

4.1 WATER QUALITY PARAMETERS

This section outlines the requirements, methodology, equipment, monitoring locations and mitigation measures for the monitoring of water quality impacts from the construction of Eastern MDC to detect any deterioration of water quality. The monitoring shall be carried out by the ET Leader to ensure that any deteriorating water quality could be readily detected and action be taken in time to rectify the situation. The parameters to be monitored shall include the following:

Table 4.1a Water Quality Parameters

Parameter	Type of Analysis
Dissolved Oxygen (mg L^{-1} and % saturation)	} In situ measurement
Temperature ($^{\circ}\text{C}$)	
pH value	
Turbidity (NTU)	
Water Depth (m)	
Suspended Solids (mg L^{-1})	} laboratory analysis
Ammoniacal nitrogen (mg L^{-1})	

These parameters are selected for monitoring on the following basis:

- to reflect the background water quality near and within the working area; and
- the nature of the construction activities

In association with the water quality parameters, relevant data shall also be measured, including monitoring location/position, time, weather conditions, and any special phenomena and work underway at the construction site.

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

4.2 MONITORING EQUIPMENT

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

4.2.1 Dissolved Oxygen and Temperature Measuring Equipment

Dissolved oxygen and temperature measuring equipment

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

- a dissolved oxygen level in the range of 0-20 mg/l and 0-200% saturation; and
 - a temperature of 0-45 degree Celsius.
- (b) It shall have a membrane electrode with automatic temperature compensation complete with a cable. Sufficient stocks of spare electrodes and cables shall be available for replacement where necessary. (e.g. YSI model 59 meter, YSI 5739 probe, YSI 5795A submersible stirrer with reel and cable or an approved similar instrument).
- (c) Should salinity compensation not be built-in in the DO equipment, in-situ salinity shall be measured to calibrate the DO equipment prior to each DO measurement.

4.2.2 *Turbidity Measurement Instrument*

The instrument shall be a portable, weatherproof turbidity-measuring instrument complete with 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).

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

4.2.3 *Suspended Solids*

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

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

4.2.4 *Water Depth Detector*

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

4.2.5

Water Sampling Equipment

A water sampler, consisting of a transparent PVC or glass cylinder of not less than two litres which can be effectively sealed with cups at both ends, shall be used. The water sampler shall have a positive latching system to keep it open and prevent premature closure until released by a messenger when the sampler is at the selected water depth (e.g. Kahlsico Water Sampler 13SWB203 or an approved similar instrument).

4.2.6

Location of the Monitoring Stations

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

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

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

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

4.3

LABORATORY MEASUREMENT / ANALYSIS

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

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

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

4.4

MONITORING LOCATIONS

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

From the commencement of excavation works water quality monitoring shall be carried out at all points where construction site runoff enters the surface drainage system. The monitoring location at the ultimate discharge point of the Eastern Channel is Shenzhen River. The monitoring location for the mixing zone with Shenzhen River (WM3) is taken to be 10 m downstream from the point at which the discharge water will meet the Shenzhen River, with one control station 25 m upstream (WM4). In terms of monitoring the water quality at the existing streams, two monitoring locations are chosen, one control station at 25 m upstream of the proposed channel excavation (WM1) and one at 50 m downstream of the channel excavation (WM2). Other discharge monitoring points shall be determined during the detailed design.

All measurements of temperature, dissolved oxygen concentration, dissolved oxygen saturation and turbidity shall be taken *in situ* at surface and bottom of the water column at the monitoring locations except that when the water column at the monitoring station is less than 1.5 m at the time of sampling, then only one sample should be taken from the middle of the water column (e.g. inland streams). Surface sample shall be taken within 0.5 m of the surface of the water and bottom samples shall be taken no closer than 0.5 m to the river bed. Three measurements at each depth of each station shall be taken.

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

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

- (c) for monitoring locations located in the vicinity of the sensitive receptors, care shall be taken to cause minimal disturbance during monitoring;
- (d) two or more control stations which shall be at locations representative of the project site in its undisturbed condition. Control stations shall be located, as far as is practicable, both upstream and down stream of the works area.

4.5

BASELINE MONITORING

Baseline conditions for water quality shall be established and agreed with EPD prior to the commencement of works. The purposes of the baseline monitoring are to establish ambient conditions prior to the commencement of the works and to demonstrate the suitability of the proposed impact, control and reference monitoring stations. The baseline conditions shall normally be established by measuring the water quality parameters specified in *Section 4.1*. The measurements shall be taken at all designated monitoring stations including control stations, during mid ebb tide, for 4 days per week for 4 consecutive weeks, applicable with a period of six weeks prior to commencement of the works.

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

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

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

4.6

IMPACT MONITORING

Construction Phase

During the course of the construction for the MDC, monitoring shall be undertaken twice per week at mid tides during the first three months. If exceedance are not recorded during that period, the monitoring frequency can then be reduced to once per week at mid ebb tides, with sampling/measurement at the designated monitoring stations. However, the ET Leader should report and seek approval from EPD before changing the monitoring frequency.

All monitoring information including date and time, weather conditions, operator, identification and description of monitoring locations, works, progress and construction activities, sample ID, method, analytical data and calculation etc, shall be recorded in the monitoring data sheet.

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

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

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

Table 4.7a *Discharge Standards for Water Quality*

<i>Parameters</i>	<i>Discharge Standard</i>
DO in mg/l (depth-averaged)	4 mg/l
SS in mg/l (depth-averaged)	20 mg/l
Turbidity (Tby) in NTU (depth-averaged)	N/A
Ammoniacal nitrogen (NH ₄) (depth-averaged)	0.021 as unionised form

Table 4.7b Event and Action Plan for Water Quality

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

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

The Contractor shall be aware of and comply with the *Buildings Ordinance*, the *Water Pollution Control Ordinance* and the *Technical Memorandum Standards for Effluent Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters*.

The following mitigation measures should be complied by during construction (by Contractor) and operation (by DSD) phases of Eastern MDC.

4.8.1

Construction Phase

To safeguard the water quality of the sensitive receivers within and downstream of San Tin villages during construction, the Contractor should implement mitigation measures. EPD Practice Note for Professional Persons, Construction Site Drainage (ProPECC PN 1/94) provide advice on how to handle and reduce construction site discharge.

Excavation of Drainage Channel

Excavation of the existing stream is confined at the beginning the Eastern MDC (Castle Peak Road). Excavation within the stream channel, disposal and fill activities is likely result in deteriorated water quality through turbidity and increased concentration of contaminants. The Contractor will be required to minimise adverse impacts on water quality resulting from excavation and marine disposal activities.

Remove the stream sediment from dried area first, and carry out lining working in these sections. Divert water flow onto prepared channel lining, dry sediment in other sections and remove the sediment from behind bund or dam.

If excavation on wet stream is not avoidable, the Contractor should implement the following:

- (a) minimise disturbance to the river bed while excavating;
- (b) minimise leakage of excavating material during lifting;
- (c) prevent loss of material during transport of excavated material;
- (e) prevent discharge of excavated material except at approved locations;
- (f) prevent the avoidable reduction, due to the works, of the dissolved oxygen content of the water adjacent to the works; and
- (g) minimise deterioration in the water quality which may cause adverse effects on marine fauna and flora.

To minimise the leakage and loss of sediments during excavation, tightly sealed closed grab excavators should be employed in river sections where material to be handled is wet. Where material is dry and in non-river sections, conventional excavators can be used.

Works Timing

It is considered that excavation at existing stream course should be undertaken during periods of low flow (dry season). These temporal restrictions in the works would minimise downstream impacts on sensitive water bodies. However, the programme should also take into account other construction stage environmental issues such as air (dust and odour) and noise.

Construction Runoff and Drainage

Exposed soil areas should be minimised to reduce the potential for increased siltation, contamination of run-off and erosion. Site run-off should not be directed to fishponds. Construction run-off impacts associated with above ground construction activities can be readily controlled through the use of appropriate mitigation measures which include:

- temporary ditches should be provided to facilitate run-off discharge into appropriate watercourses, via a silt retention pond;
- the boundaries of earthworks should be marked and surrounded by dykes or embankments for flood protection, as necessary;
- open material storage stockpiles should be covered with tarpaulin or similar fabric to prevent material washing away;
- exposed soil areas should be minimised to reduce the potential for increased siltation and contamination of runoff;
- earthwork final surfaces should be well compacted and subsequent permanent work should be immediately preformed;
- the use of sediment traps; and
- adequate maintenance of drainage systems to prevent flooding and overflow.

All temporary drainage pipes and culverts provided to facilitate runoff discharge should be adequately designed to facilitate rapid discharge of storm flows. All sediment traps should be regularly cleaned and maintained. The temporarily diverted drainage should be reinstated to its original condition, when the construction work is completed or the temporary diversion is no longer required.

Sand and silt in wash water from wheel washing facilities should be settled out and removed before discharge into temporary drainage pipes or culverts. A section of the haul road between the wheel washing bay and the public road should be paved with backfall to prevent wash water or other site run-off from entering public road drains.

Oil interceptors should be provided in the drainage system downstream of any significant oil and grease sources. They should be regularly maintained to prevent the release of oils and grease into the storm water drainage system after accidental spillage. The interceptor should have a bypass to prevent flushing during periods of heavy rain, as specified in ProPECC PN 1/94.

General Construction Activities

Debris and rubbish on site should be collected, handled and disposed of properly to avoid water quality impacts. Requirements for solid waste management are detailed in *Section 5* of this report.

All fuel tanks and storage areas should be provided with locks and placed on sealed areas, within bunds of a capacity equal to 110% of the storage capacity of the largest tank to prevent spilled fuel oils from reaching the downstream WSRs.

Marine Disposal of Excavated Sediment

The following measures have been identified to minimise potential impacts on water quality arising during marine transportation of the excavated material (including sediment excavated from stream beds and fishponds) for marine disposal:

- The decks of all marine dumping disposal barges and floating pontoons will be kept tidy and free of oil or other substances or articles which might be accidentally or otherwise washed overboard.
- All off-site vessels and barges should be sized such that adequate clearance is maintained between vessels and the sea bed at all states of the tide to ensure that undue turbidity is not generated by turbulence from vessel movement or propeller wash.
- The works should cause no visible foam, oil, grease, scum, litter or other objectionable matter to be present on the water at the loading berth or dumping grounds.
- Special measures will be taken during transportation and disposal of all excavated material. This includes the use of water tight trucks as discussed in the Waste Management *Section 5*.

Additional provisions will be required upon confirmation that marine sediments are contaminated. The locations and depths of any areas of contaminated marine sediments should be indicated in the construction contract. The Contractor would ensure that contaminated sediments are excavated, transported and placed in approved special dumping grounds in accordance with the EPD Technical Circular No. 1-1-92, Works Branch Technical Circular (WBTC) No. 22/92 and WBTC No. 6/92.

Mitigation measures to minimise the loss of contaminated material to the water column are listed below:

- Transport of contaminated marine mud to the marine disposal grounds should be by split barge (off-site) of not less than 750 m³ capacity, well maintained and capable of rapid opening and discharge at the disposal site.
- The material should be placed in the pit by bottom dumping, at a location within the pit specified by the Fill Management Committee (FMC).

- Discharge should be undertaken rapidly and the hoppers should then immediately be closed, material adhering to the sides of the hopper should not be washed out of the hopper and the hopper should remain closed until the barge next returns to the disposal site.
- The dumping vessel should be stationary throughout the dumping operation.
- The Contractor must be able to position the dumping vessel to an accuracy of +/- 10 m.
- Barge loading should be monitored to ensure that loss of material does not take place during transportation.
- Transport barges or vessels will be equipped with automatic self monitoring devices as specified by the EPD.
- The Contractor should follow procedures as outlined in the Guidance Note for Dumping and Additional Conditions on Disposal of Contaminated Marine Mud at East Sha Chau Contaminated Mud Disposal Pits.

Sewage Effluents

Construction work force sewage is expected to be handled by portable chemical toilets along the alignment if connection to a public sanitary sewer system is not feasible. Appropriate and adequate portable toilets should be provided by licensed Contractors who will be responsible for appropriate disposal and maintenance of these facilities.

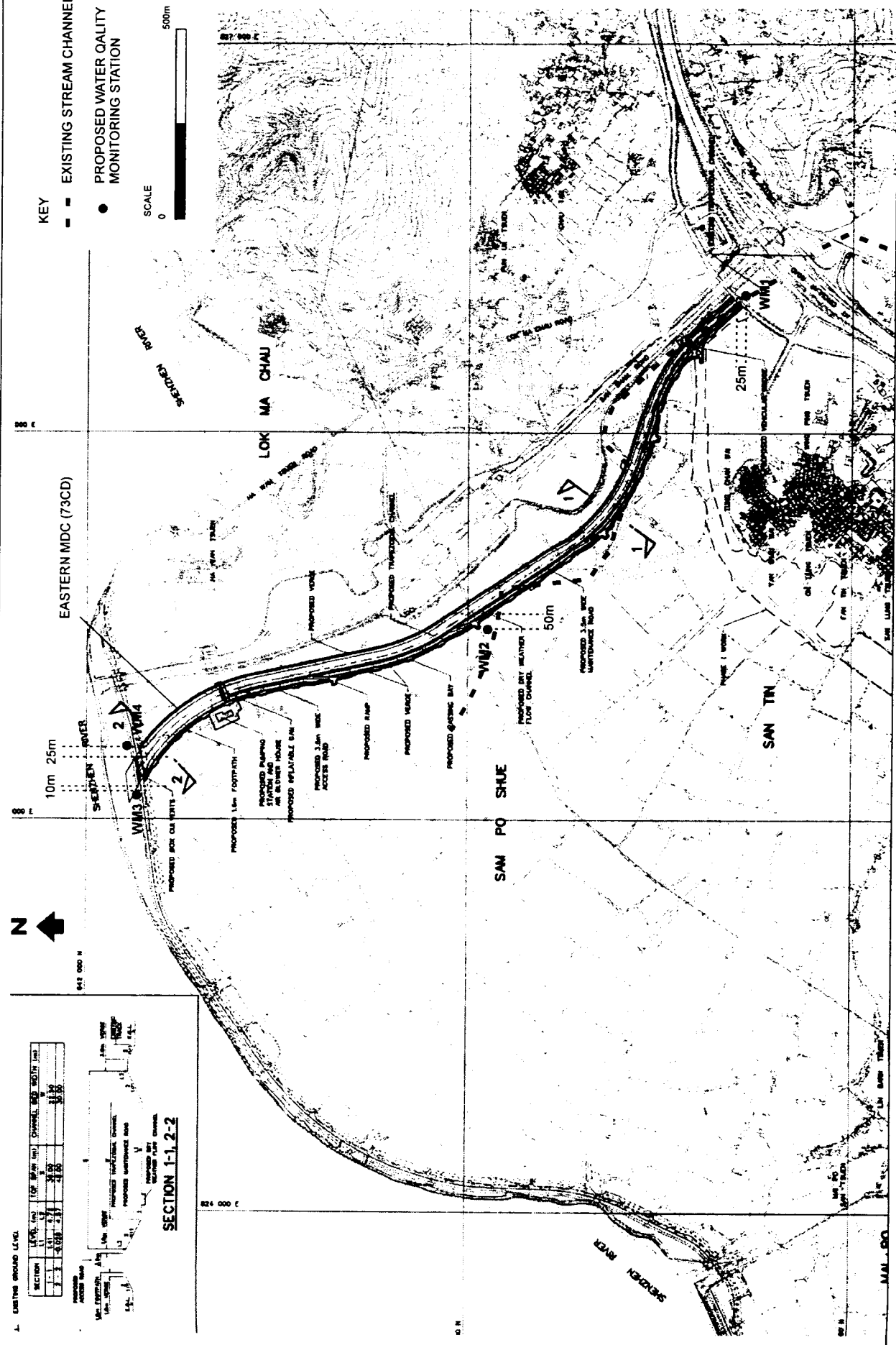
4.8.2

Operation Phase

With regard to mitigation, maintenance dredging will be undertaken on a need basis to maintain adequate flows and capacity. It will be imperative that appropriate disposal of dredged materials are handled and managed in accordance with current EPD guidelines at the time of dredging. Given the small quantity during the operation phase, it is suggested that any excavated contaminated material be stored in a water tight container before removal.

Site Specific Mitigation Measures

For works involving maintenance dredging (the removal of silt and other materials) from the Eastern MDC, a system of containment or isolation must be specified to prevent water, heavily contaminated with the removed material from being carried downstream into Deep Bay.



LOCATIONS OF PROPOSED WATER QUALITY MONITORING STATIONS

FIGURE 4.4a