational requirements are resolved at the earliest possible date and without compromise to the intention of the mitigation measures.

#### 7.2 Construction Phase EM&A Requirements

- 7.2.1 Regular audits shall be carried out to ensure all the recommended landscape and visual mitigation measures would be effectively implemented.
- 7.2.2 A certified Arborist, Landscape Architect or related professional shall be employed for the implementation of landscape construction works particularly during site clearance operations when the proposed tree felling and transplanting will take place and subsequent maintenance operations.
- 7.2.3 All measures undertaken during the construction stage shall be audited by competent person, as a member of the Environmental Team. This shall be completed on a regular basis to ensure compliance with the intended aims of the EIA. Site inspections shall be undertaken at two times a month throughout the construction period.

#### 7.3 Operational Phase EM&A Requirements

- 7.3.1 During the operational phase, it is recommended that the landscape mitigation measures shall be monitored during the 12 month establishment period by a competent person to ensure the intended mitigation effects are sustained. Compensatory tree planting required to offset the loss of existing trees if transplanting of trees is not feasible or not preferable. Additional planting works for screening and amenity purposes shall be checked regularly to ensure their health conditions are well managed. Planting must be established and sustainable to provide long term landscape mitigation.
- 7.3.2 All measures undertaken during the first year of the operational stage shall be audited by the competent person. This shall be completed on a regular basis to ensure compliance with the intended aims of the EIA. Site inspections shall be undertaken once every quarter during the first year of the operational stage.

## 7.4 Mitigation Measures

7.4.1 The EIA Study has recommended mitigation measures for landscape and visual impacts during both construction and operational phase of the Project. A summary of the recommended mitigation measures is provided in **Table 7.1** and **Table 7.2**. The implementation schedule of the recommended mitigation measures is provided in **Appendix C, Table C6**.



**Table 7.1 Proposed Mitigation Measures during Construction Phase** 

Landso	cape and Visual Impact Mitigation Measures	Implementation Agent	Management/ Maintenance Agent
CM-1	Visual Screen/Hoarding	Contractor	Contractor
	Decorative hoarding or boundary fence for construction sites shall be considered, and designed to be compatible to the surroundings.		
CM-2	Protection to Existing Trees within Works Areas	DSD and	DSD and
	All existing trees which are not in direct conflict with the proposed works will be retained. The existing trees proposed to be retained shall be properly maintained and protected by means of fencing to prevent vehicular or pedestrian intrusion that may potentially damage tree canopies, trunks and root zones. Detailed tree protection specifications shall be allowed and included in the Contract Specification, which specifying the tree protection requirement, submission and approval system, and tree monitoring system. For trees with high preservation value, individual tree assessments and continuous tree monitoring reports shall be provided by a certified Arborist, Landscape Architect or related professional during construction. All retained trees shall be recorded photographically at the commencement of contract.	Contractors	Contractors
	Root pruning to the retained trees should be prohibited. Retained trees should be well-preserved by setting up a tree protection zone throughout the construction period for protecting the retained trees from damages.		
	To maximize protection to existing trees and ground vegetation, construction contracts may designate "No-intrusion Zone" to various areas within the site boundary with rigid and durable fencing for each individual no-intrusion zone. The contractor should close monitor and restrict the site working staff not to enter the "no-intrusion zone", even for non-direct construction activities and storage of equipment.		
CM-3	Tree Transplanting	Contractors	Contractors
	Existing trees to be affected shall be directly transplanted to the proposed tree receiving sites, or to temporary tree nurseries alternatively. Temporary tree nurseries may be set up for the transplanted tree and proposed trees at an early stage to allow small trees to grow during the construction stage. By the time when planting area becomes available, trees have been mature and required minimal pruning and suffer much less damage during transplanting. The construction programme should also allow sufficient time for root pruning and root ball preparation prior to transplanting, if necessary, and transplanting operations to be carried out in planting season.		
	Tree pruning such as topping, lion tailing would be prohibited as far as possible. Also, frequent keep watering would be necessary for transplanting trees. The proposed tree preservation measures during construction would be carried out and approved by the competent persons.		
CM-4	Construction Light	Contractor	Contractor
	Security floodlight for construction areas shall be controlled, such as equipped with adjustable shield, frosted diffusers and reflective covers, at night to avoid excessive glare to the nearby areas and residents. Other security measures shall also be considered to minimize the visual impacts by construction light.		



Landso	cape and Visual Impact Mitigation Measures	Implementation Agent	Management/ Maintenance Agent
CM-5	Dust and Erosion Control for Exposed Soil  Excavation works and demolition of existing building blocks shall be well planned with precautions to suppress dust. Exposed soil shall be covered or watered often. Areas that are expected to be left with bare soul for a long period of time after excavation shall be properly covered with suitable protective fabric. Suitable drainage shall be provided around construction sites to avoid discharge of contaminants and sediments into sensitive water-based habitats.	Contractor	Contractor
CM-6	Reinstatement of Works Areas  The affected works areas shall be properly reinstated to the satisfaction of relevant government departments.	Contractor	Contractor

**Table 7.2 Proposed Mitigation Measures during Operational Phase** 

Landsc	ape and Visual Impact Mitigation Measures	Implementation Agent	Management / Maintenance Agent
OM-1	Architectural and Landscape Design  The appearance of the proposed structures shall be properly designed, including a careful selection of material, colour and texture, so as to fit into the existing suburban, natural to semi-natural surroundings. The aesthetic design of the proposed structures will follow the requirements in the Guidelines on Aesthetic Design of Pumping Station Buildings and submitted to Vetting Committee on Aesthetic Design of Pumping Station Buildings (VCAB) for approval in accordance with DSD TC No. 9/2006, and circulated to ASD for comment in accordance with ETWB TCW No. 8/2005. Sufficient planting shall be considered and provided around the boundary fence of the proposed buildings for screening. Buffer planting will also be considered during the detailed design.	DSD	DSD
OM-2	Establishment Period  A 12-month establishment period for the soft landscape works shall be allowed in the main contract for contractor to carry out routine horticultural operations, including watering, pruning, weeding, pest control, replacement of dead plants etc. to ensure healthy establishment of new planting during a 12 month establishment period. This period can also serves as a kind of warranty/guarantee on the quality of the plants supplied and installed by the contractor. Monthly monitoring during the first year of establishment period is recommended.	DSD and Contractor	DSD and Contractor



#### 8. SITE INSPECTION / AUDIT

#### 8.1 Site Inspection Requirements

- 8.1.1 Site inspections/audits provide a direct means to trigger and enforce the specified environmental protection and pollution control measures. They shall be undertaken routinely, at least once per week, to inspect/audit the construction activities in order to ensure that appropriate environmental protection and pollution control mitigation measures are properly implemented. With reference to the Project's contractual environmental requirements, pollution control and mitigation specifications and a well established site inspection/audit, deficiency and action reporting system in accordance with the event contingency plan of the EM&A programme, the site inspection/audit would be one of the most effective tools used to enforce the environmental protection requirements on the construction site. A site inspection/audit checklist, to be used for undertaking site inspection/audit, will be prepared by the ET and submitted to the ER for approval.
- 8.1.2 The ET is responsible for formulation of the environmental site inspection/audit, deficiency and action reporting system, and for carrying out the site inspection/audit works.
- 8.1.3 Regular site inspections/audits shall be carried out at least once per week. All observations and results will be recorded in the data record sheets, which will pass to the Contractor. If non-compliance is found on site, the Event / Action Plan will be implemented.
- 8.1.4 The areas of inspection/audit shall not be limited to the environmental situation, pollution control and mitigation measures within the site; it will also review the environmental situation outside the site area which is likely to be affected, directly or indirectly, by the site activities. The ET shall make reference to the following information in conducting the inspection/audit:
  - (i) The EIA recommendations on environmental protection and pollution control mitigation measures;
  - (ii) Works progress and programme;
  - (iii) Individual works methodology proposals (which shall include proposal on associated pollution control measures);
  - (iv) The contract specifications on environmental protection;
  - (v) The relevant environmental protection and pollution control laws; and
  - (vi) Previous site inspection/audit results.
- 8.1.5 The Contractor shall update the ET Leader with all relevant information of the construction contract for him to carry out the site inspections/audits. The inspection/audit results and its associated recommendations on improvements to the environmental protection and pollution control works shall be submitted to the ER and the Contractor within 24 hours, for reference and for taking immediate action. The Contractor shall follow the procedures and time-frame as stipulated in the environmental site inspection/audit, deficiency and action reporting system formulated by the ET to report on any remedial measures subsequent to the site inspections/audits.
- 8.1.6 Ad hoc site inspections/audits shall also be carried out if significant environmental problems are identified. Inspections/audits may also be required subsequent to receipt of an environmental complaint, or as part of the investigation/audit work, as specified in Action Plan for environmental monitoring and audit.



### 8.2 Compliance with Legal and Contractual Requirements

- 8.2.1 There are contractual environmental protection and pollution control requirements as well as environmental protection and pollution control laws in Hong Kong, which the construction activities shall comply with.
- 8.2.2 In order that the works are in compliance with the contractual requirements, all the works method statements submitted by the Contractor to the ER for approval shall be sent to ET Leader of vetting to see whether sufficient environmental protection and pollution control measures have been included.
- 8.2.3 The ET Leader shall also review the progress and programme of the works to check that relevant environmental laws have not been violated and that the any foreseeable potential for violating the laws can be prevented.
- 8.2.4 The Contractor shall regularly copy relevant documents to the ET Leader so that the checking work can be carried out. The document shall at least include the updated Work Progress Reports, the updated Works Programme, the application letters for different licence/permits under the environmental protection laws, and all the valid licence/permit. The site diary shall also be available for the ET Leader's inspection upon his request.
- 8.2.5 The ET Leader shall advise the ER and the Contractor of any non-compliance with the contractual and legislative requirements on environmental protection and pollution control for them to take follow-up actions. If the ET Leader 's review concludes that the current status on licence/permit application and any environmental protection and pollution control preparation works may not cope with the works programme or may result in potential violation of environmental protection and pollution control requirements by the works in due course, he shall also advise the Contractor and the ER accordingly.
- 8.2.6 Upon receipt of the advice, the Contractor shall undertake immediate action to remedy the situation. The ER shall follow up to ensure that appropriate action has been taken by the Contractor in order that the environmental protection and pollution control requirements are fulfilled.

#### 8.3 Environmental Complaints

- 8.3.1 Complaints shall be referred to the ET Leader for carrying out complaint investigation procedures. The ET Leader shall undertake the following procedures upon receipt of the complaints:
  - (i) log complaint and date of receipt and inform the ER immediately;
  - (ii) investigate the complaint to determine its validity, and to assess whether the source of the problem is due to works activities;
  - (iii) if a complaint is valid and due to works, identify mitigation measures;
  - (iv) if mitigation measures are required, advise the Contractor accordingly;
  - (v) review the Contractor's response on the identified mitigation measures, and the updated situation;
  - (vi) if the complaint is transferred from EPD, submit interim report to EPD after endorsement by ER on status of the complaint investigation and follow-up action within the time frame assigned by EPD;
  - (vii) undertake additional monitoring and audit to verify the situation if necessary, and review that any valid reason for complaint does not recur,



- (viii) report the investigation results and the subsequent actions to the source of complaint for responding to complainant (If the source of complaint is FM), the results should be reported within the time frame assigned by EPD); and
- (ix) record the complaint, Investigation, the subsequent actions and the results in the monthly EM&A reports.
- 8.3.2 During the complaint investigation work, the Contractor and ER shall cooperate with the ET Leader in providing all necessary information and assistance for completion of the investigation. If mitigation measures are identified in the investigation, the Contractor shall promptly carry out the mitigation. The ER shall ensure that the measures have been carried out by the Contractor.



#### 9. REPORTING

#### 9.1 Baseline Monitoring Report

- 9.1.1 The baseline monitoring results, their interpretation and proposals for the Action / Limit level parameters will be presented in the form of a report which will be submitted to the ER for agreement. The report will be supported by the baseline monitoring data in electronic format prepared in HTML or PDF format, along with information from the covering monitoring locations, equipment and protocols. The agreed baseline report will then be reissued as a standalone report.
- 9.1.2 The baseline monitoring report shall include (but not limited to) the following elements:
  - (i) Executive Summary;
  - (ii) Project background information;
  - (iii) Drawings showing the locations of the baseline monitoring stations;
  - (iv) Monitoring methodology, equipment used and calibration details, parameters monitored, locations, dates and times, etc.;
  - (v) Monitoring results (in both hard and diskette copies) including graphical plots;
  - (vi) Interpretation of the significance of monitoring results and explanation of influencing factors;
  - (vii) Determination of the Action and Limit levels for each monitoring parameter and statistical analysis of the baseline data;
  - (viii) Revisions for inclusion in the EM&A programme; and
  - (ix) Comments and conclusions.

#### 9.2 Monthly EM&A Reports

- 9.2.1 The results and finding of all EM&A work required in the EM&A programme shall be recorded in the monthly EM&A reports prepared by the ET Leader. Monthly EM&A Reports shall be submitted to the ER within 10 working days of the end of each reporting month, the first report will be submitted in the month after construction works commence. Copies of each monthly EM&A report shall be submitted to each of the three parties: the Contractor, the ER and DSD), and the electronic copy shall be prepared in HTML or PDF format.
- 9.2.2 The first monthly EM&A Report shall be included at least the following:
  - (i) 1-2 pages executive summary;
  - (ii) Basic project information including a synopsis of the project organisation programme and management structure, and the work undertaken during the month;
  - (iii) Brief summary of EM&A requirement:
  - (iv) All monitoring parameters;
  - (v) Environmental quality performance limits (Action and Limit Levels);
  - (vi) Event/Action Plan
  - (vii) Environmental mitigation measures;
  - (viii) Environmental requirements in contract documents;



- (ix) Advice on the implementation status of environmental protection and pollution control/mitigation measures:
- (x) Drawing showing the project area, any environmental sensitive receivers and the monitoring location;
- (xi) Monitoring results together the following information:
- (xii) Monitoring Methodology;
- (xiii) Equipment used and calibration details;
- (xiv) Parameter monitored;
- (xv) Monitoring location (and depth);and
- (xvi) Monitoring date, time, frequency and duration.
- (xvii) Graphical plots of monitored trends over the past four reporting periods and the following information:
  - Major activities being carried out on site during the period;
  - · Weather condition during the period; and
  - Other factor which might affect the monitoring results.
- (xviii) Summary of non-compliance (exceedance) of the environmental quality performance limits (Action and Limit Levels);
- (xix) Review of the reasons for and the implications of non-compliance including review of pollution sources and working procedures;
- (xx) Description of recommendations and/or actions taken, or outstanding, in the event of non-compliances or deficiencies, including site inspections and audits;
- (xxi) A summary record of all complaints received and follow-up actions;
- (xxii) Summary record of notification of summons, successful prosecutions for breaches of environmental protection/pollution control legislation, and actions taken to rectify such breaches; and
- (xxiii) Future key issues as reviewed from the work programme and work method statements
- 9.2.3 The subsequent EM&A Reports shall include the following:
  - (i) Title page;
    - 1-2 pages executive summary
    - Breaches of Action / Limit Levels;
    - Complaint Log;
    - Reporting Changes; and
    - Future key issues.
  - (ii) Content Page
  - (iii) Environmental Status
    - Drawing showing the project area, any environmental sensitive receivers and monitoring locations;
    - · Monitoring results;
    - Summary of non-compliance with the AL Levels; and



- Summary of complaints.
- (iv) Environmental Issues and Actions
  - Review issues carried forward and/or follow-up procedures related to earlier non-compliance (complaints and deficiencies);
  - Description of the action taken in the event of non-compliance and deficiency reporting;
  - Recommendations and advice on the implementation status of the environmental mitigation measures and the corresponding effectiveness of the measurement; and
  - Summary of the updated implementation schedules.
- (v) Future Key Issues; and
- (vi) Appendix.
  - · Action / Limit Levels
  - Graphical plot of monitored parameters over the past four reporting period and the following information:
    - (a) major activities being carried out on site during the period;
    - (b) Weather condition during the period; and
    - (c) Other factor which might affect the monitoring results.
  - Monitoring schedule for the next reporting month;
  - · Cumulative complaints statistics; and
  - Details of complaints, outstanding issues and deficiencies.

#### 9.3 Final Summary EM&A Report

- 9.3.1 The Final Summary EM&A Report shall contain at least the following information:
  - (i) Executive Summary (1-2 pages);
  - (ii) Drawings showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations;
  - (iii) basic project information including a synopsis of the project organization contacts of key management, and a synopsis of work undertaken during the course of the project or past twelve months;
  - (iv) A brief summary of EM&A requirements including:
    - environmental mitigation measures, as recommended in the EIA Report;
    - environmental impact hypotheses tested;
    - · Action / Limit Levels;
    - all monitoring parameters; and
    - Event Action Plans.



- (v) A summary of the implementation status of environmental protection and pollution control/mitigation measures as recommended in the EIA report summarized in the updated implementation schedule;
- (vi) Graphical plots and the statistical analysis of the trends of monitored parameters over the course of the project, including the post project monitoring (for the past twelve months for annual report) for all monitoring stations against;
  - the major activities being carried out on site during the period;
  - weather conditions during the period; and
  - any other factors which might affect the monitoring results
- (vii) A summary of non-compliance (exceedances) of the environmental quality performance limits (Action / Limit Levels);
- (viii) A review of the reasons for and the implications of non-compliance including review of pollution sources and working procedures as appropriate;
- (ix) A description of the actions taken in the event of non-compliance;
- (x) A summary record of all complaints received (written or verbal) for each media liaison and consultation undertaken, action and follow-up procedures taken;
- (xi) A summary record of notifications of summons and successful prosecutions for breathes of the current environmental protection/pollution control legislations including locations and nature of the breaches, investigation, follow-up actions taken and results;
- (xii) A review of the validity of EIA Report predictions and identification of shortcomings in EIA Report recommendations;
- (xiii) A review of the effectiveness and efficiency of the mitigation measures; and
- (xiv) A review of success of the EM&A programme to cost effectively identify deterioration and to initiate prompt effective mitigation action when necessary.

#### 9.4 Data Keeping

9.4.1 The site document such as the monitoring field records, laboratory analysis records, site inspection forms etc. are not required to be included in the monthly EM&A reports for submission. However, all documents and records shall be well kept by the ET and be ready for inspection upon request. All documents and data shall be kept for at least one year after completion of the construction contract.

#### 9.5 Interim Notifications of Environmental Quality Limit Exceedances

9.5.1 Interim notifications of exceedances of Limit Levels will be issued to the ER within 24 hours of the identification of an exceedance. The notification shall be followed with advice to ER on the results of investigation, proposed action and any necessary follow-up proposals in case of exceedance.

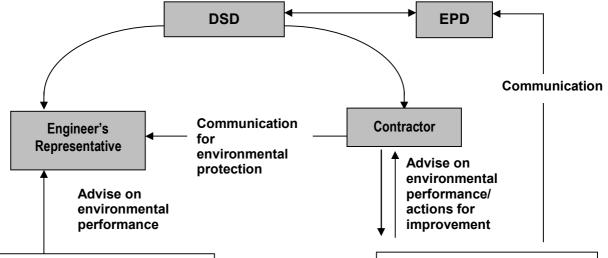


# Appendix A

# Line of Communication



### Appendix A - Line of Communication



# Independent Environmental Checker (IEC)

- Validate accuracy of monitoring equipment, monitoring location, monitoring results, locations of sensitive receivers and monitoring procedure;
- Random sample check and audit on monitoring data;
- Site inspection;
- Audit construction and operation methodology;
- Advise on proactive action;
- Review the effectiveness of environmental mitigation measures;
- Verify EM&A report prepared by ET and provide feedback;
- Check on complaint cases & effectiveness of corrective measures;
- Review monitoring requirements.

- Implementation status proforma on mitigation action
- Proactive environmental protection proforma for construction / operation method alternatives
- Regulatory compliance proforma
- Site inspection proforma
- Complaint report
- EM&A report for endorsement
- Effectiveness of mitigation measures
- Advise on environmental performance
- Return/ sign off audit proformas
- Environmental concerns and recommendations on construction/ operation methods

#### **Environment Team (ET)**

- Sampling, analysis and statistical evaluation of monitoring parameters;
- Site surveillance;
- Review construction and operation programme and methodology, and equipment used;
- Audit of compliance with environmental protection clauses;
- Advice to the contractor on environmental improvement on site;
- Monitoring mitigation measures implementation;
- Complaint investigation & corrective measures;
- Timely submission of EM&A reports, summary reports.
- Equipment compliance/ purchase/ maintenance
- Legislative issues summons, prosecution, fines/etc.



# Appendix B

Sample of Monitoring Data Record Sheet



# Data Sheet for 24-hr TSP Monitoring

Monitoring Location			
Details of Location			
Sampler Identification			
Date & Time of Sampli	ng		
Elapsed-time	Start	(hour)	
Meter Reading	Stop	(hour)	
Total Sampling Time (	mins.)		
Weather Conditions			Fine / Sunny / Cloudy / Rainy
Site Conditions			
Initial Flow Rate,	Pi	(hpa)	
Qsi	Ti	(°C)	
	Hi	(cfm)	
	Qsi	(Std, m <sup>3</sup> )	
Final Flow Rate,	Pf	(hpa)	
Qsf	Tf	(°C)	
	Hf	(cfm)	
	Qsf	(Std, m <sup>3</sup> )	
Average Flow Rate	(Std,	$m^3$ )	
Total Volume	(Std,	$m^3$ )	
Filter Identification No.			
Initial Weight of Filter (g)			
Final Weight of Filter (g)			
Measured TSP Level (μg/m³)			
Observations / Remarks			

	Name & Designation	Signature	Date
Recorded by:			
Checked by:			



## **Data Sheet for 1-hr TSP Monitoring**

Monitoring Location					
Details of Location					
Sampler Identification					
Date of Sampling					
Time of Sampling		1	2	3	
Elapsed-time	Start Time				
Meter Reading	End Time				
Total Sampling Time (	min.)				
Measured TSP Level	(µg/m³)				
Weather Conditions		Fine / Sunny /	Fine / Sunny / Cloudy / Rainy		
Site Conditions					
Observations / Remarks					

	Name & Designation	Signature	Date
Recorded by:			
Checked by:			



## AIR QUALITY (H<sub>2</sub>S) MONITORING DATA RECORD SHEET

General Information					
Monitoring Loc	cation				
Date					
Weather					
		Monitoring	Results		
Sample No.	Time	Wind Speed	Wind Direction	Temperature	Level (ppb)
Sample 1	Start:				
	Stop:				
Sample 2	Start:				
	Stop:				
Sample 3	Start:				
	Stop:				
Sample 4	Start:				
	Stop:				
Sample 5	Start:				
	Stop:				
Sample 6	Start:				
	Stop:				
Sample 7	Start:				
	Stop:				
Sample 8	Start:				
	Stop:				
Other Observations					

	Name & Designation	Signature	Date
Recorded by:			
Checked by:			



## SAMPLE OF ODOUR COMPLAINT REGISTRATION FORM

Subject	Description
Name of Complainant:	
Complainant's Contact	Tel:
Information:	Fax:
	Address:
Location of Odour Nuisance:	
Date of Odour Nuisance:	
Time of Odour Nuisance:	
Type of Odour Nuisance:	
Extent of Odour Strength:	Highly Offensive/
(delete as appropriate)	Offensive/
	Slightly Offensive/
	Continuously Detectable/
	Intermittently Detectable/
Meteorological Conditions:	
Temperature	
Wind Speed	
Relative Humidity	
Wind Direction	
SPS Operation Conditions:	Normal / Abnormal
Details of Operation Conditions:	



## **Noise Monitoring Data Record Sheet**

Monitoring Location	on					
Description of Lo	cation					
Date of Monitoring	g					
Weather Conditio	n					
Wind Strength (m	ı/s)					
		,				
Equipment		Equip	oment No.			
Sound Level Mete	er					
Sound Pressure (	Calibrator					
Calibration before	measuren	nent				
(dB(A))						 
Calibration after r	neasureme	nt (dB	(A))			 
			T			
Measurement Sta	art Time					
Measurement Tin	ne Length (	min)				
Measurement Re	sults (dB(A	.))				
L <sub>eq</sub>						
L <sub>10</sub>						
L <sub>90</sub>						
Major Noise Sour Measurement	ce(s) Durin	g				
Measurement						
Surrounding Activ	ities Durino	ר				
Measurement	indo Barin	9				
Remarks		Free Field	l / Faça	de Measurement		
	T					Τ
	Name & D	Designa	ation		Signature	 Date
Recorded by:						
Checked by:						



## **Water Quality Monitoring Data Record Sheet**

Location			
Date			
Start Time (hh:mm)			
Weather			
Sea Conditions			
Tide Mode			
Water Depth (m)			
Monitoring Depth	Surface	Middle	Bottom
рН			
Salinity (ppt)			
Temperature (°C)			
DO Saturation (%)			
DO (mg/L)			
BOD <sub>5</sub> (mg/L)			
Turbidity (NTU)			
SS (mg/L)			
NH <sub>3</sub> -N (mg/L)			
TIN (mg/L)			
E.coli (cfu/100ml)			
Observed Construction Activities	<100m from location		
Observed Construction Activities	>100m from location		
Other Observation			
Name & Designa	tion Sign	ature	<u>Date</u>
Recorded By:			
Checked By:			



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

# Appendix C

Implementation Schedule of Mitigation Measures



Table C1 Implementation Schedule of Recommended Mitigation Measures – Air Quality

EIA Ref.	Recommended Environmental Protection Measures/ Mitigation Measures	Objectives of the recommended measures & main concerns to address	Who to implement the	Location / Timing of implementation of Measures			What requirements or standards for the measures to achieve?
			measures?	D	С	0	
Construction Phase	(Upgrading Works of Cheung Chau STW and Pak She SPS	(DP Component))					
S.3.5.5	Appropriate dust control measures should be implemented during the construction stage in accordance with the requirements in the Air Pollution Control (Construction Dust) Regulation. Dust control techniques should be considered to control dust to a level not exceeding the AQOs as well as the 1-hour TSP guideline level of 500 µg/m³. These measures include, but are not limited to, the following:  • Adoption of good site practices; • Avoid practices likely to raise dust level; • Frequent cleaning and damping down of stockpiles and dusty areas of the site; • Covering the exposed areas with tarpaulin; • Reducing drop height during material handling; • Provision of wheel-washing facilities for site vehicles leaving the site; • Regular plant maintenance to minimize exhaust emission; and • Sweep up dust and debris at the end of each shift.	Air Quality (fugitive dust) Control during Construction Phase	Contractors		√ ·		Annex 4 and Annex 12 of EIAO -TM, Air Pollution Control (Construction Dust) Regulation
S.3.10.1	All the dust control measures as recommended in the Air Pollution Control (Construction Dust) Regulation, where applicable, should be implemented. Typical dust control measures include:	Air Quality (fugitive dust) Control during Construction Phase	Contractors		1		Annex 4 and Annex 12 of EIAO -TM, Air Pollution Control (Construction Dust) Regulation



EIA Ref.	Recommended Environmental Protection Measures/ Mitigation Measures	Objectives of the recommended measures & main concerns to address	Who to implement the measures?	Location / Timing of implementation of Measures			What requirements or standards for the measures to achieve?
				D	С	0	
S.3.10.1	Watering every 1.5 hours on active works areas and paved haul roads to reduce dust emissions by 90.9% (e.g. watering intensity at 0.5 litres/m². Actual application shall depend on the site condition and weather conditions).	Air Quality (fugitive dust) Control during Construction Phase	Contractors		√		EIA, Annex 4 and Annex 12 of EIAO -TM, Air Pollution Control (Construction Dust) Regulation
S.3.10.1	Watering every hour on unpaved areas and stockpiles of dusty materials (if no tarpaulin is provided) to reduce dust emissions by 90% (e.g. watering intensity at 1.5 litre/m² during the first hour, subsequent application at 0.2 litre/m². Actual application shall depend on the site condition and weather conditions).	Air Quality (fugitive dust) Control during Construction Phase	Contractors		٧		EIA, Annex 4 and Annex 12 of EIAO -TM, Air Pollution Control (Construction Dust) Regulation
S.3.10.1	Use of regular watering, with complete coverage, to reduce dust emissions from exposed site surfaces and unpaved roads, particularly during dry weather	Air Quality (fugitive dust) Control during Construction Phase	Contractors		√		Annex 4 and Annex 12 of EIAO -TM, Air Pollution Control (Construction Dust) Regulation
S.3.10.1	Use of frequent watering for particularly dusty construction areas and areas close to ASRs	Air Quality (fugitive dust) Control during Construction Phase	Contractors		√		Annex 4 and Annex 12 of EIAO -TM, Air Pollution Control (Construction Dust) Regulation
S.3.10.1	Vehicle washing facilities should be provided at every vehicle exit point	Air Quality (fugitive dust) Control during Construction Phase	Contractors		√		Annex 4 and Annex 12 of EIAO -TM, Air Pollution Control (Construction Dust) Regulation



EIA Ref.	Recommended Environmental Protection Measures/ Mitigation Measures	Objectives of the recommended measures & main concerns to address	Who to implement the measures?	Location / Timing of implementation of Measures			What requirements or standards for the measures to achieve?
				D	С	0	
S.3.10.1	Where a site boundary adjoins a road, streets or other areas accessible to the public, hoarding of not less than 2.4 m high from ground level should be provided along the entire length except for a site entrance or exit	Air Quality (fugitive dust) Control during Construction Phase	Contractors		<b>V</b>		Annex 4 and Annex 12 of EIAO -TM, Air Pollution Control (Construction Dust) Regulation
S.3.10.1	Stockpiles of imported material kept on site shall be contained within hoarding, dampened and/or covered during dry and windy weather	Air Quality (fugitive dust) Control during Construction Phase	Contractors		<b>V</b>		Annex 4 and Annex 12 of EIAO -TM, Air Pollution Control (Construction Dust) Regulation
S.3.10.1	Material stockpiled alongside trenches should be covered with tarpaulins	Air Quality (fugitive dust) Control during Construction Phase	Contractors		<b>V</b>		Annex 4 and Annex 12 of EIAO -TM, Air Pollution Control (Construction Dust) Regulation
S.3.10.1	Open stockpiles shall be avoided or covered. Where possible, prevent placing dusty material storage piles near ASRs	Air Quality (fugitive dust) Control during Construction Phase	Contractors		<b>V</b>		Annex 4 and Annex 12 of EIAO -TM, Air Pollution Control (Construction Dust) Regulation



EIA Ref.	Recommended Environmental Protection Measures/ Mitigation Measures	Objectives of the recommended measures & main concerns to address	Who to implement the measures?	Location / Timing of implementation of Measures			What requirements or standards for the measures to achieve?
			measures?	D	С	0	
S.3.10.1	Any excavated or stockpile of dusty material should be covered entirely by impervious sheeting or spayed with water to maintain the entire surface wet during the non-working hours	Air Quality (fugitive dust) Control during Construction Phase	Contractors		٧		Annex 4 and Annex 12 of EIAO -TM, Air Pollution Control (Construction Dust) Regulation
S.3.10.1	All dusty materials shall be sprayed with water prior to any loading, unloading or transfer operation so as to keep the dusty materials wet	Air Quality (fugitive dust) Control during Construction Phase	Contractors		√		Annex 4 and Annex 12 of EIAO -TM, Air Pollution Control (Construction Dust) Regulation
S.3.10.1	Water sprays shall be used during the delivery and handling of sands aggregates and the like	Air Quality (fugitive dust) Control during Construction Phase	Contractors		٧		Annex 4 and Annex 12 of EIAO -TM, Air Pollution Control (Construction Dust) Regulation
S.3.10.1	All demolished items that may emit dust particles should be covered entirely by impervious sheeting or placed in an area sheltered on the top and the 3 sides within a day of demolition	Air Quality (fugitive dust) Control during Construction Phase	Contractors		٧		Annex 4 and Annex 12 of EIAO -TM, Air Pollution Control (Construction Dust) Regulation



EIA Ref.	Recommended Environmental Protection Measures/ Mitigation Measures	Objectives of the recommended measures & main concerns to address	Who to implement the	Location / Timing of implementation of Measures			What requirements or standards for the measures to achieve?
			measures?	D	С	0	_
S.3.10.1	Good site practices for concrete batching plant  Every stock of more than 20 bags of cement or dry pulverized fuel ash(PFA) should be cover entirely by impervious sheeting or placed in an area sheltered on the top and the sides.  Cement or dry PFA delivered in bulk should stored in a closed silo fitted with an audible high level alarm which is interlocked with the material filling line and no overfilling is allowed.  Loading, unloading, transfer, handling or storage of bulk cement or dry PFA should be carried out in a totally enclosed system or facility, and any vent or exhaust should be fitted with effective fabric filter or equivalent air pollution control system (Maximum TSP emission factor of Silos and Mising Tower: 50mg/m³)	Air Quality (fugitive dust) Control during Construction Phase	Contractors		V		Annex 4 and Annex 12 of EIAO -TM, Air Pollution Control (Construction Dust) Regulation  Best Practical Means for Cement Works (Concrete Batching Plant) BPM 3/2(93)



EIA Ref.	Recommended Environmental Protection Measures/ Mitigation Measures	Objectives of the recommended measures & main concerns to address	Who to implement the	Location / Timing of implementation of Measures			What requirements or standards for the measures to achieve?
			measures?	D	С	0	
Construction Phase	(Sewers Works (non-DP Component))						
S.3.5.8	Appropriate dust control measures should be implemented during the construction stage in accordance with the requirements in the Air Pollution Control (Construction Dust) Regulation. Dust control techniques should be considered to control dust to a level not exceeding the AQOs as well as the 1-hour TSP guideline level of 500 µg/m³. These measures include, but are not limited to, the following:  • Adoption of good site practices; • Avoid practices likely to raise dust level; • Frequent cleaning and damping down of stockpiles and dusty areas of the site; • Covering the exposed areas with tarpaulin; • Reducing drop height during material handling; • Regular plant maintenance to minimize exhaust emission; and • Sweep up dust and debris at the end of each shift.	Air Quality (fugitive dust) Control during Construction Phase	Contractors		√ 		EIA, Air Pollution Control (Construction Dust) Regulation
S.3.10.1	All the dust control measures as recommended in the Air Pollution Control (Construction Dust) Regulation, where applicable, should be implemented. Typical dust control measures include:	Air Quality (fugitive dust) Control during Construction Phase	Contractors		<b>V</b>		EIA, Air Pollution Contro (Construction Dust) Regulation
S.3.10.1	Use of regular watering, with complete coverage, to reduce dust emissions from exposed site surfaces and unpaved roads, particularly during dry weather	Air Quality (fugitive dust) Control during Construction Phase	Contractors		√		EIA, Air Pollution Contro (Construction Dust) Regulation



EIA Ref.	Recommended Environmental Protection Measures/ Mitigation Measures	Objectives of the recommended measures & main concerns to address	Who to implement the	Location / Timing of implementation of Measures			What requirements or standards for the measures to achieve?
			measures?	D	С	0	-
S.3.10.1	Use of frequent watering for particularly dusty construction areas and areas close to ASRs	Air Quality (fugitive dust) Control during Construction Phase	Contractors		√		EIA, Air Pollution Control (Construction Dust) Regulation
S.3.10.1	Material stockpiled alongside trenches should be covered with tarpaulins	Air Quality (fugitive dust) Control during Construction Phase	Contractors		√		EIA, Air Pollution Control (Construction Dust) Regulation
S.3.10.1	Open stockpiles shall be avoided or covered. Where possible, prevent placing dusty material storage piles near ASRs	Air Quality (fugitive dust) Control during Construction Phase	Contractors		√		EIA, Air Pollution Control (Construction Dust) Regulation
S.3.10.1	Any excavated or stockpile of dusty material should be covered entirely by impervious sheeting or spayed with water to maintain the entire surface wet during the non-working hours	Air Quality (fugitive dust) Control during Construction Phase	Contractors		V		EIA, Air Pollution Control (Construction Dust) Regulation
S.3.10.1	All dusty materials shall be sprayed with water prior to any loading, unloading or transfer operation so as to keep the dusty materials wet	Air Quality (fugitive dust) Control during Construction Phase	Contractors		√		EIA, Air Pollution Control (Construction Dust) Regulation
S.3.10.1	Water sprays shall be used during the delivery and handling of sands aggregates and the like	Air Quality (fugitive dust) Control during Construction Phase	Contractors		√		EIA, Air Pollution Control (Construction Dust) Regulation



EIA Ref.	Recommended Environmental Protection Measures/ Mitigation Measures	Objectives of the recommended measures & main concerns to address	Who to implement the measures?	Location / Timing of implementation of Measures			What requirements or standards for the measures to achieve?
			measures?	D	С	0	
S.3.5.8	Appropriate dust control measures should be implemented during the construction stage in accordance with the requirements in the Air Pollution Control (Construction Dust) Regulation. Dust control techniques should be considered to control dust to a level not exceeding the AQOs as well as the 1-hour TSP guideline level of 500 µg/m³. These measures include, but are not limited to, the following:  • Adoption of good site practices;  • Avoid practices likely to raise dust level;  • Frequent cleaning and damping down of stockpiles and dusty areas of the site;  • Covering the exposed areas with tarpaulin;  • Reducing drop height during material handling;  • Regular plant maintenance to minimize exhaust emission; and  • Sweep up dust and debris at the end of each shift.	Air Quality (fugitive dust) Control during Construction Phase	Contractors		√ 		EIA, Air Pollution Control (Construction Dust) Regulation
Operational Phase	(Upgrading Works of Cheung Chau STW and Pak She SPS (D	P Component))					
S.3.10.2	The design of enclosing the odour sources of the upgraded Cheung Chau STW and Pak She SPS and the installation of deodorization units would readily reduce the potential odour impacts. Adverse odour impact from the upgraded Cheung Chau STW and Pak She SPS is not anticipated. The current design information of deodourizing units is summarized in Table 3.13 of EIA	Odour control during operation phase	DSD and Contractors	V	٧	1	EIA



EIA Ref.	Recommended Environmental Protection Measures/ Mitigation Measures	Objectives of the recommended measures & main concerns to address	Who to implement the measures?	Location / Timing of implementation of Measures			What requirements or standards for the measures to achieve?
			illeasures :	D	С	0	
S.3.10.3	In addition, good housekeeping practices listed below should be followed to control odour emissions from the plant and these standard practices should be included in the plant operator manual:  Screens should be cleaned regularly to remove accumulated organic debris; Grit and screening transfer systems should be flushed regularly with water to remove organic debris and grit; Grit and screened materials should be transferred to closed containers to minimize odour escape; Sludge should be frequently withdrawn from tanks to prevent the production of gases; Sludge should be transferred to closed containers; and Sludge containers should be flushed with water regularly	Odour Control during Operation Phase	DSD and Contractors	√	√	V	EIA



Table C2 Implementation Schedule of Recommended Mitigation Measures – Noise

EIA Ref.	Recommended Environmental Protection Measures / Mitigation Measures	Objectives of the recommended measures & main concerns to address	Who to implement the measures?	Location / Timing of implementation of Measures	What requirements or standards for the measures to achieve?
Construction Phase	(Upgrading Works of Cheung Chau STW and Pak She SPS	(DP Component))			
S.4.4.12	Only well-maintained plant should be operated on-site and plant should be serviced regularly during the construction works.	Noise control during construction	Contractors	At all construction areas of the site during the entire construction period	EIA, Contractual requirements
S.4.4.12	Machines and plant that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum.	Noise control during construction	Contractors	At all construction areas of the site during the entire construction period	EIA, Contractual requirements
S.4.4.12	Plant known to emit noise strongly in one direction should, where possible, be orientated to direct noise away from the NSRs.	Noise control during construction	Contractors	At all construction areas of the site during the entire construction period	EIA, Contractual requirements
S.4.4.12	Mobile plant should be sited as far away from NSRs as possible.	Noise control during construction	Contractors	At all construction areas of the site during the entire construction period	EIA, Contractual requirements
S.4.4.12	Material stockpiles and other structures should be effectively utilized, where practicable, to screen noise from on-site construction activities.	Noise control during construction	Contractors	At all construction areas of the site during the entire construction period	EIA, Contractual requirements



EIA Ref.	Recommended Environmental Protection Measures / Mitigation Measures	Objectives of the recommended measures & main concerns to address	Who to implement the measures?	Location / Timing of implementation of Measures	What requirements or standards for the measures to achieve?
S.4.4.13	Use of quiet plant (PME):  Generator Poker, vibratory, hand-held Breaker, excavator mounted (hydraulic) Excavator Tracked Mobile Crane Vibratory Compactor Dumper Air compressor Concrete Pump Pilling Rig	Noise control during construction	Contractors	At all construction areas of the site during the entire construction period	EIA, Contractual requirements
S.4.4.14	Temporary site hoardings of 2.4 m high are recommended for the works at the Pak She SPS. The hoardings will be erected along the works boundary facing the NSRs. The PME involved in the works would be screened by the erected site hoardings. Without direct line of sight from the affected NSRs, a noise reduction of 10 dB(A) could be achieved provided that the hoardings have no openings or gaps and have a surface mass of at least 7 kg/m². Nonetheless, a -5 dB(A) screening correction for site hoardings has been applied as a more conservative approach.	Noise control during construction	Contractors	At Pak She SPS during the entire construction period	EIA
S.4.4.23	For NSRs which would be affected by more than one Works Types, good scheduling works is recommended to minimize the cumulative construction noise impacts due to different Works Types.	Noise control during construction	Contractors	Construction areas near the specified locations during the construction period	EIA, Contractual requirements



EIA Ref.	Recommended Environmental Protection Measures / Mitigation Measures	Objectives of the recommended measures & main concerns to address	Who to implement the measures?	Location / Timing of implementation of Measures	What requirements or standards for the measures to achieve?
S.4.4.29	In order to prevent potential cumulative construction noise impacts to NSRs, the works at Tai Kwai Wan San Tsuen are recommended to be scheduled to avoid concurrent works at the areas near Tai Kwai Wan of the Improvement of Fresh Water Supply to Cheung Chau project.	Noise control during construction	DSD and Contractors	Construction areas near the specified locations during the construction period	EIA, Contractual requirements
S.4.4.30	The contractor shall liaise with "Replacement and Rehabilitation of Water Mains Stage 4, Mains on Hong Kong and Islands – Investigation, Design and Construction" contractors so as to avoid undertaking works concurrently with the works when they are in the close proximity as far as practicable.	Noise control during construction	DSD and Contractors	Construction areas near the specified locations during the construction period	EIA, Contractual requirements
S.4.4.31	The contractor shall liaise with Improvement to Existing Roads and Drains in Cheung Chau Old Town, Remaining Engineering Works Stage 3 works contractors so as to avoid undertaking works concurrently with the works when they are in the close proximity as far as practicable.	Noise control during construction	DSD and Contractors	Construction areas near the specified locations during the construction period	EIA, Contractual requirements
Construction Phase (Se	ewers Works (non-DP Component))				
S.4.4.18	Quieter equipment shall be adopted as far as possible.	Noise control during construction	Contractors	At all construction areas of the site during the entire construction period	EIA, Contractual requirements



EIA Ref.	Recommended Environmental Protection Measures / Mitigation Measures	Objectives of the recommended measures & main concerns to address	Who to implement the measures?	Location / Timing of implementation of Measures	What requirements or standards for the measures to achieve?
S.4.4.20 S.4.4.20	Noise barrier in the form of site hoarding shall be used for the following PMEs where practicable:  Backhoe (mini) Breaker, hand-held, mass>10Kg and <20Kg Generator Poker, vibratory hand-held Bar Bender and cutter (electric) Vibratory compactor Breaker, excavator mounted (hydraulic) Pilling, Rig Hoist (electric) Excavator Dumper Submersible Pump Rock Drill, hand-held (pneumatic) Air Compressor Ventilation Fan Grout Mixer Grout Pump Winch (electric) Grinder, hand held (electric)	Noise control during construction	Contractors	At all construction areas of the site close to identified NSRs during the entire construction period	EIA, Contractual requirements
S.4.4.20	The barrier / enclosure material's surface mass shall be in excess of 7kg/m².	Noise control during construction	Contractors	At all construction areas of the site during the entire construction period	EIA, Contractual requirements
S.4.4.23	Good scheduling of works is recommended to further mitigate the potential construction noise impacts.	Noise control during construction	Contractors	At all construction areas of the site during the entire construction period	EIA, Contractual requirements



EIA Ref.	Recommended Environmental Protection Measures / Mitigation Measures	Objectives of the recommended measures & main concerns to address	Who to implement the measures?	Location / Timing of implementation of Measures	What requirements or standards for the measures to achieve?
S.4.4.12	Only well-maintained plant should be operated on-site and plant should be serviced regularly during the construction works.	Noise control during construction	Contractors	At all construction areas of the site during the entire construction period	EIA, Contractual requirements
S.4.4.12	Machines and plant that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum.	Noise control during construction	Contractors	At all construction areas of the site during the entire construction period	EIA, Contractual requirements
S.4.4.12	Plant known to emit noise strongly in one direction should, where possible, be orientated to direct noise away from the NSRs.	Noise control during construction	Contractors	At all construction areas of the site during the entire construction period	EIA, Contractual requirements
S.4.4.12	Mobile plant should be sited as far away from NSRs as possible.	Noise control during construction	Contractors	At all construction areas of the site during the entire construction period	EIA, Contractual requirements
S.4.4.12	Material stockpiles and other structures should be effectively utilized, where practicable, to screen noise from on-site construction activities.	Noise control during construction	Contractors	At all construction areas of the site during the entire construction period	EIA, Contractual requirements
S.4.4.23	For NSRs which would be affected by more than one Works Types, good scheduling works is recommended to minimize the cumulative construction noise impacts due to different Works Types.	Noise control during construction	Contractors	Construction areas near the specified locations during the construction period	EIA, Contractual requirements



EIA Ref.	Recommended Environmental Protection Measures / Mitigation Measures	Objectives of the recommended measures & main concerns to address	Who to implement the measures?	Location / Timing of implementation of Measures	What requirements or standards for the measures to achieve?
S.4.4.25	The Contractor shall liaise with the schools that are located near the works sites regarding their examination period and schedule the noisy works to avoid the examination period as far as possible.	Noise control during construction	Contractors	At construction areas near schools during the entire construction period	Annex 5 and Annex 13 of EIAO-TM
S.4.4.27	For the soil excavation works, the contractor shall avoid the use of PME as far as possible and adopting hand digging method to reduce the noise impacts if the site condition is allowed.	Noise control during construction	Contractors	At construction areas of constructing sewer (open cut method) and upgrading of existing sewer during the entire construction period.	EIA, Contractual requirements
S.4.4.29	In order to prevent potential cumulative construction noise impacts to NSRs, the works at Tai Kwai Wan San Tsuen are recommended to be scheduled to avoid concurrent works at the areas near Tai Kwai Wan of the Improvement of Fresh Water Supply to Cheung Chau project.	Noise control during construction	DSD and Contractors	Construction areas near the specified locations during the construction period	EIA, Contractual requirements
S.4.4.30	The contractor shall liaise with "Replacement and Rehabilitation of Water Mains Stage 4, Mains on Hong Kong and Islands – Investigation, Design and Construction" contractors so as to avoid undertaking works concurrently with the works when they are in the close proximity as far as practicable.	Noise control during construction	DSD and Contractors	Construction areas near the specified locations during the construction period	EIA, Contractual requirements
S.4.4.31	The contractor shall liaise with Improvement to Existing Roads and Drains in Cheung Chau Old Town, Remaining Engineering Works Stage 3 works contractors so as to avoid undertaking works concurrently with the works when they are in the close proximity as far as practicable.	Noise control during construction	DSD and Contractors	Construction areas near the specified locations during the construction period	EIA, Contractual requirements



EIA Ref.	Recommended Environmental Protection Measures / Mitigation Measures	Objectives of the recommended measures & main concerns to address	Who to implement the measures?	Location / Timing of implementation of Measures	What requirements or standards for the measures to achieve?
S.4.5.6 S.4.5.7 S.4.5.8	All the noisy pumps, mechanically raked fine screen, deodourization fans and blowers are to be enclosed in building structures. Acoustic louvers are to be implemented to all exhausted fans.	Noise Control	DSD	Cheung Chau STW	Annex 5 of EIAO-TM, NCO; Good Practices on Ventilation Systems Noise Control; Good Practices on Pumping Systems Noise Control
S.4.5.8	The recommended mitigation measures for the operation of SPS and STW and the proposed noise reduction are listed below:  Pak She Sewage Pumping Station	Noise Control	DSD	Cheung Chau STW	EIA
	<ul> <li>Submersible pump – enclosed inside SPS building structure(-20 dB(A))</li> <li>Mechanically raked fine screen – enclosed inside SPS building structure(-20 dB(A))</li> <li>Deodourization fan – enclosed inside SPS building structure(-20 dB(A))</li> </ul>				
	<ul> <li>Cheung Chau Sewage Treatment Works</li> <li>Submersible pump – enclosed inside treatment unit building structure (-20 dB(A))</li> <li>Mechanically raked fine screen – enclosed inside STW building structure (-20 dB(A))</li> <li>Deodourization fan – enclosed inside STW building structure (-20 dB(A))</li> <li>Exhaust fan – provide acoustic louver at discharge point(-10 dB(A))</li> <li>Blower – enclosed inside STW building structure (-20 dB(A))</li> <li>Mechanical pump – enclosed inside STW building structure (-20 dB(A))</li> </ul>				



Table C3 Implementation Schedule of Recommended Mitigation Measures – Water Quality

EIA Ref.	Recommended Environmental Protection Measures/ Mitigation Measures	Objectives of the recommended	Who to implement the	When to implement the measures?			What requirements or
		measures & main concerns to address	measures?	D	С	0	standards for the measures to achieve?
Construction Phase (U	pgrading Works of Cheung Chau STW and Pak She SPS (DP Com	ponent) and Sewers Work	s (non-DP Compo	nent))			
S.5.7.1	Practices outlined in ProPECC PN 1/94 Construction Site Drainage are recommended, as highlighted below:  • Perimeter channels are to be installed in works areas to intercept runoff at the site boundary prior to the commencement of any earthworks. Surface runoff should be discharged into storm drains via sand/ silt removal facilities with an adequate capacity;  • Works programme should be designed to minimize works areas to reduce soil exposure and site runoff;  • Silt removal facilities, channels and manholes should be maintained and cleaned regularly to ensure their proper functions;  • Works programme should be carefully planned to minimize the scale of soil excavation during the rainy season;  • Earthworks surfaces should be well compacted and subsequent permanent works or surface protection measures should be carried out immediately;  • All vehicles should be washed before they leave the construction site to avoid earth, mud, and debris being carried	Water Quality Control	Contractors		1		WPCO;     TM –Effluent     Standards for     Effluents     Discharged into     Drainage and     Sewerage     Systems, Inland     and Coastal     Water



EIA Ref.	Recommended Environmental Protection Measures/ Mitigation Measures	Objectives of the recommended measures & main concerns to address	Who to implement the	When to implement the measures?			What requirements or standards for the
			measures?	D	С	0	measures to achieve?
(cont)	<ul> <li>Open stockpiles of construction materials on site should be covered with tarpaulin or similar fabric materials during storms;</li> <li>For sections of pipes that need to be laid underneath water courses with the open cut method, site works should be carried out during the dry season with a temporary drainage diversion; and;</li> <li>Any construction works along Hak Pai Road immediately by the Kwun Yam beach and Cheung Chau Tung Wan beach should be avoided during the swimming season.</li> </ul>		Contractors		√		WPCO;     TM –Effluent     Standards for     Effluents     Discharged into     Drainage and     Sewerage     Systems, Inland     and Coastal     Water
S.5.7.2 and S.5.7.3	Mitigations Measures for General Construction Activities:     Good site practices should be adopted to regularly clean the construction sites to avoid rubbish, debris and litter from entering to nearby water bodies; and     Good construction and site management practices should be implemented to ensure that litter, fuels, and solvents would not enter the public drainage systems.	Water Quality Control	Contractors		٧		WPCO;     TM –Effluent     Standards for     Effluents     Discharged into     Drainage and     Sewerage     Systems, Inland     and Coastal     Water



EIA Ref.	Recommended Environmental Protection Measures/ Mitigation Measures	Objectives of the recommended measures & main concerns to address	Who to implement the measures?	When to implement the measures?			What requirements or standards for the
			illeasures:	D	С	0	measures to achieve?
S.5.7.4	Domestic sewage generated by workforce would be collected and discharged to the STW for proper treatment. Portable toilets should be provided by the Contractor, where necessary, to handle sewage from the workforce. The Contractor should also be responsible for waste disposal.	Water Quality Control	Contractors		<b>V</b>		WPCO;     TM –Effluent     Standards for     Effluents     Discharged into     Drainage and     Sewerage     Systems, Inland     and Coastal     Water
S.5.7.5 and S.5.7.6	<ul> <li>Mitigations Measures for Spillage of Chemicals:</li> <li>Registration to EPD as a Chemical Waste Producer if chemical wastes are generated and need to be disposed of;</li> <li>Illegal disposal of chemicals should be strictly prohibited; and</li> <li>Oils and fuels should only be used and stored in the designated area which has polluting prevention facilities.</li> </ul>	Water Quality Control	Contractors		٧		WPCO;     TM –Effluent     Standards for     Effluents     Discharged into     Drainage and     Sewerage     Systems, Inland     and Coastal     Water



EIA Ref.	Recommended Environmental Protection Measures/ Mitigation Measures	Objectives of the recommended measures & main concerns to address	Who to implement the	When to implement the measures?			What requirements or standards for the
			measures?	D	С	0	measures to achieve?
Operational Phase (Upg	rading Works of Cheung Chau STW and Pak She SPS (DP Compo	onent))					
S.5.7.7	The STW operator should maintain a good line of communication with various parties involved in an emergency discharge event.	Water Quality Control	DSD			√ 	WPCO;      TM –Effluent     Standards for     Effluents     Discharged into     Drainage and     Sewerage     Systems, Inland     and Coastal     Water
S.5.7.8	<ul> <li>Standby facilities for the main treatment units and standby pumps, accessories/ equipment parts should be provided.</li> <li>Storm Tanks would also be incorporated to provide temporary storage of flow under extremely high flow conditions.</li> <li>Dual power supply or standby power sources should also be provided for Cheung Chau STW.</li> </ul>	Water Quality Control	DSD	V			WPCO;     TM –Effluent     Standards for     Effluents     Discharged into     Drainage and     Sewerage     Systems, Inland     and Coastal     Water



EIA Ref.	Recommended Environmental Protection Measures/ Mitigation Measures	Objectives of the recommended measures & main	Who to implement the measures?	When to implement the measures?			What requirements or standards for the
		concerns to address	illeasures:	D	С	0	measures to achieve?
S.5.7.9	A contingency plan should be developed to deal with the occurrence of an emergency discharge during the operation of the STW.	Water Quality Control	Contractors			<b>V</b>	WPCO;      TM –Effluent     Standards for     Effluents     Discharged into     Drainage and     Sewerage     Systems, Inland     and Coastal     Water
S.5.7.10	<ul> <li>Standby pump and backup power supply should be provided for Pak She SPS and will continue to be provided after the upgrading to cater for breakdown and maintenance of duty pumps to reduce the chance of occurrence of sewage bypass;</li> <li>A backup power supply would be provided to secure electrical power supply; and</li> <li>Regular maintenance and checking of equipment should be carried out to prevent equipment failure.</li> </ul>	Water Quality Control	DSD			√	WPCO;     TM –Effluent     Standards for     Effluents     Discharged into     Drainage and     Sewerage     Systems, Inland     and Coastal     Water



EIA Ref.	Recommended Environmental Protection Measures/ Mitigation Measures	Objectives of the recommended measures & main concerns to address	Who to implement the		to impl measu		What requirements or standards for the
			measures?	D	С	0	measures to achieve?
S.5.7.11	A contingency plan should be developed to deal with the emergency discharges the contingency plan should include the following:  - Locations of the sensitive receivers in vicinity of the	Water Quality Control	DSD			<b>V</b>	WPCO;     TM –Effluent     Standards for
	<ul><li>emergency discharge;</li><li>A list of relevant governmental bodies to inform of and to ask</li></ul>						Effluents Discharged into
	for assistance in the event of an emergency discharge, including key contact persons and telephone numbers;						Drainage and Sewerage Systems, Inland
	Reporting procedures required in the event of an emergency discharge;						and Coastal Water
	Responsibility and procedure for clean-up of the affected water body/sensitive receivers after the emergency discharge; and						
	Procedures listing the most effective means in rectifying the breakdown of the pumping station to minimize the discharge duration.						



Table C4 Implementation Schedule of Recommended Mitigation Measures – Waste Management Implication

EIA Ref.	Recommended Environmental Protection Measures/ Mitigation Measures	Objectives of the recommended measures & main concerns to address	Who to implement the	When to implement the measures?			What requirements or standards for the
			measures?	D	С	0	measures to achieve?
Construction Phase (U	pgrading Works of Cheung Chau STW and Pak She SPS (DP Comp	oonent) and Sewers Work	s (non-DP Compor	ent))	11		
S.6.6.1	The Contractor shall prepare a Waste Management Plan in accordance with the requirements set out in the ETWB TCW No. 19/2005, Waste Management on Construction Site, for the ER's approval. The WMP shall include monthly and yearly Waste Flow Tables that indicate the amounts of waste generated, recycled and disposed of (including final disposal site).	Waste management during construction	Contractors		<b>V</b>		ETWB TCW No. 19/2005, Waste Management on Construction Sites
S.6.6.1	The Contractor's waste management practices and effectiveness shall be audited by the Engineer's Representative on regular basis.	Waste management during construction	DSD		√		Waste Disposal Ordinance
S.6.6.1	The Contractor shall provide training for site staff concept of site cleanliness and appropriate waste management procedures, including waste reduction, reuse and recycling.	Waste management during construction	Contractors		V		Waste Disposal Ordinance
S.6.6.1	Sufficient waste disposal points and regular collection of waste shall be provided.	Waste management during construction	Contractors		√		Waste Disposal Ordinance
S.6.6.1	Trucks with covering for the open-box bed and enclosed container shall be used to minimise windblown litter and dust during transportation of waste.	Waste management during construction	Contractors		V		Waste Disposal Ordinance
S.6.6.1	Regular cleaning and maintenance programme for drainage systems, pumps and oil interceptors.	Waste management during construction	Contractors		√		Waste Disposal Ordinance



EIA Ref.	Recommended Environmental Protection Measures/ Mitigation Measures	Objectives of the recommended measures & main	Who to implement the measures?	When to implement the measures?			What requirements or standards for the
		concerns to address	illedSuleS?	D	С	0	measures to achieve?
S.6.6.1	Separation of chemical wastes for special handling and appropriate treatment at a Chemical Waste Treatment Facility (CWTF).	Waste management during construction	Contractors		√		Waste Disposal (Chemical Waste) (General) Regulation
S.6.6.1	Encourage collection of aluminium cans, paper and plastic bottles by providing separate labelled bins to enable these wastes to be segregated from other general refuse generated by the workforce.	Waste management during construction	Contractors		√		Waste Disposal Ordinance
S.6.6.1	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.	Waste management during construction	Contractors		√		Waste Disposal Ordinance
S.6.6.1	A recording system for the amount of wastes generated, recycled and disposed (including disposal sites) should be proposed.	Waste management during construction	Contractors		√		Waste Disposal Ordinance
S.6.6.1	Plan and stock construction materials to minimise amount of waste generated and avoid unnecessary generation of waste.	Waste management during construction	Contractors		√		Waste Disposal Ordinance
S.6.6.2	Alternatives C&D materials such as steel frameworks and plastic fencing can be considered to increase the chances for reuse.	Waste management during construction	Contractors		√		Waste Disposal Ordinance
S.6.6.3	In order to minimise the potential environmental impacts resulting from collection and transportation of C&D materials for off-site disposal, the excavated materials comprising fill materials should be reused on-site as backfilling materials as far as practicable.	Waste management during construction	Contractors		√		Waste Disposal Ordinance



EIA Ref.	Recommended Environmental Protection Measures/ Mitigation Measures	Objectives of the recommended measures & main	Who to implement the measures?	When to implement the measures?			What requirements or standards for the
		concerns to address	illeasules ?	D	С	0	measures to achieve?
S.6.6.4	C&D waste, such as wood, plastic, steel and other metals should be reused or recycled and, as a last resort, disposed of to landfill sites. A suitable area should be designated within the site for temporary stockpiling of C&D materials and to facilitate the sorting process. In order to monitor the disposal of C&D materials at the designated public fill reception facility and landfill and to control fly-tipping, a trip ticket system should be included. Reference can be made to Development Bureau Technical Circular (Works) (TC(W)) No. 6/2010 for details.	during construction	Contractors		√		Development Bureau Technical Circular (Works) (TC(W)) No. 6/2010, Waste Disposal Ordinance
S.6.6.5	The C&D materials to be disposed of at public filling reception facilities shall be only materials consist of brick, concrete, cement plaster, soil and inert building debris. The materials shall be free from plastics, chemical waste, industrial metals and other materials that are considered unsuitable at the facility.	Waste management during construction	Contractors		1		Waste Disposal Ordinance
S.6.6.6	General refuse should be stored in enclosed bins or compaction units separate from C&D materials. A reputable waste collector should be employed by the contractor to remove general refuse from the site regularly, separately from C&D materials. An enclosed and covered area is preferred to reduce the occurrence of 'wind blown' light materials. In addition, a sufficient number of enclosed bins shall be provided on site for containment of general refuse to prevent visual impacts and nuisance to the sensitive surrounding.	Waste management during construction	Contractors		<b>V</b>		Waste Disposal Ordinance



EIA Ref.	Recommended Environmental Protection Measures/ Mitigation Measures	Objectives of the recommended measures & main concerns to address	Who to implement the measures?	When to implement the measures?			What requirements or standards for the
			measures?	D	С	0	measures to achieve?
S.6.6.7	For the disposal of chemical wastes produced at the construction site, the Contractor is required to register with the EPD as a Chemical Waste Producer and to follow the requirements 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. Appropriate labels should be securely attached on each chemical waste container indicating the chemical characteristics of the chemical waste, such as explosives, flammable oxidizing, irritant, toxic, harmful, corrosive, etc. The Contractor shall also use a licensed waste collector engaged to transport and dispose of the chemical wastes in accordance with the Waste Disposal (Chemical Waste) (General) Regulation.	Waste management during construction	Contractors		٧		Waste Disposal (Chemical Waste) (General) Regulation
S.6.6.8	Chemical toilets to be provided on-site shall be regularly cleaned and the night-soil collected and transported by a licensed contractor to a Government Sewage Treatment Works facility for disposal.	Waste management during construction	Contractors		√		Waste Disposal Ordinance
Operational Phase (U	pgrading Works of Cheung Chau STW and Pak She SPS (DP Comp	onent))			•		
S.6.6.9	The major waste generated during the operational phase will be screenings, silt and debris, grits and dewatered sludge. The screenings, silt and debris and grits are considered similar in nature to general refuse and will be disposed of at landfill sites regularly by a reputable waste collector to reduce pest, odour and litter impacts. As the project will be commissioned in 2019, it is expected that dewatered sludge will be disposed of at Sludge Treatment Facilities regularly.	Waste management during construction	DSD			√ 	Waste Disposal Ordinance
S.6.6.10	For chemical waste generated during the operational phase, the handling procedures and disposal method are the same as those presented in Section 6.6.7 of EIA.	Waste management during construction	DSD			<b>V</b>	Waste Disposal (Chemical Waste) (General) Regulation



# Table C5 Implementation Schedule of Recommended Mitigation Measures - Cultural Heritage

EIA Ref.	Recommended Environmental Protection Measures/ Mitigation Measures	Objectives of the recommended measures & main concerns to	Who to implement the measures?	When to implement the measures?			What requirements or standards for the measures to
		address	modour co :	D	С	0	achieve?
Construction Phase (S	Sewers Works (non-DP Component))						
S.10.3.15, S.10.3.22	Undertake an archaeological watching brief programme at Tai San Street, Tai San Back Street, Chung Hing Street and Chung Hing Back Street, Cheung Chau Rock Carving and Tung Wan Road. Note: Archaeological Watching Brief should be undertaken by a qualified archaeologist, who must apply for a licence under the Antiquities and Monuments Ordinance (Cap. 53) from the Antiquity Authority before the commencement of archaeological fieldwork.	Identification, retrieval and recording of potential archaeological material and deposits.	DSD and Contractors		V		EIAO-TM and Antiquities and Monuments Ordinance
S.10.3.16 to S.10.3.19 and S.10.3.23 to S.10.3.26	Since the proposed works area is at a distance of at least 6m from the Rock Carving, and the constructor is not allowed under the contract to carry out any works outside of the designated works area. Buffer zone should be provided to ensure that the Declared Monument and its environs are not infringed upon during the construction works.	Prevention of damage to the rock carving from contact with equipment and machinery during the construction works.	DSD and Contractors		√		EIAO-TM and Antiquities and Monuments Ordinance
	Within the buffer zone, construction works as well as storage of construction materials are not allowed. Erection of temporary fencing/barriers to demarcate the buffer zone is not required.						
	In addition, access to the rock carving should be maintained and directional signages should be erected or installed at appropriate location(s) near the rock carving to facilitate visitors to access the rock carving during the construction phase.						
	In addition, periodic monitoring of the declared monument is recommended. It is recommended to conduct inspection of the site every 3 months during the construction phase. Inspection record supplemented with the site photos showing the condition of the overall declared monument should be submitted to AMO for record purposes.						
	For auditing purposes the Independent Environmental Checker (IEC) must ensure that the above periodic monitoring is conducted properly and that the information from the site inspection is delivered promptly to the Engineer and the AMO.						



EIA Ref.	Recommended Environmental Protection Measures/ Mitigation Measures	Objectives of the recommended measures & main concerns to	Who to implement the measures?	When to implement the measures?			What requirements or standards for the measures to
		address	illeasules:	D	С	0	achieve?
S.10.4.32 to S.10.4.33	Condition survey must be carried out by qualified building surveyor or engineer in advance of works for Graded Historic Buildings and structures and Nil Grade heritage structures that may be affected by ground borne vibration.  The condition survey report for Graded Historic Buildings must be submitted to AMO before construction activities commence. The contractor must implement the approved monitoring and precautionary measures.	Records of the existing structures, identification of fragile elements, and recommend monitoring and precautionary measures if necessary	DSD and Contractors		√		EIAO-TM
S.10.4.34	Conduct vibration monitoring on structures as stated in the requirements of the condition survey report.	Prevention of damage from ground borne vibration during the construction phase.	DSD and Contractors		V		EIAO-TM
S.10.4.35	A buffer zone should be provided to separate the building from the construction works. The buffer zone should be clearly marked out by temporary fencing. The buffer zone should be made as large as the site restrictions allow.	Prevention of damage to heritage structures	DSD and Contractors		V		EIAO-TM
S.10.4.36	Provision of protective covering for external surfaces of heritage structures that are situated 5 m or closer to construction works.	Prevention of damage to heritage structures from contact with equipment and machinery during the construction works	DSD and Contractors		√		EIAO-TM
S.10.4.37	Provision of safe public access to temples, shrines, ancestral halls and any other heritage buildings and structures for public use that are 5 m or closer to construction works.	To ensure the safety of members of the public when using heritage structures during the construction works	DSD and Contractors		V		EIAO-TM
Operational Phase				•			
N/A	None specific	N/A	N/A	N/A	N/A	N/A	N/A



## Table C6 Implementation Schedule of Recommended Mitigation Measures - Landscape & Visual

EIA Ref.	Recommended Environmental Protection Measures/ Mitigation Measures	Objectives of the recommended measures & main concerns to address	Who to implement the		to impl measur		What requirements or standards for the
			measures?	D	С	0	measures to achieve?
Construction Phas	e (Upgrading Works of Cheung Chau STW (DP Component))						
Table 11.8	Visual Screen/Hoarding  Decorative hoarding or boundary fence for construction sites shall be considered, and designed to be compatible to the surroundings.	To minimise the potential visual impacts	Contractors		V		N/A



EIA Ref.	Measures recommended measures	_	•			to impl measu		What requirements or standards for the
		address	measures?	D	С	0	measures to achieve?	
Table 11.8	Protection to Existing Trees within Works Areas  All existing trees which are not in direct conflict with the proposed works will be retained. The existing trees proposed to be retained shall be properly maintained and protected by means of fencing to prevent vehicular or pedestrian intrusion that may potentially damage tree canopies, trunks and root zones. Detailed tree protection specifications shall be allowed and included in the Contract Specification, which specifying the tree protection requirement, submission and approval system, and tree monitoring system. For trees with high preservation value, individual tree assessments and continuous tree monitoring reports shall be provided by a certified Arborist, Landscape Architect or related professional during construction. All retained trees shall be recorded photographically at the commencement of contract.  Root pruning to the retained trees should be prohibited. Retained trees should be well-preserved by setting up a tree protection zone throughout the construction period for protecting the retained trees from damages.  To maximize protection to existing trees and ground vegetation, construction contracts may designate "No-intrusion Zone" to various areas within the site boundary with rigid and durable fencing for each individual no-intrusion zone. The contractor should close monitor and restrict the site working staff not to enter the "no-intrusion zone", even for non-direct construction activities and storage of equipment.	Landscape mitigation measures	DSD and Contractors	√	<b>V</b>		EIA, Annex 10 and Annex 18 of EIAO- TM	



EIA Ref.	Recommended Environmental Protection Measures/ Mitigation Measures	Objectives of the recommended measures & main concerns to	Who to implement the	When to implement the measures?			What requirements or standards for the
		address	measures?	D	С	0	measures to achieve?
Table 11.8	Tree Transplanting  Existing trees to be affected shall be directly transplanted to the proposed tree receiving sites, or to temporary tree nurseries alternatively. Temporary tree nurseries may be set up for the transplanted tree and proposed trees at an early stage to allow small trees to grow during the construction stage. By the time when planting area becomes available, trees have been mature and required minimal pruning and suffer much less damage during transplanting. The construction programme should also allow sufficient time for root pruning and root ball preparation prior to transplanting, if necessary, and transplanting operations to be carried out in planting season.  Tree pruning such as topping, lion tailing would be prohibited as far as possible. Also, frequent keep watering would be necessary for transplanting trees. The proposed tree preservation measures during construction would be carried out and approved by the competent persons.	Landscape mitigation measures	DSD and Contractors	√ ·	√ ·		EIA, Annex 10 and Annex 18 of EIAO- TM
Table 11.8	Construction Light  Security floodlight for construction areas shall be controlled, such as equipped with adjustable shield, frosted diffusers and reflective covers, at night to avoid excessive glare to the nearby areas and residents.  Other security measures shall also be considered to minimize the visual impacts by construction light.	To reduce the night-time glare effect to the surrounding environs.	Contractors		<b>√</b>		EIA, Annex 10 and Annex 18 of EIAO- TM



EIA Ref.	Recommended Environmental Protection Measures/ Mitigation Measures	Objectives of the recommended measures & main concerns to	Who to implement	When to implement the measures?			What requirements or standards for the
		address	the measures?	D	С	0	measures to achieve?
Table 11.8	Dust and Erosion Control for Exposed Soil  Excavation works and demolition of existing building blocks shall be well planned with precautions to suppress dust. Exposed soil shall be covered or watered often. Areas that are expected to be left with bare soul for a long period of time after excavation shall be properly covered with suitable protective fabric. Suitable drainage shall be provided around construction sites to avoid discharge of contaminants and sediments into sensitive water-based habitats.	To minimise the disturbance to existing landscape resources and minimise the impacts on the visual amenity of the area	Contractors		√		EIA, Annex 10 and Annex 18 of EIAO- TM
Table 11.8	Reinstatement of Works Areas  The affected works areas shall be properly reinstated to the satisfaction of relevant government departments.	Landscape mitigation measures	Contractors		1		EIA, Annex 10 and Annex 18 of EIAO- TM
Operational Phas	e (Upgrading Works of Cheung Chau STW (DP Component))		-			•	
Table 11.9	Architectural and Landscape Design  The appearance of the proposed structures shall be properly designed, including a careful selection of material, colour and texture, so as to fit into the existing suburban, natural to semi-natural surroundings. The aesthetic design of the proposed structures will follow the requirements in the Guidelines on Aesthetic Design of Pumping Station Buildings and submitted to Vetting Committee on Aesthetic Design of Pumping Station Buildings (VCAB) for approval in accordance with DSD TC No. 9/2006, and circulated to ASD for comment in accordance with ETWB TCW No. 8/2005. Sufficient planting shall be considered and provided around the boundary fence of the proposed buildings for screening. Buffer planting will also be considered during the detailed design.		DSD	√		√ 	EIA, Annex 10 and Annex 18 of EIAO- TM



EIA Ref.	Recommended Environmental Protection Measures/ Mitigation  Measures  Measures  Measures  Measures  Measures  Measures  Measures		Who to implement the		•	implement What requirements o standards for the	
		address	measures?	D	С	0	measures to achieve?
Table 11.9	Establishment Period  A 12-month establishment period for the soft landscape works shall be allowed in the main contract for contractor to carry out routine horticultural operations, including watering, pruning, weeding, pest control, replacement of dead plants etc. to ensure healthy establishment of new planting during a 12 month establishment period. This period can also serves as a kind of warranty/guarantee on the quality of the plants supplied and installed by the contractor. Monthly monitoring during the first year of establishment period is recommended.	from the construction of the proposed works, visually integrate the proposals within its existing landscape	DSD and Contractors			V	EIA, Annex 10 and Annex 18 of EIAO- TM

Notes: D – Design, C – Construction, O - Operation

BD - Building Ordinance

ETWB TCW - Environmental and Transport Works Bureau Technical Circular

HKPSG – Hong Kong Planning Standards and Guidelines

EIAO-TM - Technical Memorandum on Environmental Impact Assessment Process

TPO - Town Planning Ordinance

WBTC - Works Bureau Technical Circulars



Appendix D

Methodology for Archaeological Watching Brief (AWB)



## Appendix D Methodology for Archaeological Watching Brief (AWB)

### 1. Introduction

Archaeological Watching Brief (AWB) is a form of mitigation which is required when engineering works impact on areas that have been assessed as having some degree of archaeological potential and where conventional testing methods are deemed insufficient. The range of archaeological resources that require monitoring include both historical and prehistoric material and features.

An AWB should be undertaken by a qualified and licensed archaeologist during engineering groundworks works during the construction stage. A qualified archaeologist should inspect the site at an interval that will depend upon the archaeological potential of the area in question and the nature and duration of the construction programme. Details of the frequency of inspection will be provided to AMO for review and comment once the detailed construction programme has been finalised. A construction programme should be provided to the archaeologist carrying out such Watching Brief prior to the commencement of site works in order to arrange the inspection schedule. The archaeologist should be notified no less than 3 working days prior to any changes to the construction programme so that arrangements can be made to monitor the works. The Engineer should facilitate arrangements and liaise between the archaeologist and construction contractor.

The Watching Brief process entails the observation of the engineering works by qualified archaeologists in order to identify any archaeological material or features revealed during engineering groundworks. Site staff within the project area should inform the archaeologist in case of discovery of antiquities in the course of excavation works. Upon identification of such material or features the archaeologists will require immediate access to the excavation area for recording of the material/features *in situ*, artefact/ecofacts retrieval and sample collection. The archaeologist should recommend and agree with AMO appropriate mitigation measures/follow up action(s) including arranging more time and resources to conduct necessary archaeological works.

These guidelines serve two basic purposes: firstly, to ensure that the archaeological resources are adequately recorded and recovered and secondly, that appropriate measures are taken on site to create a minimum of delays to the engineering schedule.

### 2. Detailed Methodology of the Archaeological Watching Brief (AWB)

#### 2.1 Watching Brief Personnel & Licence Requirements

Watching Brief should be undertaken by a qualified archaeologist, who must apply for a licence under the Antiquities and Monuments Ordinance (Cap. 53) from the Antiquity Authority before the commencement of archaeological fieldwork. Such licences are valid for a period of 12 months, and for projects lasting longer than one year it will therefore be necessary to renew the licence. In order to facilitate such licence renewal, the archaeologist must provide with the application an interim report summarising the works conducted and findings made during the existing licence period. All staff employed by the archaeologist must be suitably qualified and experienced for their roles.

#### 2.2 Areas to be monitored

The areas which require AWB must be defined and submitted by the qualified archaeologist under the project and agreed with AMO prior to commencement of works.



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#### 2.3 Site access

Archaeologists should be allowed reasonable access to relevant areas of engineering groundworks, so that deposits can be examined and recorded. Trenches may require temporary shoring and engineering groundworks might need to be temporarily rescheduled, to provide a safe environment for such works. Provision should be made, at the earliest stage of construction programming, for specific blocks of time to be available for unrestricted archaeological access to areas of groundworks in the identified area of archaeological potential.

## 2.4 Monitoring and retrieval methodology

The table below shows the various categories of archaeological material and features that are most likely to occur in local contexts. Also listed are the recommended type and degree of recording and retrieval required for each category.

CATEGORIES OF ARCHAEOLOGICAL MATERIALS	Retrieval & Recording Procedures
1. HUMAN BURIAL	Full Recording & Recovery of Human Remains & Associated Artefacts & Ecofacts
Skeletal remains Items associated with human burial, i.e. grave goods	<ul> <li>Complete recording by photography, drawing, written description</li> <li>Full measurement of burial and surrounding matrix</li> <li>Retrieval of human remains and associated artefacts &amp; ecofacts</li> <li>Retrieval of surrounding soil for further analysis</li> </ul>
2. INTACT FEATURES	Full Recording of Archaeological Features & Recovery of Artefacts/Ecofacts
Structural/architectural remains Undisturbed contexts, e.g. hearth, midden, habitation area, assemblages of artefacts and/or environmental material	<ul> <li>Recording and measurement of salient features by photography, drawing and written description</li> <li>Retrieval of artefacts &amp; ecofacts</li> <li>Retrieval of samples from the surrounding matrix</li> </ul>
3. INTACT ARTEFACTS	Recovery of Artefacts & Record of Matrix
Complete objects, e.g. pottery, metal objects, stone and bone tools. The objects are complete but isolated and are not part of assemblage of feature	<ul> <li>Retrieval of objects</li> <li>Recording by written description, drawing and photography</li> <li>Sampling of surrounding matrix</li> </ul>
4. ISOLATED & FRAGMENTARY MATERIAL	Recovery of Archaeological Material & Recording as Appropriate
Pottery sherds, non-human bone, other artefact fragments (e.g. metal, tile, glass). There are no complete objects, the material	<ul> <li>Retrieval of fragmentary artefacts &amp; ecofacts</li> <li>Recording by written description, drawing and photography, as appropriate</li> </ul>



CATEGORIES OF ARCHAEOLOGICAL MATERIALS	Retrieval & Recording Procedures
is isolated and fragmentary in nature	<ul> <li>Sampling of surrounding matrix</li> </ul>
5. DEPOSITS WITH ARCHAEOLOGICAL POTENTIAL	Sampling of Deposit
Soil deposits which exhibit characteristics associated with archaeological remains in Hong Kong	<ul> <li>Recording of soils by photography and written description</li> </ul>
	<ul> <li>Collection of soil samples from deposits displaying archaeological potential</li> </ul>

Any archaeological materials recovered during the programme should be properly recorded and submitted to the AMO. Upon the discovery of significant archaeological remains, the qualified archaeologist will contact immediately both the AMO informing them of the discovery and the Site Engineer to ensure a temporary suspension of works. The archaeologist is required to prepare a written brief regarding the findings upon the request from the AMO. Any follow-up works, if required, should be conducted following consultation and agreement with the AMO.

## 2.5 Recording forms for Archaeological Watching Brief (AWB)

Full and proper records (written, graphic, electronic and photographic as appropriate) should be made for all work undertaken. Standardised forms are used for the recording of any archaeological material identified during the AWB and these would typically include the following:

- Registers to record the finds, special finds, contexts, photographs, drawings, levels and samples;
- Context description forms; and
- A daily record form designed specifically for AWB. This form must locate clearly the area of works monitored, the nature and extent of the works, and summaries of the day's findings all cross-referenced to register numbers used that day.

#### 2.6 Safety requirements

Archaeologists and staff employed in monitoring must follow the safety procedures enforced by the contractors on site.

## 2.7 Archaeological Watching Brief Report

The procedures and result of the AWB should be presented in report form, following standards set by the AMO for reports on other types of archaeological field work. This includes details of the overall programme, methodology, sampling strategy, implementation, findings and interpretation. The report should be submitted to the AMO for approval in draft and, following resolution of any comments, in final form. All data, material and records forming the site archive must be submitted to the AMO upon completion of the project. The Watching Brief report should contain, as a minimum, the following elements:

- Non-technical summary
- Site location (including maps and relevant drawings) and descriptions
- Context of the project



- Geological and topographical background
- Archaeological and historical background
- General and specific aims of field works monitoring
- Reference to relevant legislation
- Field methodology
- Results
- Conclusion
- Recommendations
- Appendices and supporting illustrations including maps, drawings, photos of site and finds
- References

In addition to the draft and final Watching Brief Report, periodic progress reports will be compiled for the separate works areas and submitted to AMO. The duration which each progress report should cover is to be decided in agreement with AMO, bi-monthly progress reports are proposed.

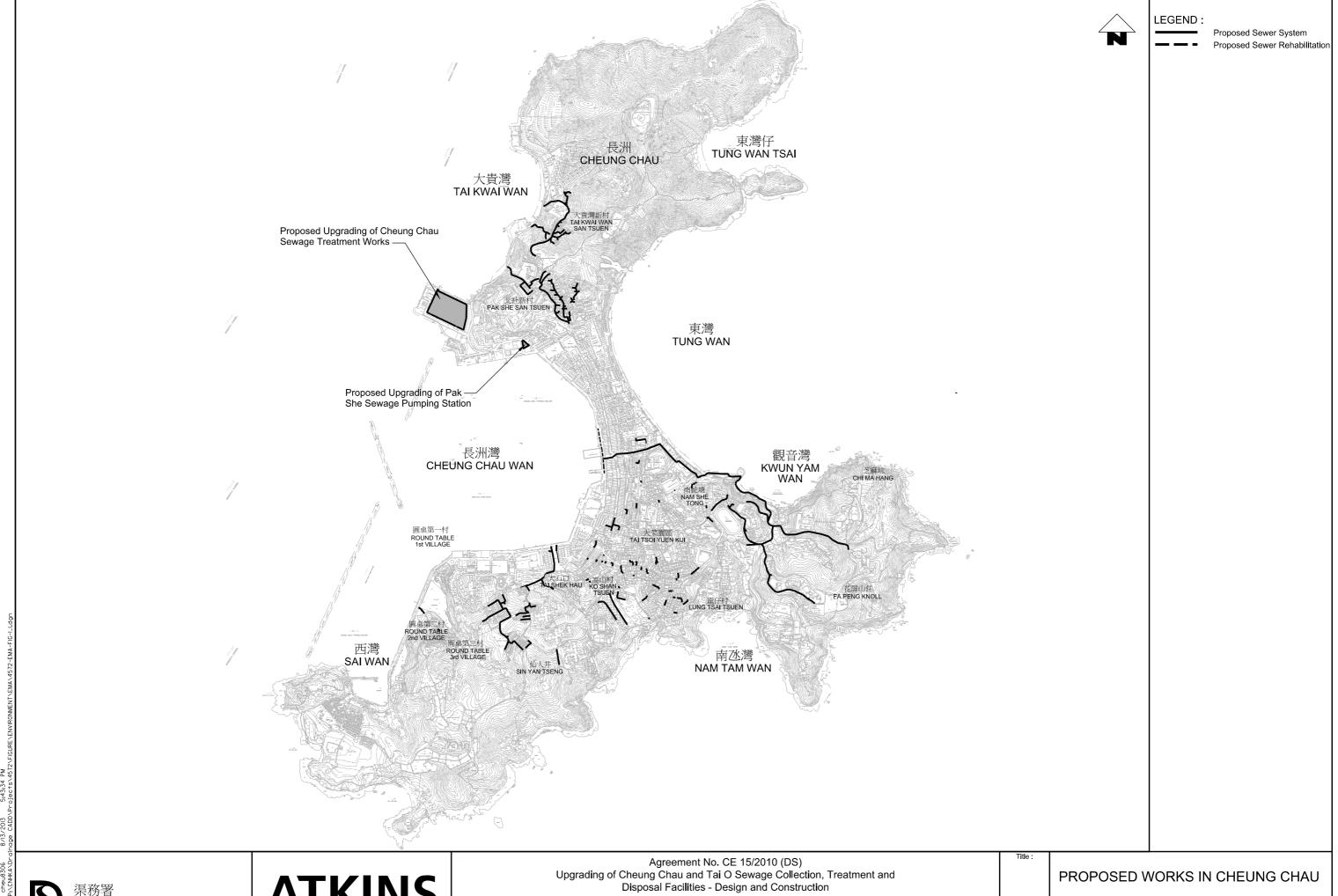
#### 2.8 Mitigation Measures

The Contractor should be sufficiently flexible to allow any necessary contingency arrangements to be implemented. Should significant archaeological materials be discovered, appropriate mitigation measures will be designed and implemented with the prior approval of the AMO.



# **Figures**





DRAINAGE SERVICES DEPARTMENT

**ATKINS** 

Outlying Islands Sewerage Stage 2 - Upgrading of Cheung Chau Sewage Collection, Treatment and Disposal Facilities

1.1 August 2013

