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1 Environmental Monitoring and Audit

1.1 Introduction of the Project and Environmental Status

The Stage Ⅲ Project covers an area between Stage I Project (Pile No. 9+416.963) and the mouth of Ping Yuen River (River Ganges) (Chainge. 13+465.136). The length of the new river channel is 4.05 km. According to the proposed arrangement for the Project, Stage Ⅲ is to be implemented in two phases. In the Phase Ⅰ, the border patrol roads and fences will be constructed before removal of the existing border patrol roads and fences on both sides in the area affected by the Stage Ⅲ Project. The design, management and construction for the first phase will be carried out by Shenzhen and the Hong Kong on their own side. In the Phase Ⅱ, the river channel from Liu Pok, the starting location of Stage I Project, to the mouth of Ping Yuen River (River Ganges) will be regulated. The objective of the Phase Ⅱ is to improve the channel from upstream of Liu Pok Meander to the mouth of Ping Yuen River (River Ganges), including channel widening, deepening, and reprovisioning with a construction period of 42 months.

To the north of the reach of Stage III Project is Lo Wu District of Shenzhen City, where the area near the River has already been developed to an urban environment. To the south of the reach of the Project is Hong Kong New Territory, which almost remains natural except for some border patrol roads, watching towers, pumping stations, storages, ponds and farmlands.

Shenzhen River is the main water body receiving sewage from Shenzhen City and has been severely polluted. Apart from the section upstream of the mouth of Ping Yuan River remains in good condition, the water quality downstream of the reach has been too poor to comply with Class V of *Water Quality Standard for Surface Waters (GB3838-88)*. The water pollution is even worse in low-flow period. The pollutants in the River are mainly organics and the heavy metal concentration in the sediment is usually higher than that of soil in Shenzhen City. Some of them have already reached the Class C of *Hong Kong Classification of Dredged Mud for Marine Disposal (Environmental Protection Department Technical Circular (TC) No. 1-1-92)*. Air pollution in Shenzhen is also high and showing an increasing trend. The annual average of NO_x

is around 0. 033-0. 073 mg/m^3, TSP is around 0. 130-0. 197 mg/m^3, and dustfall is around 6. 23-9. 27 mg/m^3. Regional noise pollution exists in Shenzhen City. The five-year average ratio complies with the stipulated standards of 68. 2% and 74. 4% for all sorts of mixed industrial areas and on both sides of the main traffic road, respectively. However, the ratio is quite low in the residential and civic districts as well as Class I mixed districts, being only 4. 4% and 11. 3%, respectively. On Hong Kong side of the Shenzhen River is undeveloped environment with few human activities, the background level of air and noise pollution is therefore relatively low.

1. 2 Purposes of Environmental Monitoring and Audit and Requirements for Construction Activities

The purposes of an environmental monitoring and audit system are to master the environmental status and trend in all stages of the Project, to mitigate the adverse environmental impact proactively, to avoid potential impact on ecosystem during construction period, to take mitigation measures timely in the case of the ecosystem damaged. The Consultant has proposed environmental monitoring and audit guidelines for Stage III Project according to the conclusion of environmental impact assessment. In addition, experience of environmental monitoring and audit during Stage I and II of the Project has been thoroughly investigated, and opinions and suggestions from the Employer and associated departments have also been fully incorporated in the guidelines.

Environmental monitoring and audit provides not only a procedure for evaluating the impacts of construction activities on ecology and environment, but also for protecting ecology and environment to mitigate the adverse impacts. According to the guidelines, detailed requirements on obligation and measures for environmental protection which must be strictly followed by construction contractors during construction should be clearly stated in associated contracts. Moreover, at-source inspection and monitoring during the construction period should be conducted so as to ensure that the contractors strictly comply with requirements related to environmental protection and pollution control.

1. 3 Framework of Organization and Management

In order to ensure the implementation of the environmental monitoring and audit

plan, an Environmental Monitoring and Audit Team (hereafter called the ET) will be established. The members of the ET will be selected by the Employer with qualification and experience in this field and should have no conflict of interest with the Project.

The ET consists of the following members:

Leader of the ET: 1

Deputy of the ET: 1

Members:

Air quality and noise: 2

Water quality: 2

Ecology: 1

Birds: 1

Environmental chemist: 1

All the members of the ET should be full time on site and be responsible directly to Leader of the ET who is responsible to the Employer. The Engineer or the Employer should timely provide the ET Leader with construction programme so that the associated environmental monitoring can be arranged. If the construction plan is to be changed, the ET Leader should be informed in advance. The organization and management of the ET is shown in Figure 1.1:

1.4 Responsibilities

1.4.1 *Leader of the Environmental Monitoring and Audit Panel*

The responsibilities of the ET Leader include:

(1) Planning for detailed environmental monitoring according to the construction programme, examining implementation of the plan monthly. If construction programme is changed, the monitoring plan should also be modified correspondingly.

(2) Auditing the results of environmental monitoring to determine whether the asso-

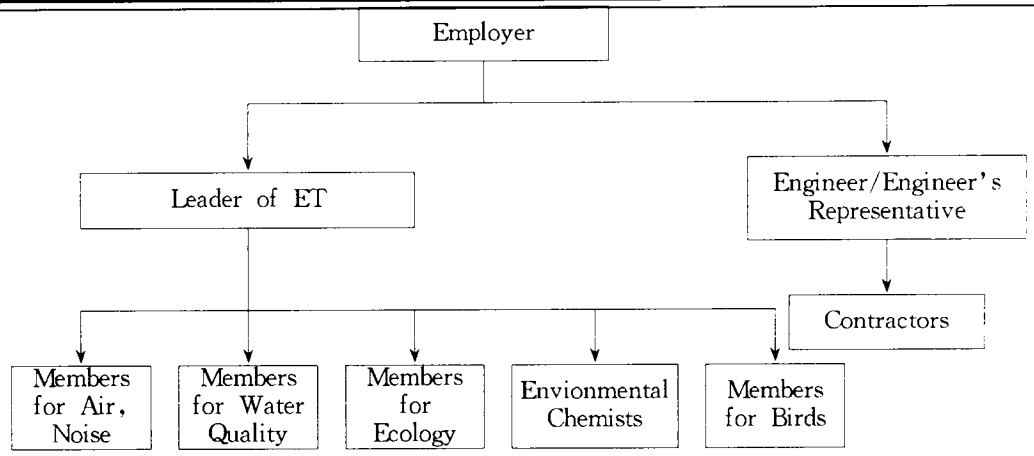

Figure 1.1 Organization and Management of the Environmental Monitoring and Audit Team

ciated environmental laws and standards are satisfied, determining the environmental status, identifying the impact sources, reporting the potential issues and proposing solutions to the issues.

(3) Enforcing implementation of the related environmental pollution control. Proposing opinions or suggestions to rectify the problems when contractor violates the environmental requirements.

(4) Enforcing implementation of the measures for mitigating environmental impact, and evaluating their effectiveness.

(5) Dealing with public complaints, investigating and responding to complaints on the Employer's behalf. Following up corrective action by contractors, if necessary.

(6) Providing monthly and quarterly environmental monitoring and audit reports to the Employer.

1.4.2 *Environmental Monitoring and Audit Team*

The duties of the ET are:

(1) To monitor the various environmental parameters as required by this EM&A Manual;

(2) To follow up and close out of the non-compliance actions;

(3) 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;

(4) To audit and prepare audit report on the environmental monitoring data and the site environmental conditions; and

(5) To report the environmental monitoring and audit results to the Contractor and the Engineer/Engineer's Representative.

1.4.3 *Engineer/Engineer's Representative*

The Engineer/Engineer's Representative shall appoint an appropriate member of the resident site staff, who shall:

(1) Monitor the contractors' compliance with contractual specifications, including the effective implementation and operation of the environmental mitigation measures.

(2) Instruct the contractors to follow the agreed protocols or those in the contractual specifications in the event of exceedances or complaints; and

(3) Comply with the agreed Event Contingency Plan in the event of any exceedances.

1.5 Trigger Level, Action Level and Limit Level

In order to eliminate construction impacts on the environment, to prevent it from further deteriorating, environmental quality in Project related areas is to be controlled using the following three levels: trigger level, action level and limit level (abbreviated as TAL). According to the requirements for environmental monitoring and audit during construction in Hong Kong, this is not only a mechanism of environmental protection, but also a proactive measure for environmental pollution. It provides a basis for proper precaution and remedial measures to protect the environment.

Trigger Level: when environmental monitoring results show that environmental quality is to be changing adversely.

Action Level: when environmental monitoring results have shown that deterioration of environmental quality persists, or the public complain about environmental issues of the project and investigation confirms noncompliance of construction activities. Remedial measures are required in order to prevent environmental quality from ex-

ceedance the limit level.

Limit Level: When environmental quality can not be maintained against stipulated environmental standards, or the Environmental Monitoring and Audit Team has continuously received the public's complaints about the same environmental issues and non-compliance have been confirmed, it should be considered that the environmental quality has reached the limit level.

Measures should be taken if environmental quality has reached or is going to exceed the above-mentioned three levels.

2 Air Quality Monitoring

Stage III Project consists of Phase I and Phase II. Phase I is mainly reconstruction of the border patrol roads and fences, while Phase II is regulation of the river channel. Air quality monitoring is required for both Phases.

Because Phase I and Phase II will be carried out within the same-area, the potential sensitive receivers of air quality for both phases are identical. The monitoring parameters, location, frequency, duration, instrument and facilities, methods, TAL levels and action plan for air quality monitoring for Phase I and Phase II are also identical. Therefore, this monitoring plan covers both Phases. According to the Project schedule, Phase I will be implemented by Shenzhen government and Hong Kong SAR Government on their own side, while Phase II will be jointly carried out by both of Shenzhen and Hong Kong government. That is to say, the Shenzhen and Hong Kong governments will be respectively responsible for air quality monitoring on Shenzhen and Hong Kong sides during Phase I construction, while during Phase II construction both government will jointly carry out the air quality monitoring in the whole area affected by the project.

2.1 Construction Period

2.1.1 *Air Quality Monitoring*

(1) Parameters to be monitored

Total suspended particles (TSP).

Air temperature, atmospheric pressure, wind direction, wind speed, weather, construction progress and conditions of the construction site should be simultaneously observed and recorded. The measurement should not be carried out under conditions of rains or wind with the speed over 5.5 m/s.

(2) Location of monitoring locations

In order to obtain reliable result, monitoring should be carried out not only at boundaries of construction site or near representative sensitive receivers, but also on surrounding areas where construction impacts can not reach. According to construction layout, monitoring locations should be separately distributed in Hong Kong and Shenzhen, including the boundary of construction site and the representative sensitive receivers. Besides, control monitoring locations that are not affected by construction activity should also be established.

Baseline monitoring locations

Baseline monitoring should be carried out prior to commencement of construction. On the Shenzhen side, the baseline monitoring locations are located at Lo Wu and Xinxiu Village, while on the Hong Kong side, the baseline monitoring locations are located at Lo Wu and Muk Wu Pumping Station.

Monitoring locations during construction period

According to construction plan, two monitoring locations will be set up at the boundary of construction site or near the representative sensitive receivers during construction period on each side. In addition, two control stations, one on each side, will be set up on locations not affected by the construction. Monitoring should be carried out in all the locations at the same time.

During Phase I construction, Shenzhen government will be responsible for monitoring at locations on Shenzhen side, while Hong Kong government will be responsible for monitoring at locations on Hong Kong side. During Phase II construction, monitoring will be carried out in all the locations at the same time.

Description about the monitoring locations should be included in monthly environmental monitoring and audit reports.

For baseline monitoring location of air quality, see Figure 2.1.

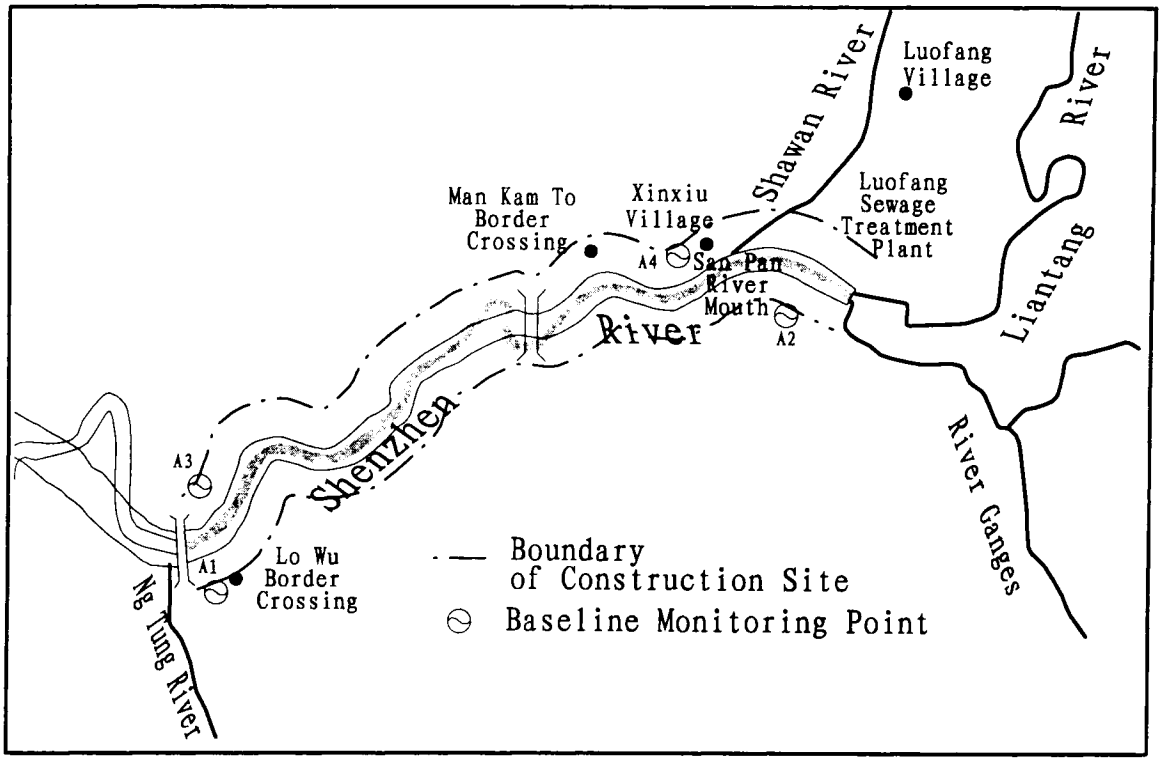

Figure 2.1 Location of Air Baseline Monitoring Points

(3) Frequency, duration and requirements for monitoring

Shenzhen side

Baseline monitoring should be carried out for a period of consecutive 5 days within 2 months prior to commencement of construction when there is no construction activity. The parameter to be monitored is 24-hour TSP. If construction begins within 12 months upon completion of the EIA, the monitoring data in EIA report can be used as baseline.

During construction period, 24-hour TSP monitoring is conducted once a week for mean 24-hr TSP.

In case of exceedancees of action level and if the exceedancees are confirmed to be related to construction activities, monitoring frequency should be increased to three times a week until the 24-hour TSP decreases to below the action level.

In case of exceedancees of limit level and if the exceedancees are confirmed to be relat-

ed to construction activities, monitoring frequency should be increased to once every day until the 24-hour TSP reduces to below the limit level.

Hong Kong side

Baseline monitoring should be carried out for a period of consecutive fourteen days within 2 months prior to commencement of construction when there is no construction activities. The monitoring parameters are 24-hour TSP and 1-hour TSP. The 24-hour TSP should be monitored once every day and the 1-hour TSP should be monitored three times a day. Data form Yuen Long monitoring station can be used as baseline data.

During construction period, 24-hour TSP monitoring should be conducted once a week. During dusty processes of the construction, 1-hour TSP should also be monitored three times a week.

In cases of exceedance of action level, and if the exceedancees are confirmed to be related to construction activities, monitoring frequency of 24-hour TSP should be increased to three times a week, and 1-hour TSP should be increased to once every day, until the 24-hour TSP reduces to below the action level.

In cases of exceedance of limit level, and if the exceedancees are confirmed to be related to construction activities, monitoring frequency of 24-hour TSP should be increased to five times a week, and 1-hour TSP should be increased to twice a day, until the 24-hour TSP reduces to below the limit level.

The Environmental Monitoring and Audit Panel should assess and identify the causes of exceedancees according to the construction situation and monitoring findings. If the impact is caused by construction, the ET should report the findings to the Employer timely.

2.1.2 *Instrument and Equipment*

Instrument and equipment to be used in the laboratory or at-source for air quality monitoring should be approved by the Engineer/Engineer's Representative prior to use. The following instrument and equipment which have been used in Stage I and Stage II of the Project are recommended for Stage III.

MWL-2000 High Volume sampler will be used for monitoring of 24-hour TSP, following the standard method by U. S. NEPA, 40 CFR Part 50, Appendix B.

Haz-Dust HD 1000 portable automatic dust recorder will be used for monitoring the 1-hour TSP. The detection limit ranges from 0. 01 to 50μm and 0. 001 to 200 mg/m^3, with accuracy of ±0. 02 mg/m^3 and precision of ±10%.

Analytical balance readable to 0. 1 mg precision (electronic balance) is preferred.

Dryer.

WD401 wind speed and direction meter equipped with METEL8 data logger.

2. 1. 3 *Instrument Calibration and Monitoring Methods*

Instrument calibration

The flow controller of High Volume sampler for 24-hour TSP should be calibrated with orifice-plate flow calibrator prior to use. One-point and five-point calibration of the flow controller should also be conducted bi-monthly and six-monthly respectively.

The 1-hour TSP meter should be calibrated using the known standard provided by manufacturer before use. It should also be calibrated with the High Volume sampler once every six month.

Monitoring methods

For 24-hour TSP monitoring, first, use approved filter papers with no pin holes, incubate the filters for at least 24 hours and weigh, place the prepared filter on the filter holder of the sampler. When sampling is completed, collect the filter paper into a clean plastic bag, seal the bag, deliver to the laboratory and weigh after incubation for at least 24 hours.

For 1-hour TSP monitoring, in-situ measurement with real-time dust meter will be adopted on the spot.

2. 1. 4 *TAL Levels and Action Plan*

TAL levels on the Shenzhen side: Monitoring of TSP for Stage I and Stage II of the Project has been carried out within the construction site boundaries and the nearby

sensitive receivers. The monitoring findings summarized in monthly and quarterly reports cover a long time span, including each month and week of the four seasons of the site. They are highly representative of the air quality of the site and provide the basis for establishment of the TAL levels for air monitoring on the Shenzhen side (See Table 2.1).

TAL levels on the Hong Kong side are established according to environmental requirements of Hong Kong (See Table 2.1).

Table 2.1 TAL Levels for Air Quality Monitoring in Shenzhen and Hong Kong

Level	Shenzhen ($\mu g/m^3$)	Hong Kong ($\mu g/m^3$)
Trigger level	24-hour TSP:260	24-hour TSP:200
Action level	24-hour TSP:310	24-hour TSP:230
Limit level	24-hour TSP:360	24-hour TSP:260,1-hour TSP:500

In the events of exceedancees to TAL levels during construction, the action plan shown in Table 2.2 should be implemented.

During construction period the contractors are responsible for implementing TSP control and mitigation measures recommended in the EIA report.

After implementation of all recommended mitigation measures if the air quality within the site still can not be maintained at acceptable level, the contractors should discuss other remedial measures with the Engineer/Engineer's representative and the Environmental Monitoring and Audit Team, and implement the remedial measures upon approval from the Employer.

2.2 Maintenance Period

Mitigation measures and air quality monitoring are not requiredduring maintenance period.

3 Noise Monitoring

Table 2.2 Action Plan for Air Quality Monitoring during Construction Period

Events		Action Plan		
		Environmental Monitoring and Audit Team	**Employer**	**Contractors**
Trigger Level	One or more exceedancees	1. repeat measurement 2. identify pollution sources 3. inform Employer	1. inform contractors 2. check monitoring data 3. inspect construction method	1.rectify improper operation methods 2.change construction method if necessary
Action Level	A. one exceedancees	same as for trigger level. In addition, increase the monitoring frequency	same as trigger level	same as trigger level
	B. two or more consecutive exceedancees	same as for events of level A, in addition, 1. discuss necessary remedial measures with the Employer 2. if exceedance persists, discuss with the Employer 3. if exceedance stops, restore normal monitoring frequency	1. notify contractor in writing 2.check monitoring data and inspect construction method 3.discuss possible remedial measures with the ET Leader, Engineer/Engineer's Representative and contractors 4. ensure implementation of proper remedial measures	1.propose remedial measures to the Employer within 3 days after notification 2. implement approved remedial measures 3.revise recommended remedial measures if necessary

Table 2.2 Action Plan for Air Quality Monitoring during Construction Period (Cont'd)

Events		Action Plan		
		Environmental Monitoring and Audit Team	**Employer**	**Contractors**
Limit Level	A. one sample exceeds standard	1.Identify pollution sources 2.Inform the Employer and environmental protection agencies of both Shenzhen and Hong Kong 3.Repeat measurement. 4.Increase monitoring frequency 5.Evaluate the effectiveness of contractors' remedial measures, and report the result to environmental protection departments of both sides	1. Notify contractors in writing. 2.Check monitoring data and inspect contractors' construction method 3.Discuss possible remedial measures with the ET Leader, Engineer/Engineer's representative and contractors 4.Ensure effective implementation of the remedial measures	1.Take measures immediately, to avoid exceedance 2. The same as 1, 2, 3 of B for Action level.
	B. two or more consecutive exceedances.	Same as 1, 3, 4 and 5 for limit level A, in addition, 1.Inform Employer and environmental protection departments of both sides 2.Investigate the cause of exceedance. 3.Discuss remedial measures with Employer and environmental protection departments of both sides 4.If exceedance stops, resume normal monitoring frequency	Same as 1, 2 for limit level A. In addition: 1.Analyze contractors' working procedure, determine possible mitigation measures 2.Discuss with the ET Leader, Engineer/Engineer's representative and contractors to discuss remedies 3. Inspect contractors' implementation of remedial measures to ensure effectiveness 4. If exceedance persists, analyze project activities, stop related construction activities, until no exceedance.	Same as 1, 2, 3 for limit level A, in addition, 1.If exceedance persists, propose further remedial measures 2.Stop related construction activities until no exceedance.

The noise monitoring for Stage III covers two construction phases: Phase I and Phase II.

Due to the same site boundary, conditions and potential sensitive receivers between Phase I and Phase II, the monitoring parameters, location, frequency, duration, instrument, methods, TAL levels and action plan for Phase I are also the same as Phase II. Shenzhen and Hong Kong governments will respectively be responsible for Phase I monitoring of Shenzhen and Hong Kong sides, while both governments will jointly carry out the Phase II monitoring over the whole project area.

3.1 Construction Period

3.1.1 *Noise Monitoring*

(1) Parameter to be monitored

Leq (30 min) is to be monitored during daytime (7：00～19：00, except public holidays); Leq (5 min) is monitored during nighttime (19：00～23：00, 23：00～7：00) and public holidays (7：00～19：00).

L_{10} and L_{90} are calculated as supplementary data for reference.

(2) Monitoring locations

Monitoring locations are the same as those for air quality monitoring. Monitoring should be carried out at control stations where construction impacts can not reach during construction period. The monitoring locations are selected based on construction layout to cover the project area and nearby representative sensitive receivers.

Baseline monitoring

Baseline monitoring should be carried out prior to commencement of the construction works. On Shenzhen side, the baseline monitoring locations are Lo Wu and Xinxiu Village, while on the Hong Kong side are Lo Wu and Muk Wu Pumping Station.

The baseline monitoring locations are shown in Figure 3.1.

Impact monitoring

According to the construction plan, four monitoring locations, two on each side, will be established at boundary of the construction site and nearby representative sensitive

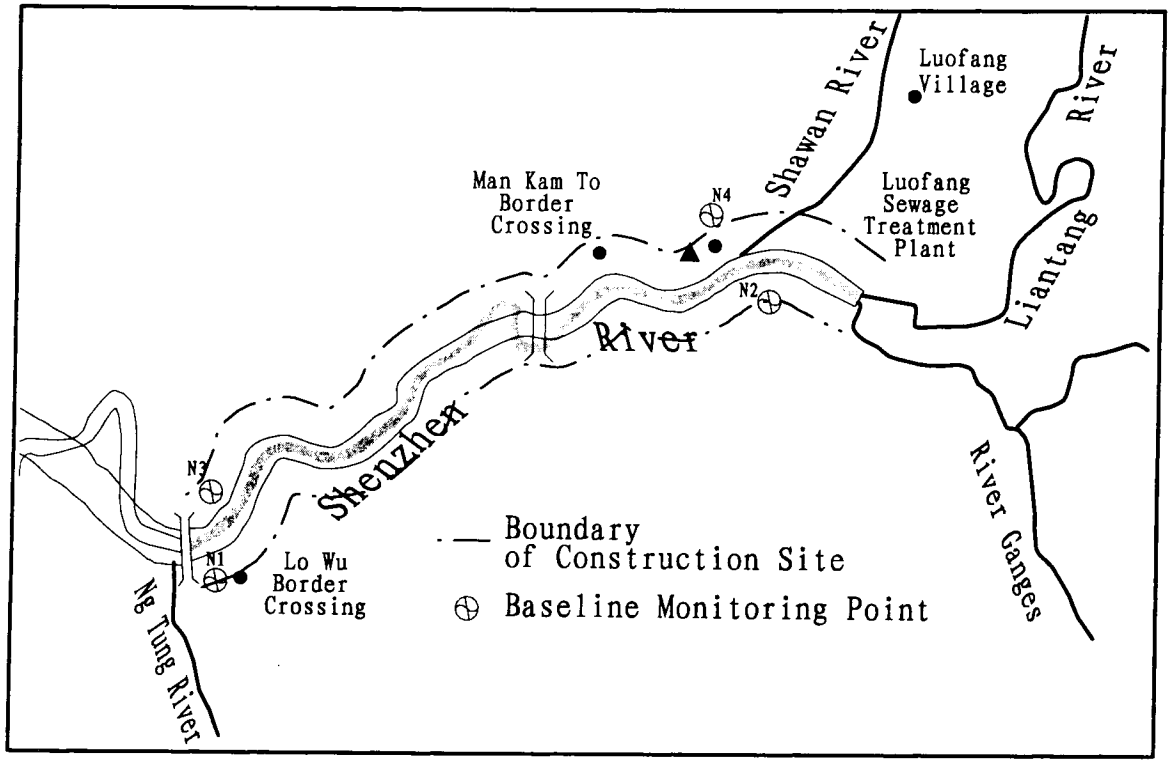

Figure 3.1 Location of Noise Baseline Monitoring Points

receivers during construction period. In addition, two control stations, one on each side, will be set up at locations unlikely to be affected by construction.

During Phase I construction, the monitoring on Shenzhen side will be carried out by Shenzhen government, while monitoring on Hong Kong side will be carried out by Hong Kong government. During Phase II construction, both government will carry out noise monitoring within the whole project area.

Conditions of the monitoring locations should be illustrated in the monthly environmental monitoring and audit reports.

(3) Frequency, duration and requirements for noise monitoring

Baseline monitoring

Baseline monitoring should be carried out at designated monitoring locations within 2 months prior to commencement of construction. The monitoring frequency is once every day for five days on Shenzhen side and for fourteen consecutive days on Hong Kong side.

Impact monitoring

During construction period, Leq (30 min) should be measured at designated monitoring locations once a week. If construction is carried out during nighttime or public holidays, Leq (5 min) should be measured three times a week at designated monitoring locations on Hong Kong side.

In the events of exceedances to action level, if the exceedances are confirmed to be related to construction activities, monitoring frequency should be increased to three times a week until the noise level reduces to below the action level.

In the events of exceedances to limit level, if the exceedances are confirmed to be related to construction activities, monitoring frequency should be increased to once a day until the noise level reduces to below the limit level.

The Environmental Monitoring and Audit Team should identify cause of exceedances against associated standards and audit the construction method and monitoring findings. If the impacts are caused by construction activities, the ET should report to the Employer timely and make sure that the responsible contractor take corrective actions.

3.1.2 *Instrument*

The instrument used for noise monitoring should be approved by the Engineer/ Engineer's Representative prior to use. The following instrument which has been used in Stage I and Stage II monitoring are proven to be effective, and is recommended to be used for Stage III project:

Bruel and Kjaer 2231 modulus precision sound level meter equipped with BE7101 statistical analyzer.

3.1.3 *Instrument Calibration and Monitoring Methods*

Before and after monitoring, the sound level meter should be calibrated and the calibration results should be recorded on a field datasheet used. The noise measurement should be repeated if the calibration results before and after monitoring deviate from reference value over 1 dB (A).

Full calibration of sound level meter by authorized metrological department or recognized laboratory should be conducted once every two years to ensure accuracy and precision of the monitoring results.

The sound level meter should be at least 1 m away from buildings and 1.2 m above the ground.

3.1.4 *TAL Levels and Action Plan*

TAL levels for noise monitoring during construction period are established based on national and local acoustic laws, regulations, standards and public complaints.

TAL levels for noise monitoring during construction period are shown in Table 3.1.

Table 3.1 TAL Levels for Noise during Construction Period

<table>
<tr><th rowspan="2">Trigger Level</th><th colspan="2" rowspan="2">Action Level</th><th colspan="2">Limit Level</th></tr>
<tr><th>Hong Kong Side</th><th>Shenzhen Side</th></tr>
<tr><td rowspan="3">Receipt of any complaint on noise during construction 19:00~7:00</td><td>Non-holidays and weekends from 7:00 ~ 19:00</td><td rowspan="3">Hong Kong:
One or more complaint (s) received in one week;
Shenzhen:
Three complaints about the same noise source are received</td><td>Two consecutive monitoring data exceed 75 dB(A) at one location</td><td rowspan="3">Four or more complaints on the same noise source are received in a week</td></tr>
<tr><td>19:00-23:00, holidays and weekdays from 7:00 to 23:00</td><td>Two consecutive monitoring data exceed 70 dB(A) at one location</td></tr>
<tr><td>23:00~7:00</td><td>Two consecutive monitoring data exceed 55 dB(A) at one location</td></tr>
</table>

Note: If there are schools near the construction sites, monitoring should be carried out during school examination period, besides, the limit level (daytime) should be lowered to 70 dB (A) during non-exam period, and to 65 dB (A) during examination period. This requirement also applies to Shenzhen side.

In the events of exceedances to TAL levels, the action plan shown in Table 3.2 should be implemented.

Contractors are responsible for controlling construction noise and implementing the mitigation measures recommended in the EIA report.

If after implementation of the recommended mitigation measures the noise level still can not be maintained within acceptable level, the contractors should discuss other remedial measures with the Engineer/Engineer's representative and the environmental monitoring and audit team, and implement the remedial measures upon approval by the Employer.

Table3. 2 Action Plan for Noise Monitoring during Construction Period

	Action Plan	
	Environmental Monitoring and Audit Team or Employer	Contractors
Trigger level	1. Notify contractors 2. Investigate and analyze the cause 3. Inform contractors to take proper mitigation measures	1. Implement mitigation measures
Action level	1. Notify contractors 2. Investigate and analyze the cause 3. Inform contractors to propose and implement mitigation measures to be implemented 4. Increase monitoring frequency to check the effectiveness of mitigation measures.	1. Provide the Employer and the ET with noise reduction measures 2. Implement mitigation measures
Limit level	1. Notify contractors 2. Notify environmental protection departments on both sides 3. Require the contractors to carry out mitigation measures, increase monitoring frequency to check the effectiveness of mitigation measures.	1. Implement mitigation measures 2. Provide the Employer and the ET with data on effectiveness of the mitigation measures

3. 2 Maintenance Period

3. 2. 1 *Noise Monitoring*

(1) Parameter to be monitored

During daytime (7:00～19:00, except public holidays): Leq (30 min) is monitored. During nighttime (19:00～23:00, 23:00～7:00) and public holidays (7:00～19:00): Leq (5 min).

L_{10} and L_{90} are calculated as supplementary data for reference.

(2) Monitoring location

Baseline monitoring

The baseline monitoring locations are located at Lo Wu and Xinxiu Village on the Shenzhen side at Lo Wu and Muk Wu Pumping Station on Hong Kong side.

Maintenance monitoring

According to the maintenance plan for dredging, two monitoring locations, one on each side, will be established on the boundary of construction sites and nearby sensitive receivers during maintenance dredging period. In addition, two control stations,

one on each side, will be established in places not affected by maintenance dredging.

(3) Frequency, duration and requirements for noise monitoring

Baseline monitoring:

Baseline monitoring should be carried out at designated monitoring locations within 2 months prior to commencement of maintenance for dredging. The monitoring frequency is once a day for five days on Shenzhen side and for 14 consecutive days on Hong Kong side. If the time between two dredging operations is less than six months, the baseline monitoring will not be required.

Maintenance monitoring

During maintenance period, Leq (30 min) should be conducted at designated monitoring locations once a week. For construction during nighttime and public holidays, Leq (5 min) should be conducted three times a week at designated monitoring locations on Hong Kong side.

In the events of exceedances to action level, if the exceedances are confirmed to be related to construction activities, monitoring frequency should be increased to three times a week until the noise level reduces to below the action level.

In the events of exceedances to limit level, if the exceedances are confirmed to be related to construction activities, monitoring frequency should be increased to once a day until the noise level reduces to below the limit level.

3.2.2 *TAL Levels and Action Plan*

TAL levels and action plan are the same as those for construction period.

4 Water Quality Monitoring

As Phase I involves only construction of the border patrol roads and fences which is unlikely to impact water quality within the project area, water quality monitoring is not necessary. In this section, the requirement for water quality monitoring applies only to Phase II monitoring.

4.1 Construction Period

4.1.1 *River Water Quality Monitoring*

(1) Monitoring parameters

pH, DO, flow velocity, conductivity, SS and salinity should be monitored three days a week during ebb tide and flood tide of the day.

BOD_5, TN, NH_3-N, TP and Cu should be monitored once a month during ebb and flood tide of the day.

Relevant information such as construction activities at the monitoring locations, sampling time, hydrological factors (water depth, water temperature, weather and tide condition etc.), and meteorologic factors (wind speed, wind direction, air temperature and weather condition etc.), should also be collected and recorded.

TAL level will be determined only according to suspended solid level. Flow velocity and conductivity will be used to characterize the dispersion condition and the total quantity of ions. DO will be used to indicate the degree of organic poilution and the redox status of water body. BOD_5, TN, NH_3-N, TP and Cu are not used as indicators to trigger any immediate actions for water environmental protection due to the lengthy time required for the analysis. However, they reflect pollution trend of organics, nutrients, and heavy metals in the water body.

(2) Monitoring location

In order to identify the impacts of the construction on river water quality during both ebb and flood tides of Shenzhen River, monitoring locations and control stations have been selected at upstream and downstream of the river within construction sites. The control stations are located in the places where the impact of construction activity can not reach. In addition, water quality of the relevant tributaries should also be monitored. The monitoring locations should be selected to reflect the water quality of all discharges from the construction sites and the water quality after the discharged are fully mixed.

Baseline monitoring

The control stations for baseline water quality monitoring are Lo Wu Bridge, San Pan Kou and the Ping Yuen River mouth and the Shenzhen River mouth. The baseline

monitoring should be conducted within one month prior to commencement of the construction.

Impact monitoring

During construction period, impact monitoring locations are estuary of Shenzhen River and at 1,500 m (Chainage. 7+917 m) downstream from the Stage III Project section. In addition, the upstream control station is selected at 500 m upstream the dredging section and the downstream control station is at 1,000 m downstream the dredging section. If there is any tributary within the section 500 m upstream from the dredging section, an upstream control station at downstream of the tributary not affected by the construction activities should be set up. An downstream control station should also be included at upstream of the tributary if there is any tributary within the section 1,000 m downstream from the dredging section. A monitoring location should also be established upstream the river mouth of tributary.

The water quality monitoring locations (excluding non-fixed monitoring locations which are to be decided by the ET during construction) are illustrated in Figure 4.1.

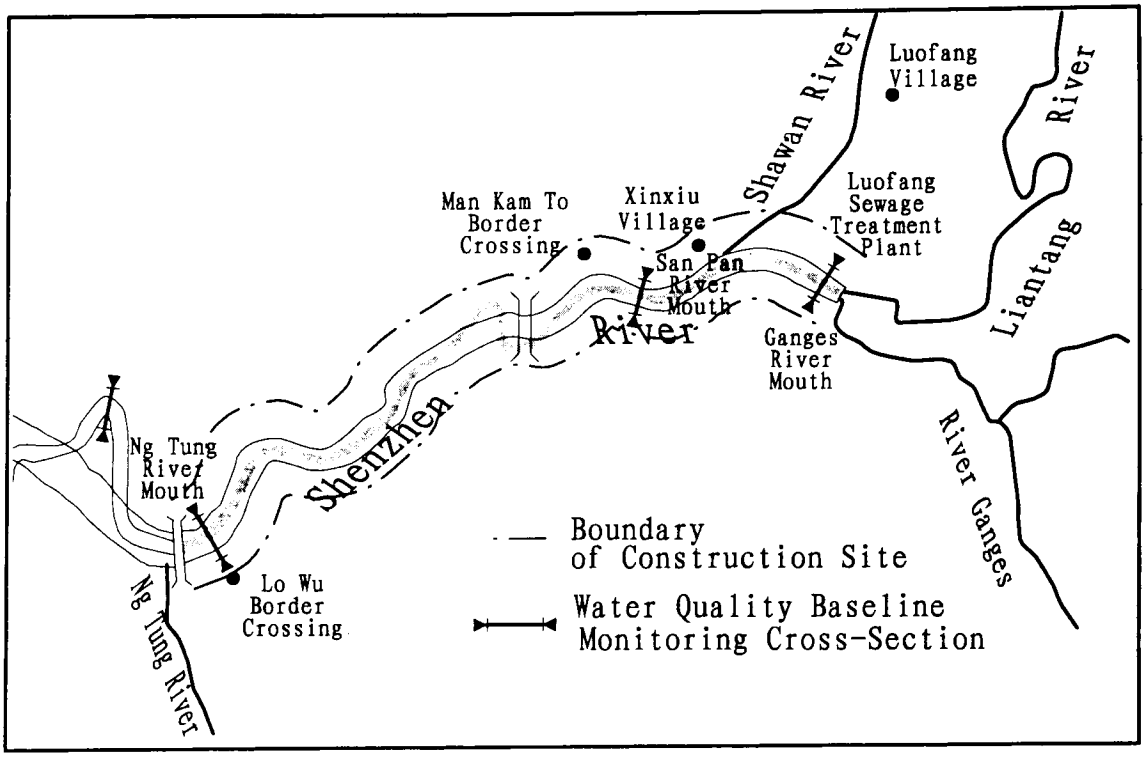

Figure 4.1 Location of Water Quality baseline Monitoring Cross-sections

Conditions of the monitoring locations and results of monitoring should be presented

in monthly monitoring and audit report.

(3) Frequency, duration and requirement of monitoring

Baseline monitoring for river water quality should be carried out within one month prior to commencement of construction works. Monitoring should be carried out once a week for BOD_5, NH_3-N, TN, TP and Cu during ebb tide and flood tide for four weeks. For pH, DO, flow velocity, conductivity, suspended solids and salinity, monitoring is conducted three times a week during ebb tide and flood tide for four weeks.

During construction period, monitoring of BOD_5, NH_3-N, TN, TP and Cu should be conducted monthly. Monitoring frequency for pH, DO, flow velocity, conductivity, suspended solids are as follows: Once a month during ebb tide and flood tide during non-dredging period, and three times a week during dredging period until two weeks after completion of dredging operation. If there is no exceedance to trigger levels for two consecutive months during dredging period, the monitoring frequency may be reduced to once a week upon approval from the Employer. The monitoring frequency of three times a week should be resumed whenever an exceedance is identified.

In the events of one or more exceedance(s) to Action levels, if the exceedance(s) is (are) confirmed to be related to the construction works, the monitoring frequency should be increased to once a day until the SS level restores to below action level. The normal monitoring above shall resume.

In the events of one or more exceedance(s) to Limit levels, if the exceedance(s) is (are) confirmed to be related to the construction works, the monitoring frequency should be increased to once every day until the exceedance(s) restore(s) to below Limit levels for two consecutive days.

The Environmental Monitoring and Audit Team should identify the cause of the exceedances and assess the impact to the environment according to the construction activities and monitoring findings. If the impact is confirmed to be related to construction activities, the Employer should be informed of the situation and remedial actions.

4.1.2 *Instrument*

The instrument to be used in water quality monitoring should be approved by the Engineer/Engineer's Representative prior to use. The following instrument which has

been used in Stage I and Stage II Project is recommended for Stage III.

Wildco vane-style water sampler with 10 m cable

Flow-meter or hydro-dynamometer

YSI temperature/conductivity meter

DO meter

Seafarer701 depthometer

Vacuum pump and filtration system

Oven

Dryer

Analytical balance readable to 0.1 mg.

4.1.3 *Instrument Calibration and Monitoring Methods*

(1) Calibration of instrument

Hydro-dynamometer and conductivity meter should be calibrated every two months. Analytical balance should be calibrated once a year. Calibration should be performed by qualified personnel.

(2) Monitoring method

The procedure for water quality monitoring is as follows:

Determine water depths at each monitoring location with depthometer, carry out sampling and measurement at mid-depth. For DO, flow velocity and conductivity duplicate measurement is required. If the difference between duplicate results exceeds 25%, measurement should be repeated or corrective actions are taken to restore the precision. Water samples should be collected at the same depths and kept under 2～5℃. Water samples should be delivered to laboratory for analysis as soon as possible. SS determination should be carried out within 24 hours after sampling and the results should be reported to the Environmental Monitoring and Audit Team for information. Analysis for other parameters should also be carried out as soon as possible.

4.1.4 *TAL Level and Action Plan*

Table 4.1 shows the statistics by Shenzhen Environmental Monitoring Station of SS during dry season and wet season from 1992 to 1994. No statistical data of recent years are available. From Table 4.1, the concentration of SS in the river water fluctuated between 0.400 and 823 mg/L, showing a great spatial difference. The concentration of SS also significantly varied temporally: seasonally, monthly and even daily. The TAL levels are therefore determined by the SS levels at control stations, which are used as a background. For example, according to the real situation of Shenzhen River and environmental monitoring and audit reports for Stage I and Stage II, 130% of the SS ($\overline{SS}$) at the control stations (i.e., $\overline{SS}+\overline{SS}\times 30\%$), and the baseline plus two standard deviations are used as the trigger level. The action levels and limit levels are determined similarly. Table 4.2 shows the TAL levels to be used for the environmental monitoring of water quality. The action plan shown in Table 4.3 should be implemented.

Table 4.1 **Statistics of SS from 1992 to 1994** **unit: mg/L**

Seasons \ Monitoring Locations		Mouth of River Ganges	Yumin Village	Zhuanmatou	Yunong Village	Estuary
Dry season	Number of samples	6	12	12	12	12
	Minimum	1.00	28.0	77.3	60.0	71.3
	Maximum	2.10	464	547	151	546
	Average	1.30	165	286	104	336
	Standard deviation	0.5	174.2	184.4	33.0	207.6
Wet season	Number of samples	8	16	16	16	16
	Minimum	0.400	18.0	22.6	56.0	32.8
	Maxim	10.4	237	823	386	48.3
	Average	2.90	80.7	188	217	256
	Standard deviation	3.5	74.0	201.8	120.1	165.3

Note: "wet season" is from April to October; "dry season" is November, December, to next March.

Table 4.2 **TAL Levels for Water Quality Monitoring and Audit during Construction Period**

Level	Recommended Limit
Trigger level	SS concentration at monitoring stations exceeds: (1) Mean value of baseline monitoring result − two standard deviation, and (2) 130% of control stations (i.e., more than $\overline{SS}+\overline{SS}\times 30\%$).

Level	Recommended Limit
Action level	Concentration at control station exceeds the trigger level in successive two monitoring days.
Limit level	Concentration at control station exceeds the trigger level in successive three monitoring days.

Note: the mean value and standard deviation are determined according to the baseline monitoring result and existing data.

4.2 Maintenance Period

4.2.1 *Water Quality Monitoring*

(1) Monitoring parameters

pH. DO. flow velocity, conductivity, SS and salinity should be monitored three days a week during ebb tide and flood tide.

BOD_5. TN. NH_3-N, TP and Cu should be monitored once a month during ebb and flood tide.

When the above parameters are monitored, associated parameters such as location, sampling time, hydrological factors, such as water depth, water temperature, weather and tide condition etc., and meteorologic factors, such as wind speed, wind direction, temperature and sunshine condition and so on, should also be measured and recorded.

(2) Monitoring location

During maintenance period, ad hoc monitoring and audit for water quality should be determined according to the requirement of the maintenance activities. For maintenance, dredging less than six months, baseline monitoring is not required. For dredging more than six months, baseline monitoring should be carried out. A control station should be included at 500 m upstream from the excavated section or at 1,000 m downstream of the excavated section depending on tidal condition. If there are tributary within 500 m upstream of the excavated section, the control station should be selected at upstream of each tributary mouth where construction impact can not reach. Similarly, a control station should be established at upstream of the river mouth. If there is a tributary within the 1000 m downstream from the dredging section a downstream control station should be included at upstream of the tributary. An impact monitoring location should be established at estuary of Shenzhen River.

The monitoring results should be described in monthly monitoring and audit report.

Table 4.3 Action Plan for Water Quality Monitoring during Construction Period

Events	Action Plan		
	Environmental Monitoring and Audit Panel	**Employer**	**Contractors**
Trigger Level	1. Confirm monitoring results; 2. Identify impact sources; 3. Inform Employer and contractors if impact is confirmed to be related to construction activities; 4. Examine monitoring data, laboratory, instrument, equipment and the working method of contractors; 5. Discuss mitigation measures with Employer, Engineer/Engineer's Representative and contractors; 6. Inform Engineer/Engineer's Representative when the exceedance stops.	1. Discuss the recommended mitigation measures with ET, Engineer/Engineer's Representative and contractors; 2. Approve the implementation of mitigation measures; 3. Evaluate the effectiveness of the mitigation measures.	1. Inspect construction method and equipment; 2. Rectify improper operation methods; 3. Propose mitigation measures within three days receiving notice from Engineer/Engineer's Representative; 4. Implement the approved mitigation measures.
Action Level	Same as that for trigger level, in addition, 1. Repeat monitoring next day; 2. Discuss mitigation measures with Employer, Engineer/Engineer's Representative, H.K. EPD and Shenzhen EPB, if exceedance persists; 3. Report the implementation of the mitigation measures to Employer, H.K. EPD and Shenzhen EPB;	1. Notify H.K. EDP and Shenzhen EPB timely; 2. Require contractors to implement mitigation measures to prevent water quality from deteriorating; 3. Evaluate the effectiveness of the mitigation measures; 4. Require contractors to implement further mitigation measures.	Same as that for trigger level, in addition, 1. Consider changing construction method; 2. Propose mitigation measures within three days upon notification of Engineer/Engineer's Representative.

Table 4.3 Action Plan for Water Quality Monitoring during Construction Period

Events	Action Plan		
	Environmental Monitoring and Audit Panel	**Employer**	**Contractors**
Limit Level	Same as that for action level, in addition, 1. Report to Employer and Engineer/Engineer's Representative timely the cause of exceedances and propose corrective actions.	Same as that for the action level B, in addition, 1.Instruct Engineer/ER and contractors to review their working method; 2. Instruct contractor to stop or slow down whole or part of construction activities or schedule, if exceedance persists.	1. Implement mitigation measures to avoid reoccurrence immediately; 2. Inspect construction method and equipment; and consider change the construction method. 3. Propose further mitigation measures within three days upon receipt of notification of Engineer/Engineer's Representative; 4. Implement the approved mitigation measures. 5. Propose and implement further mitigation measures, if exceedance persists; 6.Slow down or stop whole or part of construction activity according to the Engineer's instruction until no exceedances of the standard.

4.2.2 *TAL Level and Action Plan*

TAL levels and the action plan are identical to those for construction period.

5 Ecological Monitoring

As the Stage III construction site will be located above Lo Wu Bridge, the construction impacts are expected to be considerably less significant. Moreover, water quality monitoring and audit and the action plan will ensure effective protection for the environment. Therefore, ecological monitoring will be focused on birds that enter or inhabit in the construction site or nearby habitat. Benthos monitoring is not required because no benthos has been found during the Stage III EIA. Ecological monitoring shall be continued for two years after completion of the channel construction.

5.1 Bird Survey

Bird survey should be carried out upon commencement of the construction within the Stage III area from Lo Wu Bridge to Ping Yuen River mouth. The survey should be conducted by walking along the new embankment. The bird monitoring parameters include identification of species, number of each species, abundance and activities and habitats. The survey will be performed once a month from October to the next March when birds migrate, and once every two months for the remaining months.

5.2 Effectiveness of Wetland Restoration

Upon completion of compensation and restoration works, a survey should be carried out on the restored ponds, marshes and meanders to determine the effectiveness of the recommended mitigation measures.

The species, quantity and abundance of birds, butterflies, dragonflies, amphibians and reptiles should be monitored. In addition, birds using the fishponds, and fishes in the restored ponds should also be observed.

The growth of the herbaceous and woody species should also be included in the survey. The parameters for plant monitoring include species identification, survival rate (%), plant density (individuals/km^2), plant height (m) and coverage rate (%).

In the first year, survey should be carried out once every three months and once every six months after then.

5.3 Effectiveness of Vegetation Restoration

A survey should be conducted on plants in grasscrete on embankment crests and on the berm and, the compensatory woodland in the Nam Hang middle valley. The parameters for plant monitoring include species identification, survival rate (%), plant density (individuals/km^2), plant height (m) and coverage rate (%).

In the first year, survey will be carried out once every three months and once every six months after then.

6 Landscape and Visual Monitoring

6.1 Site Inspection

Prior to construction, the Environmental Monitoring and Audit Team shall ensure that all mitigation measures are included in the design and the tender documents.

During construction, the Environmental Monitoring and Audit Team shall carry out, regular inspection to ensure that all mitigation measures are carried out accordingly.

Regular site inspection is to monitor contractors' implementation of mitigation measures for protection of landscape and vision. The site inspection includes:

Contractors' supervision to their workers for restriction not to trample grassland arbitrary and not to damage trees to reduce the loss of vegetation as much as possible.

Ensure the contractors to replant trees to other proper places during site clearing before the construction formally starts.

Remind the contractors to pay attention to the aesthetic design of all temporary buildings and construction facilities.

Remind the contractors to manage the construction site properly, e.g., to park vehicles and install machinery so that construction materials are handled in order and covered. Ensure the contractors to improve when the performances are not satisfactory.

Upon completion of each construction, ensure the contractors to remove all temporary construction facilities and to restore the construction occupied land. If restoration is impossible, encourage planting trees and grass to improve local landscape.

Upon completion of construction, the Environment Monitoring and Audit Team shall

ensure all mitigation measures are completed.

6.2 Ensuring Effectiveness of Landscape and Visual Mitigation Measures

The effectiveness of compensation and restoration measures for landscape and vision mitigation should be assessed regularly. The compensation and restoration of pond, marsh and vegetation proposed for ecological protection will have beneficial landscape and visual effects. Emphases should be placed on planting trees before construction and the restoration of construction occupied land. Monitoring parameters include growth of trees and grass, density, height of the plant and vegetation coverage rate (%). If growth and density cannot meet the requirement, contractors are responsible to replant.

7 Monitoring of Cultural and Heritage

Before the Project commencement, Environmental monitoring and audit panel should consult with responsible departments to verify whether the archeological investigation has been done within the construction site and whether cultural and historical heritages are found. If any archeological ruins are found in Project Area, the ET must immediately inform Hong Kong Antiquities and Monuments Office and work out mitigation measures such as removing heritages or archeological excavating etc., which should be approved in advance by the relevant authorities. Contractors will not be permitted to start construction until the relevant mitigation measures are applied.

Before construction, ET should make inspection tours around construction sites near the Nga Yiu ancient kiln, and remind contractors to isolate Nga Yiu ancient kiln outside the construction site by fence in order to avoid the impact on the anicent kiln caused by construction activities.

Before demolishing the old Lo Wu Pedestrian Bridge, ET should consult with relevant authorities whether the survey and photograph of the old bridge have been taken. The demolishment of the bridge by contractors can be conducted after these work are finished.

Before demolishing Lo Wu Railway Bridge, ET should examine the report "Dismantling of Lo Wu Railway Bridge", and consult with Shenzhen Cultural Relic Management Commission and Hong Kong Antiquities and Monuments Office respectively whether the report is approved and whether both sides reach the agreement on

restoration place. After the above problems are solved, the reconstruction of the bridge can then be started.

During construction period, ET should frequently carry out on-the spot inspection to discover the possible archeological ruins. If any archeological ruins are found in Project Area, the Group must instruct contractors to stop construction activities temporarily in the relevant sites, and immediately inform Shenzhen Cultural Relic Management Commission (on the Shenzhen side) and Hong Kong Antiquities and Monuments Office(on the Hong Kong side). After proper measures are taken by the relevant authorities, contractors may be permitted to re-start construction activities.

8 Monitoring of Water and Soil Conservation

(1) Protective measures in construction material sites

During the borrowing period, ET should make on-the-spot inspection around borrow areas to monitor contractor's implementation of mitigation measures for water and soil conservation such as drainage ditches, settling tanks etc. , and instruct contractors to correct if they do not conduct the measures properly.

ET should monitor contractors 's spoil disposal during construction period, and remind contractors not to stack construction materials randomly to reduce water and soil erosion.

After completion of excavation in each borrow area, the construction site should be cleaned and vegetation should be restored.

(2) Spoil disposal

During construction period, waste enclosing facilities should be established to effectively control water and soil erosion in spoil ground, and drainage facilities should be constructed in surrounding area of the spoil disposal ground for draining.

Measures for preventing leakage should be adopted in transporting spoil, and if leakage happens, the improvement is required.

After completion of discarding, soil should be covered on the surface of the spoil yard and vegetation should be restored.

(3) Excavation of river course and construction of embankments

The field that is not liable to eroding by run-off should be selected to specially store

the silts and soils excavated, and temporary drainage ditch is needed in surrounding area to drain water.

Outer slope of the new-built dyke should be grassed with drainage facilities.

(4) Storage of construction material

The field that is not liable to erosion should be selected to store the material in open air, and temporary drainage facilities should be needed in surrounding area to drain water.

(5) Restoration of the construction site

When construction has been finished in each construction site, supervising and urging contractors to clear the construction site and restore the vegetation.

9 Environmental Management Plans

9.1 Environmental Management Plans (EMP)

(1) For the effective implementation of the mitigation measures, monitoring and remedial requirements presented in the EIA, EM&A and Implementation Schedule (IS), a systematic Environmental Management Plans (EMP) shall be set up by the Contractor. The Project Proponent will audit against the EMP and advise the necessary remedial actions required. These remedial actions shall be enforced by the Engineer through contractual means.

(2) The EMP will require the Contractor (together with it's sub-contractors)to define in details how to implement the recommended mitigation measures in order to achieve the environmental performance defined in the Hong Kong Environmental Legislation and the EIA documentation.

(3) In the first instance, each Tenderer shall prepare a skeletal EMP for submission as part of the tendering process; the skeletal EMP will demonstrate the determination and commitment of the organisation and indicate how the environmental requirements laid out in the available EIA documentation will be met. It is a clear indication to all Tenderers of the Project Proponent's commitment to the minimisation and management of environmental impacts. Upon Contract Award, the successful Tenderer shall be required to submit a draft EMP for the approval of the Engineer and a final version prior to the commencement of the works.

(4) Under the EMP, the Contractor is recommended to define the significant environmental aspects for each construction activities , identify the legal requirement need to comply with , setup an objective and target in order to achieve the requirement . The environmental management programme shall be formulated. The structure and responsibilities of each operation team leaders shall be identified. Appropriate training shall be provided to both management and working levels in order to meet the specified performance. Channels of communication, document control, operational control and emergency procedure shall be listed out in detail in the EMP. The checking and corrective action procedures, together with the Contractor's management review procedure shall be elaborated. This requirement shall be put down as the tender requirement.

(5) The environmental performance review programme comprises the regular assessment of the effectiveness of the EMPs. Specifically it shall ensure that the environmental aspects are correctly identified, site practices and procedures are being followed. reliable internal audit work are in placed, and environmental standards are maintained.

(6) The criteria against which the reviews will be conducted shall be derived from:

- The approaches, procedures and commitments given by the Contractor in the EMP;
- The clauses contained within the Contractual Documentation ; and
- Those parts of the Contractor's Method Statements which relate to the minimisation of environmental impacts

(7) The review of on-site environmental performance shall be undertaken by Project Proponent through a systemic checklist and audit trail once the project commences . Objective evidence shall be inspected in the following areas:

- The identification and evaluation of significant environmental aspects;
- The consequent objectives and targets;
- The performance monitoring , measuring , reporting and review against the objective and targets;
- The effectiveness of the environmental management activities;
- The speed and effectiveness of response to complaints; and

● The way to handle frequent non-compliance.

9.2 Construction Method Statement

In case the Contractor would like to adopt a different construction method or implementation schedule, it is required to submit details of methodology and equipment proposed to use to the Engineer for approval before the commencement of the work. These changes in construction method will need to be reflected in a revised EMP or the Contractor will be required to demonstrate the manner in which the existing EMP should accommodate the proposed changes. For the designated project, a Further Permit from EPD may be necessary from the contractor before commencement of any construction activities.

9.3 Contractual Documentation

(1) The EMP places a contractual responsibility for on-site environmental management with the Contractor. The contractual documentation would generally comprise appropriate extracts from the EIA report. EM&A Manual and Environmental Permit. The typical elements in the relevant statutory environmental standards shall be included in the General Clauses, whereas the site-specific environmental impacts and mitigation measures shall be detailed in the Specific Clauses of the Contract.

10 Site Environmental Monitoring and Audit

In order to effectively minimise environmental impacts of construction activities, the ET should assessed and identify potential environmental impacts and report the findings timely to the Employer. Proper mitigation measures should also be recommended.

(1) Audit of contractors' construction procedure

If the contractors' construction deviate from construction progress, the ET should review the contractors' working plan, situation of construction site, condition of equipment and its application to identify potential environmental issues timely and propose pertinent solutions. Environmental monitoring and audit plan should be kept in pace with construction progress, so that monitoring locations and frequency can be timely modified.

(2) On-site inspection

The Environmental Monitoring and Audit Team should independently conduct on-site inspection regularly (once a week) to check contractors' implementation of the contractual provisions on environmental protection, and to identify existing and potential environmental issues. Records including photographs of the sites should be made timely as necessary. If non-compliances are found, action plan should be implemented immediately.

(3) Monitoring

The Environmental Monitoring and Audit Team should be equipped with portable monitoring equipment so that at-source measurement can be performed as necessary to identify pollution sources.

11 Complaints

The environmental monitoring and audit panel should provide complaint hotline in Shenzhen and Hong Kong for public complaints. The ET should make detailed record and investigation for any complaints. If investigation confirms that the complaints are related directly or indirectly to construction activities, the ET should report to the Employer and implement corrective actions. A written response should be made for any compliant received.

12 Report Submission

The environmental monitoring and audit panel should submit monthly and quarterly reports to environmental monitoring and audit and the Engineer/Engineer's Representative.

12.1 Monthly Report

The monthly environmental monitoring and audit reports should be submitted to the Employer. The following should be included in the reports:

(1) Executive summary

(2) Project description of construction, organization, Project progress

(3) Summary of the requirements of the environmental monitoring and audit manual,

including:

Environmental quality (water quality, air, noise, ecology)

Requirements for monitoring and audit (monitoring parameters, locations. TAL levels and action plan)

Map of sensitive receivers and monitoring locations

Monitoring frequency and time of monitoring (monitoring time, frequency, period. cycle)

Monitoring methods

Monitoring results (including hydrology and weather conditions)

Audit

Complaint and response

(4) Construction impact analysis (main construction activities, construction site inspection, impact analysis)

(5) Conclusion and recommendation (works of current month, construction site inspection, environmental issues and suggestion, works for next month)

12.2 Quarterly Report

The quarterly environmental monitoring and audit reports should be submitted tothe Engineer/Engineer's Representative and the Employer. The following should be included in the reports:

(1) Executive summary and description of the project organization, construction condition and progress

(2) Summary of the requirements of the environmental monitoring and audit manual (monitoring parameters, TAL levels and action plan)

(3) Area of construction activities (maps of construction sites, receivers and environmental monitoring locations)

(4) Identification of the cause for exceedances (summary on exceedance, their causes and the corrective actions to be taken)

(5) Implementation of environmental mitigation measures (mitigation measures, im-

plementation, evaluation of effectiveness, suggestion on remediation)

(6) Variation trend of the environmental quality

(7) Complaints and response

(8) Conclusion and suggestion

13 Schedule Arrangement

The construction will commence in April 2001 and complete in September 2004. Baseline monitoring should be carried out within two months prior to the commencement of the construction. Post project ecology monitoring is required to be performed until two years after the project completion. As a result, the environmental monitoring and audit will be implemented from February 2001 to September 2006 (or September 2007).

For air quality, noise and ecology, data from the Stage III EIA report can be used as baseline data for construction period if the project starts within twelve months after completion of EIA. This and the completion of the project (early or late) will affect the EM&A implementation duration.

The environmental impacts and their mitigation measures are listed in Table 13. 1.

Table 13-1 Summary of Mitigation Measures for the Project

Parameters	Mitigation Measures	Responsible parties	Timing			
			Pre-construction Stage	Construction Stage	Maintenance Stage	Operation Stage
Air	1) The vehicle velocity on the haul road and at the site shall be restricted within 8 km/h; 2) The bulldozer traveled on the haul road and at the site shall be limited within 8km/h; 3) Water spray shall be applied four times a day on the haul roads and twice a day at the construction site; 4) Every vehicle shall be washed to remove any dusty material from its body and wheels before leaving the site.; 5)The watering device shall be used during the handling of dusty material; 6) The sealed system shall be adopted for cement transportation; 7) Stockpiling of cement at open space shall be avoided; 8) All vent holes shall be fixed with appropriate filter; 9) Watering and cleaning of the construction site, shall be carried out regularly especially during dry season; 10) Construction equipment with minimum dust emission shall be used; 11) The raw material for concrete production shall be wetted before putting in the concrete mixer; 12) Any stockpile of aggregates or spoil shall be completely covered and water applied. 13) Any stockpile of dusty material shall be located from any ASRs and the entrance of the construction site ;	Contractor		X	X	

Table 13-1 Summary of Mitigation Measures for the Project

Parameters	Mitigation Measures	Responsible parties	Timing			
			Pre-construction Stage	Construction Stage	Maintenance Stage	Operation Stage
	14) The load on the vehicles shall be covered entirely by clean impervious sheeting to ensure that the dusty materials do not leak from the vehicle; 15) The haul road and construction machinery should be arranged as far away as possible from the sensitive receivers; 16) Water spray shall be applied to dusty materials before it is unloaded on site; 17) In the process of typical concrete mixing, dustproof methods should be adopted, such as installing filter on the ventilation opening, watering regularly, spraying water at loading areas and enclosing part of or whole material-loading area etc.. 18) The contaminated mud shall be removed at once;					

Table 13-1 Summary of Mitigation Measures for the Project

Parameters	Mitigation Measures	Responsible parties	Timing			
			Pre-construction Stage	Construction Stage	Maintenance Stage	Operation Stage
Noise	**Construction noise:** 1) The construction programme shall be arranged carefully. 2) The mechanical equipment shall be carefully arranged to avoid working in the same area (especially on the site boundary) 3) Engine noise silencer muffler and temporary noise barrier shall be used as far as possible 4) Use quite power mechanical equipment 5) Unused equipment for a long time shall not be used and maintenance of renewal of equipment shall be carried out regularly 6) Setting up temporary noise barrier 7) On the Shenzhen side, within 145 m away from NSRs only one set of construction activity can be carried out. On the Hong Kong side , within 84m away from NSRs only one set of construction activity can be carried out. 8) Construction at night time shall be prohibited.	Contractor		**X**		
	Shipping noise: 1) Whistling is prohibited 2) Adopting engine noise abatement, silencer; 3) Adopting engine enclosure	Contractor		**X**	X	
Water Quality	**(1) Construction method** Closed grab dredger shall be used for dredging of mud in the river channel. Silt curtain shall be used across the river channel at 200m upstream and 500m downstream of the dredging work to prevent the re-suspended sediment from transport to downstream of the river. Dreading rate shall be reduced by 10% or more if exceedance in relevant standards is recorded during the EM&A work. The dredging rate shall be further reduced until no exceedance is recorded.	Contractor		**X**	**X**	

Table 13-1 Summary of Mitigation Measures for the Project

Parameters	Mitigation Measures	Responsible parties	Timing			
			Pre-construction Stage	Construction Stage	Maintenance Stage	Operation Stage
	The construction method of separating and isolating the excavated channel from the existing river shall be used to reduce the impact on water environment. Dredging grab raising speed shall be as slow as possible to avoid loss of sediment into the river water. Leakage of fuel oil shall be avoided. The mud shall be stacked steadily on the barges and the height of the stack shall be of suitable height to avoid leakage. Covering the stack of mud by suitable materials shall be used whenever necessary. **(2) Construction arrangement** **Dredging shall be reduced as far as possible. The unavoidable dredging shall be arranged in high tide to avoid sediment re-suspension.** **Dredging shall be carried out at any one of the sections at a time only. Only one set of dredger is allowed to work at the same time.** (3) Mitigation measures for maintenance dredging **The mitigation measures used during the construction period are also applicable and effective in maintenance dredging.**	Contractor Contractr		**X**	**X** **X**	
Spoil Disposal	**Water quality**	Contractor		**X**		

Table 13-1 Summary of Mitigation Measures for the Project

Parameters	Mitigation Measures	Responsible parties	Timing			
			Pre-construction Stage	Construction Stage	Maintenance Stage	Operation Stage
	1) The management of barges shall be strengthened and discharge of wastewater into the water is not allowed. 2) Drainage ditches hall be provided at the non-contaminated disposal ground to collect the surface run-off. Discharge shall be permitted only where the water complies with the requirements in "Standard for effluent discharge into group D inland water" in the Technical Memorandum of Water Pollution Control Ordinance in HK. **Air Quality** The contractors should take the following necessary measures to reduce dust emission: 1) The vehicle velocity on the haul road and at the site shall be restricted within 8 km/h; 2) Water spray shall be applied four times a day on the haul roads and twice a day at the construction site; 3) Every vehicle shall be washed to remove any dusty material from its body and wheels before leaving the site.; 4) The load on the vehicles shall be covered	Contractor		X		

Table 13-1 Summary of Mitigation Measures for the Project

Parameters	Mitigation Measures	Responsible parties	Timing			
			Pre-construction Stage	Construction Stage	Maintenance Stage	Operation Stage
	entirely by clean impervious sheeting to ensure that the dusty materials do not leak from the vehicle; 5) The haul road shall be located from ASRs as far as possible.; 6) The mud loaded onto the vehicles shall be covered during transportation to avoid leakage and odour emission. **Noise** 1) 1) Whistling is prohibited 2) Shipping must be prohibited from 11:00 pm-7: 00 am.	Contractor		X		
	Ecology The construction site shall be fenced to avoid disturbance on the wild life.. The marshes in the north of bloodworm ponds should be preserved for natural conservation. After completion of the Project, the marshes shall be permanently preserved. Spoil disposal in the Nam Hang middle valley will form two platforms with elevations of 12 m and 18 m respectively. According to the project design, it is recommended to relocate the border fence onto the outer slope of the	Design engineer to design, contractor to construct, AFCD to maintain on Hong Kong side and SZRRO to maintain on Shenzhen side	X	X	X	X

Table 13-1 Summary of Mitigation Measures for the Project

Parameters	Mitigation Measures	Responsible parties	Timing			
			Pre-construction Stage	Construction Stage	Maintenance Stage	Operation Stage
	new dyke and plant trees and grasses on the platforms. The areas within the Sandy Ridge Cemetery are to be restored as grassland after completion of spoil disposal. The other part of the upper terrace is to be covered by local lignosa, including arbor and shrub. Priority is given to the native plants, which are more suited to the living conditions in the Nam Hang middle valley and also provide food for wild animals. Construction work shall be arranged to avoid disturbance of barges to bird especially during bird migrating period. The construction programme should reflect this requirement. **Landscape** After completion of spoil disposal, the dumping ground must be cleared and re-vegetated. **Construction Method** **Before construction activity begins, a detailed contaminated spoil distribution map should be made. During construction, the dredging of Class C contaminated soil should be separated from dredging of other materials according to the map. A system**	Contractor		X		

Table 13-1 Summary of Mitigation Measures for the Project

Parameters	Mitigation Measures	Responsible parties	Timing			
			Pre-construction Stage	Construction Stage	Maintenance Stage	Operation Stage
	should be designed to record the final disposal position of each part of contaminated soil.					
Ecology	1) Reprovisioning of two-way vehicular bridge in Man Kam To; 2) No dumping of dredged spoil in ecologically important habitats adjacent to the construction site; 3) Ecological habitats outside the river channel shall be protected by fences barriers; 4) Minimizing barging disturbance to wildlife; 5) Preventing the residual marshes from deterioration 6) Planting native species trees along the outside embankment slopes; 7) Restoring the abandoned meanders to marshcrete; 8) Restoring the temporarily occupied fishponds; 9) Establishing grasscrete along the crests of embankments; 10) Compensation for the lost woodland. 11) Creation of grasscrete berm along the embankments;	Design engineer to design, contractor to construct, AFCD to maintain on Hong Kong side and SZRRO to maintain on Shenzhen side	X	X	X	X
		Design engineer to design, contractor to construct, DSD to	X	X	X	X

Table 13-1 Summary of Mitigation Measures for the Project

Parameters	Mitigation Measures	Responsible parties	Timing			
			Pre-construction Stage	Construction Stage	Maintenance Stage	Operation Stage
		maintain on Hong Kong side and SZRRO to maintain on Shenzhen side				
Landscape and Vision	1) Design carefully and construct nicely to reduce losses of woodland, grassland, pond and marsh as much as possible. 2) When construction is completed, all temporary construction establishments must be removed in each construction site and original usage or vegetation must be restored. 3) Restore the temporary works area to its original usage and vegetation. 4) Roads planned for transportation of spoil must be as far away from VSRs as possible. 5) All machinery and vehicles parked temporarily should be laid in order. 6) When temporary construction facilities, such as housing, storage and processing plant, are designed and built, aesthetic requirements must be considered in designing and construction. 7) For river section with vertical wall cross-section, liane will be planted on the dyke crests. （such as 爬墙虎）	Design engineer to design, contractor to construct, AFCD to maintain on Hong Kong side and SZRRO to maintain on Shenzhen side	X	X	X	X

Table 13-1 Summary of Mitigation Measures for the Project

Parameters	Mitigation Measures	Responsible parties	Timing			
			Pre-construction Stage	Construction Stage	Maintenance Stage	Operation Stage
	8) Plant grasscrete on the newly built banks. 9) Restore the river meander into ponds and marshes and plant native riparian trees. 10) A Landscape Master Plan should be submitted to relevant department before the commencement of the Project. 11) Establish grasscrete along the berm of the new river channel.	Design engineer Design engineer to design, contractor to construct, DSD to maintain on Hong Kong side and SZRRO to maintain on Shenzhen side	X X	X	X	X
Cultural Heritage	Responsible parties and funding agent: Project proponent Timing: 12 months before project commencement to the completion of the project A detailed scheme has to be worked out and agreed by both Shenzhen and Hong Kong on whether to re-erect the Lo Wu Railway Bridge on the upper reach of the Shenzhen River but prohibit its use by passenger or to re-erect the bridge as a pedestrian bridge in other place or to preserve the bridge in the museum. Before the demolition of the Lo Wu Railway Bridge, the project proponents (Shenzhen River Regulation Office and Hong Kong	DSD SZRRO	**X**	**X**		

Table 13-1 Summary of Mitigation Measures for the Project

Parameters	Mitigation Measures	Responsible parties	Timing			
			Pre-construction Stage	Construction Stage	Maintenance Stage	Operation Stage
	Drainage Services Department) have to engage historical heritage experts whose qualification has to be verified by the Hong Kong Antiquities and Monuments Office and Shenzhen Relics Management Committee. The experts have to conduct a study on the "Dismantle of Lo Wu Railway Bridge " within at least 6 months before start of the project. The content of the "Dismantle of Lo Wu Railway Bridge " shall include detailed rules on information recording, dismantle procedures, dismantle programme, guidelines for preserving the dismantled materials, location of re-erection, restoration programme and detailed rules for restoration. The bridge shall only be demolished after the dismantle proposal has been approved by the Hong Kong Antiquities and Monuments Office and other relevant offices. The project proponent should preserve and store the parts of the bridge according to the Guidelines for preserving components of structures of the "Dismantle of Lo Wu Railway Bridge ". The project proponent should employ experts for mapping, recording and taking photographs of the Lo Wu Old Footbridge. The project proponent should start the demolition of the bridge only after the mapping and photography are taken and the records are submitted to and approved by the Hong Kong Antiquities and Monuments Office and Shenzhen Relics Management Committee. The ancient kiln should be excluded from the					

Table 13-1 Summary of Mitigation Measures for the Project

Parameters	Mitigation Measures	Responsible parties	Timing			
			Pre-construction Stage	Construction Stage	Maintenance Stage	Operation Stage
	site and be protected by site fence. A detailed special archeology investigation should be carried out in the Study Area. If any archaeological sites are found in the Project Area, archaeologist must report to the Hong Kong Antiquities and Monuments Office and prepare further mitigation measures such as relocation of ancient site or archaeological excavation after the investigation. But the Hong Kong Antiquities and Monuments Office must approve these mitigation measures in advance.					
Water and Soil Conservation	**(1) Preventive measures in borrow area** 1) Excavation should be carried out in steps of divided sub-areas, which should be restored timely after construction is completed. This will avoid the forming bare land to reduce water and soil erosion. 2) The water retaining facilities should be provided in upper-stream side of the excavation face to hold up the run-off from upper-stream; drainage ditches should e provided in the other marginal part for rainwater drainage in the surrounding area, to prevent the erosion around the borrow area. 3) Settling tanks shall be set up in theborrow area., In addition, water drainage system needs to be improved. 4) The slope of the excavated face must be less than the natural stable angle of the earth material. The height of the excavation shall generally be less than 4 m. 5) The spoils and rocks produced in the borrow area shall be properly stored to prevent loss.	Contractor		X		

Table 13-1 Summary of Mitigation Measures for the Project

Parameters	Mitigation Measures	Responsible parties	Timing			
			Pre-construction Stage	Construction Stage	Maintenance Stage	Operation Stage
	They could be used for back-filling pits in the borrow area after completion of borrowing. 6) After borrowing, the area shall be restored in accordance with the measures for water and soil conservation. **(2) Measures for spoil disposal** 1) Cut-off facilities shall be established to effectively control water and soil erosion in spoil ground 2) Drainage ditch shall be constructed in surrounding area of the spoil disposal ground for draining. 3) After completion of disposal, soil shall be covered and vegetation shall be restored. 4) Measures for preventing leakage shall be adopted in transporting spoil. **(3) Preventive measures for construction of river channel, embankment reprovisioning work** 1) Proper dredging equipment shall be used to minimize the discharge and re-suspension of sediments in dredging operation in the existing river. 2) When excavation in new river channels or for reprovisioning work, dry excavation inside cofferdam is recommended to prevent water and soil erosion. 3) Dredging and excavation should be arranged in dry season as much as possible. 4) The site that is not liable to erosion by run-off shall be selected to store the soils excavated, with temporary drainage ditch in surrounding area to drain water. 5) Outer slope of the new built dyke shall be grassed with drainage facility.	Contractor Contractor		X X		

Table 13-1 Summary of Mitigation Measures for the Project

Parameters	Mitigation Measures	Responsible parties	Timing			
			Pre-construction Stage	Construction Stage	Maintenance Stage	Operation Stage
	(4) Preventive measures for material storage 1) Measures for preventing leakage shall be adopted in transporting material. 2) The field that is not liable to erosion shall be chosen to store the material in the open air and the material shall be covered by felt. 3) Temporary drainage ditches shall be built in the surrounding area of the stockpiling area to drain water.	Contractor		X		
	(5) Restoration of the construction site	Contractor		X		

Note: DSD – Drainage Services Department of Hong Kong SAR Government
AFCD – Agriculture, Fisheries and Conservation Department of Hong Kong SAR Government
SZRRO – Shenzhen River Regulation Office of Shenzhen Municipal Government