AIRPORT AUTHORITY
HONG KONG

NEW AIRPORT MASTER PLAN

Environmental Impact Assessment Update

香 港 機 場 管 理 局

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Environmental Impact Assessment Update

February 1998

PART A INTRODUCTION

PART B ISSUES RELATING TO AIRPORT CONSTRUCTION

Introduction

1.1 Background

The New Airport Master Plan (NAMP), which provided the basis for construction of the new airport, was completed in December 1991. The NAMP included an Environmental Impact Assessment (NAMP-EIA) which was based on designs, construction methodologies and operational forecasts presented in the NAMP-Planning and NAMP-Civil Engineering Report. Based on subsequent engineering and cost considerations, the airport layout was modified resulting in the shifting of portions of the airport platform from east to west. The changes in environmental impacts resulting from these modifications were assessed and documented in the detailed NAMP-EIA Supplement, which was completed in October 1992. Additional elements of the NAMP have since been modified during the detailed design phase of the airport project. These included changes in agreed mitigation measures, identification of additional mitigation requirements as well as operational procedures to be developed and implemented during the operational phase of the airport. Operational forecasts contained in the original NAMP have also been revised based on changes in traffic demands and aircraft technology.

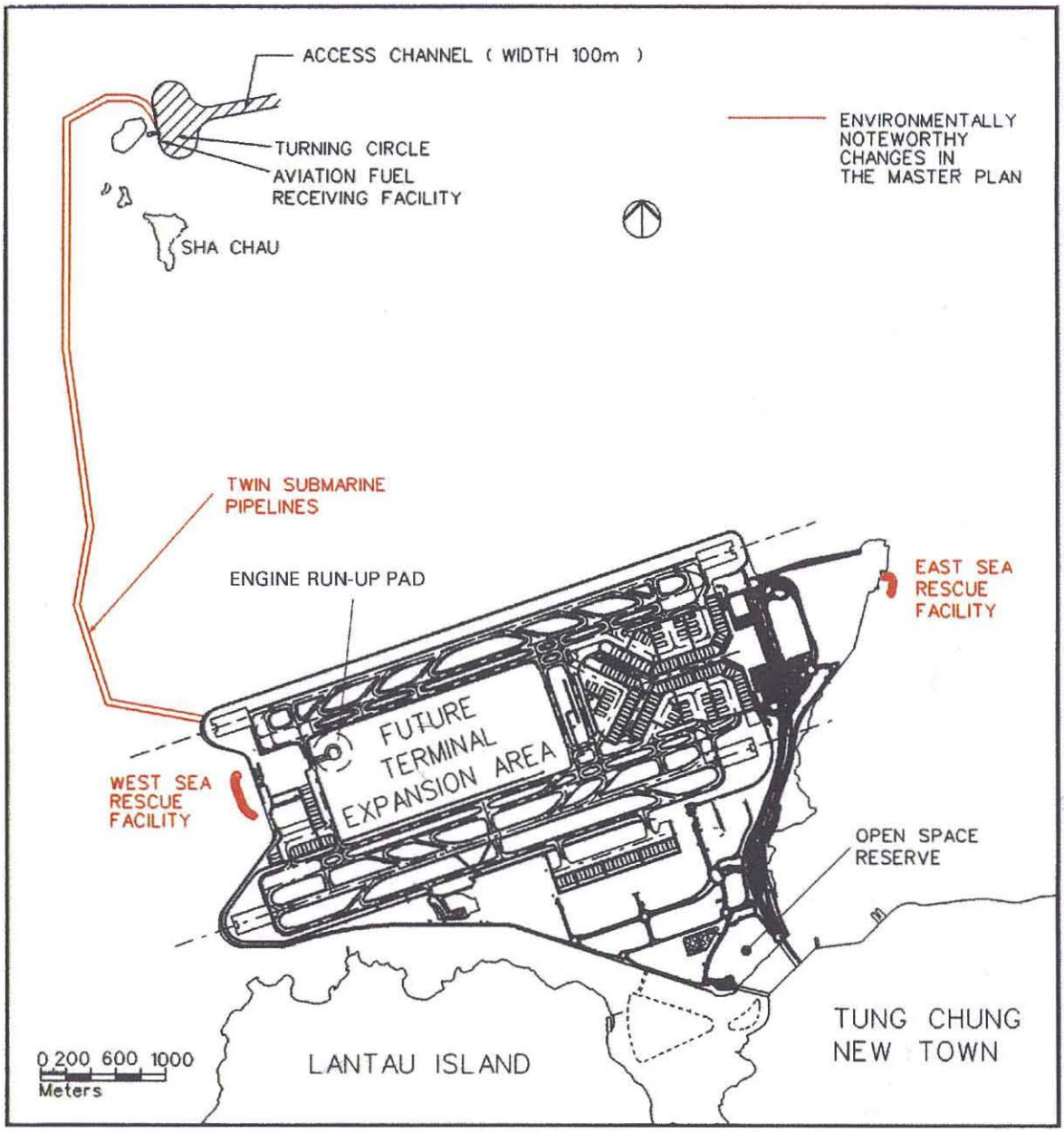
In addition, an Environmental Impact Assessment was completed in March 1995 for an Aviation Fuel Receiving Facility at Sha Chau which had not been proposed in the NAMP. Other specialised environmental reports have also been prepared on issues related to marine borrow and dumping operations, the hydraulic performance of the southern sea channel and potential impacts to the Indo-Pacific Humpbacked Dolphin, *Sousa chinensis*. All environmentally significant, currently envisioned modifications to the physical airport development, from that described in the NAMP-EIA and EIA Supplement, have therefore already been evaluated for environmental impacts and the resulting documents, as well as proposed mitigation and environmental monitoring programmes, have been accepted by Government. These documents are incorporated into this EIA Update by reference.

The organisation of the EIA Update is patterned after the original 1991 NAMP-EIA. Construction impacts are addressed first, with the Summary and Recommendations from the NAMP-EIA and EIA Supplement repeated verbatim in italics, section by section (e.g. Noise, Air Quality, Tidal Flow and Water Quality). Minor liberties were taken in adjusting some of the section titles and references in order to merge the summaries and recommendations of these documents into this EIA Update. A summary of impacts and recommendations extracted from the Aviation Fuel Receiving Facility EIA is also presented in relevant sections. Following each extracted recommendation is a non-italicised, bold type faced, statement describing the status of implementation. Reviews and updates of impacts, levels of task completion, and comparisons of projected to actual impacts then complete each section. The same pattern is followed for operational impacts.

1.2 Purpose

All environmentally significant modifications to the NAMP, both physical and operational, which have either already been implemented or are currently envisioned, are addressed in this EIA Update. Potential environmental impacts which have already been studied, as discussed above, are summarised and the documents are incorporated into this EIA Update by reference. Additionally, the operational phase environmental monitoring and audit (EM&A) programme will be further refined and a stand-alone manual will be produced. However, opening the airport will be a dynamic process and it is anticipated that the EM&A manual will need to be modified extensively to reflect adjustments in procedures and processes during the early operational stages of the airport.

The Airport is programmed to open in April of 1998. At opening one runway will be operational with the second runway being completed by the end of 1998. Exhibit 2.1 illustrates the opening year layout and highlights environmentally noteworthy alterations from the NAMP.



Environmentally Noteworthy Changes from the NAMP ***Exhibit 2.1***

The completed NAMP-EIA and NAMP-EIA Supplement identified a range of mitigation measures based upon proposed construction practices, preliminary infrastructure designs, and anticipated operational plans. The first step in the process was to implement the NAMP-EIA recommendations for the reclamation phase of construction. This work commenced in January of 1993 and involved establishing an air, noise and water quality monitoring programme and agreeing monitoring reporting formats and procedures with the Environmental Protection Department (EPD). As airport construction advanced, a site audit programme for contractor compliance was also implemented and is being carried through, with the construction monitoring programme, until airport opening.

In parallel with the reclamation phase of the project, was the development of detailed designs for airport buildings and infrastructure. To ensure proper implementation of NAMP-EIA mitigation measures, each design consultant was required to conduct an environmental review of each detailed design. This involved a comparison of the proposed final design

with that envisioned by the NAMP-EIA and documenting any potential changes in predicted impacts. These reviews were reported in Environmental Assessments (EAs) which were submitted to the Environmental Protection Department (EPD) for comments. In these EAs, NAMP-EIA mitigation measures were accounted for and, where necessary, amended. In addition, regular meetings were held with EPD and the Agriculture and Fisheries Department (AFD) to review the implementation status of NAMP-EIA mitigation measures.

During the review of the detailed design for the Airport Fuel Receiving Facility (AFRF), it was determined that the proposed NAMP-EIA location for this facility off the north shore of the airport platform was not practical. In its place, it was agreed with Government, that the only practical alternative was to locate the AFRF north of the airport platform near the island of Sha Chau. Since this was not evaluated by the original NAMP-EIA, a detailed EIA (referenced in Section 1.1) was prepared by the Authority in March 1995. The recommendations contained in this document, have been incorporated into the planning process and are a part of this EIA Update .

The following discussion addresses changes, since 1991, in environmental legislation and guidelines which are likely to apply to activities and facilities for which the Airport Authority has direct responsibility.

3.1 Environmental Impact Assessment (EIA) Ordinance

In February of 1997, the Hong Kong Government enacted the Environmental Impact Assessment (EIA) Ordinance. The new EIA Ordinance essentially codifies earlier "Administrative EIA" requirements contained in Works Branch Technical Circular 14/92 and EPD Advice Note 2/92.

The EIA Ordinance now requires that project proponents for a range of "designated projects" obtain "Environmental Permits" prior to start of construction. In most cases, the acquisition of the permit will require the approval of an EIA prepared in accordance with the formal approval process detailed in the Ordinance although approval may be given to apply for a permit directly, without conducting an EIA. A granted Environmental Permit will likely be conditional upon the implementation of any mitigation measures recommended in the EIA studies.

Under Section 15(1)(f) of the Ordinance, the Director of Environmental Protection established a register of EIAs approved by Government prior to the enactment of the Ordinance. Included in this register is the New Airport Master Plan-EIA (NAMP-EIA), the NAMP-EIA Supplement and the EIA prepared in support of the Aviation Fuel Receiving Facility at Sha Chau.

In addition, Section 9(2)(g) of the Ordinance exempts a project from obtaining an Environmental Permit if it has commenced construction or operation prior to enactment. As a result, the New Airport does not require an environmental permit to complete its construction or for its operations. However, should there be a "material change" to the project as defined in Schedule 1 of the Ordinance, then that change would be subject to the environmental permit process. Guidelines for evaluating whether a proposed project modification is a material change are presented in Chapter 6 of the Technical Memorandum on the Environmental Impact Assessment Process (TM). The TM is the document that sets out the procedures and guidelines for the new EIA process.

3.2 Noise

3.2.1 Construction Noise

Construction noise is regulated under the Noise Control Ordinance (Cap. 400). Under Section 6(1) and (2) of the Ordinance, a permit must be in effect during restricted hours for general construction works using Powered Mechanical Equipment (PME). Issuance of the permit is guided by the Technical Memorandum on Noise from Construction Work other than Percussive Piling.

In view of the significant social implications of the airport construction works, the Government gazetted an Exemption Order in 1991 known as the Noise Control Ordinance (Exemption from Section 6(1) and (2) (Chek Lap Kok) Order 1991 (*L.N.358 of 1991*). The Order authorised a 24-hour construction programme, without requiring individual contractors to obtain a permit, subject to the following conditions:

a) Maximum allowable noise levels for the works at Chek Lap Kok site shall not exceed the values stipulated in Table 3.1 at various Noise Sensitive Receivers (NSRs) at North Lantau;

b) The southern tip of Chek Lap Kok shall be preserved to act as a natural noise barrier;

c) An earth bund (referred to as a "berm" in the NAMP-EIA and in this Update) shall be progressively constructed to +10mPD along the southern boundary of the airport platform to serve as a temporary noise barrier until unmitigated noise from main reclamation activities shall no longer exceed the maximum allowable noise levels in Table 3.1;

d) Chek Lap Kok excavation plan shall be stipulated so that all prudent measures are taken to shield Tai Po from PME noise until the villagers at Tai Po have been relocated elsewhere;

e) All rock drills for the construction works shall have a sound power level of 110 dB(A) or less.

The above conditions essentially follow the recommendations made in the NAMP-EIA for mitigation of construction noise.

A new Order was gazetted on 2 May 1997 (*L.N.190 of 1997*) to extend the effect of the 1991 Order for another 2 years immediately following expiration of the 1991 Order on 31 May 1997. The new 1997 Order takes into account the revised opening date of the airport from July 1997 to April 1998 and the approval to construct the second runway granted by the Airport Committee under the Joint Liaison Group on 30 May 1996.

The 1997 Order contains similar provisions for noise control and monitoring as the 1991 Order except that Table 3.1 is revised to Table 3.2 and conditions (c) and (d) of the 1991 Order are deleted. The changes were made to reflect the changes of the NSRs and the completion of the last phase of site reclamation works in January 1996.

Table 3.1 Allowable Noise Levels in dB(A) in the 1991 Exemption Order (*L.N.358 of 1991*)

	Areas of Noise Sensitive Receivers				
Restricted Periods	Tai Po	Tung Chung	San Tau	Sha Lo Wan	Sha Lo Wan (Shore)
0700-1900 Holidays + 1900-2300 All	65	65	65	60	65
2300-0700 All	62	55	60	55	60

Table 3.2 Allowable Noise Levels in dB(A) in the 1997 Exemption Order (*L.N.190 of 1997*)

	Areas of Noise Sensitive Receivers				
Restricted Periods	Tung Chung New Town	Tung Chung	San Tau	Sha Lo Wan	Sha Lo Wan (Shore)
0700-1900 Holidays + 1900-2300 All	65	65	65	60	65
2300-0700 All	55	55	60	55	60

3.2.2 Operational Noise

Aircraft noise is regulated under the Civil Aviation (Aircraft Noise) Ordinance (Cap. 312). The Civil Aviation Department will propose any modifications, if required, to adapt the legislation to operations at the new airport.

3.3 Air Quality

3.3.1 Construction Dust

The Air Pollution Control (Construction Dust) Regulation (Cap. 311) was gazetted on 4 April 1997 and will come into effect on 16 June 1997. Detailed dust suppression measures are prescribed in the Regulation. Prior notification to the EPD is required for some specific construction activities. The Regulation applies to existing construction works that will continue after 16 June 1998 i.e. over 1 year after the Regulation came into effect or any new works immediately after 16 June 1997.

3.3.2 Vehicle Emissions and Motor Vehicle Fuel Quality

Amendments to the Air Pollution Control (Vehicle Design Standards) (Emission) Regulations and the Air Pollution Control (Motor Vehicle Fuel) Regulation (Cap. 311) came into operation on 1 April 1997. A set of new vehicle emission standards commonly known as "EURO-2" have since then been implemented in Hong Kong.

Further initiatives to improve road-side air quality are being investigated by the Government. A pilot scheme to test the actual operations of Liquefied Petroleum Gas (LPG) - powered taxis will commence early in 1998. There is an on-going effort to reduce air quality impacts due to road traffic in Hong Kong.

3.4 Water Quality

3.4.1 Dumping at Sea Ordinance

The Dumping at Sea Ordinance (April 1995) (Cap. 466), which replaced the Dumping at Sea Act (1974) (Overseas Territories) Order 1975, provides the main legislative framework for controlling dumping and incineration of substances and articles at sea. The Ordinance applies to and requires permits for a number of operations including but not limited to marine construction work, dredging, marine borrowing, land reclamation, and stock piling on the sea-bed. Section 2 defines "dumping" as any deliberate disposal of materials, including any discharge, from any aircraft or vessel, regardless of the country of origin, or a marine structure. However, dumping that is incidental to the operation of an aircraft, vessel or marine structure is excluded under the definition except when the materials transported to or by such means are intended for dumping or treatment before dumping. This Ordinance is most applicable during remaining airport construction activities and less so during operation.

3.4.2 Water Pollution Control (Sewerage) Regulation

The Water Pollution Control (Sewerage) Regulation (1994) (Cap. 358) mandates private lot owners to collect and connect wastewater to communal sewers. It provides the government the authority to control the operation and maintenance of private wastewater treatment facilities. Sections 7 and 8 empower the government to carry out necessary works and/or take over operation of a facility at the owner(s)' expense if the facility fails to comply with any license requirements, poses any safety or public health hazards, or causes damage to any drainage or sewerage system.

Airport Authority owned wastewater treatment facilities are covered by this regulation.

3.5 Ecology

The Environmental Impact Assessment (EIA) Ordinance (see Section 3.1 above) Technical Memorandum (TM), which became effective on 18 June 1997, requires prospective developers "to identify and quantify any potential losses or damage to flora, fauna and natural habitats". Details for accomplishing this are contained in the TM in Annex 8 : Criteria for Evaluating Ecological Impact and Annex 16 : Guidelines for Ecological Assessment. Any future airport development which would result in ecological impacts which are significantly different from those envisioned in the NAMP-EIA could be considered a "material change" and could therefore trigger the requirement for a permit.

3.6 Waste and Hazardous Materials

3.6.1 Waste Disposal Ordinance

The Waste Disposal Ordinance (WDO) (1980) (Cap 354), is the principal legislation encompassing all stages of waste management from point of arising to the point of final disposal. Subsidiary legislation to the WDO, the Waste Disposal (Chemical Waste) (General) Regulation, 1992, provides for the control of chemical waste, including storage, collection, transport, treatment and final disposal. The Regulation defines chemical waste as any scrap material, or unwanted substances specified under Schedule 1 of the WDO. Chemical waste produced at the New Airport will be managed in accordance with the regulation.

3.6.2 Waste Disposal (Amendment) Ordinance

The Waste Disposal (Amendment) Ordinance (1995), provides for the control of waste particularly that of hazardous wastes, into and out of Hong Kong, and their disposal. A permit from the EPD is required before wastes which fall under the control of the Ordinance are imported or exported. The person who applies for the permit must make arrangements for the waste to be managed in an "environmentally sound manner". If the wastes listed in Schedules 6 or 7 of the Ordinance are handled at the New Airport, this regulation will apply.

Issues Relating To Airport Construction

4.1 NAMP-EIA (1991) Summary and Recommendations

4.1.1 Summary of Impacts

Development of the new airport involves two major phases of construction: site formation which consist of blasting, excavation and construction of seawalls under the Site Preparation Contract (SPC) and the follow-up construction works under the Building and Infrastructure Contracts (BIC).

An analysis of construction noise impacts has shown that unmitigated 24-hour site formation activities will produce noise levels which will clearly be unacceptable at Noise Sensitive Receivers (NSRs) along the North Lantau coast to the south of the airport site. Mitigation measures were therefore designed, with the assistance of the Environmental Protection Department (EPD), to bring noise levels down to more acceptable levels. With all practical mitigation implemented at the construction site, approximately 350 NSRs will still be exposed to noise levels in excess of EPD designated Basic Noise Levels (BNLs).

Impacts from dredging activities and Building and Infrastructure Contracts (BICs) activities generate lower noise levels at the closest NSRs, and these activities can be more readily constrained, and noise mitigated, so as to make them acceptable.

4.1.2 Recommendations and Current Status of Implementation

In order to minimise the noise leaving the airport construction site and to mitigate noise levels at the NSRs the following mitigation measures should be implemented:

a) *Preserve the southern tip of Chek Lap Kok to act as a natural noise barrier.*

The southern tip of Chek Lap Kok was retained and serves as a noise barrier mainly for ground level NSRs at Tung Chung.

b) *Construct a southern berm to +10 mPD and sufficiently in advance of the main reclamation to break line of sight between sensitive receptors and noise generating plant. The portions of the berm required to shield BIC activities will be retained until unmitigated noise from those activities will no longer exceed Base Noise Levels.*

A berm, also referred to as a bund in some documents, was constructed along the southern edge of the airport platform to shield NSRs from noise. Portions of the berm were modified following completion of construction activities. Portions of the berm will be retained, further modified, and landscaped for incorporation into the operating airport.

c) *Develop the Chek Lap Kok excavation plan so that all prudent measures are taken to shield Tai Po from noise generating plant.*

All residents from Tai Po were relocated away from the site prior to commencement of major excavation activities on Chek Lap Kok in January 1993. Since no NSRs remained in this area, no special precautions were required.

d) *Specify the use of rock drills that have a sound power level of 110 dB(A) or less.*

This specification was added to all contract documents. Drilling was completed in mid-1995 and noise monitoring results show no exceedances due to operation of rock drills at any of the NSRs.

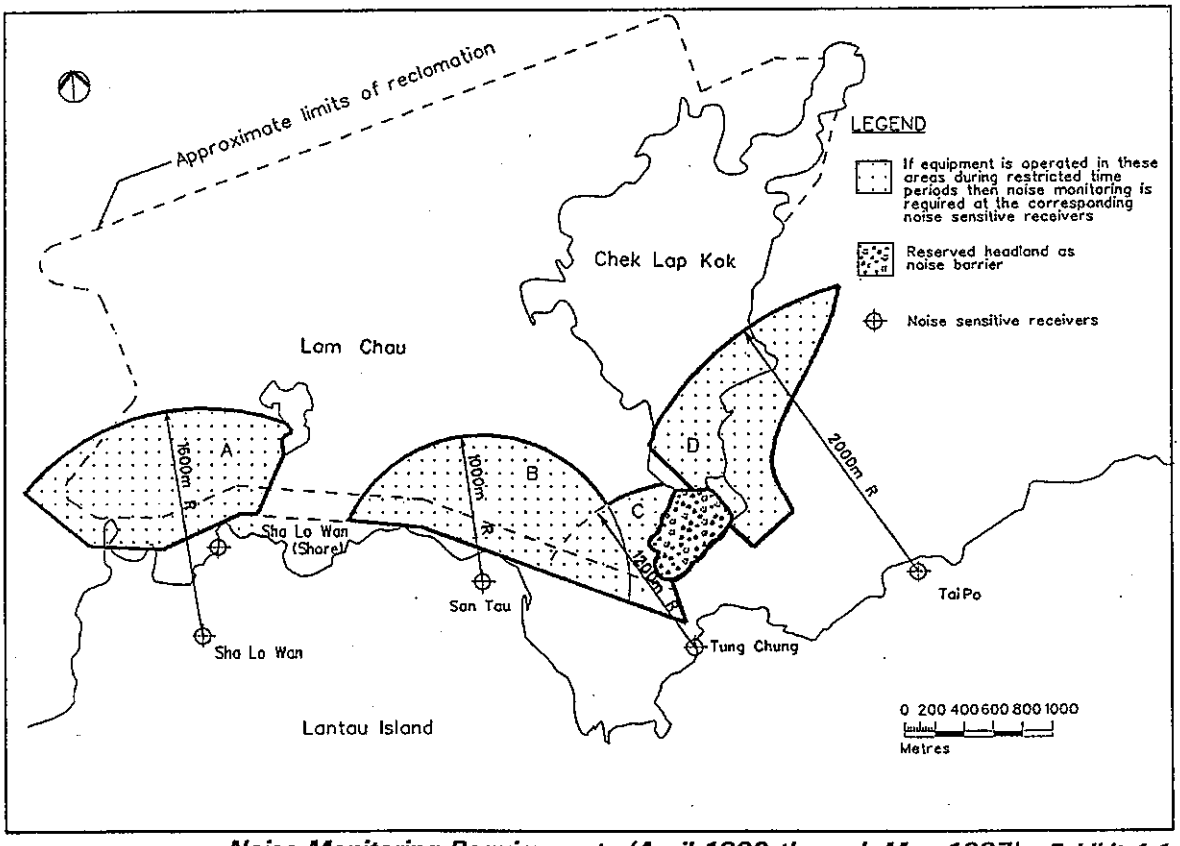
e) *Provide funding for the acquisition and operation of air conditioners for approximately 73 NSRs. With air conditioners in use, a portion of the dwelling unit can be closed and the walls can provide insulation from external noise.*

A total of 319 air-conditioners were provided to 62 households in late 1993. Payments for electricity costs ended in October 1996 as construction neared completion and following a long period where noise levels were found to be consistently below 55dB(A).

If these mitigation measures are implemented the analysis shows that EPD established Allowable Noise Levels for all NSRs can be complied with. To assure compliance with Allowable Noise Levels the following measure should be taken:

f) *Compliance monitoring should be conducted by the Engineer and if the Allowable Noise Levels are exceeded the Contractor should be required to adjust the use of his plant.*

Monitoring was conducted at the locations and according to the specifications shown in Exhibit 4.1 below, except at Tai Po where all residents were relocated prior to commencement of major excavation.



Noise Monitoring Requirements (April 1992 through May 1997) ***Exhibit 4.1***

4.2 NAMP-EIA Supplement (1992) Summary and Recommendations

4.2.1 Summary of Impacts

An analysis of the combined construction noise impacts resulting from the modified reclamation and berm construction activities, as well as the headland excavation work, was conducted for the Sha Lo Wan village and shoreline areas. Noise levels, as projected for the village of Sha Lo Wan, were shown to exceed the evening, night-time and holiday Allowable Noise Levels (ANLs), but were below the 70 dB(A) target level established for daytime activities. The same situation was projected to occur at the Sha Lo Wan (Shore) NSRs.

As mitigation for these impacts, the excavation of the headland and construction of the berm will be constrained during evenings, nights and holidays in order to comply with established ANLs.

4.2.2 Recommendations and Current Status of Implementation

Continued adoption of all recommendations made in the NAMP-EIA, as presented above in Section 4.1.2. In addition, constraining excavation of the headland and construction of the berm during evenings, nights and holidays in order to comply with established ANLs.

All NAMP-EIA recommendations were implemented and the excavation of the headland and construction of the berm were restricted to non-holiday, daytime hours.

4.3 Current Status of Development and Remaining Impacts

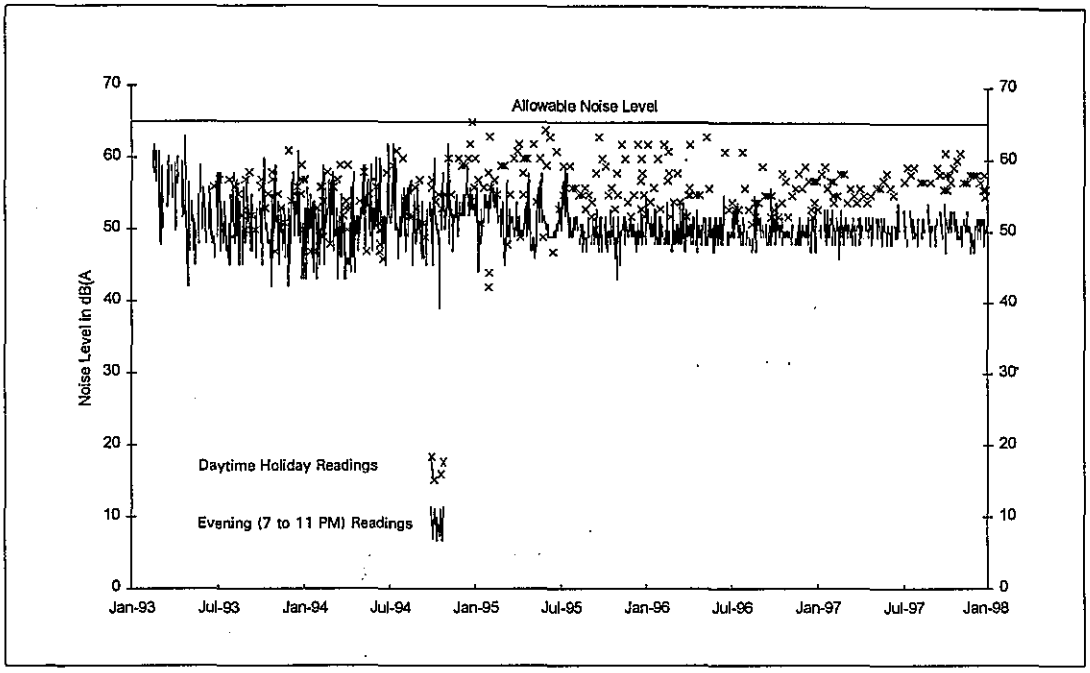
Following substantial completion of the SPC on 2 January 1996, the noise emissions from the airport construction site have significantly decreased. Since then, remaining construction on the airport platform has consisted of general building and infrastructure related activities which, in terms of noise generating potential, has compared very favourably with the blasting and excavation which occurred in the early stage of site formation. Until the new airport opens, the remaining construction activities will be widespread, including remaining works on and around the Passenger Terminal Building and Ground Transportation Centre, continuing road and rail construction taking place along the east coast, and significant building and infrastructure construction being carried out by franchisees and government tenants across the southern and eastern portion of the airport. However, none of these activities are expected to cause significant noise levels at the NSRs, given the limited use of powered mechanical equipment and the distance from the NSRs. Construction on the northern runway commenced in May of 1997 and is scheduled for completion in November 1998. The related Northwest Concourse Extension of the Passenger Terminal Building is expected to begin in the 4th Quarter of 1997. Given the great distance separation, the associated noise impacts are expected to be insignificant at North Lantau.

There have been significant changes in the NSRs in the vicinity of Tung Chung in recent years. Tai Po was relocated prior to commencement of the SPC, which reduced the overall noise concerns and simplified the noise monitoring and mitigation programme as originally envisaged in the NAMP-EIA and its Supplement. However the gradual occupation of the high-rise housing estates in Tung Chung New Town since June 1997 is now adding new NSRs to the area.

4.4 Comparison of Projected to Actual Impacts

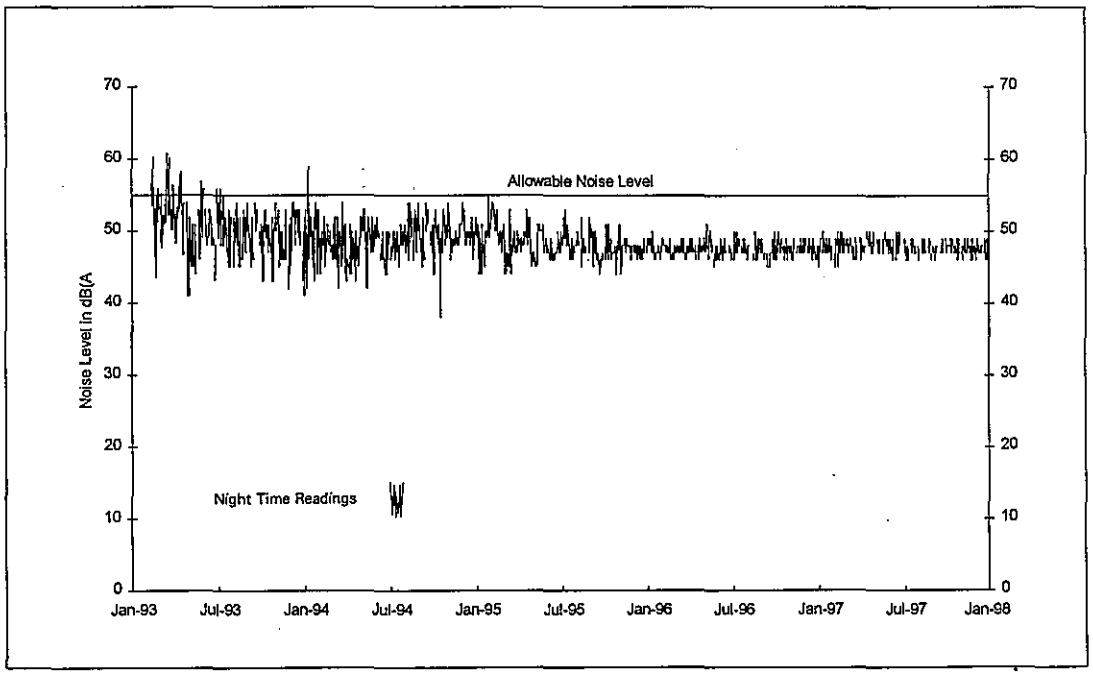
As a result of implementing the mitigation measures recommended in the NAMP-EIA, there were less than a dozen noise complaints from North Lantau villagers, relating

primarily to loud hailers and blasting, in 1993 and 1994. There have been no complaints since the peak in land formation activities in those years. Monitoring data for the sites shown in Exhibit 4.1 are presented in Exhibits 4.2 through 4.9.



Tung Chung Evening and Daytime Holiday Readings *Exhibit 4.2*

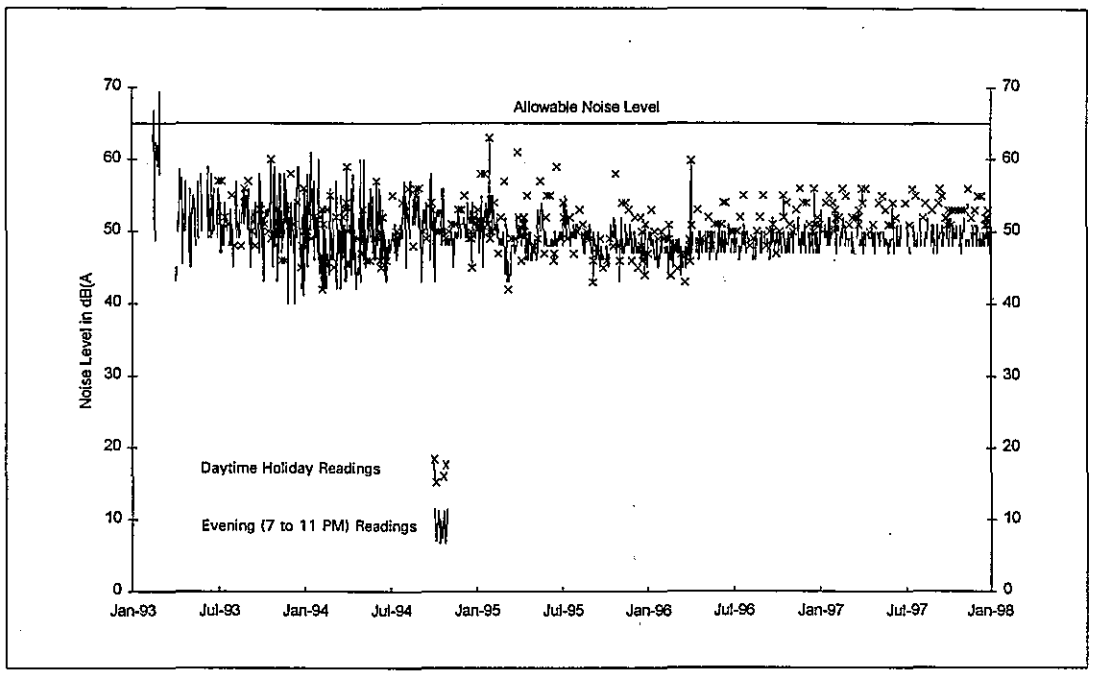
ANLs were established based on projected noise levels, Area Sensitivity Ratings and the level of mitigation provided on the site.



Tung Chung Night Time Readings *Exhibit 4.3*

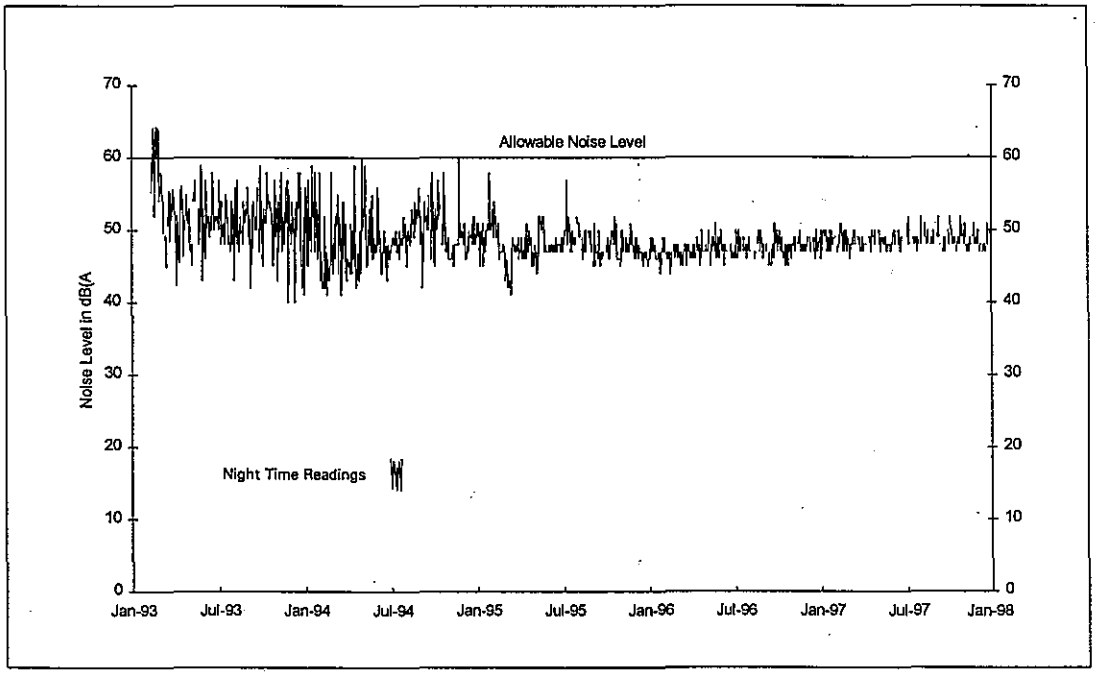
Based on the monitoring data, it appears that construction noise was effectively mitigated and that noise levels were very close to projected levels and generally well within the ANLs. Monitoring logs indicate that for the few exceedances that were recorded during the early phases of construction, noise sources other than construction activities, such as Chinese opera performances, loud hailers from boats, insects and boisterous restaurant patrons, were most likely responsible for the

exceedances. As monitoring technicians gained experience, they were able to exclude these non-construction related noise sources from the monitoring data.



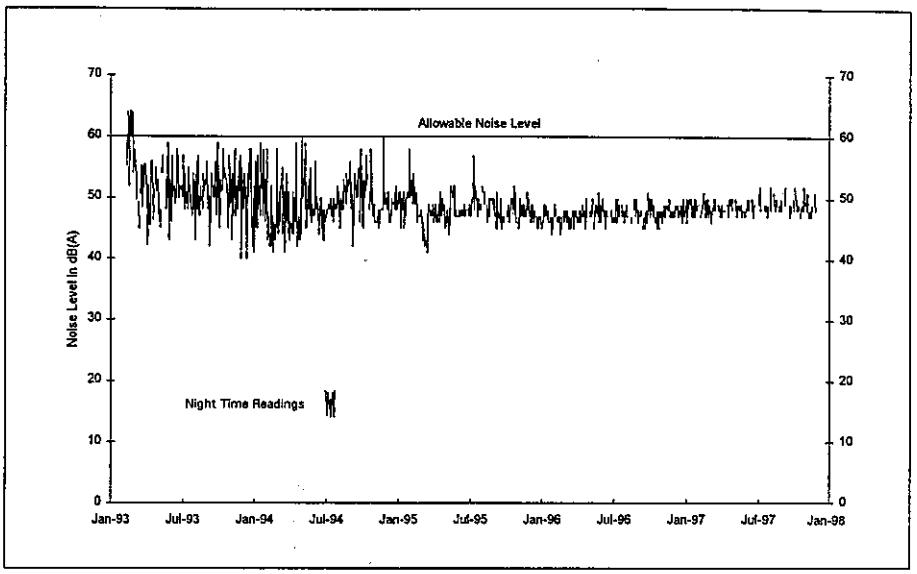
San Tau Evening and Daytime Holiday Readings *Exhibit 4.4*

After land formation activities on the airport platform were largely completed in mid 1995, there is a noticeable reduction in peak noise levels at all four of the monitored sites. This dropping off in the peak and average noise levels is particularly visible in the night time readings taken at San Tau, as shown in Exhibit 4.5.

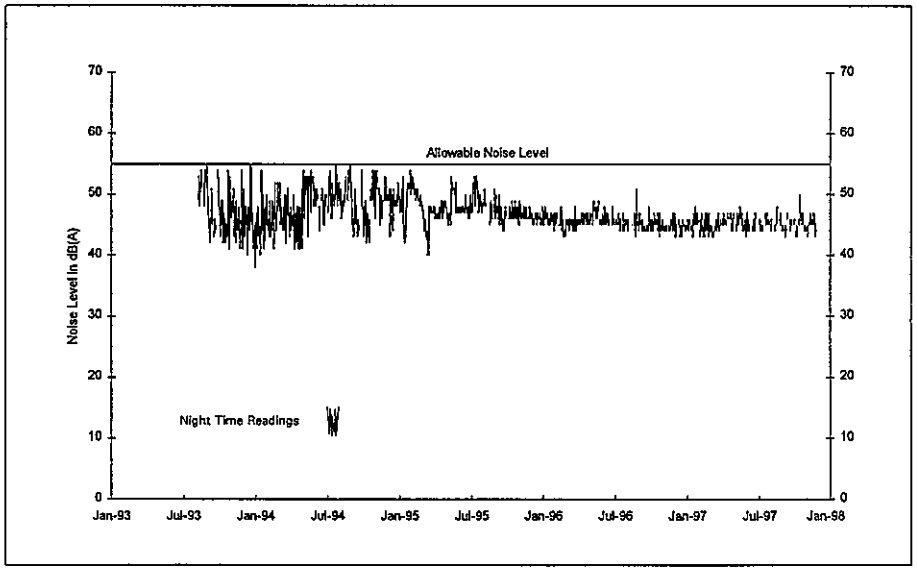


San Tau Night Time Readings *Exhibit 4.5*

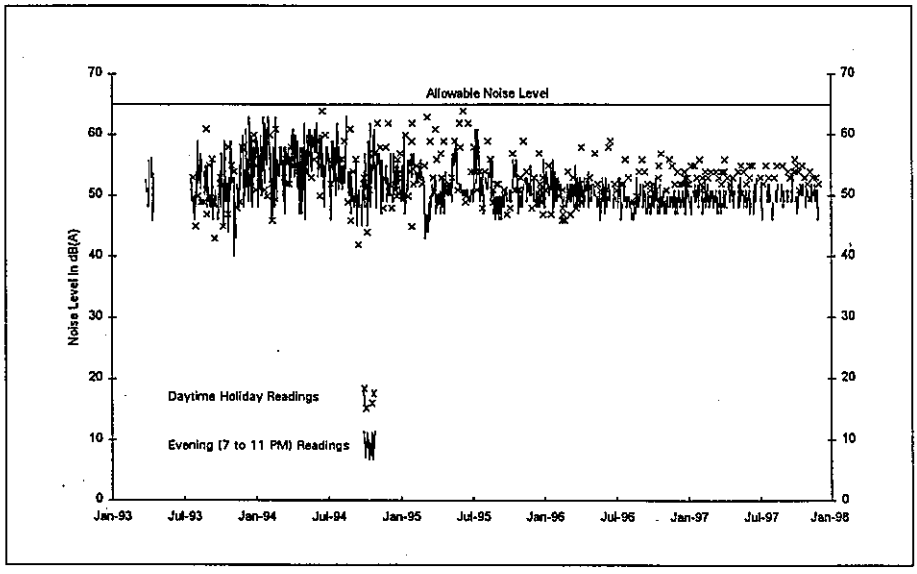
It appears that noise levels monitored since completion of the SPC are more representative of local background noise than from noise generated by airport construction activities.



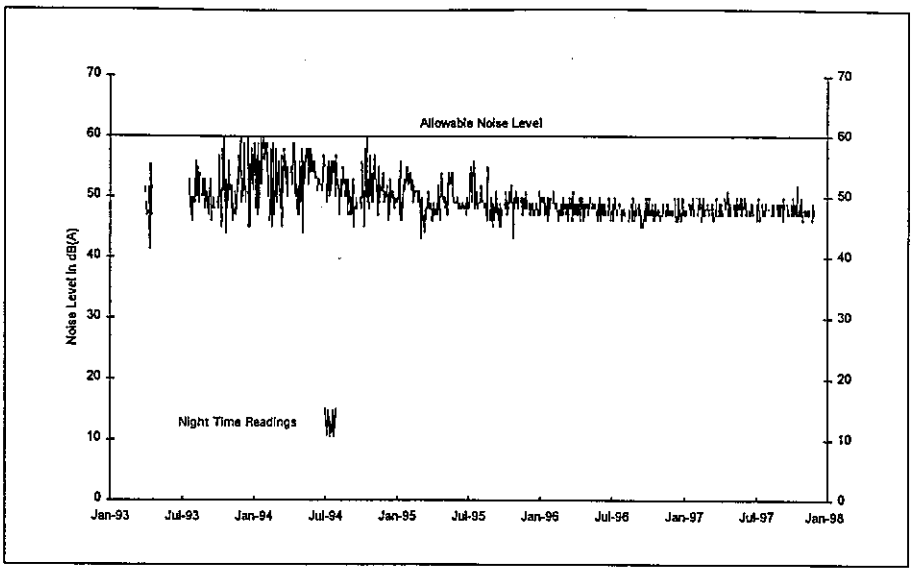
Sha Lo Wan Village Evening and Daytime Holiday Readings Exhibit 4.6



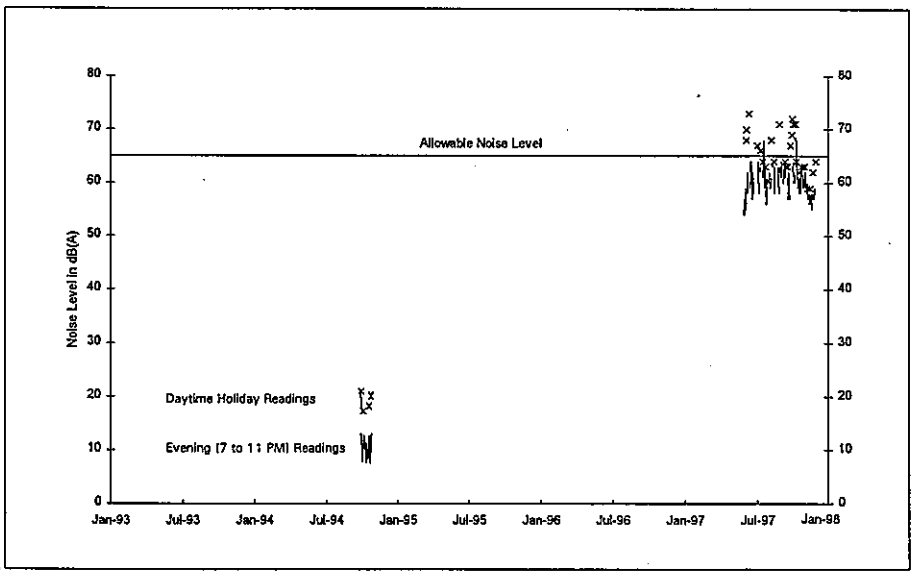
Sha Lo Wan Village Night Time Readings Exhibit 4.7



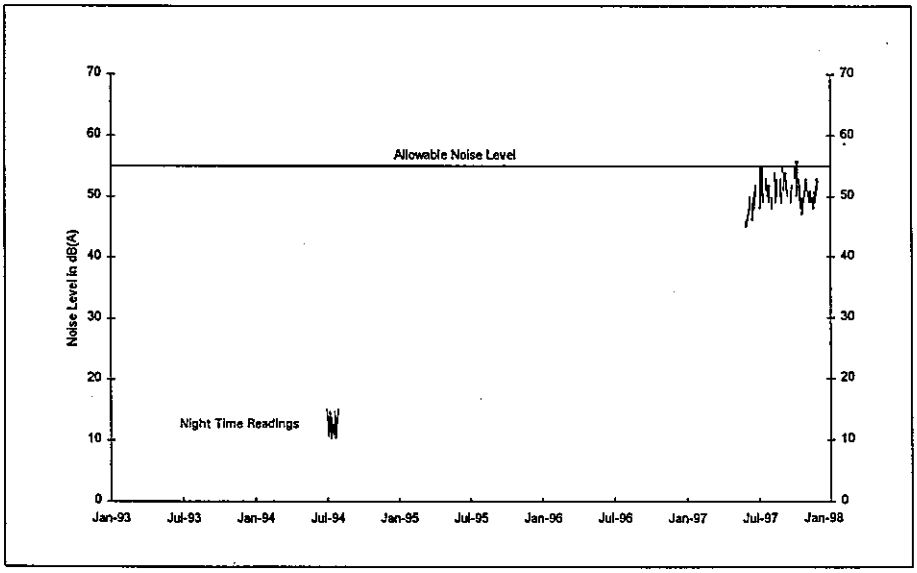
Sha Lo Wan Shore Evening and Daytime Holiday Readings Exhibit 4.8



Sha Lo Wan Shore Night Time Readings Exhibit 4.9



Tung Chung New Town Evening and Daytime Holiday Readings Exhibit 4.10

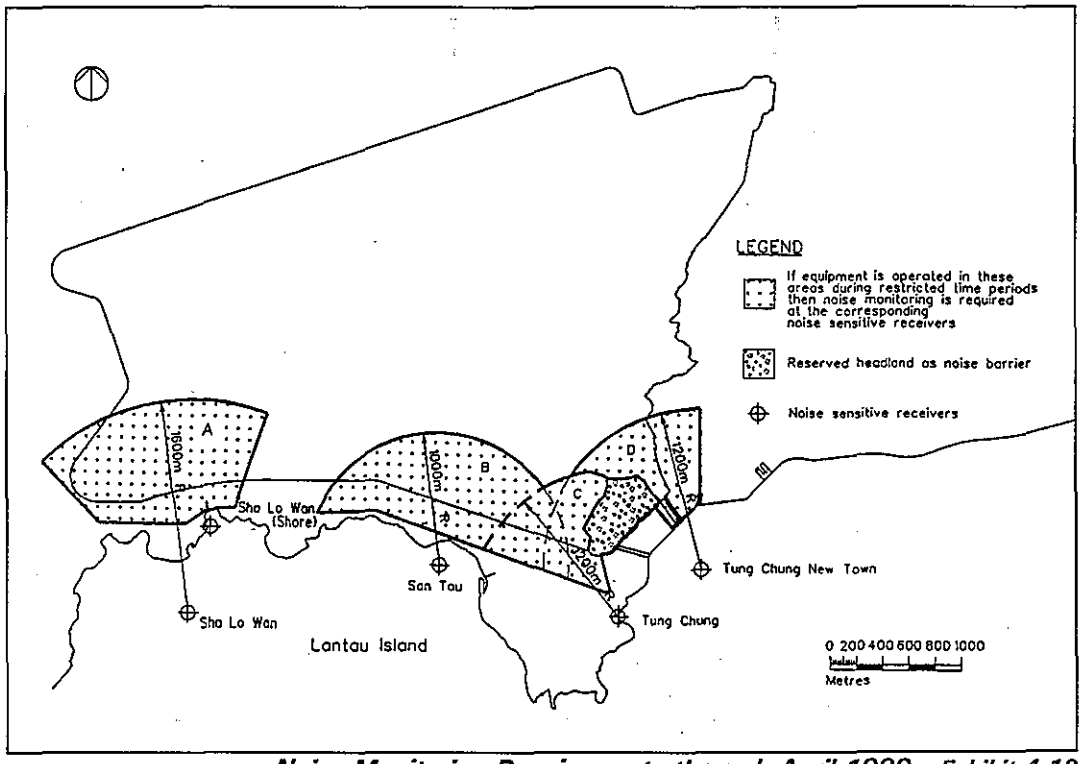


Tung Chung New Town Night Time Readings Exhibit 4.11

A new monitoring site was established, with EPD participation, at Tung Chung New Town in mid-1997. The monitoring was initially conducted at street level, until access could be obtained to the roof of one of the high-rise residential towers. The exceedances recorded at this site through October, 1997, are due to noise generated by roadway traffic and New Town construction activities. No exceedances have been recorded since the monitoring has been conducted on the roof.

4.5 Remaining Monitoring and Audit Programme

In order to implement the noise monitoring requirement under the 1997 Exemption Order, as described in Section 3.2.1, monitoring will be carried out at the locations shown in Exhibit 4.10 below, during restricted hours. The monitoring equipment at Tung Chung New Town is located at roof top so that maximum exposure to the airport site and minimum influence due to local noise sources are ensured.



Noise Monitoring Requirements through April 1999 *Exhibit 4.12*

5.1 NAMP-EIA (1991) Summary and Recommendations

5.1.1 Summary of Impacts

Excavation and land reclamation activities associated with the new airport site at Chek Lap Kok will have a temporary impact on local air quality with particulate matter (dust) having the greatest impact. Blasting, excavation, loading, transport and the placement of fill material are the primary sources of dust associated with a project of this magnitude. Concrete/asphalt plants are also potential sources of air emissions.

In order to determine the potential impact of dust in the vicinity of Chek Lap Kok and Lantau Island, an assessment was conducted using an atmospheric computer dispersion model and the general design principles of the site excavation and reclamation plan. Both "worst case" and "most probable" meteorological conditions were examined in order to more fully evaluate the potential effects of this project.

The highest predicted "worst case" one hour Total Suspended Particulates (TSP) levels are expected to occur immediately following blasting operations. For example, during Quarter 1 the maximum blast-related TSP levels are predicted to range from 308 to 1,286 $\mu g/m^3$ at the 13 receptors located along the north-central coastline of Lantau Island. During Quarter 2, the maximum blast-related TSP levels are predicted to increase to the range of 616 to 5,882 $\mu g/m^3$ at these same receptors in response to a corresponding increase in production rates and the work site moving further south on Chek Lap Kok. However, as the project progresses to Quarter 3, TSP levels following a blast are expected to decline significantly, ranging from 111 to 509 $\mu g/m^3$ by Quarter 7, as the elevation of Chek Lap Kok is lowered. Measured one-hour TSP values in excess of 500 $\mu g/m^3$ exceed the EPD-recommended Dust Suppression Measures Guidelines for construction activities.

By comparison, the highest predicted "worst case" one hour TSP levels associated with the excavation/reclamation process are within the EPD Dust Suppression Measures Guidelines level of 500 $\mu g/m^3$ for TSP.

The Hong Kong Air Quality Objectives (AQOs) and EPD 24-hour TSP Dust Suppression Measures Guidelines level of 260 $\mu g/m^3$ could be exceeded by the highest predicted "worst case" 24-hour TSP levels at two receptors in Quarter 2 and at one receptor in Quarter 3. However, there are no predicted exceedances of the 24-hour TSP AQO or the EPD guideline in Quarter 1 or Quarters 4 through 7.

Finally, the "worst case" 24-hour Respirable Suspended Particulates (RSP) levels which include contributions from both blasting and the excavation/reclamation operations are predicted to be well within the 24-hour AQO for RSP of 180 $\mu g/m^3$. No one hour AQO or EPD guideline exists for RSP.

Under "most probable" meteorological conditions, or when the wind is from the east across Chek Lap Kok Island, the dispersion of TSP and RSP is towards the west and the dust plume will likely remain distributed over water and the land reclamation area. The highest predicted one hour TSP impacts at the 13 receptors on Lantau Island are well within the EPD one hour TSP Dust Suppression Measures Guidelines level of 500 $\mu g/m^3$. Similarly, the highest predicted 24-hour TSP impact at the 13 receptors on Lantau Island will not be more than 1 $\mu g/m^3$ under the "most probable" meteorological conditions. Again, this is well within the 24-hour AQO and EPD guideline of 260 $\mu g/m^3$.

The RSP modelling results, under most probable meteorological conditions, also indicate that the potential impact to receptors on Lantau Island will be minor when the wind direction is from the east.

The creation of dust during the airport site preparation project is unavoidable. Fortunately, the remote location of the project site and the prevailing wind patterns will limit the potential impacts at receptors on Lantau Island. Based on the computer modelling results, the greatest potential impacts are limited to the initial construction period and when the wind is from the north over Chek Lap Kok. In particular, under these worst case conditions, the dust plume created by the blasting operations could unavoidably contribute heavily to elevated TSP levels along the coastline of North Lantau Island in the vicinity of Tung Chung, Sha Tsui Tau and Ma Wan Chung.

5.1.2 Recommendations and Current Status of Implementation

a) *As a control measure, TSP monitoring should be conducted by the Engineer at the closest downwind receptors on Lantau Island. The monitoring should be undertaken to measure compliance with the AQOs for TSP and RSP, and the EPD Dust Suppression Measures Guidelines, which will be defined as the Air Quality Requirements (AQRs) for the Site Preparation Contract (SPC) and BICs.*

Air quality monitoring was initiated in the spring of 1993 at the villages of Tung Chung, Sha Lo Wan and San Tau. Monitoring sites and protocols were agreed with EPD and followed standard procedures for the use of high volume TSP samplers as shown in Exhibit 5.1 below. Each station was monitored for a 24 hour period every 6 days on a staggered sampling programme. It was agreed with EPD that RSP monitoring would not be required.

High Volume TSP Sampler at Tung Chung ***Exhibit 5.1***

b) *The SPC Contractor should at all times be required to minimise dust nuisance resulting from his non-blasting activities and shall keep available adequate plant including water bowsers and spray bars for this purpose, and in the absence of suitable rainfall any exposed area should be wetted down as far as is practicable to meet the AQRs. The Contractor should also be required to properly manage, to the extent possible, the blasting and excavation operations during periods of worst case meteorological conditions so as to minimise the generation of dust.*

The last blast during the SPC was conducted on 16 June 1995. To minimise dust, contractors have used well defined and well graded, rock sub-based, haul roads. These roads are rugged, fast and wettable. The use of sea water for wetting down the roads, as shown below in Exhibit 5.2, has the advantage of being cheap, conserving fresh water and resulting in the roads remaining wet for longer periods because of the presence of deliquescent salts. Contractors also installed and maintained dust cyclones on drill rigs, used upturned exhaust systems and generally employed best practicable means to mitigate air quality impacts.

Water Bowser Applying Sea Water for Fugitive Dust Control ***Exhibit 5.2***

c) *If AQRs are exceeded despite these mitigation measures, the Contractor should be required to identify the source of the dust generation and implement operational controls for activities, other than blasting, such as:*

i) *Adjust his method of working to minimise the generation of dust.*

On the few occasions when North Lantau AQRs were exceeded, the Authority undertook a review of all potentially dust generating activities on site to determine the source of the exceedance, both on and off site. This generally involved reviewing the extent of bowsing activities and increasing or concentrating activity as necessary.

ii) *Limit, to the extent possible, the surface area of potentially erodible earth material exposed by clearing, grubbing, excavation, and fill operation.*

During the SPC the extent of potentially erodible earth exposed on site increased as the reclamation grew. Now, during the BIC stage, large areas of the airport platform are being progressively occupied by buildings and infrastructure, which in many cases, has had the effect of reducing the extent of exposed open areas. As works on site have progressed, the number of vehicles and plant mobilised has rapidly increased, reaching a maximum of over 9,000 operating across the project site. Observations have shown that vehicle activity is one of the most significant contributors to air-borne dust, and the Authority's dust minimisation effort has therefore been directed at ensuring that all contract specific as well as communal roads have been adequately wetted year round.

iii) *Place dust collectors on drill rigs.*

This recommendation was implemented by means of contract stipulations and regular site auditing to ensure contract compliance. Drill rigs used during the SPC were fitted with cyclone dust collectors.

iv) *To the extent practicable: 1) treat material, which when handled is causing the AQR to be violated, with water or watering agent sprays prior to being loaded into a vehicle; and 2) for stockpiles of sand and aggregate, use water sprays to dampen stored materials and when receiving raw material as necessary.*

This recommendation was implemented by means of contract stipulations and regular site auditing to ensure contract compliance. General practice on site has been to dampen stockpiles.

v) *Where dusty materials are being discharged to vehicles from a conveying system at a fixed transfer point, a three-sided roofed enclosure with a flexible curtain across the entry shall be provided where necessary.*

This recommendation was implemented by means of contract stipulations and regular site auditing to ensure contract compliance. General practice on site has been to enclose materials being conveyed at fixed transfer points.

vi) *Where necessary fit conveyor belts with windboards and conveyor transfer points and hopper discharge areas with enclosures to minimise emission of dust, and enclose all conveyors carrying materials which have the potential to create dust and install belt cleaners.*

This recommendation was implemented by means of contract stipulations and regular site auditing to ensure contract compliance. General practice on site has been to enclose conveying systems, including transfer points and hopper discharge points.

The SPC Contractor is likely to establish his principal site of operations in the vicinity of the Advance Works Contract reclamation, but the BIC Contractors may well carry out activities at locations closer to sensitive

receptors. For cement handling and batching in close proximity to sensitive receptors the following clauses should be mandatory:

d) Store cement or pulverised fuel ash delivered in bulk in closed silos fitted with high level alarm indicators. Fit all air vents on cement silos with EPD approved fabric filters provided with either shaking or pulse-air cleaning mechanisms.

These operational controls are specified in all contracts. AA staff conducted regular site audits of specified processes to ensure compliance with EPD licence requirements. Maintenance schedules for dust filtration equipment are a compulsory part of each contractor's quality assurance procedures. Where cement has been bulk stored in silos, dust extraction vents were installed containing the required fabric filters and air cleaning mechanisms. BIC contractors established several concrete batching plants on site, some at locations closer to North Lantau sensitive receptors than the original concrete silos in place for the SPC. Batching plants often incorporated bulk cement storage silos. All operators have applied for and been issued Specified Process Licenses with their plant/equipment conforming to the EPD prescribed standards. Two asphalt plants have also been established on site and these have also been issued with Specified Process Licenses.

e) For dry mix batching have the truck batching aperture shrouded and fitted with water suppression sprays.

Where practicable, truck batching apertures have been fitted with shrouding and water suppression capability.

5.2 NAMP-EIA Supplement (1992) Summary and Recommendations

5.2.1 Summary of Impacts

In order to assess changes in dust levels associated with the modified NAMP, four additional source areas were created for the atmospheric computer dispersion model. A worst case scenario was evaluated so as to fully evaluate the maximum potential increase in dust levels. It should be noted that worst case conditions occur only 20% of the time at the Chek Lap Kok project area.

The results indicate that for Quarters 5, 6 and 7, the worst case one hour TSP associated with the modified excavation/reclamation activities vary slightly from the results presented in the NAMP-EIA. However, the maximum predicted TSP level is still well within the EPD Dust Suppression Guideline of 500 ug/m^3.

In Quarter 7, blasting activities on the headland west of Sha Lo Wan will increase TSP and RSP levels at Receptors Nos. 1, 2 and 3 because of the proximity of the headland to these receptors. The predicted worst case TSP levels for these three receptors range from 935 ug/m^3 to 1,136 ug/m^3, thus exceeding the EPD Dust Suppression Guideline of 500 ug/m^3. However, under most probable meteorological conditions, or when the wind is blowing from the east, none of the receptors on Lantau Island would be impacted by construction activities on the headland.

AQOs establish standards for TSP and RSP for a 24 hour averaging time. For quarters affected by the revised master plan (Quarters 5, 6 and 7) the highest predicted worst case 24 hour TSP and RSP levels are 158 ug/m^3 and 28 ug/m^3

respectively. These highest levels are well within the 24 hour AQO of 260 ug/m^3 for TSP and 180 ug/m^3 for RSP.

5.2.2 Recommendations

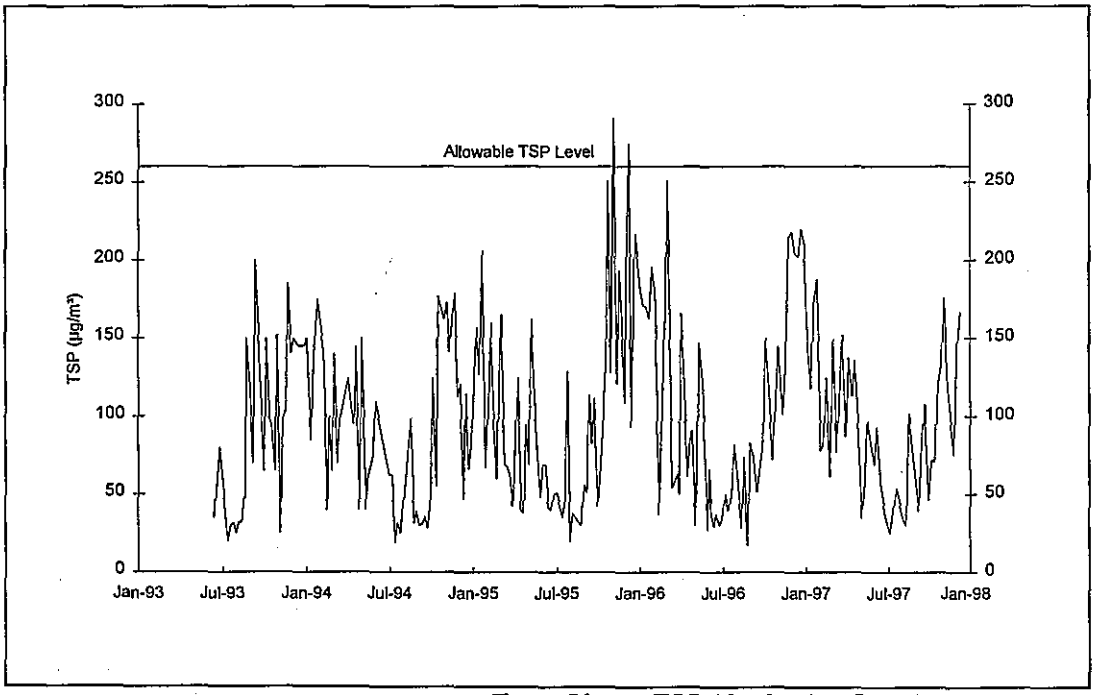
The results of the analysis indicate that, except for potential increases in predicted one hour worst case TSP levels at Receptor Nos. 1, 2 and 3 in Quarter 7, excavation of the headland and modifications to the reclaimed area will have a very minor effect on the results presented in the NAMP-EIA. Furthermore, the previous assessment showed potential exceedances of the EPD Dust Suppression Guideline of 500 ug/m^3 during blasting including exceedances at Receptor Nos. 1, 2, and 3 in Quarter 2. Therefore the recommendations made in the NAMP-EIA, as presented above in Section 5.1.2 should be adequate to mitigate for and monitor any additional impacts.

5.3 Current Status of Development and Remaining Impacts

Land formation work for the airport platform was fully completed in early 1996 and raw land is rapidly being converted to aprons, roads, parking lots and buildings and remaining open areas will mostly be vegetated by the time the airport becomes operational. However, a significant portion of the central part of the reclamation will remain as a construction site, as will the northern runway and Northwest concourse works areas. Surface treatment of the midfield area is being implemented and all dust reduction mitigation recommended in the NAMP-EIA and EIA Supplement will remain in place for the remaining construction works.

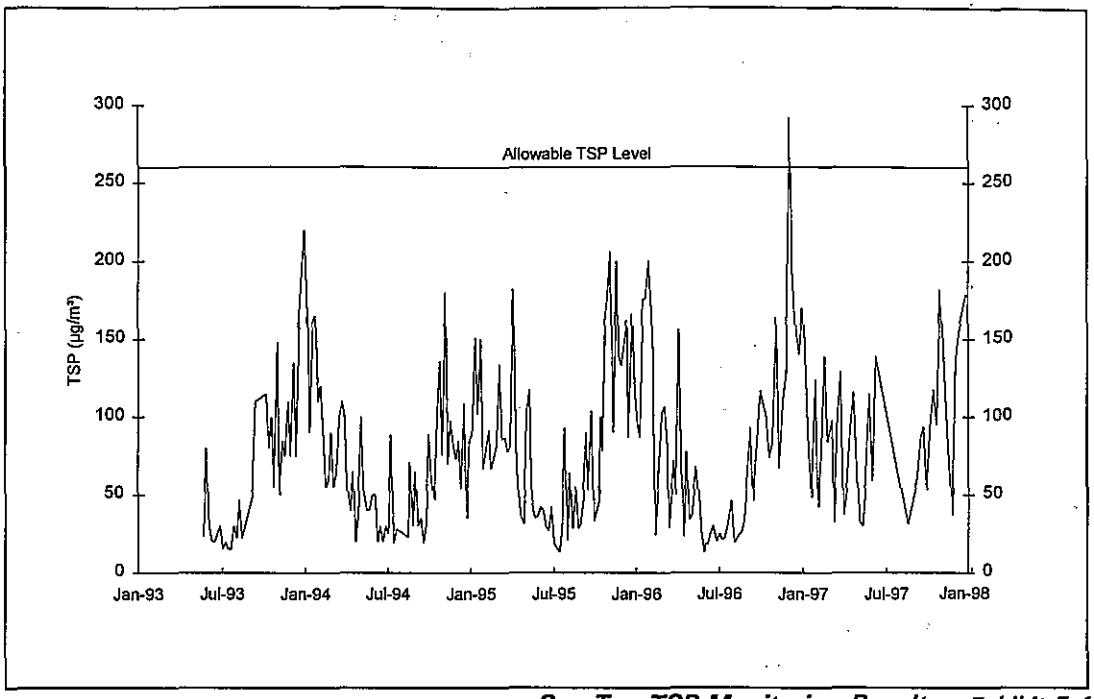
5.4 Comparison of Projected to Actual Impacts

Monitoring stations were set up at Tung Chung, San Tau and Sha Lo Wan to provide information on the air quality impact at the nearest villages. TSP data shown in Exhibits 5.1, 5.2 and 5.3 are representative of the ambient dust levels in the vicinity of local communities on North Lantau.



Tung Chung TSP Monitoring Results ***Exhibit 5.3***

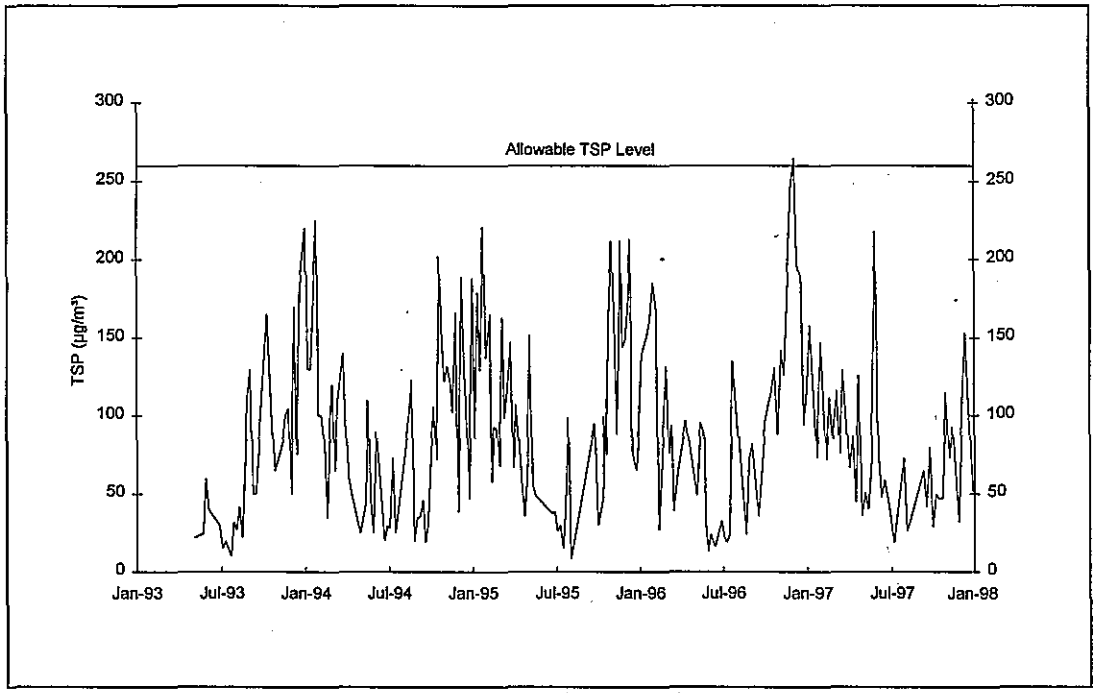
It should be noted that TSP samplers are not directionally sensitive or source selective and they therefore provide a record of the total dust levels to which a community is exposed, rather than specific contributions from the airport construction site.



San Tau TSP Monitoring Results *Exhibit 5.4*

Over the past 4 years, only two exceedances of criteria were recorded in Tung Chung, while one exceedance was recorded at both San Tau and Sha Lo Wan.

The NAMP-EIA predicted that the greatest potential for dust creation would be limited to the initial construction period whenever winds were from the north. Exceedances were in fact first recorded at Tung Chung, San Tau and Sha Lo Wan well after this initial phase. Monitoring results from all ASRs show a very clear seasonal pattern, with TSP levels substantially higher in the dry season than at other times of the year.



Sha Lo Wan TSP Monitoring Results *Exhibit 5.5*

In comparing the actual monitoring results of 24-hour average TSP against the AQO criterion of a maximum of one exceedance per year, the AQO has successfully been complied with at San Tau and Sha Lo Wan. Based on the same criterion, the AQO has

only been breached once at Tung Chung in late 1995. It should be noted that the source of this breach was not positively identified and other construction activities, such as those at Tung Chung New Town and the North Lantau Expressway, may well have contributed substantially to the breach.

No records of 1-hour average TSP levels or site-specific wind data were available for analysis.

5.5 Remaining Monitoring and Audit Programme

The air monitoring stations established on North Lantau will continue to be operated on the same schedule, using the same audit procedures, until six months after the second runway is completed, as agreed with the EPD

6.1 NAMP-EIA (1991) Summary and Recommendations

6.1.1 Summary of Impacts

The recalibrated Tidal Flow Model from the Government's Water Quality and Hydraulic Model (WAHMO) suite was used to simulate effects on tidal flow of the airport reclamation configuration. The model runs excluded a flushing channel between the reclamation and North Lantau, in order to assess "worst case" conditions. It was found that the reclamation had insignificant impact on flows remote from Chek Lap Kok. Significant local effects observed were 100 percent increases in water speed in the channel between West Brother Island and the north-eastern corner of the reclamation, which would result in local erosion. Flows were predicted to reduce to the west of the reclamation and in East Tung Chung Bay, which could result in increased local siltation and potential decreases in water quality should the area be subject to additional pollutant loading.

Potential effects of maintaining a flushing channel were assessed. The analysis suggested that East Tung Chung Bay, east of Chek Lap Kok, is relatively well flushed by the flows presently entering the bay south of Chek Lap Kok Island. Provided existing flows with peak speeds of approximately 1.0 m/s are maintained, water quality and siltation patterns following construction of the airport should not change significantly, unless new pollutant loads are introduced. It will therefore be important to ensure that no pollutant flows are discharged to the channel.

The recalibrated WAHMO tidal water quality model was used to assess water quality impacts of the airport reclamation configuration, again without a flushing channel to simulate "worst case" conditions. The only significant effects observed were increases in chlorophyll a in East Tung Chung Bay indicative of increases in algal growth. Hong Kong's inshore waters are known to have the potential for development of algal blooms known as red tides, some of which contain toxic phytoplankton. The reduction in flushing of the East Tung Chung Bay which would result from an airport reclamation continuous with the North Lantau shoreline would therefore have potential adverse impacts.

Potential impacts arising from dredging and dumping operations at the airport, borrow areas and disposal sites were simulated using sediment dispersion and transport models. It was found that:

a) Dredging at the airport site would have a small impact (generally less than 10 mg/l) on far-field suspended solids concentrations when taken in the context of the natural background variability. Tidal currents at the site are such that much of the sediment would be re-deposited locally and probably re-dredged.

b) Dredging of overburden in the Urmston Road just off Castle Peak Power Station resulted in the sediment losses being dispersed over a large area as a result of the large tidal excursions in this area. Locally, concentrations would increase by the order of 10 mg/l in a narrow plume close to the dredger with lower concentration increases over a wider area. At the power station intakes, it is unlikely that the dredging would result in concentrations exceeding the 150 mg/l limit assigned by China Light and Power to the cooling water intake, except on the few occasions when it is exceeded naturally.

c) Overflowing of barges during dredging for fill would result in the greatest rate of sediment input to the water column. Sites were examined at

Deep Bay, Urmston Road and The Brothers. In all cases, the sediment losses were dispersed over a large area at low concentration. Dredging of fill at the Urmston Road site off Castle Peak would increase suspended solids concentrations by the order of 30 mg/l, which would double the mean concentration in the lower layers of the water column. Concentrations in the upper layer, from which cooling water would be abstracted, would increase by approximately 5 mg/l and would not be expected to cause adverse impact at the power station.

d) *Dredging for fill in the Urmston Road and Deep Bay borrow areas was predicted to give increases of generally less than 10 mg/l in the vicinity of oyster beds in Deep Bay. This is insignificant compared to maximum concentrations (31-210 mg/l) experienced under ambient conditions.*

e) *Combined, simultaneous cycles of dredging overburden, fill and dumping spoil in individual pits within The Brothers and Deep Bay borrow areas were predicted to give increases of over 10 mg/l suspended solids in some areas but this would not be expected to result in significant adverse impact.*

f) *Spoil dumping in disused borrow pits at the entrance to Deep Bay was simulated and it was found that, again, the sediment losses were rapidly dispersed over a large area at low concentration and no significant adverse impact on sensitive receivers would be expected.*

Sampling and analysis of marine mud at Chek Lap Kok, The Brothers, Urmston Road and Deep Bay borrow areas showed no significant contamination with heavy metals and from this it was inferred that East Sha Chau would be similarly uncontaminated. On the basis of an empirical model relating inorganic nitrogen and chlorophyll a concentrations, nutrient loading from sediments disturbed by dredging at Chek Lap Kok would not be expected to cause enhanced algal growth.

6.1.2 Recommendations and Current Status of Implementation

a) *A flushing channel which would maintain tidal flows and water speeds similar to those at present was previously strongly recommended to PAA and was approved. It is understood that this concept was endorsed by the Development Progress Committee of Government on 9th May 1991. Implementation of the channel will prevent potential siltation and enhanced phytoplankton growth in East Tung Chung Bay.*

The final design of the airport platform incorporated a flushing channel between North Lantau and the airport as shown in Exhibit 6.1. Studies done as part of the NAMP-EIA projected that flows within the completed sea channel would equal those measured prior to any reclamation works in the channel between the southern part of Chek Lap Kok island and Tung Chung.

Environmental studies (Greiner-Maunsell, 1996, Assessment of the Performance of the Sea Channel - Analysis of Wet and Dry Season Conditions; Greiner-Maunsell, 1996 and 1997, Assessment of Seabed Stability Interim Reports Nos. 2, 3 and 4; Greiner-Maunsell, 1996, Assessment of Bed Stability off the North West Corner of the Platform) undertaken, following completion of the sea channel, incorporated an assessment of the hydraulic performance of the completed sea channel against that anticipated at the design stage, as well as an assessment of seabed stability around the platform, including the sea channel. The studies utilised both dry/wet season and spring/neap tidal measurements

and made use of periodically updated bathymetric survey data supplied by the Authority covering the period from Summer 1995 to the end of 1996. In summary, studies concluded that:

- flushing charateristics assumed in the design study were being met and exceeded,
- net deposition in the channel was not occurring, based on bathymetric data or on water speed and suspended sediment analysis, and,
- the sea channel will be at least self-cleansing

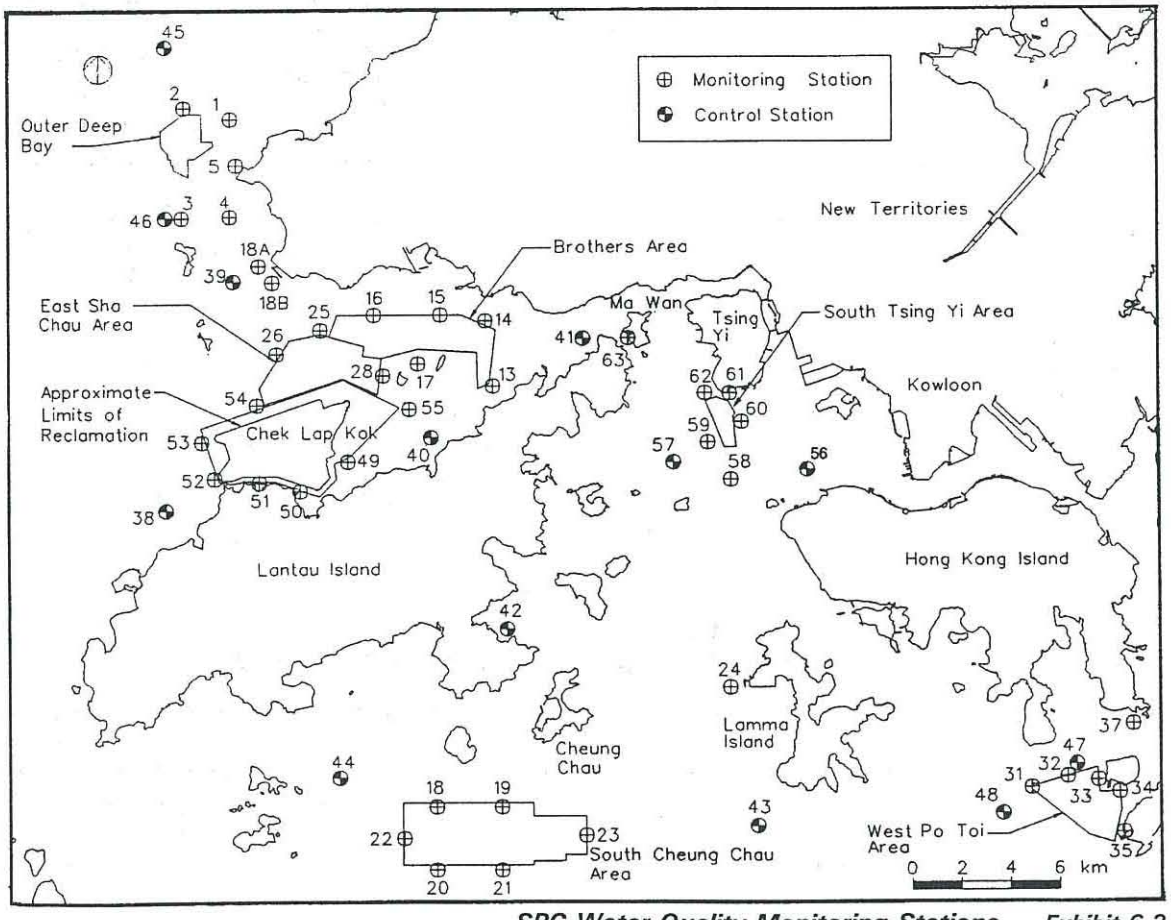
Based on existing water quality in the area, tidal flow through the sea channel is expected to adequately safe-guard water quality within the channel and in East Tung Chung Bay and it is not anticipated that maintenance dredging will be required to maintain the channel's final configuration. The Authority will continue to undertake periodic bathymetric surveys.

b) *A water quality monitoring programme should be implemented by AA and carried out by the Engineer. Monitoring should be undertaken at the airport site and borrow areas to determine background conditions, assess compliance during the works and as a final check on water quality once the scheme has been completed. Water quality monitoring stations should be sited to reflect the position of sensitive receivers. Background monitoring at all gazetted areas should commence as soon as possible after the contract is awarded.*

A water quality monitoring programme has been implemented by the Authority as required in the NAMP-EIA and as stipulated in all marine borrow/dumping permits issued to the Authority.

All marine works areas used by the Authority during the SPC are shown in Exhibit 6.2. The main aim of the monitoring programme was the measurement of a range of water quality parameters so as to detect changes which could be attributable to the Authority's marine works. Specific monitoring and control stations around marine works areas (e.g. fish culture zones) were detailed in borrow/dumping licences, as were specific "sensitive receivers" located close to marine works sites which were particularly at risk from elevations in Suspended Solids (SS).

At its peak the water quality monitoring programme involved sampling at over 45 monitoring, control and sensitive receiver stations within Hong Kong Territorial Waters as shown in Exhibit 6.2. Water quality monitoring requirements specified in licence conditions relevant for the whole SPC period are summarised in Table 6.1 . Parameters monitored included turbidity, dissolved oxygen (DO)/dissolved oxygen percent saturation (DOS%) and SS. At monitoring stations, turbidity target levels were established on a daily basis at 30% above the average reading obtained from the corresponding control stations. Target levels for DO/DOS% were set at 2mg/l or 30% saturation for bottom waters and 4mg/l or 60% saturation for the remaining water column. For sensitive receivers the target level for SS was established at 80mg/l by Agriculture and Fisheries Department (AFD).



SPC Water Quality Monitoring Stations *Exhibit 6.2*

Table 6.1 Summary of Water Quality Monitoring Requirements

Location	Parameter	Stations	Time	Frequency	Duration
Gazetted Reclamation and Borrow Areas	- dissolved oxygen (mg/l, % sat.) - temperature (°C) - turbidity (NTU) - suspended solids (mg/l)	- 5-6 stations 100-250m away from each gazetted area + 2 control stations - Depths of: 1m below surface, 1m above seabed mid-depth	mid-tide	3 days per week (intervals between samples >36 hrs)	- to commence within 7 days of works - throughout duration of works - for 6-weeks after completion of works
Po Toi Sensitive Receivers	- dissolved oxygen (mg/l, % sat.) - temperature (°C) - turbidity (NTU) - suspended solids (mg/l)	- Po Toi Mariculture Zone - Swire Marine Lab	mid-tide	3 days per week (intervals between samples >36 hrs)	- to commence within 7 days of works - for duration of works - for 6 weeks after completion of works
Ma Wan Fish Culture Zone Sensitive Receiver	- dissolved oxygen (mg/l, % sat.) - temperature (°C) - turbidity (NTU) - suspended solids (mg/l)	- 100m from Ma Wan Fish Culture Area	mid flood tide	5 days per week	- to commence within 7 days of works - for duration of works - for 6 weeks after completion of works
Castle Peak Power Station	- turbidity (NTU) - suspended solids (mg/l)	- 2 stations 100m from cooling water intakes	whenever works activity <5 km from Castle Peak Power Station	as required	- to commence within 7 days of works
South Cheung chau Dumping Ground	- dissolved oxygen (mg/l, % sat.) - temperature (°C) - turbidity (NTU) - suspended solids (mg/l)	- 5 stations 100-250m away from gazetted area + 1 control - Depths of: 1m below surface, 1m above seabed mid-depth		3 days per week every 2 months (intervals between samples >36 hrs)	- to commence within 7 days of works - for duration of works - for 6 weeks after completion of works

Under an EPD agreed Action Response Plan (ARP), when a limit was exceeded and reported, a series of actions had to be initiated. The contractor faced the possibility of having to amend or ultimately cease works activities dependent on the prescribed actions of EPD, AFD or the Fill Management Committee (FMC), if recorded exceedances could be attributed to marine works activities (see Table 6.2). In the latter stages of SPC marine works monitoring, some minor amendments were made to the ARP. The main change, after agreeing with EPD, was the incorporation of a very good correlation between turbidity and SS such that water samples for laboratory SS analysis only had to be taken in North Lantau waters if SS equivalents, given from the in-situ turbidity measurement, were above both target levels established from control stations and a standard turbidity target level of 56 NTU.

Table 6.2 Summary of Water Quality Target Criteria and Action Responses

Water Quality Parameter	Trigger Level	Action Level	Target Level	Action Response Plan
Turbidity	20%[1]	30%[1]	40%[1]	Implemented if exceedence was recorded on two consecutive days.
DO	10%[1]	20%[1]	30%[1]	Implemented if exceedence was recorded on two consecutive days.
Suspended Solids (measured in cases where turbidity exceeded the daily target)	68mg/l (sensitive receivers)	72mg/l (sensitive receivers)	80mg/l (sensitive receivers)	No immediate ARP as measurement not in-situ .

[1] - "X% of total sample station average readings for a given work site exceed criteria"

c) *Contractors should be required to provide portable sewage facilities for construction workers and to make appropriate arrangements for sewage collection and disposal.*

The majority of sewage generated on Chek Lap Kok during the construction phase has been disposed of via the Authority's screening plant and temporary sea outfall, which started receiving sewage in late 1994. The design of the outfall was fully evaluated under the temporary utilities design contract and gained EPD approval. This outfall is expected to remain in service until construction related activity on site is substantially complete. Most Authority site offices, all temporary workers accommodation villages, and one main contractor are directly connected to the plant via temporary sewers.

Approximately 60% of contractor buildings on site discharge sewage to holding tanks which are periodically emptied by tanker to the screening plant. Most of the remaining contractor sewage wastes are handled by the Water Pollution Control Ordinance (WPCO) licensed septic tank/soak away systems or chemical toilets which are used in remote office locations.

d) *Contractors should be required to provide silt traps at concrete-batching and asphalt plants to collect, settle and recycle water used for dust suppression purposes and vehicle washing.*

Specific clauses within the General Specification prohibit the discharge of any matter arising from site activities into the sea or any other waters; require the construction and maintenance of sediment traps for sedimentation of particulate matter, and; prohibit waste waters associated with batching plants, vehicle washing areas or other sources being directly discharged to the sea or any other waters.

There are currently (1997) seven concrete batching plants operating on Chek Lap Kok and containment of run-off has not been a problem, with all plants taking adequate measures to ensure that suspended solids from waste waters are adequately settled out by sediment traps and settlement pits. Supernatant in many cases has been reused in the concrete production process and has also been used for vehicle washing and on-site dust suppression. Settlement traps have been adequately maintained and it has not been necessary for any plant to apply for a WPCO discharge licence.

6.2 NAMP-EIA Supplement (1992) Summary and Recommendations

6.2.1 Summary of Impacts

A study was made of the possible effect of the removal of the headland west of Sha Lo Wan on tidal flow and discharges through the sea channel created between the airport and North Lantau Island. The assessment was based on previous work on the sea channel geometry and discharge characteristics carried out by others under the North Lantau Development Study, which has been accepted by EPD.

The revised channel geometry results in a 120 metre increase in the channel's length as well as a 35 metre (15%) increase in the western entrance width of the channel. Moreover, the revised channel entrance is now perpendicular to the flow direction. This results in a reduction in eddy effects created by the original channel configuration. Within the limits of the study, it was calculated that the increased channel length could result in a 1% decrease in peak

channel flows, using the original channel's entrance configuration. However, the original channel entrance had a rapid expansion on either side of the Sha Lo Wan headland which has been eliminated by the revised entrance layout.

The new entrance layout is considered more efficient in that the tendency to generate eddies has been reduced and the flow area is larger than that for the original layout. Moreover, the hydraulically improved entrance will reduce head losses although it is not possible to quantify the improvement in flow this might allow.

Given these factors, the revised channel geometry would not have a significant impact on tidal discharges. On this basis, it was also concluded that in the absence of additional effluent loads to the sea channel, major changes in water quality resulting from removal of the headland would not be expected from those discussed in the NAMP-EIA.

6.2.2 Recommendations and Current Status of Implementation

The results of the analysis indicate that there are no significant changes in tidal discharges or water quality from those described in the NAMP-EIA. Therefore the recommendations made in that document, as presented in Section 6.1.2 and Section 13.1.2 are still valid and should be adopted.

The final configuration of the western entrance to the sea channel differs slightly to that originally designed and documented in the NAMP-EIA Supplement, which stipulated that this feature be excavated to a water depth of -8mPD. Certain difficulties with excavation meant that a period of underwater blasting was required to reach -7mPD. In order to avoid further underwater blasting to -8mPD, and the potential adverse impacts on marine mammals, it was agreed with EPD and the Lands Department that the final depth would remain at -7mPD. The agreement was conditional on the Authority fulfilling a previous commitment to undertake further environmental studies to confirm the flushing capability of the channel. An environmental study (Greiner-Maunsell,1996, Assessment of the Performance of the Sea Channel - Analysis of Wet and Dry Season Conditions) have since shown that the hydrodynamics within the sea channel at least meet, and in most cases exceed, design criteria. Flow in the channel has been found to be more restricted in the vicinity of the Sha Lo Wan pier than in the area from where the Sha Lo Wan headland was removed.

6.3 Aviation Fuel Receiving Facility EIA (1995) Summary and Recommendations

6.3.1 Summary of Impacts

Impacts on SS and DO concentrations will result from the construction phase of the AFRF. The use of closed grab clamshell dredgers is the preferred method of turning basin/access channel dredging, and it is therefore recommended that the specification of tightly sealed grab dredgers are included as a contract specification, unless it can be demonstrated such methods are unsuitable. In addition, closed grab clamshell dredging is the preferred method of pipeline installation, and the specification of this method in the contract specification is therefore also recommended.

Mitigation measures have been recommended and these would reduce the scale of impacts resulting from the AFRF project or submarine power cable installation to within acceptable levels as defined by the WQO. The reduction of direct water quality impacts will, in turn, result in reduced indirect impacts upon water sensitive receivers from changes in water quality, including marine biota within the Study Area.

The impacts on water quality, as a result of the submarine power cable installation, will be assessed during the detailed design stage upon finalisation of installation methods.

Based on tidal flow modelling and on coastal geomorphological appraisal, the construction of the turning basin and fairway for access to the sites from the Urmston Road main channel will not change the hydrodynamics in the Study Area, and will have negligible impact on the stability of the beaches connecting Sha Chau to the nearby Islets.

6.3.2 Recommendations and Current Status of Implementation

Recommendations and implementation status are detailed in Table 6.3 below.

Table 6.3 Aviation Fuel Receiving Facility EIA Recommendations and Implementation Status

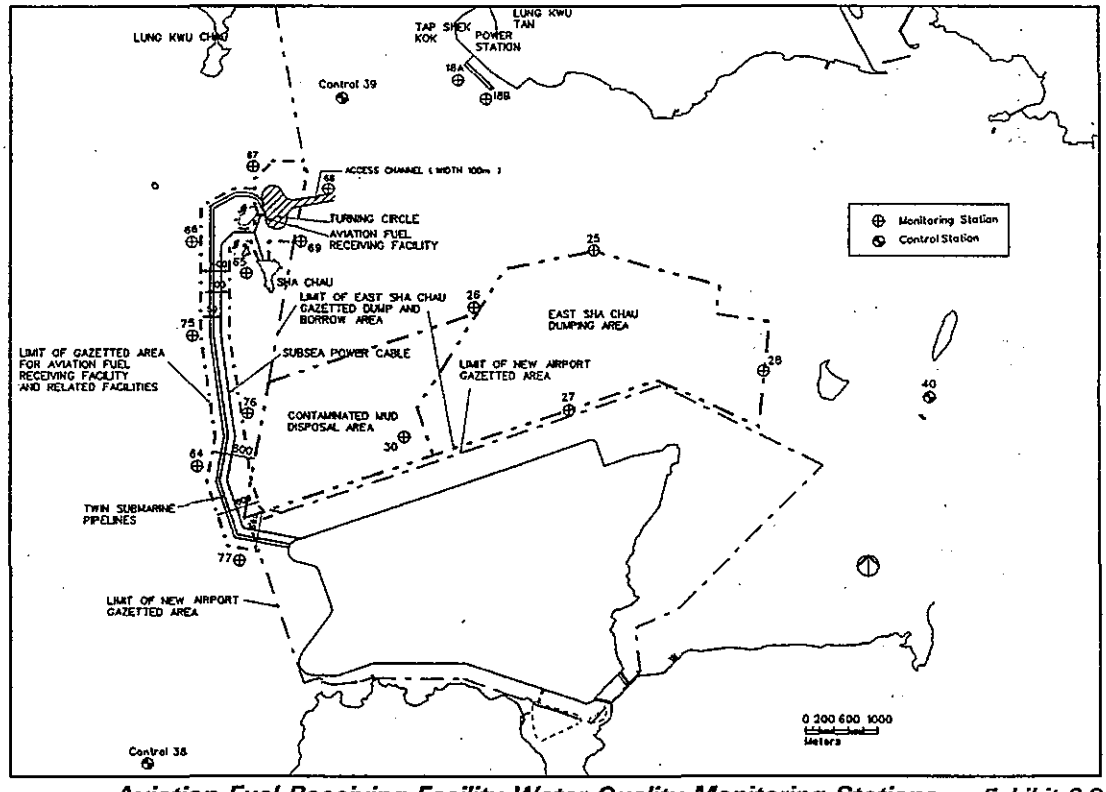
EIA Reference	Recommended Mitigation Measure	Responsibility	Implementation Status
Construction of the Turning Basin and Access Fairway			
Sec. 4.1.13 p. 54-55	*The Contractor will be required to minimise adverse impacts on water quality resulting from dredging and dumping operations to within acceptable levels as defined by the WPCO.*	Franchisee/ Contractor	The Contractor is aware of this requirement and has incorporated practical means for minimising impacts. This includes the use of closed grab dredgers as recommended in the EIA.
Sec. 4.1.13 p. 54-55	*Low impact dredging techniques are recommended.*	Franchisee/ Contractor	The EIA-recommended closed grab method of dredging has been adopted.
Sec. 4.1.13 p. 55	*The licensee will formulate his design and construction and operation methods with pollution avoidance measures in mind, and provide specification in the tender submission.*	AA/Franchisee/ Contractor	The Franchisee and Contractor have and will abide by the mitigation measures as proposed in the EIA, where practicable.
Sec. 4.1.13 p. 55-56	*The successful Tenderer would be required to undertake a detailed sediment quality assessment in a sediment quality report. This must be submitted to DEP at lease three months prior to contract tendering, or the commencement of dredging, whichever is earliest.*	AA/Franchisee	Done. Material was classified as Class A (uncontaminated).
Sec. 4.1.13 p. 56-58	*Dredged material to be disposed of at a gazetted marine disposal ground.*	AA/Franchisee/ Contractor	A dumping licence has been issued and material has been disposed of according to license requirements.
Sec. 4.1.13 p. 58	*Track record of the Contractor and vessel operators to be investigated prior to awarding work.*	AA/Franchisee	A reputable Contractor was selected who is fully committed to implementing mitigation measures wherever practical. They have worked closely with Dr Jefferson on developing noise mitigation measures and have attended environmental awareness courses conducted by Dr Jefferson and AA Environmental staff.
Pre-commissioning and Commissioning of Pipeline			
Sec. 4.1.15 p. 59	*Proper disposal of testing and cleansing waters removed from the pipeline.*	Franchisee/ Contractor	Proper testing and disposal procedures will be implemented, pursuant to EPD license requirements.
Construction EM&A			
Sec. 4.1.16 p. 59	*AA water quality monitoring and audit required during AFRF construction.*	AA	A monitoring programme has been approved by EPD and implemented by the AA.
Construction Waste Management			
Sec. 4.3.5 p. 73	*Comprehensive waste management proce-dures and appropriate staff environmental training to ensure that waste arising during the construction works do not enter surrounding waters.*	AA/Franchisee/ Contractor	The AA and Dr. Thomas Jefferson have conducted a site induction course and outlined all environmental require-ments. The Contractor submitted a written environmental management plan including a waste management plan prior to start of works. AA is conducting regular audits of construction site practices.
Construction Waste Management			
Sec. 4.3.5 p. 74	*Sewage storage or initial treatment facilities will be necessary on the works vessels.*	Franchisee/ Contractor	The Contractor is exercising a zero discharge policy throughout AFRF Construction. Wastes are being contained and disposed of at a suitable site.
Sec. 4.3.6 p. 74	*During facility construction and pipeline installation, a waste monitoring pro-gramme to be implemented to ensure that all wastes are collected, handled, stored and disposed off-site in accordance with EPD regulations and this will be incorporated into the ongoing AA Site Audit programme.*	AA/Franchisee/ Contractor	See response above for Sec. 4.3.5 p. 73 and Sec. 4.3.5 p. 74.
Sec. 4.3.8 p. 75	*Waste management practices on works vessels and barges should be defined.*	Franchisee/ Contractor	The Franchisee's Contractor provided written procedures prior to start of works.

6.4 Current Status of Development and Remaining Impacts

Reclamation leading to the formation of the airport platform was completed by January 1996 and the eastern and western entrances to the Sea Channel are now confined within their ultimate horizontal configuration. Changes to the Airport layout, as envisioned in the NAMP-EIA, are minimal, consisting of the Sea Rescue Facilities (SRFs) to be located on the east and west sides of the platform, as shown in Exhibit 2.1 and the Aviation Fuel Receiving Facility situated to the east of Sha Chau Island. Works still underway which have a potential impact on tidal flows and water quality are (i) dredging activity associated with AFRF works, and (ii) dredging and filling work for the SRF's.

Aviation Fuel Receiving Facility

The EIA prepared for the AFRF at Sha Chau (January 1995) stipulated that the Authority would have responsibility for undertaking water quality monitoring around all AFRF marine works undertaken for the construction of the facility as well as around the East Sha Chau dumping area. Specific monitoring and control stations around marine works areas, as shown in Exhibit 6.3, were detailed in the borrow/dumping licence issued to the aviation fuel supply franchisee's contractor, as were specific "sensitive receivers" located near the cooling water intake pipes at the Castle Peak power station.



Aviation Fuel Receiving Facility Water Quality Monitoring Stations *Exhibit 6.3*

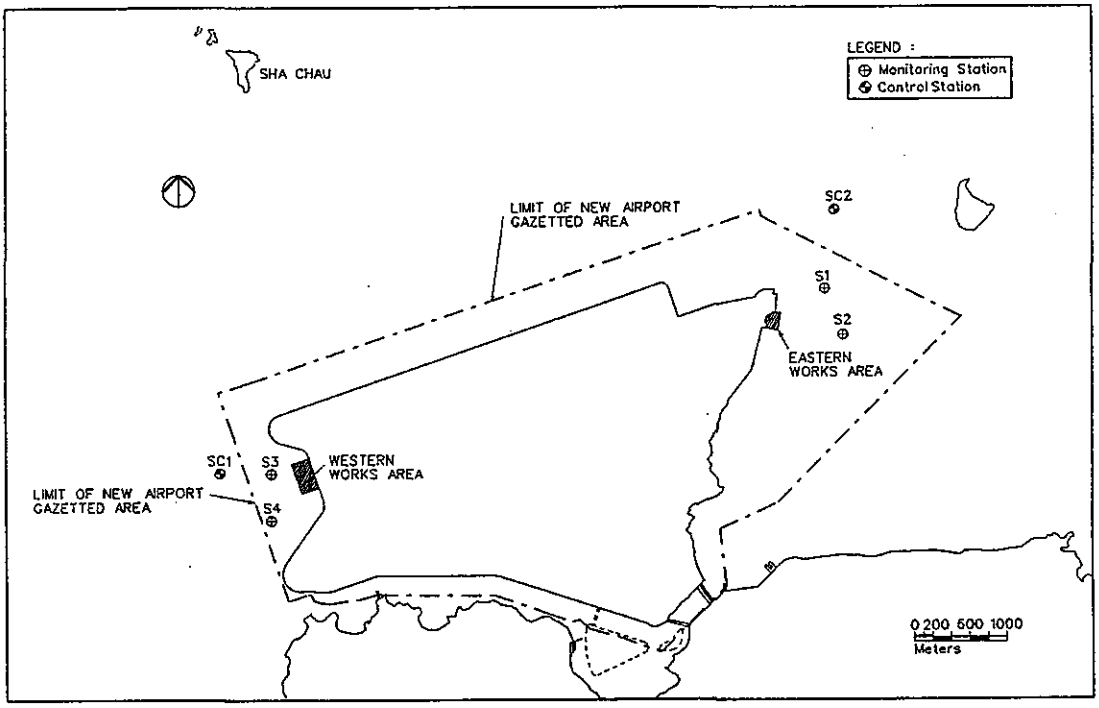
Monitoring at these locations commenced in November 1995 and is due to be completed by November 1997 when outstanding works on the AFRF are due to be completed. Works undertaken as part of the AFRF development have included dredging and backfilling the channel for the twin pipeline, and dredging the turning circle and access channel as also shown in Exhibit 6.3. In addition to this, works have involved placing over 150 piles for the foundation of the jetty structure.

The main marine works contractor has consistently implemented a number of measures to minimise the potential release of suspended solids to surrounding waters. During back-filling works on the pipeline trench, for example, all marine sand was

placed in the excavated trench via a "fall pipe" attached to the barge which enclosed falling material to just above the trench level, or via reverse closed grab-dredging to the trench level.

Sea Rescue Facilities

The development of the design for the Sea Rescue Facilities (SRF) on Chek Lap Kok ultimately required that certain changes to the preliminary design put forward in the NAMP had to be made. Both SRFs incorporate a breakwater. The finalised designs for the SRFs extended to areas outside the original Chek Lap Kok Land Grant and early in 1997 the Authority was granted a licence from the Lands Department, pending formal extension of the Land Grant area, which extended the right to occupy and develop these additional areas. From April 1997 the Authority has conducted water quality monitoring around the two marine works sites for the SRFs and works are scheduled to be completed by February 1998. Monitoring and control stations are shown in Exhibit 6.4.



Sea Rescue Facilities Water Quality Monitoring Stations *Exhibit 6.4*

6.5 Comparison of Projected to Actual Impacts

The NAMP-EIA made predictions on potential impacts from dredging and dumping operations in all marine works areas based on sediment dispersion and transport models. A general conclusion was that the impact on far-field SS concentrations would not be significant. The monitoring strategy was targeted at detecting elevations in water quality parameters which could directly be attributable to Authority works and at protecting certain identified sensitive receivers near to each gazetted works area. Marine water quality in Hong Kong is influenced by a whole range of factors, both natural and resulting from human habitation. Pearl River influence combines with seasonal variations in rainfall and water currents to exert a very strong influence on the range of natural levels of SS in Hong Kong waters, particularly to the north west of Lantau. Here, SS can range from less than 10mg/l to 500mg/l under ambient conditions. The complexities of the hydrodynamics in North Lantau Waters and the obvious influence of river-borne SS on western Hong Kong Territorial Waters are clearly shown on the LandSat Mosaic taken in November 1994 and presented in Exhibit 6.5.

LandSat Mosaic of Pearl River Delta (Courtesy of CED, HKG) *Exhibit 6.5*

A detailed assessment of monitoring results, as well as results from a period of post works audit monitoring (undertaken in all works areas on completion of marine works) is contained in post-project audit reports (Airport Authority 1994, 1995 and 1996). During the course of marine works, there were very few significant exceedance episodes at either the Outer Deep Bay (ODB), the West Po Toi (WPT) or the South Cheung Chau (SCC) works areas. Monitoring around Chek Lap Kok (CLK), The Brothers (BRO), East Sha Chau (ESC) and South Tsing Yi (STY) did result in some exceedances of turbidity and SS criteria and in some instances, DO levels fell below targets, although no exceedances were directly attributable to the Authority's marine works activities.

Outer Deep Bay

Dumping of marine mud took place at ODB between February and October 1993. Although a number of exceedance incidents were recorded over this period, in no cases were these directly attributable to marine works activities. Monitoring results from the post project audit period for ODB were similar to results obtained during the marine works phase.

West Po Toi

Marine Sand Dredging took place at WPT from June 1993 to March 1995. Although a number of exceedance incidents were recorded over the period of works in this area, in no cases were these directly attributable to marine works activities. Monitoring results from the post project audit period for WPT were similar to results obtained during the marine works phase.

South Cheung Chau

Dumping of marine mud took place at SCC between February 1993 and January 1995. Although a number of exceedance incidents were recorded over the period of works in this area, in no cases were these directly attributable to marine works activities. A post project audit was not required at SCC.

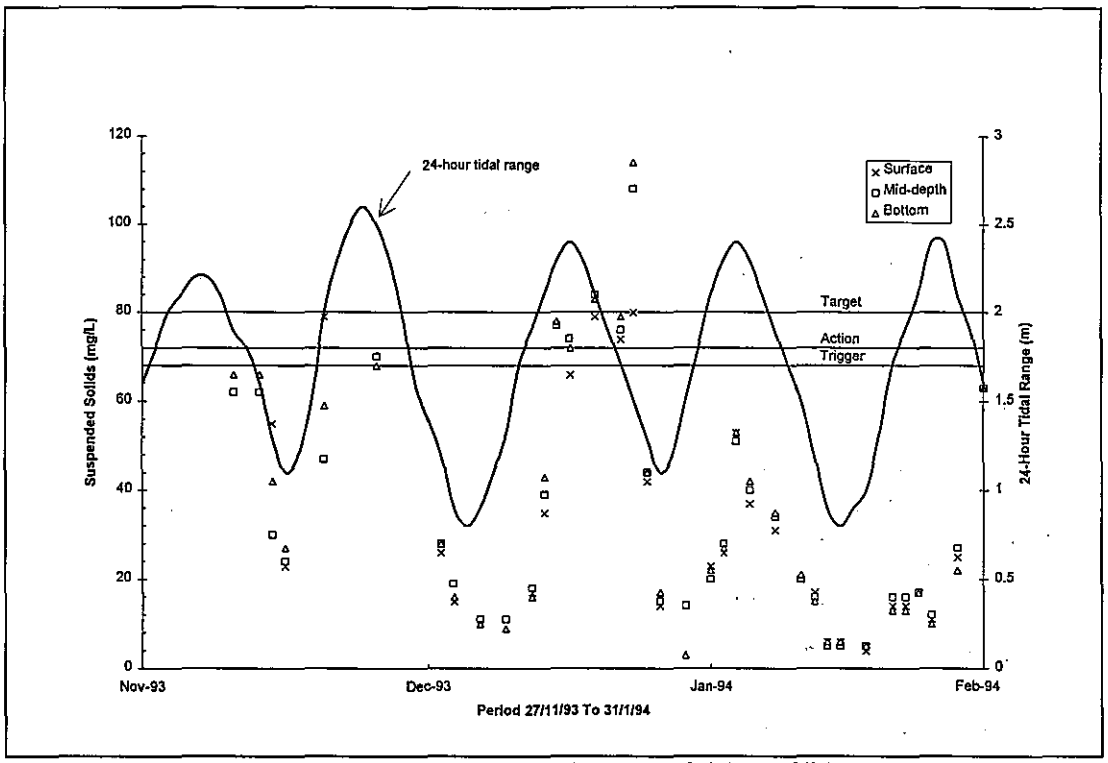
South Tsing Yi

Early in the SPC a supplemental dredging/dumping Licence was issued which allowed the contractor to undertake dredging and backfilling works at the STY gazetted area. Marine sand was dredged from STY between early September and late November 1993 with the exhausted pit being back-filled with marine mud immediately on completion of dredging through to May 1994.

Monitoring requirements detailed in the supplemental licence were standard, however the licence also stipulated that the Ma Wan fish culture zone sensitive receiver (Station 63 - see Exhibit 6.2) had to be monitored on the mid-flood tide, five days per week to safeguard against elevated SS levels, as the Fish Culture Zone is located in the confined Kap Shui Mun channel.

Shortly after dumping commenced at STY, elevated turbidity was measured periodically at monitoring stations around the works site, and this was reflected on several occasions by a series of SS exceedances recorded during December 1993 and January 1994 at the local sensitive receiver (Station 63). Investigations revealed that in late 1993 the SPC Contractor had been advised that the Marine Department were planning to close the Ma Wan Channel in early 1994 because of the requirement for overhead cabling works on the Tsing Ma bridge. Faced with a much longer journey time from Chek Lap Kok to STY, the SPC Contractor had started dumping operations at approximately three times the rate assumed in the focused EIA in order to complete as much of their back-filling as possible before the anticipated closure. Ultimately, the threatened extended closure of the channel never took place.

An analysis of all SPC Contractor works records, specific tidal conditions and Authority monitoring results did not reveal an obvious relationship between the amount of material dumped in the hours immediately preceding SS exceedances at the Ma Wan sensitive receiver and the exceedances themselves. An apparent relationship was however observed between the 24-hour tidal range and elevated SS levels recorded at this station as shown in Exhibit 6.6.



SS Levels at Receiver 63 Showing 24 Hour Tidal Range *Exhibit 6.6*

A review of the volume of marine mud dumped at STY over the course of works shows that the SPC Contractor completed 60% of scheduled dumping in the first two months of the six month period that had been reserved for dumping. The remaining 40% was back-filled more evenly over the remaining four month period during which time SS levels at the Ma Wan Fish Culture Zone stayed well within the target level. As SS exceedances did not persist at Ma Wan after early January, no instruction was issued to the SPC Contractor to alter the working methodology. On review of the licence issued for these marine works, it was apparent that a maximum dumping rate had not been specified, although a slower rate of dumping had been assumed in the *Focused EIA of Backfilling Operation at South Tsing Yi Marine Borrow Area* (Greiner-Maunsell, December 1993) undertaken on the area prior to commencement of marine works.

Although a number of exceedance incidents were recorded over the period of works, in no cases were these directly attributable to marine works activities and monitoring results from the post project audit period for STY were similar to results obtained during the marine works phase.

Chek Lap Kok, The Brothers and East Sha Chau Areas

These three works areas were originally identified as separate monitoring areas in the NAMP-EIA as well as the dredging/dumping licence, with independent monitoring requirements stipulated at each area. Because of ambiguities in attempting to monitor each of the three areas separately, they were combined from January 1994 and monitored as one large area.

During the course of works, monitoring stations around the combined area were rearranged on at least two occasions in an attempt to find the configuration of monitoring and control stations giving the best indication of deteriorating water quality. This proved to be challenging, although it was agreed with EPD that monitoring the combined area was preferable to independent monitoring at the three separate areas. This arrangement was maintained for most of the SPC, although during the final months of reduced works, monitoring was scaled down as agreed with EPD.

Although exceedances were recorded and reported to EPD as required throughout the works period, the combination of complex tidal and local current regimes, potential impacts from other projects undertaking marine works within the same works areas (e.g. Civil Engineering Department work on the contaminated mud disposal area as shown on Exhibit 6.3) and significant daily and seasonal variations in ambient water quality meant that directly attributing recorded exceedances around the combined area to the Authority's works activities was never possible. However, in all instances exceedances were reported to the Statutory Authorities as required.

Exhibit 6.7 shows recorded turbidity levels, in Nephelometric Turbidity Units (NTU), at two monitoring stations and one control station, while Exhibit 6.8 shows DO levels for the same locations. Daily turbidity target levels are not shown as daily targets do not reflect when the ARP was followed. Both monitoring and control station locations recorded some intermittent high turbidity levels, particularly at the 1-meter above sea-bed location.

In many cases elevations in turbidity may have been the result of the water sampler coming into contact with the muddy bottom during sampling. Slightly different periods of elevated turbidity were recorded at the two monitoring stations shown, possibly a reflection of marine works moving closer to or away from the specific monitoring sites during the course of works. Elevated turbidity levels recorded at the control station were broadly similar to those recorded at the monitoring stations.

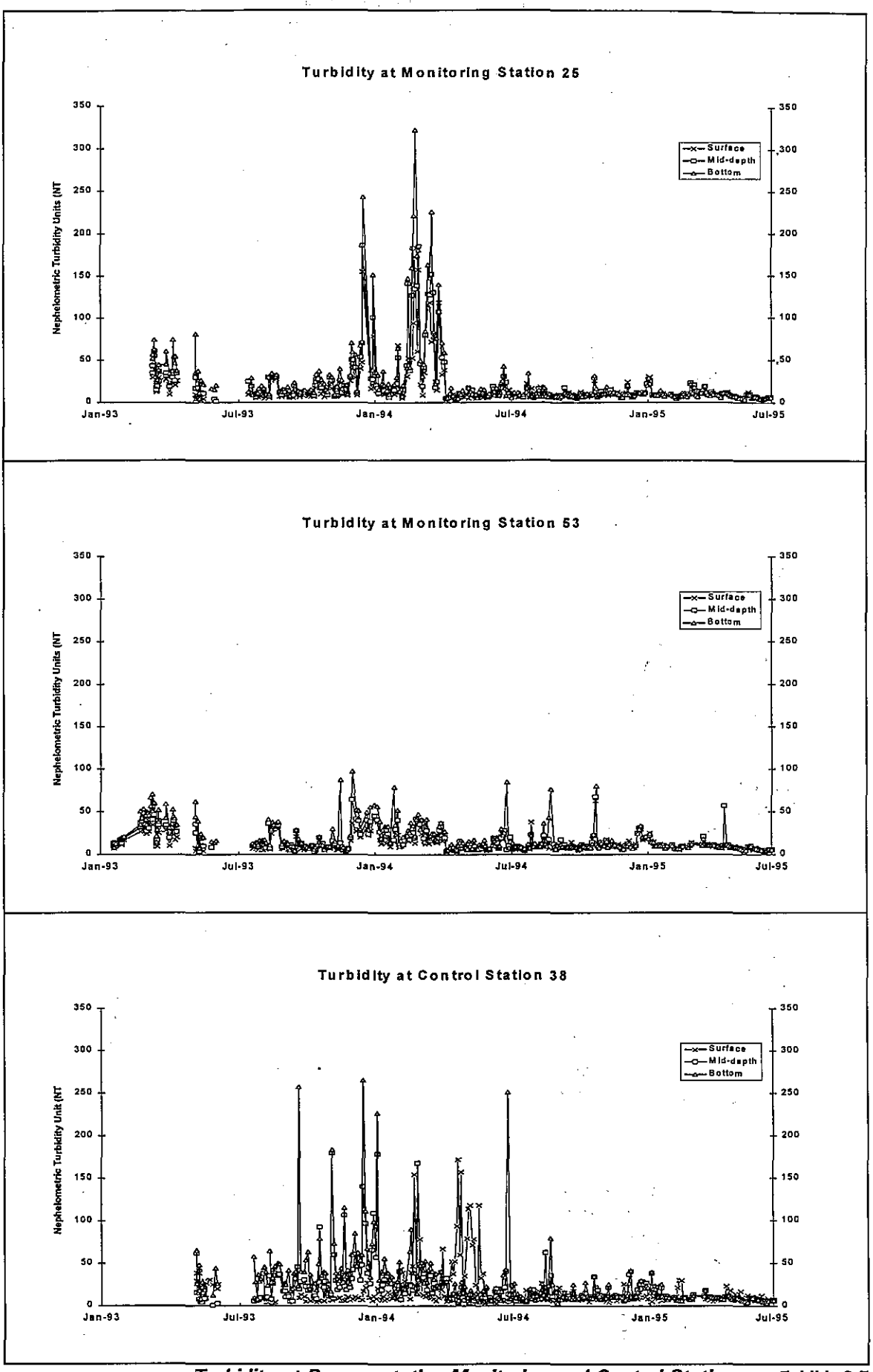
Dissolved Oxygen levels were similar at both monitoring and control stations and the fluctuations shown on all the exhibits are thought to represent seasonal variations in ambient water quality.

Aviation Fuel Receiving Facility and East Sha Chau

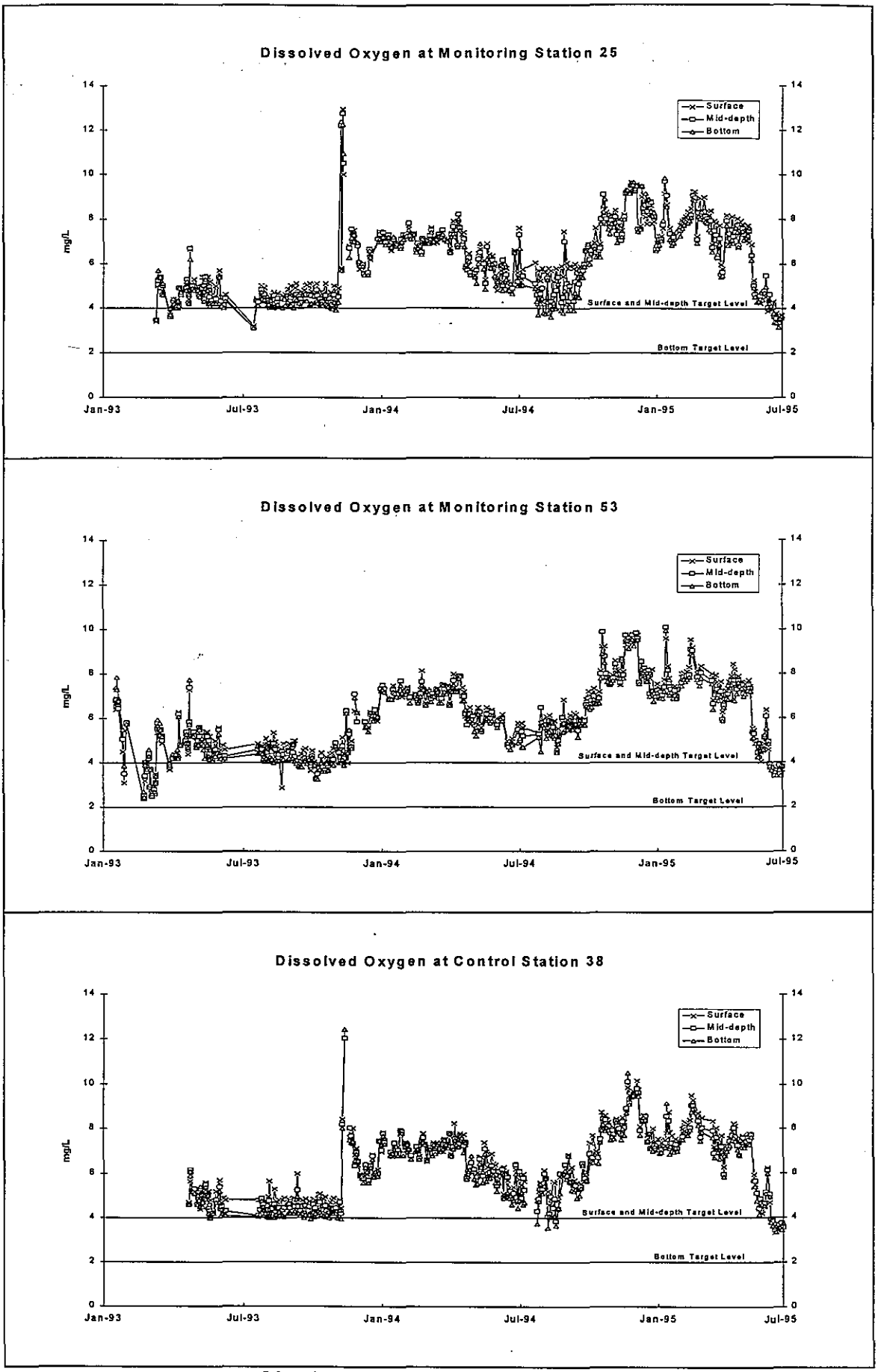
Based on targets established from upstream control stations, monitoring results around works areas have shown periodic exceedances of both turbidity and DO criteria at a number of monitoring stations. However, the combination of complex tidal and local current regimes around Sha Chau and NW Chek Lap Kok, potential impacts from other projects undertaking marine works within the same works areas (e.g. Civil Engineering Department work on the contaminated mud pits) and significant daily and seasonal external influences meant that directly attributing recorded exceedances around these works to works activities has not been possible.

Sea Rescue Facilities

A limited water quality monitoring programme was agreed with EPD for the marine works being undertaken for construction of the two sea rescue facilities and the programme has been underway since April 1997. A number of exceedance incidents have been recorded to date over the period of works in this area. However, as with the AFRF in the vicinity of Sha Chau, the combination of complex tidal and local current regimes around Sha Chau and NW Chek Lap Kok, potential impacts from other projects undertaking marine works within the same works areas (e.g. Civil Engineering Department work on the contaminated mud pits) and significant daily and seasonal external influences meant that directly attributing recorded exceedances around these works to works activities has not been possible.



Turbidity at Representative Monitoring and Control Stations ***Exhibit 6.7***



Dissolved Oxygen at Monitoring and Control Stations ***Exhibit 6.8***

6.6 Effectiveness of Water Quality Monitoring Programme

The value of the water quality monitoring undertaken in terms of providing a quick and effective indication of deteriorating water quality arising directly from APCJV marine works was questionable given the range of external factors influencing water quality in works areas, particularly in North Lantau waters. A number of factors have interfered with results over the course of monitoring around works areas and some of these are : -

- significant fluctuations in ambient water quality over the whole monitoring area were evident (e.g. widespread seasonal fluctuations in DO in North Lantau waters, sometimes to levels below the fixed target criteria),
- very localised variations in water quality resulting, for example, from vessel movement over shallow areas, localised current/tidal effects, and so on,
- works being undertaken by others in the same borrow and dumping areas at the same time as Authority works or during post-project audits.

The main problem encountered during the course of the water quality monitoring programme has been that of determining whether each recorded exceedance is the direct result of the relevant marine works activities, rather than the result of highly variable, seasonal and localised fluctuations in water quality. A direct cause/effect relationship was never identified during the course of all marine works activity.

6.7 Remaining Monitoring and Audit Programme

The only remaining water quality monitoring programme is for the SRFs. This will be continued until completion of construction, currently anticipated to be in February of 1998, at which time 6 weeks of post project audit monitoring will be conducted.

7.1 NAMP-EIA (1991) Summary and Recommendations

7.1.1 Summary of Impacts

A marine ecological survey of the seabed around Chek Lap Kok and The Brothers showed heterogeneous sediment types and associated fauna. The bottom invertebrate community was a good example of that expected in Hong Kong coastal waters with high species diversity, although a reduced echinoderm diversity was attributed to low salinity. Species new to science were collected including the pycnogonid Neopallene *sp. and the gastropod* Pseudoliotia *sp. This was indicative of the paucity of information on Hong Kong's sublittoral fauna rather than of particularly special sublittoral habitats. Fish diversity was high and, similarly to the benthic invertebrate species composition, comparable to that reported in a similar study ten years ago. Records of dolphins in the North Lantau, Deep Bay and Pearl River Estuary show 51 sightings of the Indo-Pacific Humpbacked (Chinese White) Dolphin (*Sousa chinensis*) between 1980-1991, of which 42 were live and 9 dead. Two individuals of this species are shown in Exhibit 7.1 below.*

Indo-Pacific Humpbacked (Chinese White) Dolphins *Exhibit 7.1*

Shorelines of the Chek Lap Kok and Tung Chung area comprise rock cliff, jetty, boulder, Zoysia *bed, sandy shore, mangrove and open shore communities. The littoral flora and fauna of these communities are diverse and compare favourably with that of other Hong Kong shores. A new species of predatory gastropod,* Cymia trigona*, was recorded on oyster clumps. Valuable habitats include mangrove, containing the relatively rare* Bruguiera gymnorrhiza *on Chek Lap Kok, and a mangrove and eel grass (*Zostera nana*) community south of Tin Sam jetty on North Lantau. This is of international conservation importance because there is only one other* Zostera *bed in Hong Kong at Li Chi Wo beach, which together with the beds at Tin Sam form the most southerly beds in China; the nearest sites elsewhere are 1,500 km north. The World Wide Fund for Nature Hong Kong have recommended that this site is designated as a Site of Special Scientific Interest.*

The impact of airport construction on marine biota will be the destruction of benthic fauna in the immediate vicinity of dredging, reclamation and dumping operations, and disturbance to fauna in the surrounding areas through the dispersion of suspended sediments. The benthic communities in the North Lantau area are already acclimatised to periods of high suspended solids and sediment deposition due to the effects of the Pearl River discharge, and are known to recolonise naturally depopulated areas. Once disturbance in the areas affected by construction has ceased, recolonisation would be expected to occur fairly rapidly, with similar communities developing in areas where the

substrate type is maintained. In others, i.e. borrow areas from which the original marine mud overburden is removed to expose sand, different communities will develop. Given the heterogeneity of North Lantau sediments, however, it is not considered that this will be detrimental to the sublittoral marine ecosystem as a whole.

Shoreline communities on Chek Lap Kok will be almost entirely destroyed during construction. The seawalls of the reclamation will offer some scope for recolonisation by rocky shore fauna, but in lower diversity due to the lack of microhabitat variation. The formation of a flushing channel will permit retention of shoreline communities on North Lantau, although change to wave exposure and localised tidal flushing may cause the present rock cliff and sandy shore communities to be replaced over time by sheltered rocky communities dominated by oysters or by comparatively depauperate muddy shore communities. The mangrove and Zostera beds at Tin Sam may be adversely affected by dredging, through coating of mangrove aerial roots with silt, and alteration of the nutrient levels, to which Zostera is sensitive.

7.1.2 Recommendations and Current Status of Implementation

a) *Bi-annual surveys of sublittoral communities affected by the airport and by new Port and Airport Development Strategy (PADS) construction projects should be carried out by Government for six years after completion of construction. Inspection of the mangrove and eel grass community south of Tin Sam jetty should be carried out on a quarterly basis during airport construction to assess dredging impacts.*

During discussions between Government and the Authority, in 1992, it was agreed that instead of Government carrying out 6 years of bi-annual surveys, the Authority would instead carry out three years of annual surveys. Government would remain responsible for carrying out inspections of the Mangrove and eel grass community south of Tin Sam Jetty during airport construction.

In terms of the annual surveys, the Authority and AFD have agreed that surveys should not be initiated until all marine works have been completed (estimated at early 1998). Discussions are now in progress regarding the details of this survey programme. See response to (e) below, in regard to the seagrass community south of Tin Sam Jetty.

b) *The southern seawall of the airport reclamation should be progressively constructed in advance of the dredging works to contain sediment dispersion as far as possible and to protect the North Lantau shoreline.*

During the early reclamation period, the Authority progressively constructed the southern portion of the platform in advance of mud dredging works to minimise sediment dispersion to surrounding waters, in particular to mangrove and sea grass communities along the North Lantau coastline.

c) *Water quality monitoring stations should be established by PAA within the proposed channel, one north of Tin Sam jetty between the dredging area and the mangrove/eel grass community and one at its western end off the sandy shore, to provide data on turbidity generation in this area. Remedial measures should be implemented by the Contractor if suspended solids levels become unacceptably high in relation to measured background concentrations.*

Three water quality monitoring stations were established by the Authority within the sea channel at the start of reclamation works and, with the exception of a 6-month period in 1994 when a mixing zone study was underway, these have been monitored for the duration of marine works around Chek Lap Kok.

d) *Disturbance of the sea bed outside the airport footprint, channel excavation, marine borrow areas and marine mud disposal areas should be avoided wherever possible.*

Both the General Specification, and dredging/dumping permit requirements issued to the Authority's contractors by EPD/Fill Management Committee (FMC), required that disturbance to the seabed outside designated works areas be minimised. Contractors were required to supply full details on barges and works vessels to be utilised for marine works and were required to equip all vessels involved in dredging and dumping with Automatic Self-Monitoring Devices, with records from these to be periodically sent to EPD.

e) *Should surveys of the existing Zostera beds indicate deterioration, consideration should be given by Government to the possibility of transplanting Zostera turfs from Tung Chung Bay to any new mudflats engineered for mangrove replanting adjacent to PADS developments along the North Lantau Coastline.*

Government surveys of the Tin Sam Jetty seagrasses have indicated that increased suspended solids levels related to reclamation activities have likely had a negative impact upon the seagrass beds. In view of this impact, the Authority (then the PAA) provided $0.2M to the AFD to fund a University of Hong Kong study to evaluate the potential for transplanting a part of the seagrass community to other suitable sites away from Tin Sam. This study was complimentary to a three-year ecological study on seagrass. Trial transplantations at the initial transplantation sites failed. Consideration is being given to replanting the seagrass at Tin Sam, subject to further study and conclusions from the ecological study.

The three-year ecological study was a joint University of Hong Kong and City University study, funded by the Authority and the Government, and due for completion in 1997. The seagrass in the area was confirmed to be *Zostera japonica* (previously identified as *Zostera nana)* and a new seagrass community was discovered at Pak Kok Wan near Lai Chi Wo. The study has shown that seagrass can be successfully cultivated under laboratory conditions with subsequent transplantation possible to the natural environment. Conclusions from the final report are expected to help in developing a long-term conservation plan for seagrass in Hong Kong.

f) *Where practicable, marine borrow areas should be worked individually, and backfilled while the next area is being worked. This will reduce the extent of disturbance at any one time to marine communities. Recolonisation of affected areas depends on a supply of animals from unaffected areas, and may be significantly slower and less successful if large surface areas of seabed are destroyed simultaneously.*

Within the constraints of the overall allocation strategy adopted by FMC for use of gazzetted borrow/dumping areas, the Authority attempted to ensure that this was implemented. The scale of the dredging and

dumping required during the reclamation meant that for most of the main works period, several gazetted areas were in use at any one time.

g) *Where practicable, worked out borrow areas should be backfilled to the original level, with at least 5m of uncontaminated marine mud at the surface, to permit recolonisation to begin within as short a time as possible.*

Within the constraints of the overall allocation strategy adopted by FMC for use of gazzetted borrow/dumping areas, the Authority attempted to ensure that exhausted borrow pits were back-filled where possible to the level of the original seabed. This was to try and ensure that species of marine flora and fauna specific to the top 1 metre of the seabed were provided a good chance of recolonisation once work activity was completed in any area.

h) *Contractors should be advised of the possible presence of dolphins in the area and of the need for their protection.*

Dolphin sighting forms were provided to all Authority boat crews and to all vessels operating during the SPC. The issue has been a component of the site induction programme on environmental issues held for all new contractors mobilising on site. The presence of dolphins around the AFRF at Sha Chau was a key environmental concern and mitigation intended to safeguard normal dolphin activity around Sha Chau had to be implemented by both the Franchisee and the Authority in order for works to go ahead at the Sha Chau works site.

7.2 NAMP-EIA Supplement (1992) Summary and Recommendations

7.2.1 Summary of Impacts

An assessment was made of the marine impacts resulting from the proposed modifications to the airport configuration. Since the westward shift of the airport configuration results in no net change in the area of seafloor affected by reclamation activities, this assessment focused upon the removal of the headland to the west of Sha Lo Wan.

The sublittoral of Sha Lo Wan shows a more abundant and diverse fish population than adjacent sites due to local tidal currents. Evidence suggests that the bay at Sha Lo Wan may also serve as a nursery area for a number of commercially important fish species including snappers (Lutjanids) and sea bream (Mylio and Rhadosarga). This is attributable to the shallow sheltered conditions, abundant food supplies and the nutrient flows from the streams discharging into the sea at the head of the bay.

The area of the Sha Lo Wan headland is comprised of rocky shore habitat with granite cliffs passing into moderately deep waters inshore. The beach zone on the inner northern side of the headland sustains a fauna typical of this part of the territory including ghost crabs and bivalves. The transitional area between beach and shore is characterised by a range of animals typical of boulder shores including rock oysters (Saccostria cucullata), and associated gastropods and molluscs.

The magnitude of the changes in the sublittoral communities resulting from the headland removal will be small, in comparison to the changes predicted as a result of the airport reclamation and formation of the sea channel. In comparison to the changes predicted in the NAMP-EIA, further sublittoral

changes resulting from removal of the headland are unlikely to be distinguishable.

Direct impacts to littoral communities will result from the loss of the headland west of Sha Lo Wan. The littoral ecology of the peninsula typifies that found in similar habitat types on the North Lantau Coast and there is no evidence of the presence of any unusual, rare or protected marine species. Moreover, the removal of the headland will be effectively compensated for by the retention of approximately 2.5 kilometres of coastline on the eastern side of Chek Lap Kok as a result of the westward shift in the reclamation footprint.

Blasting activities associated with the removal of the headland could result in short term impacts to marine fauna. Detonation of high explosives below sea level produces a strong shock wave with a steep, high pressure front. Underwater blasting can kill or cause damage to fish and marine mammals if they are within a range where pressure exceeds tolerable limits.

7.2.2 Recommendations and Current Status of Implementation

In view of the concern over potential impacts to fish during construction and the known presence of the Indo-Pacific Humpbacked Dolphin (Sousa chinensis) in the area around the airport site, the following mitigation practices will be adopted.

a) In the event that blasting is required, efforts will be made to minimise pressure wave transmissions by containing the explosive in drill holes.

See response to (c) below.

b) To further minimise impacts to dolphins and pelagic fish species, small non-lethal "seal bombs" will be utilised to scare marine fauna from the construction area, prior to a blasting event.

See response to (c) below.

c) If a dolphin or other marine mammal species is observed in the construction area, blasting will cease until the animal leaves the area.

The Authority's contractor attempted to remove the need for underwater blasting by adopting a working methodology designed to effectively shield all below sea-level blasting from surrounding waters. Initially, a large percentage of the headland above sea-level was excavated to provide fill to place on the seabed surrounding the headland. This effectively covered the underwater rock side slopes of the headland, which could then be charged from land using drill holes, drilled to the required depth, directly through the overburden and into the bedrock. Sleeved blast holes were then fired, with the later excavation of shattered material possible once the layer of overburden was removed.

Upon excavation of this material, large areas of bedrock in the channel remained above the required dredged level. This meant that underwater blasting was required to remove the remaining high spots and this ultimately took over two months, with blasts taking place up to three times per week.

Use of small seal bombs to scare marine fauna from the blasting zone was ruled out following a recommendation made by the Swire Institute of Marine Science research team. Instead, prior to each blast, APCJV deployed two vessels in radio contact with the blast co-ordinator, to

patrol the 500m area around the blast sight for a 30 minute period preceding each blast. The Authority also deployed a vessel to patrol the area for 40 minutes prior to each blast, with the requirement that if dolphins were sighted, firing would be delayed until the dolphins left the area.

The methodology utilised by both the Authority and APCJV was reviewed by an internationally renowned marine mammal expert (Dr. Thomas Jefferson) who approved the procedures in place.

7.3 Aviation Fuel Receiving Facility EIA (1995) Summary and Recommendations

7.3.1 Summary of Impacts

The results of the preliminary marine ecological study indicate that the sub-tidal invertebrates and fish community of Sha Chau are of both ecological and fisheries interest. However follow up work is required both to assess their importance and to identify and evaluate practical mitigation measures.. The area supports a high diversity of fish and shrimp, many of which are commercially important species (e.g. sole, flounder, croakers, flat heads and penaeid shrimps). Penaeid shrimps and sole were particularly abundant. Juvenile fish, shrimp, crabs and molluscan egg cases were commonly found, indicating the high fisheries value of the area. It is likely that the area may serve as an important spawning and nursery ground for these commercially important species.

The sensitive environmental receptors identified are

- *the penaeid shrimp and other important commercial fish species.*
- *the habitat as a nursery and spawning ground of marine animals in general and penaeid shrimps and food fish in particular; and*
- *sea pens and stone corals*

Dredging activities during the construction phase of the AFRF are likely to locally increase the turbidity of water, smother/disturb the sensitive species and modify the bottom substratum, and hence potentially affect the sensitive receptors described above. The ecology and survival of sea pens and stone corals, juvenile stages and recruitment of fish and shrimps in the area are of particular concern. The sediment plume modelling simulations undertaken to simulate the fate of sediment lost to suspension during dredging associated with the AFRF, predicted an elevation of suspended solid (SS) levels in exceedance of the WQO at one of eleven sensitive receivers, in relation to the background concentrations in the area. However, provided the recommended mitigation measures are fully implemented, including the use of closed-grab dredgers for construction of the turning circle, fairway and submarine pipeline, it is considered that water quality impacts will be minimised to within WQO acceptable levels. It should be noted that, at the time of the proposed AFRF construction the seafloor ecology in the area of the access fairway may have already been disturbed by dredging activities in the Urmston Road.

Fish and benthic communities in Hong Kong typically exhibit marked seasonal variations and thus the survey does not take account of seasonal changes. Judging from the documented occurrence of the Chinese King Crab species in similar habitats in the vicinity, the absence of this important species in the present survey may only reflect the seasonal occurrence of this species in the area. The importance of the area as a nursery and spawning ground for penaeid shrimps, food fish and the Chinese King Crab needs to be further established so that appropriate mitigatory measures can be introduced to minimise potential impacts as far as possible.

In addition, practicable efforts should be taken to minimise potential impacts on Indo-Pacific Humpbacked Dolphins arising from the construction works. Although limited, the data suggest that stationary offshore activities producing continuous noise result in less marked reactions by cetaceans than do moving sound sources, particularly ships, and this should be taken into consideration during construction of the AFRF. There are indications that some cetaceans may partially acclimate to continuous noise. To minimise potential adverse impacts on Indo-Pacific Humpbacked Dolphins it is the AA's intention to implement practical mitigation measures recommended in consultation with AFD Indo-Pacific Humpbacked Dolphins research studies, and consider incorporating these in the detailed design of the AFRF. As such, it is considered that the implementation of this comprehensive package of mitigation measures and the recommended comprehensive monitoring and audit requirements are likely, in combination, to minimise the potential for both direct and indirect impacts on Indo-Pacific Humpbacked Dolphins from the AFRF construction.

A key issue identified during the EIA process for the AFRF was the potential impacts on local populations of the Indo-Pacific Humpbacked Dolphins. Given the uncertainties and lack of Hong Kong based expertise, the Airport Authority retained the services of internationally renowned cetacean expert Dr Bernd Würsig who prepared an initial report entitled Potential Effects of a Proposed Aviation Fuel Receiving Facility at Sha Chau on the Health and Survivability of the Indo-Pacific Humpbacked (Chinese White) Dolphin, *Sousa chinensis,* in Waters North of Lantau island, Hong Kong Territory. *The key conclusions contained in this report are as follows:*

a) *Construction of the AFRF may well initially cause dolphins to vacate the immediate area (within 300 meters of the facility), but they will likely habituate to construction noise within days to weeks. They can reasonably be assumed to again utilise the site during latter stages of construction or soon after construction is completed. Facility construction and operation noises are below the major sensitivities of hearing of delphinids of the size of Indo-Pacific Humpbacked Dolphins, and therefore, we believe that there may be no significant masking of sounds or other sound-related problems. Nevertheless, caution is necessary, because it is likely that at very high sound pressure levels, even low frequencies are audible to Indo-Pacific Humpbacked Dolphins, and may mask especially sounds of their prey*

b) *With vessel traffic as proposed for use on the site, it is likely that dolphins will initially avoid the immediate and possibly the general areas (within about 300 meters of the AFRF and the off loading tankers) around the AFRF, but will habituate to the traffic and return to the general area. (There is the possibility of an escalation of other traffic in the general area, as part of China's overall increased use of Pearl River associated waterways. The present analysis does not include such potential increase in traffic, but this needs to be discussed in an overall management plan and potential sanctuary status; see below).*

c) *The immediate area of presence of the AFRF (probably within about 300 meters of the facility and associated tankers) is not likely to be used by the dolphins, and therefore this immediate area will be lost as dolphin habitat. This may change with time, especially as the pilings of the facility attract faunal assemblages which may serve as partial prey for the dolphins.*

d) *Dolphins at south Sha Chau, Pak Chau, and Lung Kwu Chau should not be affected by construction or operation of the AFRF (However, they*

may be affected by other construction and servicing activities in the area unless and until a sanctuary is established and administered; see below).

e) *The Sha Chau AFRF by itself will probably not greatly affect dolphin distribution or habitat use, since the dolphins in the Hong Kong "population" range outside of the Sha Chau/Lung Kwu Chau area. Nevertheless, it is possible that this well-defined small area is especially critical to the dolphins, and it may therefore be in need of immediate strict protection*

f) *Cumulative effects to dolphins in west Hong Kong waters must be considered in an overall Indo-Pacific Humpbacked Dolphin management plan. Due to ship traffic, jet airplane noise, over-fishing, habitat degradation (including probably unsafely stored toxic wastes in mud pits in the area), habitat loss, and potential problems associated with inadequately treated sewage, Indo-Pacific Humpbacked Dolphins in future may well be killed, or may avoid, or totally abandon waters north of Lantau Island. Although this is not directly a part of the present Sha Chau AFRF facility consideration, we would be remiss in not pointing out that marine mammals are often at risk of health and life in highly industrialised and polluted waters.*

7.3.2 Recommendations and Current Status of Implementation

Table 7.1 provides the recommended mitigation measures contained in the AFRF EIA. The table identifies the responsible party for the implementation of the recommendation and its current status.

Dr Würsig's potential effects report focused mainly upon the AFRF's potential impacts upon dolphins. His recommended mitigation measures were presented in a companion report entitled ***Health and Survivability of the Indo-Pacific Humpbacked (Chinese White) Dolphin, Sousa chinensis : Recommended Mitigation and Research Needs Relative to a Proposed Aviation Fuel Receiving Facility at Sha Chau, Northwest Hong Kong***. Table 7.2 presents his mitigation recommendations and their implementation status.

Attenuation of Percussive Piling Noise

The AFRF EIA recognised that using bored piling for the construction of the AFRF would result in less potential noise impacts to surrounding marine life than percussive piling. However, a panel of cetacean experts, chaired by Dr. Bernd Würsig, approved a decision to allow a significantly quicker, but noisier, percussive piling option to go ahead, on condition that noise mitigation measures be investigated, and if practical, adopted during piling.

In early 1996 the Authority undertook trials of the effectiveness of a bubble curtain in a swimming pool using impulsive sound sources on one side of the curtain and a calibrated recording system on the other. Trials showed that a 90% reduction in sound pressure density at all frequencies was achievable, based on the use of a single continuous bubble curtain.

Table 7.1 AFRF EIA Recommended Mitigation Measures

AFRF EIA Reference	Recommended Mitigation Measure	Responsibility	Implementation Status
Sec. 4.4.7 p. 98	*A detailed ecological study should be carried out, in parallel with the facility design, to provide seasonal data and properly assess the importance of the area as the nursery and spawning ground for penaeid shrimps, fish and the Chinese King Crab*	AA	These studies started in January 1995 and were concluded in April 1996. A final report was issued to AFD in April 1996.
Sec. 4.4.7 p.98 / Sec. 4.4.7 p. 99	*Based on the findings of the ecological study, appropriate mitigation measures should be developed at the detailed design stage, so that potential impacts on reproduction of these sensitive species can be avoided/minimised wherever practicable*	Franchisee	Dredging is being undertaken with closed grab clamshell dredgers. Investigation on the practical use of silt curtains revealed that the method is not practical because of shifting currents.
Sec. 4.4.7 p. 99	*Use low impact dredging techniques*	Franchisee/ Contractor	The EIA-recommended closed grab method of dredging has been adopted.
Sec. 4.4.7 p. 99	*The use of silt curtains during dredging activity should be investigated to assess their practicality.*	Franchisee/ Contractor	See response to sec. 4.4.7 p.99 above
Sec. 4.4.7 p. 99	*Maintain a dolphin monitoring programme during construction works.*	Franchisee/ Contractor	All North Lantau monitoring data collected by AA and ERM personnel are submitted to Dr. Jefferson for entry into the distribution and abundance database. These data, along with data from the current AFD-funded dolphin study, have been used to produce preliminary estimates of dolphin distribution and abundance in North Lantau. This work is ongoing and estimates will be refined as more data are collected. Four progress reports have been presented to the MMCWG
Sec. 4.4.7 p. 99	*Assure that waste management procedures are strictly enforced and monitored*	AA	AA are conducting regular audits of construction waste management practices.
Sec. 4.4.7 p. 100	*Piled structure for AFRF preferred over blockwork structure*	AA/Franchisee	Pile structure is the adopted design
Sec. 4.4.7 p. 100-101	*In order to minimise noise disturbance, all AFRF construction activities should be considered, wherever practicable, such that:* - *they are as short in duration as possible* - *work effort is regular* - *activities are continuous, without short breaks or unpredictable outbursts at random intervals* - *activity should cease for a period of 4 to 6 hours each day* - *use of quiet construction vessels and plant where practicable* - *scheduling of construction works during wet season period* - *vessel movements should be minimised*	Franchisee/ Contractor	The Contractor is committed to working with the Authority and Dr. Jefferson to minimise noise impacts wherever practical
Sec. 7.4 p. 180-182	*Conduct Sousa monitoring for one month in the vicinity of the AFRF at Sha Chau, one month prior to the commencement of construction, to establish baseline Sousa numbers.*	Franchisee/ Contractor	This was implemented under the guidance of Dr. Jefferson and Dr. Würsig have outlined a monitoring programme for the construction phase of the project. This programme has been agreed with AFD and implemented by the Contractor.

Table 7.2 Dolphin Conservation Measures and Studies as Recommended in "Health and Survivability of the Indo-Pacific Humpbacked (Chinese White) Dolphin, Sousa chinensis: Recommended Mitigation and Research Needs Relative to a Proposed Aviation Fuel Receiving Facility at Sha Chau, Northwest Hong Kong."

Reference	Recommended Mitigation Measure	Responsibility	Implementation Status
para. I A	*Put structures on piles*	AA/ Franchisee	Done. Pile structure is the adopted design.
para. I B	*Boring or percussive pile driving should be used to put the piles in place*	AA/ Franchisee/ Contractor	Based on the recommendation of a four member panel of cetacean experts chaired by Dr. Würsig, percussive piling is the preferred piling method. This was largely due to the shorter construction programme. However, the Cetacean experts recommended that noise mitigation measures be investigated and if practical adopted during piling. Based upon further analysis cetacean experts recommended a "bubble curtain" mitigation which was put in place by the contractor. Noise measurements have demonstrated that the bubble curtain significantly reduced noise emissions associated with piling operations.
para. I C	*Assure that vessel screw or associated noise of tankers and other support vessels <300 Hz*	Vessel Supplier	Vessel design to be implemented through the Supplier Agreement.
para. I D	*Provide propelling shrouding to reduce noise.*	Vessel Supplier	Vessel design to be implemented through the Supplier Agreement.
para. I E	*Assure that solid and liquid wastes are properly contained*	AA/ Franchisee/ Contractor/ Vessel Supplier	Addressed by AFRF designer, undertaken during construction and to be addressed by Franchisee during facility operation.
para. I F	*Provide training for AFRF and boat personnel*	AA/ Franchisee/ Dr. Jefferson/ Contractor	Implemented by the AA and Dr. Jefferson. Contractor personnel have attended site induction courses, on environmental issues and environmentally friendly construction practices.
para. I G	*Provide daily time out*	Franchisee/ Contractor	Now being implemented by the Franchisee and will be implemented during operation.
para. I H	*Create a artificial reef.*	AFD	Finance Committee have approved the necessary funding. AFD will undertake the implementation of artificial reefs in phases; initially on an experimental basis. A new Artificial Reef Division was established within AFD in July 1996 to implement AR projects. Baseline studies have been gathered from East Sha Chau and Lung Kwu Chau prior to deployment of pilot artificial reef.
para. I I	*Provide periodic review of newly analysed data by "Dolphin Management Plan Committee" (i.e. the MMCWG as referred in para III A).*	AA/AFD	All North Lantau monitoring data collected by AA and consultants are submitted to Dr. Jefferson for entry into the distribution and abundance database. These data, along with data from the current AFD-funded dolphin study, have been used to produce preliminary estimates of dolphin distribution and abundance in North Lantau. This work is ongoing and estimates will be refined as more data are collected. Four progress reports have been presented to the MMCWG.
Reference	**Major considerations to Allow the AFRF to Proceed**	**Responsibility**	**Implementation Status**
para. II A	*The AFRF is to be temporary*	AA	AA have targeted for an approximate 3-year primary operation period; the facility will then be used for emergency back-up only.
para. II B	*Create a marine sanctuary*	AFD/AA	Finance Committee approved the funding for AFD to designate, manage and enforce a marine park in the Sha Chau/Lung Kwu Chau area. The Sha Chau and Lung Kwu Chau Marine Park was designated on 22 November 1996. AA agreed to fund the recurrent costs in planning and managing the Marine Park for the operational life-time of the proposed AFRF at Sha Chau.

Table 7.2 Dolphin Conservation Measures and Studies as Recommended in "Health and Survivability of the Indo-Pacific Humpbacked (Chinese White) Dolphin, Sousa chinensis: Recommended Mitigation and Research Needs Relative to a Proposed Aviation Fuel Receiving Facility at Sha Chau, Northwest Hong Kong." (Continued)

Reference	Summary of Focused Studies	Responsibility	Implementation Status
para. III A	*(1) Develop a dolphin management plan,* *(2) Form a Dolphin Management Plan Committee, and* *(3) Appoint a reputable dolphin expert to advise the Government on dolphin issues.*	AFD	(1) and (2) A Marine Mammal Conservation Working Group (MMCWG) under the Marine Parks Committee of the Country and Marine Parks Board has been established by AFD to advise government on the management of the Sha Chau and Lung Kwu Chau Marine Park and in developing other conservation and management plans for the dolphin. (3) Dr. Thomas Jefferson (an experienced Post-Doc level cetacean expert) was appointed by AFD in April 1996 to carry out a 2 year in-depth study on the Indo-Pacific Hump-backed Dolphin and to advise the MMCWG and the Government on dolphin conservation.
para. III B para. III C para. III D	*Conduct a land based Sha Chau dolphin monitoring study, conduct a boat based Sha Chau dolphin monitoring study, and conduct aerial surveys*	AA/AFD/ Franchisee	The land based and boat based monitoring procedures have been developed in concert with Dr. Jefferson. It is Dr. Jefferson's view that air surveys are not required as part of the AFRF construction monitoring programme, however, limited air surveys have been undertaken as part of Dr. Jefferson's overview of North Lantau waters.
para. III E	*Conduct photo-recognition studies outside HK. waters.*	AFD	AFD will take every opportunity to co-operate and exchange information with mainland government officials and dolphin experts, especially through the Study Group for the Conservation of the Chinese White Dolphin, recently established under the Technical Sub-Group of the Hong Kong - Guangdong Environmental Protection Liaison Group.
para. III F	*Provide water quality and benthic fauna monitoring around Sha Chau as recommended in ERM's AFRF EIA.*	AA	Monthly benthic surveys commenced in January, 1995 and were completed in April 1996. A final report was issued to AFD in April 1996. A water quality monitoring programme is also now in place with results reported to EPD and AFD.
para. III G	*Create a artificial reef*	AFD	See para 1H.
para. III H	*Conduct radio-tracking*	AFD	It is Dr. Jefferson's view that capturing animals for radio-tracking studies has the potential for serious harm to individual dolphins. As a result he does not feel that radio-tracking should be included in the AFRF construction monitoring programme. However, once more is known about the local population Dr. Jefferson feels that radio-tracking may play a role in a larger territory-wide analysis of dolphin movements.
Reference	**General Studies and Procedures**	**Responsibility**	**Implementation Status**
para. IV A	*Determine population range, size and trends of dolphin in and around HK waters.*	AFD	See response to para. III A.
para. IV B	*Conduct a genetic analysis.*	AFD/SWIMS	Government funded work by SWIMS on genetic analysis has been completed. Dr. Jefferson will carry out further work in this area.
para. IV C	*Determine habitat requirements of dolphins in Hong Kong and elsewhere.*	AFD/ Dr. Thomas Jefferson	See response to para. III A and III E.
para. IV D	*Assess dolphins' reaction to development.*	AA/AFD	Dolphin monitoring programme for AFRF at Sha Chau should serve to provide useful data. Data will be reviewed by Dr. Jefferson on behalf of AFD and Dr. Würsig on behalf of AA.
para. IV E	*Determine health status of Indo-Pacific Humpbacked Dolphins.*	AFD	See response to para. III A.
para. IV F	*Conduct age and reproductive studies.*	AFD	See response to para. III A.

The optimum arrangement found for the bubble curtain in the pool was deployed around the percussive piling rig mobilised for the Sha Chau AFRF works. A field study of the effectiveness of this bubble curtain was conducted with the sounds of pile driving being recorded at distances of 250, 500 and 1000 metres from the piling rig, under the two conditions of bubble curtain on and bubble curtain off. Although there is some ambiguity over how different sound pressure levels are received and processed by different biological systems, due to loudness being a function of perception, a conservative interpretation of results showed that significant noise attenuation was achieved with the bubble curtain in place.

As Würsig (1996) concluded "mid-frequency range sounds are perceived at least half to one-quarter as loud with the bubble curtain on than with it off". The bubble curtain was deployed around all piles being driven for construction of the AFRF.

7.4 Current Status of Development and Remaining Impacts

The Airport Platform was essentially completed by mid 1995 with construction works for the Aviation Fuel Receiving Facility to be completed by November 1997. Marine works for the Sea Rescue Facilities are due to be completed by February 1998. Remaining impacts on marine ecology are minimal with mitigation measures specified in the above reports now implemented or scheduled to be implemented by Aviation Fuel System Franchisee or AFD. The Authority originally funded Dr Thomas Jefferson to undertake a 7-month study on the population ecology of the Indo-Pacific Humpbacked Dolphin (*Sousa chinensis*) from October 1995. Dr. Jefferson then transferred to the AFD where the study was continued and expanded in April 1996 with 2 years of additional funding provided by AFD. A number of the recommendations made in the AFRF EIA and in Dr Würsig's report are now being taken forward by AFD and Government under the guidance of a Marine Mammal Conservation Working Group.

7.5 Remaining Monitoring and Audit Programme

None remaining.

8.1 NAMP-EIA (1991) Summary and Recommendations

8.1.1 Summary of Impacts

A study of the terrestrial flora and fauna of Chek Lap Kok identified the island's wetland habitats as the most valuable. These contain mangroves, including the relatively rare Bruguiera gymnorrhiza which has a restricted distribution in Hong Kong. The fresh water areas are home to Romer's Treefrog (Philautus romeri). This rare species is endemic to Hong Kong and is only known to occur in three sites in the world: Chek Lap Kok, North Lantau and parts of Lamma Island. Several wet valleys also support large populations of the protected pitcher plant, Nepenthes mirabilis. This species is protected and is fairly common on granite seeps elsewhere in Hong Kong. The dry hill slopes are generally species-poor, but one protected species, Gardenia jasminoides and one species recently removed from the protected species list, Phoenix hanceana, were found in the hill-slope grassland. Protected species of orchids would also be expected, although these are not rare. Apart from birds and bats, the only protected animal species known to occur on the island is the Chinese Pangolin (Manis pentadactyla).

Monthly observations of birds on Chek Lap Kok indicate that the island supports a relatively rich avifauna, with a total number of 101 species recorded to date. Of these, only one (Seicercus burkii) is rare in Hong Kong. All of the birds recorded on Chek Lap Kok are protected under Hong Kong legislation. The birds of prey and shorebirds are listed under the "Bonn Convention", an international convention which aims to protect migratory species.

The impact of airport construction will be to destroy almost all the terrestrial flora and fauna and to displace all the island's avifauna. The southern headland, which is to be retained, is too small and dry to preserve any significant proportion of the island's biota. Shorebirds may be attracted to new reclamation areas to roost, but as building and infrastructure development proceeds, they will again be displaced.

Off-site impacts of airport construction may involve terrain cuts on north-east Lantau and Tai Lam Country Park in the southern New Territories. Although of little special ecological value, the access and works involved in terrain cuts could have adverse aesthetic impact until the areas are restored to a natural state. Off-site impacts may also arise from the siting of obstruction lights on Sunset and Lantau Peaks and on peaks in southern Tai Lam Country Park, and terrain cuts for the siting of electronic equipment on The Brothers Islands, Lung Kwu Chau, Sha Chau, Tai Lam Kok (Brothers Point) and hillsides on north-east Lantau.

There are ecologically sensitive Sites of Special Scientific Interest (SSSI) near the summits of both Sunset and Lantau Peaks which could be adversely affected by installation of lights unless construction and maintenance works are strictly controlled. Impacts will be significant on west Brother, which is densely vegetated and provides bird habitat; Lung Kwu Chau which is a Site of Special Scientific Interest due to the past presence of nesting sea-eagles and which has a protected plant species Pavetta hongkongensis; and Sha Chau which provides a roost for cormorants. Impacts at Tai Lam Kok and north-east Lantau, providing the latter is accessed by helicopter only, will be small.

8.1.2 Recommendations and Current Status of Implementation

The loss of habitats, flora and fauna on Chek Lap Kok cannot be mitigated directly. However a number of measures to compensate for this loss are recommended, as follows :

a) *A detailed field investigation of Romer's Treefrog on Lantau and Lamma Islands should be implemented and a laboratory breeding population of P. romeri captured from Chek Lap Kok should be established. Information obtained from the field and laboratory studies will provide data on the habitat requirements of the species which are essential for the development of a conservation and habitat management strategy. (This recommendation has already been implemented and is on-going.)*

A comprehensive ecological study on the frog, funded by the Royal Hong Kong Jockey Club, was undertaken by a research student at the University of Hong Kong between 1992 and 1995. The main findings of the study were:

- **Over 300 frogs of the Chek Lap Kok population were removed from site prior to vegetation clearance and these were then bred successfully in a University of Hong Kong laboratory,**
- **Over 200 wetland sites in the Territory of Hong Kong were surveyed to determine their amphibian fauna. New localities of Romer's Tree Frog were identified during the surveys,**
- **Some 400 adults and 600 young frogs and over 1,000 captive bred tadpoles were released to several sites within Hong Kong. Breeding activity has since been confirmed in 6 of the 8 release sites,**
- **Isoelectric focusing experiments found that there is some genetic variation among the four island populations of Romer's Tree Frog, and certain alleles could only be found in particular populations.**

Since the study, release site locations have been mapped on survey sheets accompanied with brief information about each site. Ongoing monitoring of the sites has shown that releases have generally been successful.

b) *Creation of new mangrove habitats outside the seawalls of the North Lantau Development or other PADS developments should be implemented by Government once schemes are finalised and appropriate areas can be identified. Alternatively, mangroves could be recreated in already disturbed coastal areas on North Lantau, such as the disused salt pans at Tai O. Creation of mangrove communities in existing natural shoreline areas is not recommended as it would risk damaging coastal environments which could otherwise be preserved.*

The Authority contributed funding for a 3-year joint university study on mangrove stands in Hong Kong. The study had the specific aims of (i) helping in the formulation of a management plan for the remaining mangrove stands in Hong Kong, and, (ii) establishing stands at the Tai O salt pans for compensating the loss of mangrove habitat on Chek Lap Kok and North Lantau. The study has located 43 stands of mangroves in Hong Kong and of these 23 were studied in depth. Important mangrove stands were identified, and the study also found it feasible to convert the Tai O salt pans to a created habitat for mangrove replanting. AFD will consider the conservation strategies proposed in the report.

The creation of a new mangrove habitat is now planned at the disused Tai O salt pans, which the Authority will also help fund on a cost-share basis with Government. Consideration is being given to accomplishing this work in conjunction with the Territory Development Department's construction of a sheltered boat anchorage at Tai O, now scheduled to commence in 1999.

c) *Enhanced protection of* Nepenthes mirabilis *populations and mangroves outside Country Parks should be provided by Government.*

See response to (d) below for ***Nepenthes*** and (b) above for mangroves.

d) *Representative freshwater wetland habitats elsewhere within the Territory should be protected by Government by their inclusion within the Country Parks system.*

The Authority contributed funding for a 3-year university study on freshwater wetland habitats in Hong Kong which was completed in 1996. The objectives of the study were to (i) provide information and scientific data to aid the formulation of conservation management plans to enhance the protection of freshwater wetland habitats in Hong Kong, and (ii) to develop propagation methods and establish new populations of ***Nepenthes mirabilis*** (Pitcher plants) at suitable localities. A total of 28 freshwater wetland sites across the Territory were located and studied, with each site ranked with a conservation priority according to size, species richness, species rarity and development pressure. Of these, 16 sites were selected and recommended for conservation by either extending the existing Country Park boundaries or listing them as SSSI. AFD is considering these recommendations.

Distribution surveys on the Pitcher plant have shown that they are widely distributed throughout the Territory and are usually found growing on granitic soils. Both seed germination and vegetative propagation using nodal cuttings proved successful when open, wet granitic soils were used as the transplant medium.

e) *A management strategy for woodland habitat on North Lantau should be developed and implemented by Government to improve conditions for wildlife. This should include enhancing natural woodlands by additional fringe and corridor planting and planting of urban landscaping areas with native species.*

The Authority helped fund a government project whose main objective was to re-create 60 hectares of woodland to compensate for the loss of 20 hectares of woodland habitats on Chek Lap Kok and North Lantau. The planting was carried out on hill slopes near Tung Chung and the intention is that the woodland will be managed for 10 years. Over 260,000 seedlings of some 60 species have been planted with the average survival rate around 50%. An additional 35,000 seedlings were planted in May of 1997 and additional planting and other woodlands maintenance work, such as weeding and fertilising, are ongoing.

f) *PAA should ensure that disturbance to areas identified for off-site terrain cuts, if any, are minimised by restricting the extent of access clearance wherever possible and restoring cut areas by reshaping the terrain and planting with native species.*

The Authority has not and does not anticipate making any off-site terrain cuts, as this is solely a government responsibility.

g) *The extent of disturbance to Sunset and Lantau Peaks should be minimised and strictly controlled, with equipment brought in by helicopter or on foot. The location of equipment and extent of any excavation should be discussed with Agriculture and Fisheries Department before work proceeds and maintenance staff should be made aware of the ecological sensitivity of the sites.*

The Authority will not be responsible for any activities on Sunset and Lantau Peaks. Any such work would be the responsibility of Government.

h) *After levelling of the Brothers Islands, the centre of West Brother Island should be excavated and reinstated with low stature vegetation. Additional areas of woodland should be planted on North Lantau to compensate for that lost on West Brother.*

Hydroseeding of the Brothers Islands has now been completed and both the East and West Brothers have now been handed back to Government. The status of North Lantau woodland plantings is discussed in (e) above.

i) *Lung Kwu Chau should be removed from the SSSI list, since sea-eagles no longer nest there. Construction work should be restricted to September-October to avoid disturbance to cormorants and nesting Reef Egrets. The Southern part of this island should be off limits to construction workers. If practicable, disruptive activities such as blasting should be restricted to September and October.*

The Government reviewed the status of Lung Kwu Chau as a SSSI in 1993 and considered that its delisting from a SSSI should be deferred until after the designation of Sha Chau and Lung Kwu Chau Marine Park. AFD is now conducting a further review to consider the recommendation to remove Lung Kwu Chau from the SSSI list. No work has or is anticipated to be done at Lung Kwu Chau by the Authority. For works done by the Government, reinstatement of the work areas is being, or has already been, carried out.

j) *Spoil removed from the top of Sha Chau should be disposed of to the west of the island, over the existing eroded shoreline. The north-western part of the island should be off limits to construction workers. If practicable, disruptive activities such as blasting should be restricted to September and October.*

No work has or is anticipated to be done on Sha Chau Island by the Authority. All Authority works have been confined to offshore activities related to the Aviation Fuel Receiving Facility. Government has had responsibility for all work done on Sha Chau during airport construction. Reinstatement of work areas was carried out by the Government.

k) *Permits to allow the destruction of birds' nests should be obtained under the Wild Animals Protection Ordinance prior to construction works commencing. Strict controls should be exerted to prevent fires and fuel/oil spillage at the remote sites.*

Permits were obtained and strict controls were exerted to prevent fires and fuel/oil spillage on all remote sites over which the Authority had control.

8.2 NAMP-EIA Supplement (1992) Summary and Recommendations

8.2.1 Summary of Impacts

Brief surveys of flora and fauna on the Sha Lo Wan headland were made in August and September of 1992. In addition, due to the 360 metre shift in the southern runway, a revised evaluation of the runways approach and departure surfaces was made to evaluate any potential change in the location and degree of terrain cuts. This analysis also considered whether there would be any change in the location of obstruction lights or other types of electronic equipment.

The Sha Lo Wan headland was evaluated as being botanically unexceptional and lacking a permanent freshwater source. Although the density of vegetation makes it attractive to many vertebrates, the lack of fresh water suggests that the headland is unlikely to be of major significance. However, these conclusions only apply to that portion of the headland to be removed. Construction of an access road could result in significant impacts, However, since only marine access will be provided to the headland construction area, off-site impacts on terrestrial ecology are not expected.

An analysis of the revised departure and approach surfaces indicates that all previously reported terrain cut requirements are either the same or slightly less than those reported in the NAMP-EIA. There are also no required changes in the location of any obstruction lights or electronic equipment. As a result, impacts on remote sites are the same as those reported in the NAMP-EIA.

8.2.2 Recommendations and Current Status of Implementation

All recommendations presented in the NAMP-EIA, as presented above in Section 8.1.2, should be adopted. In addition, it is recommended that the Birdstrike Control Unit include observations of birds along the natural coastline as part of their regular monitoring programme.

The Scope of the Bird Control Study incorporated observations of bird activity along the natural coastline opposite the airport platform. In addition, regular visits were made during 1996 to observe bird activity at both the Tung Chung new town site and at Tai O. These visits were discontinued in 1997 as observations were judged of limited value to the overall study, although the natural coastline continues to be observed during site visits.

8.3 Current Status of Development and Remaining Impacts

All planned activities involving the displacement of terrestrial habitat on the Sha Lo Wan headland, The Brothers, Lam Chau and Chek Lap Kok have been completed with the results as projected in the NAMP-EIA and EIA Supplement. Other construction activities at various off-site locations (e.g. Sunset and Lantau Peaks, Lung Kwu Chau, Sha Chau, Tai Lam Kok, hillsides on north-east Lantau, Tai Lam Country Park), which were projected to have adverse environmental impacts, have not been and are not expected to be the responsibility of the Airport Authority. Reinstatement of work areas is being, or has already been, carried out by Government.

9.1 NAMP-EIA (1991) Summary and Recommendations

9.1.1 Summary of Impacts

The excavation of Chek Lap Kok will require stripping the existing vegetation. It is anticipated that remaining vegetation will weigh approximately 25,000 tonnes. Construction wastes are expected to be generated at an average rate of 42,000 tonnes/year resulting in an additional 210,000 tonnes of material.

Domestic waste will be generated at a rate of approximately 0.3 tonnes/day during 1992-93, rising to an estimated 2 tonnes/day for the later construction years.

Potentially hazardous materials and chemical wastes associated with construction activities at the new airport site are primarily limited to those required for the fuelling, servicing and repair of earth moving and construction equipment. The raw materials used to make explosives associated with blasting activities will not be stored in quantities in excess of exempted quantities for a Potentially Hazardous Installation.

Plans are to isolate the storage and handling of fuel and other petroleum-based fluids in specially designed zones of the contractor staging areas. In this way, fuel storage, hazardous material and waste disposal vessels can be better protected and properly maintained. Additionally, should an accidental leak, spill or discharge occur, it can be contained more effectively in these specially prepared areas. Finally, should these materials need to be transported out of these designated zones to the job site, other special precautions can be taken to help prevent them from being discharged to the environment. Should a discharge occur under these conditions, absorbent materials or temporary barriers can be used by the Contractor to help minimise the potential environmental impact. If necessary, plans can then be developed for the clean up and removal of the materials.

Explosives used for blasting are considered Dangerous Goods and therefore the manner in which these materials are stored and handled at the airport site will be determined by the Mines Division of the Civil Engineering Services Department.

9.1.2 Recommendations and Current Status of Implementation

a) *The Contractor should not be permitted to burn waste such as cleared vegetation or timber within the site. Cleared vegetation should either be chopped or shredded and stockpiled on the site for later use (as a mulch on the upper layers of the reclamation in those areas adjacent to runways and taxiways which will later be grassed); removed off site to the Contractor's tip; or disposed of in some other manner acceptable to the Engineer.*

   The General Specification for contractors, franchisees and licensees incorporated these recommendations, and requirements were enforced on site by the Authority. Prior to proceeding with excavation work on the islands of Chek Lap Kok and Lam Chau, vegetation was cleared and removed to set-aside areas for temporary storage. This material will be utilised in landscaping works on site. Timber with no further use on site has routinely been removed, along with other construction wastes by the site waste disposal hauliers and taken to landfill sites.

b) *Any suitably inert building material should be utilised as fill. Remaining building wastes should be transferred to controlled tips for disposal.*

In some instances inert building wastes have been used in certain areas of the reclamation as fill material where specific material has met the required fill specification. In early 1994, the Authority established an inert waste stockpile in the mid-field area to the west of the Air Traffic Control Tower. Approximately 200,000m^3 of inert waste has been stockpiled since commencement of BIC works.

c) *During the later stages of construction work, domestic waste should be removed together with any building waste. In the initial phase the relatively small quantities of domestic waste involved do not justify the use of containerised facilities. A refuse collection point similar to those used elsewhere in the Territory would give sufficient provision for collection and short term storage of domestic wastes. For environmental hygiene reasons it is recommended that this waste is not stored for any period exceeding 48 hours and preferably only 24 hours.*

Refuse compactors serving the accommodation camps were provided and serviced twice a week. On substantial completion of the SPC, two major waste disposal hauliers undertook to dispose of wastes, including domestic wastes, arising from construction activity. They provide a broad-based service, providing skips as required to contractors, as well as other waste disposal services such as chemical toilet provision/servicing, clinical wastes and septic tank sludge removal, chemical waste disposal capability, and the removal of scrap vehicles. Construction wastes are routinely shipped from site and disposed primarily to WENT and SENT landfills.

d) *The Contractor should be required to co-ordinate any activities or operations that involve potentially hazardous materials or chemical wastes with the appropriate authorities including EPD, the Fire Services Department and the Marine Department.*

These recommendations have been incorporated in the General Specification of all contracts issued to contractors, franchisees and licensees operating on site. All contractors are bound by all statutory regulations in Hong Kong. Contractors on site, where necessary, have been required to register as chemical waste producers with the EPD and have had to comply with requirements for storing and disposing of all chemical wastes arising (e.g. waste oil) in accordance with the relevant regulation. In all cases, chemical waste has been disposed of by a licensed chemical waste collector. The Authority's environmental auditing team has made a concerted effort to ensure site compliance with this regulation.

All Dangerous Goods on site have had to be handled in accordance with the Dangerous Goods Ordinance (DGO), and subsidiary legislation. Hazardous goods on site have mainly been limited to explosives used for blasting works during the SPC and the handling and storage of bulk fuel and other petroleum-based fluids in specially designated areas around site, as well as on a smaller scale for fuel stored within individual contractor compounds.

e) *The Contractor should undertake at all times to prevent the uncontrolled disposal of hazardous materials and chemical wastes to the air, soil, surface waters, groundwaters and coastal waters.*

See response to (f) below.

f) *The Contractor should be responsible for collection and disposal of hazardous materials and chemical wastes and ensure that these tasks be carried out by competent and experienced personnel or subcontractors who are licensed to provide such services.*

These recommendations were incorporated in the General Specification. Where necessary, contractors on site have been required to register as a chemical waste producers and have had to comply with all requirements for storing and disposing of chemical wastes arising (e.g. waste oil). In all cases, chemical waste has been disposed of via a licensed chemical waste collector using a "trip-ticket" system to ensure "cradle to grave" control. The Authority's environmental auditing team has made a concerted effort to ensure site compliance with these regulations and regularly inspects trip-tickets.

g) *The Contractor should monitor the safe progress of Hazardous materials and chemical wastes from their point of arising to the final disposal point. This process is commonly referred to as "cradle-to-grave" control.*

See response to (f) above.

h) *The Contractor should be responsible for complying with the requirements of the Dangerous Goods Ordinance as they pertain to the use, storage and disposal of nonexempted quantities of these materials.*

In all cases, each contractor has had responsibility for complying with the provisions of the DGO, as stipulated in General Specification requirements. Contractors wishing to store Dangerous Goods on site have been required to obtain Fire Services Department (FSD) approval for the category of goods to be used. Methods used for the drilling, blasting and storage of explosives at Chek Lap Kok were in full compliance with the DGO, with the storage of explosives, the licensing of carrying trucks and all matters relating to safety and security of explosive usage on site being closely controlled by the Government Mines Division. The FSD issued the license for ammonium nitrate storage facilities and emulsion manufacturing plant on site.

i) *The Contractor should be responsible for developing and, if necessary, implementing a plan for the containment and cleanup of hazardous materials, chemical wastes or oil. The plan should be developed in consultation with the Fire Services Department and the Marine Department and consistent with the Water Pollution Control and Oil Pollution Ordinances.*

During the Site Preparation phase of the development the sole supplier of fuel and oil to site was Mobil HK Ltd. For the duration of the SPC, Mobil had responsibility for potential spills on or from site and had a comprehensive spill containment and clean-up plan in place, including provision of specialist equipment and training of staff. Since completion of the SPC, Caltex has also mobilised on site and they also have a corporate spill response plan in place for their operations.

j) *The Contractor should insure that hazardous materials, chemical wastes and fuel are packed or stored in containers or vessels of suitable design and construction so as to prevent leakage, spillage or escape of the contents under normal conditions of handing, storage and transport.*

These recommendations were incorporated in the General Specification. Where necessary, contractors on site have been required to register as chemical waste producers and have had to comply with all requirements for storing and disposing of all chemical wastes arising (e.g. waste oil), in accordance with the relevant regulation.

9.2 NAMP-EIA Supplement (1992) Summary and Recommendations

There are no significant changes in potential solid waste impacts from those assessed in the NAMP-EIA. Under the proposed modification approximately 2.5 kilometres of natural coastline along Chek Lap Kok's eastern shore will remain intact. However, the revised configuration will also require the excavation of part of a headland located to the west of Sha Lo Wan. All vegetative wastes resulting from this excavation will be removed to off-site landfills. All other excavated portions of the headland will be used as fill material for airport reclamation efforts. Disposal alternatives for all types of solid wastes remain the same as those discussed in the NAMP-EIA. All recommendations discussed in the NAMP-EIA, as presented above in Section 9.1.2 and following in Section 16.1.2, are still valid and have not changed as a result of the modification to the NAMP.

There are no significant changes in potential hazardous material impacts from those assessed in the NAMP-EIA. All recommendations discussed in the NAMP-EIA, as presented above in Section 9.1.2 and following in Section 16.1.2, are still valid and have not changed as a result of the modifications to the NAMP.

9.3 Aviation Fuel Receiving Facility EIA (1995) Summary and Recommendations

9.3.1 Summary of Impacts

a) Marine Sediments

The potential environmental effects of marine sediment disposal will vary according to the level of contamination of the sediment, and may lead to water quality impacts, and indirect adverse effects on marine biota. Sediment should be disposed of in a manner which minimises the loss of pollutants into solution or by resuspension. It is anticipated that, provided all recommended mitigation measures are enforced, no unacceptable impacts will result from the dredging, transport and disposal of the marine sediments.

b) Construction Waste

The construction activities for the facility site, turning basin, access fairway and pipeline installation will be marine-based, and thus have the potential to cause water pollution from packaging and construction materials, and spillages of slurry/grouting mixes. Potential impacts on water quality arising from general construction activities are discussed in Section 6.3.1. This assessment concluded that release of these potential pollutants into marine waters should not be permitted as introduction of these wastes is likely to have detrimental effects on marine biota in the area. Potential direct and indirect impacts on marine biota arising from general construction activities are discussed in Section 7.3.1.

c) Chemical Waste

Chemical wastes arising during the construction phase may pose serious environmental, and health and safety hazards if not stored and disposed

of in an appropriate manner as outlined in the Chemical Waste Regulations. These hazards include :

i) toxic effects to workers;
ii) adverse impacts on water quality from spills and associated adverse impacts on marine biota; and
iii) fire hazards

d) General Refuse

General refuse may include food wastes and packaging, waste paper, etc. and has the potential to cause impacts on water quality. Release of general refuse into marine waters should not be permitted as introduction of these wastes is likely to have detrimental effects on marine biota in the area.

e) Sewage Effluents

Sewage effluents will arise from the construction workforce. The discharge of sewage effluents into the marine waters has the potential to result in unacceptable water quality impacts and associated adverse impacts on marine biota.

9.3.2 Recommendations and Current Status of Implementation

Table 9.1, below, contains the recommended mitigation measures contained in the AFRF EIA. The table identifies the responsible party for the implementation of the recommendation and its status.

Table 9.1 Recommended Mitigation Measures Contained in the AFRF EIA

EIA Reference	Recommended Mitigation Measure	Responsibility	Implementation Status
Construction of the Turning Basin and Access Fairway			
Sec. 4.1.13 p. 55-56	*A detailed sediment quality assessment is required to be undertaken, as part of a sediment quality report, with the report submitted to the DEP at least three months prior to contract tendering or the commencement of dredging, whichever is earliest.*	AA/Franchisee	Done. Material was classified as Class A (uncontaminated).
Sec. 4.1.13 p. 56-58	*Dredged material to be disposed of at a gazetted marine disposal ground.*	AA/Franchisee / Contractor	Done. A dumping license was issued.
Sec. 4.1.13 p. 58	*The track record of the Contractor and vessels is investigated to ensure that poor operators are not contracted for construction of the AFRF.*	AA/Franchisee	A reputable Contractor was selected who is fully committed to implementing mitigation measures wherever practical. They have attended environmental awareness courses conducted by AA environmental staff.
Sec. 4.3.5 p. 73	*Comprehensive waste management procedures and appropriate staff environmental training should be employed.*	AA/Franchisee / Contractor	The AA and Dr. Thomas Jefferson have conducted a site induction course and outlined all environmental requirements. The Contractor submitted a written environmental plan, including a waste management plan prior to start of works. AA conducts regular audits of construction site practices.

EIA Reference	Recommended Mitigation Measure	Responsibility	Implementation Status at 30/5/97
Construction of the Turning Basin and Access Fairway			
Sec. 4.3.5 p. 74	*Sewage storage or initial treatment facilities are required to hold sewage prior to collection and removal.*	Franchisee/ Contractor	The Contractor is exercising a zero discharge policy throughout AFRF Construction. Wastes are being contained and disposed of at a suitable site.
Sec. 4.3.6 p. 74	*During facility construction and pipeline installation, a waste monitoring programme (to be incorporated within the ongoing PAA monitoring programme) should be implemented to ensure that all wastes are collected, handled, stored and disposed off-site in accordance with EPD regulations and requirements.*	AA/ Franchisee/ Contractor	See response above for Sec. 4.3.5 p. 73 and Sec. 4.3.5 p. 74.
Sec. 4.3.8 p. 75	*Waste management on the works vessels and barges should be defined by the Tenderer, strictly enforced and monitored by specified personnel to ensure no waste arisings enter surrounding marine waters.*	Franchisee/ Contractor	The Franchisee's Contractor provided written waste management procedures prior to the start of works.

10.1 NAMP-EIA (1991) Summary

Throughout the development of the new airport at Chek Lap Kok the Authority has given full access to the site for archaeological investigations. After a one month survey of Chek Lap Kok in September, 1990, seven major sites were excavated over a nine-month period. The major excavations were carried out at Fu Tei Wan, where charcoal samples gave ages of 4,000 to 3,300 BC and stone tools and other items were found; at Kwo Lo Wan, where six Bronze Age burials, dating from between 1,400 to 800 BC were found; at Sham Wan Tsuen a major Tang Dynasty lime kiln site, dating from 800 to 965 AD was found, together with coins and pottery. Nearby another site yielded artefacts dating to the earliest known phase of Hong Kong's prehistory - red painted pottery dating back to 5,000 to 4,000 BC.

In order to preserve evidence of the early occupation of Chek Lap Kok for the future, the Authority extended the size of the open space reserve at the southern part of the island to include the Ha Lo Wan archaeological site. This meant that the kiln complex which had been discovered there could be retained, rather than lost to development. On the advice of the Antiquities and Monuments Office of the Hong Kong Government, the kilns were re-buried for protection and subsequently protective earthworks were erected. A landscaping scheme for Ha Lo Wan is being implemented to allow public access on a controlled basis and provision has been made for car parking for visitors.

10.2 NAMP-EIA Supplement (1992) Summary

During field surveys of the headland west of Sha Lo Wan, a grave dating from 1959 was located. The grave site is situated near the top of the headland and faces north/north-east. This grave site will be eliminated by the proposed removal of the headland. The PAA is currently co-ordinating with the Buildings and Lands Department to ensure that appropriate procedures for relocating the grave site are followed. With this exception, all mitigation measures and recommendations discussed in the NAMP-EIA are still valid and have not changed as a result of the modification to the Master Plan.

In addition, the proposed modification to the NAMP layout and configuration results in construction cost savings. A reduction in the cost of the airport's construction will be a direct economic benefit to the territory.

The modification to the airport configuration does not alter impacts to archaeological and historic sites described in the NAMP-EIA. However, co-ordination with the Antiquities and Monuments Office of the Government Recreation and Culture Branch has indicated that a significant archaeological site is located on the headland west of Sha Lo Wan proposed for partial excavation. The archaeological site, known as the Sha Lo Wan West Site is known to contain artefacts of the Neolithic and Bronze Age periods.

The excavation of the headlands will result in the loss of a portion of the Sha Lo Wan West archaeological site. This impact is unavoidable since the headland must be excavated in order to maintain water circulation in East Tung Chung Bay. To help mitigate impacts, the AA will not commence construction operations on the headland until September 1993. This will allow the Antiquities and Monuments Office to excavate that portion of the archaeological site to be physically impacted and recover scientifically significant features and artefacts. Although some of the valuable information within the site may be lost, the extensive scientific excavation and documentation of findings, which might otherwise not have occurred, will mitigate much of the unavoidable destruction. The Antiquities and Monuments Office has indicated that 6 months will be required for it to conduct its excavation and data recovery efforts. In addition, marine access to the Sha Lo Wan ferry pier will be

maintained throughout the excavation of the Sha Lo Wan headland. All other mitigation measures and recommendations discussed in the NAMP-EIA are still valid.

A major archaeological investigation was launched prior to the removal of the Sha Lo Wan headland and evidence of early settlement was found together with many artefacts.

Part C

Issues
Relating
To Airport
Operation

11.1 NAMP-EIA (1991) Summary and Recommendations

11.1.1 Summary of Impacts

Noise Exposure Forecast (NEF) contours for 25, 30 and 40 values were generated for the years 2000 and 2030. Based on existing (year 1991) development, in the year 2000 only approximately 14 NSRs, all along the shore of Sha Lo Wan on North Lantau, will be within the 25 NEF contour. In the year 2030 approximately 500 NSRs are projected to be within the 25 NEF contour. These NSRs are primarily located in and around the village of Sha Lo Wan and on the island of Ma Wan, with a few being scattered along the north coast of Lantau and along Castle Peak Road. Approximately 14 of these NSRs, all along the shore of Sha Lo Wan, are projected to be within the 30 NEF contour in the year 2030. The total number of NSRs projected to be impacted is exceptionally small for a major international airport - primarily because such a large proportion of the contours is over open water.

11.1.2 Recommendations and Current Status of Implementation

Throughout the master planning process noise impacts have been an important consideration in developing and selecting alternative facility locations and configurations. In the Phase 1 screening process runway configurations and alignments were favoured which minimised noise impacts. Later, the midfield location of aircraft maintenance facilities was selected from several alternative locations, all of which would have been closer to NSRs. Additionally, a noise/blast barrier is proposed to shield the maintenance run-up pad from NSRs, and thus noise from this type of activity is even further reduced.

a) *For those NSRs which fall within the 25 NEF, year 2000 noise contour, relocation by Government is recommended. All of these NSRs are also impacted by construction noise and are to be provided mitigation for these impacts. Rather than providing some mitigation for construction noise and then additional mitigation for operational noise, it is recommended that residents of these NSRs be compensated just once by means of permanent relocation. All new construction of NSRs within the 25 NEF, year 2030 noise contour, should be prohibited.*

   The relocation of residents and land use policy are Government responsibilities. The final policy decision is to be made by the Secretary for Planning, Environment and Lands.

b) *A portable noise meter, capable of interfacing with a computer system, should be acquired by AA for validating modelled contours and for collecting site specific data if a complaint is received.*

   The Civil Aviation Department is installing, and will operate, a state-of-the-art computerised noise tracking system at the New Airport. This system will be useful in validating noise contours as well as in collecting specific noise level readings from dedicated and mobile monitoring stations. The resulting noise and flight tracking data will be used to identify and evaluate activities which result in noise complaints.

c) *The Master Plan and associated operational forecasts should be updated prior to the programmed airport opening in May 1997. Subsequent to the opening of the airport the Master Plan and operational forecasts should be updated in five year increments. During each revision of the Master Plan, operational noise should be modelled based on a revised forecast. This should be done using the then current noise model which will have new, and likely quieter aircraft in the data base. During each*

of the noise modelling updates, 25 NEF contours should be projected for the existing year and the fifth year into the future. If newly impacted NSRs are identified within these contours then mitigation measures should be developed and implemented.

Updated 25 NEF contours have been prepared based on the latest operational forecasts and anticipated modes of operation for the year 2000, year 2005 and for the airport operating at Design Capacity. The newly upgraded version of the FAA Integrated Noise Model (INM), version 5.1a, has been used. Changes in major assumptions, model inputs, the model itself and associated noise impacts, compared with the NAMP-EIA Supplement, will be presented below.

11.2 NAMP-EIA Supplement (1992) Summary and Recommendations

11.2.1 Summary of Impacts

Noise Exposure Forecast (NEF) contours for 25, 30 and 40 values were generated for the years 2000 and 2030. The contours for the revised master plan configuration now cover slightly less land area (1.2 ha less for year 2000, 17.85 ha less for year 2030) than the contours presented in the NAMP-EIA. Impacts are identical however, since there are no NSRs within this land area.

Due to the availability of revised operational forecasts, which are discussed in the following sections, the NEF contours were updated and are presented below.

The revised NAMP configuration also places a maintenance runup pad adjacent to the northern runway approximately 40 metres closer to Sha Lo Wan relative to the pad's position described in the NAMP-EIA. However, this pad is still over 1600 metres from the nearest NSR and noise levels produced from the new runup pad location are anticipated to remain within acceptable levels.

Plans for landuse in the aircraft maintenance base area were revised in 1996 in order to accommodate essential facilities such as the western sea rescue facility. The maintenance runup pad was subsequently relocated to a site north of the aircraft maintenance hangar. The revised location of the runup pad is shown in Exhibit 2.1 and the distance to the nearest NSR is approximately 1350m. As stated in the NAMP-EIA and reconfirmed by letter from EPD in 1993, locating the runup pad 1000 or more meters from the nearest NSR provides adequate noise protection for North Lantau residents. A purpose-built noise barrier, which provides at least a 10 dB(A) insertion loss, will also be completed prior to the runup pad becoming operational.

11.2.2 Recommendations

Continued adoption of all recommendations made in the New Airport Master Plan, as presented above in Section 11.1.2.

11.3 Revised Noise Contours

In the NAMP-EIA and its Supplement, noise contours were produced for the years 2000 and 2030 to represent the potential noise impacts of the initial phase and final phase, respectively, of the new dual runway airport. It was assumed that both the southern and northern runways would be used for independent, simultaneous, arrivals and departures (i.e. the airport would operate in the integrated mode). CAD now envisions that, in order to operate the airport safely, there is a need for a transition to the integrated mode of operation in order to allow time for air traffic controllers, who are primarily accustomed to operating a single runway airport, to familiarise

themselves with dual runway operations. Initially, when the northern runway comes into operation in late 1998, one of the two runways will be designated for departures only and the other for arrivals only (i.e. the runways will operate in segregated mode). Further, consideration of air traffic handling complexity would dictate the use of the southern runway as the departure runway and the northern runway as the arrival runway. As the date for transition from segregated mode to integrated mode is yet to be determined, it is assumed that in the year 2000 the airport will be operating in segregated mode and that the transition to integrated mode will be completed before 2005. Operations in the integrated mode will then continue for the life of the facility.

The NAMP-EIA and its Supplement assumed that in 2030 the dual runway system would approach Design Capacity and was therefore considered to be representative of the final phase of operational noise impacts. In order to emphasise the significance of this modelling scenario, the updated contours that were generated using the Design Capacity operating characteristics are now referred to as Design Capacity contours.

Based on the above mentioned considerations, revised contours were generated for the years 2000 and 2005, as well as for the airport operating at Design Capacity. The methodology of producing the NEF contours and the detailed steps leading to the development of the noise model are fully discussed in the NAMP-EIA. Relevant changes in the assumptions and input data for the revised contours are provided below.

11.3.1 Updated Flight Tracks

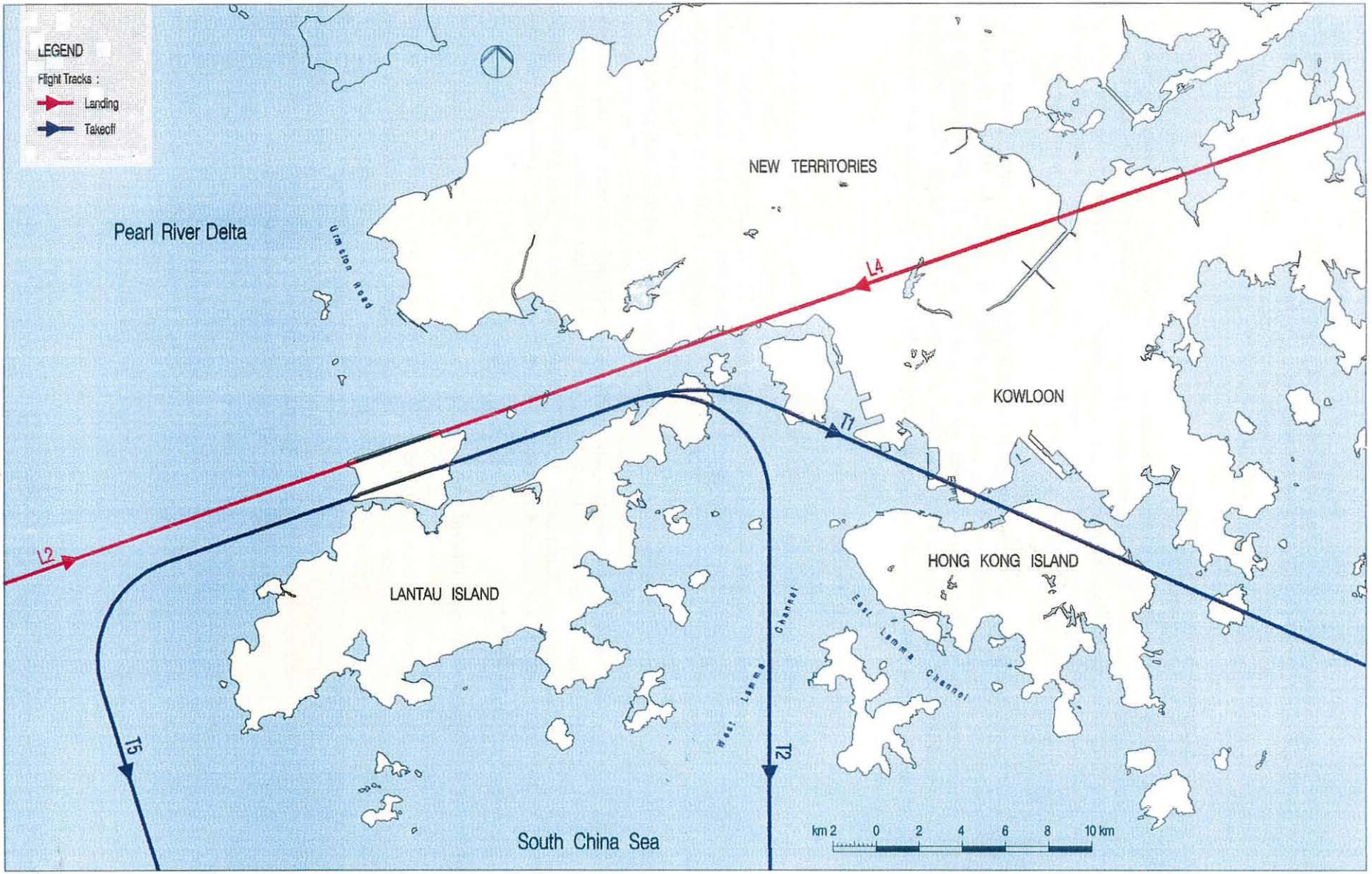
In 1994, subsequent to the NAMP-EIA and EIAS, CAD commissioned a detailed study to evaluate airspace use, which took into consideration operational details, terrain and the presence of neighbouring airports. The flight procedures recommended by the consultants have recently been finalised and the resulting flight tracks have been adopted for this analysis. Flight tracks for the segregated and integrated mode are shown in Exhibits 11.1 and 11.2 respectively. It is now assumed that aircraft will generally be assigned to flight tracks irrespective of origin or destination. The exception to this rule is for departures using the southern runway in an easterly direction. In this case, Track T1 is for aircraft going to China, Japan, South Korea, Taiwan, Australasia, Europe, North America and the Philippines while Track T2 is for aircraft to Singapore, Malaysia, Thailand, Indonesia and the rest of the world.

11.3.2 Updated Aircraft Operational Forecasts

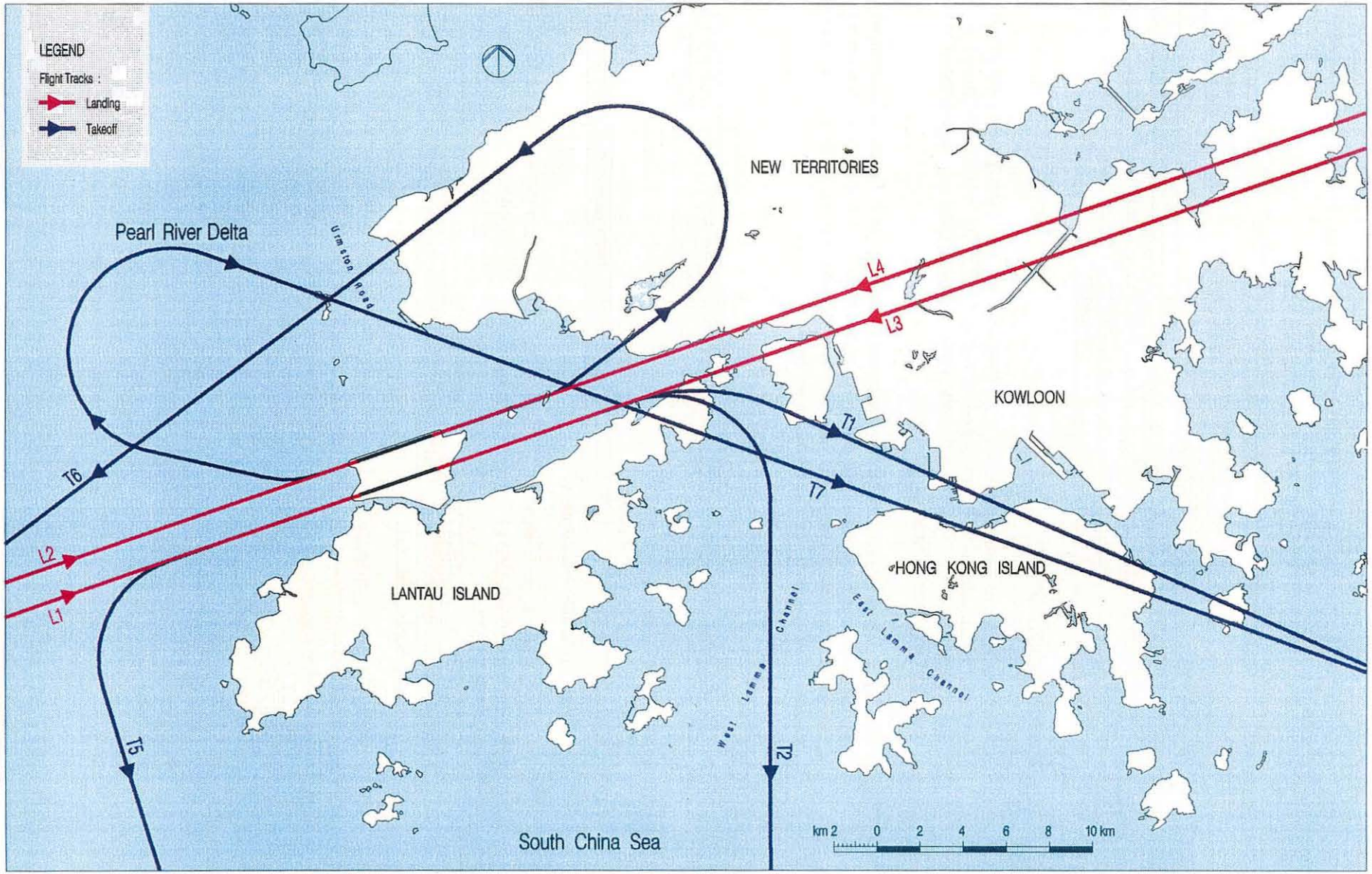
Aircraft noise impacts are dependent on, among other factors, the air traffic volume, aircraft fleet mix, percentages of night-time operations and flight destinations. Based on a Comprehensive Traffic Forecast Study (CTFS) approved by Government in 1994, new noise projections were made with this latest approved information. Following the format set out in the NAMP-EIA, the updated aircraft operational data for the years 2000 and 2005, as well as for the airport operating at Design Capacity are presented below.

Number of Aircraft Operations

The CTFS forecast shows that the total annual aircraft movements are 205,480, 265,600 and 343,040 for the years 2000 and 2005, and at Design Capacity respectively. The numbers exclude operations of small aircraft and helicopters which have been demonstrated in the NAMP-EIA to be insignificant in terms of overall noise impact. On an average day, the equivalent daily aircraft movements are 563, 728 and 940, respectively, for the years 2000 and 2005, and at Design Capacity.



Revised Flight Tracks for Segregated Mode ***Exhibit 11.1***



Revised Flight Tracks for Integrated Mode ***Exhibit 11.2***

Table 11.1 shows the composition of the aircraft movements. It should be noted that one aircraft movement means either one take-off or one landing, and non-revenue flights include executive jets, testing, training and ferrying operations.

Table 11.1 Updated Annual Aircraft Movement Forecast

Category	Year 2000	Year 2005	Design Capacity
Passenger	182,860	236,620	307,330
Freighter	16,960	21,820	26,610
Non-Revenue	5,140	6,640	8,580
Military	520	520	520
Total	205,480	265,600	343,040

Aircraft Fleet Mix

A summary of the anticipated aircraft fleet mix for the year 2000, year 2005 and at Design Capacity is presented in Table 11.2 The results are based on the CTFS forecasts augmented with data derived from an assessment of historical fleet mix trends at Kai Tak.

The data are grouped into three categories: Boeing 747, other wide-bodied aircraft and narrow-bodied aircraft. To date, B747 and derivatives remain as the most frequently expected aircraft, and approximately 80% of the total fleet is anticipated to be wide-bodied aircraft.

Table 11.2 Updated Aircraft Fleet Mix

Aircraft Type	Year 2000	Year 2005	Design Capacity
Boeing 747			
747-400/74720A/747SP	37.39%	37.44%	37.21%
Subtotal	37.39%	37.44%	37.21%
Other Wide-Bodied Aircraft			
A300/A310/A330/A340	24.55%	24.75%	24.90%
DC10-10/30/40, MD11	5.80%	6.04%	6.19%
L1011/L10115	2.21%	2.24%	2.25%
B767-300/B767JT9/B777	9.02%	8.80%	8.64%
Subtotal	41.58%	41.83%	41.98%
Narrow-Bodied Aircraft			
B737-100/200/300/400	7.73%	7.56%	7.51%
B757PW	2.56%	2.75%	3.00%
BAE146	0.01%	0.01%	0.01%
B727	0.15%	0.16%	0.16%
A320	5.73%	5.53%	5.44%
MD81	3.49%	3.42%	3.40%
DC870	0.29%	0.31%	0.32%
Others	1.07%	0.99%	0.97%
Subtotal	21.03%	20.73%	20.81%
Total	100%	100%	100%

Note: Wide-bodied aircraft are aircraft with maximum cabin width greater than 4.5m and a maximum total authorised weight exceeding 100 tonnes. Narrow-bodied aircraft are aircraft other than wide-bodied aircraft.

Day/Night Splits

Aircraft operations generally cause greater annoyance to the public at night than during the day. In order to account for this annoyance due to night-time operations, the INM model imposes a 12dB penalty, in accordance with standard methodology, to flights between 10 p.m. and 7 a.m. It is therefore important to distinguish the percentages of daily operations during this period.

Based on the updated busiest day, hourly operation profiles, the aggregate night-time operation percentages would be 8.8%, 9.0%, 9.3% respectively for year 2000, year 2005 and at Design Capacity.

Flight Destinations

Flight destinations affect aircraft noise impacts in two major ways. First, the scheduled distance is a prime factor in determining the amount of fuel loaded onto an aircraft, and hence the takeoff weight which significantly affects the engine thrust and departure profiles.

Second, the destination affects assignment of aircraft fleet to various flight tracks details of which are further discussed in the following section. Data shown in Table 11.3 form the basis of the INM input.

Table 11.3 Updated Summary of City-Pair Aircraft Movements

	Year 2000	Year 2005	Design Capacity
Japan	11.30%	10.80%	10.11%
North America	3.76%	3.67%	3.58%
Australasia	2.28%	2.17%	2.06%
Taiwan	20.47%	20.96%	21.45%
Europe	3.13%	2.97%	2.82%
Singapore	5.17%	5.02%	4.76%
Thailand	10.82%	10.70%	10.57%
Malaysia	2.44%	2.46%	2.49%
Indonesia	1.15%	1.15%	1.16%
Philippines	3.92%	3.89%	3.88%
South Korea	4.03%	4.02%	4.00%
China	24.66%	25.12%	25.94%
Rest of World	6.87%	7.07%	7.18%
Total	100%	100%	100%

11.3.3 Updated Runway and Flight Track Utilisation Data

It was assumed in the NAMP-EIA that, taking into account the prevailing wind direction at the New Airport site and the ability of aircraft to operate at tailwind conditions of less than 5 knots, 55% of the flights will take-off to the east or land from the west. The balance of flights, 45%, will take-off to the west or land from the east.

It has been confirmed with the Civil Aviation Department that the above assumptions would still stand. The same directional splits would apply to both runways for segregated mode as well as integrated mode.

In Section 11.3.1, it has been mentioned that all flights using the same runway in the same direction are assumed to follow the same flight track on an average day. The exceptional case is for departures using the southern runway to the east (see Exhibits 11.1 and 11.2). For commercial aircraft, the splits between T1 and T2 are given in Table 11.4 for the 3 modelling scenarios. Military aircraft are all assigned to T1 to the north.

Table 11.4 Flight Track Utilisation for Eastbound Departures along Southern Runway

Departure Tracks	Year 2000	Year 2005	Design Capacity
T1	73.4%	73.6%	73.7%
T2	26.6%	26.4%	26.3%
Total	100%	100%	100%

11.3.4 Updated Noise Model

The Integrated Noise Model (INM) was developed by the Federal Aviation Administration (FAA) as the statutory tool for airport noise assessment in the United States. It was first available in 1978, and since completion of the NAMP-EIA in 1991, has evolved from version 3.9 to version 5.1a. The current version was upgraded in May of 1997 from version 5.1. Compared with version 3.9, the most significant change is in the much expanded data base which increases from 81 aircraft/engine combinations to 216 combinations and 263 standard aircraft substitutions. Other changes include enhancement of features and capabilities of the model and corrections of anomalies for specific applications, impacts of which are considered to be minor on the NEF contours.

Using INM version 5.1a, 29 aircraft types were used to represent forecasted fleet mix, compared with only 8 aircraft types used in the NAMP-EIA. As a result of this refinement, the aircraft fleet mix used for the updated noise contours is anticipated to be significantly more representative of the aircraft fleet operating at the new airport.

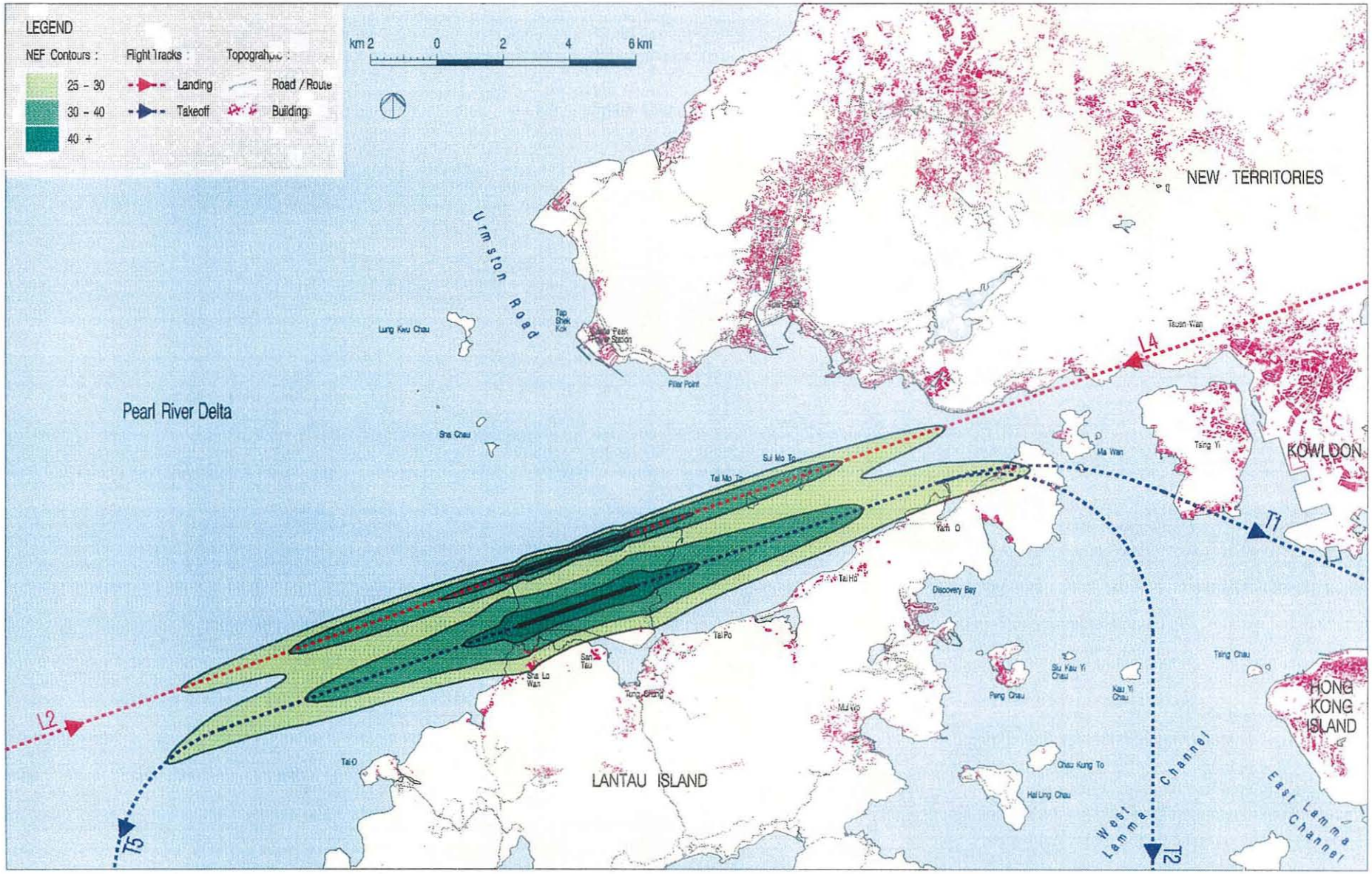
11.3.5 Updated NEF Contours

Based on the updated operational forecasts, which were discussed above, the INM was used to generate updated NEF contours. Contours for the years 2000 and 2005, and for the airport operating at Design Capacity, are presented in Exhibits 11.3, 11.4 and 11.5 respectively.

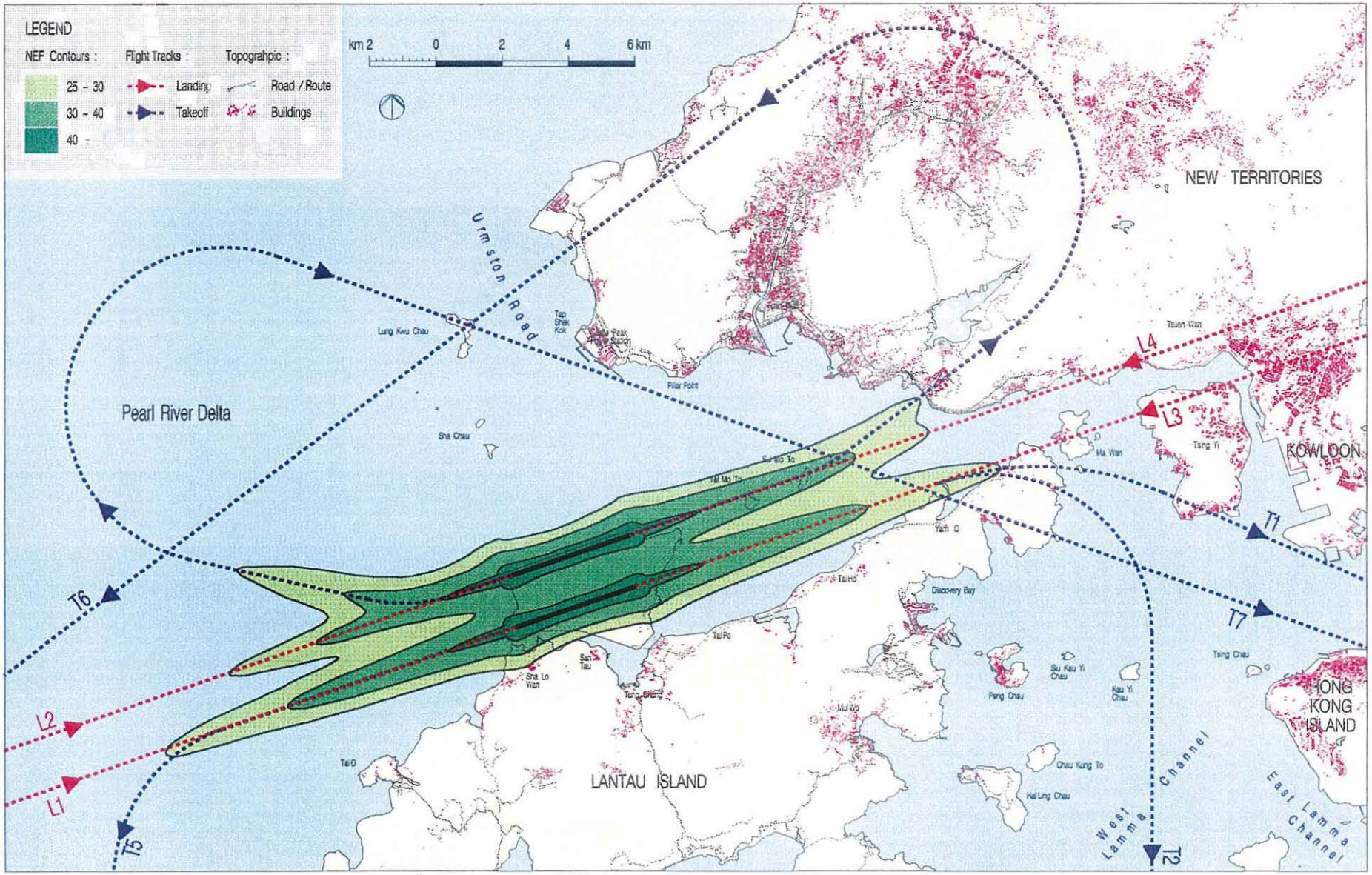
11.4 Revised Noise Impacts

The NAMP-EIA and EIAS predicted that approximately 500 NSRs would be within the 25 NEF contour when the New Airport operates at Design Capacity. These NSRs were in Sha Lo Wan, Ma Wan, along the coast of Northeast Lantau and along Castle Peak Road. The updated contours shown in Exhibits 11.3, 11.4 and 11.5 show that Ma Wan and the section of Castle Peak Road are no longer within the contours. Due to the revised flight tracks, the 25 NEF contour is now projected to encroach into Tai Lam Chung when air traffic demand approaches Design Capacity. Although impacts on Tai Lam Chung could be mitigated by shifting flights from the northern to the southern runway, the resulting adverse impacts on operating safety and capacity, as well as increased impacts on North Lantau, are not acceptable to CAD. Sha Lo Wan and the shore along Northeast Lantau are projected to remain within the contours for the life of the New Airport.

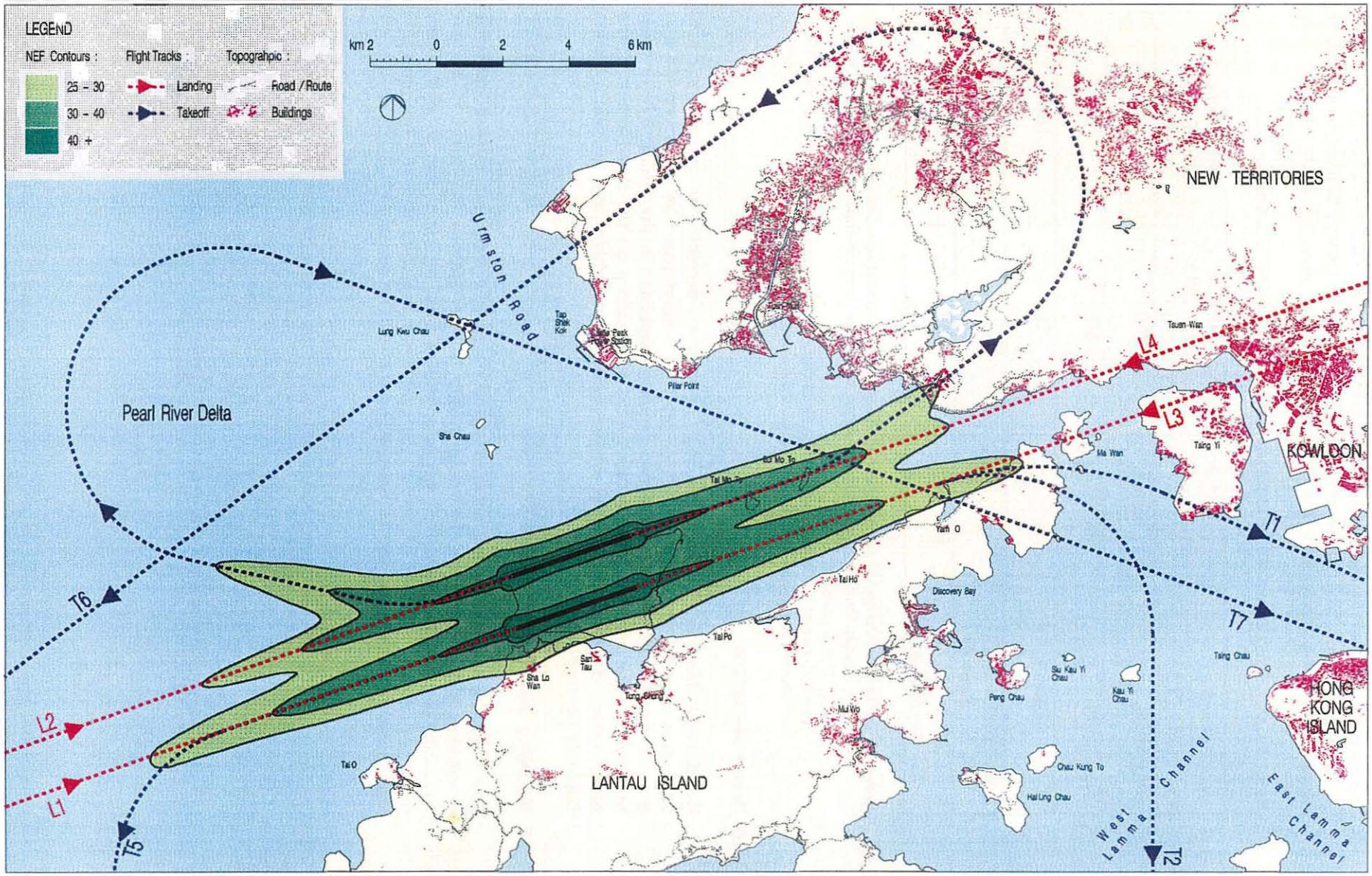
Based on updated projections, it is estimated that in the year 2000 there will be approximately 200 NSRs within the 25 NEF contour. Because of the transition in the operation of the New Airport from the segregated mode to the integrated mode, sometime between the years 2000 and 2005, most of these impacts are temporary. For the year 2005, when the airport is anticipated to be operating in the integrated mode, only 50 NSRs are projected to remain within the 25 NEF contour. Based on the updated Design Capacity contours shown in Exhibit 11.5, the number of NSRs within the 25 NEF contour has been reduced from 500 to approximately 150. This improvement is largely due to the shift in the contours away from Ma Wan and Castle



Updated NEF Contours for the Year 2000 ***Exhibit 11.3***



Updated NEF Contours for the Year 2005 ***Exhibit 11.4***



Updated NEF Contours at Design Capacity ***Exhibit 11.5***

Peak Road. The total land area, the approximate number of NSRs, and the approximate number of residents within the 25 NEF contour for each of the three currently projected scenarios (year 2000, year 2005 and Design Capacity), as well as for the projections presented in the EIA Supplement, are shown in Table 11.5.

Table 11.5 Updated Noise Impacts Within the 25 NEF Contours

Scenario	Total Land Area (ha) *	Approximate Number of NSRs	Approximate Number of Residents
Year 2000	159	200	50
Year 2005	65	50	10
Design Capacity	141	150	150
Year 2000 - EIA Supplement	N/A	14	N/A
Year 2030 - EIA Supplement	N/A	500	N/A

Notes: Estimates are based on data provided by Lands Department, December 1997.
* - excludes land area on the New Airport platform and uninhabited outlying islands.
N/A - Not Available.
The number of NSRs may exceed the number of residents because many of the NSRs on North Lantau are occupied only on week-ends and holidays.

11.5 Recommendations

Residents within the year 2005, 25 NEF, contour are projected to be impacted with unacceptable noise levels for the life of the New Airport and it is recommended that they be relocated by Government. As was recommended in the NAMP EIA, in order to prevent noise sensitive development from encroaching on the New Airport in the future, such development should be excluded from within the 25 NEF, Design Capacity contour.

11.6 Modelling, Monitoring and Audit Programme

The Authority will update the noise contours every five years, but operational noise monitoring will primarily be the responsibility of the CAD as discussed in Section 11.1.2(b) above. The Authority will support the CAD in responding to any citizen noise complaints. Details of coordination between the CAD and the Authority are now under discussion and will be finalised prior to airport opening.

12.1 NAMP-EIA (1991) Summary and Recommendations

12.1.1 Summary of Impacts

The two principal sources of air emissions associated with the new airport are aircraft and motor vehicles. Other sources include aircraft support equipment, fuel facilities, maintenance areas and a variety of other smaller sources.

Based on the design and operational elements of the NAMP, the generation of air emissions associated with the primary sources of air pollution at the airport and the associated North Lantau Expressway (NLE) access facility was estimated for 2040 conditions. The results indicate that aircraft are predicted to generate 15,450 tonnes/year (42,339 kg/avg. day) of emissions; motor vehicles, 13,409 tonnes/year (36,736 kg/avg. day); ground support equipment 2,534 tonnes/year (6,942 kg/avg. day) and fuel facilities, 33 tonnes/year (90 kg/avg. day).

The results of the PAL model dispersion analyses indicate that, under "worst case" meteorological conditions, the highest one and 24-hour levels of airport and NLE related nitrogen dioxide concentrations are 251 and 124 ug/m^3, respectively, at a receptor in close proximity to the expressway. The highest one and 8-hour carbon monoxide levels are predicted to range between 2955 and 2561 ug/m^3. Under "most probable" meteorological conditions, the nitrogen dioxide levels are expected to range between <1 and 74 ug/m^3 over the one hour period and range between <1 and 37 ug/m^3 over the 24-hour period. Contributions to pollution levels on North Lantau from on-airport activities are projected to be well within AQOs in the year 2040 for all receptors except those along the shore of Sha Lo Wan (244 ug/m^3 for "worst case" meteorological conditions).

The results of the terminal area dispersion model indicate that, under "worst case" meteorological conditions, the highest one and 24-hour nitrogen dioxide levels are 175 and 92 ug/m^3, respectively. The highest predicted one and 8-hour carbon monoxide levels in the vicinity of the terminal are 33 and 41 ug/m^3, respectively. Including the combined contributions from aircraft and motor vehicles, these levels are well within the AQOs for these pollutants.

12.1.2 Recommendations and Current Status of Implementation

a) *Airport activities, other than expressway traffic, are projected to have a significant impact in the year 2040, only during "worst case" meteorological conditions (less than 25 percent of the time) on residences along the shore of Sha Lo Wan. It has already been recommended, based on noise impacts, that the residents in this area be relocated and replaced with less sensitive land use. The results of the air quality analysis further supports this recommendation.*

   Relocation of the Sha Lo Wan Citizens is a Government responsibility. To date a formal decision on this issue has not been made by Government.

b) *For the analysis of landside terminal air quality it was assumed that design features, as represented in the current Master Plan, will be implemented. The location of the main terminal complex close to the eastern airport boundary maximises natural ventilation benefits of land-sea breezes, and the segregated airside/landside main terminal complex configuration reduces co-mixing of aircraft and motor vehicle emissions. These air quality enhancing features should be incorporated into the final*

design, or a revised air quality assessment should be made to assure that compliance with the AQOs can be achieved without them.

All of these mitigation measures have been implemented.

12.2 Review of NAMP-EIA Emissions Inventory

The NAMP-EIA emissions inventory confirmed the two predominant sources of emissions from the new airport to be aircraft (49%) and motor vehicles (43%). The emissions inventory for aircraft was based on the number of operations at runway design capacity. No modifications have been made, since preparation of the NAMP, which increase the airport's design capacity. Additionally, other factors such as operating modes, aircraft types and fleet mix have not changed in a manner that would result in higher emissions from what was assumed in the NAMP-EIA.

In regard to the motor vehicle emission inventory performed for the NAMP-EIA, it was assumed that "reasonable worst case" busy day traffic would consist of approximately 218,000 vehicles travelling to and from the airport. The equivalent currently projected vehicle movement rate, for passenger and commercial traffic, when the runways are operating at its design capacity throughout the day is less than 200,000. At this condition the roads linking the airport island to North Lantau are also operating at their design capacity. It is therefore reasonable to assume that emissions from motor vehicles will not exceed the projections made in the NAMP-EIA.

Since emissions from aircraft and motor vehicles are not anticipated to exceed NAMP-EIA projections, there is currently no basis for preparing a revised emissions inventory.

13.1 NAMP-EIA (1991) Summary and Recommendations

13.1.1 Summary of Impacts

WAHMO modelling of sediment transport, deposition and erosion was carried out to simulate existing conditions and those following airport reclamation. The sediment transport model was used to simulate sedimentation processes for both tidal currents alone and under the action of tidal currents and wave disturbance.

It was concluded that the impact of the airport would be limited to within 3 km of the reclamation. The main effects predicated were low net deposition in shallow areas to the west of the reclamation and net erosion at the north-east corner of the reclamation, caused by local acceleration in flows. The bed levels to the west of the reclamation are considered likely to remain in a state of dynamic equilibrium, maintained by long term steady deposition of sediments and periodic erosion by wave action during storm conditions.

On the basis of the current land use plans, the main sources of foul sewage at the new airport will be the airside terminal complex, aircraft catering operations, aircraft discharges, aircraft maintenance and washing operations, vehicle maintenance and washing operations, an airport hotel, airport-related activities such as a business park and cargo village, a refuse transfer station and a fire training facility. Total pollutant loads entering the foul sewage system estimated for the year 2010 are 0.67 tonnes/day biochemical oxygen demand, 1.39 tonnes/day chemical oxygen demand, 0.53 tonnes/day suspended solids and 0.95 tonnes/day total kjeldahl nitrogen. Foul sewage will be pumped to the main treatment works at Siu Ho Wan on North Lantau for treatment and discharge. Effluent from an on-site treatment plant serving the catering facility may be partially reused for irrigation purposes.

Stormwater quality at the new airport is likely to be generally comparable with that of urban runoff containing solids, organic matter, nutrients and micropollutants such as heavy metals and petroleum hydrocarbon residues. However, airport stormwater can be additionally liable to intermittent contamination as a result of oil/fuel spills, fire fighting, chemical spills, pesticide application or the uncontrolled discharge of trade effluents (e.g. workshop/maintenance wastewaters, aircraft washwater). All commercial and industrial trade effluents will require to be licensed under the Water Pollution Control Technical Memorandum of Effluent Standards, once the North Western Water Control Zone is gazetted.

An assessment of the impact of possible pollutant loads from the southern part of the airport reclamation discharged into the sea channel suggested that pollutant concentrations are likely to remain relatively low due to the flushing effect of tidal water movement along the sea channel. However, discharge of stormwater to the sea channel is being minimised due to the potentially sensitive nature of this water body. Only one catchment will drain to the sea channel, while runoff from the fuel farm within this catchment will be discharged to the west of the reclamation.

13.1.2 Recommendations and Current Status of Implementation

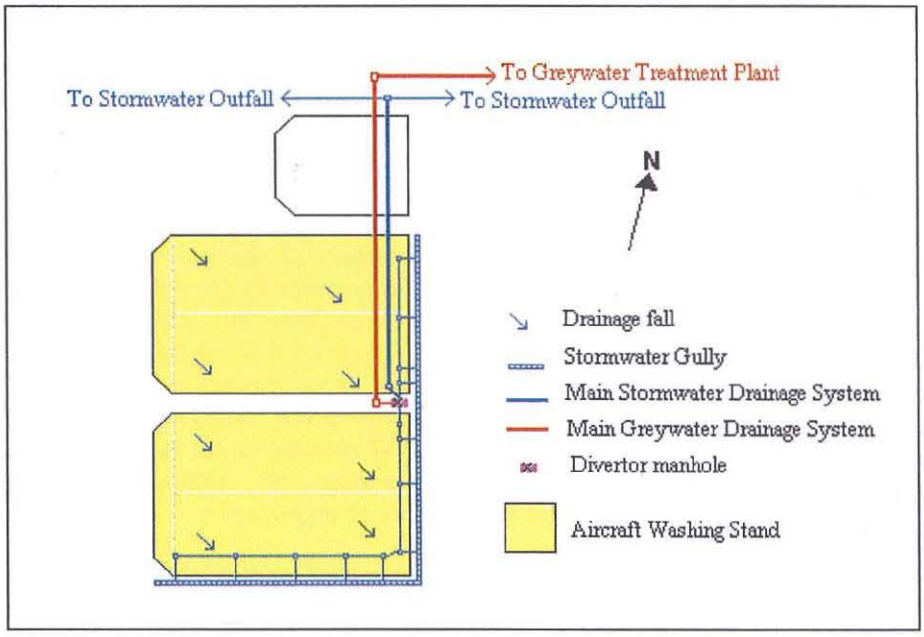
a) *The sea channel, which is a PAA approved feature of the Master Plan, should be retained and protected to ensure that East Tung Chung Bay is properly flushed.*

The sea channel was created and is functioning as anticipated. For additional details see Section 6.1.2.

b) *Dredged navigation channels approaching the west of the reclamation should be broad and shallow in section rather than deep and narrow, since periodic wave action under storm conditions may cause narrow navigation channels to become unusable. PAA should provide dedicated aircraft washing bays with interception and discharge of runoff to foul sewer, and an automatic bypass to the storm sewer system under storm conditions. Tenants may need to consider flow balancing and/or pre-treatment of washwater to comply with the Technical Memorandum on Effluent Standards, or substitution of lighter detergent formulations used at low application rates.*

There are no dredged navigation approaches west of the airport platform.

The Airport Authority has constructed seven dedicated aircraft wash bays. Five of these bays are located on the main ramp around the terminal building while two are located adjacent to the maintenance base (see Exhibit 13.1). The five washbays located around the terminal building are equipped with systems to intercept and divert wash waters to the Authority's Waste Water Treatment Plant. The stands are also equipped with bypass systems to the storm sewer system under storm conditions. Treated water will be used for irrigation during the dry season, while during the wet season it will be discharged to foul sewer.



Aircraft Wash Bays *Exhibit 13.1*

Wash water from the maintenance base wash stands are intercepted and diverted to an underground storage tank. Upon completion of a wash event, effluents will be pumped from the tank and taken to an appropriate treatment facility. During storm events water will be diverted to the storm sewer system. Pursuant to terms included in their lease agreement, all franchisees and tenants are required to complete a detailed Environment Management Plan (EMP) pursuant to generic guidelines presented in Exhibit 13.2. Sections 3 & 4 of the EMP require franchisees and tenants to present diagrams of their facilities and identify all statutory licence requirements. For any vehicle wash facility, franchisees and tenants are required to obtain a WPCO discharge licence from EPD and, when necessary, to treat washwater prior to discharge in order to meet the relevant standards.

Environmental Management Plan Outline

1. **Company Organisation**
   - Company details and Organisation chart (this should include the position responsible for environmental matters)
   - Environmental Policy Statement

2. **Overall Description of the Company's business**
   - CLK Activities (how will it work)

3. **Simplified Design of CLK Facility**
   Locate Environmental Issue Points such as :
   - Sewer discharge and sampling points
   - Sources of emissions (including chemical waste arisings)
   - Effluent generating processes and treatment methods
   - Underground fuel storage tanks

4. **Environmental Licensing Issues**
   For each, summarise Hong Kong regulations and the relevant licenses required.
   - Air
   - Noise
   - Water
   - Waste
   - Dangerous Goods

5. **Environmental Management Strategy**
   - How will you manage your environmental issues at CLK
   - Relate to your organisation's environmental policy
   - Air
   - Noise
   - Water
   - Waste Management and Minimisation
   - Energy Management
   - Pest Control

6. **Environmental Audit Programme**
   - How will the auditing be undertaken
   - How often will the auditing be undertaken
   - Action/Response Plan (i.e., if problems are identified, how will they be corrected)
   - Who will do audits, staff or consultants

7. **Programme for Updating Plan**
   - It's a dynamic regulatory environment and plans will require regular updates

Environmental Management Plan Generic Guidelines *Exhibit 13.2*

c) *PAA should provide or specify in lease conditions centralised vehicle washing facilities, preferably with brush washing and water recycling, to be used by tenants undertaking vehicle washing.*

The Airport Authority has constructed a vehicle wash facility at its Vehicle Examination Centre. The wash facility incorporates a water recycling system and treatment system, prior to discharging to foul sewer.

Vehicle washing facilities are being constructed on the airside and will also be part of the landside petrol filling stations. Franchisees and tenants are required to obtain WPCO licenses from EPD. In certain special cases, the 5 dedicated aircraft wash bays near the terminal building could be used to wash vehicles. Effluent from these stands will be treated by the Authority's Waste Water Treatment Plant.

d) *PAA should develop a standardised spill response for fuel or oil spills, involving the use of vacuum suction or absorbent materials for small spills on non-critical areas and water dispersion and containment in the storm sewer system for large spills on critical areas such as runways. An emergency response plan should be developed for the latter, using a computer programme of the storm sewer system to identify appropriate containment locations.*

Spill response at the airport involves the co-ordination of many different parties with varying levels of responsibility. For small spills on the apron, including the cargo apron, clean-up activities will be the responsibility of the Into-plane Fuelling Franchisee and the line Maintenance Franchisee. In emergency situations, the lead response agency will be the Fire Services Department. Spills entering the marine environment will also involve the Marine Department as well as the Environmental Protection Department.

The majority of spills at an airport are minor in nature. Table 13.1 presents a list of possible causes of spill and assigns the most likely party responsible for cleanup.

Table 13.1 Potential Locations and Causes of Fuel Spills

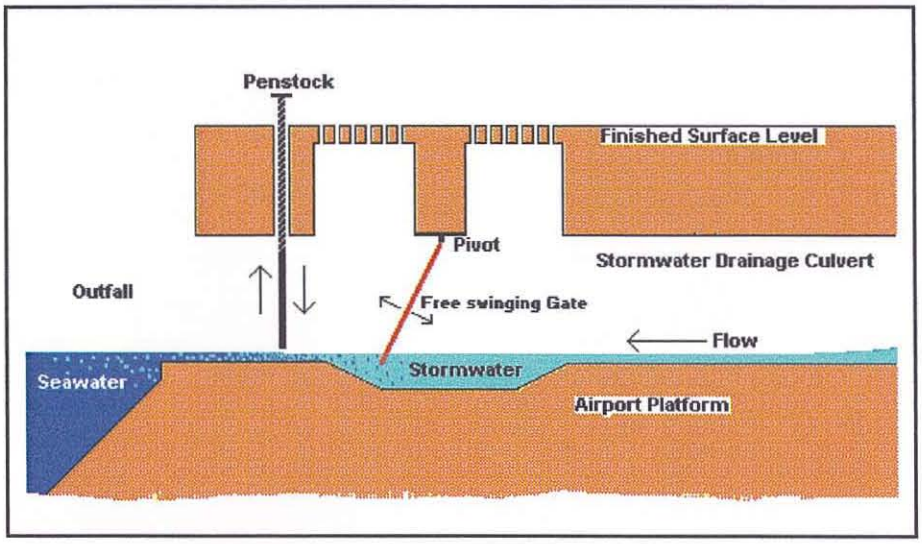
Cause/Location	Party Responsible for Clean-up
Refuelling of aircraft at the Passenger Terminal Building and Air Cargo stands	Into-plane Fuelling Franchisees, with Line Maintenance Franchisees providing first response
Refuelling of aircraft at Government Flying Services	Government Flying Service
Refuelling at Business Aviation Centre	Business Aviation Franchisee
Improper operation of fuel hydrant controls	Into-plane Fuelling Franchisees
Overfilling of fuel storage tanks or break in fuel line	Fuel System Franchisee
Spillage at Petrol Station	Petrol Station Franchisee
Vehicle fuel leaks/venting from parked/taxiing aircraft	Vehicle Owner/For Taxiing Aircraft, Apron Cleaning Contractor
Refuelling of aircraft at main apron	Into-plane Fuelling Franchisees

If a fuel spill should take place and it is not possible to identify the offender, then the Authority will take appropriate clean-up action through the Apron Cleaning Contractor or one of the Line Maintenance Franchisees. The Authority's overall emergency response plan is developed and maintained by its Airport Management Division.

During the development of the detailed design for the stormwater drainage system, a "Spill Trap Containment System" was located at 12 of the 13 airport outfalls (see Exhibit 13.4). Outfall 7 does not have a

spill trap as it was considered it would impede the flow from the Passenger Terminal Building Chiller Plants. This was acceptable to EPD since the drainage area for this outfall does not include any fuelling or fuel storage areas.

A cross section of a typical spill trap is shown at Exhibit 13.3. A moveable penstock can be closed to contain spills and a free swinging gate is included in the design to provide a degree of containment in low flow events.

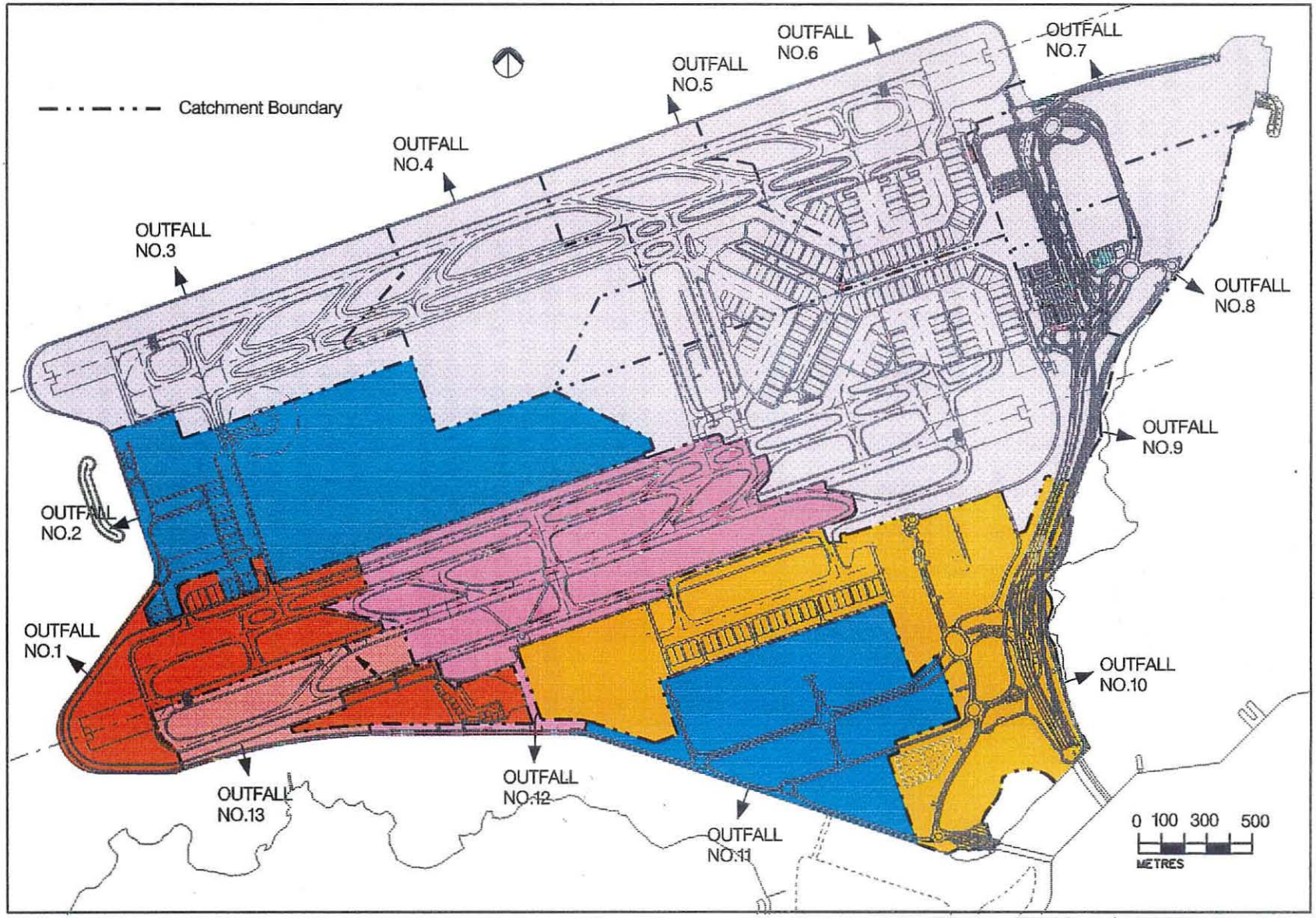


Cross Section of a Typical Spill Trap *Exhibit 13.3*

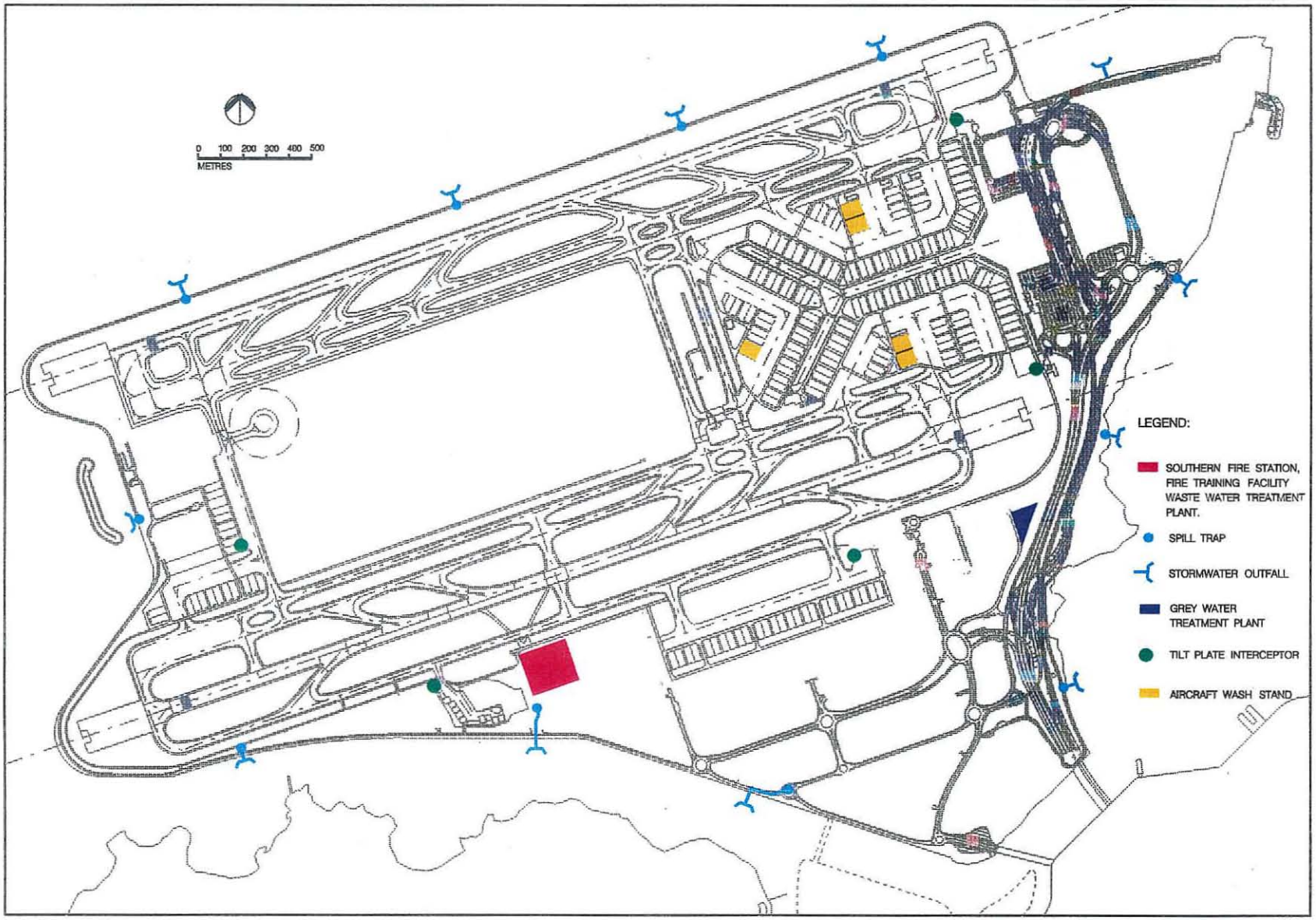
e) *PAA should provide oil interception systems for the removal of oil and fuel from stormwater. These should include tilted plate oil interceptors serving the main apron areas were refuelling occurs, and interceptors at the fire training facility. Requirements for oil interceptors at the fuel farm and bypass interceptors at car parks and vehicle refuelling stations should be specified in lease conditions as appropriate. PAA should maintain oil booms for emergency deployment at the main stormwater outfalls.*

The Authority has installed tilt plate interceptors at the five locations indicated on Exhibit 13.5. This system will serve the main apron areas for the PTB, Air Cargo Centre, Maintenance Base and the Government Flying Service and Business Aviation Centres. All Government tenants and commercial franchisees have been notified of the requirement for interceptors and they have been installed at the Fire Training Centre, Petrol Stations, tank farms and parking lots serving 30 or more cars or being greater than 500m^2 in size. These interceptors will require WPCO licenses from the EPD.

The Authority will maintain oil booms for emergency deployment at the appropriate stormwater outfalls.



Drainage Basins and Outfalls ***Exhibit 13.4***



Location of Tilt Plate Interceptors ***Exhibit 13.5***

f) *PAA should consider a penalty system for fuel and oil spills associated with poor maintenance of aircraft, vehicles and refuelling systems. Detailed records of all spills should be kept for auditing purposes.*

The Authority will hold liable any tenant or other party responsible for a spill. The Authority's Airport Management Division will maintain a log of all spills for auditing purposes.

g) *PAA should ensure regular and effective maintenance of storm drains and oil interception and removal installations. PAA environmental staff should be given a mandate to monitor the maintenance operations.*

Maintenance of storm drains and oil interceptors will be provided by the Authority's Maintenance Department. The Authority's Environmental Group will audit these activities as part of its operational environmental monitoring and audit programme. In addition, Government and private tenants will be responsible for maintaining their own oil interceptors and are required to conduct regular audits on these systems as part of their own EM&A and EPD license compliance programmes.

h) *PAA should maintain a centralised inventory of chemicals and review new chemicals before adoption. An operations manual should be developed by PAA environmental staff detailing good practice procedures for the storage, handling and use of chemicals, and clean-up strategies for chemical spills, once land use and design details have been finalised. Tenants should be required through lease conditions to adopts these good practice procedures.*

The Authority will maintain a centralised inventory of chemicals, and ensure that any new chemical used within the Authority's premises is reviewed before approval. All employees handling, storing or using chemicals will be trained in the proper handling of these materials, and in proper clean-up techniques. Tenants, pursuant to their lease conditions, are responsible for the proper management of their chemicals in accordance with the relevant regulations.

i) *PAA should highlight the requirements for monitoring licensed trade effluents in lease conditions, and should undertake monitoring of stormwater quality including discharges from oil interception systems and the main stormwater outfalls. Monitoring data for both foul and stormwater discharges should be audited on a regular basis by PAA environmental staff to check compliance with standards and the need for improved pollution control measures.*

Pursuant to the terms of their lease agreements, all franchisees and tenants are required to complete an EMP. These EMPs identify a given tenant's statutory licence responsibilities and associated environmental management strategy. Where licences are required, it is the responsibility of the tenant to obtain these licences and to comply with licence conditions (including monitoring). As part of their EMPs, airport tenants are also required to conduct regular audits of environmental compliance.

13.2 Aviation Fuel Receiving Facility EIA (1995) Summary and Recommendations

13.2.1 Summary of Impacts

No polluted discharges into the marine waters from this facility should be permitted and no solid nor liquid wastes should be allowed to enter marine

waters at this facility. Other activities such as fuel vessel operation and movements and maintenance dredging (during subsequent back-up and emergency use) will not cause any unacceptable impacts on water quality, provided mitigation measures, including the use of dedicated fuel shuttle vessels, operational controls over vessel movements and low impact maintenance dredging techniques are implemented where practicable.

13.2.2 Recommendations and Current Status of Implementation

Table 13.2 provides the recommended mitigation measures contained in the AFRF EIA. The table identifies the responsible party for the implementation of the recommendation and its current status.

Table 13.2 AFRF EIA Recommended Mitigation Measures

EIA Reference	Recommended Mitigation Measure	Responsibility	Implementation Status
Operational Impacts on Water Quality and Water Movements Impacts			
Sec. 5.1.5 p. 107-108	*Solid and liquid wastes should be handled, stored and disposed of in accordance with waste management practices defined by the tenderer and EPD regulations and requirements.*	Franchisee	All sewage wastes will be drained to a waste storage tank. The contents of the tank will be pumped out as required and taken off site for treatment and disposal by a licensed sewage waste contractor. Solid wastes will be separated into paper, glass, metal, plastics and other (e.g. food scraps) and transported at least daily to Chek Lap Kok where the contents of the bags are sorted into waste bins. The waste bins will be cleared regularly for disposal to landfill. All chemical waste will be collected transported and disposed of in accordance with the relevant Regulations by a waste management contractor licensed for such a purpose.
Sec. 5.1.5 p. 108	*Discharge of oil from vessels into the sea is forbidden and dedicated vessels should contain solid and liquid waste storage tank facilities.*	Vessel Supplier	Discharge of bilge water and oily waste will not be permitted at the AFRF. All bilge water is required to be taken to the Chemical Waste Treatment Centre (CWTC) at Tsing Yi. Receipts for all bilge wastes disposed of by the AFRF boat crew will be retained by the coxswains and audited on a regular basis by the Airport Authority to ensure compliance with the Regulation.
Sec. 5.1.5 p. 108	*Dedicated fuel shuttle vessels are to be used at the facility. These should be single propeller vessels with a "Schilling" rudder and bow thrusters.*	Vessel Supplier	Highly manoeuvrable vessels will be employed through Supplier Agreement.
Sec. 5.1.5 p. 108	*Restrictions on vessel speed to be imposed on the approach to the facility.*	Franchisee	The vessel operators will comply with the speed restrictions as per the Supplier Agreement, subject to Marine Department approval.
Sec. 5.1.5 p.108	*Low impact dredging techniques recommended for maintenance dredging activity.*	Franchisee	Franchisees' responsibility. As recommended in the EIA, closed clam shell dredgers will be used for all future dredging.
Sec. 5.1.5	*The Tenderer's detailed design should identify rapid, non-toxic spill response technologies to be implemented on the facility.*	Franchisee	Franchisees' responsibility, to be implemented through the Operations Manual.
Sec. 5.3.4 p. 116	*The recommended waste disposal requirements for the AFRF should be incorporated into the Comprehensive Environmental Management Plan to be developed for the entire new airport operation.*	AA/ Franchisee	The Franchisee has developed an Environmental Management Plan for the AFRF.

13.3 Monitoring and Audit Programme

Statutory monitoring requirements for licensed discharges are specified in individual licenses issued by the EPD. Non-statutory monitoring is largely related to stormwater runoff and potential declines in Sea Channel and regional water quality. Discussions are now in progress between the AA and EPD concerning the future monitoring programme.

14.1 NAMP-EIA (1991) Summary and Recommendations

14.1.1 Summary of Impacts

Impacts on marine flora and fauna could arise as a result of the discharge of foul sewage or contaminated stormwater runoff. Foul sewage from the airport and related developments will be pumped to the treatment works at Siu Ho Wan and treated prior to discharge through a long outfall terminating near The Brothers. Impacts arising from this discharge have been considered under the North Lantau Development Study.

Potential sources of stormwater contamination include, inter alia, oil and fuel spillages, chemical spillages, uncontrolled discharges from aircraft and vehicle maintenance and washing, and runoff from aprons, runways and taxiways. Polluted runoff may cause short term effects such as intermittent decreases in dissolved oxygen due to heavy loading of organic matter during storm conditions, or longer term chronic effects from gradual bioaccumulation in marine organisms of micropollutants such as heavy metals or chlorinated hydrocarbons. Persistent accumulation of organic matter and toxic pollutants, if permitted, could cause an adverse effect on marine community structure and composition; in the "worst case" replacing a highly diverse faunal community with large numbers of pollution tolerant organisms such as polychaetes, or microbial communities able to live in toxic and anoxic conditions.

14.1.2 Recommendations and Current Status of Implementation

a) *Mitigation measures as recommended in section 13.1.2 should be adopted in order to minimise stormwater contamination. Stormwater drainage from potentially contaminated areas should be discharged to dispersive receiving waters, wherever practicable, as opposed to sheltered areas such as the sea channel.*

Mitigation measures recommended in section 13.1.2 have been implemented. Wherever practical, stormwater drainage from potentially contaminated areas (i.e. aircraft aprons, fuel tank farm) have been discharged to dispersive receiving waters as opposed to sheltered areas such as the sea channel.

b) *Monitoring of sublittoral communities as recommended for the construction phase, i.e. by carrying out bi-annual benthic surveys for six years after completion, should also be used to determine operational impacts. Monitoring should be extended to intertidal sites on North Lantau and control sites remote from the airport at Tai O and South Lantau, measuring changes in representative species such as oysters and barnacles on shore transacts, to determine impacts on littoral communities.*

Per agreements between the AFD and AA, the proposed monitoring programme has been modified to support AFD fisheries conservation efforts for North Lantau waters. The AFD has proposed to construct a number of artificial reefs within the Marine Exclusion Zone (MEZ) surrounding the New Airport. The MEZ will be off limits to marine traffic, including fishing vessels, to ensure proper safeguard limits for approaching and departing aircraft. As a result, it is anticipated that the proposed reefs will offer a protected habitat area for a variety of commercial and ecologically important species. Following agreement to establish artificial reefs in the MEZ, the AA will transfer the approved

benthic survey funds to the AFD for the provision of a reef monitoring programme.

14.2 Aviation Fuel Receiving Facility EIA (1995) Summary and Recommendations

14.2.1 Summary of Impacts

In normal operation, it is anticipated that the AFRF facility will have minimal impact on the marine ecology around Sha Chau, however, the following operational AFRF activities were identified as having the potential to impact *Sousa chinensis*:

- vessel operation and movements
- fuel spillage
- solid and liquid waste generation
- maintenance dredging
- background activities

14.2.2 Recommendations and Current Status of Implementation

Table 14.1 provides the recommended mitigation measures contained in the AFRF. The table identifies the responsible party for the implementation of the recommendation and its current status.

Table 14.1 AFRF EIA Recommended Mitigation Measures

EIA Reference	Recommended Mitigation Measure	Responsibility	Implementation Status
Operational Impacts on Marine Ecology			
Sec. 5.4.3 p. 123	*Further ecological studies as detailed.*	Franchisee	Section 5.4.3 of the EIA cross refers to ecological studies carried out as part of the design and construction process. These have been completed with a final report issued to AFD in April 1996. No further ecological studies are required.
Sec. 5.4.3 p. 123	*Operational phase solid and liquid waste generation control measures.*	Franchisee	An Environmental Management Plan outlining waste management practices for the AFRF has been completed.
Sec. 5.4.3 p. 123	*The use of larger dedicated fuel vessels is preferable to minimise the number of daily trips and hence minimise sediment resuspension, noise and physical harm potential.*	Vessel Supplier	This will be taken into account in the selection of the vessel by the Supplier. The size of vessel will range between 3,000 and 6,000 dwt.
Sec. 5.4.3 p. 124	*Vessel crew training to minimise impact on dolphins.*	Franchisee	Franchisee will include crew training within the Operations Manual.
Operational Stage Dolphin Monitoring			
Sec. 7.6 p. 184	*The Indo-Pacific Humpbacked Dolphin monitoring programme should be continued during the operation of the AFRF at a tentative frequency of every six months.*	Franchisee	It is the Franchisees' responsibility to conduct dolphin monitoring, during the operational stage, as outlined in the EIA.

As discussed in Section 7, a key issue identified during the EIA process for the AFRF was the potential impacts on local populations of the Indo-Pacific Humpbacked Dolphins. As discussed in Section 7, a report undertaken for the Authority by internationally renowned cetacean expert, Dr Bernd Würsig came to a number of key conclusions which covered both the construction and

operation phases of the AFRF. Table 7.2 in Section 7 presents his mitigation recommendations and their implementation status in full.

15.1 NAMP-EIA (1991) Summary and Recommendations

15.1.1 Summary of Impacts

Operational impacts on the terrestrial ecology of Chek Lap Kok will not arise, since almost all of the flora and fauna will have been destroyed during the construction phase. No significant off-site operational impacts are envisaged. The only section of the island remaining will be the southern-most headland, which has been designated as an open space reserve. Although having some open secondary woodland on its northern slopes, the majority of the headland is covered in grassland and low scrub, with patches of bare soil on the steep slopes and the hill top. The area has been extensively burned over the last year, although burned areas are now beginning to be recolonised. The headland on its own is too small and dry to support any natural vegetation of conservation value.

15.1.2 Recommendations and Current Status of Implementation

The natural character of the southern headland should be preserved through the replanting of indigenous plant species. This should include the establishment of scrubland and woodland species and the retention of selective areas of open grassland.

Additional planting will be undertaken on the headland with native or naturalised trees, shrubs and ground cover, provided as infill to the existing areas of vegetation. The headland will not be irrigated, due to the difficulties in establishing an automated system within the existing vegetation, and therefore species to be planted have been chosen, in part, for their drought tolerance.

A chinese style pavilion has been constructed on the summit of the headland providing a viewpoint of the New Airport. An information board identifies principal features.

The area around the Ha Law Wan kilns will be partially cleared and replanted. A viewing platform will be constructed with information boards for visitors.

16.1 NAMP-EIA (1991) Summary and Recommendations

16.1.1 Summary of Impacts

Waste arisings from the new airport are predicted to be approximately 280 tonnes/day in 2010 and 500 tonnes/day in 2040. Of this, 63-76 percent will be generated from the airside areas, 18-31 percent from the landside areas and 6 percent from the airport related areas. Waste types will include domestic waste from the terminal and from aircraft, commercial waste from the administrative, catering and hotel facilities and from the airport related areas, industrial waste from the maintenance and cargo areas, putrescible waste from the catering operations and miscellaneous waste from customs and quarantine facilities.

In a 1994 waste management study, conducted on behalf of the Authority, waste estimates were revised. It is now estimated that approximately 383 tonnes/day will be generated in 2010 and 946 tonnes/day in 2040. This includes 32 and 40 tonnes/day of greywater treatment plant sludge in 2010 and 2040 respectively. Of this, the percentage generated from airside areas is estimated at approximately 12%; while landside areas are 58 - 66% with the airport related activities consisting of the remaining 14 - 22%.

The preferred disposal strategy is for wastes to be collected and compacted at a Refuse Transfer Station (RTS) on the airside/landside boundary. Containerised waste will then be transferred to the North Lantau Development RTS at Siu Ho Wan for disposal by barge to the Western New Territories (WENT) landfill. This will require a degree of compatibility between container types used at the two transfer stations.

Potential environmental impacts from solid waste handling and disposal include dust, odour, noise and leachate generation. Noise is not considered to be a major issue as current land use plans show no sensitive receptors in the vicinity. Enclosure of operations and restrictions on sound power levels of plants for health and safety reasons will result in acceptable noise levels outside the RTS.

As agreed with Government, no RTS was constructed at the New Airport. All suitable waste will be taken to the North Lantau Refuse Transfer Station for processing prior to onward transfer by barge to the WENT landfill.

Daily airport operations will involve a limited variety of hazardous materials, chemical wastes and Dangerous Goods. Without proper management, storage and treatment, these materials can pose both potential health and environmental risks. Based on the new airport Master Plan, existing conditions at Kai Tak, and what is known about hazardous materials at other major airports, the primary areas where these materials will occur are as follows :

- *Aircraft Maintenance Facilities*
- *Fuel Storage and Transfer Facilities*
- *Ground Support Equipment Maintenance Facilities*
- *Air Cargo Storage Areas*
- *Fire Training Facility*
- *Airport Maintenance Facilities*
- *Isolation Pad*
- *Utilities*
- *Roadways and Aprons*

Routine maintenance of aircraft airframes, engines and components will give rise to waste fuel, used oil, and other petroleum-based solvents. Other

services involving metal stripping, cleaning and plating generate waste materials containing acids, alkalis, cyanides, chromium, lead and other metals. Painting operations create paint waste and spent solvents. These materials will be collected and either reused on-site or transported off-site for recycling or disposal.

The on-site storage of hazardous materials and chemical wastes will only be permitted in specially designated areas. The design and use of these areas will incorporate secondary containment, air ventilation and a wide range of requirements for the labelling, construction and contents of storage vessels.

Fuel storage and transfer facilities will contain jet A-1, avgas, petrol and diesel. Most of the fuel will be stored in two fuel farms located at the south side support area and will be distributed through underground pipelines and hydrant systems. Close supervision and record keeping; secondary containment of tanks, pipes and hydrants; and strict design and performance specifications will help prevent leaks and spills.

One fuel tank farm has been constructed at the New Airport, adjacent to the southern headland. A further site to the west has been safeguarded for expansion of the tank farm if required.

All aviation fuel tanks have been provided with secondary containment. In addition, all parking bays for fuel bowsers at the into-plane fuellers area are bunded. Aviation fuel pipes, pipelines and hydrants, except in bunded areas, have not been provided with secondary containment. However, they will be subject to on-going leak detection by the Fuel Supply Franchisee's leak detection system during their operational life. All fuel pipes, pipelines and hydrants have been subject to pressure testing and, where underground, have been subject to 100% radiography of the welds to ensure a complete seal.

Similar to aircraft, the servicing and maintenance of aircraft ground support equipment will also involve used oil and other petroleum products which will be reused or transported off-site for disposal.

A very small portion of the air cargo that passes through the airport will be classifiable as hazardous or Dangerous Goods. The proper labelling, packaging, handling and storage of these materials will minimise their potential risk.

At the fire training facility, the fuel/water firefighting foam mixture will be drained from the burn pit after each drill, treated in a fuel/water separator and stored on site for reuse.

Firefighting wastewater containing foam will be drained to a wastewater treatment facility adjacent to the fire training pit, for treatment to required standards, before discharge to the foul sewer. Firefighting wastewater not containing foam will pass through an oil/water interceptor prior to discharge to storm sewers.

The airport maintenance facility will contain stores of herbicides, insecticides, fertilisers, paint and other similar materials. Again, proper labelling, application and disposal will minimise their potential environmental impact.

PCB-containing electrical transformers are being phased out and will not likely be use at the new airport. Fluorescent light tubes will be segregated from the solid waste stream for proper disposal. Chlorofluorocarbons used in air conditioners and halons in fire extinguishers will be limited only to essential uses.

No PCBs are present within the New Airport's transformers. Fluorescent light tubes are not classed as a chemical waste in Hong Kong, however all light tubes will be disposed of in the appropriate manner. Halon fire extinguishers will not be used at the New Airport.

On the airport site, vehicles carrying hazardous loads will be restricted to perimeter roadways and will not be permitted in tunnels. The isolation pad will be used to segregate aircraft carrying hazardous cargo from the rest of the airport.

Vehicles carrying Category 1 Dangerous Goods are prohibited from using the airport tunnels. Vehicles carrying Category 2 and Category 5 Dangerous Goods may only do so, if the goods they are carrying are below the Airport Authority's specified quantities. Conveyance of goods in excess of the specified quantities is prohibited.

Wherever possible, the use of hazardous materials or Dangerous goods will be eliminated. If substitutes are not available, waste minimisation and recycling policies will be implemented. To the extent necessary, chemical wastes can be transported to the Chemical Waste Treatment Facility at Tsing Yi for disposal by licensed contractors.

The use of hazardous materials or dangerous goods will be minimised where possible. Waste minimisation and recycling policies for hazardous/chemical wastes will be undertaken where feasible. All suitable chemical wastes will be taken to the Chemical Waste Treatment Centre for treatment and disposal by licensed chemical waste contractors.

As a precautionary measure, the stormwater drainage system is designed with safeguards that will help isolate potential pollutants and prevent them from being discharged to surface waters. Air emissions that are hazardous, toxic or corrosive will be captured and recovered wherever possible using the best available control technology. Air stripping, carbon absorption and dilution air will also be used to reduce ground level concentrations to acceptable levels.

The devices to safeguard the stormwater drainage system from pollutants are detailed in Section 13.1.2. Filters and vapour recovery will be used in areas (e.g. paint spraying and petrol filling stations) where potentially polluting air emissions may be generated. Ground level concentrations of air emissions will be maintained at acceptable levels.

16.1.2 Recommendations and Current Status of Implementation

a) *Dust and odour emissions should be controlled by total enclosure of the tipping, compaction and containerisation operations within the RTS building, and installation of scrubbers and filters on the ventilation systems. Odour from refuse collection vehicles should be minimised by vehicle washing after each delivery to the RTS.*

   As agreed with Government, no RTS was constructed at the New Airport. All suitable waste will be taken to the North Lantau Refuse Transfer Station (NLRTS) for processing prior to transfer by barge to the WENT Landfill. All vehicles delivering waste must pass through a vehicle wash facility prior to their departure from the NLRTS.

b) *A wastewater treatment plant should be installed to treat leachate and washdown water at the RTS. Liquors should be treated by a fill and draw or batch reactor system to comply with the appropriate limits in*

the Technical Memorandum on Effluent Standards and the treated effluent discharged to foul sewer.

Leachate from compactor stations owned by the Airport Authority will be treated at the on-airport Waste Water Treatment Plant. Franchisees and tenants of the Airport (other than these located in the Passenger Terminal Building) are responsible for ensuring that any discharge from their compactor stations is in compliance with *Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters*.

c) *Reciprocal arrangements between the Provisional Airport Authority and EPD should be established to ensure that compatibility issues are fully addressed at feasibility, outline design, financial assessment and detailed design stages of the airport and North Lantau transfer stations.*

These issues have been fully addressed.

d) *Waste recovery, recycling and minimisation technologies should become standard operating procedures adopted by both airport staff and all airport tenants. Airport facilities should be required to designate areas within the facilities where hazardous materials, chemical wastes and Dangerous Goods are to be stored. These storage facilities should incorporate fail-safe provisions for the containment of spills and other accidental releases. All involved employees should be trained in the proper waste and chemical handling procedures.*

Waste recovery recycling and minimisation are an important part of the airport's overall waste management strategy. It is the Airport Authority's intention to implement a waste recycling scheme in the Passenger Terminal Building within twelve months of airport opening. Other airport users, such as Franchisees, are required to produce environmental management plans, that include a review of practicable waste management practices including waste minimisation and recycling opportunities.

All hazardous materials, chemical wastes and dangerous goods will be stored in accordance with the relevant regulations and all employees will be trained in the proper handling of these materials.

e) *When the Waste Disposal Ordinance Chemical Waste Regulations are adopted, the off-site transport and disposal of hazardous and chemical wastes will have to be carried out by qualified and licensed contractors. A manifest system for tracking the waste materials from arising to final deposition "cradle to grave" should also be adopted.*

The Waste Disposal (Chemical Waste) (General) Regulation was enacted in 1992. All chemical waste collected, transported and disposed from the New Airport, will be done in accordance with the relevant Regulations, by waste management contractors licensed for such purposes.

f) *Secondary containment of fuel tanks, distribution mains and hydrants will help prevent discharges to the environment, storm sewer or foul sewer. Should accidental releases occur, a spill containment plan must be enacted immediately by the responsible party in co-operation with the PAA, Fire services Department and the Marine Department, as necessary.*

All aviation fuel tanks have been provided with secondary containment.

Aviation fuel pipes, pipelines and hydrants, except in bunded areas, have not been provided with secondary containment. However, they will be subject to on-going leak detection by the AFSC's leak detection system, during their operational life.

A spill response plan will be enacted immediately by the responsible party if a spill occurs. Spill response at the airport involves co-ordination of many different parties, with varying levels of responsibility. In emergency response situations, the lead response agency will be the Fire Services Department. However, for fuel spills at the main tank farm, the AFSC will be responsible for spill clean-up and reporting to FSD. Spills entering the marine environment will also involve the Marine Department as well as the Environmental Protection Department. Smaller spills will be the responsibility of different parties, such as the line maintenance franchisees, the into-plane fuel franchisee, or the Aviation Fuel System franchisee.

g) *A centralised recording system, established to maintain a current inventory of the types, quantities and locations of hazardous materials and chemical wastes on the airport site, should be adopted by the airport fire services and environmental units.*

All movements of chemical waste will be monitored, using a trip ticket system, ensuring 'cradle to grave' control. Copies of the waste producer's trip ticket will be provided to the Airport Authority's Environmental Group for incorporation into a database.

h) *PAA should conduct regular surveys to determine if any changes occur in the sources, characteristics and volumes of hazardous materials and chemical wastes. These surveys should also include inspections of facility records, storage facilities, containment structures and disposal practices. The aim is to assist the airport and its tenants in establishing a basis for additional corrective actions, if necessary, including recycling, waste minimising or elimination.*

The Airport Authority's Environmental Group will conduct regular audits of both facilities and records of all franchisees/tenants, to ensure good environmental practice and compliance with relevant regulations.

16.2 Aviation Fuel Receiving Facility EIA (1995) Summary and Recommendations

16.2.1 Summary of Impacts

During the temporary operation of the AFRF, the following solid and liquid waste arisings may be generated:

- *sewage effluents;*
- *domestic waste;*
- *chemical waste;*
- *commercial/industrial waste;*
- *office waste;*
- *waste generated on board vessels associated with the AFRF;*
- *foam and fuel spill remediation chemicals; and*
- *dredged sediments from maintenance dredging.*

The above solid and liquid waste arisings at the AFRF have the potential to cause unacceptable water quality impacts and may therefore result in

detrimental effects on marine biota. These sources of waste will thus require appropriate methods of removal from the AFRF in order to prevent the potential for adverse water quality impacts and associated adverse impacts on marine fauna and flora.

a) Sewage

It is presently considered that approximately 17 persons will be located on the facility at any time with the equivalent of a total of around 35 persons employed on daily shift work (morning, afternoon or night shifts) or in residence on the AFRF. This staffing level will generate around 2,000 litres of sewage and wastewater per day. The SER would be serviced by chemical toilets and all effluent produced would be collected and disposed off-site in accordance with EPD requirements.

b) Domestic Waste

The estimated daily total of 35 persons will also generate a total of approximately 50 kg/day of domestic waste, based on 1.4 kg/person/key per head. This type of waste would normally be contained in plastic bags, except for items such as broken fluorescent lighting strips or clinical waste which may require special measures. In addition, further wastes of a similar domestic nature would arise from the canteen and cleaning service.

c) Chemical Waste

Chemical wastes will arise from the drips and small spills collected from coupling and uncoupling of the unloading arms to and from the fuel vessel manifold. The aviation fuel would be directed through an oil interceptor to remove water (for example rainwater) before draining to a slops tank containing all intercepted oil from other sources, such as the workshop area.

Other typical chemical wastes likely to arise include used lubricating oil, spent acid/alkali from batteries, spent mineral oil, paint, solvents and cleaning agents etc used in routine maintenance activities, and other wastes such as spent filter cartridges containing heavy metals and scrap battery casings.

It is difficult to quantify the amount of chemical waste which will arise from AFRF maintenance activities since this will be highly dependent on the facility maintenance requirements.

d) Commercial/Industrial Wastes

The workshop and stores will generate waste such as packaging, metal swarf, spent filters, irreparable and replaceable components and gaskets.

e) Office Wastes

Waste generated from office activities will comprise mainly paper, plastic, consumable components and cans.

f) *Waste Generated on Board Vessels Associated with the AFRF*

Oily waste generated from aviation fuel vessel stripping and deballasting operations will be classified as MARPOL waste. These oily mixtures may include:

- *dirty ballast water;*
- *tank washings;*
- *oil bilge wastes; and*
- *oily residues and liquid and solid sludges.*

It is difficult to estimate the volume of these "MARPOL waste" arisings as it will vary with the size and type of the vessels. Stripping or deballasting will not be required for every trip and will be carried out only as necessary. In general, such stripping and deballasting "MARPOL waste" arising will be in the region of 100 to 200 tonnes per vessel per occasion, depending on the vessel size.

The fuel delivery vessels and transport workboats will need to discharge their bilge water. However, this will not be permitted at the AFRF but will be accommodated by discharge into appropriate bilge water reception tanks at a suitable off-facility location. No removal directly from the AFRF will be required.

g) *Foam and Fuel Spill Remediation Chemicals*

Should it be found to be appropriate to allow the storage of foam for fire fighting and chemicals for aviation fuel spill remediation against the relatively rare occasions that they would be deployed, then the waste resulting from their use would, of necessity, spread over the water surface. No waste removal would be required.

h) *Dredged sediments from maintenance dredging*

Maintenance dredging would only be required intermittently during subsequent back up and emergency use, to remove sediments settled within the turning basin and access fairway. Potential impacts include sediment resuspension and associated direct and indirect impacts on marine fauna and flora.

16.2.2 Recommendations and Current Status of Implementation

All wastes should be handled, stored and disposed of in accordance with good practice, and EPD regulations and requirements. The recommended disposal requirements for the AFRF should be incorporated into the comprehensive Environmental Management Plan to be developed for the entire new airport operation. It is anticipated that those wastes that need to be removed from the AFRF will be removed at regular intervals (to be determined at a later stage) by the following means (using either a specialised hired service vessel or via the fuel shuttle vessel).

The franchisee has developed an Environmental Management Plan for this facility.

a) *Sewage*

Pumped from temporary storage tank to transit tank on the vessel.

All sewage wastes arising from staff toilets and amenities will be drained to a waste storage tank. The contents of the tank will be pumped out as required and taken off site for treatment and disposal by a licensed sewage waste contractor. The level of the tank will be monitored daily so that more frequent clearance of the tank can be arranged if required.

b) *Domestic and Office Wastes*

By hand or compacted and bound into packs and hoisted aboard the vessel. Putrescible wastes should not be stored on board for longer than 48 hours and may require a chiller room for storage.

Domestic waste will be sorted by placing paper, glass, metal, plastics and other (e.g. food scraps) into separate heavy duty plastic bags for transport, at least once a day, to Chek Lap Kok.

c) *Chemical Waste (Paint, Solvents)*

Enclosed in sealed reusable acid resistant containers. The Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes issued by EPD shall be followed. These wastes should be sent to the CWTC. Recycling of chemical wastes should be considered where possible. It may be possible for used lubricating oil to be sent for recycling to the oil recovery plant in Yuen Long should this be operational.

Other chemical wastes, such as spent filter cartridges containing heavy metals and scrap battery casings, which are not acceptable for treatment and disposal at the CWTC can be disposed of by licensed chemical waste collector at a designated landfill approved for chemical waste.

Liquid chemical waste will be collected in suitable chemical resistant drums and containers, clearly and properly labelled and held in a secure covered bunded area until collection and transport off-site by a licensed chemical waste contractor to the Chemical Waste Treatment Centre at Tsing Yi.

For wastes in solid and bulky form, heavy duty and leak proof plastic bags will be used. The solid wastes will be taken away by a licensed chemical waste Contractor before being disposed of to a designated landfill approved for chemical waste.

d) *Chemical Waste (Oily Water)*

Drip tray/spill collection systems collected via a manfold arrangement and pumped from temporary slops tank to transit tank on the vessel, for off-site disposal at the CWTC.

Recovered oil and sludge will be collected in suitable containers, clearly and properly labelled, and held in a secure covered bunded area for collection and disposal by a licensed chemical waste contractor.

e) *Commercial/Industrial Waste*

Collect for disposal to landfill using separate containers. Certain commercial/industrial wastes such as scrap metals and other suitable waste materials should be reused wherever possible.

Wastes will be separated, as for domestic waste, into paper, glass, plastics, metal and other (e.g. food scraps). These wastes will be transferred in heavy duty plastic bags to Chek Lap Kok where they will be sorted into waste bins. The waste bins will be cleared regularly for disposal to landfill. Recycling and reuse will be employed wherever practicable.

f) *Waste Generated on Board Vessels Associated with the AFRF*

The discharge of bilge water will normally be accomplished by discharge into appropriate bilge water receipt tanks at a suitable off-AFRF site location. No removal of bilge waters directly from the AFRF will be permitted. Under the Merchant Shipping Ordinance, this "MARPOL waste" will have to be treated on board the vessel or sent to the CWTC for appropriate treatment. The discharge of oil from vessels into the sea is forbidden under this Ordinance. The Licensees dedicated fuel shuttle vessels should contain solid and liquid waste storage tank facilities and should not empty or wash out bilges or discharge any solid waste at the AFRF site. The Licensee should arrange collection of this "MARPOL waste" with the CWTC operator where necessary.

Discharge of bilge water and oily waste will not be permitted at the AFRF. All bilge water is required to be discharged into appropriate bilge water reception tanks and taken to the Chemical Waste Treatment Centre (CWTC) at Tsing Yi. Receipts for all bilge wastes disposed of by the AFRF boat crew will be retained by the coxswain and audited on a regular basis by the Airport Authority to ensure compliance with the Regulation.

The vessels bringing fuel to the facility will be responsible for the safe and proper disposal of their MARPOL wastes.

g) *Dredged sediments from maintenance dredging*

Mitigation measures to minimise potential impacts from dredging are detailed in Section 9.3.2.

17.1 NAMP-EIA (1991) Summary and Recommendations

17.1.1 Summary of Impacts

The Chek Lap Kok airport site has an extensive area of visual influence bounded to the south by the Lantau Peak Ranges and to the north by the western New Territory Ranges and developments such as Tuen Mun. The extremities of this broad area contain the most distant views of the island of Chek Lap Kok, whereby it appears as a headland to Lantau Island.

The proposed airport and related developments will incur a significant impact within the zone of visual influence. The scale of development will entail a dramatic change to views throughout North Lantau and the adjacent channel.

The extensive visual impact can be interpreted at varying levels. Selective views of the airport and flight activity throughout the channel area are considered exciting and interesting visually, particularly for passengers and visitors to the airport. Conversely, the airport and related activities may be considered a significant visual intrusion from the elevated vantage points of the surrounding Country Parks.

The most significant visual impact is considered to be within the near views from the villages along North Lantau, and the middle range views from Lantau Country Park.

17.1.2 Recommendations and Current Status of Implementation

The main areas where account can be taken of visual impact is in the design of the buildings and localised screening. The following recommendations should be considered :

a) maintenance of location, colour and building form to provide visual interest to distant views;

Forward views of 'landmark' buildings, such as the Passenger Terminal and Cathay Pacific Headquarters, will be maintained for passengers travelling north along the eastern approach corridor. Similar, views of the Lantau hills and the Headland Preserve will remain prominent for southbound passengers. Views to left and right, travelling along the approach corridor, will reveal glimpses of the operational airport, franchisee buildings and the sea, interspersed with blocks of taller planting.

b) selection of location, colour and building form to provide visual interest to distant views;

The establishment of an Urban Design Steering Committee, to vet the design and colour treatment of all airport buildings and signage, has ensured a consistent design approach by the Authority's consultants and those employed by tenants and licensees.

c) maintenance of visual interest with localised screening of cargo, freight and service areas;

Internal roads will generally have a 5 metre wide band of planting on either side to screen adjacent development. Specifically, the Wastewater Treatment Plant and the Refueller Calibration Area will be screened from the Expressway and the Airport Railway.

d) *construction detailing of seawalls to reduce the apparent rigidity in landform;*

Sloping random stone block walls are used to give a 'naturalised' appearance to the sea edge.

e) *off-site planting by Government within adjacent villages;*

The Authority is funding off-site screening of Outfall No. 11 from San Tau village, at the request of the villagers.

f) *the NLE and rail developers should provide selective screen planting along the road and rail approach routes to screen adjacent development;*

This is a Government and MTRC responsibility.

g) *retaining and planting the open space reserve area as a focal point to the airport entrance;*

The headland has been preserved and will be selectively replanted to increase the variety of vegetation.

h) *development of visual links with the adjacent New Town;*

The high rise buildings in the new town are prominent from most parts of the airport and vice versa.

i) *maintenance of views of the natural surroundings; and*

The mountains of North Lantau dominate the airport platform and can be clearly seen from the south frontage of the Terminal Building. Both the mountains and the sea will remain prominent features for passengers travelling south on the Expressway and the Airport Railway.

j) *ground modelling and screen planting along the airport's southern boundary and entrance roads to screen peripheral areas to adjacent villages on Lantau Island.*

An earth bund, to be planted with trees and shrubs, has been constructed along the southern coastline of the airport to form a partial screen from the villages of North Lantau.

17.2 NAMP-EIA Supplement (1992) Summary and Recommendations

Land use impacts resulting from the modified master plan configuration are similar to impacts assessed in the NAMP-EIA. As a result of the altered configuration, approximately 2.5 kilometres of natural coastline along Chek Lap Kok's eastern shore will now be retained. In addition, a portion of a headland located to the west of Sha Lo Wan will have to be removed to maintain adequate flushing of East Tung Chung Bay and to provide marine access.

The modification to the Master Plan configuration will have both positive and negative aesthetic impacts. As a result of the altered configuration approximately 2.5 kilometres of additional natural coastline along Chek Lap Kok's eastern shore will be retained. This shoreline area will act as a visual buffer of the airport for residents of Tai Po and other communities east of the airport.

The revised configuration will also require the excavation of part of the headland located to the west of Sha Lo Wan. This headland rises sharply from the sea and is a visually attractive topographic feature. The excavation of this headland is required in order to allow for adequate flushing of East Tung Chung Bay and marine access following airport construction. The remaining portion of the headland will be left in a natural and aesthetically pleasing state.

No additional mitigation is recommended other than what is recommended in the NAMP-EIA, as presented above in Section 17.1.2.