

Territory Development Department
New Territory North Development Office

Agreement No CE 43/96
Main Drainage Channels and
Poldered Village Protection Scheme
for San Tin, NWNT : *Environmental
Impact Assessment Study*

Working Paper for 35CD Works

24 October 1997

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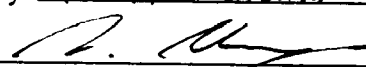
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Reference C1618

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| For and on behalf of ERM-Hong Kong, Ltd |
| Approved by: <u>FREEMAN CHEUNG</u> |
| Signed: <u></u> |
| Position: <u>Technical Director</u> |
| Date: <u>24 October 1997</u> |

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INTRODUCTION

1.1

PREAMBLE

ERM - Hong Kong Limited (ERM), in association with Maunsell Consultants Asia Limited (Maunsell), Ecosystems Limited (Ecosystems), Shankland Cox Limited (Shankland Cox) and Mr Paul Leader (Ornithologist), have been commissioned by the Government of Hong Kong, Territory Development Department - New Territories North Department Office (TDD NTN) to undertake an Environmental Impact Assessment (EIA) Study for the *Agreement No. CE 43/96 Main Drainage Channels and Poldered Village Protection Scheme for San Tin, North West New Territories* (the Study). The Study commenced on 14 February 1997. *Figure 1.1a* shows the location of the main drainage channels and village flood protection works.

This Working Paper for 35CD is the second output from the Study which provides a review of the potential environmental impacts arising from the 35CD village flood protection works, and the mitigation measures in the 35CD contract clauses which were derived from a similar project, *71CD, Village Flood Protection for Sha Po Tsuen, Kam Tin, New Territories*.

1.2

BACKGROUND OF THE 35CD WORKS

The San Tin Basin is a small subsidiary (21 km²) of the Shenzhen River Basin and comprises a number of minor tributaries to the Shenzhen River. The North Territories Circular Road (NTCR) and the Lok Ma Chau Border Link are the two main physical barriers crossing the drainage basin. The construction of road network including the NTCR, the expansion of the rural communities, the modification of the drainage system, the infilling of fishponds and the encroachment on downstream watercourses have increased the incidence of flooding in the San Tin Basin.

Loss of wetland, lack of regular maintenance and local constrictions in the watercourses cause flooding in even minor rainstorms. San Tin and Chau Tau area are most susceptible to flooding in the vicinity of the NTCR where all the major villages in the basin lie.

Owing to the urgent need to protect the seven San Tin villages and the village of Chau Tau Tsuen from the risk of recurrent flooding, village flood protection work under 35CD has been given the highest priority in the Brief. The 35CD has been assessed in advance of the Eastern (73CD) and the Western Main Drainage Channel (non-itemized) works due to the existing major flood hazard problem. The construction work is being carried out by the Contractor of the Drainage Services Department. The Contractor of the 35CD works should implement environmental recommended for PWP item *71CD Village Flood Protection for Sha Po Tsuen, Kam Tin, New Territories*, as specified in the contract clauses (see *Annexes A and B*).

OBJECTIVES OF THE WORKING PAPER FOR 35CD

The objectives of the Working Paper for 35CD as set out in the Brief are:




- to provide an initial assessment and evaluation of the environmental impacts and cumulative effects arising from the 35CD works sufficient to identify those issues of key concern during the construction, operation and decommissioning of the works;
- to define measurable environmental parameters and environmental features likely to be affected by the 35CD works of the Project and identifies the environmental monitoring programmes which are required both to provide a baseline profile of existing environmental conditions and to monitor impacts and compliance during construction, commissioning, operation (and decommissioning) of the works; and
- to define the environmental audit requirements for compliance and post-project audit, which would include a review of the monitoring data both to identify compliance with regulatory requirements, policies and standards and to define any remedial works required to redress unanticipated or unacceptable consequential environmental impacts.

STRUCTURE OF THE WORKING PAPER FOR 35CD

This Working Paper is organised into 5 sections. Following this introductory section, the subsequent sections are described below:

- *Section 2* describes the village flood protection works for the Chau Tau Tsuen and the seven San Tin villages of the 35CD works;
- *Section 3* describes the relevant Government legislation, standards and guidelines;
- *Section 4* reviews the environmental impacts of 35CD with respect to ecology, water quality, noise, air quality and solid waste management for the construction and operational phases; and identifies any further mitigation and monitoring clauses necessary to reduce potential impacts to the standards presented in *Section 3*; and
- *Section 5* provides an overall summary of the report.



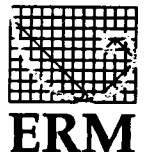
- KEY
-  STAGE 1 WORKS OF PWP ITEM NO. 35CD
 -  STAGE 2 WORKS OF PWP ITEM NO. 73CD
 -  STAGE 3 NON-ITEMIZED WORKS (ALTERNATIVE ALIGNMENTS)



SCALE 1:20000

FIGURE 1.1a - LOCATION OF PROJECT WORKS

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2.1

INTRODUCTION

The 35CD works (i.e. flood protection schemes) involve the construction of "polders" in the flood prone villages of Chau Tau and San Tin which includes Wing Ping Tsuen, Tung Chan Wai, Yan Shau Wai, On Lung Tsuen, Fan Tin Tsuen, San Lung Tsuen and Tsing Lung Tsuen.

The polders (ie: flood protection bunds) surrounding the villages will be formed by flood protection embankments with access/maintenance roads on top. A flood pumping station and a flood storage pond will also be provided to collect and discharge flood water within the polders.

The construction work for the 35CD village flood protection works for San Tin villages and Chau Tau Tsuen commenced on 20 November 1996 and 30 April 1997 respectively. Both of them have been scheduled to be completed by May 1999. The 35CD construction mainly involves earthworks and concreting works. Land access is available over the length of the embankment via the NTCR (ie: Castle Peak Road - San Tin and Sham San Road) and Lok Ma Chau Road. Marine access is restricted by shallow water within the existing channel and river courses.

2.2

CHAU TAU TSUEN

The flood protection works include the construction of an earth bund, approximately 3 m high by 16 m wide on the three sides of the village and extended to a local road. An access/maintenance road to the village will be constructed along the top of the bund, connecting the Lok Ma Chau Road and the local road. Concrete U-channels and rectangular interceptor channels will be constructed at the base of the bund to provide drainage of the village, bund and adjacent areas. A flood storage pond and flood water pumping station will also be constructed to the south-west of Chau Tau Tsuen. *Figure 2.2a* shows the layout of the flood protection works for Chau Tau Tsuen.

2.3

SAN TIN VILLAGES

The flood protection works at the villages of San Tin are similar to those for Chau Tau Tsuen. An earth bund approximately 1 m high by 11 m wide will be constructed on three sides of the villages and extended to the Castle Peak Road - San Tin of NTCR. An access/maintenance road will be constructed along the top of the bund. Concrete U or rectangular channels will be constructed at the base of the bund to provide drainage of the villages. A twin cell box culvert will be connected with a flood water pumping station to divert the flood water the drainage channel. The existing fish ponds to the west of On Lung Tsuen will be converted to flood storage and located adjacent to the pumping station. *Figure 2.3a* shows the layout of the flood protection works for the San Tin villages.

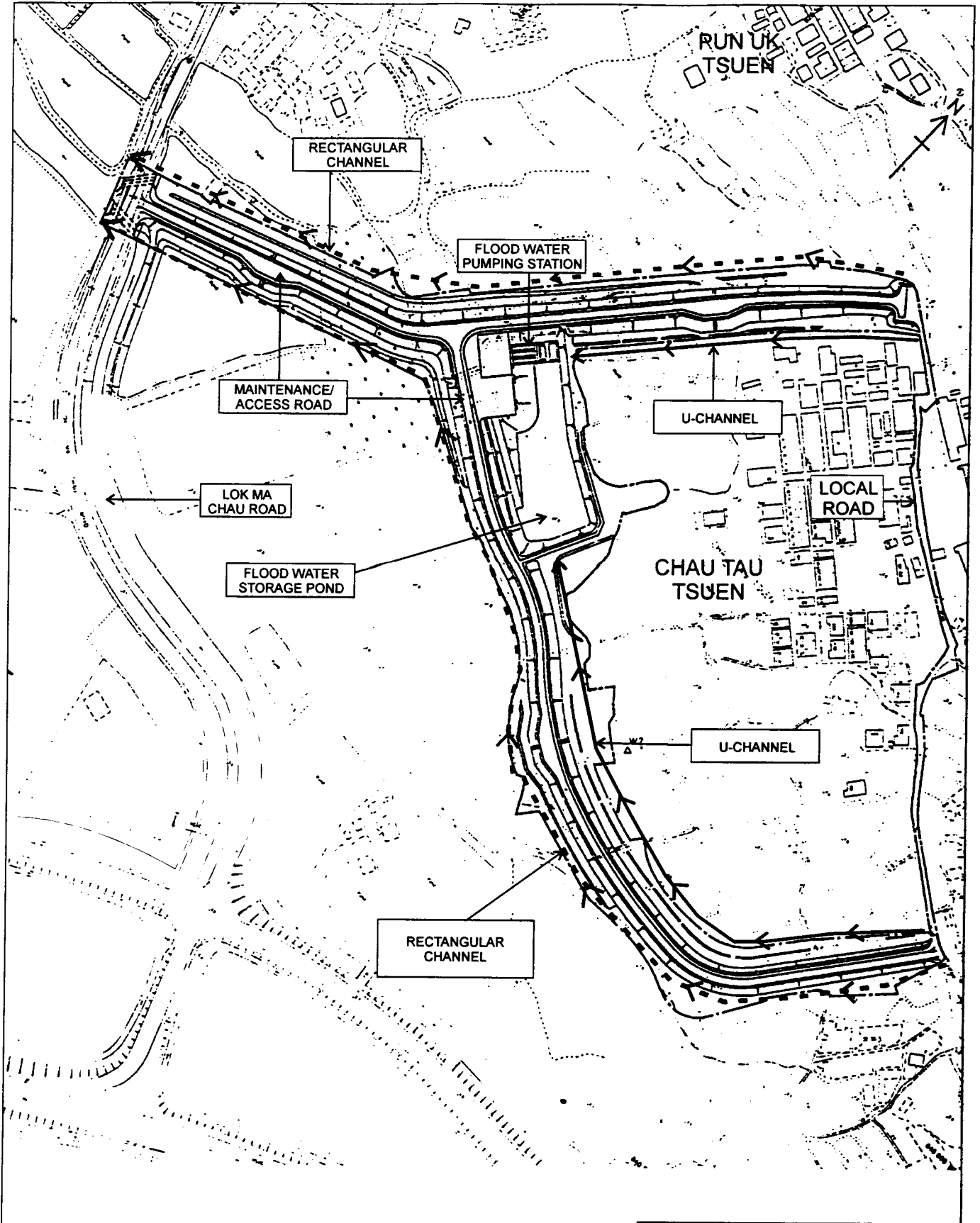
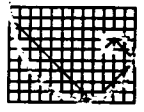


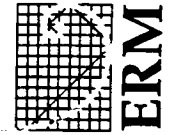
FIGURE 2.2a - THE LAYOUT OF THE VILLAGE FLOOD PROTECTION WORKS FOR CHAU TAU TSEUN

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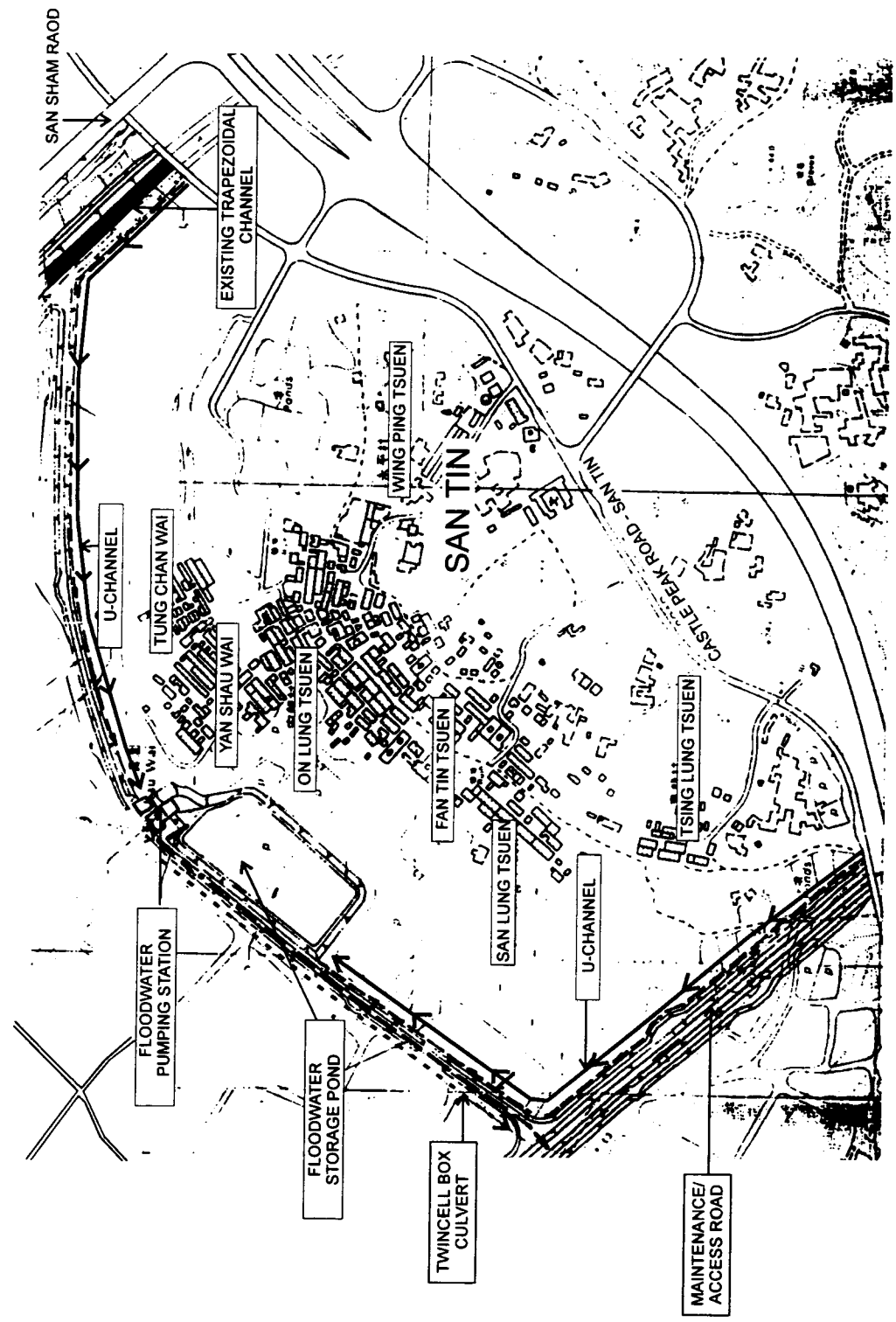


FIGURE 2.3a - THE LAYOUT OF THE VILLAGE FLOOD PROTECTION WORKS FOR SAN TIN VILLAGES

3.1 *ECOLOGY*

The following regulations are related to the environmental parameters of Stage 1 35CD Poldered Village Protection (PVP) scheme in terms of ecological considerations.

3.1.1 *Hong Kong Legislation and Guidelines*

Hong Kong government ordinances and regulations relevant to the present project include the following:

The Forests and Countryside Ordinance (Cap. 96), which protects both natural and planted forests and prohibits burning in areas of open countryside. The Forestry Regulations, which protect listed local wild plant species.

The Wild Animals Protection Ordinance (Cap. 170), which provides for protection of listed species of wild animals by prohibiting the disturbance, taking or removal of animals or their nests or eggs. The Ordinance also provides for the protection of habitat via entry restriction, eg. the the Restricted Areas of Yim Tso Ha egretry and the Mai Po Marshes.

The Town Planning Ordinance (Cap. 131), which provides for the drawing up of statutory plans to control development, including the conservation of areas such as Sites of Special Scientific Interest (SSSIs), Green Belts, Conservation Areas, and Coastal Protection Areas to protect natural features, and includes the prohibition of pond filling without planning permission for some zones.

In addition, the study makes reference to the following guidelines and other documents of Hong Kong Government:

Hong Kong Planning Standards and Guidelines (HKPSG) Chapter 10, "Conservation", which provides guidelines on incorporating nature conservation objectives into landuse planning and new development.

Guidelines for Implementing the Policy on Off-site Ecological Mitigation Measures (PELB Technical Circular 1/97, Works Branch Technical Circular 4/97, dated 17 February 1997). This Technical Circular sets out guidelines for implementation of Government policy on off-site ecological mitigation measures

Agriculture & Fisheries Department Fish Pond Categories, which categorise Hong Kong fish ponds into four grades depending on surface area, proximity to other ponds, quality of management, security from development, and access (AFD undated map). Conservation of native flora and fauna is not a criterion of the AFD fish pond classification, but there is a general relationship between the classification scheme and the potential for ponds to provide foraging areas for birds: the better managed, more secure ponds (Grade A ponds) would be expected to provide more reliable foraging areas over a longer time period than would the Grade C ponds, which are susceptible to conversion for other uses and are not as well managed.

The study takes note of the following international agreements which currently apply to Hong Kong, as a Special Administrative Region of the PRC:

Ramsar Convention

Through the PRC, Hong Kong is a party to The Convention on Wetlands of International Importance Especially as Waterfowl Habitat (the *Ramsar Convention*). The Convention requires parties to conserve and make wise use of wetland areas, particularly those supporting waterfowl populations (Article 3.1). "Wise use" of wetlands is defined as "their sustainable utilisation for the benefit of mankind in a way compatible with the maintenance of the natural properties of the ecosystem". The primary concern of the Convention is the welfare of wetlands and the waterfowl dependent on them.

Article 1 of the Convention defines wetlands as 'areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres.' All river, stream, pond, marsh, mangrove and mudflat habitats upstream of, within and downstream of the study area, whether natural or artificial, qualify as wetlands under this definition.

The ecological value of wetlands in the NWNT is high (Chu 1993) and the fish ponds in the Deep Bay Area are the subject of the ongoing Fish Pond Ecology study commissioned by the Planning Department. Although fishponds are man-made wetlands, their natural properties must be maintained for Hong Kong to meet its responsibilities under the Ramsar Convention as highlighted by AFD in the Ramsar Site Study.

The Mai Po/Inner Deep Bay wetland was declared a Wetland of International Importance ("Ramsar site") under the Convention in 1995. The PRC is also a signatory of the Ramsar Convention, and the Joint Liaison Group has approved the Convention's continued application to Hong Kong after 1 July 1997 (D. Melville, pers. comm.).

Bonn Convention

Hong Kong was originally a Party to the Convention on the Conservation of Migratory Species of Wild Animals (the *Bonn Convention*) through the UK. The Bonn Convention has two major objectives:

- to provide strict protection for species listed in Appendix I of the Convention (migratory species in danger of extinction throughout all or a significant portion of their range); and
- to encourage Range States for such species to conclude agreements for the conservation and management of Appendix II species (migratory species

which have an unfavourable conservation status and require international agreements for their conservation, or which have a conservation status which would significantly benefit from international co-operation). At present no such agreements are relevant to Hong Kong.

The first objective above includes obligations to conserve and restore those habitats which are important in removing the species from danger of extinction, and to prevent, remove, compensate for or minimise the adverse effects of activities or obstacles that impede or prevent migration of the species. The Bonn Convention is primarily of interest in Hong Kong with regard to migratory bird species.

United Nations Convention on Biodiversity

The PRC is a Contracting Party to the United Nations Convention on Biological Diversity of 1992. The present study takes note primarily of Article 8 of the Convention, which states (Paragraph (c)) that each Contracting Party shall regulate or manage biological resources important for the conservation of biological diversity whether within or outside protected areas, with a view to ensuring their conservation and sustainable use. Paragraph (d) of Article 8 adds that each Contracting Party shall promote the protection of ecosystems, natural habitats and the maintenance of viable populations of species in natural surroundings.

The UK did not extend application of the Convention to Hong Kong, nor has the PRC yet indicated whether it will extend application to Hong Kong after 1 July 1997 (S. Broome, pers. comm.). However, the Hong Kong Government has stated that it is "committed to meeting the environmental objectives" of the Convention (PELB 1996).

3.2

WATER QUALITY

The *Water Pollution Control Ordinance, Waste Disposal (Chemical Waste) (General) Regulations* and the *Waste Disposal (Livestock Waste) Regulations* are the relevant pollution control legislations which regulate impact on inland water quality.

Under the *Water Pollution Control Ordinance (WPCO)*, Hong Kong waters are subdivided into 10 Water Control Zones (WCZ). Each WCZ has a designated set of statutory Water Quality Objectives (WQO). The streams and rivers from San Tin area drain into Sham Chun River and eventually into Deep Bay. Under the Ordinance, Deep Bay falls under the Deep Bay WCZ, any discharge into the WCZ will require licensing.

The *Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters (TM)*, issued under Section 21 of the WPCO, defines acceptable discharge limits to different types of receiving waters. Under the TM, effluents discharged into the inland waters are subject to standards for particular volumes of discharge (as stated in *Tables 3, 4, 5 and 6* of the TM). The discharge standard will vary with the use of downstream water. Group B waters are mainly those draining through agricultural lands. Group C waters refers to those which run across large numbers of fish ponds. These are defined by the Environmental Protection Department (EPD) and specified in licence conditions for any new discharge within a WCZ.

Waste Disposal Ordinance 1980 (WDO) provides an overall management framework for the collection and disposal of Hong Kong's waste. The Ordinance was amended in 1991 to provide specific control over chemical waste. The *Waste Disposal (Chemical Waste) (General) Regulation 1992* controls chemical waste and specifies the requirements for the packaging, labelling, storage, collection and disposal of chemical waste. Under the regulations, all chemical waste generators will have to register with the EPD and all chemical waste generated will have to be disposed of at a licensed facility such as the Chemical Waste Treatment Centre (CWTC) at Tsing Yi.

The control of livestock waste has been encompassed within the WDO since 1988. Under the WDO, keeping of livestock is banned in designated urban areas and a phased programme of progressive controls on livestock keeping in control and restriction areas has been defined. However, the livestock waste remains a major source of pollution for inland wastes due to problems with implementation and enforcement. The WDO and the relevant regulations were amended recently and a new implementation programme has been introduced.

3.3 NOISE

3.3.1 Construction Phase

It is anticipated that the construction works would be undertaken within normal working hours, ie the period of 0800 to 1800 hours. There are currently no legislative standards in Hong Kong for the control of construction activities during normal working hours. A limit of $L_{Aeq, 30min}$ 75 dB has been proposed in the *Practice Note for Professional Persons - Noise from Construction Activities - Non-statutory Controls, Environmental Protection Department, June 1993 (ProPECC PN2/93)* for sensitive residential receivers. This limit has been adopted in the Contract Clauses for the 35CD works to protect Noise Sensitive Receivers (NSRs).

Apart from the *Technical Memorandum on Noise From Construction Work Other Than Percussive Piling (TM1)* and the *Technical Memorandum on Noise From Percussive Piling (TM2)*, which are published under the *Noise Control Ordinance (NCO)* for controlling construction noise during restricted hours (1900-0700 hours) and at any time on a general holiday, including Sunday. Construction Noise Permit is required for the 35CD works under the control of the TMs. There is also the *Technical Memorandum on Noise From Construction Work in Designated Areas (TM3)* for controlling the use of Specified Powered Mechanical Equipment (SPME) other than percussive piling and the undertaking of Prescribed Construction Work (PCW) during restricted hours. However, the project site is not within the noise control designated area, TM3 will not be applicable.

3.3.2 Operational Phase

Noise from the Flood Water Pumping Station will be controlled by the *Technical Memorandum For The Assessment of Noise From Places Other Than Domestic Premises, Public Places Or Construction Sites (TM4)* and Hong Kong Planning Standards and Guidelines (HKPSG).

All fixed noise sources should be so located and designed that the noise levels at the façade of the nearest NSRs would be at least 5 dB(A) lower than the

appropriate Acceptable Noise Level (ANL) in accordance with the HKPSG.

The annual average daily traffic flow for Castle Peak Road - Tam Mi, Mai Po & San Tin Section is under 30,000 vehicles according to the *Annual Traffic Census 1995* published by Transport Department. The Area Sensitivity Rating for both San Tin Villages and Chau Tau Tsuen, in which the low density residential area consisting of low-rise developments located, has assigned as 'A' according to TM4. The HKPSG fixed plant noise criteria (ANL-5) would therefore be L_{Aeq} 55 dB for daytime and evening period; and L_{Aeq} 45 dB for night-time period.

3.4

AIR

The principal legislation for the management of air quality is the *Air Pollution Control Ordinance (APCO) (Cap 311)*. The whole of the Hong Kong Territory is covered by the Hong Kong Air Quality Objectives (AQOs) which stipulate the statutory limits of a number of air pollution parameters and the maximum allowable numbers of exceedance over specific periods.

In accordance with the *Technical Memorandum on Environmental Impact Assessment Process, Environmental Impact Assessment Ordinance*, an hourly average TSP concentration of $500 \mu\text{g m}^{-3}$ should not be exceeded for construction dust impact. This limit has been adopted in the Contract Clauses for the 35CD works to protect Air Sensitive Receivers (ASRs). Any objectionable odour emission of air pollutant from any stationary source causing or contributing to the existence or imminence of a nuisance, should meet 5 odour units based on an averaging time of 5 seconds for odour.

Open burning in the 35CD construction area will be controlled by the *Air Pollution Control (Open Burning) Regulation (1996)*. Any open burning for the purpose of disposal of construction waste or clearance of a site in preparation for construction works are subject to this Regulation and strictly prohibited.

3.5

SOLID WASTE MANAGEMENT

3.5.1

Legislation

The following legislation covers or has some bearing upon the storage, collection, treatment and disposal of the wastes arising from the 35CD contract:

- Waste Disposal Ordinance (Cap 354);
- Waste Disposal (Chemical Waste) (General) Regulation (Cap 354);
- Crown Land Ordinance (Cap 28);
- Public Health and Municipal Services Ordinance (Cap 132) - Public Cleansing and Prevention of Nuisances (Urban Council) and (Regional Council) By-laws; and
- Dumping At Sea Ordinance (Cap 466).

3.5.2

Guidelines

Other 'guideline' documents which detail how the Contractor should comply with the regulations are as follows:

- Waste Disposal Plan for Hong Kong (December 1989), Planning, Environment

and Lands Branch Government Secretariat;

- Environmental Guidelines for Planning In Hong Kong (1990), Hong Kong Planning and Standards Guidelines, Hong Kong Government;
- New Disposal Arrangements for Construction Waste (1992), Environmental Protection Department & Civil Engineering Department;
- Code of Practice on the Packaging , Labelling and Storage of Chemical Wastes (1992), Environmental Protection Department;
- Works Branch Technical Circular No. 2/93, Public Dumps;
- Works Branch Technical Circular No. 16/96, Wet Soil in Public Dumps;
- Environmental Protection Department Technical Circular No. (TC) 1-1-92, Classification of Dredged Sediments for Marine Disposal; and
- Works Branch Technical Circular No. 22/92, Marine Disposal of Dredged Mud.

4.1 CHAU TAU TSUEN

4.1.1 Ecology

Baseline Conditions and Sensitive Receivers

A field survey was performed on 23 May 1997. Major habitats of the area included active and abandoned agricultural plots, a stream/drainage channel and a marsh (Figure 4.1a). No extensive woodland was found on the site. The existing stream channel bisected a portion of the agricultural land. The stream measured approximately 2m in width, and contained non-flowing black and odorous water which appeared to be polluted by agricultural and industrial wastes. The channel was completely overgrown with grasses and weeds. The stream bank vegetation was poor in terms of structure and diversity. This was apparently due to frequent disturbance which resulted in dominance of non-native and opportunistic weeds and plants.

A marsh was located in the Southwest corner of the study area. The marsh was apparently maintained by a combination of collapsed bunds surrounding abandoned agricultural plots together with flooding from the nearby water channel. A few Tallow-trees (*Sapium sebiferum*) were found near the centre of the marsh.

No plant species protected under Hong Kong regulations or known to be rare were found on the site. All Odonate and Lepidopteran species recorded are common (see Annex C-Table 1). One uncommon frog species (Narrow-mouthed Frog, *Kalophrynus plerostigma*), 10 bird species (see Annex C-Table 3) of limited local or regional distribution and 3 bats protected under the Wild Protection Ordinance were recorded in the nearby vicinity.

Sensitive receivers which include Mai Po Village SSSI, Mai Po Marshes SSSI, and Inner Deep Bay SSSI are discussed in Annex D.

Construction Impacts

Impacts resulting from the construction of the polder, the flood storage pond and pumping station will be a diversion of about 300 m of stream, and a loss of 0.6 ha of active and abandoned agricultural land, 0.4 ha of marsh and all their associated flora.

Impacts to flora are considered to be minimal based on the small number of species to be affected, and the commonness and weedy nature of the flora to be disturbed. The 35CD works are not expected to reduce or threaten the diversity of Hong Kong's flora.

Although losses of vegetation may not be significant floristically, they may result in degradation of habitats and affect the associated wildlife, particularly the wetland habitat (marsh, stream and agricultural habitat), which is ecologically important in providing breeding, feeding, roosting and nesting site for a diverse array of wildlife including dragonflies, damselflies, amphibian, bird (both resident and migrant) as well as mammal. The impact on most fauna is

considered to be minimal due to the limited size of 35CD and the small area of existing habitat to be affected. However the impact to birds will be moderate as the project would contribute to moderate losses of wetland/marsh and agricultural habitats in NWNT, which is known to be an important foraging area for birds.

No direct impacts upon the birds from the Ramsar Site, Ho Sheung Heung egretty, Mai Po Village SSSI egretty and Mai Po Marshes SSSI (and the former Lok Ma Chau egretty) would result from the project, but loss of feeding habitat for birds at these egrettries might constitute an indirect impact of the project, as some birds could utilise the site as a feeding habitat as shown in *Figure 4.1b*. Based on the small area of wetland to be affected by the proposed project, this impact on the SSSIs is assessed as minimal.

Operational Impacts

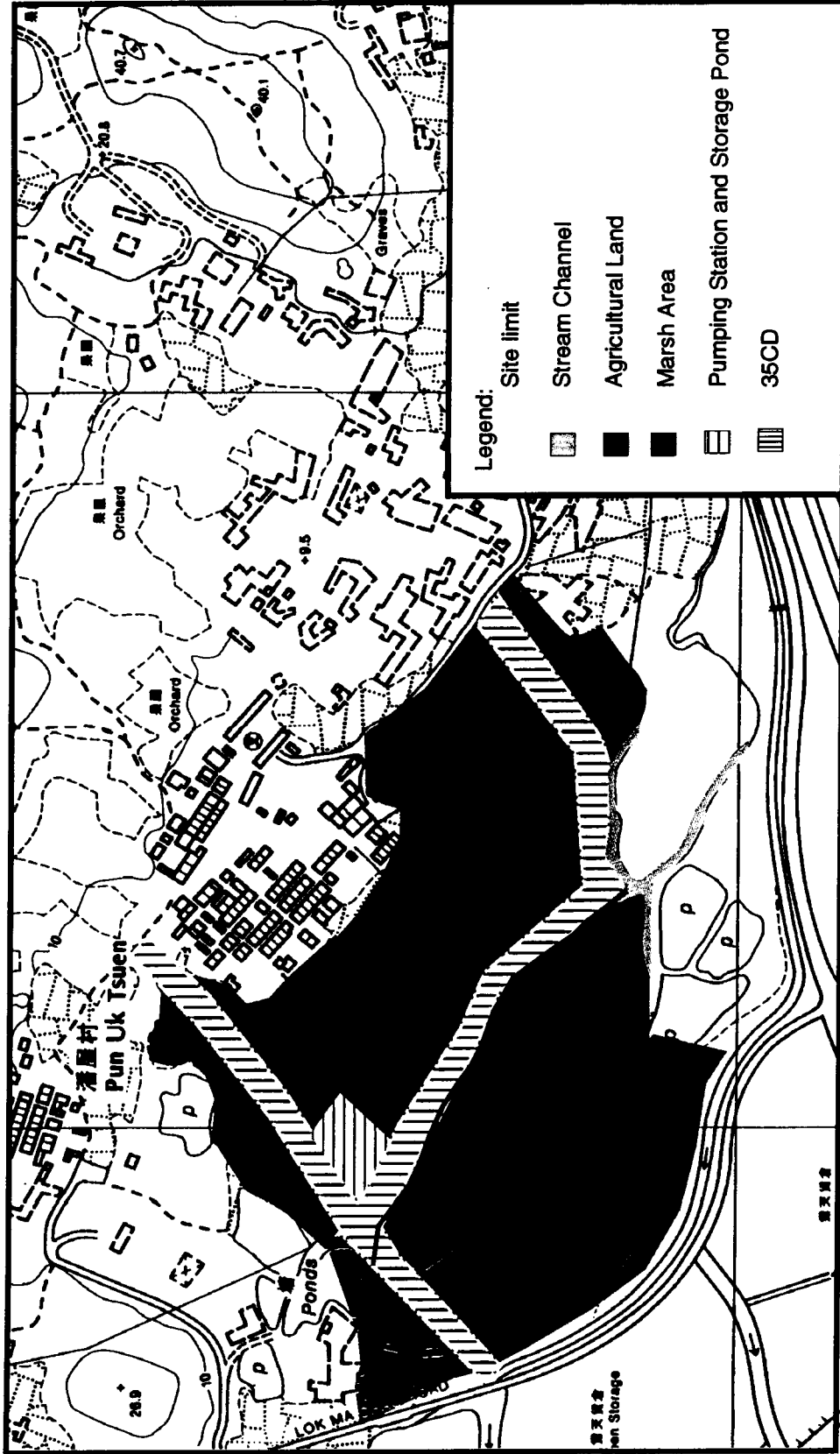
The direct operational impacts of the project to flora and fauna are predicted to be minimal. Operations will consist of periodic pumping of flood waters from the area within the polder. It is expected that most of the sediments in the flood water would be settled before the water is pumped out, therefore impact on ecological resources will be minimal.

Residual impacts would result from the inability to provide agricultural, stream, and marsh habitats in compensation for losses due to the project. There are no on-site opportunities to provide these habitats, thus the only option would be off-site re-provision. Based on the small surface area of wetlands to be lost, off-site mitigation is not justifiable.

Review of the Mitigation Clauses of 35CD Contract Document

The mitigation measures in the 35CD contract document adequately address temporary disturbance to fish ponds through reinstatement requirements. Water quality protection is also adequately addressed through measures to prevent or monitor and correct sedimentation. Construction waste management is addressed in 4.1.5 but it should be emphasised that during polder construction any large items of solid waste (automobile tires, etc.) should not be disposed in the stream. Also, the Contractor should be advised that the marsh habitat is important as a wetland, therefore encroachment onto the marsh by construction equipment outside the works limit should be avoided.

Despite the mentioned measures, some residual losses are unavoidable. There will be a net loss in agricultural land and marsh area, and modification of the stream channel. The outer embankment of the polder will require protection and this may necessitate placement of grasscrete as illustrated in DSD plans. It is suggested that both banks of the stream and all outside embankments of the polder should be planted with native trees including *Sapium sebiferum*, *Ficus microcarpa*, *Ficus variegata*, *Celtis sinensis* and bamboo following hydroseeding. This would encourage development of a stand of native riparian vegetation which would partially mitigate losses of vegetation due to construction of the polder.



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FIGURE 4.1a - HABITAT MAP OF CHAU TAU TSUEN

Based on the small surface area to be affected and the lack of baseline data, the absence of ecological monitoring requirements from the contract documents is considered appropriate.

Recommendation and Conclusion

Baseline surveys have identified agricultural lands, a marsh, and a stream as key habitats that will be effected by the flood protection works. No plant species were identified on-site which are rare or protected under Hong Kong regulations. The wetland/agricultural habitats on the project area are similar and near to those described by Chu (1995), thus are considered potentially important to fauna. Therefore, habitat losses due to the project were assessed as moderate direct impacts and, in a cumulative sense, moderate impacts in the context of the NWNT. The mitigation clauses for the 35CD contract document adequately address the adverse impact arising from the project, and replanting of vegetation is recommended to reduce the ecological impacts resulting from the proposed works. Off-site mitigation is not recommended due to the small surface area to be affected.

4.1.2 ***Water Quality***

Baseline Conditions and Sensitive Receivers

Existing Conditions

The location of Chau Tau Tsuen is shown in *Figure 2.2a*. The village is about 800 m from the Sham Chun River. It consists of discrete blocks of building located north of the site and farmlands and ponds located towards the south. To the south, a small stream is draining towards the west. Although there has been no water quality monitoring for this stream, visual observation of the blackish stream river and the accumulation of rubbish along the stream indicate that the stream water has been heavily polluted. Vegetable farming is the main economic activity found in the village; there is no major livestock farming within or near the village.

Future Conditions

During the operation phase of the flood protection works, stormwater will be drained along the two 1.4 m x 1.0 m rectangular interceptor channels and two U-shaped rectangular channels constructed along the west and south of the village (*Figure 2.2a*) near the existing stream. The rectangular interceptor channels will divert storm flow away from the village to the main channel near Lok Ma Chau Road and eventually to the Sham Chun River and Deep Bay. The U-shaped channel will convey excess stormwater to the proposed flood storage pond (*Figure 2.2a*). The design should minimise flooding and increase the peak flows in the channels. After the commission of the flood protection works, the existing stream will be largely unchanged.

Sensitive Receivers

Streams and rivers which drain the San Tin area discharge into Sham Chun River and eventually into Inner Deep Bay. Deep Bay is of great environmental conservation value as an internationally recognised site for waterfowl and other

birds. Within Deep Bay, there are two nature reserves (at Mai Po and at Fu Tien) and five SSSIs, namely Inner Deep Bay SSSI, Mai Po Egrettry SSSI, Mai Po Marshes SSSI, Tsim Bei Tsui SSSI, and Pak Nei SSSI. There are two principal fishery resources in Deep Bay: the oyster shellfishery and the inland freshwater fishponds. All of these are sensitive receivers to pollutants which are discharge from the Yuen Long, Kam Tin and San Tin rivers, and so could potentially be impacted by the proposed flood protection works.

Agricultural lands are located south of Chau Tau Tsuen and fish ponds downstream (west of the village). These comprise the water quality sensitive receivers of the proposed flood protection works within and near the village.

Construction Impact

Construction methods may involve piling, dredging, formation of embankments, infilling of fish ponds, and permanent and temporary diversion of water courses, each of which could lead to temporary or permanent obstruction of flows. In addition, construction activities which are carried out along the stream and within ponds may lead to scouring and deposition of sediment which, if not contained, will result in an increase in SS levels and turbidity of the water bodies locally and downstream of the works, thereby altering the existing natural processes such as siltation, flows, and water velocities. Potential increases in SS and increased siltation may therefore affect the water sensitive uses downstream of the works, such as active fish ponds, the receiving water body of Inner Deep Bay, and associated ecological sensitive receivers. Besides the construction works at San Tin villages (about 450 m away from Chau Tau Tsuen), there are no construction works currently undertaken near Chau Tau Tsuen.

Based on the information from the Drainage Services Department (DSD), the excavated material will be uncontaminated and is approximately 77,000 m³. The chemical effect of the release of suspended solids into the water column will only confine to depletion of dissolved oxygen, if any. Uncontaminated spoil should be disposed at marine dumps, or at public dumps if the sediment is sandy material suitable for filling.

Given the observable poor water quality of the stream at Chau Tau Tsuen, further deterioration in water quality would be particularly undesirable. Potential water quality impacts can be minimised on-site by restricting the construction activities within the enclosed area. It is therefore considered important to emphasize that containment measures including bunds and sheet pile walls should be adopted to minimise potential impacts upon the water quality.

Operational Impact

During operation, the flood protection works will not produce extra pollutant loading to the flow. On the other hand, the water quality of the existing stream can be improved if the upstream pollution sources (such as rubbish accumulation along the channel) are strictly controlled.

Review the Mitigation Clauses of 35CD Contract Document

To safeguard the water quality of the sensitive receivers within and downstream of Chau Tau Tsuen during project construction, the Contract specifies that the Contractor shall design and implement mitigation measures and appropriate

working methods to avoid deterioration of water quality. The mitigation measures include:

- Use of closed grab excavators when materials are excavated underwater, from the river bed, or bottom of watercourses and ponds;
- use of silt curtains, temporary bunds and sheet pile walls within the rivers, watercourses and ponds; and
- use of cut-off drains, large scale silt traps and temporary pumping systems to control the surface of ground water run-off from the Site.

These mitigation measures should be adequate in consideration of the scale of construction works.

Review the Environmental Monitoring Clauses of 35CD Contract Document

The Contract requirements of environmental monitoring for the 35CD works is essentially based on the Final Report of the *Main Drainage Channels for Ngau Tam Mei, Yuen Long and Kam Tin: Environmental Schedule*⁽¹⁾. As the scale of construction works, construction methodology and background conditions at Chau Tau Tsuen are similar to main drainage channels works at Ngau Tam Mei, Yuen Long and Kam Tin, it is considered that the environmental monitoring requirements specified in the 35CD contract should be adequate.

Recommendation and Conclusion

River water quality impact during construction (dredging) works at Chau Tau Tsuen will be limited to resuspension of disturbed river sediment and associated depletion of dissolved oxygen in the water column. Provided the mitigation measures specified in the Contract are properly implemented, water quality impact will be contained within the construction area.

The operation of flood protection work will not introduce any additional pollutant discharge and, provided that upstream pollutant discharge and accumulation of rubbish near the streams are effectively controlled, stream water quality will be improved.

As the construction methodology and scale of construction works at Chau Tau Tsuen are similar to the main drainage channel works at Ngau Tam Mei, Yuen Long and Kam Tin, Contract requirements of environmental monitoring that are specified according to the *Environmental Schedule* of the Main Drainage Works⁽²⁾ should be adequate.

4.1.3

Noise

Baseline Conditions

A site visit was conducted on 28 May 1997. Ambient noise levels were measured for reference and recorded a level of approximately $L_{eq\ 15\ min.}$ 50 dB(A).

⁽¹⁾ Main Drainage Channels for Ngau Tam Mei, Yuen Long and Kam Tin: *Environmental Impact Assessment*, Final Report, ERM-Hong Kong, Ltd., 23 May 1996.

⁽²⁾ Main Drainage Channels for Ngau Tam Mei, Yuen Long and Kam Tin: *Environmental Impact Assessment*, Final Report, ERM-Hong Kong, Ltd., 23 May 1996.

The noise environment is dominated by animal sounds and noise associated with village and agricultural settlements, with minor contribution from NTCR and Castle Peak Road - Chau Tau Section, which are located over 300m away from the village.

Noise Sensitive Receivers (NSRs)

NSRs, as defined by HKPSG and the NCO, have been identified with reference to site survey and by referring to survey sheets. The identified NSRs, Chau Tau Tsuen and Pun Uk Tsuen are in low-rise nature (2 to 3 storeys high) and are located approximately 20 - 100 m and 150 m respectively from the nearest site boundary of the work areas.

Construction Impact

Construction activities associated with the 35CD drainage operations are potential sources of noise impacts to the nearby NSRs. Construction activities as listed below are considered to be typical as required in other village flood protection projects. These are:

- Site Clearance;
- Dredging Activities;
- Excavation Operations;
- Bund Construction Activities; and
- Pumping Station Construction - piling work and concreting work.

Owing to the close proximity of the Chau Tau Tsuen and Pun Uk Tsuen NSRs, it is expected that construction noise levels may exceed the $L_{Aeq, 30 \text{ min}}$ 75 dB daytime noise criteria for residential uses. Mitigation measures for the on-site construction works are therefore required and have been included in the *Clauses of 35CD Contract Document*.

Operational Impact

A Flood Water Pumping Station containing generators and pumps will be located at the north-west corner of the Chau Tau Tsuen. According to the criteria mentioned in *Section 3.3*, the noise levels at the NSRs will need to achieve the ANL-5 dB(A) levels (i.e. L_{Aeq} 55 dB for daytime and evening period; and L_{Aeq} 45 dB for night-time period). By achieving a sound level of $L_{eq, 5 \text{ min}}$ 80 dB(A) measured at 1 m from the louvre, the NSRs will comply with the HKPSG standard.

Review the Mitigation Clauses of 35CD Contract Document

Existing mitigation measures for the 35CD construction in the *Clauses of 35CD Contract Document* has included the usage of silencers, mufflers, acoustic screens to reduce the construction noise. It is recommended that the Contractor should also consider the use of standard good on-site noise management practice to minimise the construction noise impacts as listed below:

- selection of quiet construction plant and working methods;
- only well maintained construction plant should be operated on-site and plant should be serviced regularly during the construction programme;

- plant known to emit noise strongly in one direction, should, where possible, be orientated so that the noise is directed away from nearby NSRs;
- machines and plant that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum; and
- material stockpiles and other structures should be effectively utilised, where practicable, to screen noise from on-site construction activities.

It should also be noted that any acoustic screens provided by the Contractor for the purpose of noise reducing, should have no openings or gaps and have a superficial surface density of at least 10 kg m².

The Clauses 1.71 (5) in the contract DC/96/02 for Chau Tau Tsuen that requires the Contractor to apply for a Construction Noise Permit in accordance with the TM1 on *Noise from Construction Work other than Percussive Piling* should only be applicable to works during the restricted hours (see Section 3.3). Should there be any percussive piling work, the Contractor should apply for a Construction Noise Permit as required in TM2 (see Section 3.3).

The Contract Specification for DC/96/02 for Chau Tau Tsuen does not include mitigation measures for operation of the fixed plant in the pumping station. It is therefore recommended that the following clause be added :

"1.xxx FIXED PLANT NOISE FROM FLOOD WATER PUMPING STATION

For the fixed plant in the Flood Water Pumping Station, a sound level of $L_{eq, 5min}$ 80 dB(A) measured at 1 m from the louvre shall be achieved to meet the HKPSG criteria."

Review the Environmental Monitoring Clauses of 35CD Contract Document

The Contract requirements of environmental monitoring for the 35CD works is essentially based on the *Final Report of the Main Drainage Channels for Ngau Tam Mei, Yuen Long and Kam Tin : Environmental Schedule*. As the scale of construction works, construction methodology and background conditions at Chau Tau Tsuen are similar to the main drainage channels works at Ngau Tam Mei, Yuen Long and Kam Tin, it is considered that the environmental monitoring requirements specified in the 35CD contract should be adequate.

Recommendation and Conclusion

Mitigation measures and noise monitoring requirements in the *Clauses of 35CD Contract Document* have been reviewed. With the implementation of the mitigation measures, adverse construction noise impacts from the 35CD works on the NSRs will be minimised. Further noise pollution control clause and measures as part of good site practice is recommended to minimise any noise impacts.

4.1.4

Air Quality

Baseline Condition

The areas in which the 35CD works are to be constructed are currently rural in nature. NTCR and Castle Peak Road - Chau Tau Section are major sources of air

pollution in the region, however, the Air Sensitive Receivers (ASRs), Chau Tau Tsuen, are located over 300 m from these roads. As the ASRs are located well away from these roads, and there is no other major pollution source identified, the ambient air quality is believed to be in compliance with the Hong Kong AQOs.

Air Sensitive Receivers

ASRs, as defined by HKPSG, have been identified with reference to site survey and by referring to survey sheets. The identified ASRs, Chau Tau Tsuen and Pun Uk Tsuen, are low-rise (2 to 3 storeys high) and are located approximately 20 - 100 m and 150 m respectively from the nearest site boundary of the work areas.

Construction Impact

The likely air quality impacts arising from the construction activities are related to dust and odour nuisance, and gaseous emissions from the diesel-powered equipment used for construction works. Since the number of construction plant required on-site will be limited, their gaseous emissions will be low. Potential dust nuisance during construction and odour emissions from dredged material will be the key issue for the construction of 35CD.

Odour

The main potential source of odour from construction activities will be from decomposing organic material from pond/stream sediments to be dredged. Experience from similar works indicate that the material within the ponds should not be particularly malodorous. However, if the material is allowed to dry and decompose, especially under very hot weather conditions, odours could emanate from the breakdown of organic materials. Mitigation measures for handling the dredged materials should be considered to minimise potential nuisance to nearby ASRs.

Dust

There will be four main dust generation sources:

- handling of stock piles;
- stockpiled spoil;
- uncovered, excavated areas; and
- truck movements over unpaved access roads.

Experiences from similar village flood protection works indicate that 35CD works have the potential to create dust impacts at nearby ASRs if unmitigated. However, with the implementation of mitigation measures in the form of wheel washing, watering of roads and haul road management (vehicle speed and location), as part of good site practice, should reduce impacts at nearby ASRs within the government criteria.

Operational Impact

There will be no sources of air pollution emission during the operational phase of the 35CD works. Potential air quality impacts may arise during maintenance dredging. It is anticipated that the impacts from maintenance dredging will be similar to capital dredging during the construction phase but possibly to a

smaller scale as less dredged material will be handled for maintenance dredging. Mitigation measures recommended for the construction phase will generally apply to maintenance dredging.

Review the Mitigation Clauses of 35CD Contract Document

A review of the dust mitigation measures in *Clauses of 35CD Contract Document*, such as frequent watering and reduction in traffic speeds indicate that dust levels could be reduced by 60-90% (*US EPA - Compilation of Air Pollutant Emission Factor (AP-42)*). It is considered that the implementation of the dust control measures should reduce the dust impacts at the ASRs to within the government criteria. However, the following standard dust control measures should also be considered by the Contractor as part of good site practice to minimise dust nuisance:

- dropping heights for excavated materials should be controlled to a practical height to minimize the fugitive dust arising from unloading;
- during transportation by truck, materials should not be loaded to a level higher than the side and tail boards, and should be dampened or covered before transport; and
- erect hoarding at the site boundary, particularly at the site boundary adjacent to Chau Tau Tsuen.

Stockpiling of dredged mud on site may cause odour nuisance. Mitigation measures should be considered as recommended in *Section 4.1.5*.

The Contractor should designate a suitably qualified person to be responsible for implementing the mitigation measures.

Review the Environmental Monitoring Clauses of 35CD Contract Document

The construction dust monitoring specified in the *Clauses of 35CD Contract Document* should be adequate. The Contractor should designate a suitably qualified person to be responsible for the dust monitoring.

Recommendation and Conclusion

Mitigation measures and dust monitoring in the *Clauses of 35CD Contract Document* have been reviewed. With the implementation of the mitigation measures, adverse construction air quality impacts from the 35CD works on the ASRs will be minimised. It is recommended that further dust and odour pollution control measures as part of good site practice should be considered to minimise any potential nuisance.

4.1.5

Solid Waste

Construction Impact

Construction activities of village flood protection works for Chau Tau Tsuen under Contract 35CD will result in the generation of a variety of wastes and can be divided into distinct categories based on their nature and ultimate method of disposal. The types of waste include: dredged or excavated river and pond

sediments; construction and demolition waste; chemical waste; and general refuse.

Given the nature and scale of the works, the key environmental impacts arising from solid waste handling and disposal are related to dredged or excavated river and pond sediment.

According to EPD's guideline ⁽³⁾, river sediment is referred to sediment generated from dredging of nullahs and watercourses, and pond sediment or mud is referred to mud or deposit excavated from fish ponds or plant ponds which is usually contaminated with organic matter. As the construction of the Contract 35CD Village Flood Protection Works will involve dredging of sections of the existing water courses, river sediment will be generated. DSD estimated that a total volume of approximately 77,000 m³ of uncontaminated sediment would be excavated/dredged from the works.

When the sediment is disturbed by dredging, the potential exists for increasing the suspended solids and turbidity of the stream water, if it is not properly mitigated. Details of recommended mitigated measures are discussed in *Section 4.1.2*.

The handling and disposal methods of river sediment will depend on the nature and quality of the sediment, ie whether the sediment is mud or sandy material, contaminated (in accordance with EPD's sediment classification system ⁽⁴⁾) or uncontaminated. In order to control water quality impact during dredging, it is recommended that closed grab dredger or excavator should be used. As the dredged sediment is not contaminated, it can be reused or disposed of as follows:

- stockpiling on site and reuse for the construction of embankment;
- beneficially reuse for reclamation at public dump sites; and
- disposal of at marine dumping grounds.

As the construction of embankment requires importation of fill material, it is recommended that dredged sandy material (soil) should be reused on site if it meets the necessary engineering requirements. The dredged soil could be stockpiled at a designated area to allow it to dry off for subsequent reuse.

If the sandy material cannot be reused on site and it is free from organic materials, it could be delivered to public dump sites. It is recommended that the material should be dewatered prior to delivery to public dump sites.

For sandy material which contains high organic content and mud which is not suitable for construction of embankment or reclamation, it should be disposed of at one of the marine dumping grounds such as East of Ninepins, North Lantau and South Tsing Yi dumping grounds. Although it is unlikely to be the case, dredged/excavated river sediments which contain abnormally high organic contaminants but are not classified as contaminated sediments under EPD TC No 1-1-92 may require confined marine disposal at East Sha Chau Contaminated Mud Pits.

⁽³⁾ Disposal of Problematic Waste Arising from Construction and Dredging Activities after the Closure of Pillar Point Valley Landfill

⁽⁴⁾ Environmental Protection Department Technical Circular No. (TC) 1-1-92, Classification of Dredged Sediments for Marine Disposal

Due to inadequate water depth of the channel, it will not be possible to load the dredged mud directly onto a shallow draft barge. The dredged materials have to be transported to an off-site berth for transfer to a dumping barge. Stockpiling of mud on site may cause odour problems and it is recommended that dredged mud should be discharged to water tight trucks and removed from site as soon as practical.

Pond sediment with high organic content and moisture content less than 70% (by weight) would be allowed to dispose of at landfills. The Environmental Protection Department should be notified in advance on the detailed disposal arrangement of the sediment at the landfill. Information including but not limited to nature, total quality, rate of disposal and delivery dates should be provided to EPD.

With the approval of the EPD, pond sediment with moisture content more than 70% (by weight) should be disposed of at marine dumping grounds. The handling and transportation methods for this sediment should be similar to those for river mud. As indicated previously, although it is unlikely to be the case, dredged/excavated pond sediments which contain abnormally high organic contaminants but are not classified as contaminated sediments under EPD TC No 1-1-92 may require confined marine disposal at East Sha Chau Contaminated Mud Pits.

Operational Impact

During the operation of the 35CD Contract, waste arisings will typically consist of:

- material from maintenance dredging; and
- chemical waste from maintenance of pumping station.

The requirements for maintenance dredging will depend on the settlement rates of the channel. With reference to the operational experience of similar drainage channels in the north-east New Territories, it is expected that dredging will only be required at a frequency of 4 to 5 years and the quantity of material to be dredged is expected to be small. The handling and disposal methods of dredged mud should follow the recommendations for the construction phase.

Small volumes of oily material will arise from the maintenance of the pumping station. Provided that this waste is disposed of at the Chemical Waste Treatment Centre or other EPD approved facilities, the environmental impact will be negligible.

Review the Mitigation Measures of 35CD Contract Document

The recommendations made above are covered in the 35CD contract document DC/96/02 for Chau Tau.

Recommendation and Conclusion

The key environmental impacts related to waste arising from the construction of the village flood protection works for Chau Tau Tsuen are the handling and disposal of dredged/excavated sediment. Provided that the mitigation measures specified in the Contract are properly implemented, the environmental impacts of handling and disposal of dredged/excavated sediment will be minimal.

It is not expected that the operational phase of the village flood protection works will cause adverse environmental impacts.

4.2 SAN TIN VILLAGES

4.2.1 Ecology

Baseline Conditions and Sensitive Receivers

A field survey was performed on 23 May 1997. At that time site preparation work was underway on the study area, and included draining of ponds, earth works, and channel excavation on about a quarter of the polder alignment.

The habitats observed include fish ponds (active and abandoned), stream channels and an area of marsh (which was being infilled at the time of survey) as shown in *Figure 4.2a*. Major plant recorded at the pond bunds were all common and ruderal species, but some pond bunds had been planted with Indian Shot (*Canna indica*) and Sweet Potato (*Ipomoea batatas*) to prevent dense growth of grasses.

The stream channel had a width of about 4 m. Water was black, odorous and non-flowing during the time of survey. Dense stands of Water Hyacinth (*Eichhornia crassipes*) dominated the aquatic zone and Guinea Grass (*Panicum maximum*) covered the stream bank. Tree species found on the site along the pond bunds included China Berry (*Melia azedarach*), Papaya (*Carica papaya*) and *Macaranga tanarius*. Around the proposed pumping station, a large stand of trees containing *Macaranga tanarius*, Wampi (*Clausena lansium*) and Mango (*Mangifera indica*) was noted.

No plant species protected under Hong Kong regulations or known to be rare were found on the proposed project site. All Odonate and Lepidopteran species recorded are common (Annex C-Table 2). One uncommon frog species (Narrow-mouthed Frog, *Kalophrynus pleurostigma*), 10 bird species (Annex C-Table 3) of limited local or regional distribution and 3 bats protected under the Wild Protection Ordinance were reported in the nearby vicinity. The Black-faced Spoonbill (*Platalea minor*) was ranked in the critical category (survival most threatened), and it could use the San Tin area as a nocturnal feeding site. To date the local movements of Black-faced Spoonbills have not been studied in detail and therefore it is not possible to state whether the San Tin study area is or has been used by the forenamed species.

Construction Impacts

Direct impacts from the construction of the polder, the flood storage pond and pumping station will be a permanent loss of about 500 m of stream channel, 1.5 ha of marsh, and 4.5 ha of grade B fish ponds and pond bunds (1.9% of the Territory total of grade B ponds, AFD 1995). The 1.5 ha of marsh was formerly in the vicinity of the proposed floodwater pumping station works area. From aerial photographs and previous field surveys in the area set-aside as the location for the pumping station was a marsh. At the time of field survey work site formation was underway for the foundation of the pumping station and the marsh had been destroyed. The 4.5 ha of fish pond is derived from the 1:2000 engineering plan. Total amount of fish pond loss is calculated from the polder alignment, pumping station and Western Main Drainage Channel intersection.

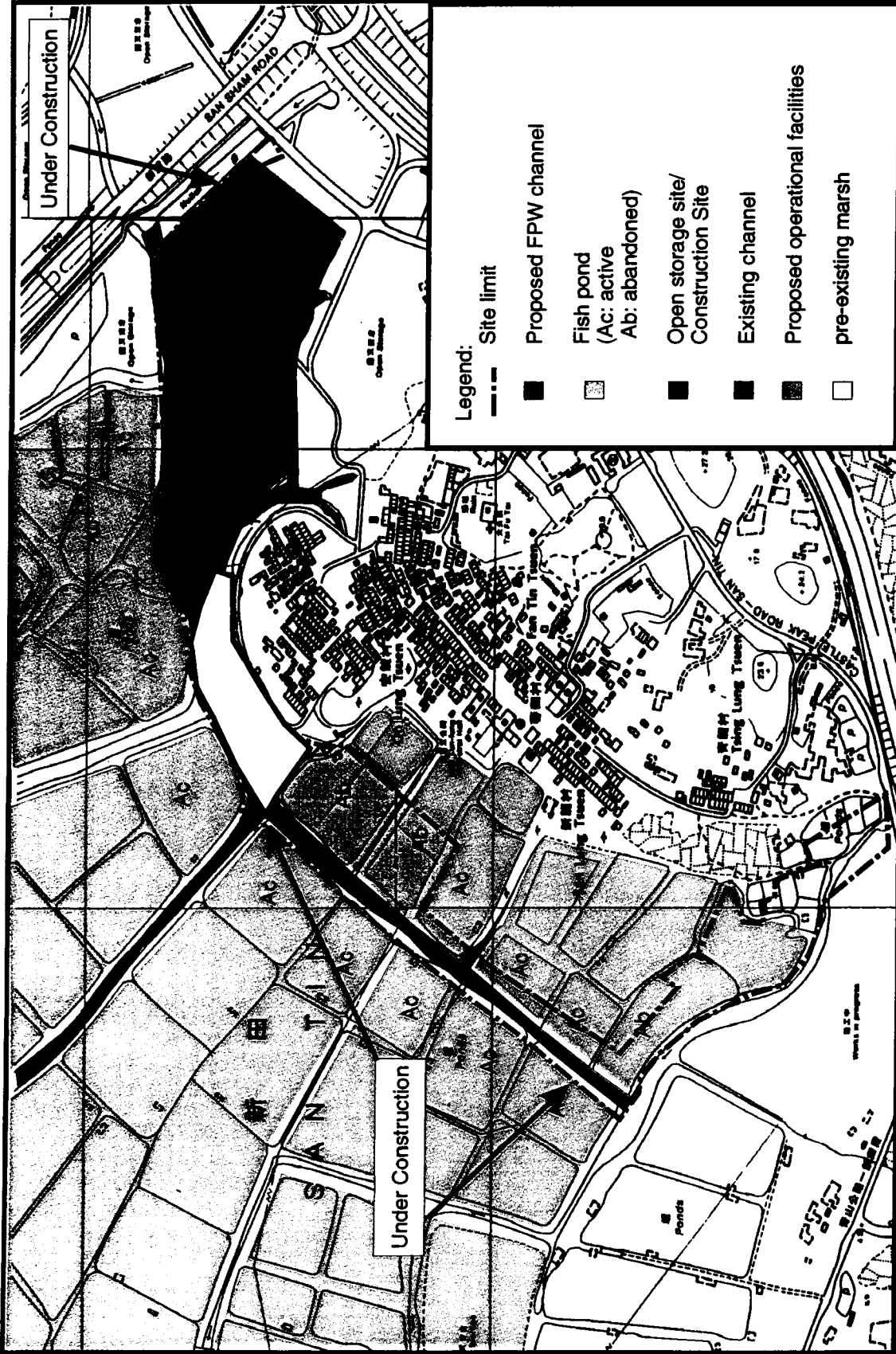


FIGURE 4.2a - HABITAT MAP OF SAN TIN VILLAGES FOR STAGE 1 WORKS OF FPW ITEM NO. 35CD

Figure 4.2a shows the pre-existing marsh area and area of abandoned fish ponds to be converted to a storage pond.

Potential (and actual) habitat losses are considered to be a minimal impact to flora because of the limited number of species in the area and the commonness and weedy nature of the species to be affected. The loss of the 1.5 ha marsh and 4.5 ha fish pond habitats that are of potential ecological significance will be addressed as cumulative loss of the main drainage channel project as a whole at the next stage of the EIA study.

Operational Impact

The direct and indirect operational impacts as well as residual impacts are considered to be similar to that of Chau Tau Tsuen and are discussed in Section 4.1.1.

Review the Mitigation Clauses of 35CD Contract Document

The trees to be retained along the alignment of the polder should be adequately protected as specified in mitigation clauses, and the measures for fish pond restoration are adequate, but do not compensate for the overall wetland losses predicted for the project. There is no plan for mitigation of marsh or stream losses. It is suggested that the wetland loss be addressed as cumulative loss to the whole Project at the later stages of the EIA Study.

Review the Environmental Monitoring Clauses of 35CD Contract Document

The water quality monitoring requirements are considered adequate to minimise threats to aquatic environments. No ecological monitoring has been proposed in the contract document, and none is considered necessary.

Recommendation and Conclusion

No severe impacts were predicted for flora affected by the project. Fauna inhabiting the project site and nearby areas was considered to be diverse and abundant, and numerous species are predicted to be affected locally, regionally, and, in the case of birds, possibly globally. This habitat loss will be assessed as cumulative loss, together with the loss due to the two channel improvement works, and mitigation measures developed in the following EIA reports.

4.2.2 *Water Quality*

4.2.2.1 *Baseline Condition and Sensitive Receivers*

Existing Conditions

The location of San Tin villages is shown in *Figure 2.3a*. The location is about 1,640 m away from the Sham Chun River. It consists of seven villages formed by discrete blocks of building. Most of the farmlands and ponds are located north and north-west from the villages. A small stream originates from the wetlands near San Lung Tsuen is draining towards north-east and supplies water for the wetlands near Yan Shau Wai and Tung Chan Wai. Water is diverted away from Yan Shau Wai via two small streams which drains through the pond area at San Tin towards the north-west and converge near Sham Chun River. Although there has been no water quality monitoring, visual observation of the stream water and water plants growing along the stream indicate that the water is free from heavy pollution. Freshwater fisheries and vegetable farming are the main economic activities found near the villages; there is no major livestock farming within or near the villages.

Future Conditions

During the operation phase of the flood protection works, stormwater will be conveyed away from the wetland near Yan Shau Wai and Tung Chan Wai by a U-shaped channel towards the proposed flood storage pond north-west from Fan Tin Tsuen. Excess stormwater will also be conveyed to the storage pond via another U-shaped channel at the west of the villages. After storm events, stormwater will be conveyed from the storage pond by a proposed twincell box culvert towards the proposed alternative main channel alignment at the west of the villages.

Sensitive Receivers

Sham Chun River, Inner Deep Bay and Mai Po Nature Reserve are the main off-site water quality sensitive receivers as described in *Section 4.1.2.1*. There are fish ponds and agricultural land towards the north and north-west of the villages. These comprise the water quality sensitive receivers of the proposed flood protection works at San Tin, although stream water does not directly drain through the fish ponds.

Construction Impact

The extent of construction water quality impact at San Tin villages will be similar to the flood protection works at Chau Tau Tsuen. Besides the construction works at Chau Tau Tsuen (about 450 m away from San Tin villages), there are no construction works currently undertaken near San Tin villages.

According to the information from the DSD, approximately 114,000 m³ uncontaminated material and approximately 30,200 m³ of contaminated material will be excavated during construction. Uncontaminated spoil should be disposed at marine dumps, or at public dumps if the sediment is sandy material suitable for filling. Contaminated material comprise copper and zinc contaminated sediment, i.e. Class B and Class C according to EPD TC no. 1-1-92. The source of contamination is likely to arise from livestock waste disposal

practices (particularly for Cu and Zn). Other contamination is likely to have arisen from industrial discharges.

The potential impacts to water quality from dredging and disposal of contaminated material will vary according to the quantities and level of contamination, as well as the sensitive receivers at the dredged and disposal sites. These impacts may include:

- release of previously bound heavy metals contaminants and nutrients into the water column, either via suspension or by disturbance from turbulent flow or mud waves as a result of dredging activities, disposal of muds, or depositing fill materials;
- release of the heavy metal contaminants due to leakages and spillages as a result of poor handling and overflow from barges during dredging and transport; and
- suspension of solids in the water column during dredging activities and marine sediment dumping activities, with the likely consequence of reducing DO levels and increasing nutrient levels.

All of the above can result in deterioration in the receiving water quality and may have adverse effects on inland and coastal sensitive receivers.

Potential water quality impacts can be minimised on-site by restricting the construction activities within the enclosed area. Containment measures including bunds and sheet pile walls should be adopted to minimise potential impacts upon the water quality.

Operation Impact

During operation, the U-shaped rectangular channels will divert excess stormwater from the eastern (73CD) channel alignment and western (alternative) channel alignment into the flood storage pond (*Figure 2.3a*). The commission of the flood protection works will not produce extra pollutant loading to local streams and rivers and, provided upstream pollution sources are strictly controlled, good water quality of the stream can be maintained.

Review the Mitigation Clauses of 35CD Contract Document

To safeguard the water quality of the sensitive receivers within and downstream of San Tin villages during project construction, the Contract specifies that the Contractor shall design and implement mitigation measures described in *Section 4.1.1.4*. The decks of all barges and floating pontoons should be kept tidy and free of oil or any other substances or articles which might be accidentally or otherwise washed overboard. No rubbish could be dumped into the sea and river.

The mitigation measures specified in the Contract should be adequate in consideration of the scale of construction works.

Review the Environmental Monitoring Clauses Of 35CD Contract Document

The Contract requirements of environmental monitoring for the 35CD works is essentially based on the Final Report of the *Main Drainage Channels for Ngau Tam*

Mei, Yuen Long and Kam Tin: Environmental Schedule ⁽⁵⁾. As the scale of construction works, construction methodology and background conditions at San Tin villages are similar to main drainage channels works at Ngau Tam Mei, Yuen Long and Kam Tin, it is considered that the environmental monitoring requirements specified in the 35CD Contract should be adequate.

Recommendation and Conclusion

River water quality impact during construction (dredging) works at San Tin villages will include resuspension of disturbed river sediment, depletion of dissolved oxygen in the water column, and release of organic and inorganic contaminants. However, provided the mitigation measures specified in the Contract are properly implemented, water quality impact will be largely contained within the construction area. Mitigation measures specified in the Contract should be adequate to control and minimize the extent of water quality pollution.

The operation of flood protection work will not introduce any additional pollutant discharge and, provided upstream pollutant discharge are effectively controlled, good stream water quality could be maintained.

As the construction methodology and scale of construction works at San Tin villages are similar to the main drainage channel works at Ngau Tam Mei, Yuen Long and Kam Tin, Contract requirements of environmental monitoring that are specified according to the *Environmental Schedule* of the Main Drainage Works ⁽⁶⁾ should be adequate.

4.2.3

Noise

Baseline Conditions

A site visit was conducted on 28 May 1997. Ambient noise levels were measured for reference and recorded a level of approximately $L_{eq\ 15\ min.}$ 50 dB(A).

The noise environment is dominated by animal sounds and noise associated with village and agricultural settlements, with minor contribution from Castle Peak Road - San Tin Section and NTCR which are located over 150 m away from the villages.

Noise Sensitive Receivers (NSRs)

NSRs, as defined by HKPSG and the NCO, have been identified with reference to site survey and by referring to survey sheets. The identified NSRs in San Tin comprise seven villages and are all low-rise (2 to 3 storeys high). Their distances from the nearest work boundary are listed below:

- Tung Chan Wai - 50 m;
- Yan Shau Wai - 30 m;
- On Lung Tsuen - 80 m;
- Fan Tin Tsuen - 110 m;

⁽⁵⁾ Main Drainage Channels for Ngau Tam Mei, Yuen Long and Kam Tin: *Environmental Impact Assessment*, Final Report, ERM-Hong Kong, Ltd., 23 May 1996.

⁽⁶⁾ Main Drainage Channels for Ngau Tam Mei, Yuen Long and Kam Tin: *Environmental Impact Assessment*, Final Report, ERM-Hong Kong, Ltd., 23 May 1996.

- San Lung Tsuen - 120 m;
- Tsing Lung Tsuen - 80 m; and
- Wing Ping Tsuen - 360 m.

Construction Impact

The potential noise impacts from the San Tin Villages works will be similar to that of Chau Tau Tsuen, arising from site clearance, bund construction activities, dredging activities, excavation operations and pumping station construction, as discussed in *Section 4.1.3*.

Operational Impact

A Flood Water Pumping Station containing generators and pumps will be located at the north-west corner of the San Tin Villages, near Yan Shau Village. According to the criteria mentioned in *Section 3.3*, the noise levels at the NSRs will need to achieve the ANL-5 dB(A) levels (i.e. L_{Aeq} 55 dB for daytime and evening period; and L_{Aeq} 45 dB for night-time period). By achieving a sound level of $L_{eq, 5min}$ 75 dB(A) measured at 1 m from the louvre, the NSRs will comply with the HKPSG standard.

Review the Mitigation Clauses of 35CD Contract Document

The mitigation measures for the 35CD works for San Tin Villages is similar to that of Chau Tau Tsuen and good noise management practice recommended as discussed in *Section 4.1.3*.

The Clauses 1.72 (5) in the contract DC/95/03 for San Tin Villages that requires the Contractor to apply for a Construction Noise Permit in accordance with the TM1 on *Noise from Construction Work other than Percussive Piling* should only be applicable to works during the restricted hours (see *Section 3.3*). Should there be any percussive piling work, the Contractor should apply for a Construction Noise Permit as required in TM2 (see *Section 3.3*).

The Contract Specification for DC/95/03 for San Tin Villages does not include mitigation measures for operation of the fixed plant in the pumping station. It is therefore recommended that the following clause be added :

"1.xxx FIXED PLANT NOISE FROM FLOOD WATER PUMPING STATION

For the fixed plant in the Flood Water Pumping Station, a sound level of $L_{eq, 5min}$ 75 dB(A) measured at 1 m from the louvre room should be achieved to meet the HKPSG criteria."

Review the Environmental Monitoring Clauses of 35CD Contract Document

Similar to Chau Tau Tsuen as discussed in *Section 4.1.3*, the Contract requirements of environmental monitoring for the 35CD works is essentially based on the *Final Report of the Main Drainage Channels for Ngau Tam Mei, Yuen Long and Kam Tin : Environmental Schedule*. It is considered that the environmental monitoring requirements specified in the 35CD contract should be adequate.

Recommendation and Conclusion

The construction and operation noise impacts related to 35CD works for San Tin Villages are similar to that of Chau Tau Tsuen. Further pollution control clause and measures as part of good site practice is recommended to minimise any noise impacts.

4.2.4

Air Quality

Baseline Conditions

The areas in which the proposed 35CD works are to be constructed are currently rural in nature. Castle Peak Road - San Tin Section and NTCR are major sources of air pollution in the region, however, the Air Sensitive Receivers (ASRs), San Tin Villages, are located over 150 m from these roads. As the ASRs are located well away from these roads, and there is no other major pollution source identified, the ambient air is believed to be in compliance with all of the Hong Kong AQOs.

Air Sensitive Receivers

ASRs, as defined by HKPSG, have been identified with reference to site survey and by referring to survey sheets. The identified ASRs, San Tin Villages, consist of seven villages and are low-rise (2 to 3 storeys high). Their distances from the nearest work site boundary are listed below:

- Tung Chan Wai - 50 m;
- Yan Shau Wai - 30 m;
- On Lung Tsuen - 80 m;
- Fan Tin Tsuen - 110 m;
- San Lung Tsuen - 120 m;
- Tsing Lung Tsuen - 80 m; and
- Wing Ping Tsuen - 360 m.

Construction Impact

The likely air quality impacts arising from the construction activities are similar to that at Chau Tau Tsuen, including dust and odour nuisance (see discussion in *Section 4.1.4*).

Operational Impact

There will be no major source of air pollution emission during the operational phase of the 35CD works at San Tin Villages. As discussed in *Section 4.1.4*, potential air quality impacts may arise during maintenance dredging. Mitigation measures recommended for the construction phase will generally apply to maintenance dredging.

Review the Mitigation Clauses of 35CD Contract Document

Dust mitigation measures in *Clauses of 35CD Contract Document* for San Tin Villages are similar to that of Chau Tau Tsuen. Dust levels could be reduced by 60-90% by dust controls, such as frequent watering and reduction in traffic speeds. Further mitigation measures as recommended in *Section 4.1.4* should be

considered by the Contractor to minimise any dust nuisance should also be considered for the 35CD works for the San Tin Villages.

Mitigation measures for odour nuisance arising from the dredged mud should be implemented as recommended in *Section 4.2.5*.

Review the Environmental Monitoring Clauses of 35CD Contract Document

The construction dust monitoring specified in the *Clauses of 35CD Contract Document* should be adequate. The Contractor should designate a suitably qualified person to be responsible for proposed dust monitoring.

Recommendation and Conclusions

The dust and odour impacts related to 35CD works for San Tin Villages are similar to that of Chau Tau Tsuen. Further pollution control measures as part of good site practice should be considered to minimise any potential nuisance.

4.2.5

Solid Waste

Construction Impact

Similar to the works for Chau Tau Tsuen, the key environmental impacts from the village flood protection works for San Tin Villages will arise from solid waste handling and disposal related to dredged or excavated river and pond sediments (see *Section 4.1.5* discussion).

As the construction of the village flood protection works for San Tin Villages will involve dredging of sections of the existing water courses, river sediment will be generated. Due to inadequate water depth of the channel, it will not be possible to load the dredged mud directly onto a shallow draft barge. The dredged materials have to be transported to an off-site berth for transfer to a dumping barge. Stockpiling of mud on site may cause odour problems and it is recommended that dredged or excavated mud should be discharged to water tight trucks and removed from site as soon as practical. Based on information from DSD a total volume of approximately 144,200 m³ of river and pond sediment would be excavated/dredged from the works. About 114,000 m³ of the sediment is uncontaminated and 30,200 m³ is contaminated in accordance with the EPD's Technical Circular No. 1-1-92, *Classification of Dredged Sediments for Marine Disposal*. The contaminated sediment is categorised under Class C (seriously contaminated).

The handling and disposal methods of river sediment will depend on the nature and quality of the sediment, ie whether the sediment is mud or sandy material, contaminated or uncontaminated. As some of the sediments are contaminated, closed grab dredger or excavator should be used.

For uncontaminated sediment, it can be reused or disposed of in the three ways as described in details in *Section 4.1.5* for Chau Tau Tsuen, including:

- stockpiling on site and reuse for the construction of embankment;
- beneficially reuse for reclamation at public dump sites; and
- disposal of at marine dumping grounds.

Great care should be taken when dredging, handling and transport of the

contaminated sediment in order to ensure that it will not cause adverse environmental impacts. When contaminated sediments are disturbed by dredging, the potential exists for toxic metals previously bound to the sediment particles to be mobilised into the water column. To minimise the potential impacts on water quality, seriously contaminated sediments must be dredged with great care. Details of recommended mitigated measures are discussed in Section 4.1.2.

Given the quantity (about 30,200 m³) and high moisture content of contaminated river and pond sediments to be generated, it is recommended that they should be disposed of at the contaminated mud pits at East Sha Chau.

Operational Impact

The potential impacts and recommendations for the operational phase of the San Tin Villages work will be similar to that of the Chau Tau Tsuen as discussed in Section 4.1.5, in relation to:

- material from maintenance dredging; and
- chemical waste from maintenance of pumping station.

Review of the Mitigation Clauses of 35CD Contract

Most of the clauses in the Contract Specification for DC/95/03 of Contract 35CD for San Tin Villages cover the recommendations above.

However the current contract does not include mitigation measures for the handling and disposal of river mud and pond sediment at other disposal sites. It is recommended that the following Specification Clauses should be added. It should be noted that the landfill disposal option should only be considered for highly contaminated materials (in small quantity) which meet the landfill acceptance criteria presented below and in cases where the on-site situation does not actually allow arrangement for marine disposal.

"1.79a LANDFILL DISPOSAL OF EXCAVATED MUD OF SEDIMENT

- (1) *The Contractor shall when applying a licence or appropriate permissions under the Waste Disposal Ordinance for landfill disposal of excavated mud or sediment copy to the Engineer all correspondences concerning the application and any permission granted, and the information shall include detail of:*
 - (a) *the total volume of excavated mud or sediment to be disposed of;*
 - (b) *the quality (including the moisture content) of the excavated mud or sediment to be disposed of; and*
 - (c) *a programme showing the volume of excavated material to be disposed of at landfill each month.*
- (2) *The mud and sediment shall contain no free water and the moisture content of the material shall not exceed 70% by weight.*
- (3) *Stockpiling of excavated river mud and pond sediment on Site is not permitted.*

- (4) *The Contractor shall satisfy the Engineer before commencing any disposal at landfill that he has obtained all necessary approvals. The Contractor shall employ water tight trucks for transporting excavated mud and sediment and shall maintain them to prevent leakage of material between the place of loading and landfill. The Contractor shall provide the Engineer with facilities for inspecting the trucks prior to their use and shall not use any trucks until that trucks has been inspected by the Engineer.*
- (5) *The Contractor shall carry out the dumping operation in strict accordance with the method statement agreed by the Licensing Authority."*

Recommendation and Conclusion

The key environmental impacts related to waste arising from the construction of the village flood protection works for San Tin Villages are the handling and disposal of dredged/excavated sediment, in particular the contaminated sediment. Provided that the mitigation measures specified in the Contract are properly implemented, the environmental impacts of handling and disposal of dredged/excavated sediment will be minimal. Additional Specification Clauses are recommended for inclusion into DC/95/03 of Contract 35CD.

It is not expected that the operational phase of the village flood protection works will cause adverse environmental impacts.

OVERALL CONCLUSION

This Working Paper has reviewed the potential environmental impacts associated with the 35CD village flood protection works, as well as the adequacy of the environmental control measures and monitoring requirements in the present contract documents DC/96/02 and DC/95/03 for Chau Tau Tsuen and San Tin Villages respectively.

The potential environmental impacts on Chau Tau Tsuen and San Tin Villages with regard to ecology, water quality, noise, air quality and solid waste are similar. It is considered that the contract clauses are generally adequate to provide the necessary environmental protection to achieve Government standards. Additional mitigation measures and clauses are recommended to minimise any potential environmental impacts:

Ecology

- Chau Tau Tsuen: A strategy recommended for revegetation of the project site
- San Tin Villages: Wetland/fishpond loss due to 35CD works recommended for consideration in Stage 2 and Stage 3 of the Project

Noise

- Use of further good on-site noise management practice
- Additional clause to specify maximum sound level allowed for the pumping station

Air Quality

- Use of further measures as part of good site practice for dust and odour nuisance control

Solid Waste

- San Tin Villages: Additional clause to require proper handling and disposal of river mud and pond sediment, particularly in relation to contaminated sediments

Annex A

35CD Village Flood Protection
Works for Chau Tau Tsuen
DC/96/02
Environmental Control
Clauses

- (1) The following precautions shall be taken to protect the existing trees:
 - (a) The tree trunks shall be protected from abrasions by strapping temporary buffers to them.
 - (b) Building materials, site huts and vehicles shall not be permitted over the root spread causing compaction.
 - (c) Building materials, fillings and soil shall not be stored in the root spread of trees.
 - (d) Oil, petrol, creosote and other toxic chemicals shall be kept away from the root spread of the tree.
 - (e) Site fires shall be kept well away from the trees and roots.
 - (f) Mechanical trench diggers shall be used with care and the area around roots hand dug.
 - (g) If the existing hard paving around the tree is to be removed, it shall be replaced immediately with topsoil to prevent surface roots from drying out.
 - (h) No roots greater than 75 mm in diameter should be severed. Where such roots are exposed they shall be wrapped in hessian during operations and later reburied. If concrete is necessary in trenches all encased roots shall be protected with several layers of hessian.
 - (i) If roots are exposed and damaged, they shall be cut off clean and treated with a wound sealant e.g. 'Zineb' or 'Dithane M45'

1.67 LAND ACCESS

- (1) The existing tracks and roads in the vicinity of the Site are currently being used by local villagers as a major access to the village and surrounding holdings. The Contractor shall maintain these accesses and ensure that through accesses can be provided at all times during the construction period. The Contractor are required to provide alternative access in the event that the existing access is obstructed by his activities.

1.68 FISH PONDS WITHIN THE SITE

- (1) All affected fish ponds shall be drained prior to any works being carried out. The contractor shall not disturb any parts of the fish ponds that are outside the embankment. On completion of the Works, the remaining parts of the fish ponds shall be handed over in a state in the opinion of the Engineer similar to that when they were handed over to the Contractor. They shall be filled with fresh water suitable for fish farming. Should any damage or disturbance be caused to these remaining parts of the fish ponds, the Contractor shall rectify the situation and bear the cost of the same.

- (2) The Contractor shall carry out water tests for each fish pond to demonstrate to the Engineer that the refilled water has satisfied the quality criteria as specified in PS Clause 26.01.
- (3) The Contractor shall not disturb any parts of the fish ponds that are outside the Site. They should note of requirements of PS Clause 1.22 regarding works in the vicinity of fish ponds that are outside the Site. Should any damage or disturbance caused to these fish ponds, the Contractor shall rectify the situation and bear the cost of the same.

1.69 AMENITIES TO BE PRESERVED

- (1) The Contractor shall except as provided in the Contract cause the least possible interference with existing environment and amenities, whether natural or man-made. The Employer is committed to protecting the environment.

1.70 CONTROL OF WATER QUALITY

- (1) The Contractor shall execute the Works in a manner so as not to adversely affect the water quality of the rivers, watercourses and ponds within or adjacent to the Site and of the rivers, watercourses, ponds and the sea when loading, transporting and disposing of excavated material from the Site.
- (2) All construction plant shall be properly designed and carefully maintained so as to eliminate the risk of sediments or other pollutants being deposited in the rivers or the sea.
- (3) The Contractor shall design and implement mitigation measures and methods of working to avoid adversely affecting water quality and shall employ experienced personnel and provide suitable training to ensure that these methods are implemented. The mitigation measures shall include, but are not necessarily limited to the following: -
 - (a) Only tightly sealed closed grab excavators shall be used for excavating underwater, in rivers, watercourses and ponds. The grabs shall be designed and maintained to avoid spillage and to seal tightly while being lifted and shall be of a design described as an orange-peel grab, closed-box grab and bucket grab with visor or other similar approved.
 - (b) The provision of silt curtains, temporary bunds and sheet pile walls within the rivers, watercourses and ponds; cut-off drains, large scale silt traps and temporary pumping systems to control the surface or ground water run-off from the Site.

The Contractor shall submit his proposals to the Engineer at least 28 days before any work commences that is likely to affect water quality. If the Engineer considers the proposals are not acceptable, the Contractor shall make such modification to them as the Engineer may reasonably require and the Contractor shall bear all the cost in complying with this

requirement.

- (4) The Contractor shall carry out water quality monitoring as set out in this Contract. The Contractor shall take water samples, measure and record the instrumental readings of water quality monitoring by measurement of turbidity, suspended solids (mg/l), dissolved oxygen concentration (DO in mg/l), dissolved oxygen saturation and temperature at specified locations in the watercourses in the vicinity of Chau Tau Tsuen. In addition, the Contractor shall employ an approved HOKLAS accredited laboratory, which is also agreed by the Engineer, to carry out laboratory tests, analyses and reporting for those samples.
- (5) Water monitoring shall commence six weeks prior to commencement of any excavation work, which is likely to affect the quality of water in the watercourses. Samples of water column at each water monitoring station shown on Drawings shall be taken concurrently on every alternate working day or at other intervals as instructed by the Engineer. Samples shall be taken at mid-ebb and from the surface and bottom of the water column at the sampling stations except that when the depth of water is less than 1.5m at any sampling station at the time of sampling only one sample from the middle of the water column shall be taken. Surface samples shall be taken within 0.5m of the surface of the water and bottom samples shall be taken no closer than 0.5m to the bottom of the watercourse. Three samples at each depth of each station shall be taken. The suspended solid level and dissolved oxygen level at each water sampling station for monitoring water quality shall be the mean of the suspended solid level and the mean of dissolved oxygen level respectively of all the samples at that station.
- (6) The Contractor shall provide water quality monitoring results to the Engineer within 24 hours, except for the results for the suspended solids which shall be reported no later than 48 hours after sampling. Formal reports shall be submitted to the Engineer at monthly intervals.
- (7) The Trigger/Action/Target Levels for water quality are defined in Table 1 as below:

Table 1. Water Quality - Trigger/Action/Target Levels

| Level | Definition |
|---------------|--|
| Trigger Level | Trigger Level is exceeded if Suspended Solids (SS) at water sampling station W1 exceeds the greater of either 256mg/l or 120% of the suspended solids level at water sampling station W2 or W3 measured at the same tide on any one monitoring day or Dissolved Oxygen (DO) value measured at station W1 is lower than 80% of station W2 or W3 at the same tide on the same monitoring day |
| Action Level | Action Level is exceeded if SS at water sampling station W1 exceeds the greater of either 256mg/l or 130% of the SS at water sampling station W2 or W3 measured at the same tide on any one monitoring day or DO measured at station W1 is lower than 70% of station W2 or W3 at the same tide on the same |

| | monitoring day |
|--------------|---|
| Target Level | Target Level is exceeded if SS at water sampling station W1 exceeds the greater of either 256mg/l or 130% of the SS at water sampling station W2 or W3 measured at the same tides for three consecutive monitoring days or DO measured at station W1 is lower than 70% of station W2 or W3 at the same tides for the three consecutive monitoring days. |

- (8) The Contractor shall execute the Works in a manner such that the Target Level is not exceeded.
- (9) If monitoring shows that the Trigger Level is exceeded, the Contractor shall identify the cause and take measures to avoid further exceedance. If monitoring shows that Action Level is exceeded, the Contractor shall submit proposals for remedial action for the Engineer's approval and implement the approved proposal immediately. Approval of the Engineer shall not relieve the Contractor from his obligation of not exceeding the Target Level. If the Trigger or Action Levels are exceeded, monitoring shall take place on a daily basis until the levels are not exceeded and all the cost of this additional sampling and testing shall be borne by the Contractor.
- (10) The value of 256mg/l as shown on Table 1 has been set based on the 95 percentile (for log normal distribution) of routine water monitoring data. The value may be adjusted, at the sole discretion of the Engineer, if further baseline monitoring indicates significant changes in ambient conditions.
- (11) If the Contractor's methods of excavation, stockpiling, placing fill, dewatering, pumping or any other activity involves tailwaters, surface or ground water being discharged from the Site to the nearby watercourses or any other place, then the Contractor shall arrange his method of working so that the environment shall not be adversely affected.
- (12) In addition to the water samples taken for control purposes as required above, the Contractor shall employ an approved HOKLAS accredited laboratory to carry out insitu tests and to take samples at each water sampling station to monitor the following:
 - (a) The values of turbidity, dissolved oxygen saturation and temperature shall be determined three days a week.

The Contractor shall submit preliminary results at weekly intervals. Formal reports shall be submitted to the Engineer at monthly intervals.

1.71 NOISE CONTROL

- (1) All plant and equipment used by the Contractor on the Works shall be effectively "sound reduced" by means of silencers, mufflers, acoustic linings

or shields or acoustic sheds or screens to reduce the noise level.

- (2) The Contractor shall assist the Engineer in conducting noise monitoring in the vicinity of Chau Tau Tsuen, as shown on Drawings. For construction works carried out during 0700 - 1900 Monday to Saturday except for Public Holidays, noise monitoring shall be conducted once a week at the noise level monitoring stations. For construction works carried out at other periods or on Public Holidays, noise monitoring shall be conducted twice a week at the noise level monitoring stations. For the purpose of this Clause, the Contractor shall note that construction noise levels shall be determined by carrying out measurements at monitoring stations 1m from the exterior of the nearest building facades, the exact location of each monitoring station shall be determined by the Engineer from time to time on site.
- (3) The Contractor shall execute the Works in such a manner that the Target Level is not exceeded. The Target Level is defined in Table 2 below:

Table 2. Noise - Target Level

| Time Period | Noise Level (dBA) (measured at building facade) |
|--|--|
| Daytime (0700 to 1900), Monday through Saturday excluding Public Holidays | $L_{eq,30min} = 75$ |
| All evenings (1900 to 2300) | $L_{eq,5min} = 60$ |
| General Holidays (including all Sundays) during daytime and evening (0700 to 2300) | $L_{eq,5min} = 60$ |

- (4) If a documented complaint of construction noise is received by the Engineer or his Representative, the Contractor shall identify the cause and modify his method of working. If more than one documented complaints of construction noise in any two consecutive weeks, the Contractor shall submit proposals for remedial action for the Engineer's approval.
- (5) The Contractor shall apply for a Construction Noise Permit in accordance with the Technical Memorandum on Noise from Construction Work other than Percussive Piling.
- (6) The Contractor shall take such measures as may be necessary, to assist the Engineer in determining the background noise level and these measures may include stopping work for a period of time to allow noise measurements to be made.
- (7) The Contractor shall employ a suitably qualified person to be responsible for preparing his submissions on noise control.
- (8) Notwithstanding the above sub-clauses, the Engineer may instruct the Contractor to apply further noise reduction measures including the erection of noise screens, earth bunds or other measures as circumstances may warrant.
- (9) The Contractor shall construct noise barriers as shown on drawing and at the

locations instructed by the Engineer. Any noise barriers so instructed shall be completed within 8 weeks of the instruction. The Contractor shall maintain the noise barriers and shall remove the noise barriers when instructed by the Engineer. All materials used in the construction of the noise barriers shall remain the property of the Employer after the noise barriers have been removed and shall so far as suitable be reserved and stocked for further use or disposed of as directed by the Engineer. The Contractor shall reinstate any areas of the Site affected by the noise barriers after their removal and shall fill any post or other holes with suitable material compacted in accordance with the Specification.

1.72 DUST CONTROL

- (1) Areas of the Site in which dust is likely to be generated shall be sprayed with water regularly. Screens, dust sheets, tarpaulins or other methods agreed by the Engineer shall be used to prevent generation of dust. Materials, including earthworks material, from which dust may be generated when being transported to or from the Site shall be sprayed with water or covered.
- (2) Haul roads shall be chosen such that they are at a minimum distance of 50 metres from the nearest houses.
- (3) On-site unpaved roads that are frequently used shall be regularly compacted and the road surface shall be kept clear of loose material. Water spraying shall also be used to control dust.
- (4) Vehicles shall be restricted to designated routes and shall not exceed a speed limit of 11 kilometres per hour.
- (5) The Contractor shall submit his dust control proposals to the Engineer before the commencement of construction.
- (6) The Contractor shall employ an approved HOKLAS accredited laboratory, which is also agreed by the Engineer, to conduct a baseline survey prior to the commencement of the construction works. Baseline results shall be established to determine the 1-hour and 24-hour ambient total suspended particulates (TSP) levels at the dust level monitoring stations as shown on the Drawings. The baseline survey shall be carried out for a continuous period of at least two weeks with daily ambient measurements taken at the Dust Sensitive Receiver. One hour TSP monitoring shall be undertaken at least 3 times per day. The Contractor shall note that the location of each monitoring station shall be determined by the Engineer on site.
- (7) The Contractor shall employ an approved HOKLAS accredited laboratory, which is also agreed by the Engineer, to conduct dust monitoring at each monitoring station in the Dust Sensitive Receiver. Dust (TSP) monitoring shall be as follows:
 - (a) Monitoring of (24-hour) total suspended particulates shall be carried out once every six days at each monitoring station. A monitoring shall consist of collection of 24 hour samples using High Volume Method at the monitoring station;
 - (b) Monitoring of (1-hour) total suspended particulates shall be carried out once at each monitoring station every day on which construction

- is taking place. A monitoring shall consist of collection of three, 1-hour measurements at the monitoring station and the measurements shall coincide with the construction activities with highest anticipated dust emission.
- (8) The dust (TSP) levels shall be measured by the "High Volume Method for Total Suspended Particulates" as described in Part 50 Appendix B of Title 40 of the Code of Federal Regulations of the USA.
 - (9) The Trigger/Action/Target Levels for dust are defined in Table 3 as below:

Table 3. Dust - Trigger/Action/Target Levels

| | Total Suspended Particulates |
|---------------|---|
| Trigger Level | Baseline result plus 30% margin |
| Action Level | Average value of the Trigger and Target Levels |
| Target Level | 260 Fg per m ³ averaged over 24 hours; <u>and</u> 500 Fg per m ³ averaged over 1 hour |

- (10) The Contractor shall execute the Works in such a manner that the Target Level shall not be exceeded.
- (11) If monitoring shows that the Trigger Level is exceeded, the Contractor shall identify the cause and amend working methods if appropriate. If monitoring shows that the Action Level is exceeded, the Contractor shall submit proposals for remedial action to avoid further exceedance.
- (12) One number of Wheel washing bay shall be constructed as instructed by the Engineer.

1.73 ENVIRONMENTAL MONITORING EQUIPMENT

- (1) The Contractor shall supply new water quality monitoring equipment and sound measuring equipment and accessories to the requirement in Appendix 1.6 to the Engineer for his exclusive use.
- (2) The Contractor shall supply all equipment in sub-clause (1) above in good working condition prior to the commencement of any construction works. The Contractor shall not commence any Works until all these monitoring equipment are available for use on Site.
- (3) The Contractor shall maintain the equipment in good working condition and ensure that all necessary spare parts, back-up and replacement monitoring units are available at all time of the measurement period.
- (4) The Contractor shall arrange for the calibration of the suspended solids measuring instrument to be carried out in an independent laboratory approved by the Engineer at monthly interval.

- (5) The equipment shall be reverted to the Contractor on the completion of the Works or at such earlier date as the Engineer may notify in writing.
- (6) The equipment shall be used solely for the purpose of environmental monitoring in this Contract or any other contracts as required by the Engineer.
- (7) The Contractor shall provide his own sets of monitoring equipment and accessories to the requirement in Appendix 1.6 or equivalent for environmental monitoring in the Contract.

1.74 BLACK SMOKE CONTROL

The Contractor shall ensure that exhausted gas pollutants from engines do not produce black smoke, by maintaining the engines in good running order.

1.75 DATA PROCESSING EQUIPMENT FOR THE ENGINEER

- (1) "Data Processing Equipment for the Engineer" shall comprise items satisfying the technical and functional specification stated in the "Schedule of Data Processing Equipment for the Engineer", Appendix 1.1 of this PS with, in addition, all items necessary for the data processing equipment to function together, and as specified.
- (2) The Contractor shall, within 7 days from the date of an instruction from the Engineer, submit for the Engineer's approval details of data processing equipment to be provided for the purposes of this Contract. The proposed equipment shall have been on the local market for at least three months and must not infringe any legal copyright.
- (3) The Contractor shall deliver to the Engineer's site and/or head office the data processing equipment approved by the Engineer within 14 days of the Engineer's approval or other such date agreed by the Engineer. All software shall be delivered to the location specified by the Engineer, in intact shipping cartons with all seals unbroken. At the time of delivery, the originals of all warranty agreements, invoices and other supporting documents related to the price of the equipment shall be produced for inspection by the Engineer.
- (4) Software included in the data processing equipment shall be compatible with the data processing equipment supplied by the Contractor, and be licensed in the name of the Drainage Projects Division of Drainage Services Department.
- (5) Within 24 hours of delivery, the Contractor shall arrange for the equipment to be established and tested to complete working order to the satisfaction of the Engineer. The Contractor shall be responsible for installation, testing and commissioning of the computer systems and network.
- (6) The Contractor shall license and maintain the proper functioning of both the hardware and software until the expiration of the Maintenance Period or other agreed date if so directed by the Engineer.

- (7) The Contractor shall submit to the Engineer for certification the Interim and Final statements in the forms of hard copy and computer diskette with data entered in the QSM BQ Plus software programme. The Engineer shall value and correct the statement and one corrected hard copy shall be returned to the Contractor.
- (8) Unless otherwise specified, the equipment shall revert to the Contractor on the expiry of the Maintenance Period or at such earlier date as the Engineer may notify in writing. The Contractor shall disconnect the equipment and reinstate the Engineer's head office to its original condition.

1.76 RECORD SURVEY

- (1) Before the Contractor commences any excavation, dredging or filling which is the subject of a measured item in the Bills of Quantities, a record survey of the relevant area shall be carried out and the results recorded on the Drawings which shall show plans and sections of the land surface at intervals not exceeding 20 m and on which all levels shall be referred to Principal Datum.
- (2) Record surveys of watercourses shall be made not less than 35 days after draining and at least 7 days before filling is due to commence. Throughout the 35 days prior to the survey the groundwater level shall be maintained at or below ground level over the area to be surveyed by providing drainage ditches, pump sumps and pumping where necessary.
- (3) The survey method used shall include echo sounding, chain surveying, measuring staff or other appropriate methods depending on the site condition. The Contractor shall agree with the Engineer the proposed method of executing and recording such survey prior to the actual survey. In the case of disagreement, the Engineer shall determine the method of surveying to be used.
- (4) The Contractor shall notify the Engineer in writing at least 2 weeks before such excavation, dredging or filling commences that the relevant areas are required to be surveyed.
- (5) The Contractor shall attend and check each survey and recording, and all extra surveys required to resolve any doubts which may arise as to the correctness of any survey or record. Thereafter the Engineer's decision as to what shall be recorded as the correct survey shall be final.
- (6) Each survey drawing which has been completed in the foregoing manner shall be signed by the Contractor and by the Engineer or the Engineer's Representative and shall form the basis of measurement of the relevant work. The original of each signed survey drawing shall be retained by the Engineer or the Engineer's Representative and two copies of each signed survey drawing shall be supplied to the Contractor.

1.77 SECURITY MEASURES

- (1) The Contractor shall take adequate security measures to the satisfaction of the Commissioner of Police to prevent the access of illegal immigrants into Hong Kong while the work is under progress.
- (2) The Royal Hong Kong Police Force will carry out frequent check on all works near the border area. The Contractor shall co-operate with the Police and provide any assistance required for carrying out such check.

1.78 FILLING TO FORM EMBANKMENT

- (1) Extensive monitoring will be carried out to monitor the behaviour of embankments during filling operations. The Contractor may be required to stop filling a certain section of the embankment should the monitoring results indicate that excessive movement of the embankment has occurred. The Contractor shall then reschedule the filling sequence to suit.
- (2) Construction of pavements and drainage works on embankment shall not be allowed to commence unless 3 consecutive settlement readings each measured in accordance with PS 7.213(3)S is less than 5mm or as directed by the Engineer. Nonetheless, the Contractor shall still take into account the residual settlement and submit proposals of constructing the pavements, the drainage works and the like on the embankment to the Engineer for approval.
- (3) The Contractor shall take into account the time of settlement in programming the works. The Contractor is allowed to employ accelerating consolidation methods, which are subject to the approval of the Engineer, to achieve early attainment of the stable stage mentioned in (2) above to suit his programme of the works.

1.79 CONTRACTOR TO SUPPLY FILL MATERIAL

The Contractor shall supply fill material from his own sources to the Site for uses associated with the Contract. Each source of supply shall be to the Engineer's approval prior to its use as fill material.

1.80 EXTENT OF MARINE WORKS

All works in this Contract are classified as non-marine works and shall not be measured under Section 17 of the Standard Method of Measurement for Civil Engineering Works (1992 Edition).

APPENDIX 1.6 - ENVIRONMENTAL MONITORING EQUIPMENT

A. WATER QUALITY MONITORING EQUIPMENT AND ACCESSORIES**(a) Dissolved Oxygen and Temperature Measuring Instrument**

| Description and Specification | Quantity |
|--|----------|
| <p>The instrument shall be portable, weatherproof dissolved oxygen measuring instrument complete with cable, sensor, comprehensive operation manuals, and be operable from a DC power source. It shall be capable of measuring dissolved oxygen level in the range of 0-20 mg/l with an accuracy of ± 0.03 mg/l and 0-200% saturation. It shall also be capable of measuring temperature between 0-45°C. The sensor shall have a membrane electrode with automatic temperature compensation complete with a cable of not less than 25m in length. Stocks of spare electrodes and cable shall be maintained for replacement where necessary. The Contractor shall supply a laboratory standard certified mercury thermometer with an accuracy of 0.5°C for calibration of the temperature gauge. (SI model 58 metre or similar approved)</p> | 1 set |

(b) Turbidity Measurement Instrument

| Description and Specification | Quantity |
|---|----------|
| <p>Turbidity within the water shall be measured in-situ by the nephelometric method. The instrument shall be a portable weatherproof turbidity - measuring instrument complete with cable sensor and comprehensive operation manuals. The equipment shall be operable from a DC power source and shall have a photoelectric sensor capable of measuring turbidity between 0-1000 NTU. (Hach 2100P turbidimeter or similar approved)</p> | 1 set |

(c) Suspended Solids Measurement Instrument

| Description and Specification | Quantity |
|---|----------|
| Water sampler with a minimum capacity of 1 litre complete with a rope at least 15 metres long. It shall be capable of taking water samples selectively at any specified depth between 0-15 metres. (Type - Van Doorn XRB series or similar) | 2 Nos. |
| Wide-mouthed, double-capped 1 litre capacity plastic bottle for storing water samples. | 50 Nos. |
| Plastic box for storing water samples. The boxes shall each be large enough to store at least 10 1-litre plastic bottles. | 4 Nos. |

All monitoring instruments shall be checked, calibrated and certified by an HOKLAS accredited laboratory before use on the Works and subsequently be returned to laboratory for re-calibration at 3-month intervals throughout all stages of the water quality monitoring. Responses of sensors and electrodes shall be checked with certified standard solutions before each use. The turbidity meter shall be calibrated to establish the relationship between turbidity readings (in NTU) and levels of suspended solids (in mg/l).

B. NOISE LEVEL MONITORING EQUIPMENT AND ACCESSORIES

| Description and Specification | Quantity |
|---|--------------|
| <p>a. Sound level meter (SLM) set including printer for measuring Leq. in a sample time period not exceeding 30 minutes.</p> <p>Specification for sound level meter set:</p> <ul style="list-style-type: none"> (i) SLM standard: IEC 804 Type 1 and IEC 651 Type 1. (ii) Frequency weighting: IEC 651 Type 1 Liner and A. (iii) Time weighting: IEC 804 Type 1 (Time averaging) IEC 651 Type 1 (Fast) (iv) Level range: Covering at least 40dB(A) to 110dB(A) preferably in one level range setting. (v) Measuring time: Preset time can either be defined by user or selected by user, or manually controlled. (vi) Digital output: Suitable for the associated printer. (vii) Parameter measured: Leq, SPL (maximum rms level in 1 second period in accordance with IEC 651), L90. (viii) Data inhibit function: Data inhibit on activation of Pause pushkey. Data obtained within a set period prior to activation may be deleted. The set period shall be selectable up to 9 seconds. (ix) Real time clock: Built in real time clock. Date and time information be able to be shown on display and output to printer. (x) Digital display: LCD, resolution 0.1 dB. (xi) Parameter display: SLM set-up including microphone sensitivity correction, sound incidence correction, present time, time weighting, frequency weighting, level range setting (all of these set-up parameters shall be readable from either display or other indicators); all measured parameters (1 second up-date time); elapsed time (1 second up-date rate); latched overload indicator and present overload indicator; battery low warning; overrange and underrange indicator. (xii) Printout: Full format includes SLM set up, Leq, L90, overload, elapsed time, number of interruptions. Short formal optional. (xiii) Power: Battery operated. (xiv) Accessories: 1/2" condenser microphone Windscreen Interface between SLM & printer Leather case and shoulder strips for printer | <p>1 set</p> |

| | |
|---|--------|
| <p>b. Calibrator</p> <p>Specifications for calibrator:</p> <ul style="list-style-type: none">(i) Use: Fits 1/2" microphone of the SLM set.(ii) Nominal output: 94 dB re $2 \times 10^{-3} \text{N/m}^2$, 1000 Hz.(iii) Accuracy: ± 0.3 dB at $23^\circ\text{C} \pm 3^\circ\text{C}$, ± 0.4 dB between 10°C and 40°C(iv) Influence of static pressure: Not exceeding ± 0.05 dB per 100 mbar from 500 mbar to 1100 mbar.(v) Long term stability: Better than ± 0.1 dB per year.(vi) Battery check: Battery check shall be provided.(vii) Power: Battery operated. | 2 Nos. |
|---|--------|

C. DUST LEVEL MONITORING EQUIPMENT AND ACCESSORIES

| Description and Specification |
|---|
| a) High volume air sampler with shelter and power generator can collect air samples for dust (TSP) levels measurement by the "High Volume Method for Total Suspended Particulates" as described in Part 50 Appendix B of Title 40 of the Code of Federal Regulations of the USA (USEPA in 40CFR part 50). The sampler, shelter and power generator shall be constructed to be transferable. |
| b) electronic balance for weighing solids particulates to satisfy the need in the High Volume Method for TSP as described by USEPA in 40CFR part 50 |
| c) Direct reading dust meter capable of achieving results comparable to a high volume air sampler (HVAS) for 1 hour sampling in the range of 0.1-100 mg/m ³ . |

The samplers shall be properly maintained and frequently calibrated by the Contractor. Initial calibration of dust monitoring equipment shall be conducted by the Contractor upon installation and thereafter in a bi-monthly interval.

D. GENERAL REQUIREMENT

The requirement shall apply to all monitoring equipment and accessories supplied to the Engineer under the Contract. The rate inserted in the Bills of Quantities for each type of monitoring equipment shall be deemed to the full inclusive value of the requirement stipulated in this sub-clause:

- (i) Supply of energy like batteries, fuel oil, electricity and the like to run the monitoring equipment and accessories throughout the Contract Period.

ENVIRONMENTAL MONITORING EQUIPMENT

Units 1.62

The unit of measurement shall be :

(i) noise level monitoring equipment..... set.

Itemisation 1.63

Separate items shall be provided for environmental monitoring in accordance with General Principles paragraphs 3 and 4 and the following :

| Group | Feature |
|-------|---------|
|-------|---------|

| | |
|---|--------------------------------------|
| I | 1. Noise level monitoring equipment. |
|---|--------------------------------------|

Noise level monitoring equipment 1.64

The items for noise level monitoring equipment shall, in accordance with General Preambles paragraph 2, include for :

Item coverage

- (a) noise level monitoring equipment and all necessary accessories;
- (b) wind speed anemometer;
- (c) testing, including calibration using any special instruments required by the Supplier;
- (d) maintenance of instrument in working order for the duration of the Contract;
- (e) an adequate replacement of equipment and accessories when the regular one is unserviceable;
- (f) credit value of equipment;
- (g) calibration of the instrument by an independent laboratory;
- (h) supply of energy.

Annex B

35CD Village Flood Protection
Works for San Tin Villages
DC/95/03
Environmental Control
Clauses

works being carried out. The contractor shall not disturb any parts of the fish ponds that are within the limit of right of temporary occupation as shown on Drg. Nos. DDN/35CD/1001 to DDN/35CD/1005 and shall fence off these areas or take such other precautionary measures as are necessary to prevent disturbance or damage. On completion of the Works, these remaining parts of the fish ponds shall be handed over in a state in the opinion of the Engineer similar to that when they were handed over to the Contractor. They shall be filled with fresh water suitable for fish farming. Should any damage or disturbance be caused to these remaining parts of the fish ponds, the Contractor shall rectify the situation and bear the cost of the same.

- (2) The Contractor shall carry out water tests for each fish pond to demonstrate to the Engineer that the refilled water has satisfied the quality criteria as specified in PS Clause 26.01.
- (3) The Contractor shall be extremely careful in carrying out works in the vicinity of fish ponds that are outside the Site. The Contractor should note that fish ponds are sensitive water bodies which are vulnerable to the effect of pollution and shall take such precautionary measures as are necessary along the boundaries of the Site to prevent any foreign or polluting matters entering the ponds. Should any pollution, damage or disturbance be caused to these fish ponds, the Contractor shall rectify the situation and bear the cost of the same.
- (4) The Contractor should note in particular that some of the works have to be carried out within a fish pond in Lot 764 as shown on Drg. No. DDN/35CD/1004. The area of the pond outside the Site will continue to be in private ownership and active fish farming will continue throughout the course of the Contract. In addition to (3) above, the Contractor shall carefully implement and maintain such measures and temporary works, including but not limited to, the use of sheet piling, separating boards, and the like as may be necessary to form a watertight barrier along the boundary between the Site and the remaining area of the fish pond to avoid affecting the fish pond water and the fish farming operation. The measures and temporary works shall be installed in a manner so as not to adversely affect the fish farming operation and shall be completed within 3 months from the date of Site hand over.

1.69 AMENITIES TO BE PRESERVED

- (1) The Contractor shall except as provided in the Contract cause the least possible interference with existing environment and amenities, whether natural or man-made. The Employer is committed to protecting the environment.

1.70 MARINE DUMPING OF EXCAVATED MATERIAL

- (1) The Contractor shall when applying for appropriate permissions under the Dumping at Sea Ordinance for marine dumping copy to the Engineer all correspondences concerning the application and any permission granted, and the information shall include details of :
 - (a) the total volume of excavated material to be dumped;
 - (b) a programme showing the volume of excavated material to be dumped each month;
 - (c) details of the vessels that will be used for transporting excavated material to any marine dumping grounds;
 - (d) the number of trips per day for each vessel and the route(s) proposed.
- (2) The Contractor shall satisfy the Engineer before commencing any dumping that he has obtained all necessary approvals. The Contractor shall employ suitable vessels for transporting and dumping excavated material and shall maintain them to prevent material being spilled between the place of loading and any dumping ground. The Contractor shall provide the Engineer with facilities for inspecting the vessels prior to their use and shall not use any vessel until that vessel has been inspected by the Engineer.
- (3) The Engineer may monitor vessels transporting excavated material to check that no short-dumping takes place and the Contractor shall provide all reasonable assistance to the Engineer for this purpose.
- (4) The Contractor shall provide suitable equipment for his vessels and navigation systems to ensure that his vessels are able to identify the location of the Approved Dumping Ground all to the approval of the Engineer and the satisfaction of the relevant authorities.

1.71 CONTROL OF WATER QUALITY

- (1) The Contractor shall execute the Works in a manner so as not to adversely affect the water quality of the rivers, watercourses and ponds within or adjacent to the Site and of the rivers, watercourses, ponds and the sea when loading, transporting and disposing of excavated material from the Site.
- (2) All construction plant shall be properly designed and carefully maintained so as to eliminate the risk of sediments or other pollutants being deposited in the rivers or the sea.
- (3) The Contractor shall design and implement mitigation measures and

methods of working to avoid adversely affecting water quality and shall employ experienced personnel and provide suitable training to ensure that these methods are implemented. The mitigation measures shall include, but are not necessarily limited to the following: -

- (a) Only tightly sealed closed grab excavators shall be used for excavating underwater, in rivers, watercourses and ponds. The grabs shall be designed and maintained to avoid spillage and to seal tightly while being lifted and shall be of a design described as an orange-peel grab, closed-box grab and bucket grab with visor or other similar approved.
- (b) The decks of all vessels and floating pontoons shall be kept tidy and free of oil or any other substances or articles which might be accidentally or otherwise washed overboard. Rubbish shall not be dumped in the sea and river.
- (c) The provision of silt curtains, temporary bunds and sheet pile walls within the rivers, watercourses and ponds; cut-off drains, large scale silt traps and temporary pumping systems to control the surface or ground water run-off from the Site.

The Contractor shall submit his proposals to the Engineer at least 28 days before any work commences that is likely to affect water quality. If the Engineer considers the proposals are not acceptable, the Contractor shall make such modification to them as the Engineer may reasonably require and the Contractor shall bear all the cost in complying with this requirement.

- (4) The Contractor shall carry out water quality monitoring as set out in this Contract. The Contractor shall take water samples, measure and record the instrumental readings of water quality monitoring by measurement of turbidity, suspended solids (mg/l), dissolved oxygen concentration (DO in mg/l), dissolved oxygen saturation and temperature at specified locations in the watercourses in the vicinity of San Tin villages. In addition, the Contractor shall employ an approved HOKLAS accredited laboratory, which is also agreed by the Engineer, to carry out laboratory tests, analyses and reporting for those samples.
- (5) Water monitoring shall commence six weeks prior to commencement of any excavation work, which is likely to affect the quality of water in the watercourses. Samples of water column at each water sampling station shown on Drawings shall be taken concurrently on every alternate working day or at other intervals as instructed by the Engineer. Samples shall be taken at mid-ebb and from the surface and bottom of the water column at the sampling stations except that when the depth of water is less than 1.5m at any sampling station at the time of sampling only one sample from the middle of the water column shall be taken. Surface samples shall be taken within 0.5m of the surface of the water and bottom samples shall be taken no closer than 0.5m to the bottom of the watercourse. Three samples at each depth of each station shall be taken. The suspended solid level and dissolved

oxygen level at each water sampling station for monitoring water quality shall be the mean of the suspended solid level and the mean of dissolved oxygen level respectively of all the samples at that station.

- (6) The Contractor shall provide water quality monitoring results to the Engineer within 24 hours, except for the results for the suspended solids which shall be reported no later than 48 hours after sampling. Formal reports shall be submitted to the Engineer at monthly intervals.
- (7) The Trigger/Action/Target Levels for water quality are defined in Table 1 as below:

Table 1. Water Quality - Trigger/Action/Target Levels

| Level | Definition |
|---------------|--|
| Trigger Level | Trigger Level is exceeded if Suspended Solids (SS) at water sampling station W1 exceeds 256mg/l, or 120% of the suspended solids level at water sampling station W2, whichever is the greater, at the same tide on any one monitoring day <u>or</u> Dissolved Oxygen (DO) value measured at station W1 is lower than 80% of station W2 at the same tide on the same monitoring day |
| Action Level | Action Level is exceeded if SS at water sampling station W1 exceeds 256mg/l, or 130% of the SS at water sampling station W2, whichever is the greater, at the same tide on any one monitoring day <u>or</u> DO measured at station W1 is lower than 70% of station W2 at the same tide on the same monitoring day |
| Target Level | Target Level is exceeded if SS at water sampling station W1 exceeds 256mg/l, or 130% of the SS at water sampling station W2, whichever is the greater, measured at the same tides for three consecutive monitoring days <u>or</u> DO measured at station W1 is lower than 70% of station W2 measured at the same tides for the three consecutive monitoring days . |

- (8) The Contractor shall execute the Works in a manner such that the Target Level is not exceeded.
- (9) If monitoring shows that the Trigger Level is exceeded, the Contractor shall identify the cause and take measures to avoid further exceedance. If monitoring shows that Action Level is exceeded, the Contractor shall submit proposals for remedial action for the Engineer's approval and implement the approved proposal immediately. Approval of the Engineer shall not relieve the Contractor from his obligation of not exceeding the Target Level. If the

Trigger or Action Levels are exceeded, monitoring shall take place on daily basis until the levels are not exceeded and all the cost of this additional sampling and testing shall be borne by the Contractor.

- (10) The value of 256mg/l as shown on Table 1 has been set based on the 95 percentile (for log normal distribution) of routine water monitoring data. The value may be adjusted, at the sole discretion of the Engineer, if further baseline monitoring indicates significant changes in ambient conditions.
- (11) If the Contractor's methods of excavation, stockpiling, placing fill, dewatering, pumping or any other activity involves tailwaters, surface or ground water being discharged from the Site to the nearby watercourses or any other place, then the Contractor shall arrange his method of working so that the environment shall not be adversely affected.
- (12) In addition to the water samples taken for control purposes as required above, the Contractor shall employ an approved HOKLAS accredited laboratory to carry out insitu tests and to take samples at each water sampling station to monitor the following:
 - (a) The values of turbidity, dissolved oxygen saturation and temperature shall be determined three days a week.

The Contractor shall submit preliminary results at weekly intervals. Formal reports shall be submitted to the Engineer at monthly intervals.

1.72 NOISE CONTROL

- (1) All plant and equipment used by the Contractor on the Works shall be effectively "sound reduced" by means of silencers, mufflers, acoustic linings or shields or acoustic sheds or screens to reduce the noise level.
- (2) The Contractor shall assist the Engineer in conducting noise monitoring in the vicinity of San Tin villages, as shown on Drawings. For construction works carried out during 0700 - 1900 Monday to Saturday except for Public Holidays, noise monitoring shall be conducted once a week at the noise level monitoring stations. For construction works carried out at other periods or on Public Holidays, noise monitoring shall be conducted twice a week at the noise level monitoring stations. For the purpose of this Clause, the Contractor shall note that construction noise levels shall be determined by carrying out measurements at monitoring stations 1m from the exterior of the nearest building facades, the exact location of each monitoring station shall be determined by the Engineer from time to time on site.
- (3) The Contractor shall execute the Works in such a manner that the Target Level is not exceeded. The Target Level is defined in Table 2 below:

Table 2. Noise - Target Level

| Time Period | Noise Level (dBA) (measured at building facade) |
|--|--|
| Daytime (0700 to 1900), Monday through Saturday excluding Public Holidays | $L_{eq,30min} = 75$ |
| All evenings (1900 to 2300) | $L_{eq,5min} = 60$ |
| General Holidays (including all Sundays) during daytime and evening (0700 to 2300) | $L_{eq,5min} = 60$ |

- (4) If a documented complaint of construction noise is received by the Engineer or his Representative, the Contractor shall identify the cause and modify his method of working, if found necessary. If more than one documented complaints of construction noise in any two consecutive weeks, the Contractor shall submit proposals for remedial action for the Engineer's approval.
- (5) The Contractor shall apply for a Construction Noise Permit in accordance with the Technical Memorandum on Noise from Construction Work other than Percussive Piling.
- (6) The Contractor shall take such measures as may be necessary, to assist the Engineer in determining the background noise level and these measures may include stopping work for a period of time to allow noise measurements to be made.
- (7) The Contractor shall employ a suitably qualified person to be responsible for preparing his submissions on noise control.
- (8) Notwithstanding the above sub-clauses, the Engineer may instruct the Contractor to apply further noise reduction measures including the erection of noise screens, earth bunds or other measures as circumstances may warrant.
- (9) The Contractor shall construct noise barriers as shown on Drawing No. DDN/35CD/1116 at the locations instructed by the Engineer. Any noise barriers so instructed shall be completed within 8 weeks of the instruction. The Contractor shall maintain the noise barriers and shall remove the noise barriers when instructed by the Engineer. All materials used in the construction of the noise barriers shall remain the property of the Employer after the noise barriers have been removed and shall so far as suitable be reserved and stocked for further use or disposed of as directed by the Engineer. The Contractor shall reinstate any areas of the Site affected by the noise barriers after their removal and shall fill any post or other holes with suitable material compacted in accordance with the Specification.

1.73 DUST CONTROL

- (1) Areas of the Site in which dust is likely to be generated shall be sprayed with water regularly. Screens, dust sheets, tarpaulins or other methods agreed by the Engineer shall be used to prevent generation of dust. Materials, including earthworks material, from which dust may be generated when being transported to or from the Site shall be sprayed with water or covered.
- (2) Haul roads shall be chosen such that they are at a minimum distance of 50 metres from the nearest houses.
- (3) On-site unpaved roads that are frequently used shall be regularly compacted and the road surface shall be kept clear of loose material. Water spraying shall also be used to control dust.
- (4) Vehicles shall be restricted to designated routes and shall not exceed a speed limit of 11 kilometres per hour.
- (5) The Contractor shall submit his dust control proposals to the Engineer before the commencement of construction.
- (6) The Contractor shall employ an approved HOKLAS accredited laboratory, which is also agreed by the Engineer, to conduct a baseline survey prior to the commencement of the construction works. Baseline results shall be established to determine the 1-hour and 24-hour ambient total suspended particulates (TSP) levels at the dust level monitoring stations as shown on the Drawings. The baseline survey shall be carried out for a continuous period of at least two weeks with daily ambient measurements taken at the Dust Sensitive Receiver. One hour TSP monitoring shall be undertaken at least 3 times per day. The Contractor shall note that the location of each monitoring station shall be determined by the Engineer on site.
- (7) The Contractor shall employ an approved HOKLAS accredited laboratory, which is also agreed by the Engineer, to conduct dust monitoring at each monitoring station in the Dust Sensitive Receiver. Dust (TSP) monitoring shall be as follows:
 - (a) Monitoring of (24-hour) total suspended particulates shall be carried out once every six days at each monitoring station. A monitoring shall consist of collection of 24 hour samples using High Volume Method at the monitoring station;
 - (b) Monitoring of (1-hour) total suspended particulates shall be carried out once at each monitoring station every day on which construction is taking place. A monitoring shall consist of collection of three, 1-hour measurements at the monitoring station and the measurements shall

coincide with the construction activities with highest anticipated dust emission.

- (8) The dust (TSP) levels shall be measured by the "High Volume Method for Total Suspended Particulates" as described in Part 50 Appendix B of Title 40 of the Code of Federal Regulations of the USA.
- (9) The Trigger/Action/Target Levels for dust are defined in Table 3 as below:

Table 3. Dust - Trigger/Action/Target Levels

| | Total Suspended Particulates |
|---------------|---|
| Trigger Level | Baseline result plus 30% margin |
| Action Level | Average value of the Trigger and Target Levels |
| Target Level | 260 Fg per m ³ averaged over 24 hours; <u>and</u> 500 Fg per m ³ averaged over 1 hour |

- (10) The Contractor shall execute the Works in such a manner that the Target Level shall not be exceeded.
- (11) If monitoring shows that the Trigger Level is exceeded, the Contractor shall identify the cause and amend working methods if appropriate. If monitoring shows that the Action Level is exceeded, the Contractor shall submit proposals for remedial action to avoid further exceedance.
- (12) Two numbers of Wheel washing bays shall be constructed as instructed by the Engineer.

1.74 ENVIRONMENTAL MONITORING EQUIPMENT

- (1) The Contractor shall supply new water quality monitoring equipment and sound measuring equipment and accessories to the requirement in Appendix 1.6 to the Engineer for his exclusive use.
- (2) The Contractor shall supply all equipment in sub-clause (1) above in good working condition prior to the commencement of any construction works. The Contractor shall not commence any Works until all these monitoring equipment are available for use on Site.

- (3) The Contractor shall maintain the equipment in good working condition and ensure that all necessary spare parts, back-up and replacement monitoring units are available at all time of the measurement period.
- (4) The Contractor shall arrange for the calibration of the suspended solids measuring instrument to be carried out in an independent laboratory approved by the Engineer at monthly interval.
- (5) The equipment shall be reverted to the Contractor on the completion of the Works or at such earlier date as the Engineer may notify in writing.
- (6) The equipment shall be used solely for the purpose of environmental monitoring in this Contract or any other contracts as required by the Engineer.
- (7) The Contractor shall provide his own sets of monitoring equipment and accessories to the requirement in Appendix 1.6 or equivalent for environmental monitoring in the Contract.

1.75 BLACK SMOKE CONTROL

The Contractor shall ensure that exhausted gas pollutants from engines do not produce black smoke, by maintaining the engines in good running order.

1.76 DATA PROCESSING EQUIPMENT FOR THE ENGINEER

- (1) "Data Processing Equipment for the Engineer" shall comprise items satisfying the technical and functional specification stated in the "Schedule of Data Processing Equipment for the Engineer", Appendix 1.1 of this PS with, in addition, all items necessary for the data processing equipment to function together, and as specified.
- (2) The Contractor shall, within 7 days from the date of an instruction from the Engineer, submit for the Engineer's approval details of data processing equipment to be provided for the purposes of this Contract. The proposed equipment shall have been on the local market for at least three months and must not infringe any legal copyright.
- (3) The Contractor shall deliver to the Engineer's site and/or head office the data processing equipment approved by the Engineer within 14 days of the Engineer's approval or other such date agreed by the Engineer. All software shall be delivered to the location specified by the Engineer, in intact shipping cartons with all seals unbroken. At the time of delivery, the originals of all warranty agreements, invoices and other supporting documents related to the price of the equipment shall be produced for inspection by the Engineer.

- (4) Software included in the data processing equipment shall be compatible with the data processing equipment supplied by the Contractor, and be licensed in the name of the Drainage Projects Division of Drainage Services Department.
- (5) Within 24 hours of delivery, the Contractor shall arrange for the equipment to be established and tested to complete working order to the satisfaction of the Engineer. The Contractor shall be responsible for installation, testing and commissioning of the computer systems and network.
- (6) The Contractor shall license and maintain the proper functioning of both the hardware and software until the expiration of the Maintenance Period or other agreed date if so directed by the Engineer.
- (7) Unless otherwise specified, the equipment shall revert to the Contractor on the expiry of the Maintenance Period or at such earlier date as the Engineer may notify in writing. The Contractor shall disconnect the equipment and reinstate the Engineer's head office to its original condition.

1.77 RECORD SURVEY

- (1) Before the Contractor commences any excavation, dredging or filling which is the subject of a measured item in the Bills of Quantities, a record survey of the relevant area shall be carried out and the results recorded on the Drawings which shall show plans and sections of the land surface at intervals not exceeding 20 m and on which all levels shall be referred to Principal Datum.
- (2) Record surveys of watercourses shall be made not less than 35 days after draining and at least 7 days before filling is due to commence. Throughout the 35 days prior to the survey the groundwater level shall be maintained at or below ground level over the area to be surveyed by providing drainage ditches, pump sumps and pumping where necessary.
- (3) The survey method used shall include echo sounding, chain surveying, measuring staff or other appropriate methods depending on the site condition. The Contractor shall agree with the Engineer the proposed method of executing and recording such survey prior to the actual survey. In the case of disagreement, the Engineer shall determine the method of surveying to be used.
- (4) The Contractor shall notify the Engineer in writing at least 2 weeks before such excavation, dredging or filling commences that the relevant areas are required to be surveyed.
- (5) The Contractor shall attend and check each survey and recording, and all extra surveys required to resolve any doubts which may arise as to the correctness of any survey or record. Thereafter the Engineer's decision as to what shall be recorded as the correct survey shall be final.

- (6) Each survey drawing which has been completed in the foregoing manner shall be signed by the Contractor and by the Engineer or the Engineer's Representative and shall form the basis of measurement of the relevant work. The original of each signed survey drawing shall be retained by the Engineer or the Engineer's Representative and two copies of each signed survey drawing shall be supplied to the Contractor.

1.78 SECURITY MEASURES

- (1) The Contractor shall take adequate security measures to the satisfaction of the Commissioner of Police to prevent the access of illegal immigrants into Hong Kong while the work is under progress.
- (2) The Royal Hong Kong Police Force will carry out frequent check on all works near the border area. The Contractor shall co-operate with the Police and provide any assistance required for carrying out such check.

1.79 DISPOSAL OF CONTAMINATED EXCAVATED MATERIAL

- (1) All contaminated excavated materials shall be disposed of at the Approved Dumping Ground for contaminated material. For the purpose of this Contract the Approved Dumping Ground for contaminated excavated material shall be the East Sha Chau contaminated mud marine disposal area; and other disposal areas as directed by the Licensing Authority from time to time.
- (2) Stockpiling of contaminated excavated materials on the Site is not permitted.
- (3) The Contractor shall note the specified period for his use of the Berthing Area at Tai Lam Kok for the execution of the Works.
- (4) The Contractor shall apply for a license for marine dumping of contaminated material and shall comply with the following:-
 - (a) place the contaminated excavated materials at a location and in a manner as directed on site by the Management Team of the Civil Engineering Department. The licensee shall proceed with the disposal operation as instructed by the Management Team and in accordance with the relevant sections in the Management Scheme for Contaminated Mud Disposal Pits at East Sha Chau - Guidance Notes for Dumping which may be modified from time to time by the Management Team. The licensee shall not carry out any dumping without permission of the Management Team or when the Management Team is not in operation;

- (b) carry out the dumping operation in strict accordance with the method statement agreed by the Licensing Authority;
- (c) design properly and maintain carefully all operational plant so as to minimise the risk of sediments or other pollutants being released into the water column and deposited in the seabed other than designated locations. The licensee's work shall cause no visible foam, oil, grease, scum, litter or other objectionable matter to be present in the water within the Site;
- (d) transport contaminated excavated material by split barge of not less than 750m³ capacity;
- (e) fit all barges with tight fitting seal to their bottom openings to prevent leakage of material;
- (f) release the mud rapidly and close the hoppers immediately; any material adhering to the sides of the hopper shall not be washed out of the hopper and the hopper shall remain closed until the barge next returns to the disposal site. The licensee shall ensure that the dumping vessel shall be stationary throughout the dumping operation;
- (g) size all vessels such that adequate clearance is maintained between the seabed and vessels at all states of the tide, to ensure that undue turbidity is not generated by turbulence from vessel movement or propeller wash. Adequate freeboard shall be maintained on barges to ensure that decks are not washed by wave action;
- (h) employ only barges equipped with the automatic self-monitoring device for the dumping operation, and shall cooperate with and facilitate the Licensing Authority to inspect the device and retrieve the record stored in the device on a regular basis;
- (i) provide experienced full time personnel on board all dumping vessels and provide suitable training to ensure that appropriate methods to minimise pollution are implemented. Records should be maintained to satisfy the Licensing Authority that there is no short dumping or dumping outside the Designated Dumping Area. The licensee shall also make available to the Licensing Authority and the Secretary of Fill Management Committee (S/FMC), Civil Engineering Department, at any time upon the written request of the Licensing Authority, all information and records relevant to the excavation in watercourses and ponds and mud disposal operation. This information shall include, but not be limited to, all data on the plant used by the licensee, up-to-date periodic data on production rates and record copies of Notification of Dumping which have been sent to the Management Team, etc;

- (j) fully co-operate with Government officers to allow access to barges and other craft for the purpose of sampling excavated material and for the inspection of samples and other appropriate monitoring and control information;
 - (k) provide the Licensing Authority, the Management Team and the S/FMC a programme of the excavation in ponds and watercourses and dumping operation through the Engineer's Representative on a monthly basis. In addition, the licensee shall provide the Licensing Authority and the S/FMC, within first week of each month, a monthly return of dumping records showing the number of barge loads and the quantity of contaminated mud dumped at the disposal pit. A nil return shall be provided even if no dumping operation is carried out within that particular month unless the licensee has informed the Licensing Authority of his completion of dumping operation;
 - (l) inform the Licensing Authority and the S/FMC by writing once the dumping operation is completed; and
 - (m) remove any substance which is found dumped outside the designated dumping area by the licensee or his subcontractors;
- (6) The Contractor should note that the Licensing Authority may, from time to time, impose additional conditions on dumping of contaminated material and due allowance should be made by the Contractor to cater for the same.

1.80 FILLING TO FORM EMBANKMENT

- (1) Extensive monitoring will be carried out to monitor the behaviour of embankments during filling operations. The Contractor may be required to stop filling a certain section of the embankment should the monitoring results indicate that excessive movement of the embankment has occurred. The Contractor shall then reschedule the filling sequence to suit.
- (2) Construction of pavements and drainage works on embankment shall not be allowed to commence unless the soil underneath the embankment has undergone 80% consolidation after completion of filling up the embankment or as directed by the Engineer. Nonetheless, the Contractor shall still take into account the residual settlement and submit proposals of constructing the pavements, the drainage works and the like on the embankment to the Engineer for approval.
- (3) The Contractor shall take into account the time of settlement in programming the works. The Contractor is allowed to employ accelerating consolidation methods, which are subject to the approval of the Engineer, to achieve early attainment of 80% consolidation to suit his programme of the works.

1.81 CONTRACTOR TO SUPPLY FILL MATERIAL

The Contractor shall supply fill material from his own sources to the Site for uses associated with the Contract. Each source of supply shall be to the Engineer's approval prior to its use as fill material.

1.82 EXTENT OF MARINE WORKS

All works in this Contract are classified as non-marine works and shall not be measured under Section 17 of the Standard Method of Measurement for Civil Engineering Works (1992 Edition).

1.83 WORK AFFECTED BY NON-TIDAL OPEN WATER OR TIDAL WATER

Works shall not be measured as being affected by non-tidal open water or tidal water except the works under the level of + 2.5 mPD. Under no circumstances shall the works shown on the following drawings be measured as being affected by non-tidal open water or tidal water.

| <u>Drawing No.</u> | <u>Title</u> |
|----------------------|--|
| DDN/35CD/1009 - 1013 | Setting Out Plan and Details (5 Sheets) |
| DDN/35CD/1017 | Road Improvement Works for Works Area |
| DDN/35CD/1052 - 1058 | Ducting Works (7 Sheets) |
| DDN/35CD/1059 - 1064 | Roads Lighting Layout and Details (6 Sheets) |
| DDN/35CD/1065 - 1069 | Roadworks, Warning Boards, Fences, Gates and Railing Layout (5 Sheets) |
| DDN/35CD/1070 - 1071 | Roadworks Details (2 Sheets) |
| DDN/35CD/1072 | Details of Warning Boards |
| DDN/35CD/1072 | Details of Chain Link Fence and Gates |
| DDN/35CD/1074 - 1078 | Traffic Signs and Road Markings Layout (5 Sheets) |
| DDN/35CD/1079 | Details of Traffic Signs and Road Markings |
| DDN/35CD/1080 - 1082 | Details of Inlet Chambers (3 Sheets) |
| DDN/35CD/1091 | Floodwater Pumping Station - Details of GMS Chequer Plate and Aluminium Flooring |

A. WATER QUALITY MONITORING EQUIPMENT AND ACCESSORIES

(a) Dissolved Oxygen and Temperature Measuring Instrument

| Description and Specification | Quantity |
|--|----------|
| The instrument shall be portable, weatherproof dissolved oxygen measuring instrument complete with cable, sensor, comprehensive operation manuals, and be operable from a DC power source. It shall be capable of measuring dissolved oxygen level in the range of 0-20 mg/l with an accuracy of " 0.03 mg/l and 0-200% saturation. It shall also be capable of measuring temperature between 0-45°C. The sensor shall have a membrane electrode with automatic temperature compensation complete with a cable of not less than 25m in length. Stocks of spare electrodes and cable shall be maintained for replacement where necessary. The Contractor shall supply a laboratory standard certified mercury thermometer with an accuracy of 0.5°C for calibration of the temperature gauge. (SI model 58 metre or similar approved) | 1 set |

(b) Turbidity Measurement Instrument

| Description and Specification | Quantity |
|--|----------|
| Turbidity within the water shall be measured in-situ by the nephelometric method. The instrument shall be a portable weatherproof turbidity - measuring instrument complete with cable sensor and comprehensive operation manuals. The equipment shall be operable from a DC power source and shall have a photoelectric sensor capable of measuring turbidity between 0-1000 NTU. (Hach 2100P turbidimeter or similar approved) | 1 set |

(c) Suspended Solids Measurement Instrument

| Description and Specification | Quantity |
|---|----------|
| Water sampler with a minimum capacity of 1 litre complete with a rope at least 15 metres long. It shall be capable of taking water samples selectively at any specified depth between 0-15 metres. (Type - Van Doorn XRB series or similar) | 2 Nos. |
| Wide-mouthed, double-capped 1 litre capacity plastic bottle for storing water samples. | 50 Nos. |
| Plastic box for storing water samples. The boxes shall each be large enough to store at least 10 1-litre plastic bottles. | 4 Nos. |

All monitoring instruments shall be checked, calibrated and certified by an HOKLAS accredited laboratory before use on the Works and subsequently be returned to laboratory for re-calibration at 3-month intervals throughout all stages of the water quality monitoring. Responses of sensors and electrodes shall be checked with certified standard solutions before each use. The turbidity meter shall be calibrated to establish the relationship between turbidity readings (in NTU) and levels of suspended solids (in mg/l).

B. NOISE LEVEL MONITORING EQUIPMENT AND ACCESSORIES

| Description and Specification | Quantity |
|---|----------|
| <p>a. Sound level meter (SLM) set including printer for measuring Leq. in a sample time period not exceeding 30 minutes.</p> <p>Specification for sound level meter set:</p> <ul style="list-style-type: none"> (i) SLM standard: IEC 804 Type 1 and IEC 651 Type 1. (ii) Frequency weighting: IEC 651 Type 1 Liner and A. (iii) Time weighting: IEC 804 Type 1 (Time averaging), IEC 651 Type 1 (Fast) (iv) Level range: Covering at least 40dB(A) to 110dB(A) preferably in one level range setting. (v) Measuring time: Preset time can either be defined by user or selected by user, or manually controlled. (vi) Digital output: Suitable for the associated printer. (vii) Parameter measured: Leq, SPL (maximum rms level in 1 second period in accordance with IEC 651), L90. (viii) Data inhibit function: Data inhibit on activation of Pause pushkey. Data obtained within a set period prior to activation may be deleted. The set period shall be selectable up to 9 seconds. (ix) Real time clock: Built in real time clock. Date and time information be able to be shown on display and output to printer. (x) Digital display: LCD, resolution 0.1 dB. (xi) Parameter display: SLM set-up including microphone sensitivity correction, sound incidence correction, present time, time weighting, frequency weighting, level range setting (all of these set-up parameters shall be readable from either display or other indicators); all measured parameters (1 second up-date time); elapsed time (1 second up-date rate); latched overload indicator and present overload indicator; battery low warning; overrange and underrange indicator. (xii) Printout: Full format includes SLM set up, Leq, L90, overload, elapsed time, number of interruptions. Short format optional. (xiii) Power: Battery operated. (xiv) Accessories: 1/2" condenser microphone; windscreen Interface between SLM & printer Leather case and shoulder strips for printer | 2 sets |
| b. Calibrator | 2 Nos. |

| | |
|------------------------------------|---|
| Specifications for calibrator: | |
| (i) Use: | Fits 1/2" microphone of the SLM set. |
| (ii) Nominal output: | 94 dB re $2 \times 10^{-3} \text{N/m}^2$, 1000 Hz. |
| (iii) Accuracy: | "0.3 dB at 23°C "3°C, "0.4 dB between 10°C and 40°C |
| (iv) Influence of static pressure: | Not exceeding "0.05 dB per 100 mbar from 500 mbar to 1100 mbar. |
| (v) Long term stability: | Better than "0.1 dB per year. |
| (vi) Battery check: | Battery check shall be provided. |
| (vii) Power: | Battery operated. |

C. DUST LEVEL MONITORING EQUIPMENT AND ACCESSORIES

| Description and Specification |
|---|
| a) High volume air sampler with shelter and power generator can collect air samples for dust (TSP) levels measurement by the "High Volume Method for Total Suspended Particulates" as described in Part 50 Appendix B of Title 40 of the Code of Federal Regulations of the USA (USEPA in 40CFR part 50). The sampler, shelter and power generator shall be constructed to be transferable. |
| b) electronic balance for weighing solids particulates to satisfy the need in the High Volume Method for TSP as described by USEPA in 40CFR part 50 |
| c) Direct reading dust meter capable of achieving results comparable to a high volume air sampler (HVAS) for 1 hour sampling in the range of 0.1-100 mg/m ³ |

The samplers shall be properly maintained and frequently calibrated by the Contractor. Initial calibration of dust monitoring equipment shall be conducted by the Contractor upon installation and thereafter in a bi-monthly interval.

D. GENERAL REQUIREMENT

The requirement shall apply to all monitoring equipment and accessories supplied to the Engineer under the Contract. The rate inserted in the Bills of Quantities for each type of monitoring equipment shall be deemed to the full inclusive value of the requirement stipulated in this sub-clause:

- (i) Supply of energy like batteries, fuel oil, electricity and the like to run the monitoring equipment and accessories throughout the Contract Period.

- (e) repairs and maintenance of the access road from the public road to the wheel washing bay;
- (f) high pressure hosing.

Removal of wheel washing bays 1.61 The items for removal of wheel washing bays shall, in accordance with General Preambles paragraph 2, include for :

- Item coverage*
- (a) breaking up and disposal of foundation and the like;
 - (b) disconnecting and removing utilities and sealing of disused utilities;
 - (c) filling pit and reinstatement;

Take-over or provision of wheel washing bays 1.62 The items for take-over or provision of wheel washing bays shall, in accordance with General Preambles paragraph 2, include for :

- Item coverage*
- (a) take over wheel washing bay; or
 - (b) provide wheel washing bay with item coverage stated in 1.59 (a) to (h).

ENVIRONMENTAL MONITORING EQUIPMENT

Units 1.63 The unit of measurement shall be :

- (i) noise level monitoring equipment, water quality monitoring equipment set.

Itemisation 1.64 Separate items shall be provided for environmental monitoring in accordance with General Principles paragraphs 3 and 4 and the following :

| Group | Feature |
|-------|--|
| I | <ul style="list-style-type: none"> 1. Noise level monitoring equipment. 2. Water quality monitoring equipment. |

*monitoring
equipment
Item coverage*

- 1.65 The items for noise level monitoring equipment shall, in accordance with General Preambles paragraph 2, include for :
- (a) noise level monitoring equipment and all necessary accessories;
 - (b) wind speed anemometer;
 - (c) testing, including calibration using any special instruments required by the Supplier;
 - (d) maintenance of instrument in working order for the duration of the Contract;
 - (e) an adequate replacement of equipment and accessories when the regular one is unserviceable;
 - (f) credit value of equipment;
 - (g) calibration of the instrument by an independent laboratory;
 - (h) supply of energy.

*Water quality
monitoring
equipment*

Item coverage

- 1.66 The items for water quality monitoring equipment shall, in accordance with General Preambles paragraph 2, include for :
- (a) water quality monitoring equipment and all necessary accessories;
 - (b) thermometer;
 - (c) water depth detector;
 - (d) testing, including calibration using any special instruments required by the Supplier;
 - (e) maintenance of instrument in working order for the duration of the Contract;
 - (f) an adequate replacement of equipment and accessories when the regular one is unserviceable;
 - (g) credit value of equipment;
 - (h) calibration of the instrument by an independent laboratory;
 - (i) supply of energy.

WATER QUALITY MONITORING

Units

- 1.67 The unit of measurement shall be:

Annex C

Species Identified in the Vicinity of the 35CD Works

Table 1

Odonate and Lepidopteran species recorded on May 23, 1997 in Chau Tau Tsuen. Names of dragonflies and damselflies follow Wilson (1995) and names of butterflies follow Bascombe (1995).

| Species | Habitats |
|--------------------------------|-----------|
| Odonata | |
| Zygoptera (Damselfly) | |
| Coenagrionidae (Family) | |
| <i>Agriocnemis femina</i> | fields |
| <i>Ceriagrion auranticum</i> | fields |
| <i>Ischnura senegalensis</i> | fields |
| Anisoptera (Dragonfly) | |
| Gomphidae(Family) | |
| <i>Heliogomphus scorpio ?</i> | fields |
| Libellulidae | |
| <i>Rhyothemis variegata</i> | pond bund |
| <i>Pantala flavescens</i> | pond bund |
| <i>Brachytemis contaminata</i> | pond bund |
| Lepidoptera (Butterfly) | |
| Papilionaidae (Family) | |
| <i>Graphium sarpedon</i> | pond bund |
| <i>Papilio helenus</i> | pond bund |
| <i>Papilio polytes</i> | pond bund |
| Lycaenidae | |
| <i>Chilades lajus</i> | pond bund |
| Pieridae | |
| <i>Pieris canidia</i> | pond bund |
| Nymphalidae | |
| <i>Euploea midamus</i> | pond bund |

Table 2

Odonate and Lepidopteran species recorded on May 23, 1997 in San Tin Villages.

| Species | Habitats |
|--------------------------------|-------------------|
| Odonata | |
| Zygoptera (Damselfly) | |
| Coenagrionidae (Family) | |
| <i>Agriocnemis femina</i> | stream |
| <i>Ceriagrion auranticum</i> | pond bund |
| <i>Ischnura senegalensis</i> | pond bund, stream |
| Anisoptera (Dragonfly) | |
| Libellulidae (Family) | |
| <i>Tholymis tillarga ?</i> | pond bund |
| <i>Rhyothemis variegata</i> | pond bund |
| <i>Pantala flavescens</i> | pond bund |
| <i>Brachytemis contaminata</i> | pond bund |
| Lepidoptera (Butterfly) | |
| Pieridae (Family) | |
| <i>Pieris canidia</i> | pond bund |
| Nymphalidae (Family) | |
| <i>Mycalesis mineus</i> | pond bund |
| <i>Hypolimnas bolina</i> | pond bund |

Table 3

Species recorded in Lok Ma Chau (Hong Kong Bird Report 1990 - 1995), and in San Tin nullahs in late March 1996 (Hyder 1997).

| | | 1990 | 1992 | 1993 | 1994 | 1995 | 1996 |
|---|---------------------------------|------|------|------|------|------|------|
| Chinese Pond Heron | <i>Ardeola bacchus</i> | | | | | | ✓ |
| Little Egret | <i>Egretta garzetta</i> | | | | | | ✓ |
| Yellow Bittern | <i>Ixobrychus cinnamomeus</i> | | | | ✓ | | |
| Intermediate Egret | <i>Mesophoyx intermedia</i> | | | | | | |
| Night Heron | <i>Nycticorax nycticorax</i> | | | | | | ✓ |
| Gadwall | <i>Anas strepera</i> | ✓ | | | | | |
| Black-shouldered Kite ¹ | <i>Elanus caeruleus</i> | | | ✓ | | | |
| Northern Sparrowhawk | <i>Accipiter nisus</i> | | ✓ | | ✓ | | |
| Common Buzzard | <i>Buteo buteo</i> | | | | ✓ | | |
| Imperial Eagle ¹ | <i>Aquila heliaca</i> | | | | ✓ | | |
| Bonelli's Eagle | <i>Hieraaetus fasciatus</i> | ✓ | | | | ✓ | |
| Black-eared Kite | <i>Milvus lineatus</i> | | | | | | ✓ |
| Osprey | <i>Pandion haliaetus</i> | | | | | | |
| Oriental Hobby ¹ | <i>Falco severus</i> | | ✓ | | | | |
| Peregrine Falcon | <i>Falco peregrinus</i> | | | | | | |
| Japanese Quail | <i>Coturnix japonica</i> | ✓ | | | | | |
| White-breasted Waterhen | <i>Amaurornis phoenicurus</i> | | | | | | ✓ |
| Moorhen | <i>Ballinula chloropus</i> | | | | | | ✓ |
| Pheasant-tailed Jacana ¹ | <i>Hydrophasianus chirurgus</i> | ✓ | | | | | |
| Painted Snipe | <i>Rostratula bengalensis</i> | ✓ | | | | | |
| Oriental Pratincole | <i>Glareola maldivarum</i> | ✓ | | | | | |
| Common Sandpiper | <i>Actitis hypoleucos</i> | | | | | | ✓ |
| Long-toed Stint | <i>Calidris subminuta</i> | ✓ | | | | | |
| Fantail Snipe | <i>Gallinago gallinago</i> | ✓ | ✓ | ✓ | ✓ | | |
| Pintail Snipe | <i>Gallinago stenura</i> | | ✓ | | | | |
| Swinhoe's Snipe | <i>Gallinago megala</i> | ✓ | ✓ | | ✓ | | |
| Green Sandpiper | <i>Tringa ochropus</i> | | | | ✓ | | |
| Wood Sandpiper | <i>Tringa glareola</i> | ✓ | ✓ | | | | |
| Redshank | <i>Tringa totanus</i> | | | | | | ✓ |
| Red-necked Phalarope | <i>Phalaropus lobatus</i> | | ✓ | | | | |
| Spotted Dove | <i>Streptopelia chinensis</i> | | | | | | ✓ |
| Rufous Turtle Dove | <i>Streptopelia orientalis</i> | | | | | | ✓ |
| Red-winged Crested Cuckoo | <i>Clamator coromandus</i> | ✓ | | | | | |
| Lesser Coucal | <i>Centropus bengalensis</i> | | | | ✓ | | |
| Asian Barred Owlet | <i>Glaucidium cuculoides</i> | | | | ✓ | | |
| Common Kingfisher | <i>Alcedo atthis</i> | | | | | | ✓ |
| White-breasted Kingfisher | <i>Halcyon smyrnensis</i> | | | | | | ✓ |
| Eurasian Hoopoe ¹ | <i>Upupa epops</i> | ✓ | | | | | |
| House Swift | <i>Apus nipalensis</i> | | | | | | ✓ |
| Red-rumped Swallow | <i>Hirundo daurica</i> | | | ✓ | | | |
| Barn Swallow | <i>Hirundo rustica</i> | | | | | | ✓ |
| Red-throated Pipit | <i>Anthus cervinus</i> | ✓ | ✓ | | | | ✓ |
| Olive-backed Pipit | <i>Anthus hodgsoni</i> | | | | | | ✓ |
| Richard's Pipit | <i>Anthus richardi</i> | | | | | | ✓ |
| White Wagtail | <i>Motacilla alba</i> | ✓ | | | ✓ | | ✓ |
| Grey Wagtail | <i>Motacilla cinerea</i> | | | | | | ✓ |
| Yellow Wagtail | <i>Motacilla flava</i> | ✓ | | | ✓ | | ✓ |
| Ashy Minivet | <i>Pericrocotus divaricatus</i> | | | ✓ | | | |
| Chinese Bulbul | <i>Pycnonotus sinensis</i> | | | ✓ | | ✓ | |
| Rufous-backed Shrike | <i>Lanius schach</i> | | | | | | ✓ |
| Magpie Robin | <i>Copsychus saularis</i> | | | | | | ✓ |
| Bluethroat | <i>Luscinia svecica</i> | ✓ | | | | | ✓ |
| Siberian Stonechat | <i>Saxicola maura</i> | | | | | | ✓ |
| White's Thrush ¹ | <i>Zosterops dauma</i> | ✓ | | | | | ✓ |
| Blackbird | <i>Turdus merula</i> | | | | ✓ | | |
| Fantail Warbler | <i>Cisticola juncidis</i> | ✓ | | | | | ✓ |
| Mountain Bush Warbler | <i>Cettia fortipes</i> | | ✓ | | | | |
| Pallas's Grasshopper Warbler ¹ | <i>Locustella certhiola</i> | | ✓ | | ✓ | | |
| Booted Warbler ¹ | <i>Hippolaris caligata</i> | | | | ✓ | | |
| Arctic Warbler | <i>Phylloscopus borealis</i> | | | | | ✓ | |
| Dusky Warbler | <i>Phylloscopus fuscatus</i> | | | | | | ✓ |
| Yellow-bellied Prinia | <i>Prinia flaviventris</i> | | | | | | ✓ |

| | | 1990 | 1992 | 1993 | 1994 | 1995 | 1996 |
|-------------------------------------|----------------------------------|------|------|------|------|------|------|
| Plain Prinia | <i>Prinia inornata</i> | | | | | | ✓ |
| Blue-and-white Flycatcher | <i>Cyanoptila cyanomelana</i> | | | | | ✓ | |
| Red-throated Flycatcher | <i>Ficedula parva</i> | | ✓ | | | | |
| Yellow-bellied Tit | <i>Parus venustus</i> | | | | | ✓ | |
| Chinese Penduline Tit | <i>Remiz consobrinus</i> | | | | ✓ | | |
| Black-naped Oriole ¹ | <i>Oriolus chinensis</i> | | ✓ | | ✓ | ✓ | |
| Tree Sparrow | <i>Passer montanus</i> | | | | | | ✓ |
| Black-tailed Hawfinch | <i>Eophona personata</i> | | ✓ | ✓ | ✓ | | |
| Yellow-breasted Bunting | <i>Emberiza aureola</i> | | | ✓ | | | |
| Crested bunting | <i>Melophus lathamii</i> | | | | | ✓ | |
| Black-necked Starling | <i>Sturnus nigricollis</i> | | | | | | ✓ |
| Purple-backed Starling ¹ | <i>Sturnus sturninus</i> | ✓ | ✓ | | | | |
| Chinese Starling | <i>Sturnus sinensis</i> | | | | ✓ | | |
| White-cheeked Starling | <i>Sturnus cineraceus</i> | | | | | | ✓ |
| Silky Starling ¹ | <i>Sturnus sericeus</i> | | | | | | ✓ |
| Crested Mynah | <i>Acridotheres cristatellus</i> | | | | | | ✓ |
| Common Mynah | <i>Acridotheres tristis</i> | | | | | | ✓ |
| Black Drongo | <i>Dicrurus macrocercus</i> | | | | | | ✓ |
| Magpie | <i>Pica pica</i> | | | | | | ✓ |

¹ Birds of limited local or regional distribution.

Annex D

Sites of Conservation Interest

Recognised Sites of Conservation Interest

Recognised sites of conservation interest in the area of the proposed project are described below.

1. Country Parks and Special Areas

Lam Tsuen Country Park lies approximately 3 km south of the project site.

2. Sites of Special Scientific Interest (SSSIs)

The **Mai Po Village SSSI** (No.16) lies approximately 1 km west of the project site (Anon. 1995). This site is an egretty of at least 40 years' continued occupation (Young and Cha 1995). Possible direct threats to this site were identified in Anon. (1995) as "road-widening, building and similar development". Young and Cha (1995) identify the most significant threat to this egretty as "loss of the birds' fish pond feeding habitat", a trend which has been related to a concomitant decline in the numbers of breeding Little Egrets *Egretta garzetta* at the egretty.

The **Mai Po Marshes SSSI** (No.10) lies approximately 1 km west of the project site at its closest point (Anon. 1995). The site includes Hong Kong's largest stands of mangroves, most extensive mudflats and largest annual influxes of migratory and overwintering water birds. The ecological importance of this area has been exhaustively documented (e.g. Peking University 1996). Nearby housing developments and infilling of fish ponds are two threats to the SSSI cited in Anon. (1995) which are still relevant. In addition, the welfare of this SSSI depends heavily on the condition of the Shenzhen River and other streams feeding Deep Bay.

The **Inner Deep Bay SSSI** (No.46), at 2300 ha Hong Kong's largest SSSI, lies approximately 1.5 km west of the project site at its closest point. It also lies directly downstream of the site. This SSSI is of ecological and economic importance for its mangroves, mudflats and shallow water habitats. Inner Deep Bay, together with the Mai Po Marshes SSSI, is essential to the survival of tens of thousands of migrating or overwintering water birds (Peking University 1996). Potential direct threats to this SSSI are identified in Anon. (1995) as mangrove felling and dredging; indirect threats as discharge of pollutants into the bay.

3. Restricted Areas

The **Mai Po Marshes** are listed as a Restricted Area under the Wild Animals Protection Ordinance Cap. 170. This status is intended to control human access to the site in order to minimise disturbance to wildlife. See above, Mai Po Marshes SSSI, for further discussion of the site.

4. Ramsar Site

Hong Kong's first Ramsar Site was declared at Mai Po Marshes and Inner Deep Bay in 1995 and the boundaries have now been officially approved. The main purpose of the Ramsar Site is to protect the important wetland habitats of shallow bay, mudflat, mangrove, and gei wai and their biota, particularly water birds which depend upon this site for survival. The Ramsar Site lies approximately 1.5 km west of the project site at its closest point. It covers an area similar to Deep Bay Buffer Zone 1 on the landward side and all of Deep Bay south of the main navigation channel on the seaward side.

5. *Deep Bay Buffer Zones*

Deep Bay Buffer Zones 1 and 2 were defined by the Town Planning Board in order to protect the important ecological resources of Mai Po Marshes and Deep Bay from incompatible private development (TPB 1994). Under the Guidelines (ibid), Section 16 applications for developments within Buffer Zone 2 are not to be approved unless they are shown to have "insignificant impact on environment, ecology, drainage, sewerage and traffic in the area including the MPNR and Inner Deep Bay". Also under the Guidelines, existing wetland areas in Buffer Zone 2 should be preserved unless proposed changes would enhance the wetland habitat value of the Buffer Zones. Buffer Zone 2 lies adjacent to the project site.

6. *Conservation Areas*

A large proportion of the area covered by Outline Zoning Plan (OZP) S/YL-ST/1 for San Tin is zoned as Conservation Area. This area lies to the west, Northwest and Northeast of the project site, and on the western side is adjacent to the project site. This area is "intended to give added protection to the Mai Po Nature Reserve from urban development" (Explanatory Statement to the OZP). Most of the area zoned as Conservation Area near the project site consists of active or abandoned fish ponds.

Roughly a third of the area covered by OZP S/YL/MP/1 for Mai Po & Fairview Park is zoned as Conservation Area, for purposes similar to the zoning on the San Tin OZP. This area lies roughly 1.2 km from the project site at its closest point, but should be considered for purposes of discussion as a unit contiguous with the neighbouring Conservation Area on the San Tin OZP. The two together form a large area, consisting predominantly of fish ponds, which lies between the project site and the highly sensitive area of Mai Po Marshes.

7. *Fish and Shellfish Culture and Harvesting Sites*

The expanse of fish ponds in the San Tin area and downstream near Mai Po constitute the largest and densest area of freshwater fish culture operations in Hong Kong. Both actively operated and abandoned fish ponds in this area have been shown to be of importance as feeding habitat for a variety of wild birds (Melville *et al.* 1995, Chu 1995a).

Deep Bay has active capture fisheries operations for fish and crustaceans. In addition, Hong Kong's only active oyster culture area is on the south shore of Deep Bay. Gei wais at Mai Po Marshes Nature Reserve are managed by the Reserve for production of shrimp and fish which are sold to generate revenues for operation of the Reserve.

8. *Egrettries*

Mai Po Village Egrettry: see discussion under Mai Po Village SSSI, above. Mai Po Nature Reserve Egrettry: this egrettry lies in a well protected area, the Mai Po Marshes Nature Reserve, roughly 2 km west of the project site. Ho Sheung Heung Egrettry: this egrettry lies approximately 3 km to the east of the project site. Figure 1 shows the locations of the egrettries and the two villages.

Annex E

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References and Bibliography

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