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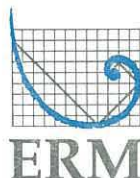
Territory Development Department
NTN Development Office

Main Drainage Channels for Ngau
Tam Mei, Yuen Long and Kam
Tin: *EIA Study for Kam Tin Section
(43CD) and Village Flood Protection
Works (30CD)*

January 1995

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January 1995

Reference C1203

For and on behalf of ERM Hong Kong

Approved by: *SM Lau*

Position: *Operations Director*

Date: *9th January 1995*

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CONTENTS

1	<i>INTRODUCTION</i>	1
1.1	<i>BACKGROUND TO THE STUDY</i>	1
1.2	<i>OBJECTIVES OF THE STUDY</i>	2
2	<i>PROJECT DESCRIPTION</i>	4
3	<i>WATER QUALITY IMPACTS</i>	5
3.1	<i>CONSTRUCTION PHASE</i>	5
3.2	<i>OPERATIONAL PHASE</i>	6
4	<i>ECOLOGICAL IMPACTS</i>	8
5	<i>WASTE MANAGEMENT</i>	10
5.1	<i>CONSTRUCTION IMPACTS</i>	10
5.2	<i>OPERATIONAL IMPACTS</i>	11
6	<i>NOISE</i>	11
6.1	<i>CONSTRUCTION PHASE</i>	11
6.2	<i>OPERATIONAL PHASE</i>	11
7	<i>AIR QUALITY</i>	12
7.1	<i>CONSTRUCTION PHASE</i>	12
7.2	<i>OPERATIONAL PHASE</i>	12
8	<i>ENVIRONMENTAL MONITORING AND AUDITING</i>	12
9	<i>OVERALL CONCLUSIONS</i>	13

1.1

BACKGROUND TO THE STUDY

The plain of Yuen Long and Kam Tin, the main agricultural area in Hong Kong, is drained by two major water courses; the Kam Tin River draining the eastern half of the plain and the Yuen Long Creek (Shan Pui River) draining the western half. In recent years, the rivers have been subject to intensive anthropogenic disturbance leading to recurrent flooding in the Yuen Long/Kam Tin and Ngau Tam Mei Basin. To alleviate the severe flooding in the lower and middle parts of this basin, two main drainage networks flowing via the Yuen Long Creek into Inner Deep Bay; the Yuen Long and Kam Tin Main Drainage Channels (MDC) and the Ngau Tam Mei MDC, were recommended in the North West New Territories Base Strategy Studies.

Extensive environmental studies and surveys have been conducted to study and to identify the net and cumulative environmental impacts of the above Main Drainage Channel Works (MDC works) and to recommend measures to mitigate these impacts. It is understood, however, that a number of objections were received during the gazettal of the Yuen Long and Kam Tin MDC Stage 1 Phase 1 Works under the Foreshore and Sea-bed (Reclamation) Ordinance. Subsequently, in the course of resolving the objection from the World Wide Fund for Nature Hong Kong (WWF-HK), it has been agreed to reassess the water quality implications if full enforcement of the Livestock Wastes Control Scheme (LWCS) in Yuen Long could not be implemented by mid 1993.

ERM Hong Kong, in association with Balfours International (Asia) Consulting Engineers Ltd and Ecosystems Ltd, have been commissioned by the Territory Development Department (TDD), New Territories North Development Office, of the Hong Kong Government, to undertake an Environmental Impact Assessment Study of the proposed MDC for Yuen Long, Kam Tin and Ngau Tam Mei.

The Study is being carried out in two stages. An Environmental Impact Assessment (EIA) Report has been prepared to assess the scale, extent and severity of environmental and ecological impacts to Deep Bay and areas along the MDC alignment due to construction and operation of the Stage 1 Phase 2 (43CD) MDC for Yuen Long and Kam Tin and Stage 1 of the Village Flood Protection Works (VFPW) (30CD), with limited or full enforcement of the LWCS (*Figure 1.1a*). The report permits any measures identified to mitigate impacts to be included in the MDC and VFPW design prior to the tendering process which will commence in June 1995. The Main Drainage Channels for Ngau Tam Mei, Yuen Long and Kam Tin: Environmental Impact Assessment Study (EIA for MDC) to cover all stages of the MDC and VFPW for Yuen Long, Kam Tin and Ngau Tam Mei is already underway.

This Executive Summary presents a summary of the potential environmental impacts associated with the construction and operational phases of 43CD of the MDC and the VFPW (30CD) in relation to water quality, ecology, waste management, air quality and noise. Details of the EIA findings were presented in the *Main Drainage Channel for Ngau Tam Mei, Yuen Long and Kam Tin : EIA Study for Kam Tin Section (43CD) and Village Flood Protection Works (30CD) (EIA for 43CD and 30CD)*.

1.2

OBJECTIVES OF THE STUDY

The objectives of the EIA for 43CD and 30CD are as follows:

- i) to review the information and data including assumptions, approaches, findings and recommendations related to the environmental and ecological aspects arising from the operation of the MDC in terms of the water quality aspects;
- ii) to review the water quality impacts at the operational stage so as to produce an assessment for the environmental and ecological concerns arising from the operation of 43CD and 30CD of the MDC Works;
- iii) to review elements of the community, environment and ecology likely to be affected by the operation of 43CD and 30CD of the MDC Works;
- iv) to review and predict the net and cumulative environmental and ecological impacts due to the operation of 43CD and 30CD of the MDC Works in relation to the Deep Bay and areas along the Works alignments;
- v) to assess the environmental improvement to Deep Bay as a result of the diversion of the effluent discharge from the Yuen Long Sewerage Treatment Works to the Urmston Road;
- vi) to minimize pollution, environmental and ecological disturbance arising from the operation;
- vii) to identify and specify methods, measures and standards to be included in the design, which may be necessary to mitigate these impacts and reduce them to acceptable levels;
- viii) to recommend environmental monitoring and audit requirements (EM&A) necessary to ensure the effectiveness of the environmental protection measures adopted; and
- ix) to identify additional studies where necessary to fulfil the objectives or requirements of this EIA for 43CD and 30CD.

This EIA for 43CD and 30CD comprises a construction and operational environmental assessment of 43CD and 30CD of the drainage works.

However, downstream (60CD) improvement works are underway and upstream (22CD) of these works, other main drainage channel improvements will be undertaken. Therefore it will not be possible, in any circumstances to holistically address all impacts although all such impacts are presently under detailed consideration in the EIA for MDC.

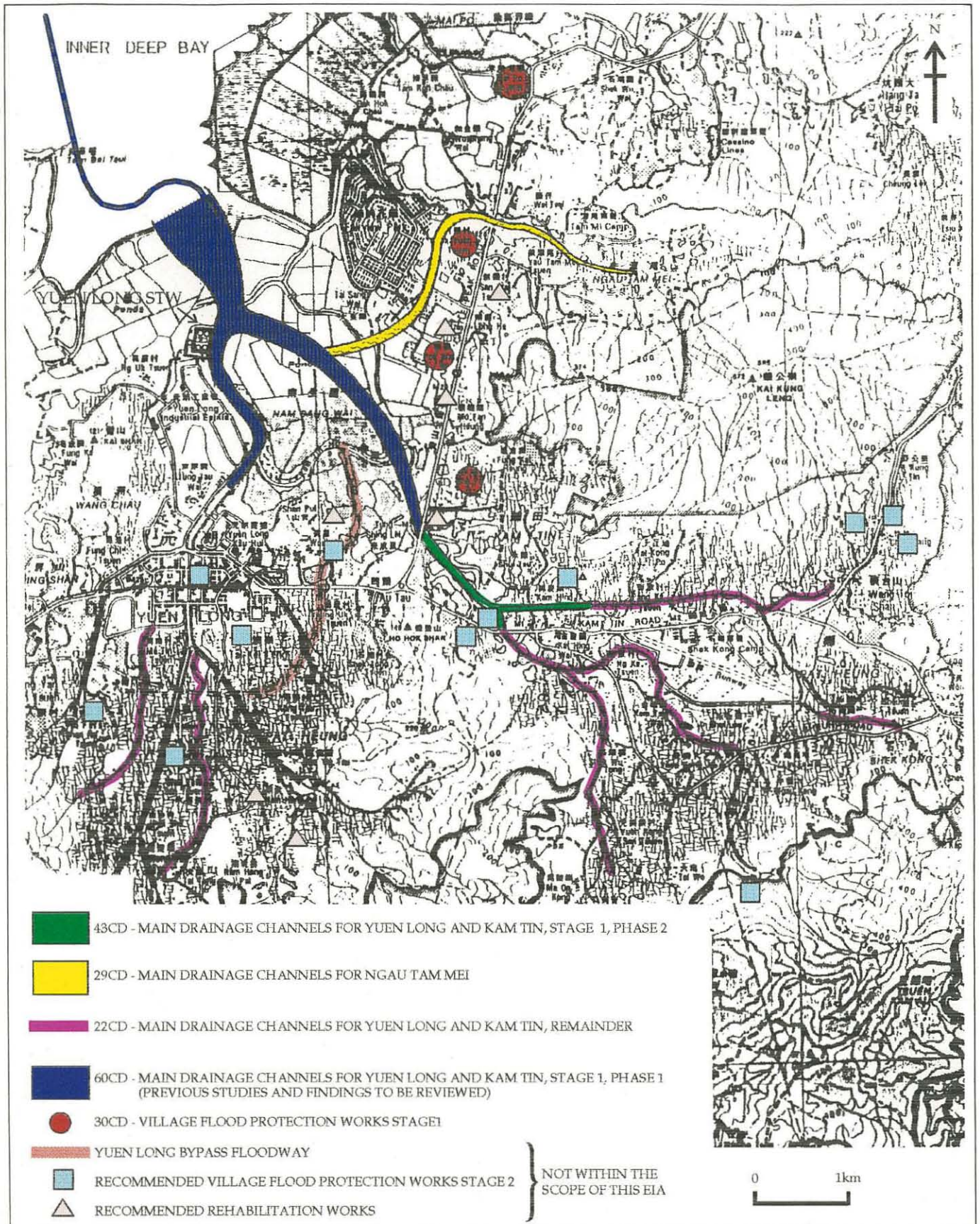


FIGURE 1.1a - MAIN DRAINAGE WORKS IN NWNT

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PROJECT DESCRIPTION

The MDCs will be constructed in the following stages as shown in *Figure 1.1a*.

- Stage 1, Phase 1 Works (60 CD) which are presently underway comprise the construction of wide river channels entering Deep Bay;
- Stage 1, Phase 2 Works (43 CD) comprise the construction of new river channel sections;
- implementation of Village Flood Protection Works (30 CD);
- the remainder of the MDC for Yuen Long and Kam Tin (22 CD) and the artificial channelization (widening, deepening and lining) of natural meandering rivers/streams; and
- the channelization of existing natural river/stream sections and the construction of a new channelized section (29 CD) running south to the 60 CD of the MDC Works.

The EIA report focused on 43CD and the VFPW (30CD). Details of these works are described below.

43CD of the MDC

This new river channel section will extend from the Kam Tin River, to the east of Castle Peak Road, through a series of fish ponds bypassing meanders until adjoining the existing Kam Tin River meander near Kam Tin San Tsuen. At the confluence, the channel branches into existing tributaries and the river section involved in 43CD Works terminates on reaching the Kam Tin Road. Upstream of the Kam Tin North and Kam Tin river confluence, two fabric dams - FD1 and FD2 - will be installed to prevent tidal intrusion upstream. Dry weather flow channels will be built upstream of the fabric dams to convey flow during the dry season. The river bed will be concrete lined with masonry and grasscrete fixed to the channel sides. A 3.5 m wide access road will be constructed alongside the channel to allow vehicular access for maintenance work. Ramps will also be built to facilitate access for clearance of sediment. *Figure 2a* shows the proposed alignment of 43CD.

Village Flood Protection Works

The VFPW will essentially comprise the construction of an earth bund around the village and a flood storage pond and pumping station within the banded area to serve the local drainage. These schemes are necessary to protect the villages which lie below the flood water level and thus unable to drain naturally. Stage 1 (30CD) of the VFPW comprises the villages of Sha Po, Pok Wai, Chuk Yuen Tsuen/Ha San Wai and Mai Po Lo Wai/San Tsuen. *Figure 2b* shows the layouts of the VFPW for the villages.

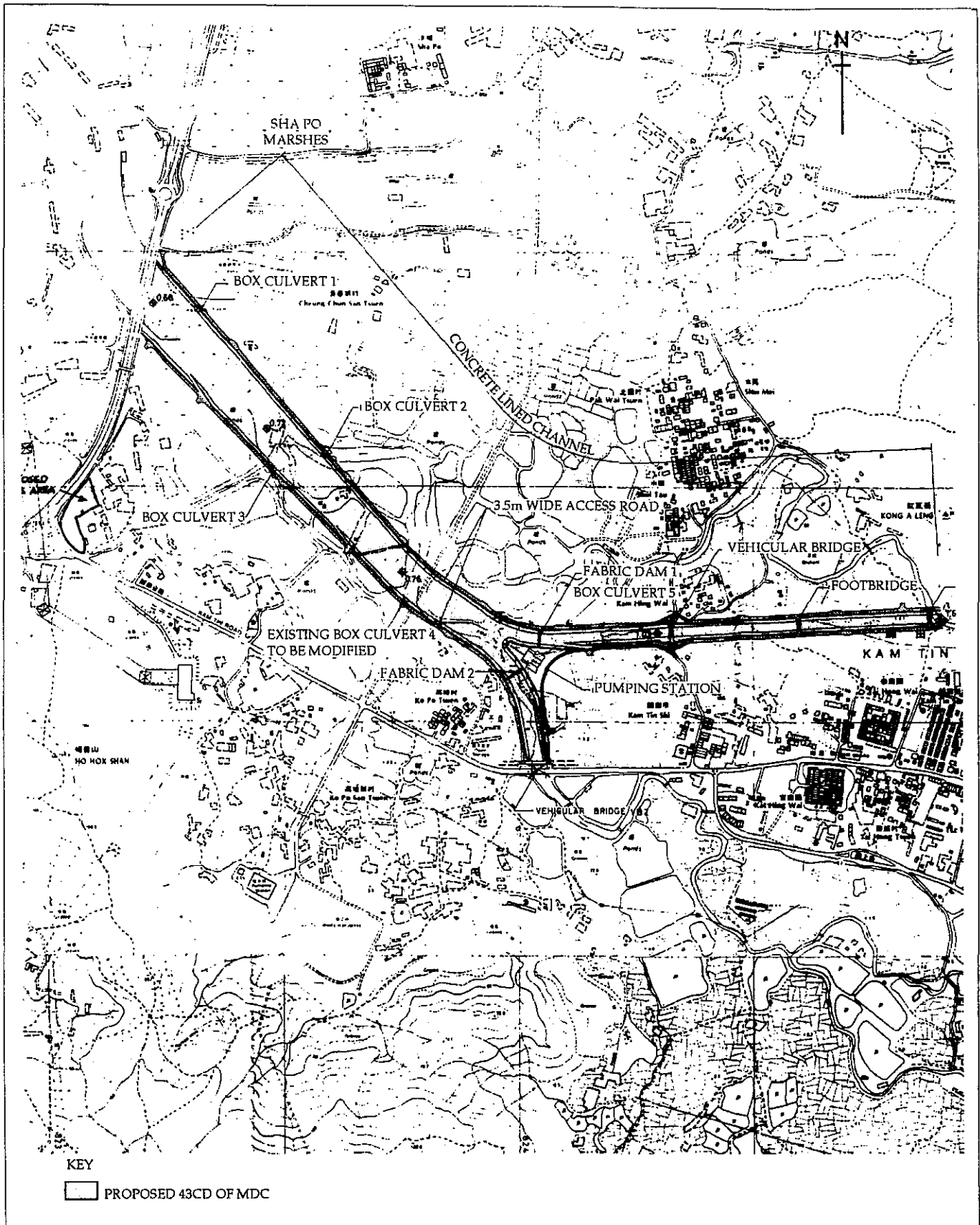
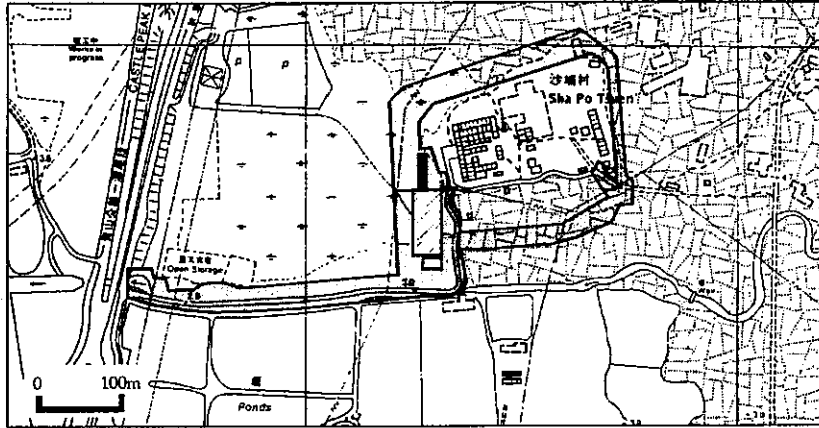


FIGURE 2a - PROPOSED LAYOUT FOR 43CD OF MDC

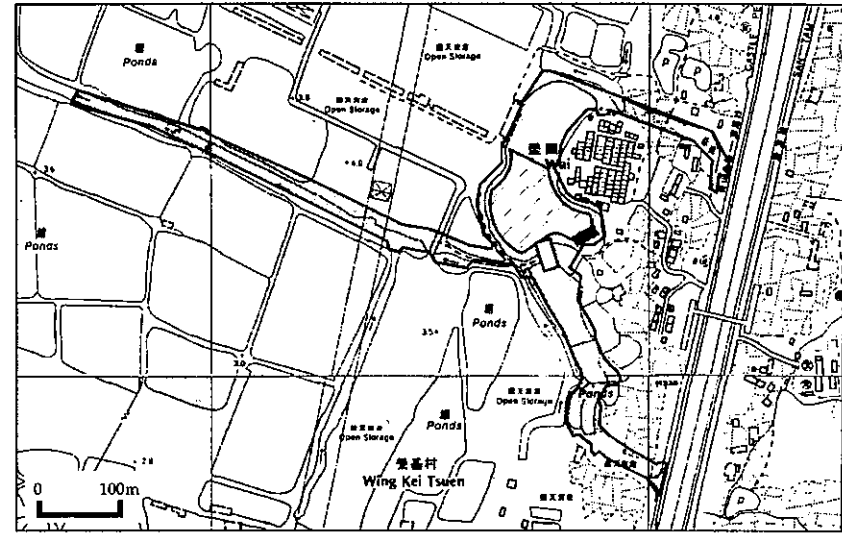
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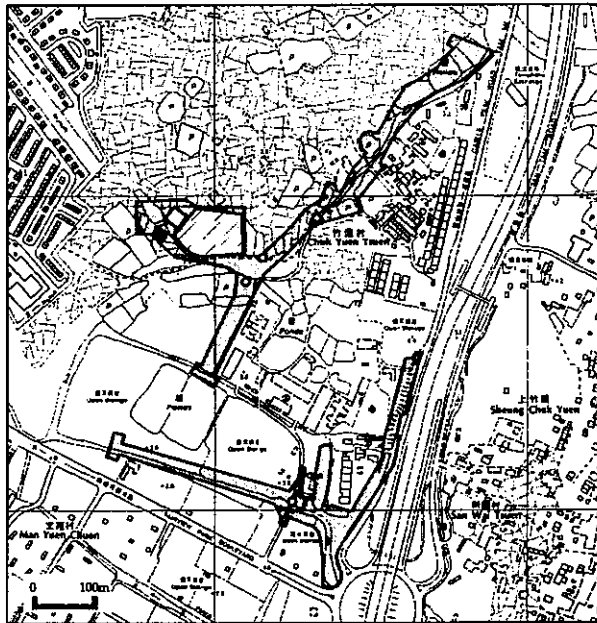




(i) SHA PO



(ii) POK WAI









(iii) CHUK YUEN TSUEN/HA SAN WAI



(iv) MAI PO LO WAI/SAN TSUEN

FIGURE 2b - LAYOUT OF VILLAGE FLOOD PROTECTION WORKS

- | | | | |
|---|-----------------------|---|------------------|
|  | FLOOD STORAGE POND |  | FOOTBRIDGE |
|  | FLOOD PUMPING STATION |  | VEHICULAR BRIDGE |
|  | SEPTIC TANK | | |
|  | MAI PO EGRETRY | | |

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3.1

CONSTRUCTION PHASE

Potential sources of water quality impacts arising from the construction of 43CD and 30CD may involve disturbance to natural processes, resuspension of contaminated material, alteration of supply of organic wastes and nutrients downstream, construction runoff and drainage, debris and rubbish, liquid spillages and sewage effluents.

In general it is anticipated that disturbances to water bodies during construction will be temporary in nature and localised. It is predicted that with the use of a closed grab dredger with silt curtains, the suspended solids level will be within the Water Quality Objectives (WQO) at around 70m downstream the dredging sites.

With the careful operation of the dredgers and implementation of recommended mitigation measures such as the use of cofferdams to contain suspended sediment, and control measures on runoff and drainage, the dredging works are not expected to result in exceedance of the defined Trigger/Action/Target (TAT) levels. Such control measures are of particular importance when the construction works are in close proximity to rivers, the freshwater marshes at Sha Po, the Au Tau Fisheries Research Station and fish ponds.

In inaccessible river sections where dredgers cannot be used, closed grab (tightly sealed) land-based excavators are recommended 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 pollutant levels, although this is expected to be within the natural variation range of pollutant levels in the existing river water. Elutriate tests specific to the Kam Tin River are recommended, however, to confirm the potential release of pollutants and these will be reported in the EIA for MDC.

To ensure the effectiveness of the recommended site management practices and control measures, 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 resulting in any non-compliances with the TAT levels.

Provided that the recommended practical and cost-effective mitigation measures are diligently implemented, it is anticipated that the construction works for 43CD and 30CD of the MDC will cause only local and temporary disturbance and will not result in any incompliances with the WQO.

43CD

The realignment of the Kam Tin River (43CD) will undoubtedly result in beneficial effects on water quality on both a local and large scale. However, the extent of the improvement will greatly depend on the successful implementation of the LWCS, the Yuen Long and Kam Tin Sewerage Master Plan (SMP) and the Water Pollution Control Ordinance (WPCO), which would all greatly reduce the pollutant load to the river.

Large Scale Improvements

With the amended LWCS, an improved compensation scheme should attract more livestock farmers to cease their livestock rearing businesses or alternatively adopt the livestock waste treatment systems. While it is difficult to estimate the resulting percentage reduction in BOD loading to the river, a further reduction in the BOD loading is anticipated when the LWCS comes into effect for the Kam Tin and Ngau Tam Mei areas by July 1996 and July 1997 respectively.

According to the Sewerage Master Plan programme, areas within the Kam Tin catchment will be served by a sewerage system by the years 1999 to 2005. It is estimated that around 70% of the population in the Yuen Long catchment will be served by a sewerage system. Domestic sewage discharges into the Kam Tin River from unsewered facilities should thereafter be greatly reduced.

The successful enforcement of the WPCO and recent implementation of the Waste Disposal (Chemical Waste)(General) Regulations will largely eliminate industrial effluents from entering water bodies, in particular chemical waste such as from electroplating processes which contain high levels of heavy metals. In addition, any industrial discharges into the rivers will have to comply with the Technical Memorandum limits.

The construction works for 43CD are scheduled to be completed by mid 1998. By then, it is anticipated that the Kam Tin area will be under the control of the LWCS. However, it will not be until 1999 that the full implementation programme will be in place. The planned sewerage system for the Kam Tin area will not be completed until 2005 and therefore until this time existing pollutant loads from domestic sewage will continue. Industries are steadily adapting to the discharge conditions stipulated under the WPCO and the Chemical Waste Regulations. Industrial loadings into the river should therefore gradually decline.

Local Improvements

Locally it is anticipated that the large amount of suspended solids brought down from various pollutant sources will accumulate behind the fabric dams. These dams will therefore substantially reduce downstream sediment pollution. Deposited material accumulated behind the fabric dam can be

removed with regular maintenance dredging. The velocities of downstream reaches are approximately 20% lower than the velocities of existing channel. Downstream of the fabric dams the channels are inter-tidal and with reduced velocity as a result of widening of the channel, further sedimentation is expected. Under low flow conditions, the flow would meander across the widened river bed which may result in sediment forming bars and islands. It is anticipated that a substantial amount of the suspended sediment would settle further downstream of the fabric dam (which will be cleared with regular maintenance), thus reducing the total sediment load reaching Deep Bay. In the event of floods, any such sediments will be washed down into Deep Bay. Thus, the increase in sediment load to Deep Bay will only be occasional and temporary after storm events. However, the routine maintenance regime should be designed such that sediments are routinely and regularly removed from river channels to minimise transfer of sediment pollution to Deep Bay.

The total volume of annual water exchange within the Deep Bay area is estimated to be around 800 times the total flow from the Kam Tin River. Thus it is anticipated that the flow from the Kam Tin River training project alone will have a minimal effect on the overall circulation pattern and water movements within Inner Deep Bay. In terms of pollutant load, the greater flushing of the river will mean that in the interim period prior to full LWCS, WPCO and SMP implementation, the existing pollutant loads into Deep Bay will continue although substantial amount of the pollutant is anticipated to settle out along the river banks as described earlier. Assessment of the temporary impact of purely 43CD works when drainage improvements are to be undertaken with upstream (22CD) and downstream (60CD) would not be appropriate and thus it is recommended that the impacts of this interim increase in pollutant loading should be holistically addressed in the EIA for MDC Report taking into consideration the entire MDC works.

Village Flood Protection Works - Stage 1 (30CD)

The VFPW will significantly improve the drainage for the Pok Wai, Sha Po, Chuk Yuen Tsuen/Ha San Wai and the Mai Po Lo Wai/San Tsuen areas. In view of the residential nature of these villages, drainage from these areas is not anticipated to be contaminated. Silt traps are recommended, to reduce the volume of potential sediment that will be washed downstream.

The habitat most affected by the MDC works will be fish ponds. It is estimated that approximately 9.6 ha of fish ponds would be lost due to the 43CD works. The estimated area of fish pond loss for the VFPW works, namely Pok Wai, Sha Po and Chuk Yuen Tsuen/Ha San Wai, will exceed 4 ha (the area lost due to the Mai Po Scheme cannot be calculated until the design is finalised). Thus it is estimated that a total area of approximately 13.6 ha of fish ponds will be lost under the MDC Works and represents over 0.77% of the Territories total fish pond area of 1760 ha.

Of particular concern will be the works at Mai Po Lo Wai/San Tsuen which are in close proximity to Mai Po Egrettry, a Site of Special Scientific Interest (SSSI). The SSSI is known to have suffered severe ecological impacts arising from previous drainage works in the area. Avoidance of direct impacts to Mai Po Egrettry from the construction of the Mai Po Village Flood Protection Scheme is recommended. Any loss of vegetation and suitable nesting sites within the SSSI must be avoided.

Birds would be the fauna most affected by potential loss of feeding grounds in the ponds and marshes within the area of the four VFPWs and the Kam Tin River flood plain. Freshwater marshes such as those found at Sha Po are scarce in Deep Bay. The area to be lost represents approximately 7.5% of the Sha Po marsh. This type of habitat provides suitable foraging for wading birds if covered with low grass and herbs, while tall grass and reeds offer good foraging for warblers. The sighting of Bright-capped Cisticola during project specific ecological field survey work suggest that other rare species like *Bradypterus* warblers may also occur.

The Hong Kong breeding areas as fish ponds and marshes of the Kam Tin Flood Plain are regionally important to ardeids, due to the paucity of available sites in southern China (WWF-HK unpublished 1994), it can reasonably be predicted that further losses of wetland/feeding habitats in Hong Kong could exert considerable pressure on local and regional breeding populations. Breeding colonies of ardeids are currently located at Ho Pui (5.5 km from Sha Po, 3.5 km from the 43CD alignment), Ko Po Egrettry (1.2 km from Sha Po, adjacent to 43CD alignment), Mai Po Egrettry (adjacent to Mai Po San Tsuen) and Mai Po Marshes Nature Reserve (3.5 km from Sha Po, 6 km from the 43CD alignment). The colony locations lie within the 10 km feeding radius specified by Hafner *et al.* (1987)*. Therefore loss of wetland habitats is likely to significantly affect the long-term survival of breeding ardeid populations at these nest sites. Although the area of freshwater marsh to be lost due to the MDC Works is small and, in many places, subject to disturbance, cumulative impacts of the loss of ardeid feeding habitat

* Hafner, H., P. Dugan, and V. Boy (1987) *Hérons and Wetlands in the Mediterranean: Development of Indices for Quality Assessment and Management of Mediterranean wetland ecosystems*. Commission of the European Communities, Tour du Valat.

would result from construction of the proposed MDC and other projects in the Kam Tin valley such as the Route 3 Highway, the Port Passenger Line and other phases of the New Territories drainage improvement scheme.

Residual impacts could result from the inability to provide marsh, pond and other wetland habitat in compensation for losses due to the MDC Works. While potential ecological impacts may result from the loss of wetland habitat for the 43CD and 30CD Works, it is recommended that the overall ecological impacts should be considered in a broader context with the other MDC Works and will be reported in the EIA for MDC. The option for replacement of lost wetland acreage such as the use of flood storage ponds into wetland areas will be explored in the EIA for MDC. In this context additional project specific field based avifauna survey is currently underway and the results will be reported in the EIA for MDC.

5.1

CONSTRUCTION IMPACTS

It is estimated that 350,000m³ and 96,000m³ of dredged/excavated material will be generated from the construction activities for 43CD and 30CD of the MDC respectively. Sediment sampling undertaken by DSD and ERM indicate that a volume of 100,000 m³ of sediment to be dredged for the 43CD drainage channel are classified as contaminated and as such will require special dredging, transport and disposal provisions. The handling of the dredged sediment is thus considered to be the key issue regarding waste management during the construction works. All procedures laid down in WBTC Nos. 6/92 and 22/92 and EPD TC No. 1-1-92 will have to be followed in order to minimize impacts associated with dredged materials. Consultation with the FMC will be necessary to finalise the disposal allocation of Class C contaminated sediment at East Sha Chau. Class B dredged mud will be disposed of to gazetted marine disposal grounds but special care must be taken during its dredging, transport and disposing so as to minimize the loss of pollutants into solution or by re-suspension. The mitigation measures recommended should be strictly followed, with strict adherence to the WBTC No. 22/92, to minimise any potential adverse impacts of the dredging works and to protect short term, local water quality.

Stockpiling of Class B and C contaminated dredged material will not be permitted due to the potential of contaminants percolating into the surrounding areas, thus it will be necessary to ensure that all contaminated material (Class B and C) immediately taken offsite for appropriate disposal. In view of the engineering difficulties associated with hydraulic dredging and vessel transfer of contaminated dredged material to a suitable marine barging location, such dredged material will have to be trucked (via water tight trucks) to a location for transfer to sea-going barges for transport to designated marine disposal grounds. In addition, in view of the EPD's requirement for no stockpiling of either Class B and C sediments, it will be necessary that all contaminated material (Class B and C) be immediately taken offsite and to the designated mud pits.

Land-based alternatives have been given due consideration for the disposal of dredged 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 will be adopted while suitable excavated material should be either reused on site or sent for land-based disposal (landfill) or public dump as far as practicable.

Providing that there is strict control of all associated wastes from the 43 CD and 30CD construction works and all arisings are stored (where permitted), transported and disposed of using approved methods, no significant adverse environmental impacts are predicted. Thus, it is anticipated that no

insurmountable waste management impacts will arise during the construction period.

5.2 OPERATIONAL IMPACTS

In general, the disposal methods for dredged material undertaken in the construction phase would be applicable to the operational phase maintenance dredging. However, the appropriateness of these recommended contaminated mud dredging mud disposal methods will be reviewed in the upcoming Sedimentation Study, which will address the environmental impacts of maintenance dredging and associated contaminated mud disposal.

6 NOISE

6.1 CONSTRUCTION PHASE

The noise assessment undertaken indicated that both the 43CD and VFPW 30CD Works will 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 the use of these mitigation measures should reduce impacts at nearby NSRs from daytime, and evening if recommended, construction activities to acceptable noise levels, stipulated in the established guideline and Noise Control Ordinance (NCO). It is not recommended that night-time (2300-0700) construction activities be carried out for any phase of the construction works.

6.2 OPERATIONAL PHASE

The assessment concluded that both 43CD and VFPW (30CD) 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, orientation of louvres away from NSRs and the use of acoustic louvres will further reduce noise levels at NSRs to within the NCO and the Hong Kong Planning Standard and Guidelines criteria.

AIR QUALITY

7.1

CONSTRUCTION PHASE

This assessment has indicated that both the 43CD and 30CD Works 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) and NO₂ associated with construction 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 albeit short-term generation of odours and associated odour impacts.

It is believed that the use of the recommended mitigation measures should reduce impacts at nearby ASRs to acceptable levels, ie. within the limits of the Air Quality Objectives.

7.2

OPERATIONAL PHASE

There will be no sources of air pollutant emissions during the operational phase of the 43CD and VFPW. Temporary 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 on a significantly smaller scale. Mitigation measures recommended for the construction phase will generally apply to maintenance dredging.

8

ENVIRONMENTAL MONITORING AND AUDITING

An environmental monitoring and audit programme has been recommended as necessary for assessing the effectiveness of the mitigatory measures employed during the construction and operational phases of 43CD of the MDC and the VFPW (30CD). The EM&A requirements and mitigation measures outlined in the EIA report shall be included in the Contract. An Environmental Manual will be prepared and agreed with EPD prior to commencement of construction.

Water quality, noise and dust monitoring is recommended for the construction phase, while water quality and noise monitoring is recommended for the operational phase. Operational water quality

monitoring, which will be considered in the context of the overall MDC Works Project, will be addressed in the EIA for MDC.

9

OVERALL CONCLUSIONS

Provided that mitigation measures are properly and fully implemented, it is considered that the works for 43CD and 30CD will not result in any insurmountable environmental problems. Furthermore, relative to the appropriate environmental criteria, no significant residual environmental impacts are anticipated to result from the 43CD Main Drainage Channel and 30CD Stage 1 Village Flood Protection Works.

The EIA of the whole MDC project is presently underway and will address the individual project components (60CD, 43CD, 30CD, 22CD and 29CD) and cumulative MDC project impacts during both construction and operation.