FINAL REPORT

Territory Development Department
NTN Development Office

Main Drainage Channels for Ngau Tam Mei, Yuen Long and Kam Tin: *Environmental Schedule*

23 May 1996

Reference C1203

For and on behalf of ERM-Hong Kong, Ltd

Approved by:

Position: Principal Consultant

Date: 20 May 1996

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1 INTRODUCTION

1.1 BACKGROUND

The North West New Territories Base Strategy Studies of 1983 recommended, among others, the construction of the Yuen Long and Kam Tin Main Drainage Channels (MDC) and the Ngau Tam Mei MDC to alleviate the recurrent floods in the Ngau Tam Mei, Yuen Long and Kam Tin Basins. ERM-Hong Kong Ltd, in association with Maunsell Consultants Asia Ltd and Ecosystems Ltd, have been commissioned by the Government of Hong Kong, Territory Development Department New Territories North Development Office (TDDNTNDO) to undertake an Environmental Impact Assessment Study for the Ngau Tam Mei, Yuen Long and Kam Tin Main Drainage Channels (MDC) Works.

As a part of the Environmental Impact Assessment (EIA) study, an Environmental Schedule which covers all the necessary monitoring and auditing requirements and mitigation measures associated with the construction of the project is required.

This Schedule covers the Environmental Monitoring and Audit (EM&A) requirements for the construction phase and the post-project operational phases of the MDC Works.

1.2 PROJECT DESCRIPTION

The Yuen Long/Kam Tin/Ngau Tam Mei Basins comprise the largest river basin system in the North West New Territories (NWNT) and is the main agricultural area in Hong Kong. The area is drained by two major water courses: Kam Tin River draining the eastern half and Yuen Long Creek (Shan Pui River) draining the western half. The current hydrological conditions are the result of natural accretion in Deep Bay, reclamation, and intensive anthropogenic disturbances in recent years. These anthropogenic disturbances include discharges of domestic sewage, industrial effluent, agricultural runoff and livestock waste. The upper parts of the drainage basins are generally steep and covered in scrub or woodland, therefore flooding is not a significant problem. Development has been mainly confined to the lower parts of the basin, where the capacity of the watercourses is exceeded and banks are overtopped even during moderate storms. This has led to regular and repeated severe floods within the Study Area.

In order to alleviate the problem of severe flooding in the lower and middle parts of the Yuen Long, Kam Tin, and Ngau Tam Mei Basins, two networks of drainage channels were recommended:

- flowing via Yuen Long Creek into Inner Deep Bay;
- the Yuen Long and Kam Tin MDC and the Ngau Tam Mei MDC.

The MDC Works will include the following components, as shown in *Figure 1.2a*.

1.2.1 *60CD*

60CD works comprise the widening and channelisation of the downstream section of the Shan Pui and Kam Tin Rivers. The construction works are now in progress and anticipated to be completed by mid 1997.

EM&A requirements for 60CD are not described in this Environmental Schedule as the construction works are nearing completion and have been monitored in accordance with the Deep Bay Guidelines.

1.2.2 *43CD*

43CD works comprise the construction of approximately 2 km of new river channel sections. This will extend from the section of the Kam Tin River to the east of Castle Peak Road, then joining the existing Kam Tin River meander near the Kam Tin San Tsuen. At the confluence, the channel will branch into existing tributaries. A summary of 43CD works is presented in *Table 1.2a.*

The 43CD construction commenced in October 1995 and the works have been environmentally monitored and audited in full accordance with the EM&A recommendations prescribed in the EIA for the 43CD and 30CD (Stage 1) works. This EIA for the 43CD and 30CD (Stage 1) works was prepared and submitted in January 1995 and was endorsed by the Advisory Council on the Environment (ACE) in February 1995. The Environmental Schedule, therefore, merely summarizes the agreed EM&A requirements in this regard.

Table 1.2a *Project Description Summary for 43CD and 29CD*

Works	43CD	29CD Phase 1	29CD Phase 2
Programme	October 1995 to July 1998	February 1998 to February 2001	February 1999 to February 2001
Length of New River Channel	2.0km		1.7km
Alignment Description	From Kam Tin River, east of Castle Peak Road to Kam Tin River meander at Kam Tin San Tseun	Diversion of Ngau Tam Mei channel fro Castle Peak Road Bridge to new 60CD MDC. Bisects Tai Sang Wai and Pok Wai with continuity of flow through drainage pipes	Ngai Tam Mei drainage channel to connect with Phase 1 at NTCR Outside existing channel except for 5 points of intersection
Channel Lining	Concrete bed, masonry and grasscrete side slopes Intertidal transition section concrete lined	Concrete lined bed with grasscrete sides	Bed and lower slopes concrete lined with grasscrete upper slopes
Cross Section	Trapezoidal	Trapezoidal	Trapezoidal
Channel width range		15-36m	20-30m (bed width 7.5-13m)
Bed level	-0.65mPD		
Berms	3.5m wide access road adjacent to channel		

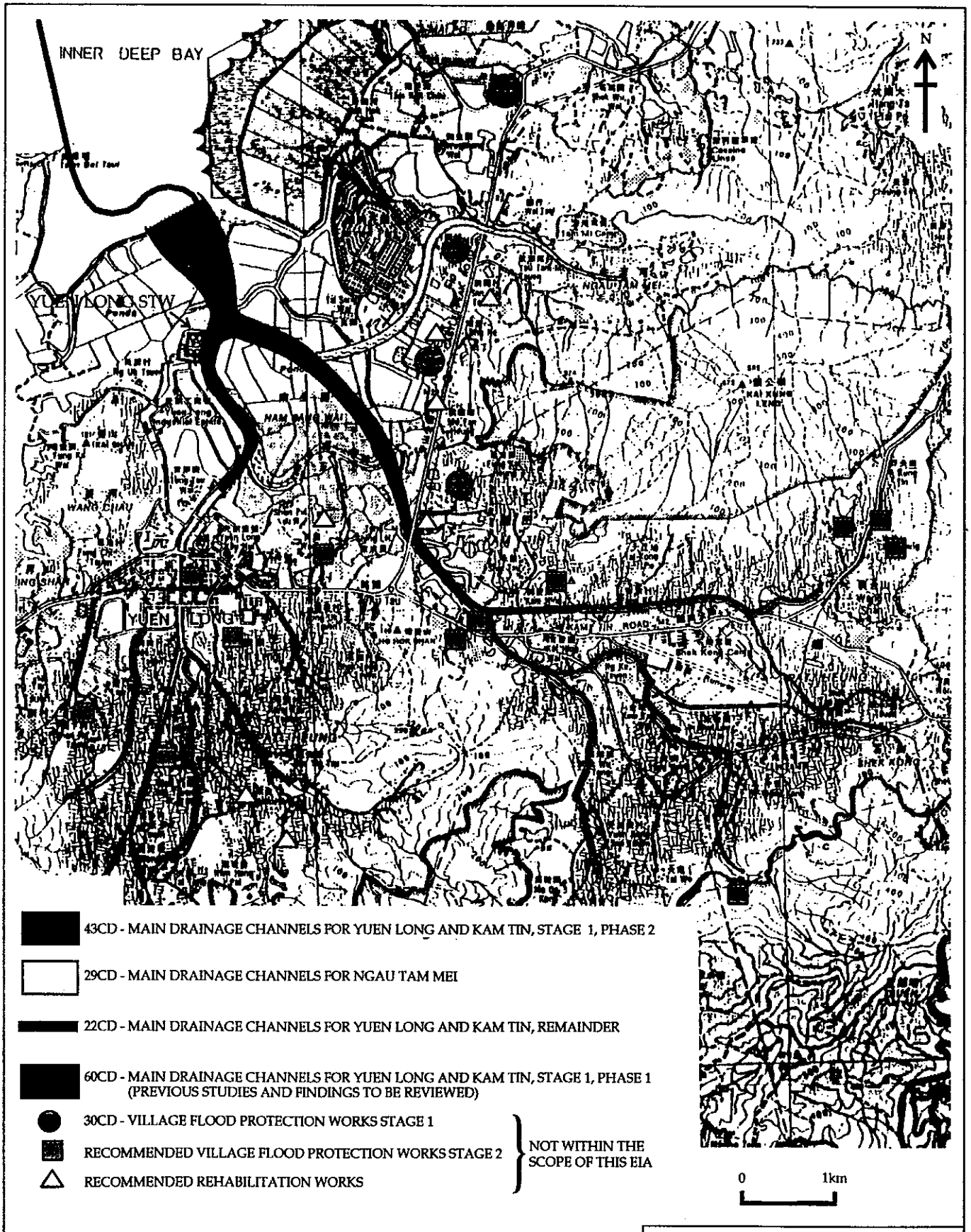

FIGURE 1.2a - MAIN DRAINAGE WORKS IN NWNT

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ERM

Works	43CD	29CD Phase 1	29CD Phase 2
Other Features	Two fabric dams to prevent upstream tidal flow Upstream silt traps for sediment entrainment Dry weather flow channels	Central low flow channel, maintenance and access roads on either side of channel, inflatable dam and pumping stations, vehicular bridges	3.5m maintenance road and 2m wide footpath on southern embankment 2m verge on northern embankment 4 footbridges replaced

1.2.3 *29CD*

This works comprise a new channelized section running south to 60CD of the Main Drainage Works. The works will be sub-divided into two phases. Phase 1 works comprise the diversion of the Ngau Tam Mei Channel from Castle Peak Road Bridge extending southwest to join the new 60CD MDC. A summary of 29CD works is presented in *Table 1.2a*. Phase 2 works comprise the construction of approximately 1.7km of the Ngau Tam Mei drainage channel which will connect with the Phase 1 channel at the New Territories Circular Road (NTCR). It should be noted that the detailed information for Phase 2 is preliminary and subject to revision.

1.2.4 *30CD (Village Flood Protection Works)*

The villages of Sha Po, Pok Wai, Chuk Yuen Tsuen/Ha San Wai and Mai Po Lo Wai are included in 30CD. The works will comprise an earth embankment around each of the villages, a flood storage pond and a pumping station. These schemes are necessary to protect the villages which cannot drain naturally because they lie below the flood water level. A summary of 30CD works is presented in *Table 1.2b.*

Additionally, it should be noted that the Sha Po Flood Protection Scheme Contract has also been finalized in accordance with the EM&A requirements described in the EIA for 43CD and 30CD (Stage 1). The Environmental Schedule, therefore, merely summarizes the agreed EM&A requirements in this regard.

Table 1.2b *Project Description Summary for 30CD*

Village	Sha Po Tseun	Pok Wai	Chuk Yuen Tsuen/Ha San Wai	Mai Po Lo Wai/San Tsuen
Programme	July 1996 to July 1998	October 1998 to October 2000	February 1999 to July 2001	November 1999 to May 2004
Embankment round village	18m wide earth bund with concrete U-channels at base on either side 3m high supporting access road to village	18m by 3m bund on three sides, extended to the south to Castle Peak Road Access road on top of bund	Diversion of upstream flow into Ngau Tam Mei MDC New channel to the west to serve local drainage and replace existing channel (to be in-filled) Maintenance access road adjacent to new channel	Design not finalised but will be similar to those for other villages (i.e. earth bund, flood storage pond and pumping station)
Flood storage pond	New pond to be constructed	Existing pond to west to be reduced in size	New flood storage pond adjacent to Ngau Tam Mei channel by five existing ponds	
Pumping station		Pumping station adjacent to storage pond	Pumping station and new bridges over new channels	
Other Works	Interceptor chamber, septic tank and soakaway pit	Interceptor chamber, septic tank and soakaway pit Channel to the south to connect with 29CD will be upgraded and embankment built on north side	Drainage pipes adjacent to Castle Peak Road, east of Ha San Wai to be upgraded Channel south of Ha San Wai widened with new vehicular bridge constructed	

1.2.5 *22CD*

The works comprise the remainder of the MDC for Yuen Long and Kam Tin. The works are divided into four phases as described in the following paragraphs.

Phase 1

22CD Phase 1 works comprise the improvement of approximately 1.26km of the Kam Tim South river channel from Kam Tin Road, which extend to 0.56km upstream of its confluence with Ho Pui, and 2.40km of the Ho Pui river channel.

Phase 2

22CD Phase 2 works involve the construction of 3.08km of new trapezoidal concrete lined channel to improve the existing Kam Tin North river channel. This will extend from Kam Tin San Tsuen up to the Kam Tin Road/Fan Kam Road Junction.

Phase 3

22CD Phase 3 includes works on the Kam Tin South and the Kam Tin South/Mai Po Ling river channels. The Kam Tin South Channel works involve the construction of approximately 0.87km of new channel, which closely follows the existing watercourse and nullah alignment. The Kam Tin South/Mai Po Ling Channel works comprise the construction of 0.946km of new Kam Tin South river channel to the confluence with Mai Po Ling river, and new channel extending upstream 1.5km along the Mai Po Ling to the point where the river is crossed by Kam Sheung Road.

It should be noted that the detailed information provided, in *Table 1.2c*, is preliminary a subject to revision.

Phase 4

22CD Phase 4 works involve the training of approximately 1.44km of a watercourse running from Shan Ha Tsuen to Ma Tin Tsuen and 2.68km of another one running form Tai Tong Tsuen (Sam Chung stream) to the eastern branch of the Yuen Long Central Nullah, both of which are located south of Yuen Long Town. A summary of all phases of 22CD works is presented in *Table 1.2c*.

Table 1.2c *Project Description Summary for 22CD*

Works	22CD (Phase 1) Kam Tin South Channel	22CD (Phase 1) Ho Pui Channel	22CD (Phase 2)	22CD (Phase 3) Kam Tin South Ch Channel	22CD (Phase 3) Kam Tin South/Mai Po Ling Channel	22CD (Phase 4)
Programme	May 1998 to November 2000	May 1998 to November 2000	July 1998 to November 2000	February 1999 to February 2001	February 1999 to February 2001	November 1999 to May 2002
Length of New River Channel	1.26km Kam Tin South	2.4km Ho Pui watercourse	3.08km Kam Tin North	0.87km Kam Tin South channel	0.94km Kam Tin South and 1.5km Mai Po Ling	1.44km (Shan Ha Tsuen to Ma Tin Tsuen) and 2.7km (Tai Tong Tsuen to Yuen Long Central Nullah eastern branch)
Alignment Description	Kam Tin south channel from Kam Tin Road to 0.56km upstream of confluence with Ho Pui watercourse Existing meanders bypassed and retained		From Kam Tin San Tseun to Fan Kam Road outside existing alignment Meanders bisected and retained	Follows existing watercourse and nullah alignment closely	Kam Tin channel to confluence with Mai Po Ling New channel upstream along the Mai Po Ling to its crossing with Kam Sheung Road Adjacent to existing watercourse which will be filled in Meanders along 600m downstream stretch retained	From Tai Tong Tsuen (Sam Chung stream) to the eastern branch of Yuen Long Central Nullah and from Shan Ha Tsuen to Ma Tin Tsuen
Channel Lining	Concrete lined	Concrete lined	Stepped bed	Concrete lined and 600m stepped	Concrete lined Upper Mai Po Ling section stepped	Concrete lined
Cross Section	Trapezoidal	Trapezoidal		Trapezoidal	Trapezoidal	Rectangular
Channel width range	35-45m	20-30m	26-37m for downstream 2km 21m for upstream 1.08km	-	29-34m for Kam Tin section 20-25m for upper Mai Po Ling section	Less than 9m in general

Works	22CD (Phase 1) Kam Tin South Channel	22CD (Phase 1) Ho Pui Channel	22CD (Phase 2)	22CD (Phase 3) Kam Tin South Ch Channel	22CD (Phase 3) Kam Tin South/Mai Po Ling Channel	22CD (Phase 4)
Bed width	16-28m	7-12m	10-18m downstream and 5m upstream	5m	13-16m for Kam Tin South section 5-7m for upper Mai Po Ling section	-
Access Road	3.5m wide on south embankment Access road on both sides of channel upstream of confluence with Ho Pui	3.5m wide on eastern embankment	3.5m wide on downstream, northern embankment (0.5-1m high)	3.5m wide on southern embankment	3.5m wide (embankment height 1.9-2.3m)	
Footpaths	1.6m wide on south embankment Access road on both sides of channel upstream of confluence with Ho Pui	1.6m wide on eastern embankment	1.6m wide	1.6m on southern embankment	1.6m wide	
Vehicular bridge	1 new	New bridge for Route 3 access road	2 rebuilt	New access bridge from Chung Sum Tsuen to Shek Tau Wai	1 new	
Verges		2m western verge	2m southern embankment	2m northern embankment	2m	
Footbridges	1 new	6 replaced	6 replaced	1 replaced and two lost	2 new	
Box culverts	1 at Kam Sheung Road	4	8	-	1	
Drainage Pipes		3	3	3	1200. The construction for 43CD (30CD) commenced in October 1995 and the construction for the Sha Po element of 30CD will commence in July 1996.mm pipe	
Access ramps to channel bed	2	4	5	2 ramps and 4 turning areas	4	

1.3 PROJECT PROGRAMME

The overall project programme for all the MDC works is shown in *Table 1.3a.*

Table 1.3a Implementation Programme for the MDC

Drainage Works	Commencement Date	Completion Date
60CD Contract A	October 1993	January 1997
60CD Contract B	April 1994	September 1997
43CD	October 1995	July 1998
22CD Phase 1	May 1998	November 2000
22CD Phase 2	February 1999	February 2001
22CD Phase 3	February 1999	February 2001
22CD Phase 4	November 1999	May 2002
29CD Phase 1	February 1998	February 2001
29CD Phase 2	February 1999	February 2001
30CD - Sha Po Tsuen	July 1996	July 1998
30CD - Pok Wai	October 1998	October 2000
30CD - Chuk Yuen Tsuen/Ha San Wai	February 1999	July 2001
30CD - Mai Po Lo/San Tsuen	November 1999	May 2004

Source : Drainage Service Department letter ref (13)in DP 5/16/20-8

1.4 OBJECTIVES OF THE ENVIRONMENTAL SCHEDULE

The objectives of the Environmental Schedule for the Proposed Project include the following:

- To provide a data base against which to determine any short or long term environmental impacts of the project;
- To provide an early indication should any of the environmental control measures or practices fail to achieve the acceptable standards;
- To monitor the performance of the project and the effectiveness of mitigation measures;
- To verify the environmental impacts predicted in the EIA study;
- To determine project compliance with regulatory requirements, standards and government policies;
- To take remedial action if unexpected problems or unacceptable impacts arise; and
- To provide data to enable an environmental audit.

1.5 THE ENVIRONMENTAL SCHEDULE

This Environmental Schedule is designed to provide information, guidance and instruction to site staff charged with environmental responsibilities and who are

undertaking the environmental monitoring work. The Environmental Schedule will cover the monitoring requirements for the construction phase of the following contracts:

- 43CD
- 29CD
- 30CD
- 22CD

EM&A requirements for 60CD are not detailed in this Environmental Schedule as the construction works are now nearing completion and have been monitored in accordance with the Deep Bay Guidelines.

As construction activities are expected to vary with the various stages of construction, it is expected that the monitoring requirements will be reviewed and revised on a regular basis. This Environmental Schedule will serve to document the progress of the monitoring requirements throughout the construction period and will be updated as necessary.

This Environmental Schedule provides comprehensive details of the water, noise, air, waste and ecology monitoring requirements and mitigation measures proposed in the EIA report. A flow chart on environmental monitoring and any subsequent action to be taken in the event of exceedance is illustrated in *Figure 1.5a*.

2 SUMMARY OF EIA FINDINGS

2.1 INTRODUCTION

The EIA for MDC assessed the environmental impacts of the construction and operation of MDC Works 60CD, 43CD, 30CD , 29CD, and 22CD. The scale, extent and severity of impacts have been described and mitigation proposals have been made to reduce the residual impacts, wherever possible, as described in *Section 3*. The following presents the key findings, with respect to ecology, water, waste, noise, and air for the construction phase.

2.2 ECOLOGY

2.2.1 *Background*

The baseline ecological conditions within the zone of impact from the MDC works has been evaluated by reviewing existing information and expanding, verifying and updating it with focused field surveys. Habitats that will be affected by the construction of the MDC works have been identified. Additionally, the ecological value of the habitats affected have been qualitatively assessed. Mitigation measures have been developed and recommended to alleviate and minimise the potential ecological impacts of the MDC works on these identified habitats as far as possible. Of these habitats, which included dryland, aquatic, riparian, mangrove and freshwater wetlands, impacts to mangrove and freshwater wetlands were of greatest concern owing to the importance of these habitats in supporting other species, e.g. invertebrates and avifauna, respectively. Mitigation measures undertaken to reduce the ecological impacts of the MDC works are described below.

Since the 60CD and 43 CD works are already under construction, it was possible to evaluate the actual impacts on wildlife. An avifauna survey commissioned by DSD for 60CD works found that although the area in the vicinity of the works are no longer inhabited by egrets, the MDC works, however, have lent themselves to become habitats for other species of avifauna, such as ducks. The 60CD works is an environmentally sympathetic design and adverse impacts imposed by these works are not anticipated.

2.2.2 *Mitigation*

Mangroves

Measures has been included in the design to ensure that existing mangroves are preserved wherever possible. A significant mitigation initiative was the development of a revised scheme for 60CD Contract A which resulted in a reduction of approximately 80% in the area of mangroves to be lost (from 88 ha to 17 ha). The revised plans were a considerable improvement on the original scheme and acceptable from an ecological standpoint partly because they allowed for protection of two macrobenthic species, the fiddler crab (*Uca cf. dussumieri*) and the burrowing sea anemone. The revised design also allowed for the conservation of other intertidal habitats important to the New Shan Pui egretry. Moreover, some of the mangroves lost due to construction of the MDC

works will be replaced, thereby reducing the net loss to 4.28 ha The landscaping mitigation measures are described below.

Fish Ponds

(a) Retainment of Fish Ponds

The original 60CD Contract A design featured a wide, dredged area at the river mouth to serve as flood storage capacity. However, this design required the resumption and destruction of eight fishponds of considerable ecological value. After careful consideration of the environmental impacts of this design to ecology, the original 60CD plans were revised to retain the eight fishponds which account for 10.5 ha of potential ecological habitat.

(b) Reinstated Fishponds

Opportunities have been identified to minimise fish pond area to be lost due to the MDC works as far as possible. In addition to the eight fish ponds at the mouth of the Shan Pui River which have been mitigated for retainment for 60CD works, specified fish ponds in the vicinity of 60CD (Contract A and B), 43CD, 29CD Phases 1 and 2, 30CD and 22CD Phase 1 have been designated for reinstatement into commercial fisheries after the completion of construction works. As a result of these mitigation measures, the original loss of 120.5 ha of fish ponds attributed to the works have been reduced to a combined net loss of approximately 86.95 ha. This represents approximately 7.2% of the total area of fish ponds in the Territory.

River Channels

Although the MDC works will contribute to a loss of 18.42 km of river channel length, the total length of new channel gained would be 28.41 km, resulting in a net gain of 9.99 km. Given that certain sections of the new channels will be unlined, as in the case of 60CD (Contract A and B) and 43CD, these unlined sections consisting of boulder, gravel, or sand channel bed would be suitable for the recolonisation of flora and fauna after completion of the works. Also, the loss of wildlife habitat will be mitigated by paving the inside embankment slopes of 43CD with grasscrete. This will provide wildlife habitat if vegetation grows tall and dense enough to provide escape or feeding cover for birds. Furthermore, many of the abandoned channel meanders which account for approximately 11.16 km, outside the works area offer an opportunity to regain lost freshwater habitat which could be managed to provide foraging habitat for wading birds. The conservation potential of abandoned stream segments could additionally be greatly enhanced through the incorporation of lands in the oxbow areas. It is understood that the rehabilitation of disused meanders will be addressed in association with the local drainage needs which will be reviewed in an upcoming Drainage Master Plan Study under TEL 3.

Landscaping

Loss of dry land habitats such as agricultural fields and fish pond bunds can be partially mitigated through revegetation of embankment slopes with species of ecological utility. Landscaping plans provided by TDD outline the areas along the embankments of 60CD (Contract A and B) in which mangroves will be replanted. The replanted areas will restore both form and function of the mangroves which were unavoidably lost due to the 60CD works and will reduce

long-term habitat loss. As stated above, a reduction from 88 ha to 17 ha of mangroves will be lost from 60CD Contract A due to redesign initiatives. However, 4.05 ha along the embankments of 60CD Contract A have been zoned for mangrove replanting. Thus, a net loss of only 12.95 ha of the original 88 ha of mangroves will be lost due to the works. In addition, 8.67 ha of mangroves will be planted along the 60CD Contract B embankments. A total area of 12.72 ha of mangroves will be recovered reducing the net loss of mangroves to 4.28 ha. Mangrove transplantation is a novel technology in Hong Kong, but is an accepted technology in other Asian locations. The anticipated success of the reintroduction of mangroves (in this project) to the environment may set a precedent towards the mitigation of future main drainage channel works.

Furthermore, vegetation to be lost due to the 60CD works will be partially replaced on areas outside the MDC embankments following completion of construction of the works. A total of 16.99 ha of vegetation (woodland) will be planted.

2.2.3 *Residual Impacts*

Despite the mitigation measures mentioned above, some residual losses are unavoidable. However, recommendations are being made for off-site compensation to be reviewed by SPEL. The relative ecological value of the residual losses of all of the MDC works have been qualitatively assessed with the following conclusions:

There will be a net fish pond area loss of 86.95 ha due to the MDC works. This loss represents about 7.2% of the Territory's remaining total. Of the loss, 68.14 ha are grade A fish ponds, 5.2 ha are grade B and 13.61 ha are of grade C. The majority of the grade A fish pond loss is attributed to 60CD Contract A and Contract B. The ecological value of the fish ponds is the subject of an ongoing study commissioned by the Planning Department.

Due to its close proximity to the mangrove habitat in the Deep Bay Area, mangrove loss will be incurred by the 60CD works. Residual impacts have been minimised through the revision of the original 60CD engineering design, from a loss of 88 ha of mangroves to a loss of 17 ha. Furthermore, the replanting of mangroves along the embankments of the created 60CD Contract A channel will partially compensate for these losses. The net mangrove loss as a result of mangrove replanting will be 4.28 ha.

The majority of the MDC works will result in the creation of river channels that will exceed the lengths of existing river channels lost. Of the works, 60CD Contract A and B will generate the largest compensation of lost channel. As mentioned previously, some of the habitat loss due to the construction of the MDC will be offset by abandoned channel meanders outside the works areas. These abandoned channel meanders offer an opportunity to regain lost freshwater habitat which could be managed to provide foraging habitat for wading birds following completion of construction. The practicability of the management of such areas will be addressed by the current and future studies by SPEL and AFD on the issue of wetland and ecological compensation.

2.3 *Construction Water Quality*

The potential sources of water quality impacts from the construction of the MDC

project could involve disturbance to natural processes, resuspension of contaminated material, alteration of supply or organic wastes and nutrients downstream; construction runoff and drainage, debris and rubbish, liquid spillages and sewage effluents.

In general it is predicted that disturbances to water bodies will be temporary and localised during construction. As described, auger dredgers or closed-grab dredgers recommended will minimise the potential for water quality impacts. With the careful operation of the dredgers and implementation of recommended mitigation measures, dredging work is not expected to cause non-compliance with the Trigger, Action, or Target (TAT) levels. In inaccessible areas where dredgers cannot be used, tightly sealed closed-grab land based excavators are recommended in river sections when handling wet material to minimise sediment loss. Where dry material is handled in non-river sections, conventional excavators may be used.

The potential release of pollutants from resuspended sediment will cause slight fluctuations in the pollutant levels, however, this is expected to be within the natural variation range of pollutant levels in the existing river water. Adverse water quality impacts may result from uncontrolled site runoff and poor construction practice. It is recommended that proper site management and good housekeeping practices such as the use of cofferdams to contain suspended sediment and control measures on the runoff and drainage will be essential to ensure that construction activities will not cause incompliances in the TAT levels. The control is of particular importance when the construction works are close to rivers, the freshwater marshes at Sha Po, the Au Tau Fisheries Research Station and fish ponds.

To ensure effectiveness of the recommended, practical and cost effective management practices, water quality monitoring and audit will be essential to proactively identify any deterioration in water quality and to check that the construction activities are not causing any incompliances with the TAT levels. In this regard, this stand alone Environmental Schedule for the MDC project has been prepared and agreed with EPD.

Provided that the recommended mitigation measures are diligently implemented, it is considered that construction activities for the MDCs will cause only local and temporary disturbance, and no water quality impacts in excess of WQO standards are envisaged.

Works for the Sha Po, Pok Wai, Chuk Yuen, and Mai Po Lo Wai/San Tsuen VFPW are not envisaged to create adverse water quality impacts. The scale of disturbance on the water bodies is comparatively smaller than works for the other contracts of the MDC. In areas where dredgers are inaccessible, closed-grab excavators are recommended to minimise the leakage and loss of sediment from the excavation.

2.4 *OPERATIONAL WATER QUALITY*

The assessment determined that, in addition to major improvements in drainage resulting from the MDCs, the straightened and widened channels, and halting of tidal intrusion by the construction of fabric dams, will lead to local improvements in water quality. These will result from increased aeration and pollutant dispersal downstream. Sedimentation behind the fabric dams and in

the widened channels will allow effective removal of a large proportion of the pollutant load before it can enter Deep Bay.

However, effective enforcement of the LWCS, WPCO and the Yuen Long and Kam Tin SMP comprise the key to long term water quality improvement in sections 60CD, 43CD, 29CD, and 22CD of the MDCs, although these factors are beyond the control of the current project. In the long term after full enforcement of the LWCS, the Yuen Long and Kam Tin SMP and WPCO, the flows into Deep Bay arising from the study area will be relatively small compared to the total receiving flows and will be rapidly dispersed.

In addition, as modelling has not been undertaken as part of this assessment, the conclusions with respect to impacts upon Deep Bay are thus semi-quantitative. However, an EPD consultancy study is currently underway to draw up strategic options for managing water quality in the Deep Bay catchment. This involves determining the overall flow and water quality regime within Deep Bay, and is developing a predictive mathematical model for quantifying the assimilative capacity of the Bay. This model should be used to verify and clarify the extent of those water quality impacts resulting from the operation of the MDCs and also from changes in the pollutant loadings, determined through the EIA.

2.5 *WASTE MANAGEMENT DURING THE CONSTRUCTION PHASE*

It is expected that the management of dredged/excavated materials arising from the MDC works will be the most important waste management issue during the Construction Phase. In terms of minimisation of environmental impacts, priority should be given to land-based disposal options and marine disposal should be considered only as a last resort. A number of land-based disposal options, including landfilling, reuse on-site and off-site, have been examined. In addition, other land-based treatment options have also been explored.

Disposal of dredged/excavated materials generated from the MDC works at the existing strategic landfills would be hindered by the large volume of such materials, their high moisture contents and the potential presence of contaminants. Difficulties in reducing the moisture content of the dredged/excavated materials to a level below 30%, as directed by EPD, are expected with present technologies. In addition, contaminated materials would not be accepted at the strategic landfills unless it can be demonstrated that co-disposal of contaminated sediments would not cause adverse impacts to the existing strategic landfills. Studies on the feasibility of co-disposal have been conducted in other countries but the efficiency and practicality of co-disposal within the local context cannot be confirmed without further detailed studies, which are not within the scope of the present EIA. Re-use of dredged/excavated materials is unlikely to be feasible as such materials are in general not suitable for engineering purposes. Alternative options for the treatment of contaminated sediments are unlikely to be viable for the MDC works in view of the large volume of material to be treated and associated prohibitive cost and land requirements. Marine disposal is therefore still recommended as an interim option in view of the above considerations. Potential disposal options for dredged/excavated materials with different degree of contamination envisaged at present are as follows:

- *Class A (uncontaminated material)*:

marine disposal at open water disposal sites, eg East of Ninepins, or designated marine borrow areas, eg North Lantau and South Tsing Yi MBAs;

- *Class B (moderately contaminated material)*:

  marine disposal at designated marine borrow areas, eg North Lantau and South Tsing Yi MBAs; and

- *Class C (seriously contaminated material)*:

  marine disposal at designated contaminated mud pits (CMPs), eg East Sha Chau CMPs.

These interim recommendations should however be subject to review and verification by the outcome of the TEL3 Study as Government has advised, for the wastes arising from the MDC project, that they have ***no objections to incorporate the appropriate recommendations, upon consultation with EPD, from TEL3 - Sedimentation Study on land disposal of contaminated mud into the contract documents of the drainage projects - PWP items 22CD and 29CD for implementation if these recommendations are finalised in the coming two years and available on time before completion of drafting of the contract documents such that the scheduled works programme of 22CD and 29CD can be met without any delays*** (sic).

As the TEL3 study will be completed in 1997, the recommendations on disposal of Class B and C material will be deferred to the TEL3 study. It is noted that a new set of sediment quality criteria which include organic pollutants and other toxic substances, and a new class of contamination level for highly contaminated sediment which is not suitable for marine disposal, as well as a new set of regulatory guidelines for contaminated sediments will be promulgated by EPD and CED in late 1996 or early 1997.

For other categories of waste, including construction waste, chemical waste and general refuse, waste reduction and management measures are recommended to control the waste related environmental impacts. With the adoption of such measures, no adverse impact from wastes other than dredged/excavated materials is expected.

2.6 *Operational Waste Management*

The management of dredged material outlined in the TEL1 and TEL2 study have been reviewed and discussed. With recent developments in the management of contaminated mud, the recommended options in the TEL1 and TEL2 may no longer be appropriate in view of the potential contamination of the rivers and underground water. In general, disposal options for dredged/excavated materials from the construction phase would be applicable to the operational phase maintenance dredging. However, the appropriateness of these recommended dredging methods and contaminated mud disposal will be reviewed in the upcoming TEL3 Sedimentation Study which will address the environmental impacts of maintenance dredging and associated contaminated mud disposal.

2.7 CONSTRUCTION NOISE

This assessment has indicated that both the MDC works (60CD, 43CD, 29CD, 22CD) and VFPW for 30CD Stage 1 have the potential to create significant impacts at nearby NSRs from unmitigated construction activities. As a result, mitigation measures in the form of reduced plant teams, noise barriers and on-site noise management are recommended to protect nearby NSRs from excessive impacts.

It is believed that use of these types of mitigation measures should reduce impacts at nearby NSRs from daytime and certain evening, construction operations to acceptable levels. It is not recommended that night time (2300-0700) construction operations be carried out for any phase of construction activities.

2.8 OPERATIONAL NOISE

In this assessment, it has been concluded that both the MDC and VFPW will have impacts at the nearby NSRs from unmitigated operational noise. For health and safety reasons, mitigation measures have been recommended to reduce the noise level inside the plant room to $L_{Aeq\ 30min}$ 85 dB. Where the reduction of the noise level inside the plant room is insufficient to protect the nearby NSRs, further mitigation has been suggested.

2.9 CONSTRUCTION AIR QUALITY

This assessment has indicated that both the MDC (Sections 60CD, 43CD, 29CD and 22CD) and VFPW for 30CD Stage 1 have the potential to create significant impacts at nearby ASRs from unmitigated construction activities. Changes to local air quality have been predicted to occur from elevated levels of dust (TSP) activities. As a result, mitigation measures in the form of dust suppression techniques (wheel washing, watering of roads, etc.), reduced plant teams and on-site plant and haul road management are recommended to protect nearby ASRs from excessive impacts. The recommended practical and cost-effective measures to prevent odour nuisance from dredged or excavated spoil will minimize the generation of odours and will minimize adverse odour impacts.

It is believed that use of these types of mitigation measures as well as the placement of limitations on all construction activities taking place within 100m of ASRs, should reduce impacts at nearby ASRs to acceptable levels (i.e. within the AQO limits).

2.10 OPERATIONAL AIR QUALITY

There will be no sources of air pollutant emission during the operational phase of the MDC . 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.

3 MITIGATION MEASURES

Environmental mitigation measures recommended in the EIA study are included as follows for easy reference.

3.1 IMPACT AVOIDANCE AND/OR MITIGATION MEASURES

3.1.1 *Mitigation for Loss of Dryland Habitats*

Loss of dry land habitats such as agricultural fields and fish pond bunds can be partially mitigated through revegetation of embankment slopes with species of ecological utility. As described in *Section 2*, embankments will be formed along the new river channel which are suitable for replanting. All sites selected are on the embankments outside the channel and are to be hydroseeded. These slopes are to be maintained with a vegetated ground cover. To enhance the ecological utility of such embankments native shrub seeds should be added to the hydroseed mix, and shrub seedlings should be transplanted to hydroseeded slopes. Shrub species should be selected for hardiness on poor soils or eroded sites and for provision of thick ground cover to maximize potential habitat utility. Tree species selected for replanting should be native pioneer species with demonstrated utility to wildlife.
Plant selection should be made with reference to approved government technical literature. The utility to wildlife of plant materials selected using these sources of information can be assessed by reference to local scientific literature (e.g. Corlett, 1992). Outside channel slopes in all other sections of the MDC project should receive similar treatment, and areas to be planted should be specified in final engineering drawings. Surplus spoil disposal areas outside the embankments should also be planted with a mixture of trees and shrubs (in addition to hydroseeding) to encourage recolonisation by native plants of ecological utility.

To accommodate the engineering requirements for high water flows, inside embankment slopes are to be paved with grasscrete. This will provide little wildlife habitat unless vegetation grows tall and dense enough to provide escape or feeding cover for birds. Although dense vegetative cover on inside channel embankments would provide greater ecological utility, it could conflict with flood control objectives by compromising the hydraulic performance of the channels. It is, therefore, recommended that inside embankments be allowed to revegetate naturally.

3.1.2 *Mitigation for Loss of Mangroves*

Mitigation measures involving revisions to the original design of the 60CD MDC have reduced the potential loss of mangroves by 80% (from 88 ha to approximately 17 ha) (see *Figure 5.5d*). Moreover, the 18 ha of mangroves to be lost during construction of the 60CD Project are to be partially restored along the inside slopes of the 60CD Contract A and Contract B embankments in which a total of 12.72 ha of mangroves will be planted (see *Figure 5.6b*). Although mangrove transplantation is not widely practised in Hong Kong, it is an accepted technology in other Asian locations (Meynell and Qureshi 1993, Villacorta and van Wetten 1993). There is a precedent for mangrove transplantation in the Deep Bay watershed at Tin Shui Wai Creek to mitigate loss of mangroves due to

construction of Tin Shui Wai new town (Chan 1993). Results of this project should be used to guide the proposed planting along the 60CD embankments. Species selected for transplantation should include *Bruguiera gymnorrhiza* due to its relatively greater decline in coverage in the Territory and previous abundance in Deep Bay.

3.1.3 *Mitigation for Loss of Freshwater Wetland*

Impacts to flora and fauna will result primarily from loss of freshwater (fish culture) and adjacent habitats. As described in the EIA, the primary impact of the Project on ecological resources would be loss of feeding habitats for wading birds. These losses are unavoidable, and mitigation must be implemented. Post construction mitigation measures should be implemented in tandem with progress in channel construction, and not left until completion of the entire MDC project. Mitigation measures unconnected to progress in channel construction should be implemented prior to or during construction in order to mitigate for the lost freshwater wetland at the earliest time. In the case of 60CD Contract A and Contract B, 43CD, 29CD and 22CD Phase 1, mitigation measures undertaken involved the preservation and reinstatment of fish ponds. A policy for off-site mitigation is being processed by Planning, Environment and Lands Branch (PELB). There will be a separate study (to be commissioned by AFD) to examine in detail potential off-site compensation measures. For the purpose of this EIA, therefore, and as a contribution to the consideration of possible mitigation measures by others two conceptual mitigation recommendations are proposed. The first seeks to mitigate impacts of lost stream channel and marsh habitats and the second seeks to mitigate lost fish pond habitat.

Mitigation for Loss of Stream Channel and Associated Riparian Habitats

Mitigation of loss of freshwater feeding habitat for ardeids can only be accomplished by provision or protection of alternate sites. Because many of the fish ponds and some of the abandoned stream beds adjacent to the proposed new channel would be filled with dredged spoil, these would not be available for retention as foraging sites. However, many of the abandoned channel meanders outside the works areas offer an opportunity to regain lost freshwater habitat which could be managed to provide foraging habitat for wading birds. It is understood that rehabilitation of disused meanders will be addressed in association with the local drainage needs which will be reviewed in an upcoming Drainage Master Plan Study under TEL 3. *Table 3.1a* shows the lengths of stream channel to be lost and the lengths to be abandoned due to MDC works. As previously mentioned, 'abandoned' river channels in this report refers to those existing river channels segments isolated or cut off by the MDC works. Following completion of the project the abandoned channels will still be in place, but will no longer be connected to the main stream on the upstream end. The downstream end will, however, be connected to the MDC channel. 'Lost' channel refers to those channel segments through which the MDC channels will be constructed. Lost channel segments will be incorporated into the MDC channels during construction. It should be noted that although abandoned meanders will be cut off from the new channel on the upstream end of the meander, in all cases they will drain to the new channel on the downstream end. This would preclude stagnation which could pose a public health threat due to impoundment of runoff or rain water.

None of the abandoned stream lengths shown in *Table 3.1a* are to be filled with dredged spoil generated by the channelisation works. All sections would

continue to receive surface runoff from surrounding areas and unaffected tributaries, but would not be continuous with upstream reaches of the former channel. Although the combined MDC projects would result in loss of 18.42 km of stream length, approximately 11.16 km of abandoned stream length would be available outside the new channels for habitat restoration management following completion of construction.

Table 3.1a *Comparison of Stream Channel to be Lost With That to be Abandoned Due to MDC Works*

Project	Stream channel lost (km)	Stream channel abandoned (km)
60CD (Contract A &B)	4.5	1.80
43CD	1.28	2.24
30CD	0	0
29CD Phases 1 and 2	2.85	0.72
22CD Stage II Phase 1	2.80	1.80
22CD Stage II Phase 2	2.25	1.90
22CD Stage II Phase 3	2.80	0.76
22CD Stage II Phase 4	1.94	1.94
Total	18.42	11.16

A management plan for the abandoned stream meanders should be developed, guidelines for which are listed below :

- creation of wetland habitats which provide ecological functions required by wildlife adversely affected by the MDC project;
- provision of wetlands which provide water purification for surface flows from surrounding villages and undisturbed tributaries;
- provision of green belts to provide visual or aesthetic values; and
- provision of habitats which enhance biological conservation values of areas affected by MDC works;

A summary of potential benefits and drawbacks of this mitigation scheme is shown below.

Benefits include:

- 62% reduction in total stream habitat lost to MDC works (18.42 km loss without mitigation, 6.82 km loss with mitigation);
- Revegetated channels potentially provide surface water purification, reducing organic (Watson *et al.* 1989, Hammer *et al.* 1993) and metal loadings (Surrency 1993, Ferlow 1993) to downstream reaches of channelised streams;
- Retention of green corridors in an urbanizing landscape;
- Increased availability of riparian woodland/scrub as bird foraging or nesting habitat;
- Potential retention of wetland suitable for ardeid foraging; and
- Partial retention of vegetated corridors which may be useful for wildlife

movements along channels.

Drawbacks include:

- Management cost input for small relative conservation gain due to small size of most segments;
- Abandoned segments may provide convenient rubbish dumping sites, therefore maintenance costs would be high;
- Limited or non-existent dry season flows may result in seasonal loss of wetland habitat value;
- Proximity to villages may result in excessive habitat damage through overuse by humans; and
- Small habitat size combined with close proximity of villages may limit wildlife attraction to sites.

Although the conservation potential of abandoned stream segments could be greatly enhanced through incorporation of lands between the old and new channels (in the "oxbow" areas) into the management plans, this would require additional land resumption which is understood to entail cost and programme complications which are unacceptable. Therefore, it is not proposed to resume such lands for the purpose of ecological mitigation.

It is recommended that the practicability of the proposed management strategy and the issue of a management authority for the abandoned stream segments be addressed in detail by government following the release of the government policy on wetland conservation and compensation. A policy statement is expected in July 1996.

Mitigation for Loss of Freshwater Fish Ponds

The Additional Avifauna Survey for the MDC project (*Annex A*) identified eight freshwater fish ponds at the mouth of the proposed 60CD flood channel which were proposed to be retained rather than dredged. Implementation of this impact avoidance measure has resulted in retention of approximately 10.5 ha of fish ponds which are of documented importance to Deep Bay avifauna. This has reduced the overall loss of fish ponds from 120.5ha to approximately 110 ha. Although the proportion of pond area retained is small (~9%), the importance of the ponds in terms of bird use demonstrates that this is a useful modification of the existing channel design. In addition, the ponds are located adjacent to the Shan Pui egretry and the mangal which was designated for protection. Retention of the ponds as bird habitat and as a buffer between the MDC channels and the mangal is particularly advantageous to overall biodiversity conservation in the Deep Bay area.

Further measures to reduce the net loss of fish ponds resulting from the MDC works will involve the reinstatement of ponds only temporarily occupied by works areas. This will further reduce the loss of ponds by approximately 21%, to a net total of 86.95 ha.

To mitigate for the loss of the remaining 86.95 ha of fishponds, it is recommended that ponds on Crown lands adjacent to MPNR be secured for

long-term conservation management. Areas proposed are shown on *Figure 5.7a*. Boundaries of the proposed area are the 60CD and 29CD channels on the west and south, MPNR on the north, and Fairview Park/Tai Sang Wai on the east. The proposed area is used entirely for fish culture, and lies within the boundaries of the Inner Deep Bay and Mai Po Marshes Ramsar Site. Existing land uses are entirely compatible with the desired conservation use. The estimated surface area of the proposed site is 150 ha, which would exceed the area of fish ponds to be lost due to MDC works. It is understood that this recommendation for off-site mitigation is to be considered in a study to be conducted by PELB, and that action on this proposal will be taken independent of the MDC project. To provide clarification of the conceptual background for this proposal the following three options are presented for securing this area for conservation management.

Option 1 - Conservation Lease

The existing fish culture would continue under management of current leaseholders. Leases, however, would be changed from agriculture to conservation leases. This would permit leaseholders to continue operation without interruption, but would preclude future conversion of lands from agricultural (fish culture) uses to residential, commercial, or industrial uses. Benefits of this option are that fish production (and associated wildlife benefits) would continue according to historic patterns. Long-term benefits to wildlife at Mai Po Marshes would accrue from the stability in land use afforded by the conservation lease. Desired changes in fish pond management aimed at wildlife conservation could be included in conservation lease clauses. These would address issues including bund vegetation management, bund maintenance, and annual pond drainage among others. Findings and recommendations arising from the ongoing study of the ecological value of fishponds may provide information on the management of ponds for conservation.

Option 2 - Government Land Acquisition

Land in the proposed area would be purchased via *ex gratia* payments to current leaseholders, and government would assume conservation management responsibility. This option would secure lands for conservation uses, and add a management responsibility to government. Fish pond management contracts could be assigned to current fish pond operators, or to other qualified and experienced contractors, perhaps overseen by the managers of the Ramsar site, once these have been established. Benefits are that management could be very responsive to wildlife needs due to control of lands by government. Innovative habitat management strategies could be readily implemented on an experimental or research basis to promote more effective conservation or education. Drawbacks of this option are the complexity of the land acquisition process, the fiscal implications of land resumption, and the added long-term management responsibility for government.

Option 3 - Government Land Acquisition, Inclusion in Mai Po Marshes

Land would be purchased as in Option 2, and would then be included within the boundaries of MPNR. Operation and management of the affected ponds would be the responsibility of MPNR. Benefits of this option are that management of the area would be unified, and could respond more sensitively to the needs of wildlife at Mai Po Marshes. Also, the proposed acquisition area has previously been included in the recommended area for a Ramsar Convention for Wetland in

Hong Kong. Securing long-term land use guidelines for this site is important to the integrity of a Ramsar wetland. Drawbacks would be those listed under Option 2 above plus the added financial and staffing requirements for the Nature Reserve.

Mitigation for Degradation of Freshwater Wetland

In addition to long-term habitat loss which would result from the Project, short-term impacts could result from sedimentation or re-suspension of pollutants due to the channel and embankment construction processes. Standard controls on these processes to minimize water quality and sedimentation impacts are proposed in *Section 6* of this report, and would contribute to minimising short-term habitat degradation. Results of sedimentation modeling for Stage 1 works of the Shenzhen River Training Project suggest that sedimentation of Inner Deep Bay from the upstream portions of the MDC works would not be a significant concern (Peking University 1994).

To minimize impacts on aquatic biological resources it was recommended by BCL. (1992) that suction dredgers be used because they are less damaging than other types of dredgers. However, because this method would create "liquefied" sludge that could not be disposed of in marine contaminated mud pits, or other potential land-based options, closed grab dredgers are recommended instead.

Avoidance of Impact at Mai Po Lo Wai Egretry

Because of the close proximity of the 30CD village flood protection works to the Mai Po Lo Wai egretry, it is recommended that construction works not be undertaken during the months from April to July. This will avoid potential impacts of equipment noise and human disturbance on herons and egrets arriving to nest at the egretry.

3.2 WATER QUALITY

General Measures: Proper site management, including defined waste management procedures, will be essential to minimise surface water runoff, and ensure that debris and rubbish cannot enter water bodies such as ponds and rivers. Discharges from the construction site must be controlled to comply with the standards for effluents discharged into the inland waters under the *TM* of the WPCO. Mitigation measures associated with management and disposal of dredged material are presented in *Section* 3.3.

The following provide guidance on the specific mitigation measures which should be enforced to prevent unacceptable construction stage impacts, ie to prevent exceedance of statutory criteria.

Dredging of Drainage Channel: For dredging the river bed or ponds, the use of only mechanical dredgers with closed-grabs will be specified in the construction contracts. In addition, the following mitigation measure should be implemented:

- closed mechanical grabs if used should be designed and maintained to avoid spillage and should seal tightly while being lifted;
- all pipe leakages should be repaired promptly and plant should not be operated with leaking pipes;

- the decks of all vessels shall be kept tidy and free of oil or other substances or articles which might be accidentally or otherwise washed overboard;

- the works should cause no visible foam, oil, grease, scum, litter or other objectionable matter to be present on the water within the Site or dumping grounds;

- loading of barges and hoppers should be controlled to prevent splashing of dredged material to the surrounding water and barges or hoppers should under no circumstances be filled to a level which will cause overflowing of material or polluted water during loading or transportation; and

- special measures shall be taken during transportation and disposal of all dredged material. This includes the use of water tight trucks as discussed in the Waste Management Section.

Excavation Works in Small Channels: Excavators may be required in small and narrow channels which are not accessible to dredgers. To minimise the leakage and loss of sediments during excavation, it is recommended that tightly sealed closed grab excavators be employed in river sections where material to be handled is wet. Where material is dry and in non river sections, conventional excavators may be used.

Cofferdams: Containment of sediments, via both diversion of channel and cofferdams, is recommended wherever possible to allow works to be carried out within a confined area, thereby minimising potential disturbance to the water bodies. Such measures will significantly limit impacts on downstream water quality and on downstream water sensitive receivers.

Site runoff: All site construction runoff should be controlled and treated to prevent runoff containing high levels of SS. The following measures should be considered:

- the boundaries of earthworks should be marked and surrounded by dykes or embankments for flood protection, as necessary;

- temporary ditches such as channels, earth bunds or sand bag barriers should be provided to facilitate runoff discharge into the stormwater drain, via a silt retention pond;

- permanent drainage channels should also incorporate sediment basins or traps and baffles to enhance deposition;

- sediment traps and channels must be regularly cleaned and maintained by the contractor. Daily inspections of such facilities should be specified in the works contract;

- perimeter channels should be provided at the site boundary to intercept storm runoff from offsite. These channels should be constructed in advance of site formation works and earthworks;

- all traps (temporary or permanent) should also incorporate oil and grease removal facilities;

- manholes should be adequately covered or temporarily sealed;

- all drainage facilities must be adequate for the controlled release of storm flows;

- open material storage stockpiles should be covered with tarpaulin or similar fabric to prevent material washing away;

- exposed soil areas should be minimised to reduce the potential for increased siltation and contamination of runoff;
- earthwork final surfaces should be well compacted and subsequent permanent work should be immediately performed; and

- as much construction as possible should be undertaken between September and April to minimize soil erosion during rainy season.

Wastewater from Construction Activities:

- bentonite slurry should be reconditioned and reused wherever practicable; spent bentonite or other grouts should be collected in a separate slurry collection system either for reuse or disposal to landfill; used bentonite slurry should only be disposed to the local sewer upon treatment to meet the TM limits;

- water used for water testing, boring, drilling works, concrete batching and precast concrete casting should be recirculated/reused as far as practicable;

- EPD should be consulted with regard to disposal of chlorinated water (sterilised water);

- online standby sump pumps should be provided to prevent wastewater overflow from any water recycling system;

- wastewater from concrete batching and precast concrete casting should be treated for pH adjustment and silt removed prior to discharge into stormwater drains;

- washwater from wheel washing facility should have sand or silt removed before discharging into stormwater drains; the section between site exit and public road should be paved with backfall to prevent site runoff from entering the public roads; and

- drainage of groundwater should be discharged into stormwater drains after removal of silt through silt removal facilities.

Oils and Solvents: All fuel tanks and storage areas should be provided with locks and be sited on sealed areas, within bunds of a capacity equal to 110% of the storage capacity of the largest tank to prevent spillages of fuel oils or other polluting fluids.

Sewage: All polluted water should be treated before discharge. Portable toilets will be provided for the on-site construction workforce and the treated effluent can subsequently be discharged providing it complies with the *TM*. This level of treatment should be achieved by standard portable treatment units.

Works Timing: It is considered that whenever possible the MDC works should be undertaken during periods of low flow (dry season). These temporal restrictions

in the works would minimise downstream impacts on sensitive water bodies. However, the programme should also take into account other construction stage environmental issues such as air (dust and odour) and noise.

Village Flood Protection Works (30CD)

In addition to the measures above, the following should be considered specifically for the 30CD works near Deep Bay, an environmentally sensitive area.
Three of the four villages associated with the 30CD works, comprising Pok Wai, Chuk Yuen Tsuen and Mai Po Village, fall in the Deep Bay Buffer Zone. According to the Deep Bay Guidelines, any construction within this area will require special attention, and mitigation measures recommended in the *Deep Bay Guidelines* should be followed to avoid adverse impacts. However, standard environmental mitigation measures drawn up for construction activities, as listed earlier in this section, are considered comprehensive and should also apply to works within the Deep Bay area.

Hydroseeding of bunds around the VFPWs should be carried out soon after completion of the bund wall to minimise soil erosion and consequent silt runoff. Wherever possible, seeding with indigenous species should be used in the seed mix on embankments, as detailed above in this section.

Operation Phase Mitigation

- Regular maintenance dredging should be undertaken to maximise flows and capacity;
- Dry weather flow channels (DWFC) should be included within the widened channels, upstream of the fabric dams to allow DWFC to be discharged downstream;
- River bed sediments should be removed frequently to prevent excess sediment and pollutant accumulation.
- Such materials should be handled, managed and disposed of in accordance with ongoing EPD guidelines at the time of dredging.

In the absence of such guidance, disposal arrangements detailed in *Section* 3.3 and mitigation measures recommended above in this section, applicable to capital dredging during the construction phase also apply to maintenance dredging.

Village Flood Protection Works (30 CD): To minimise the suspended solids carried down stream, silt traps should be installed at appropriate locations along the drainage system at the base of the bund wall. In addition, silt traps should be regularly cleaned and maintained to prevent reduction in drainage system capacity. Frequent inspection of the silt traps will therefore be necessary.

3.3 WASTE

This sub-section outlines appropriate mitigation measures to minimise any impact from the construction waste arisings.

Mitigation for Landbased Transportation of "Dredged" Materials

DSD have advised that, following a review of engineering feasibility and practicality, it will not be possible to load the dredged sediments onto shallow draft vessels and barges because of inadequate water depth and thus the waterway will not be accessible to others for river transportation of dredged material to the final marine disposal site. In addition, DSD have stated that it will not be feasible for intermediate pumped transfer of hydraulically dredged material along a pipe over 1500m due to engineering difficulties and land issues.

Transport of both contaminated and uncontaminated dredged material (not used as filling material for the drainage project) via the waterway will therefore not be possible and will thus have to be transported by water tight trucks to potential marine barging points, which could include vertical seawall sites at Tuen Mun or Tai Po, to sea-going barges for transfer to designated marine disposal grounds.

Marine Disposal of Dredged or Excavated Materials

Land-based alternatives have been given due consideration for disposal of dredged material sediments and excavated materials. However, given the high moisture content of the dredged sediments and associated problems with stockpiling and drying of contaminated mud, and the limited capacity of the existing public dumps and landfills, marine disposal of materials at the designated pits is adopted while suitable material would be reused or sent for land-based disposal as far as practicable.

The following measures have been identified to minimise potential impacts on water quality arising during marine transportation of the dredged material:

- all vessels should be sized such that adequate clearance is maintained between vessels and the sea bed at all states of the tide to ensure that undue turbidity is not generated by turbulence from vessel movement or propeller wash;

- all barges and hopper dredgers should be fitted with tight fitting seals to their bottom openings to prevent leakage of material; and

- loading of barges and hoppers should be controlled to prevent splashing of dredged material to the surrounding water, and barges or hoppers should not be filled to a level which will cause the overflow of materials or polluted water during loading or transportation; and
- the Works should cause no visible foam, oil, grease, scum, litter or other objectionable matter to be present on the water within the Site or dumping grounds.

Additional provisions will be required where sediments are contaminated. The locations and depths of any areas of contaminated sediments should be indicated in the construction contract following the completion of the Sediment Quality Report. The Contractor should be required to ensure that contaminated sediments are dredged, transported and placed in approved special dumping grounds in accordance with the EPDTC 1-1-92, WBTC 22/92 and WBTC 6/92. Typical mitigation measures to minimise the loss of contaminated material to the water column are listed below:

- transport of contaminated mud to the marine disposal site should, wherever possible, be by split barge of not less than 750 m^3 capacity, well maintained and capable of rapid opening and discharge at the disposal site;

- the material should be placed in the pit by bottom dumping, at a location within the pit specified by the FMC;

- discharge should be undertaken rapidly and the hoppers should then immediately be closed, material adhering to the sides of the hopper should not be washed out of the hopper and the hopper should remain closed until the barge next returns to the disposal site;

- the dumping vessel should be stationary throughout the dumping operation;

- the Contractor must be able to position the dumping vessel to an accuracy of +/-10 m;

- monitoring of the barge loading to ensure that loss of material does not take place during transportation; and

- transport barges or vessels shall be equipped with automatic self-monitoring devices as specified in *Annex L*.

Excavated Material and Segregation of Wastes

In order to ensure that all construction waste, excluding river and pond sediments, is disposed of in an appropriate manner, waste should be separated by category on-site by the Contractor. The criteria for sorting solid waste is described in *New Disposal Arrangements for Construction Waste*. Waste containing in excess of 20% by volume of inerts should be segregated from waste with a larger proportion of putrescible material.

It is recommended that all waste materials, excluding river and pond sediments, be segregated into the following categories which have previously been defined:

- excavated material or construction waste suitable for reuse on-site, reclamation or fill;
- construction waste for disposal at public dump or landfill;
- chemical waste; and
- general refuse.

Site Practice

Good site practice will ensure that the on-site impacts mentioned previously are minimised. These should include:

- daily collection of general refuse or as often as required;
- regular maintenance and cleaning of waste storage areas; and
- storage of waste in suitable containers/receptacles.

In general, waste generation should be minimised and materials should be recycled as far as practicable to minimize the disposal requirements.

Transportation and Disposal of General Construction Waste

It is the Contractors responsibility to ensure that only approved licensed waste collectors are used and that appropriate measures to minimise adverse impacts, including windblown litter and dust from the transportation of these wastes are employed. In addition, the Contractor must ensure that all the necessary waste disposal permits are obtained.

Operational Mitigation

The provision of silt traps at appropriate locations in the drainage system will minimise the impact of sediment resuspension and downstream transport during operation. In addition suspended solids within the water column will settle and accumulate in the vicinity of the fabric dams.

3.4 CONSTRUCTION NOISE

As a general rule, good on-site noise management can reduce the impact of a construction site activities on nearby NSRs. To provide significant noise reduction on site, the following measures should be followed during each phase of construction:

- maintenance of noisy equipment so as to minimise noise;
- reduction in the number of noisy plant operating simultaneously;
- siting of mobile plant as far away from NSRs as possible;
- turning off of noisy plant when not in use; and
- effective use of material stock piles and other structures for noise screening on-site.

In addition to these measures, specific mitigation measures for each of the construction activities during both non-restricted and restricted hours are recommended below. The restricted hours are the time between 1900 and 0700 hours on a weekday and any time on a general holiday, including Sunday.

3.4.1 *Specific Recommendations During Construction for 43CD, 29CD and 22CD of MDC*

Specific mitigation for these MDC construction is summarised in *Tables 3.4a to 3.4c* and is further described below. Specific mitigation for 60CD has been already agreed with EPD and included in contract documents and thus has not been included.

Dredging

Non-restricted hours: No mitigation is recommended except in Phases 3 and 4 of 22CD where special consideration should be given to the dredging operations; a 3m high barrier should be erected along the pond boundary during these phases.

Restricted hours: Unmitigated dredging activities are possible in the evening (1900-2300 hours) at locations where they are at least 200m away from the nearest NSRs. With a 3m noise barrier along the pond boundary, dredging operations are possible during the evening of all days and daytime on Sundays. Exceptions to this are Phase 3 and Phase 4 of 22CD where no restricted hours works are recommended.

Pond Draining

Non-restricted hours: No mitigation measures are recommended for daytime except in Phases 3 and 4 of 22CD where special consideration should be given to the draining operations; a 3m high barrier should be erected between the operating plant and the nearby NSRs.

Restricted hours: Unmitigated evening draining should be allowable where the nearby NSRs are more than 200m away from the works. With 3m mobile noise barriers (between the operating plant and the nearby NSRs), the draining operations would be allowable near most of the NSRs except in Phases 3 and 4 of 22CD where restricted hours works are not recommended.

Excavation/River Bed Construction

Non-restricted hours: Mitigation measures should be employed at locations where works are closer than 100m to the nearest NSRs. For NSRs at 60-100m from the works, a 3m high noise barrier should be erected between the plant in operation and the nearby NSRs. Barriers should be erected no farther than 20m from the operating plant. For NSRs closer than 60m to the works, a 3.5m high noise barrier should be erected between the operating plant and the nearby NSRs (as close to plant in operation as is practicable, though no farther than 20m away), and no more than 3 pieces of plant should be used simultaneously (for example, two excavators and a bulldozer) in any one area.

Restricted hours: Works are not recommended.

Access Road Construction

Non-restricted hours: Mitigation measures should be employed at the work locations which are closer than 100m to the nearest NSRs:

For NSRs at distances of 60-100m from the construction activities, a 3m high noise barrier should be erected between the plant in operation and the nearby NSRs. Barriers should be erected no farther than 20m from plant in operation.

For NSRs closer than 60m to the works, a 4m high noise barrier should be erected between the plant in operation and the nearby NSRs (as close to plant in operation as is practicable, though no farther than 20m away), and no more than 2 pieces of plant should be used simultaneously (for example, an excavator and a bulldozer) in any one work site.

Restricted hours: Works are not recommended.

Pumping Station Construction

Non-restricted hours: A 3.5m noise barrier should be erected between the works in progress and Ko Po Tsuen Village. The bored piling rigs should be individually shielded with 3.5m high mobile barriers surrounding the rigs on three sides, and within 3m of the rig. Any concrete truck mixer to be used should be replaced by an electric or petrol concrete mixer.

Restricted hours: Construction works are not recommended.

Percussive Piling

Should a double acting hammer rig or a diesel hammer rig be used to drive steel piles, without the use of noise mitigation, daily time restrictions would be placed on certain piling activities.

Cofferdam Piling

A drop hammer driving a sheet steel pile in preference to a double acting or diesel rig or similar quiet method should be used, if practicable. A 3.5m high mobile noise barrier should be placed to encircle the rig during operation. In Phases 3 and 4 of 22CD, the piling should not be more than 5 hours even with the use of quiet rig and the barriers.

Table 3.4a *Recommended Mitigation Measures by Activity for 43CD*

Activity	Mitigation Recommended for Daytime Activities	Recommended Restricted Hours for Construction
Dredging	N/A	evening permitted no night time works
Pond Draining	N/A	evening permitted no night time works
Excavation	3.5m barrier max 3 plant items	no restricted hours works
Access Road Construction	4m barrier max 2 plant items	no restricted hours works
River Bed Construction	3.5m barrier max 3 plant items	no restricted hours works
Pumping Station	3m barrier	evening permitted no night time works
Percussive Piling	3.5m barrier quiet rig	not permitted by law (NCO)

These mitigation measures are applicable primarily to locations east of Ko Po Tsuen Village. As a result, approximately 45% of the working area for 43CD is affected by these mitigation measures.

Table 3.4b *Recommended Mitigation Measures by Activity for 29CD*

Activity	Mitigation Recommended for Daytime Activities	Recommended Restriction Hours for Construction
Dredging	N/A	evening permitted no night time works
Pond Draining	N/A	evening permitted no night time works
Excavation	3.5m barrier max 3 plant items	no restricted hours works
Access Road Construction	4m barrier max 2 plant items	no restricted hours works
River Bed Construction	3.5m barrier max 3 plant items	no restricted hours works
Pumping Station	N/A	evening permitted no night time works
Percussive Piling	3.5m barrier, quiet rig	not permitted by law (NCO)

These mitigation measures are applicable primarily to Man Yuen Chuen (Phase 1); scattered dwellings by Tam Mi Camp (Phase 2); Yau Tam Mei Village (Phase 2); and scattered dwellings by Footbridge D. As a result, a small percentage of Phase 1 and the majority of Phase 2 is affected by these mitigation measures.

Table 3.4c *Recommended Mitigation Measures by Activity for 22CD*

Activity	Mitigation Recommended for Daytime Activities	Recommended Restriction Hours for Construction
Dredging	3m barrier	evening permitted no night time works
Pond Draining	3m barrier	evening permitted no night time works
Excavation	3.5m barrier max 3 plant items	no restricted hours works
Access Road Construction	3.5m barrier max 3 plant items	no restricted hours works
River Bed Construction	4m barrier max 2 plant items	no restricted hours works
Pumping Station	N/A	N/A
Percussive Piling	3.5m barrier, quiet rig	not permitted by law (NCO)

It should be noted that these mitigation measures are applicable primarily to following locations:

- Phase 2: Shek Wu Tong and Yuen Kong San Tsuen;
- Phase 2: Scattered Dwellings near Footbridge FB2, scattered dwellings (north of the MDC), Tsat Sing Kong, Lung Uk Tsuen, Pat Heung, and scattered dwellings North of the MDC;
- Phase 3: all identified sensitive receivers (especially Kam Tsin Wai);
- Phase 4, Western Channel: Tin Liu Tsuen, and Lung Tin Tsuen;
- Phase 4, Eastern Channel: all identified sensitive receivers.

3.4.2 *Specific Mitigation Recommendations During Construction for Village Flood Protection Works (30CD Stage 1)*

Table 3.4d below summarises the recommended mitigation measures for different construction activities for VFPWs. A more detailed description follows the table.

Table 3.4d *Recommended Mitigation Measures by Activity for the VFPWs*

Activity	Mitigation Recommended for Daytime Activities	Recommended Restricted Hours for Construction
Bund Formation	3.5m barrier max 2 plant items	no restricted hours works
Dredging	N/A	no restricted hours works
Excavation	3.5m barrier max 2 plant items	no restricted hours works
Pumping Station	N/A	evening permitted no night time works
Percussive Piling	3.5m barrier quiet rig	not permitted by law (NCO)

Bund Formation/Excavation

Non-restricted hours: Near Pok Wai and Sha Po Tsuen, a 3.5m barrier should be placed between the plant in operation (as close to plant in operation as is practicable, though no farther than 20m distant) and the nearby NSRs. No more than 2 items of plant (for example, a crane and a truck) should be used at any one time within 50m of an NSR, and all idle plant be turned off when not in use. Bulldozers should not be used for long periods of time when other items of plant are in continuous operation. Near Chuk Yuen Tsuen/Ha San Wai and Mai Po Lo Wai, a 3m noise barrier should be placed between the plant in operation and the nearby NSRs.

Restricted hours: Restricted hours activities are not recommended.

Dredging

Non-restricted hours: At Pok Wai and Sha Po Tsuen, a 3m high barrier should be erected at the pond boundary between the dredger and the NSRs.

Restricted hours: Restricted hours dredging activities are not recommended.

Pumping Station Construction

Non-restricted hours: No mitigation measures are recommended for daytime, non-percussive, pumping station construction activities.

Restricted hours: Activities using only hand tools or potentially an electric/petrol concrete mixer in place of a truck mixer should be allowable during 1900 and 2300 hours at Chuk Yuen Tsuen/Ha San Wai station. Night time (2300-0700) activities are not recommended for any of the VFPWs except in Man Yuen Tsuen site with the activities only needing hand tools.

Percussive Piling

By adopting the following measures, non-compliance of the NCO should be unlikely and unrestricted percussive piling activities during daytime hours should be allowable:

Encircling the rig by 3.5m high mobile noise barriers to reduce the noise annoyance at Sha Po Tsuen or at Chuk Yuen Tsuen/Ha San Wai.

For sheet steel piling operations at Mai Po Lo Wai, a drop hammer or similarly quiet method, rather than a diesel hammer rig, should be employed, if practicable. A 3.5m high mobile noise barrier should be used to encircle the rig in operation to reduce the noise annoyance.

It is understood that a comprehensive environmental monitoring and auditing programme (EM&A) will be drawn up to measure noise levels at nearby NSRs during the construction phase of this project.

3.5 *OPERATIONAL NOISE*

Mai Po San Tsuen is likely to be impacted by the pumping station noise. It is also understood that the noise levels within the station will be excessive for the occupational health and safety considerations and should be reduced to an acceptable level which is $L_{Aeq, period}$ 85 dB(A). By achieving this level within the pumping station, the resulting noise level at Ma Po San Tsuen will meet the ANL-5 noise criterion. Noise mitigation measures recommended for the pumping station include internal acoustic treatment to the plant room such as soffits (eg 50mm mineral wool) and pump acoustic shrouds or enclosures, and replacement of the standard louvre with an acoustic louvre. Alternatively, the louvre position could be made to face away from the NSRs; this takes advantage of directivity effects to reduce noise levels at the NSRs.

3.6 *AIR QUALITY*

The following air quality mitigation measures are recommended for each activity, in order to limit the dust and odour emissions. .

Dust Impacts

The following dust control measures should be implemented to minimise dust impacts arising from the construction works:
Vehicle Dust

- Haul roads should be aligned at a minimum distance of 60 m from the nearest ASRs, where possible;
- Haul roads should be regularly compacted and road surface should be kept clear of loose material. Water spraying should also be used to control dust emissions;
- Vehicles should be restricted to designated routes and should not exceed speed limit of 11 km/h. The 11 km/h speed limit should be posted and enforced by the resident engineer;
- Wheel-wash troughs and hoses should be provided at traffic exits from the site to minimise the quantity of material deposited on public roads. All haul vehicles should receive a thorough wheel washing, 1 to 1.5 minutes, prior to exiting the site; and
- Vehicles transporting spoils should have properly fitting side and tail boards. Materials transported by vehicles should be covered, with the cover properly secured and extended over the edges of the side and tail boards. The materials should also be dampened if necessary before transportation.

Handling of stockpile materials

- Stockpile areas should be placed as far from ASRs as is practicable;
- Stockpiles of sand and aggregate greater than 20 m^3 should be enclosed on three sides, with walls extending above the pile and 2 metres beyond the front of the pile;
- Stockpiled material should be moved off site as quickly as is practicable on a first-in, first-out basis (older material transferred first); and
- Water spray facilities should be provided and used both for damping during reception and storage of raw materials.

Excavation

- Amount of soil exposed and the dust generation potential should be kept as low as possible. Re-vegetation of completed earthworks, surface compaction, regular wetting of the surface and minimisation of the amount of soil exposed are recommended.

Odour Impacts

To reduce the odour impacts on ASRs, the following measures should be incorporated to minimize generation and dispersion of odours.

- odorous stockpiled material should be placed as far from ASRs as is practicable;
- odorous stockpiled material should be removed as quickly as is possible to reduce the amount of time available for decomposition;
- stockpiled material should be removed on a first-in, first-out (older material removed first) basis; and
- odorous stockpiled should be covered with plastic tarpaulin sheets if left for extended periods of time (in excess of 2 days).

It is believed that use of the above control measures and placement of limitations on all construction activities within 100 m of ASRs will reduce the air quality impacts on ASRs to acceptable levels.

Dredging: As dredging activities have not been predicted to cause significant dust impact at nearby ASRs, no mitigation is recommended for this phase of construction.

Operational Phase

There will be no source of pollutant emission during the MDC operational phase. However, potential air quality impacts may arise during maintenance dredging. Mitigation measures recommended for the construction phase will generally apply to maintenance dredging.

4 PROJECT ORGANISATION

4.1 STUDY ORGANISATION

The key parties in the EM&A programme will include the Contractor, the Engineer, the Environmental Team (composed of the environmental consultant managing the EM&A implementation, and the environmental/laboratory contractor), the Environmental Protection Department, and an Independent Environmental Consultant. Their roles and responsibilities are outlined below and further detailed in each of the Event/Action plans presented in the sections for water quality, noise, and air.

4.2 ROLE OF KEY PARTIES

4.2.1 *Contractor*

It is the responsibility of the Contractor to respond to notification by the environmental team of any exceedances (water/noise or air) and to rectify unacceptable practices. The Contractor shall discuss any additional mitigation measures with the Engineer, implement any agreed measures, and report actions taken to the Engineer and the Environmental Consultant for inclusion in the monthly report.

4.2.2 *Engineer*

The Engineer, in this case Drainage Services Department, shall be responsible for overseeing the operations of the Contractor on a day-to-day basis, and taking such steps as may be necessary to maintain compliance with statutory requirements, and the water, noise and air quality criteria specified in the individual monitoring sections. These steps may include agreeing additional mitigation measures with the Contractor, inspecting the effectiveness of mitigation measures and controlling MDC construction activities, if necessary, to ensure compliance. The Engineer's representative may be different for individual contract, and should be nominated and agreed prior to commencement of the works.

4.2.3 *Environmental Team*

The duties of the environmental team shall include collection, analysis and quality control/quality assurance review of all monitoring data. In the event of an exceedance, the environmental team will immediately inform the Contractor and Engineer in order that appropriate action can be implemented. The environmental team is also responsible for preparing monthly EM&A reports for submission to the Contractor, the Engineer and the EPD. The environmental team shall assist the Contractor and the Engineer in formulating corrective actions and liaising with government departments as necessary.

4.2.4 *Environmental Protection Department (EPD)*

EPD is the official authority to deal with environmental issues in Hong Kong. For the proposed backfilling project, EPD will be responsible for issuing the

dumping license for marine disposal of contaminated material, enforcing the environmental ordinances and regulations, and performing an independent review of the work.

4.2.5 *Independent Environmental Checker*

Based on previous experience in the review of EM&A programmes in Hong Kong, and in order to maximise environmental protection during the construction works and review the implementation of construction and operation phase mitigation measures, it is considered imperative that regular (monthly) site visits are undertaken by an Independent Environmental Checker (IEnvC) throughout the construction period.

The IEnvC, reporting to the Engineer, should be independent of the Environmental Team (engaged by the Contractor) undertaking the EM&A and should comprise a suitably qualified independent environmental consultant. The IEnvC should perform the following functions:

- to undertake an on-going review of the construction works, to review the timely implementation of construction phase mitigation recommendations detailed in the EIA;
- to undertake an on-going review of the works, to review the implementation of operational phase mitigation recommendations detailed in the EIA;
- to routinely monitor the performance of the Environmental Team to ensure that the EM&A programme strictly adheres to the EM&A requirements detailed in this stand-alone Environmental Schedule; and
- to review and verify information available in records developed through the monitoring programme;
- to simultaneously and independently provide the Engineer, Contractor and the relevant government regulatory authority (EPD) with a brief monthly IEnvC site status report summarising the status of the mitigation measure implementation, and providing an independent review of the of the EM&A programme being undertaken by the Environmental Team.

5 WATER QUALITY MONITORING

Impacts on water quality are likely to arise from construction of river training works and from excavation and dredging of channels during the MDC Works. Water quality monitoring and audit are essential tools to determine the scale of construction stage impacts and to proactively identify and remedy any deterioration in water quality associated with the works. This section presents the detailed water quality monitoring requirements during the construction and operation phases.

5.1 CONSTRUCTION PHASE

5.1.1 *Introduction*

The following sections outlines the water quality monitoring requirements to safeguard the environment on the water quality aspects during the construction of 43CD, 30CD, 29CD, and 22CD sub-project of the overall drainage project. EM&A requirements for 60CD are not described in this Environmental Schedule as the construction works are now nearing completion and have been monitored in accordance with the Deep Bay Guidelines,

5.1.2 *General Requirements*

In general, the construction works should be carried out in such a manner as to minimise adverse impacts on water quality to ensure that the Water Quality Objectives (WQO) are maintained. For the MDC Works, it is recommended that the suspended solids (SS) levels downstream of the Works Area should not be greater than 30% above the upstream SS levels. However, if baseline monitoring reveals that the SS level upstream constantly exhibits a higher value than the SS level downstream, then a compensating factor will have to be taken into account when considering the Trigger/Action/Target levels.

As a result of discussion between DSD and TDD subsequent to the EIA for 43CD and 30CD, *in situ* DO sampling was conducted in the MDCs. This sampling determined that the majority of the MDCs experience very low DO concentrations, which are virtually anoxic in places. It was therefore concluded that DO monitoring would not be appropriate, and that SS monitoring alone would provide an adequate indication of deterioration in water quality resulting from the MDC Works. DO will therefore not be monitored as part of the MDC EM&A Programme. Additionally, the EIA stated that monitoring of zinc was also recommended for all the sections of the MDC which have not commenced construction as the dredged material will be contaminated.

5.1.3 *Objectives*

The objective of the monitoring programme is to minimise adverse impacts on the water quality during the various stages of construction of the MDC Project. In order to achieve this the Contractor shall design and implement methods of working that:

(i) minimise disturbance to the river bed whilst dredging, widening and clearing of the channel;

(ii) minimise leakage of dredged material during lifting;

(iii) minimise loss of material during transport of fill or dredged material; and

(iv) prevent discharge of dredged material except at approved locations.

5.1.4 *Methodology*

Baseline Monitoring

Monitoring should be carried out in accordance with the following:

Baseline conditions should be established prior to the commencement of the MDC Works. The baseline conditions should be determined by measurement of SS and Zinc at three locations, two upstream and one downstream of the Works Area. This should be conducted for 4 sampling days per week for 4 consecutive weeks at mid-ebb (for tidal river sections), applicable within a period of six weeks prior to commencement of the works. If the section is not tidal, water quality should be sampled at the same time of day on each occasion at time to be agreed with the Environmental Team and EPD prior to commencement of the EM&A programme.

Water samples for SS and Zinc shall be taken at two depths at each monitoring location. The surface sample shall be taken within 0.5m of the surface of the water column and the bottom sample shall be taken no closer than 0.5m from the river bed. When the water column at the monitoring station is less than 1.5m at the time of sampling, then only one sample shall be taken from the middle of the water column.

Impact Monitoring

During the course of the MDC Works, SS and Zinc monitoring shall be undertaken on a working day initially on three days a week and may cease once the MDC Works have been completed. After a period of two months, the impact monitoring frequency should be reviewed based on the monitoring and auditing. Any reduction in the frequency of impact monitoring should only be undertaken with prior EPD approval. Monitoring shall be carried out at two locations, one upstream and one downstream of the Works Area at mid-ebb (for tidal river sections). If the section is not tidal, water quality should be sampled at the same time of day on each occasion at time to be agreed with the Environmental Team and EPD prior to commencement of the EM&A programme. The same sampling depth criteria should be adopted as for the baseline monitoring. For the purpose of evaluating the water quality, all values shall be depth averaged. Two samples for SS and Zinc measurements shall be taken at each depth and the SS concentration shall be ascertained by gravimetric determination and Zinc by methods acceptable to EPD in the laboratory.

Suspended solids and Zinc data shall be recorded on a standard record form as shown in *Annex A*.

Post Project Monitoring

Post-project SS and Zinc monitoring of water quality should be carried out 3 days per week for 6 weeks after the completion of construction or cessation of all construction works to monitor the impact of the MDC Works on the river water quality for comparison. Post project monitoring results can be compared with previous measurements from the established baseline water quality parameters. Appropriate remedial measures should be considered if deterioration of water quality attributable to the works is detected.

5.1.5 *Water Quality Monitoring Equipment*

The Contractor shall provide, within one week of the date of the Engineer's Representative's Order to Commence the Works, the following equipment:

(a) **Suspended Solids/Zinc**

A 12 volt DC powered peristaltic pump equipped with Tygon tubing of at least 25 m in length shall be used for sampling water. Samples shall be collected in high density polythene bottles, packed in ice (cooled to 5°C without being frozen), and delivered to the laboratory as soon as possible after collection. The samples shall be analyzed for SS in accordance with the analytical method APHA 17ed 2540D and for Zinc by agreed EPD methods.

(b) **Thermometer**

A laboratory standard certified mercury thermometer with an accuracy of at least 0.5 degree Celsius. Temperature sensors should be calibrated against a mercury thermometer of 0.1°C scale.

(c) **Water Depth Detector**

A portable, battery-operated Echo Sounder (Seafarer 901 or similar approved) or an appropriate depth measurement device shall be used for the determination of water depth within the Site and at each Designated Monitoring Station.

All monitoring instruments shall be checked, calibrated and certified by a HOKLAS or an equivalent 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. Backup equipment (water depth detector) should be kept so that the monitoring can proceed uninterrupted in case of apparatus malfunction.

5.1.6 *Monitoring Locations*.

For each of the MDC Works, except 60CD as described in *Section 5.1.11*, a water monitoring control station should be located at a sufficient distance upstream (approximately 25m) of the works to reflect the ambient condition of the affected water body. In addition, a second water monitoring station should be located at reasonable distance downstream (100m) of the works area to detect any change or deterioration in water quality as the works progresses. If construction activities are being carried out downstream, a third monitoring station should be placed within the site boundary in order to monitor the quality of the water that

is influenced solely by the works in question. In general, water sampling should be undertaken at all tributaries that are connected to the MDC Works. In order to comprehensively monitor all the construction phases, it is considered that all these water monitoring stations should be retained throughout all construction stages. Several of the works consists of construction activities that will be undertaken concurrently, as shown in *Figure 1.3a*. Thus, additional monitoring stations may be required to monitor the impingement of other works. From the proposed designated locations, the Project Engineer in consultation with the Independent Environmental Checker (IEnvC), described in *Section 4*, will select an appropriate monitoring station for the impact monitoring based on ongoing activities in the area for agreement with EPD. If there is a problem with access to the site, the proposed locations may be relocated upon consultation with EPD and the IEnvC. In this Environmental Schedule, several water quality monitoring locations for the MDC Works have been proposed. For 43CD, and 29CD, these are shown on *Figure 5.1a and Figure 5.1b*, respectively. For the Flood Protection Works, the proposed locations of the monitoring stations are indicated in *Figure 5.1c - 5.1f*. For the 22CD works, the proposed locations of the monitoring stations are shown on *Figure 5.1g* to *Figure 5.1j*.

5.1.7 *Action Plan*

Preliminary trigger, action and target levels for the water quality monitoring and auditing are defined in *Table 5.1a*. These TAT levels are based on EPD's routine water quality monitoring data for two different streams (KT1 and KT2) of the KamTin River. With access to actual baseline water quality monitoring data specific to the new section in question, this set of preliminary TAT levels should be adjusted if necessary such that the set of TAT level can become truly representative of the site's ambient conditions. It is therefore proposed that baseline water quality monitoring be carried out for the MDC Works and these preliminary TAT levels be reviewed and agreed with the IEnvC and the EPD, in light of the monitoring results, prior to works construction.

Table 5.1a *Trigger/Action/Target Levels*

	Suspended Solids[*1,2,3]
Trigger	SS > 256mg/L and SS > 120% of upstream control station at the same tide of the same day
Action	SS > 256mg/L and SS > 130% of upstream control station at the same tide of the same day
Target	SS > 256mg/L and SS > 130% of upstream control station at the same tide of the same day for three consecutive times

Note :

*1. 95% ile (for log normal distribution) of depth averaged EPD routine monitoring data for 1/90 to 7/94, subject to review when baseline monitoring data is available

*2. Baseline SS monitoring results will serve as basis for determining if a compensation factor would be justifiable. Statistical test of significance shall be performed on the baseline data to determine if there is difference between the control and impact station. A compensation factor will only be applicable if the following conditions are fulfilled:

(a) sufficient correlation (correlation coefficient r>0.8) between impact and control data is observed; and

(b) the value of impact/control ratio (slope of linear regression line for a plot of impact vs control data) excludes 1 at 95% confidence level.

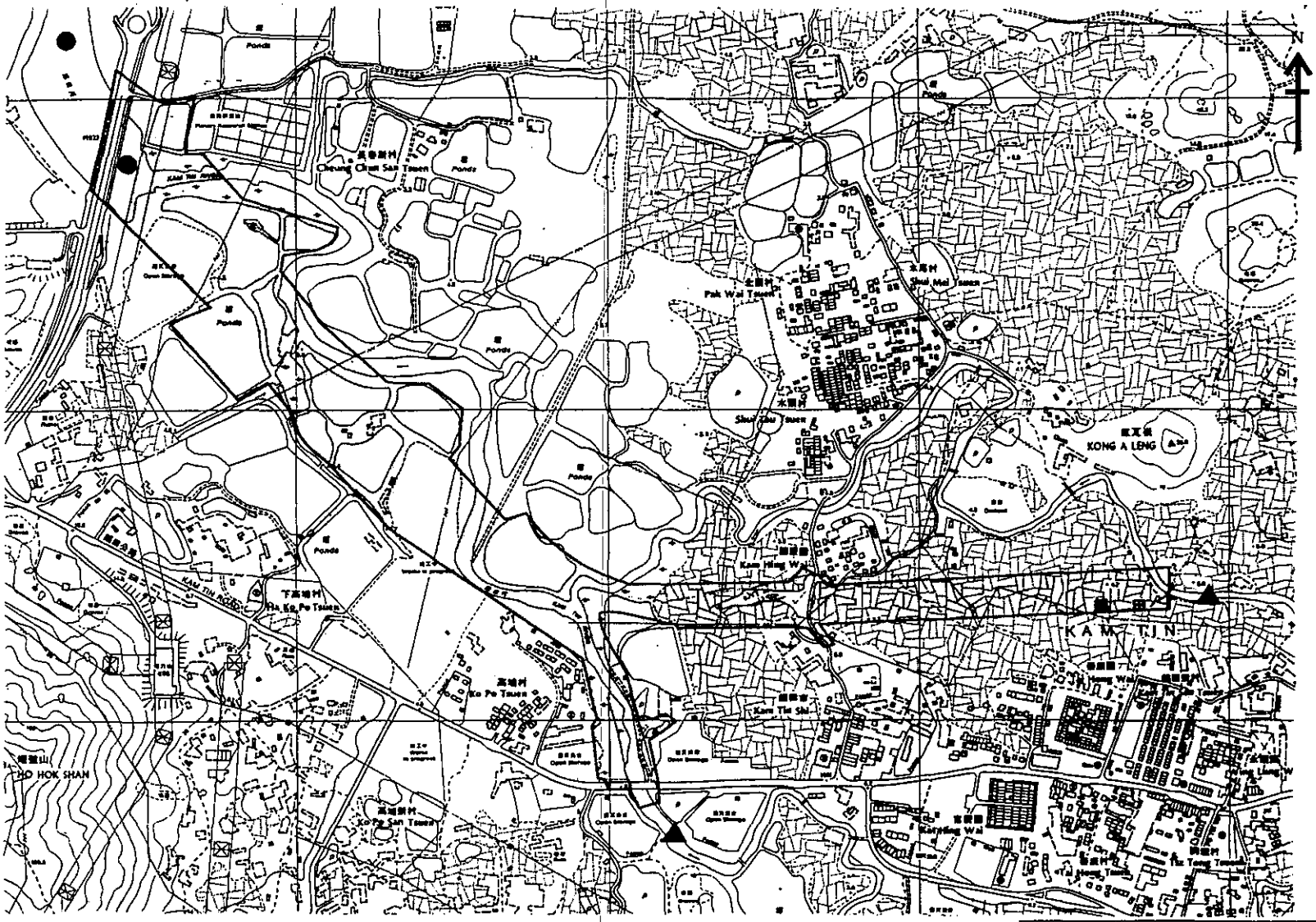


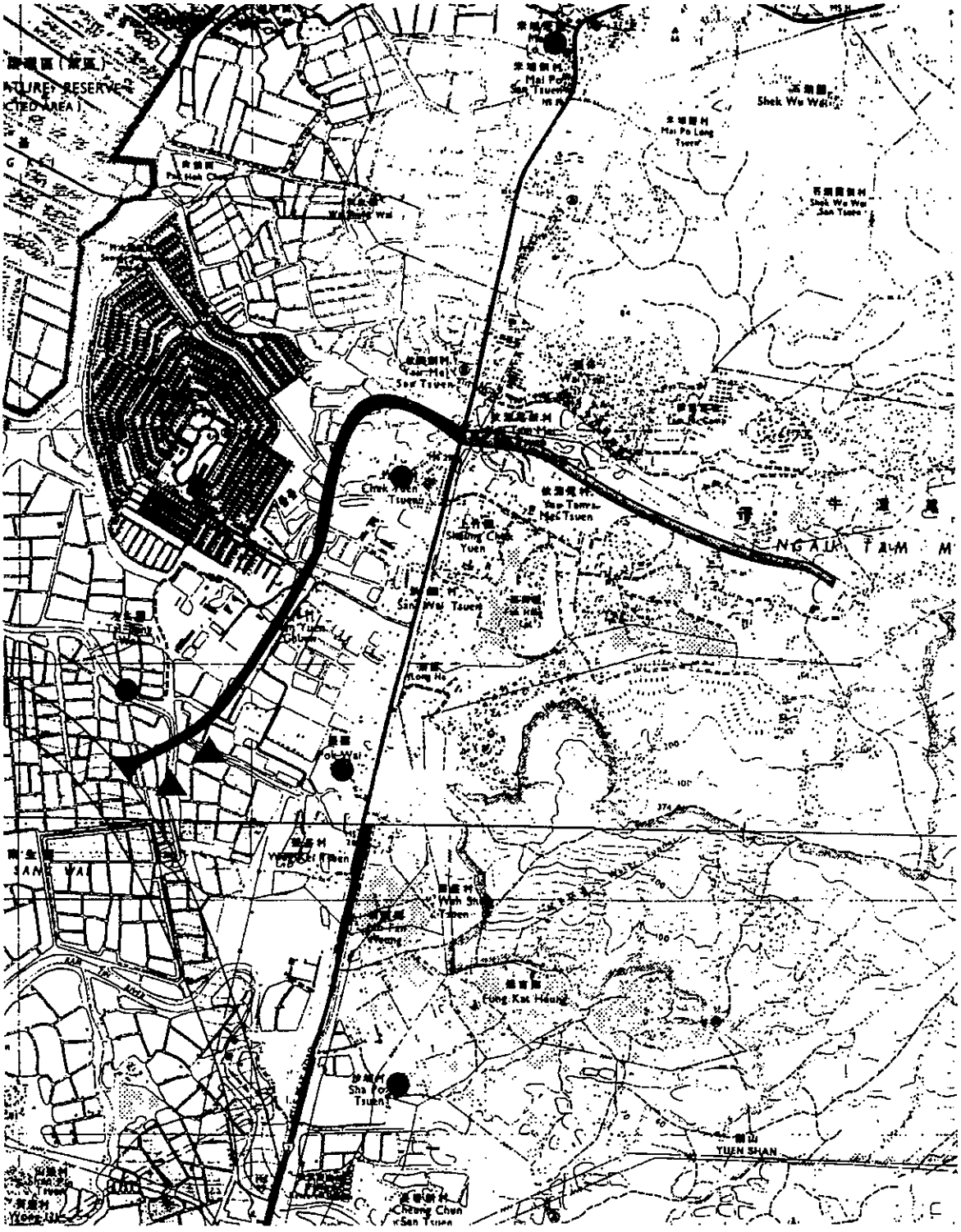
FIGURE 5.1a - PROPOSED WATER QUALITY MONITORING LOCATIONS FOR 43CD OF THE MDC

▲ UPSTREAM WATER QUALITY MONITORING STATION

● DOWNSTREAM WATER QUALITY MONITORING STATION

ERM Hong Kong, Ltd
6th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM



KEY

- 29CD - PHASE 1
- 29CD - PHASE 2
- OTHER MDC WORKS
- SECTION 30CD
- UPSTREAM WATER QUALITY MONITORING STATION
- DOWNSTREAM WATER QUALITY MONITORING STATION

FIGURE 5.1b - PROPOSED WATER QUALITY MONITORING LOCATIONS FOR 29CD OF THE MDC

ERM Hong Kong, Ltd
6th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM

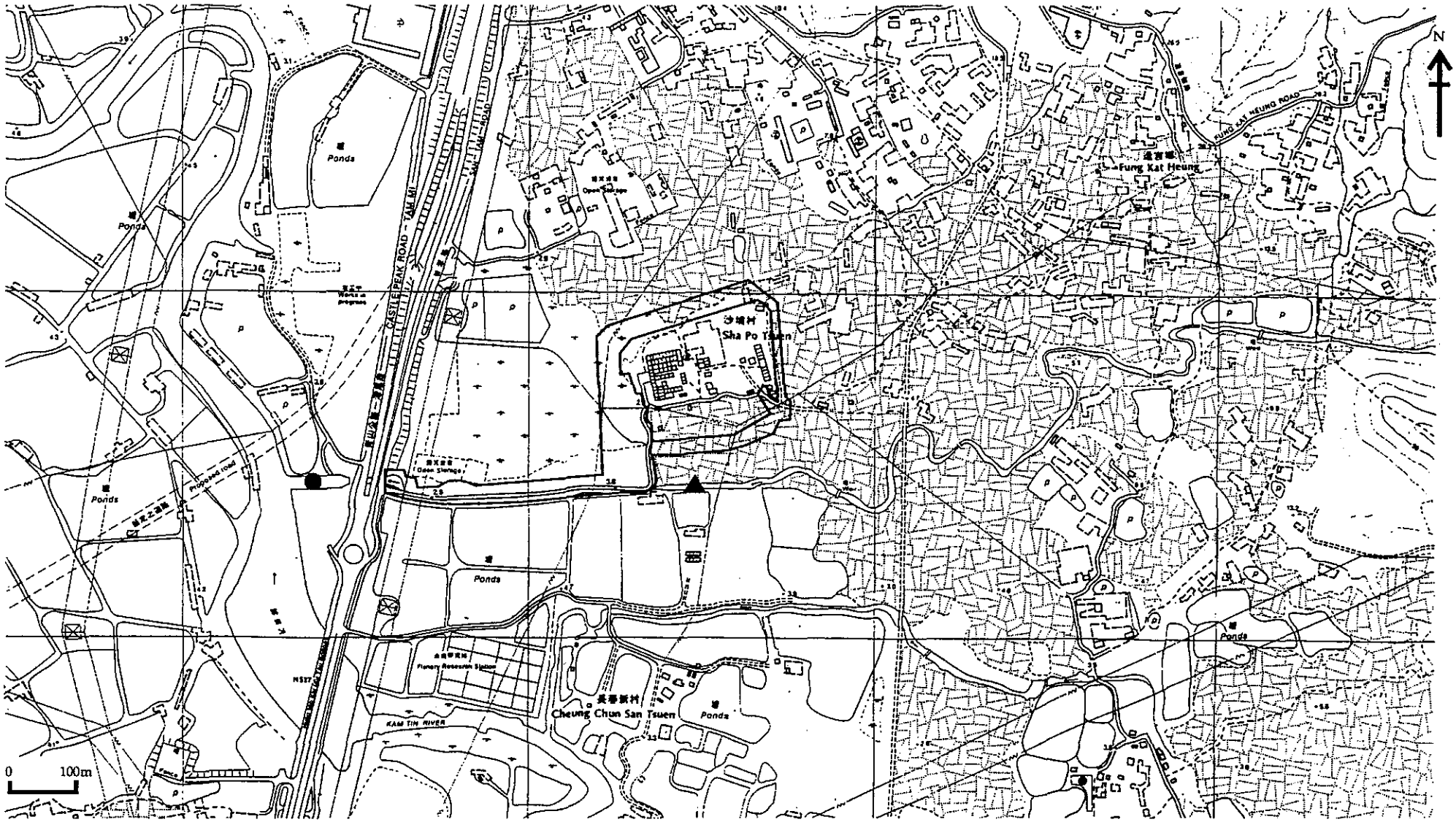


FIGURE 5.1c - PROPOSED WATER QUALITY MONITORING LOCATIONS FOR SHA PO (30CD OF VFPW)

▲ UPSTREAM WATER QUALITY MONITORING STATION

● DOWNSTREAM WATER QUALITY MONITORING STATION

ERM Hong Kong, Ltd
6th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM

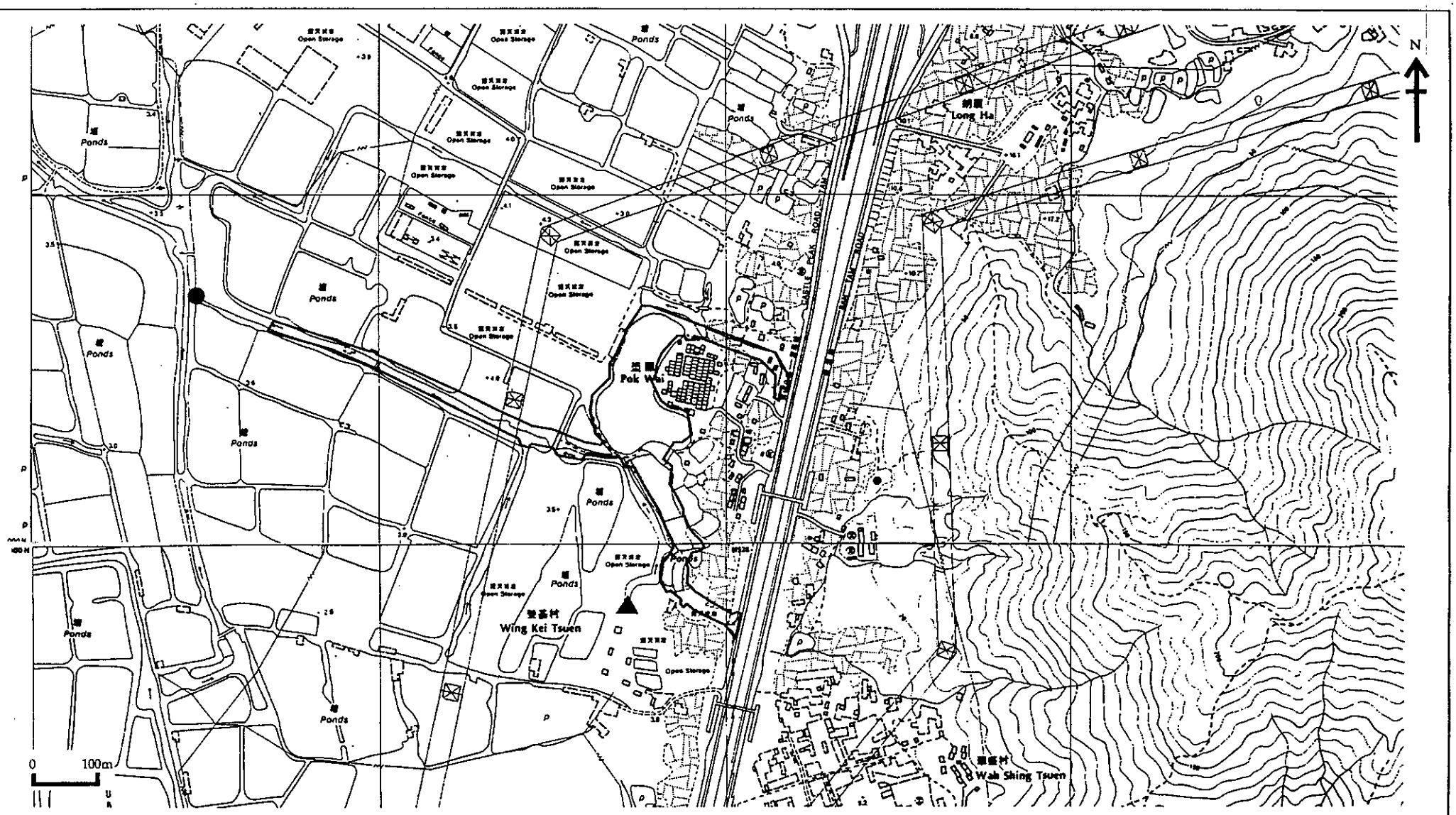


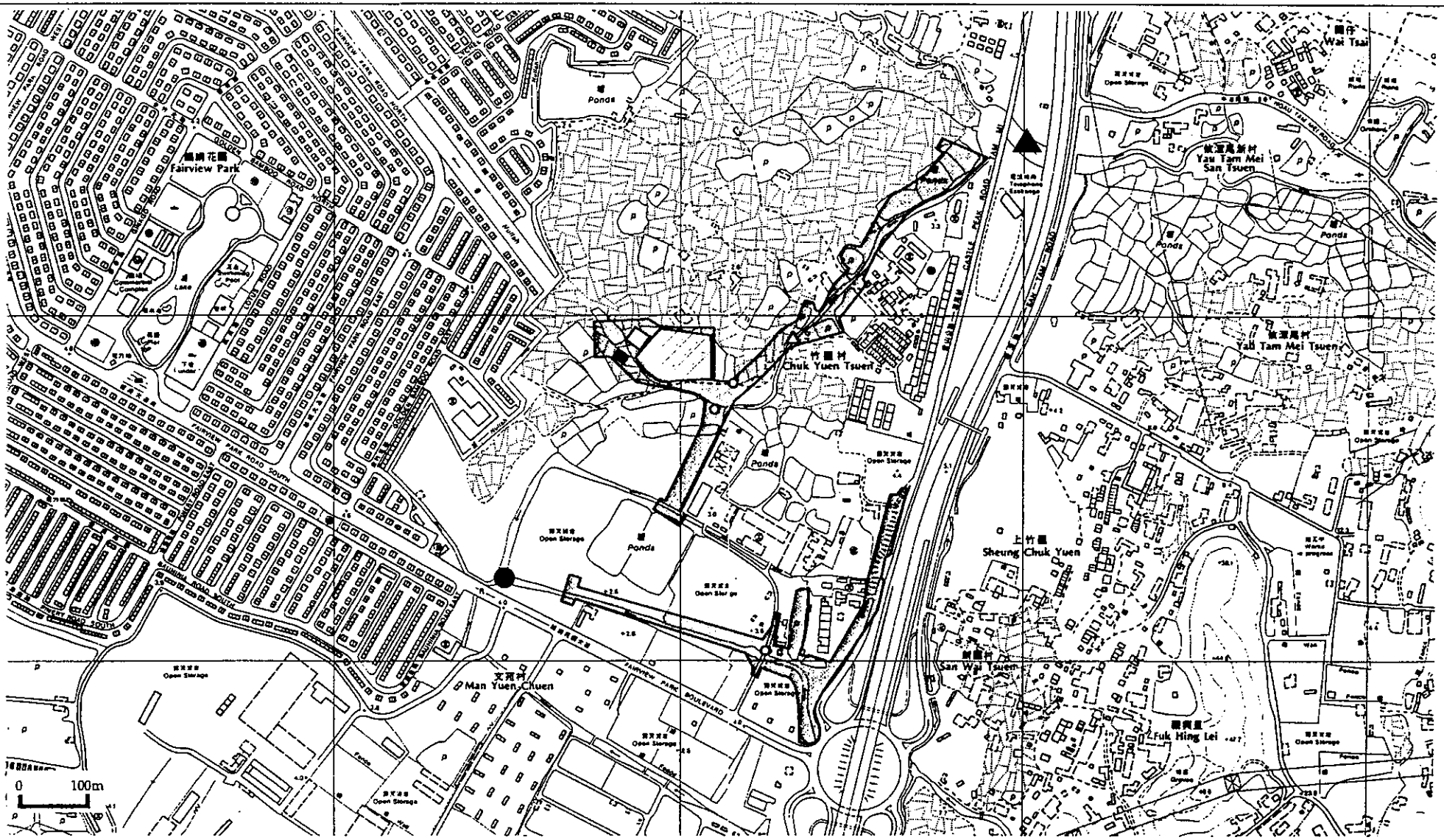
FIGURE 5.1d - PROPOSED WATER QUALITY MONITORING LOCATIONS FOR POK WAI (30CD OF VFPW)

▲ UPSTREAM WATER QUALITY MONITORING STATION

● DOWNSTREAM WATER QUALITY MONITORING STATION

ERM Hong Kong, Ltd
6th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM



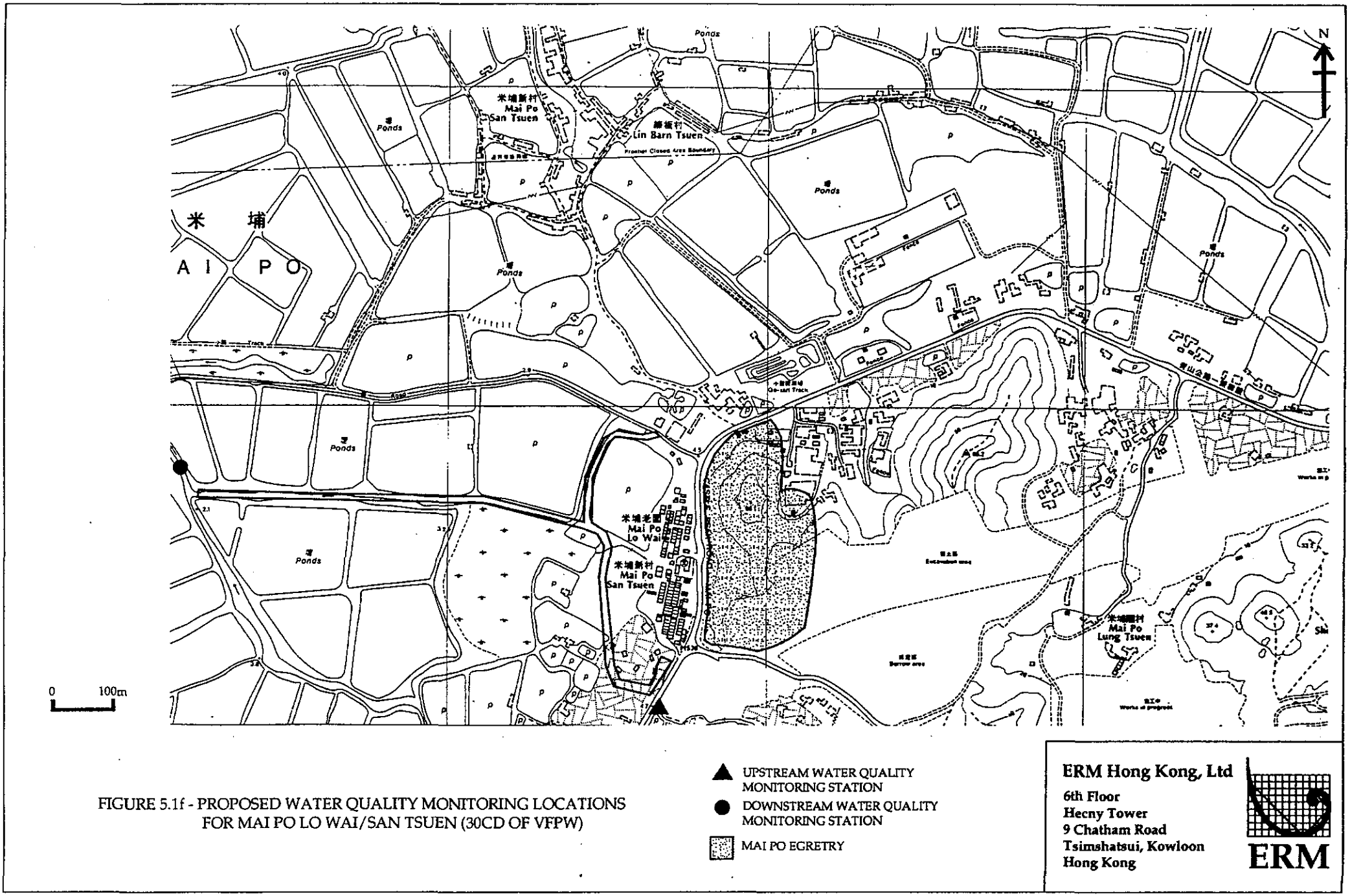
▲ UPSTREAM WATER QUALITY MONITORING STATION

● DOWNSTREAM WATER QUALITY MONITORING STATION

FIGURE 5.1e - PROPOSED WATER QUALITY MONITORING LOCATIONS FOR CHUK YUEN TSUEN (30CD OF VFPW)

ERM Hong Kong, Ltd
6th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM



▲ UPSTREAM WATER QUALITY MONITORING STATION

● DOWNSTREAM WATER QUALITY MONITORING STATION

MAI PO EGRETRY

FIGURE 5.1f - PROPOSED WATER QUALITY MONITORING LOCATIONS FOR MAI PO LO WAI/SAN TSUEN (30CD OF VFPW)

ERM Hong Kong, Ltd
6th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM

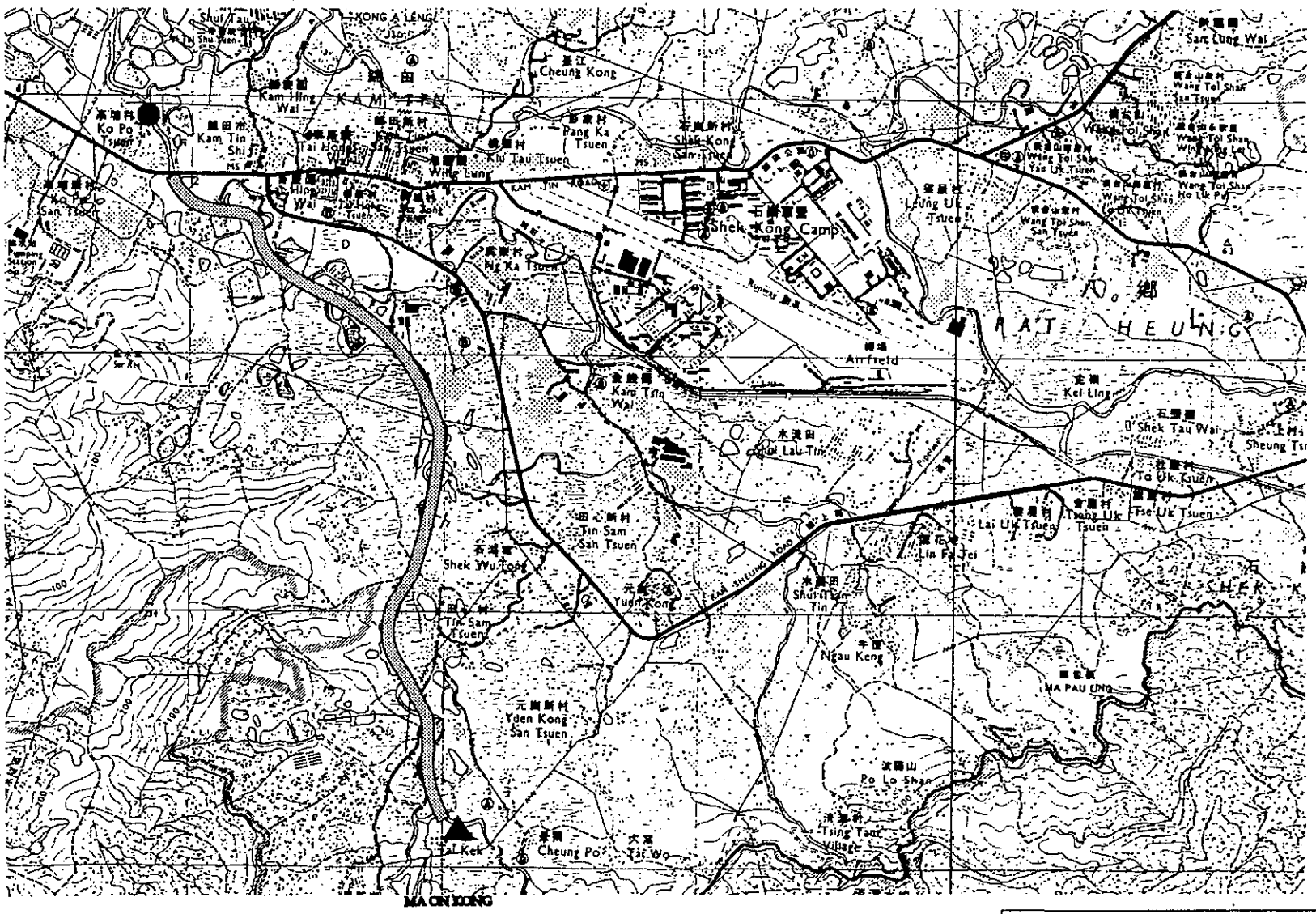
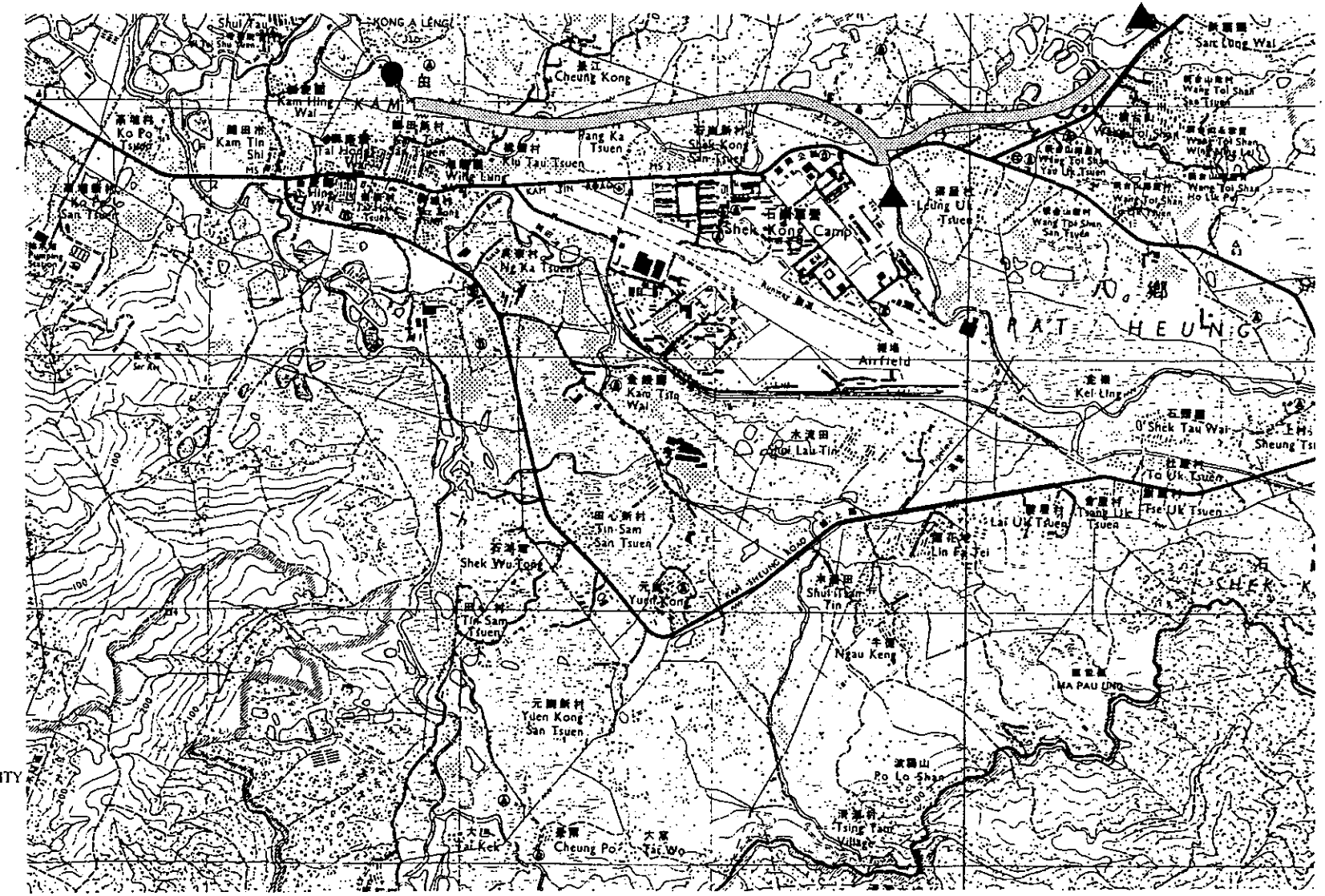


FIGURE 5.1g - PROPOSED WATER QUALITY MONITORING LOCATIONS FOR 22CD (PHASE 1) OF THE MDC

ERM Hong Kong, Ltd
6th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM



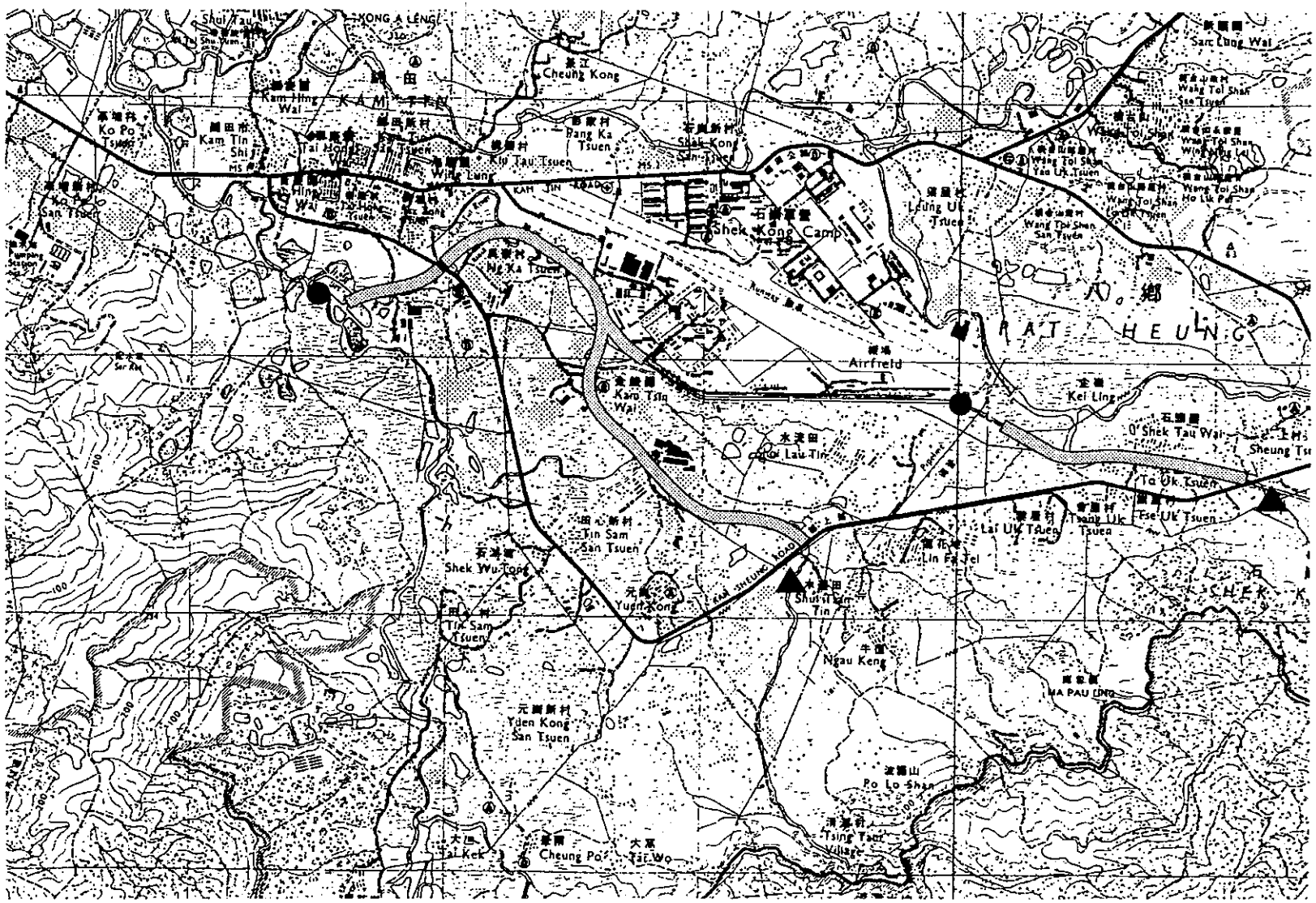
KEY

- 22CD - PHASE 2
- UPSTREAM WATER QUALITY MONITORING STATION
- DOWNSTREAM WATER QUALITY MONITORING STATION

FIGURE 5.1h - PROPOSED WATER QUALITY MONITORING LOCATIONS FOR 22CD (PHASE 2) OF THE MDC

ERM Hong Kong, Ltd
6th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM



KEY

- 22CD - PHASE 3
- ▲ UPSTREAM WATER QUALITY MONITORING STATION
- ● DOWNSTREAM WATER QUALITY MONITORING STATION

FIGURE 5.1i - PROPOSED WATER QUALITY MONITORING LOCATIONS FOR 22CD (PHASE 3) OF THE MDC

ERM Hong Kong, Ltd
6th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
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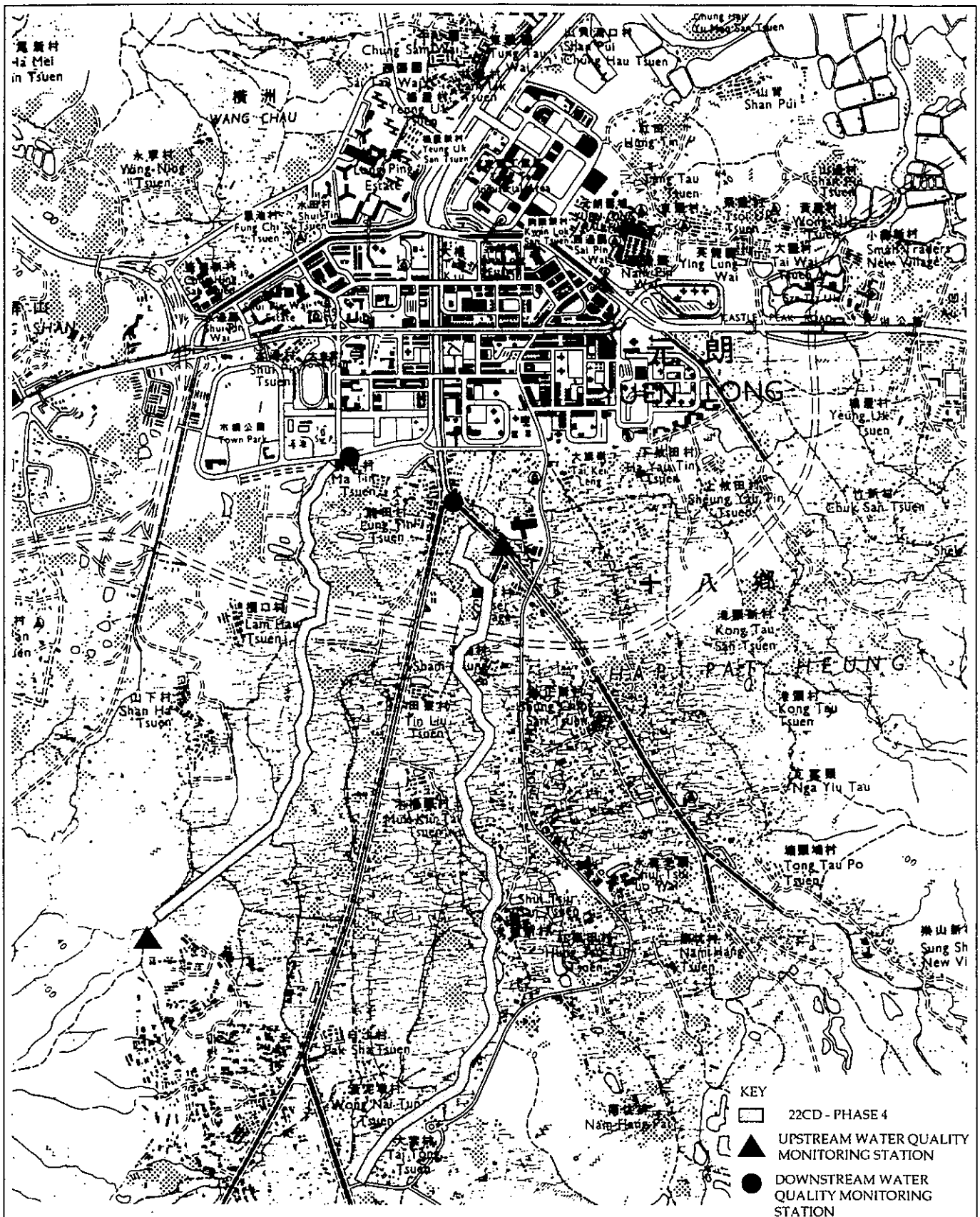

FIGURE 5.1j - PROPOSED WATER QUALITY MONITORING LOCATIONS FOR 22CD (PHASE 4) OF THE MDC

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*3 For 43CD, the weighted mean of the two control stations will be used. The weighted mean will be calculated based on the averaged flow of 0.7m^3/sec for KT1 and 0.4m^3/sec for KT2 as follows:

[0.7(reading for KT1) + 0.4(reading for KT2)] / 1.1

An action/event plan will be required to clearly define the responsibilities of the various parties in the event of an exceedance of a specified level (*Table 5.4a*).

The Zinc Trigger, Action and Target levels and a Zinc action plan should be established after the completion of the baseline Zinc analysis and should be agreed with EPD but should be based on the approach for SS.

5.2 *OPERATIONAL PHASE*

The requirement for post-project operational monitoring will be determined by the TEL 3 Sedimentation Study, which is currently ongoing. In addition, the findings of the EPD's Deep Bay Water Quality Management (DBWQM) Study may lead to recommendations for operational monitoring. The need for this will be determined upon finalisation of the DBWQM study.

5.3 *RECORDING OF MONITORING DATA*

The results of all water quality monitoring shall be provided to the Project Proponent/Engineer by the Environmental Team, in an agreed format, no later than 48 hours after sampling.

Project Proponent/Engineer shall provide a monthly EM&A progress report compiled by the Environmental Team, in an agreed format to the EPD, as detailed in *Section 9.3*. These will include the results of all water quality monitoring data obtained. In the event of any exceedance of WQOs recorded during the course of the Works, remedial actions adopted in order to restore water quality to a level compliant with the WQOs should be recorded and included in the progress report. In addition, as detailed in *Section 9.4*, the IEnvC will submit a brief monthly report to the EPD, independently reporting on the performance of the Environmental Team and commenting on the monthly EM&A report.

5.4 *MITIGATION IN THE EVENT OF AN EXCEEDANCE OF TRIGGER/ACTION/TARGET (TAT) LEVELS*

In the event of an exceedance of any one of the TAT levels as defined in *Section 5.1.7*, a review of dredging practice should be carried out by the Contractor. This may include a combination of the following:

a) a review of working methods and practices; and

b) inspection and maintenance or replacement of any marine plant or equipment contributing to the deterioration; and

The Project Engineer shall also review the overall due-diligence management practices by the dredging Contractor. A record of actions taken should be kept and made available for inspection by EPD, and the IEnvC in their role as EM&A

auditor detailed in *Section 4*.

An action/event plan which outlines details of appropriate responsibilities by relevant parties in the event of exceedance of the recommended level is given in *Table 5.4a*.

Table 5.4a *Action/Event Plan for Water Quality* *

Exceedance	Environmental Team (Environmental Consultant & Laboratory/Environmental Contractor)	Contractor	Engineer's Representative (ER)
Trigger level being exceeded by one sampling day	Inform Contractor and Independent Environmental Checker	Rectify unacceptable practice.	
Trigger level being exceeded by more than two consecutive sampling days	Repeat *in-situ* measurement to confirm findings; Identify source(s) of impact; Inform Contractor and Independent Environmental Checker; Check monitoring data, all plant, equipment and Contractor's working methods; Discuss mitigation measures with the ER and Contractor.	Inform the Engineer; Rectify unacceptable practice; Check all plant and equipment; Consider changes to working methods; Propose mitigation measures to ER and discuss with Environmental Team and the ER; Implement mitigation measures.	Discuss with Environmental Team and the Contractor on the proposed mitigation measures; Make agreement on the mitigation measures to be implemented; Assess the effectiveness of the implemented mitigation measures; EPD shall be informed by a report, summarizing monitoring data, implemented mitigation measures, and the proposed actions to avoid further occurrence.

Exceedance	Environmental Team (Environmental Consultant & Laboratory/Environmental Contractor)	Contractor	Engineer's Representative (ER)
Action level being exceeded by one sampling day	Repeat *in-situ* measurement to confirm findings; Identify source(s) of impact; Inform Contractor and Independent Environmental Checker; Check monitoring data, all plant, equipment and Contractor's working methods; Discuss mitigation measures with the ER and Contractor; Repeat measurement on the next day of exceedance.	Inform the Engineer and confirm notification of exceedance in writing; Rectify unacceptable practice; Check all plant and equipment; Consider changes of working methods; Propose mitigation measures to ER and discuss with Environmental Team and the ER; Implement the agreed mitigation measures.	Discuss with Environmental Team and the Contractor on the proposed mitigation measures; Reach agreement on the mitigation measures to be implemented; Assess the effectiveness of the implemented mitigation measures.
Action level being exceeded by more than two consecutive sampling days	Repeat *in-situ* measurement to confirm findings; Inform Contractor and Independent Environmental Checker; Check monitoring data, all plant, equipment and Contractor's working methods; Discuss mitigation measures with the ER and Contractor; Ensure mitigation measures are implemented; Prepare to increase the monitoring frequency to daily; Repeat measurement on the next day of exceedance.	Inform the Engineer and ER and confirm notification of exceedance in writing; Rectify unacceptable practice; Check all plant and equipment; Consider changes of working methods; Propose mitigation measures to ER within 3 working days upon the notification and discuss with Environmental Team and the ER; Implement the agreed mitigation measures;	Discuss with Environmental Team and the Contractor on the proposed mitigation measures; Reach agreement on the mitigation measures to be implemented; Assess the effectiveness of the implemented mitigation measures; EPD shall be informed by a report, summarizing monitoring data, implemented mitigation measures, and the proposed actions to avoid further occurrence.

Exceedance	Environmental Team (Environmental Consultant & Laboratory/Environmental Contractor)	Contractor	Engineer's Representative (ER)
Target level being exceeded	Repeat *in-situ* measurement to confirm findings; Identify source(s) of impact; Inform Contractor and Independent Environmental Checker; Check monitoring data, all plant, equipment and Contractor's working methods; Discuss mitigation measures with the Engineer and Contractor; Ensure mitigation measures are implemented; Increase the monitoring frequency to daily until no exceedance of Target level for two consecutive days.	Inform the Engineer and ER and confirm notification of exceedance in writing; Rectify unacceptable practice; Check all plant and equipment; Review critically the working methods; Propose mitigation measures to ER within 3 working days upon the notification and discuss with Environmental Team and the ER; Implement the agreed mitigation measures; As directed by the Engineer, to slow down or to STOP all or part of the marine work.	Discuss with Environmental Team and the Contractor on the proposed mitigation measures; Request Contractor to critically review the working methods; Reach agreement on the mitigation measures to be implemented; Assess the effectiveness of the implemented mitigation measures; Consider and instruct, if necessary, the Contractor to slow down or to STOP the backfilling operation until no exceedance of Target level; EPD shall be informed by a report, summarizing monitoring data, implemented mitigation measures, and the proposed actions to avoid further occurrence.

* In the event that a TAT level exceedance occurs the Independent Environmental Checker shall also be informed, such that they can independently audit the implementation of the action/event plan.

6 CONSTRUCTION NOISE MONITORING

This section presents the noise monitoring requirements for the construction phase of the MDC and the VFPW. The requirements are specified for each sub-project of the MDC, namely, 43CD, 29CD and 22CD. The VFPW project considered here is 30CD Stage 1.

EM&A requirements for 60CD are not described in this Environmental Schedule as the construction works are nearing completion and have been monitored in accordance with the Deep Bay Guidelines.

6.1 OBJECTIVES

The objectives of noise monitoring include the following:

- to establish the pre-existing baseline noise climate at NSRs, against which any short or long term noise impacts can be judged;
- to provide an early indication if any of the noise mitigation measures specified for the construction phase are failing to achieve the acceptable standards; and
- to provide data to enable an environmental audit of the construction of the project.

6.2 METHODOLOGY

Construction noise levels would be determined by carrying out measurements at the specified monitoring locations. Noise measurements will be made in terms of the A-weighted equivalent continuous sound pressure level (L_{Aeq}) measured with an integrating sound level meter set to "fast" response.

6.2.1 *Monitoring Equipment*

Prior to the commencement of the construction works, a calibrated sound level meter with appropriate calibrator should be supplied to the site. The meter should comply with the *International Electrotechnical Commission Publication* (IEC) 651:1979 (Type 1) and 804:1985 (Type 1) specification as referred to in the *Technical Memorandum to the Noise Control Ordinance*. The calibrator for routine calibration checking on site should comply with the IEC 651:1979 and 804:1985 Type 1 calibrator requirements.

The sound level meter should be equipped and operated with the manufacturers recommended wind shield, and a suitable tripod. The calibrator and the meter should be kept in good state of repair in accordance with the manufacturers recommendations.

6.2.2 *Calibration Requirement*

Immediately prior to and following each measurement, the sound level meter

should be calibrated in accordance with the IEC 651:1979 (Type 1) and 804:1985 (Type 1) specification as referred to in the *Technical Memorandum to the Noise Control Ordinance*. The measurements should be discarded if the calibrations before and after do not agree to within 1 dB(A), then repeated until the calibrations before and after agree to within 1 dB(A).

6.2.3 *Positioning of Sound Level Meter*

Where a measurement is to be carried out at a building, the assessment point would normally be at a position 1m from the exterior of the building façade. Where a measurement is to be made for noise being received at a place other than a building, the assessment point would be at a position 1.2m above the ground in a free-field situation ie at least 3.5m away from reflective surfaces such as adjacent buildings or walls.

6.2.4 *Data Collection*

The following procedures should be adopted for all noise monitoring, either of baseline noise levels or of construction noise.

- measurements should be recorded to the nearest 0.1 dB, with values of 0.05 being rounded up.
- weather conditions, including a measurement of wind speed, should be recorded for the measurement. Where the steady wind speed exceeds 5m/s, or gusts are above 10m/s, or in the presence of fog or rain, measurements should be treated as invalid, and repeated in more appropriate conditions.
- noise level should be measured at 1 m from the most affected external façade of the nearby noise sensitive receivers over a 30 minute period.
- when noise measurements are taken inside a school during the school examination periods, liaison with the schools and the Examination Authority shall be maintained to ascertain the exact dates and times of all examination periods during the course of the drainage works.
- noise monitoring data should be recorded in a format as given in *Annex A*.

6.3 *MONITORING LOCATIONS*

Noise levels should be measured at a position 1m away from the building façade of the selected NSR where noise monitoring is required, and at a height above ground that has the clearest view of the area of construction activity. Care should be taken to cause minimal disturbance to the inhabitants during monitoring. The measurement location should be photographed and carefully noted in a log for future reference purpose.

6.3.1 *Baseline Monitoring*

Baseline ambient noise levels should be measured on a weekday and on a Sunday, over full continuous 24 hour periods, at each monitoring location prior to the commissioning of the construction work for a period of at least 2 weeks. There should not be any construction works under this project or unusual activities in the vicinity of the stations during monitoring. Measurements of the

L_{Aeq}, L_{A90} and L_{A10} noise levels shall be made, over 30 minute periods, for the whole of the 24 hour survey. Baseline monitoring stations are given in *Table 6.3a*.

Table 6.3a ***Baseline, Impact and Compliance Monitoring Stations for Different Phases of MDC and VFPW***

Sub-project	Noise Sensitive Receiver Number and Name		Reference Figure	ASR	Baseline Station
43CD of MDC					
	3	Ko Po Tsuen	6.3b	A	
	6	Kam Hing Wai	6.3b	A	✓
	10	Kam Tin San Tsuen	6.3b	A	
29CD of MDC					
Phase 1	1	Yau Mei San Tsuen	6.3c	B	✓
	2	Chuk Hing Martin Kindergarten	6.3c	B	
	3	Man Yuen Chuen	6.3c	A	
	7	Wong Chan Sook Ying Memorial School	6.3c	A	✓
Phase 2	17	Scattered Dwellings by Tam Mi Camp	6.3c	A	✓
	19	Yau Tam Mei North	6.3c	A	
	21	Scattered Dwelling by Footbridge D	6.3c	A	
22CD of MDC					
Phase 1	1	Ko Po San Tsuen	6.3d	A	✓
	3	Kat Hing Wai	6.3d	A	
	5	Tsz Tong Tsuen	6.3d	A	
	6	Shek Wu Tong	6.3d	A	
	8	Yuen Kong San Tsuen	6.3d	A	
	9	Tai Kek	6.3d	A	
Phase 2	16	Cheung Kong Tsuen	6.3e	A	✓
	20	Scattered Dwellings North of MDC	6.3e	A	
	23	Leung Uk Tsuen	6.3e	A	
	26	Yau Uk Tsuen	6.3e	A	
	27	Scattered Dwellings North of MDC	6.3e	A	
Phase 3	4	Ng Ka Tsuen	6.3f	A	✓
	30	Kam Tsin Wai	6.3f	A	
	32	Tin Sam San Tsuen	6.3f	A	
	36	Chung Sum Tsuen	6.3f	A	
	38	Uk Tau Tsuen	6.3f	A	
	39	Sheung Tsuen	6.3f	A	
Phase 4, Western Channel	40	Ma Tin Tsuen	6.3g	A	

Sub-project	Noise Sensitive Receiver Number and Name		Reference Figure	ASR	Baseline Station
	42	Tin Liu Tsuen	6.3g	A	
	43	Lung Tin Tsuen	6.3g	A	✓
Phase 4, Eastern Channel	46	Fraser Village	6.3g	A	
	43	Lung Tin Tsuen	6.3g	A	
	49	Muk Kiu Tau Tsuen	6.3g	A	✓
	50	Shui Tsiu San Tsuen	6.3g	A	
	52	Wong Nai Tsuen	6.3g	A	
30CD Stage 1, VFPW	1	Pok Wai	6.3h	B	
	1	Sha Po Tsuen	6.3i	B	
	1	Chuk Yuen Tsuen	6.3j	B	
	4	San Wai Tsuen	6.3j	B	
	1	Mai Po Lo Wai	6.3k	A	✓

6.3.2 *Impact Monitoring*

Table 6.3a specifies all the impact monitoring stations (baseline monitoring stations are marked with ticks). Monitoring of $L_{Aeq(30min)}$ noise levels should be carried out at the monitoring stations on two occasions every week, during normal construction working hours (0700-1900 Monday to Saturday).

In addition, monitoring will be required at all stations if any construction activity is to be carried out during restricted hours except Wong Chan Sook Ying Memorial School near 29CD of MDC. The school is considered to be non-noise sensitive during the restricted hours. Noise levels of $L_{Aeq(5min)}$ should be measured at these monitoring stations, for three consecutive 5 minute periods, in each restricted period and twice a week. The restricted periods are daytime on Sundays and holidays only, evening or nighttime at all days.

Furthermore, monitoring at Wong Chan Sook Ying Memorial School will be required during examination periods to ensure the recommended noise criteria of $L_{Aeq(30\ min)}$ 65 dB is not exceeded. In this case noise levels of $L_{Aeq(5min)}$ should be measured for six consecutive 5 minute periods on every day that an examination is held.

The monitoring may trigger action as specified in *Section 6.4* to ensure that the noise criteria listed in *Table 6.3b* are not exceeded.

6.3.3 *Action Plan*

In case of non-compliance with the recommended noise level, more frequent noise monitoring as specified in the action/event plan (*Table 6.4a)* .should be carried out. This additional monitoring should be continued until the recorded noise levels are rectified.

Compliance Check against TAT Levels

The noise monitoring data should be checked against the trigger/action/target levels as agreed with EPD and as defined below:

The *trigger* and *action* levels for construction noise monitoring are based on monitored levels as well as complaints that might have been received from the local NSRs, as follows:

- *Trigger* level - Receipt of a single documented complaint of construction noise level.

- *Action* level - Receipt of more than one documented complaint of construction noise in any two week period on the same event or at the same location.

The *target levels* for construction noise, measured at the façade of the NSRs, are given in *Table 6.3b*.

Table 6.3b ***Construction Noise Target Levels***

Time Period	Target Level dB(A)
Daytime (0700 to 1900 hours) on normal weekdays, eg Monday through Saturday excluding Public Holidays	$L_{Aeq(30\ min)}$ 75 $L_{Aeq(30\ min)}$ 70 for schools and 65 during examination periods
Daytime on holidays; and 1900 to 2300 hours on all other days	$L_{Aeq(5\ min)}$ 60 for ASR A $L_{Aeq(5\ min)}$ 65 for ASR B Not applied to schools
All night time periods (2300 to 0700 hours)	$L_{Aeq(5\ min)}$ 45 for ASR A $L_{Aeq(5\ min)}$ 50 for ASR B Not applied to schools

6.4 EVENT/ACTION PLAN

An action plan which outlines details of appropriate responsibilities by relevant parties in the event of exceedance of the recommended trigger/action/target levels is given in *Table 6.4a*.

Table 6.4a *Event & Action Plan for Noise Monitoring* *

Event	Actions		
	Environmental Team Leader	Engineer's Representative (ER)	Contractor
Trigger			
When a complaint is received	• Notify Contractor and Independent Environmental Checker • Conduct Measurement • Investigation noisy operations		
Action Limit			
When more than one compliant are received received within 2 weeks on the same event or at the same location	• Notify Contractor and Independent Environmental Checker • Analyse investigation • Require Contractor to propose measures for the analysed noise problem • Increase monitoring frequency to check mitigation effectiveness		• Submit noise mitigation proposals to Environmental Team Leader/Engineer's Representative • Implement noise mitigation propsals
Target Limit			
Non-statutory – 75* dB(A) exceeded between 0700-1900 hrs on normal weekdays; Statutory - 60/65/70** dB(A) exceeded between 0700-2300 hrs on holidays and 1900-2300 hrs on all Statutory other days; 45/50/55** dB(A) exceeded between 2300-0700 hrs of next day	• Notify Contractor and Independent Environmental Checker • Notify EPD' • Require contractor to implement mitigation measures increase monitoring frequency to check mitigation effectiveness		• Implement mitigation measures. Prove to Environmental Team Leader • Prove to Environmental Team Leader/ER effectiveness of measures applied

* reduce to 70dB(A) for schools and 65dB(A) during school examination periods.
** to be selected based on Area Sensitivity Rating
' only applicable to projects of significant scale.

* In the event that a TAT level exceedance occurs the Independent Environmental Checker shall also be informed, such that they can independently audit the implementation of the action/event plan.

6.5 *RECORDING OF MONITORING DATA*

The results of all noise monitoring shall be provided to the Project Proponent/Engineer by the Environmental Team, in an agreed format, no later than 24 hours after the monitoring event. The Project Proponent/Engineer shall provide a monthly EM&A progress report compiled by the Environmental Team, in an agreed format to the EPD, as detailed in *Section 9.3*. This will include all noise monitoring data obtained. In the event of any exceedance of the NCO recorded during the course of the Works, or any complaints are received,

remedial actions adopted in order to restore noise environment to a level compliant with the NCOs should be recorded and included in the progress report. In addition, as detailed in *Section 9.4*, the Independent Environmental Checker will submit a brief monthly report to the EPD, independently reporting on the performance of the Environmental Team and commenting on the monthly EM&A report.

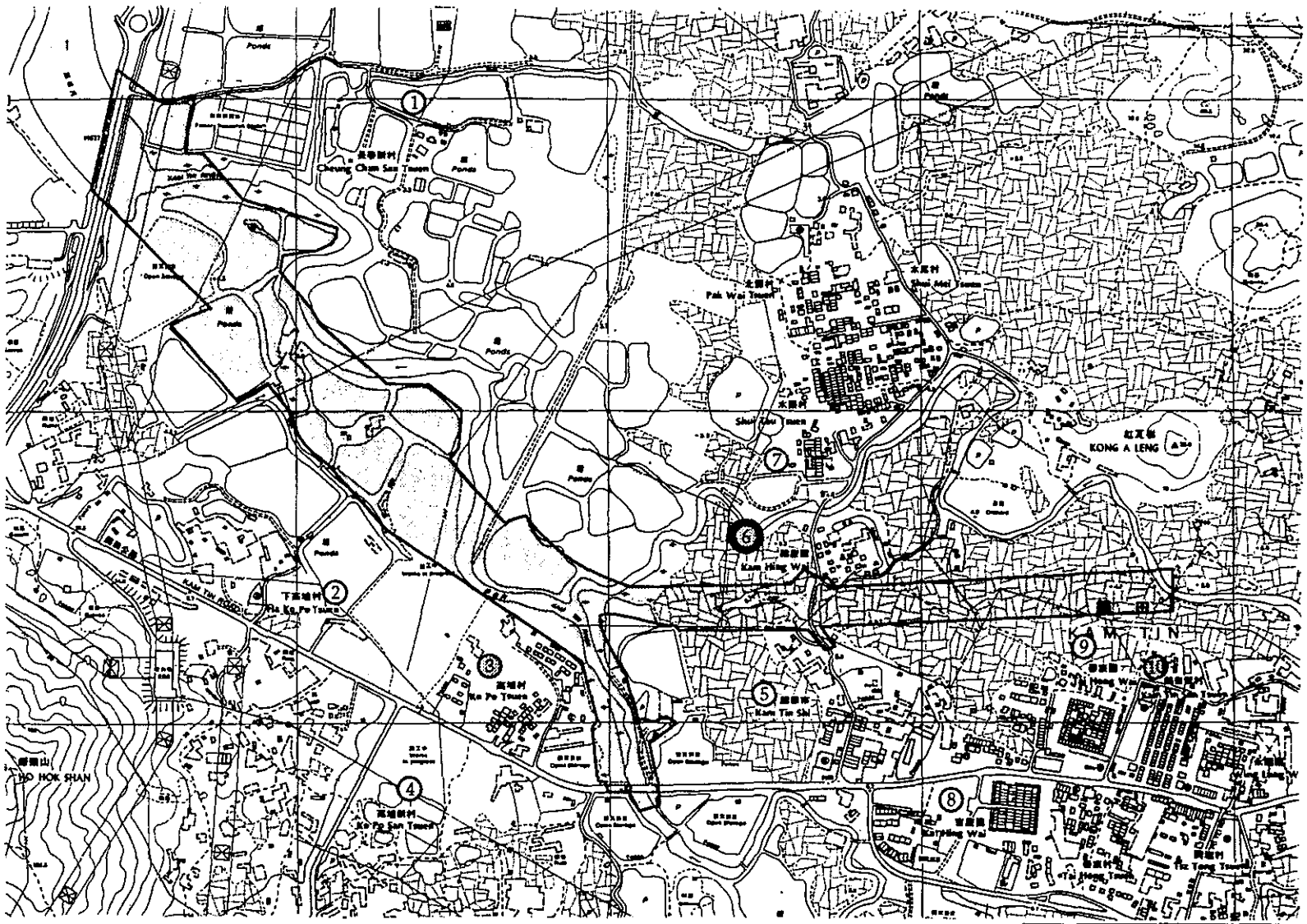

FIGURE 6.3a - NOISE MONITORING LOCATIONS NEAR 43CD OF MDC WORKS

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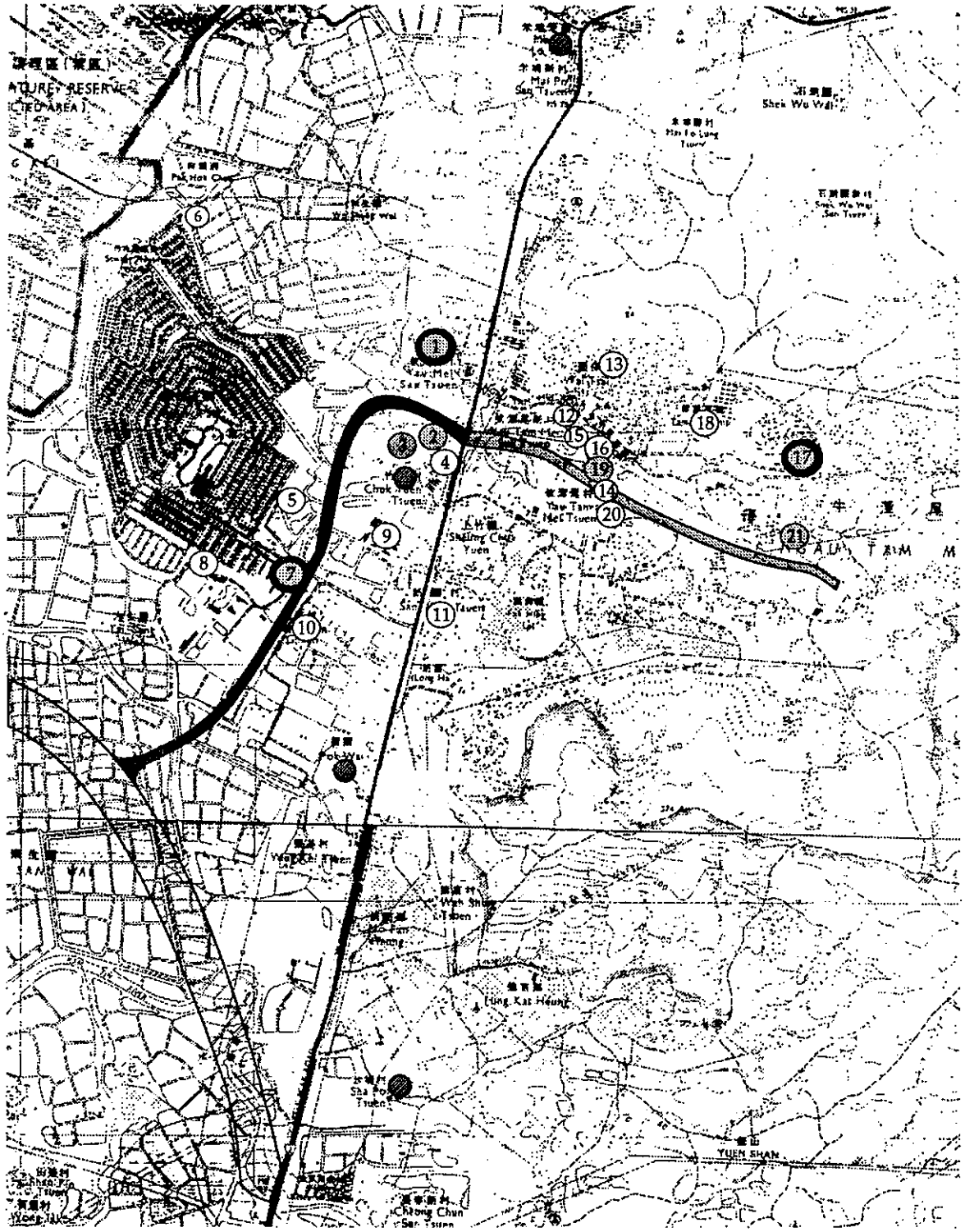

FIGURE 6.3b - NOISE MONITORING LOCATIONS NEAR 29CD OF MDC WORKS

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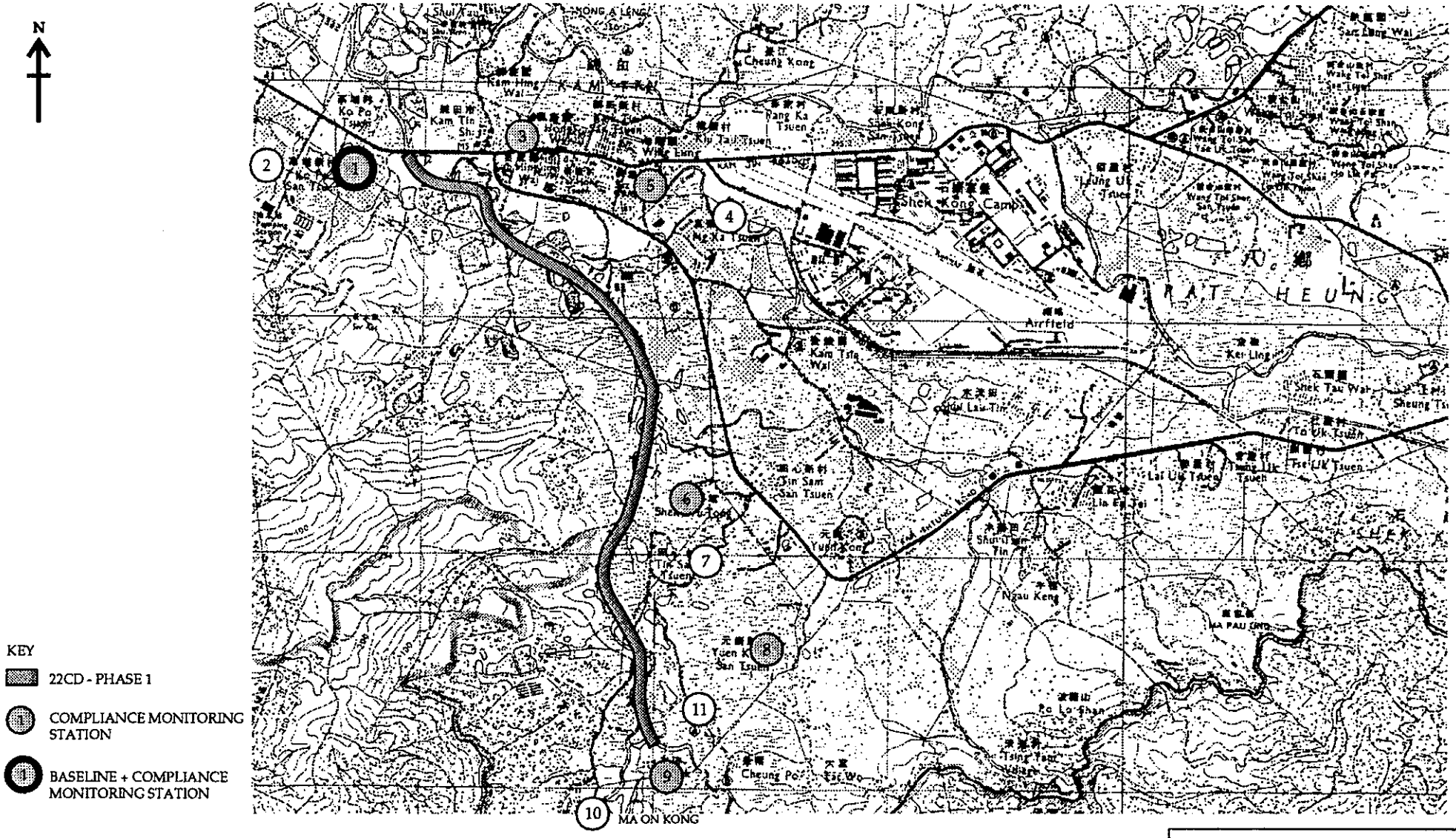

FIGURE 6.3c - NOISE MONITORING LOCATIONS NEAR 22CD (PHASE 1) OF MDC WORKS

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Hong Kong

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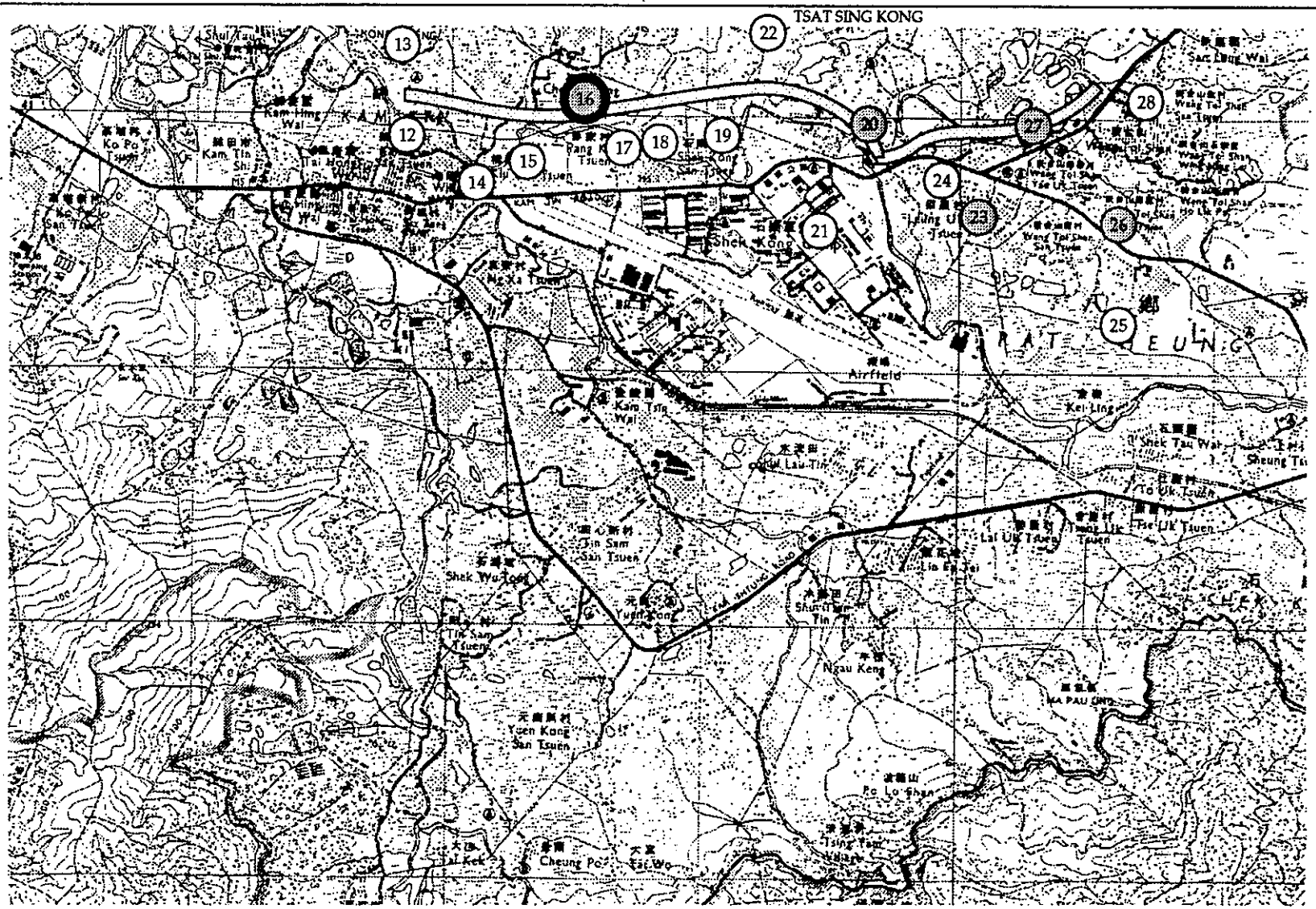

FIGURE 6.3d - NOISE MONITORING LOCATIONS NEAR 22CD (PHASE 2) OF MDC WORKS

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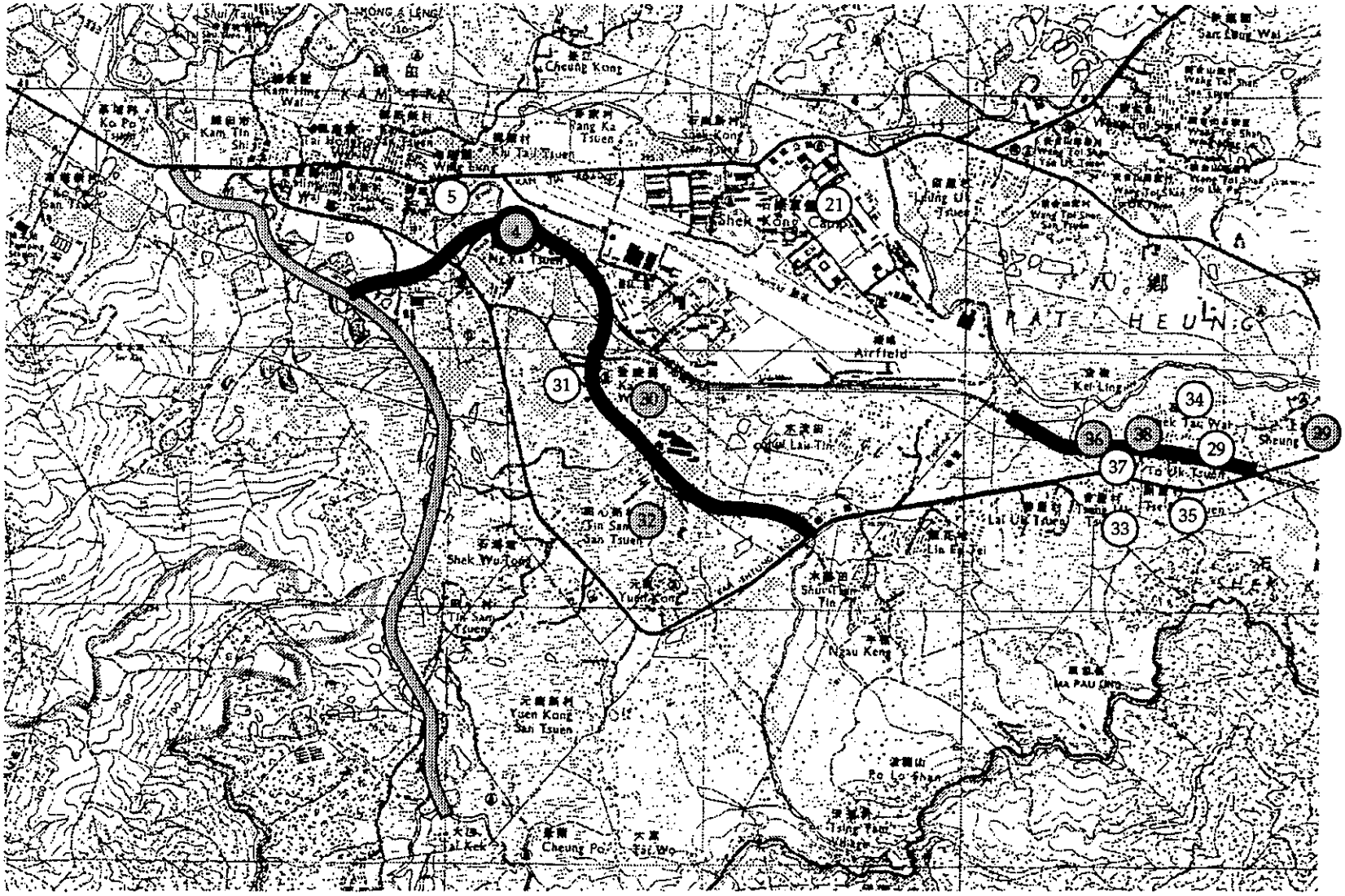

FIGURE 6.3e - NOISE MONITORING LOCATIONS NEAR 22CD (PHASE 3) OF MDC WORKS

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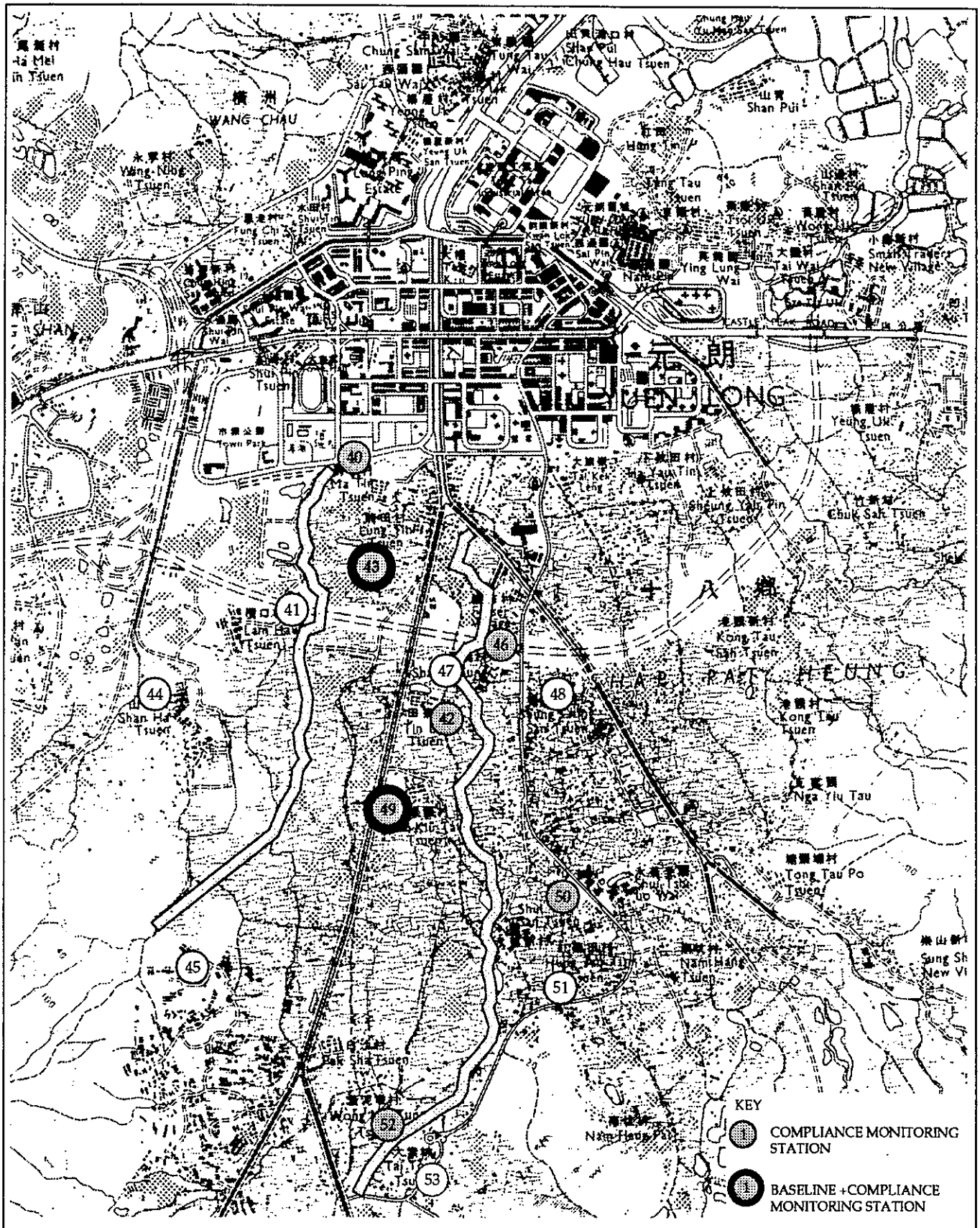

FIGURE 6.3f - NOISE MONITORING LOCATIONS NEAR 22CD (PHASE 4) MDC WORKS

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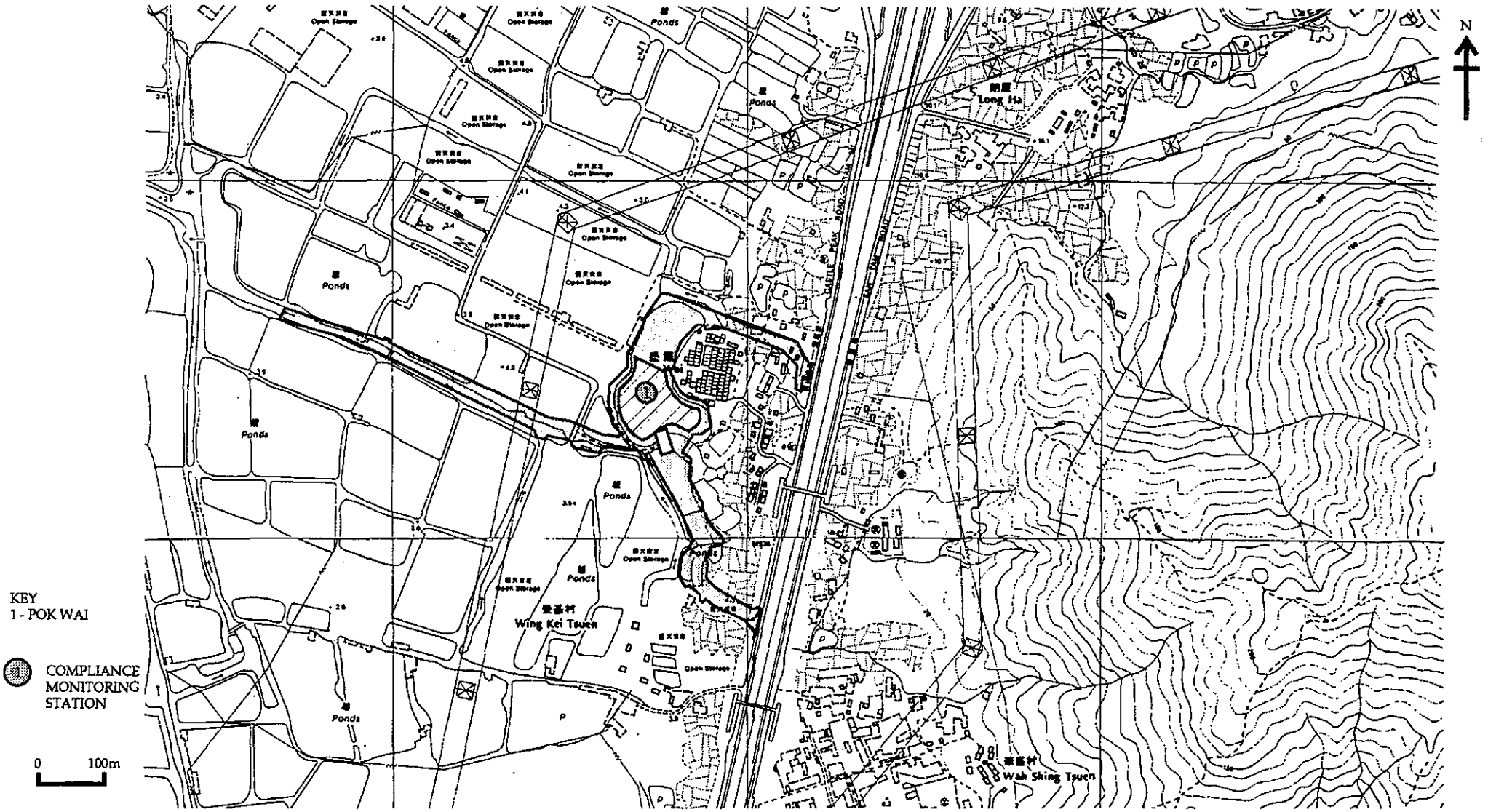

FIGURE 6.3g - NOISE MONITORING LOCATION NEAR 30CD STAGE 1 OF VFPW,PO WAI

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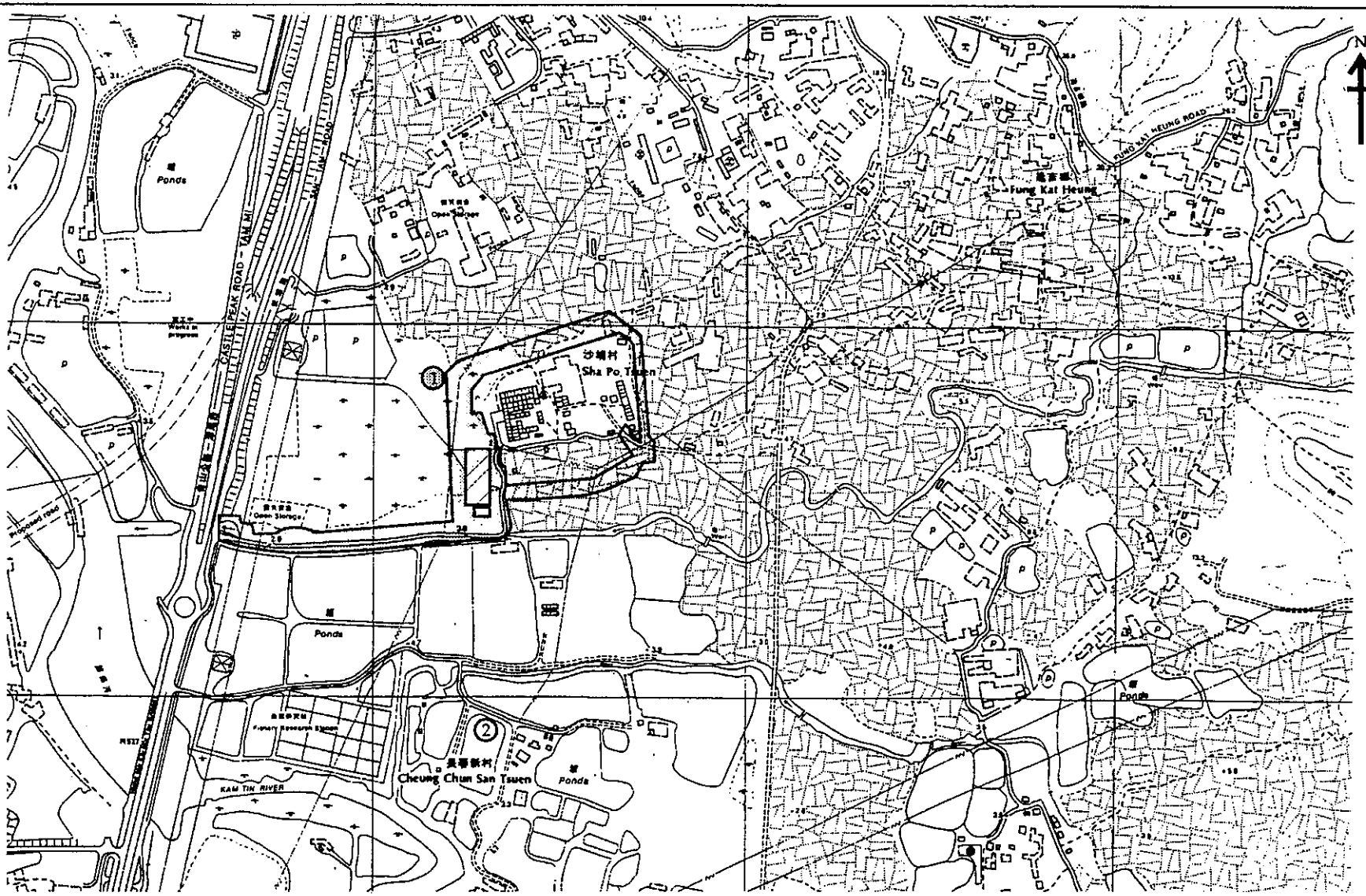

KEY
1 - SHA PO TSUEN
2 - CHEUNG CHUN SAN TSUEN

(1) COMPLIANCE MONITORING STATION

0 100m

FLOOD STORAGE POND

FLOOD PUMPING STATION

FIGURE 6.3h - NOISE MONITORING LOCATION NEAR 30CD STAGE 1 OF VFPW, SHA PO TSUEN

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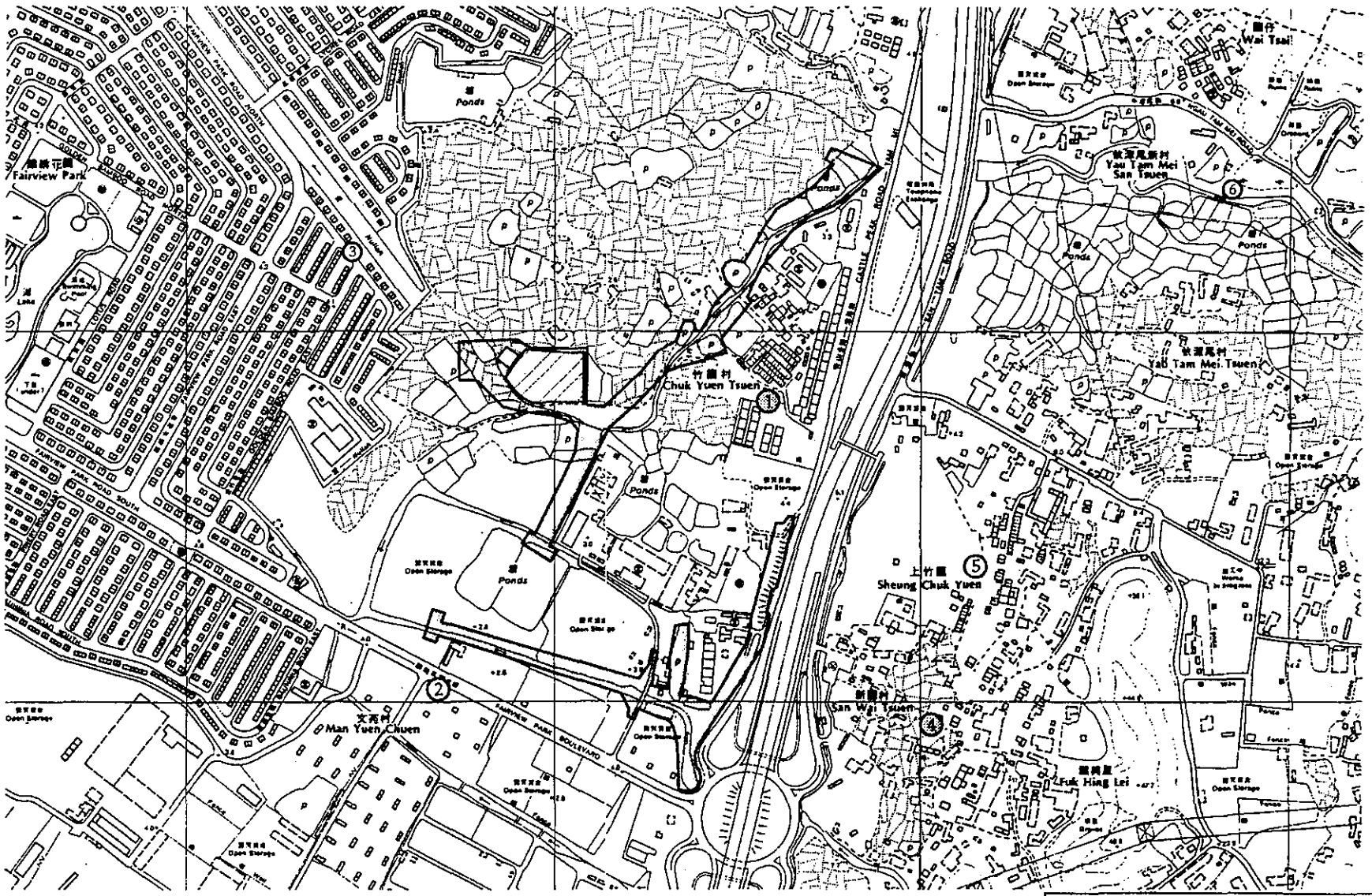

KEY
1 - CHUK YUEN TSUEN
2 - MAN YUEN TSUEN
3 - FAIRVIEW PARK
4 - SAN WAI TSUEN
5 - SHEUNG CHUK YUEN
6 - YAU TAM MEI TSUEN

(1) COMPLIANCE MONITORING STATION

FLOOD STORAGE POND

FLOOD PUMPING STATION

FIGURE 6.3i - NOISE MONITORING LOCATIONS NEAR 30CD STAGE 1 OF VFPW, CHUK YUEN TSUEN / SAN WAI TSUEN

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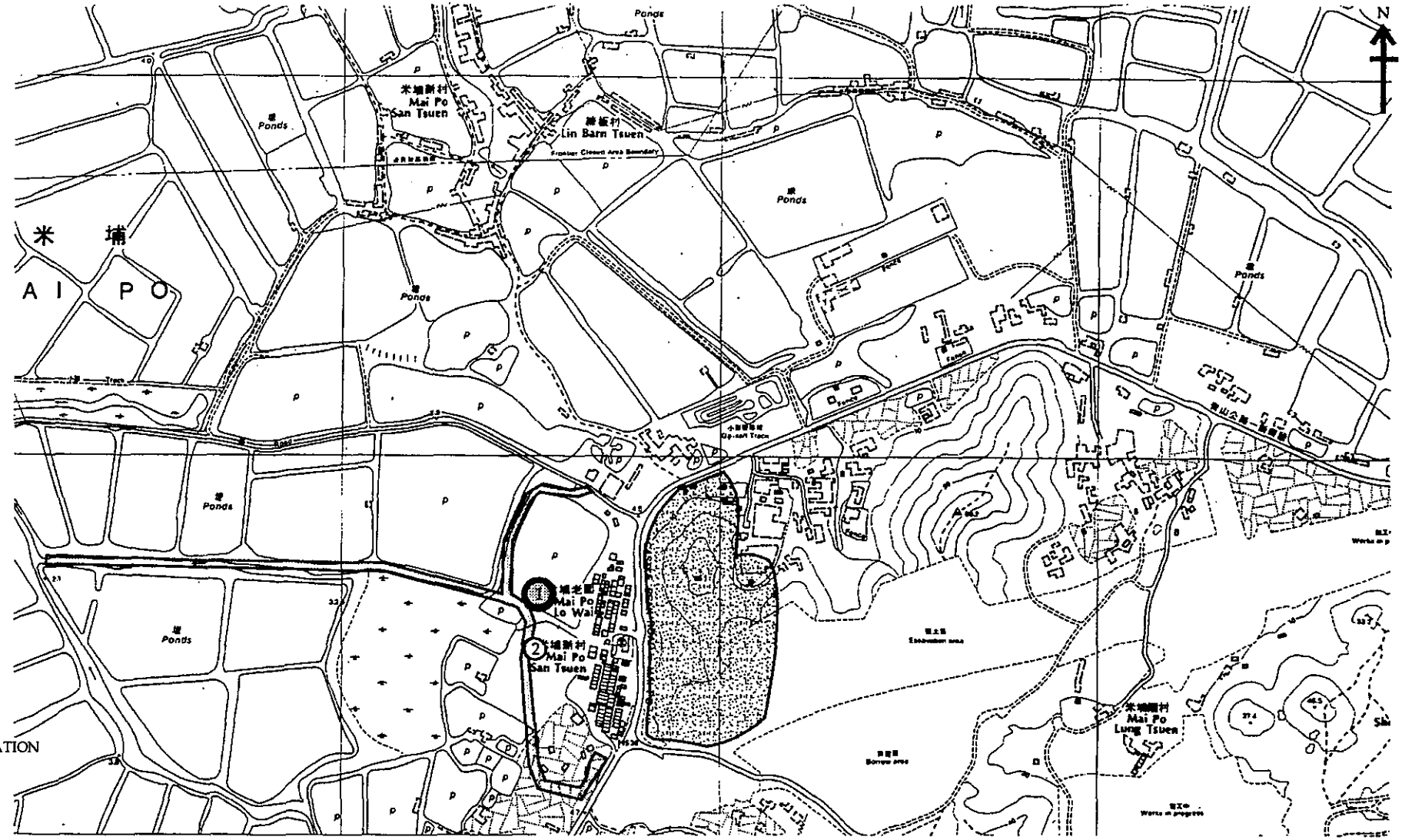

FIGURE 6.3j - NOISE MONITORING LOCATION NEAR 30CD STAGE 1 OF VFPW, MAI PO LO WAI

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7 AIR QUALITY MONITORING

This section presents the air quality monitoring requirements during the construction phase of MDC. Total suspended particulates (TSP) is the major pollutant and is recommended to be monitored.

7.1 OBJECTIVES

The objectives of TSP monitoring are to determinate:

- the extent of construction dust impacts on sensitive receivers;
- the effectiveness of dust suppression measures; and
- the need of further mitigation measures.

7.2 METHODOLOGY

Air quality monitoring would be conducted at specified monitoring stations. Measurements will be made in terms of the TSP.

7.2.1 *Monitoring Equipment*

TSP levels should be measured by High Volume Sampler (HVS) using a standard high volume sampling method as set out in the Title 40 of the Code of Federal Regulation, Chapter 1 (Part 50). The HVS should be in compliance with the specifications as follows:

- 0.6 - 1.7 m^3/min (20-60 SCFM) adjustable flow range;
- equipped with a timing/control device with 5 minutes accuracy over 24 hours operations;
- installed with elapsed-time meter with 2 minutes accuracy over 24 hours operations;
- capable of providing a minimum exposed area of 406 cm^2 (63 in^2);
- flow control accuracy: 2.5 % deviation over 24-hr sampling period;
- equipped with shelter to protect the filter and sampler;
- incorporated with an electronic mass flow rate controller or other equivalent devices;
- equipped with a flow recorder for continuous monitoring;
- provided with peaked roof inlet;
- incorporated with manometer;
- able to hold and seal the filter paper to the sampler housing at horizontal position;

- easy to change filter; and
- capable of operating continuously for 24-hr period.

A direct reading dust meter capable of achieving results comparable to a HVS for 1-hr sampling in the range of 0.1-100 mg/m^3 should also be used as an alternative provided that the instrument is to be calibrated against a traceable primary standard at regular intervals.

A sufficient number of HVS with an appropriate calibration kit should be provided for the baseline monitoring, regular impact monitoring, and *ad hoc* monitoring for the 24-hr and 1-hr measurements of the identified monitoring stations.

The HVS should be equipped with an electronics flow controller and be calibrated against a traceable standard at regular intervals.

All the equipment, calibration kits, filter papers, etc should be clearly labelled. The HVSs should be constructed so as to be transferable between monitoring stations.

The HVSs should be properly maintained and calibrated. Prior to dust monitoring, appropriate checks should be made to ensure that all equipment and necessary power supply are in good condition.

7.2.2 *Calibration Requirement*

Initial calibration of monitoring equipment should be conducted upon installation and thereafter at bimonthly intervals. The transfer standard should be traceable to the internationally recognised primary standard and be calibrated annually. The calibration data should be properly documented for future reference. All the data should be converted into standard temperature and pressure condition.

7.2.3 *Positioning of HVS*

When positioning the HVSs, the following points should be observed:

- a horizontal platform with appropriate support to secure the HVS against gusty wind, should be provided.
- no two HVSs should be placed less than 2 m apart.
- horizontal distance between the HVSs and an obstacle, such as buildings, must be at least twice the height of the obstacle protruding above the HVSs.
- a minimum separation of 2 m should be provided from walls, parapets, and penthouses for rooftop HVSs.
- a minimum separation of 2 m should be provided from any supporting structure measured horizontally.
- there should not be any furnace or incinerator flues nearby.
- there should be unrestricted airflow around the HVS.

- a minimum separation of 20 m should be provided from the dripline.
- any wire fence and gate employed to protect the HVS should not cause any obstruction during monitoring.

7.2.4 *Data Collection*

Monitoring results should be recorded in the monitoring record sheet. New sheet should be used per sampling occasion.

The flow-rate of the HVS before and after the monitoring, with the filter in position, should be verified to be constant and be recorded down in the monitoring record sheet.

7.2.5 *Laboratory Measurement Requirements*

Sample analysis and equipment calibration and maintenance should be carried out in a clean laboratory with constant temperature and humidity control. Measuring and conditioning instrument should be provided to handle the dust samples.

The filter paper, measuring 8" x 10", should be labelled before sampling, pre-dried in a clean oven for over 24-hr and pre-weighted before use for the sampling. After sampling, the dust laden filter paper should be folded lengthwise at the middle with the exposed side in. The filter paper should be kept in a clean and tightly sealed plastic bag and returned to the laboratory for analysis.

In the laboratory, the filter paper should be reconditioned in a controlled chamber and weighted with a balance with a readout down to 0.1 mg. The balance should be regularly calibrated against a traceable standard. Temperature between 15°C and 30°C with less than ±3°C variation and relative humidity less than 50% within ±5% variation should be maintained in the controlled chamber.

Additional conditioned and weighted filter papers should be ready for immediate use whenever necessary.

7.3 *MONITORING LOCATIONS*

Dust monitoring stations should be set up and equipped with basic requirements such as continuous stable supply, security set up, and laboratory support before the commissioning of baseline monitoring. The monitoring stations listed in *Table 7.3a* below have been selected for both baseline and impact TSP monitoring for different contract.

Table 7.3a *Locations of Monitoring Stations*

Contract	Stage	Monitoring Station
43CD		Ko Po Tsuen
30CD (VFPW)	Near Pok Wai	Pok Wai
	Near Sha Po Tsuen	Sha Po Tsuen
	Near Chuk Yuen Tsuen	Chuk Yuen Tsuen
	Near Mai Po Lo Wai	Mai Po Lo Wai
29CD	Phase 1	Man Yuen Chuen
	Phase 2	Yau Tam Mei Tsuen
22CD	Phase 1	Shek Wu Tong
	Phase 2	Tsing Sing Kong
	Phase 3	Kam Tsui Wai
	Phase 4	
	-Western Channel	Tin Liu Tsuen
	- Eastern Channel	Shui Tsui San Tsuen

7.4 BASELINE MONITORING

Ambient TSP levels should be measured at the air monitoring station for at least two weeks prior to the construction works. The following parameters and frequencies should be monitored at the station:

- 24-hr TSP samples taken daily; and
- 1-hr TSP samples taken at least three times per day, which should be taken when the highest dust impact is expected. (The highest dust impact is to be predicted based on the types of works scheduled to be carried out in the works programme.)

During baseline monitoring, there should be not be any dust generating construction activities under this project in the vicinity of the stations.

7.5 IMPACT MONITORING

Regular 24-hr TSP monitoring should be conducted once every six days at the monitoring stations. In case of non-compliance with the TSP criteria, more frequent monitoring exercise should be conducted.
1-hr TSP sampling should be taken 3 times for every 6 days at the highest dust impact occasion.

The specific time to start and stop the 24-hr TSP monitoring should be clearly defined for each locations and be strictly followed by the operator. Dust monitoring data should be recorded in a format as given in *Annex A*.

7.6 COMPLIANCE CHECK

The air quality monitoring data should be checked against the trigger/action/target (TAT) levels as listed in *Table 7.6a*.

Table 7.6a *TAT Level for Air Quality Monitoring*

Level	TSP level in $\mu g/m^3$
Trigger	30% above baseline
Action	Average value of the trigger and target levels
Target	1-hr TSP : 500 $\mu g/m^3$ 24-hr TSP: 260 $\mu g/m^3$

7.7 COMPLIANCE MONITORING

In case of non-compliance with the dust criteria, more frequent monitoring, as specified in the Action/Event Plan (*Table 7.9a*), should be conducted within 24 hours. This additional monitoring should be continued until the excessive dust emissions or the deterioration of air quality is rectified.

7.8 RECORDING OF MONITORING DATA

The results of all air quality monitoring shall be provided to the Project Proponent/Engineer by the Environmental Team, in an agreed format, no later than 24 hours after the monitoring event. The Project Proponent/Engineer shall provide a monthly EM&A progress report compiled by the Environmental Team, in an agreed format to the EPD, as detailed in *Section 9.3*. This will include all air quality monitoring data obtained. In the event of any exceedance of the AQOs recorded during the course of the Works, remedial actions adopted in order to restore air quality to a level compliant with the AQOs should be recorded and included in the progress report. In addition, as detailed in *Section 9.4*, the Independent Environmental Checker will submit a brief monthly report to the EPD, independently reporting on the performance of the Environmental Team and commenting on the monthly EM&A report.

7.9 ACTION PLAN

An outline event/action plan which outlines details of appropriate responsibilities by relevant parties in the event of exceedance of the recommended level is given in *Table 7.9a*.

Table 7.9a *Event/Action Plan for Air Quality Monitoring* *

Event	Actions		
	Environmental Team Leader	Engineer's Representative (ER)	Contractor
Trigger Limit			
Exceedance for one sample	• Identify sources • Inform ER and IEnvC • Repeat measurement to confirm finding	• Notify contractor • Check monitoring data and Contractor's working methods	• Rectify any unacceptable practices
Exceedance for two or more consecutive samples	• Identify source • Inform ER and IEnvC • Repeat measurement to confirm findings • Increase monitoring frequency • Discuss with ER for remedial actions required • If remedies required, contact ER to make arrangement. • If problem is short term, continue monitoring • If exceedance stops, cease additional monitoring	• Notify Contractor • Check monitoring data and Contractor's working methods • Discuss with Contractor for remedial works, if necessary	• Rectify any unacceptable practice • Consider changes to working method
Action Limit			
Exceedance for one sample	• identify source • Inform ER and IEnvC • Repeat measurement to confirm finding • Increase monitoring frequency to daily	• Notify Contractor • Check monitoring data and Contractor's. working methods	• Rectify any unacceptable practice • Amend working methods if appropriate
Exceedance for two or more consecutive samples	• Identify source • Inform ER and IEnvC • Repeat measurements to confirm findings • Increase monitoring frequency to daily • Discuss with ER for remedial actions required • If exceedance continues, arrange meeting with ER • If exceedance stops, cease additional monitoring	• Confirm receipt of notification of failure in writing • Notify Contractor • Check monitoring data and Contractor's working methods • Discuss with IEVC and Contractor on potential remedial actions • Ensure remedial actions properly implemented	• Submit proposals for remedial actions to ER within 3 working days of notification • Implement the agreed proposals • Amend proposal if appropriate

Event	Actions		
	Environmental Team Leader	Engineer's Representative (ER)	Contractor
Target Limit			
Exceedance for one sample	• Identify source • Inform ER, IEnvC and EPD verbally • Repeat measurement to confirm finding • Increase monitoring frequency to daily • Assess effectiveness of Contractor's remedial actions and keep EPD and ER informed of the results	• Confirm receipt of notification of failure in writing • Notify Contractor • Check monitoring data and Contractor's working methods • Discuss with Environmental Team Leader and Contractor potential remedial actions • Ensure remedial actions properly implemented	• Take immediate action to avoid further exceedance • Submit proposals for remedial actions to ER within 3 working days of notification • Implement the agreed proposals • Amend proposal if appropriate
Exceedance for two or more consecutive samples	• Identify source • Inform ER, IEnvC and EPD the cause and actions taken for the exceedances • Repeat measurement to confirm findings • Increase monitoring frequency to daily • Investigate the causes of exceedance • Arrange meeting with EPD and ER to discuss the remedial actions to be taken • Assess effectiveness of Contractor's remedial actions and keep EPD and ER informed of the results. • If exceedance stops, cease additional monitoring	• Confirm receipt of notification of failure in writing • Notify Contractor • Carry out analysis of Contractor's working procedure to determine possible mitigation to be implemented • Discuss amongst Environmental Team Leader and the Contractor potential remedial actions • Review Contractor's remedial actions whenever necessary to assure their effectiveness • If exceedance continues, consider what portion of the work is responsible and instruct the Contractor to stop that portion of work until the exceedance is abated.	• Take immediate action to avoid further exceedance • Submit proposals for remedial actions to ER within 3 working days of notification • Implement the agreed proposals • Resubmit proposals if problem still not under control • Stop the relevant portion of works as determined by the ER until the exceedance is abated.

* reduce to 70dB(A) for schools and 65dB(A) during school examination periods.
** to be selected based on Area Sensitivity Rating
' only applicable to projects of significant scale.

* In the event that a TAT level exceedance occurs the Independent Environmental Checker shall also be informed, such that they can independently audit the implementation of the action/event plan.

In the event that a documented complaint is received, the Engineer Representatives (ERs) should be informed immediately so that he can take appropriate action.

The ERs should undertake the following steps to rectify the situation:

- identify source of impacts;
- take necessary action to mitigate the situation;
- undertake monitoring with respect to air, noise or water;
- check compliance with trigger/action/target levels and environmental regulation;
- if monitoring results show exceedances repeat review procedures, identify possible areas of improvement and checking procedures;
- document all complaints in the monthly EM&A report to EPD and include details of mitigation measures taken and the additional monitoring results for the period; and
- Where possible, prepare a formal reply to complaints to notify the concerned person(s) that action has been taken.

Figure 8a is an illustration of the procedures recommended to be undertaken in the event of complaints.

9 REPORT PROCEDURES

9.1 MONITORING RESULTS

Monitoring data shall be reported on record sheets and should contain the following information:

- sampling points
- sampling depths
- sampling parameter
- number of measurement
- weather condition
- brief description of the construction activities (e.g. position of dredging operations)
- trigger/action/target level
- checks on compliancies

Sample record sheets for water, air, and noise are illustrated in *Annex A*.

9.2 ENVIRONMENTAL EXCEEDANCES

For environmental exceedance, in addition to notifying the contractor immediately and repeated monitoring, the Environmental Team should notify EPD and the Engineer where appropriate by fax if action/target level are exceeded. Action(s) taken should be reported in the monthly progress report.

9.3 MONTHLY EM&A REPORT

A monthly EM&A report should be prepared and submitted to EPD on the tenth working day of the each month in an agreed format (printed and/or magnetic media form). The report should include the following:

- summary of major points;
- summary of the construction activities for the month;
- monitoring data;
- audit/review of the monitoring results;
- compliance check and report on exceedances;
- remedial measures adopted to restore the adverse condition;
- record of complaints and remedial measures;
- forecast of work programme and monitoring schedule;
- proposal for changes to monitoring requirements, as appropriate;
- comments and conclusions.

Annex B shows a list of items to be included into the monthly EM&A reports, as

recommended by EPD.

9.4 *MONTHLY INDEPENDENT ENVIRONMENTAL CHECKERS REPORT*

A brief monthly site status report will be produced by the Independent Environmental Checker (IEnvC), simultaneously and independently of the Monthly EM&A Report, and submitted to the Contractor and the relevant government regulatory authority (EPD). The IEnvC Report will summarise the status of the mitigation measure implementation, providing an independent review of the EM&A programme being undertaken by the Environmental Team.

10 ECOLOGICAL MONITORING

The ecological assessment reported in the EIA and summarized in *Section 2.1* and *3.1* of this Environmental Schedule has recommended ecological monitoring and audit be carried out and this is detailed below. Additionally, *Annex C* describes recommendations for the development of a management plan for abandoned stream and channel segments.

10.1 ECOLOGICAL MONITORING AND AUDIT

10.1.1 Construction Phase

Egretry Monitoring

Egretries at Ho Pui (22CD), Shan Pui (60CD-A) and Mai Po Lo Wai (30 CD) will be monitored during the construction phase to identify and describe impacts from new channel construction. Annual counts and species identification of nesting birds will be conducted during the nesting season from April through July. Nest productivity will be estimated from samples of numbers of eggs and chicks in nests at each egretry. Nest occupancy and productivity should be determined based on 4 counts at each egretry conducted between 1 April and 31 July. Trends in numbers and species representation at egretries will be assessed for indications of adverse impacts from channel construction. Results will be included in monthly EM&A reports. The annual cost is estimated to be HK$50,000

10.1.2 Operation Phase

Mangrove plantation

Mangrove plantations will be monitored for seedling survival by annual sampling of fixed plots. Plot size will be 10x10m, and plots will number 5 on either side of the 60CD Stage 1 Contract A channel. Monitoring will be conducted during the fourth quarter of each calendar year following planting. Should surviving stem density decline below 30% of the planted density, replanting will be recommended. Annual cost of monitoring is estimated to be HK$16,000.

Invertebrate recolonisation

Invertebrate colonisation of mudflats within mangrove plantations will be assessed semi-annually using randomly located plots of 0.25m^2 surface area. The annual cost is estimated to be HK$24,000.

Avifauna use of Abandoned Channels

Abandoned channels will be surveyed during winter and spring annually using point-count or transect methods depending on the size and location of the channel segment. The study objective will be to document bird species presence and bird numbers during the winter and during breeding seasons. Estimated annual cost is HK$50,000.

Avifauna use of Constructed Channels

Constructed channels will be monitored during winter and spring using transect methods to document species presence and bird abundance. Channel segment will be selected in each of the 60CD, 43CD, 30CD, 29CD and 22CD areas. Estimated annual cost is HK$50,000.

Audit of Abandoned Channel Management

Should the abandoned channel management plan be recommended following the SPEL review of Government Policy on Wetland Conservation and Compensation, performance under the plan should be audited annually to assess the degree to which it's objectives are met. The audit should involve liaison with the management authority and field inspections.

11 *ENVIRONMENTAL AUDIT REQUIREMENTS*

Environmental auditing is recommended to test the adequacy of the overall environmental management systems and the effectiveness of the environmental monitoring programme adopted.

These audits should be carried out by an independent body, ie. the Independent Environmental Checker detailed in *Section 4*, on a regular basis. Monthly intervals are recommended. The audit should cover the following:

- reviewing and verifying information available in records developed through the monitoring programme;
- identify specific issues of non-compliance and recommendations to meet them; and
- check effectiveness of mitigatory measures and review the need for other mitigatory measures.

Annex A

Examples of Monitoring Record Sheets

Table A1 *Water Quality Monitoring Record Sheet - Suspended Solids Level*

Monitoring Station		Water Depth					
		S		M		B	
Mean							
Maximum							
Control Station	C						
	C						
	Mean						
	Maximum						
Trigger level (mg/l)							
Exceedances*1							
Action Level (30% above mean at control Station or 100mg/l at 100m from the dredger)							
Exceedances*2							
Target Level (30% above maximum at Control station or persistently (3 times) 100mg/l at 100m from the dredger)							
Exceedances*3							

Note : S = 1m below surface
M = mid-depth
B = 1m above seabed

*1 = Trigger Level - Compare with readings of the monitoring stations
*2 = Action Level - Compare with daily mean of the monitoring stations
*3 = Target Level - Compare with the daily maximum of the monitoring stations

Ambient Temperature :
Weather :
High Tide Time : Height:
Low Tide Time : Height:
Remarks :

		Name & Designation	Signature	Date
Field Operator	:	_____	_____	_____
Lab Staff	:	_____	_____	_____
Checked by	:	_____	_____	_____

Table A3 *Data Sheet for TSP Monitoring*

Monitoring Location		
Details of Location		
Sampler Identification		
Date & Time of Sampling		
Elapsed-time Meter Reading	Start Stop	(min) (min)
Total Sampling Time		(min)
Weather Conditions		
Site Conditions		
Initial Pressure	P_i	(mmHg)
Initial Temperature	T_i	(°C)
Initial Flow Rate	Q_{si}	(std. m^3/min)
Final Pressure	P_f	(mmHg)
Final Temperature	T_f	(°C)
Final Flow Rate	Q_{sf}	(std. m^3/min)
Average Flow Rate	Q_s	(std. m^3/min)
Total Volume	V_s	(std. m^3)
Filter Identification No.		
Initial Wt. of Filter	W_i	(g)
Final Wt. of Filter	W_f	(g)
Measured TSP Level		($\mu g/m^3$)

Remarks:

	Name & Designation	Signature	Date
Field Operator :	_____	_____	_____
Lab Staff :	_____	_____	_____
Checked by :	_____	_____	_____

Response to Comments
Main Drainage Channels for Ngau Tam Mei, Yuen Long and Kam Tin, EIA Study - Draft Final Environmental Schedule

No.	Department	Reference	Comments	Consultants' Response
1.	EPD Annex (2) to EP2/N6/08 13 Dec. 1995		Please note that the Schedule should comply with the following guidelines which are attached herewith for your reference a) "Engineer's Guidelines for Implementation of EM&A Programmes"; b) "Standard Air, Water and Noise Monitoring Requirements"; c) "Typical Event and Action Plan for Air, Water and Noise Monitoring during Construction"; and d) "Guidelines for Dust Monitoring".	Noted. All these elements are included in the Environmental Schedule (ES).
2.	EPD Annex (2) to EP2/N6/08 (V) 4 Jan. 1996		Further to my letter dated 13 Dec. 1995, I have the following comments: It is noted that s.2.5 and s.3.3 of the Draft ES have not incorporated our previous comments on the Discussion Paper: "Disposal Options for Dredged or Excavated Material, Main Drainage Channels Projects". Please revise these sections as appropriate in accordance with the EIA Report.	Noted. The sections will be revised, as appropriate, with consideration of EPD's previous advice, for the dredged or excavated materials arising from the MDC project, that they have *no objections to incorporate the appropriate recommendations, upon consultation with EPD, from TEL3 - Sedimentation Study on land disposal of contaminated mud into the contract documents - PWP items 22CD and 29CD for implementation if these recommendations are finalised in the coming two years and available on time before completion of drafting of the contract documents such that the scheduled works programme of 22CD and 29CD can be met without any delays* (sic).
3.		S.3.3, Subsection: Dredged and Excavated Materials	The mitigation measures to be implemented for landbased transportation of the dredged materials (if any) should also be mentioned in this section.	Noted. Mitigation measures will be included in the final version of the Environmental Schedule.
4.		S.3.3, Subsection: Construction Waste, and Segregation of Wastes	i) Construction wastes should be segregated into either inert or non-inert fraction through good site practice as far as possible. Classification of inert and non-inert materials is described in the New Disposal Arrangements for Construction Waste.	Noted, reference is made to this in the ER.

No.	Department	Reference	Comments	Consultants' Response
5.			ii) The disposal of construction waste at public dump and landfill are subject to different acceptance criteria. Public dump only accepts inert waste materials with a small amount of timber. Although construction waste with less than 20% by volume of inert material may be disposed of at landfill, public dump may not accept construction waste containing in excess of 20% by volume of inert material. It is recommended that the contractor should segregate the latter to render it acceptable at public dump.	The ES (and EIA) have been revised according to the latest EPD acceptance criteria.
6.		Figure 1.5a	Figure 1.5a should be further improved to give clear and unambiguous procedures for environmental monitoring. Additional text may help to understand the procedures more clearly. In general, it is preferred that such type of flow diagram is used to help understanding the procedures instead of using it to replace the necessary text.	Noted, text has been supplemented for clarification.
7.		Section 4.2.4	The project itself is construction of main drainage channel rather than backfilling. Please note that the proposed EM&A programme should be technically sound and project specific.	Noted.
8.		Section 4.2.5	Should the Independent Environmental Checker be set up, the findings of each inspection and the recommendations should be forwarded to the Engineer and the Contractors for immediate actions to rectify any unacceptable impacts or site malpractice.	Agreed, this was stated in Section 4.2.5, fifth bullet point.
9.		Section 5.1.4 Subsection: Baseline Monitoring and Table 5.1a	After the baseline monitoring, the collected data should be statistically analysed according to the requirements specified in Note 2 of Table 5.1a. Moreover, the preliminary TAT levels should be reviewed in conjunction with the baseline data. Global TAT levels will not be suitable for all the monitored rivers and streams if the baseline data indicates that their water quality is significantly different, in which case individual TAT levels may be required.	Agreed, as stated in Section 5.1.7.
10.		Section 5.1.4 Subsection: Impact Monitoring	i) For the starting period of the monitoring, it is good to set the monitoring frequency as 3 times per week. However, it may be too high for the work with less concern or too loose for the construction with serious impacts. Therefore, I would suggest that after a period of monitoring i.e. two months, the frequency should be reviewed based on the outcome of the monitoring and auditing.	Agreed, the ES has been accordingly revised.

No.	Department	Reference	Comments	Consultants' Response
11.			ii) The last sentence of the first paragraph "Where the difference in value between ... further readings shall be taken." is not relevant and should be deleted.	Agreed, the ES has been accordingly revised.
12.		Section 5.1.5 (a) Suspended Solids	The proposed sampling equipment should comply with the EPD's standard requirements. Except with good justifications, the water sampler shall be made of transparent PVC or glass cylinder (with capacity not less than 2 litres) which can be effectively sealed with cups at both ends. The sampler shall have a positive latching system to keep it open and prevent premature closure until released by a messenger when the sampler is at the desired water depth. The sampler can be the Kahlsico Water Sampler 135WB203 or equivalent.	Agreed, the ES has been accordingly revised.
13.		Section 5.1.5	The positioning device (such as GPS) for the purpose of locating the monitoring and control stations should be included.	Agreed, the ES has been accordingly revised.
14.		Section 5.1.6	The sampling point of the monitoring and control stations should be located at the middle of a river or stream. In case of sampling marine water, the sampling point should be at the proposed grid co-ordination.	Agreed, the ES has been accordingly revised.
15.		Figures 5.1a to 5.2k	i) It is preferable to label all the control and monitoring stations such that they can be referred easily.	The labelling of stations will be undertaken by the contractors EM&A Team.
16.			ii) Figures 5.1a to 5.12k are not legible and should be further improved so that all the locations, grid co-ordination, existing rivers or streams and the construction areas can be well and clearly identified. Please make sure that all the monitoring and control stations are accessible and shown correctly in the drawings.	The clarify of all ES figures has been improved accordingly. See also response to comment 15 re: grid coordinates.
17.			iii) A list of monitoring and control stations including the grid co-ordination of them is required on the understanding that the location of the stations may be changed slightly due to the difficulty in accessing the stations.	See response to comments 15 and 16.
18.		Section 5.3 Recording of Monitoring Data	Please amend the first paragraph as necessary. It appears that there is no other water quality parameter other than suspended solid content proposed to be measured.	Zinc and SS are required and the ES has been accordingly amended.

No.	Department	Reference	Comments	Consultants' Response
19.		Table 5.4a, Page 36	The proposed Action/Event Plan does not fully work with the proposed TAT levels. Since the Target level is defined as 3 consecutive exceedances of Action level, it is not practically possible to have an event that Target level being exceeded by one sampling day or by two sampling days. Therefore, delete the whole 3rd row in page 36 under the heading of "Target level being exceeded by one sampling day" and delete the phase of "by more than two consecutive sampling days" in the first column of page 37.	The Table 5.4a has been amended following EPD's guidance.
20	Planning Department UDUR/R/SEW/1 14 Dec. 1995		No comments.	Noted.
21.	Water Supplies Department (15) in WWO/ M911/1744/85 III 18 Dec. 1995		No comments.	Noted.
22.	Water Supplies Department (8) in WWO 3/137/1382/88 X 19 Dec. 1995		No comments.	Noted.
23.	Marine Department (3) in PA/S909/4/18 (3) 18 Dec. 1995		No comments.	Noted.
24.	Yuen Long District Office (31) in L/M(3) to YL 132/1/1/48 19 Dec. 1995		No comments	Noted.
25.	Transport Department NR 171/200-54 19 Dec. 1995		No comments.	Noted.

No.	Department	Reference	Comments	Consultants' Response
26.	CED (2) in TS CG/CE60(93).0 PT01 19 Dec. 1995		No comments.	Noted.
27.	Highways Department HNT 606/YL/11 20 Dec. 1995		No comments.	Noted.
28.	DSD LD 10/5/2 21 Dec. 1995		No comments.	Noted.
29.	AFD AF DVL 12/25 VIII 2 Jan. 1996	Section 2.2 & 3.1	Section 2.2 & 3.1 of the Environmental Schedule are summaries of the EIA studies and thus my comments on the draft EIA Final Report vide my earlier letter of 29.12.1995 also apply here. The consultants should try to minimize the habitats loss, especially fish ponds, as far as practicable. The proposed "long term conservation management" of existing active fish ponds is not a practical option and is inappropriate to be treated as a mitigation measure for the loss of fish ponds. There is no ecological monitoring recommended in the Schedule. Without full justification, this is not acceptable. The impacts to ecological sensitive areas should be monitored during the summer months (the nesting period of egrets) if major construction activities are to be carried out during this period.	TDD advises that the resumption limits have been finalised and cannot be changed without prolonged delay to MDC projects (see comment 121 of EIA Draft Final Report). Ecological monitoring has been proposed, as requested, in the Schedule.
30.	DSD DP/8/7022CD/ S2P1/17 2 Jan. 96	Chapter 1, 2 & 3	a) The comments (from items (a) to (fl) in my previous memo ref. (24) in DP/8/7022CD/S2P1/17 dated 30.11.95 on the various aspects of the Draft Final Report are also applicable to these chapters which summarize salient aspects of that report. In particular, the programmes for the various projects shown in Fig. 1.3a should be updated accordingly. A copy of my previous memo is also enclosed for your easy reference.	Agreed. The programmes have been accordingly updated.

No.	Department	Reference	Comments	Consultants' Response
31.		Fig. 1.5a	(b) This chart appears to over-simplify the EM&A process. For instance, as suggested in the Schedule, there will be two separate monthly reports to be submitted by different parties. Besides, the "Authority" party should be defined explicitly.	The "Authority" refers to EPD.
32.		Chapter 4	(c) Works for 60CD and 43CD have started and in operation for some time and the projects organizations for the EM&A programme for these work contracts have been determined in accordance with agreements between EPD/DSD before the projects were upgraded to Cat. a. So far, there are no problems for the impact monitoring for 60CD. Hence, it is almost impossible, for them to adopt the suggested organization of this Schedule at this late stage without substantial delays/claims from the Contractors. It should also be noted that the Environmental Manual for 43CD (prepared in accordance with the EIA Report for 43CD and 30CD (stage 1) and endorsed by ACE in February 1995 before the project was upgraded to Cat. A was submitted to EPD in November 95 and EPD indicated no comments on the Manual so that the EM&A programme for 43CD works is currently based on that Manual. It should also be mentioned that the Sha Po Village Flood Protection Scheme Contract has also been finalized in accordance with the EIA Report for 43CD and 30CD (stage 1) and that Contract is now under tendering.	The ES has not included EM&A for 60CD as the construction works are nearing completion and have been monitored in accordance with the Deep Bay Guidelines. Reference has also been made in Section 1 to previous EM&A agreements for 43CD and 30CD.
33.			(d) Please clarify under which parties the ***Environmental Team*** and the ***Independent Environmental Checker*** (I.EnvC) will be responsible to. It appears that they are outside the Engineer's staff establishment. If this is correct, it will seriously undermine the Engineer's contractual roles and make the contract not enforceable. Most prudent considerations of the contractual implications of the consultants organizations for E&MA are necessary before Special Conditions of Contract are drawn up and Works Branch Policy support can be sought.	This has been clarified and the I.EnvC will be reporting to the Engineer as stated in Section 4.2.5.

No.	Department	Reference	Comments	Consultants' Response
34.			(e) Since there will be a very objective Environmental Schedule to check against the impacts to the environment due to the works, it is most doubtful that the I.EnvC should be required. Similar to other civil works with comparable scale, the environmental matters could be overseen by the Engineer with due advice or authoritative approval from EPD. Otherwise, the relationships amongst the Engineer / EPD / I.EnvC must be stated explicitly to help manage the contract administration for the works with the contractors.	See response to comment 33. Experience on the Western Harbour Crossing EM&A and Route 3 Country Park EM&A has demonstrated the benefit of the IEnvC system proposed.
35.		Para 4.2.5	(f) Why should the monthly I.EnvC Report only be submitted to the Contractor and EPD, but not the Engineer?	The text will be amended as the Engineer will also receive the report.
36.		Para 4.2.5	(g) It is inappropriate to assign the I.EnvC the power to verify that whether the complaints are properly channelled and addressed by the Government.	Agreed, the ES has been amended.
37.		Chapter 5	(h) Fig. 5.2h; Fig. 5.2i; Fig. 5.2j and Fig. 5.2k should read as Fig. 5.1h; Fig. 5.1i; Fig. 5.1j and Fig. 5.1k respectively since they are so referred in Para 5.1.6.	Agreed, the ES figures have been amended.
38.		Para 5.4	(i) Does "The Project Manager" mean "The Project Engineer"?	Yes, the text has been amended.
39.		Table 5.4a	(j) Why does the contractor need to inform the Engineer in the event that the ***Action Level*** is exceeded by one sampling day while he needs to inform the ER only when the level is exceeded by more than two sampling days?	The Engineer also has to be informed when the level is exceeded on two sampling occasions. The ES has been amended.
40.		Table 5.4a	(k) In the event that the Target Level is exceeded by more than two sampling days, it is specified that the ER should consider and instruct, if necessary, the Contractor to stop work. In this respect, the power of ER to STOP the backfilling operation should be further clarified as it is normally the engineer who has the power to stop the works under the Contract.	The Table has been amended in accordance with EPD's guidance (Comment 19).
41.		Chapter 6 Para 6.3.1, line 4	(l) "There should not be any construction ..." refers. Since there might be other public work projects in the vicinity in the period, it is suggested to add "works under this project" after "any construction".	Agreed, the ES has been amended.

No.	Department	Reference	Comments	Consultants' Response
42.		Para 6.3.2	(m) Impact monitoring might not be required for all the stations at one time as some stations are too far away from the work activities in progress. Hence, please specify the distance away from the works, exceeding which the impact monitoring would not be required.	Impact monitoring is required at the prescribed stations (Table 6.3a) whenever construction of the relevant sub-project is underway.
43.		Table 6.4a	(n) It appears the roles of the ER are missing. For consistency, the format and style of this table should be compatible with that of Table 5.4a.	The Event and Action Plan for Noise Monitoring is necessarily different to that for Water Quality Monitoring.
44.		Chapter 7 Para 7.4	(o) Item (l) above should also be applicable due to the similar situation.	Agreed, the ES has been amended.
45.		Table 7.9a	(p) The roles of the Environmental Team Leaders and the ER are quite confusing in this Table. In Table 5.4a and Table 6.4a, the Environmental Team Leaders will inform the Contractor, who then inform the ER of any exceedance while this procedure is not so followed in this Table. Similar to item (n) above, these three tables should be compatible with each other.	Response to comment 4.3 similarly applies to dust monitoring.
46.		Table 7.9a	(q) Please clarify the role of the "Environmental Supervisor" and under which organization it will belong to in the paragraph of Action Limit.	This was a typographic error and has been amended to read IEnvC.
47.		Chapter 8	(r) a "documented complaint" should be preferable to "complaint whether direct or indirect".	Agreed, the ES has been amended.
48.		Fig. 8a	(s) Item (r) above should also be applicable. In addition, the responsible action party should be included so that this flowchart would be more complete.	The Section 8 text supplements this flow chart.
49.		Chapter 9 Para 9.2	(t) The input or the role of the Engineer should also be included.	Agreed.
50.		Chapter 10	(u) Last sentence: Similar comment as Item (g) above.	Agreed, see response to comment 36.

No.	Department	Reference	Comments	Consultants' Response
53.		Section 3.1, para 4	Species selected have been agreed with WWF.	Noted.
54.		Table 3.4a	Mitigation measures for 60CD have been agreed with EPD and put down in the contract documents. The measures recommended in the table should be deleted if they are different from those laid down in the Contract.	Noted, the 60CD text has been removed.
55.		S.4.2.3 and 4.2.5	The proposed environmental Team and Independent Environmental Checker may be necessary for the major projects, such as the airport core projects, of which the works are complicate and the contract sums are very large. Our drainage improvement works are generally minor and straight forward in nature. In fact, 60CD and 43CD had already commenced construction and the introduction of a new establishment at this stage is inappropriate. For 22CD, 29CD and 30CD, the projects are even smaller and less complicate. Therefore I have great reservation to set up a special environmental team and checker for the drainage projects. I consider that the present establishment adopted under 60CD which functions satisfactorily and acceptable to EPD should continue and be adopted for all the drainage projects.	See response to comment 34.
56.		Fig. 5.1a and 6.3a	Locations for monitoring of water quality and noise had been agreed with EPD and WWF. If the proposed locations are different from the agreed ones, please amend the figures.	The locations for EM&A of 60CD have been deleted as stated in Section 1.