

CONSULTING SERVICES BY ENVIRONMENTAL RESOURCES MANAGEMENT

Provisional Airport Authority

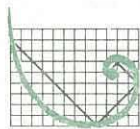
Proposed Aviation Fuel Receiving  
Facility at Sha Chau:  
*Environmental Impact Assessment*

*Volume 2: Annexes*

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Provisional Airport Authority

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For and on behalf of ERM Hong Kong

Approved by:

Position:

Date:

*J. White*  
*TECHNICAL DIRECTOR*  
*19 JANUARY 1995*

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Annex A

EIA Scope and Additional  
Items for Inclusion in the  
Detailed EIA Scope  
Required by ACE

## 1.1

*BACKGROUND TO STUDY*

The PAA propose to supply aviation fuel to Chek Lap Kok Airport by fuel vessels to an Aviation Fuel Receiving Facility, hereafter called the AFRF, located near the Airport and transfer by pipeline to an on-Airport tank farm. This is intended as an interim arrangement for supply of aviation fuel until the construction of the preferred solution, which is a pipeline supply direct from an off-airport source to the On-Airport tank farm. It is anticipated that this interim system should be operational for 5 to 7 years. A number of sites have been identified for the location of a jetty/dolphin for the AFRF but was narrowed down to two sites, namely, at Sha Chau and on the north shore of Chek Lap Kok. An Initial Assessment was carried out for the two potential sites to establish the environmentally preferable site. The Initial Assessment Report concluded that north shore of Chek Lap Kok could not be recommended in view of its proximity to the CMPs and Sha Chau was therefore recommended subject to an EIA.

The proposed AFRF will accommodate a maximum vessel size of 10,000 DWT but normal operations are likely to utilise smaller vessels of between 3,000 and 5,000 DWT. The facilities that will be covered by the EIA are as follows:

- Receiving facility for vessels between 3,000 and 10,000 DWT, comprising:
  - vessel turning circle and vessel access channel
  - Two berths on a fixed dolphin with fenders supported by driven piles
  - Proprietary chiksan unloading arms, metering and sampling facilities
  - Fire fighting systems
  - Spill clean-up facilities
  - Approach arm to receiving facility
  - Pump house/power generation
  - Supply and emergency response (SER) base on approach arm
  - Office/accommodation/laboratory on SER
  - Sub sea pipeline and pig trap



The purpose of the Environmental Impact Assessment (EIA) study is to assist in minimising pollution, environmental disturbance and nuisance arising from the construction, operation and maintenance of the AFRF by providing information on the nature and extent of the potential environmental impacts, recommending practical and cost-effective mitigation measures where appropriate. The objectives and broad scope of the EIA Study will be as outlined in the EPD Study Brief entitled "*Aviation Fuel Supply System to CLK - Airport Environmental Impact Assessment Study Brief*" with emphasis as detailed below. This has been a two-staged EIA study. The initial assessment, which was completed in May 1994, focused on the two potential sites with a view to identifying the environmentally preferable site and confirming that there are no insurmountable residual environmental impacts associated with the preferred site. Results of the initial assessment were presented through an Initial Assessment Report (IAR). This EIA comprises the second stage of the EIA process to study the key issues, associated with the AFRF in concept, identified in the IAR leading to the submission of the EIA Report. Key issues identified in the IAR comprise the following: water quality, noise, Chinese White Dolphins and contaminated mud pits.

The successful Tenderer for any AFRF at Sha Chau will be required to complete further Environmental Studies to confirm both the findings of this study and the environmental acceptability of the successful Tenderer's proposed construction and operation of the AFRF.

### SCOPE OF WORK

The EIA Study will cover the following aspects of potential environmental impacts and related issues arising from the construction, operation and maintenance of the AFRF including the marine access channel and, in particular, the key issues identified during the IAR, described above in *Section 2*.

Aspects associated with Chinese White Dolphins including assessment of the potential scale, extent and severity of impacts arising from the construction and operation of the AFRF on Chinese White Dolphins and the identification of mitigation measures and EM&A requirements to minimise impacts have already been studied. These studies which comprise part of the EIA have been advanced in view of AFRF project timing requirements and are reported in the Chinese White Dolphin Site Selection Study and Impact Assessment Reports and will be included in the EIA Report.

The EIA Study will adopt a cost-effective approach to make use available information collated from previous environmental assessment works associated with the AFRF, New Airport Projects and the North Lantau Development to minimise unnecessary duplication of work.

*Water Quality Impact*

Potential construction stage water quality impacts around Sha Chau will be assessed with regard to the Water Quality Objectives for North Western Water Control Zone. Existing information will be collated (e.g. from the EPD and the PAA's monitoring records) and used as background data for this assessment, including the derivation of potential Trigger, Action and Target levels for the environmental monitoring and audit (EM&A) aspects of the EIA.

Dredging will increase the suspended solid loadings, with the subsequent increase in turbidity, the deposition of sediment remote from its source and the potential for the release of heavy metals and other contaminants.

An appraisal of the potential interference of the AFRF with the existing and future planned CMPs and the potential impediment with the filling and capping programme for the contaminated mud pits will be carried out to investigate the potential impacts and the minimum buffer distance between the proposed pipeline and the future planned CMPs will also be recommended.

The assessment of these impacts will require consideration of sediment quality and dredging factors including:

- background water quality;
- existing sediment patterns and quality;
- the hydrodynamic behaviour of the area;
- amount of sediment likely to be resuspended by dredging;
- dispersion of released sediments;
- physical and chemical composition of released sediment;
- volume of material to be dredged; and
- contaminant release.

The cumulative effect of these factors on the water quality including BOD, organics, nutrients, suspended solids and DO level will be assessed with regard to relevant information from previous studies to confirm the acceptability of the dredging and trenching methods. Practical and cost-effective mitigation measures to minimise construction phase water quality impacts will be developed and recommended where necessary.

In addition, other potential water pollution sources during the construction phase eg. debris and rubbish from packaging and construction materials, sewage effluent from the construction workforce, spillage of oil, diesel and solvent will be assessed.

*Method of Dredging and Pipeline Installation*

There are likely to be several feasible options regarding the types of dredging and trenching activities and pipeline installation involved. Information on the performance and applications of different dredging and pipeline installation methods and types of plant will be collated, and recommendations as to the preferred environmental option will be made

from this information, taking into account the impacts identified in proceeding analyses and the degree of mitigation required.

#### *Waste Management*

Sediment quality data will be reviewed and sediment testing and analysis will be undertaken where required to determine the contamination level of the dredged material. Depending on the quality and heavy metal contamination level of the marine sediment arising from the dredging, suitable locations for disposal will be recommended in line with requirements of both the EPD and the Fill Management Committee (FMC). Assessment of contamination level will be based on the limits specified in the Works Branch Technical Circular No. 22/92 - Marine Disposal of Dredged Mud. Where necessary, the type of transport vessels and the methods for handling the dredged material will be recommended to minimise turbidity and to limit the dispersion of sediment contaminants into the surrounding water columns.

These include sediment sampling and analysis work for 15 locations, i.e. 5 within the AFRF boundary and its turning basin and 10 along the pipe route.

#### *Marine Ecological Impacts*

Dredging activities and pipelaying may have local impacts on the marine ecosystem, including the possible direct loss of communities, which will require assessment. Impacts of this nature are associated mainly with the localized increases in suspended solids associated with this work and the potential release of any heavy metal contaminants.

The increase in suspended solids may adversely affect the free swimming and benthic communities. In order to assess the potential impacts of the dredging work, data concerning local fishing activities, the extent of impact of existing works will be collated from current sources.

Impacts to the Chinese White Dolphin communities known to frequent the waters near Sha Chau and Lung Kwu Chau have been evaluated as part of the EIA and have been reported in the Chinese White Dolphin Site Selection Study and Impacts Assessment reports, described in *Section 3*. These reports will be incorporated into the EIA as necessary.

#### *Noise*

Noise from the dredgers (or the equivalent route preparation and pipe laying vessels) and marine piling will be subject to the regulations set out in the Noise Control Ordinance within restricted hours and subject to the EPD recommended (non statutory) 75dB(A) criterion otherwise. Potential noise sensitive receivers along the Southwestern New Territories, i.e. along the Tuen Mun area, which may be affected by the dredging operations will be identified based on the proposed construction activities/programme and timing and the impacts evaluated in accordance with these statutory and non-statutory criteria. These will include NSRs identified in the IEIA plus Sha Po Kong, Nan Long and Pak Long, where appropriate. With regard to future conditions these will include those identified in the IEIA plus the

River Trade Terminal, where appropriate. Practical and cost-effective mitigation measures will be recommend to minimize any identified noise impacts.

Cumulative noise impact assessment will be performed taking into background and ongoing nearby construction or other activities in the area to confirm the acceptability of the construction method and to refine recommended mitigation measures.

#### *Fung Shui*

A temple and two or three ancestral graves are present on Sha Chau. The EIA will consider the Fung Shui issues associated with the location of the AFRF on Sha Chau and recommendations on the AFRF detailed design will be made to minimise the impacts arising from the Fung Shui issue.

### 1.5

#### *OPERATIONAL PHASE*

##### *Water and Sediment Quality and Water Movement/Commissioning*

Impacts arising from maintenance dredging will be assessed and the assessment will require consideration of similar factors as described in *Section 3.1*.

Testing/cleansing waters for the submarine pipeline will require discharge and appropriate disposal. Disposal options, dependent on the degree of contamination of the waters, will be investigated and feasible disposal options listed. As discharges from stripping and ballasting operations from the ocean vessels will be handled in accordance with current environmental/marine legislation, they will not be further assessed.

The scale, extent and severity of an aviation fuel spill during the commissioning process or operation will be evaluated based on known current velocity and wind data. Spillage control/clean up measures and preliminary procedures will be evaluated and proposed.

##### *Operational Waste Management*

The issue of solid and liquid waste disposal and management from the operational facility will be addressed in detail. MARPOL waste from ocean going vessel will be estimated and the appropriate disposal options recommended.

##### *Operational Ecological Impacts*

Potential direct and indirect marine ecological impacts which may arise from accidental oil spills will be appraised and appropriate mitigation measures will be recommended. Local impacts on the marine ecosystem from oil spills will be assessed. Data on fishing activities in the area will be collated to assess the potential impacts on local fisheries.

## *Operational Noise Impacts*

Noise from the AFRF operation and from associated vessels will be assessed. Potential noise sensitive receivers along the Southwestern New Territories, i.e. along the Tuen Mun area, which may be affected by the facility operation will be identified and the impacts evaluated in accordance with relevant statutory and non-statutory criteria. Practical and cost-effective mitigation measures will be recommend to minimize any identified noise impacts.

### **1.6**      ***MITIGATION MEASURES***

Practical and cost-effective mitigation measures for significant impacts identified during the EIA Study will be proposed to minimise the occurrences and consequences of predicted impacts in terms of management and operational procedures. The recommended mitigation measures will be in a form which can be translated into enforceable contract clauses for incorporation into the future contract documents so that the measures can be effectively implemented.

### **1.7**      ***ENVIRONMENTAL MONITORING AND AUDIT***

Environmental monitoring requirements including any necessary programme for impact and compliance monitoring will be defined. Practical and cost-effective construction phase environmental monitoring and audit (EM&A) requirements necessary to audit the implementation of mitigation recommendations will be developed based on EPD requirements.

In addition, environmental audit requirement including necessary compliance and post-project audit programme will be formulated to review the environmental monitoring data in relation to any regulatory requirements, policies and standards. Compliance auditing mechanisms including Trigger, Action and Target levels, event/ action plans will be developed based on EPD requirements.

### **1.8**      ***RISK ASSESSMENT***

The only content in respect of risk/hazards in the EIA will be a brief evaluation and recommendation of what studies the eventual licensee needs to complete to demonstrate the safe operation of his facility based on works completed as part of the IAR.

### **1.9**      ***OTHER CONSIDERATIONS***

In addition to the above construction and operation assessments, and in specific response to the Planning Departments concerns, the EIA will consider and assess the implications of future "Route Y" which is under consideration in the TDS Review. This route is planned to link Shenzhen West/Zhuhai with Chek Lap Kok and the Planning Department are concerned that it may affect Sha Chau or its vicinity.

Similarly in response to comment from the District Planning Officer/Tuen Mun and Yuen Long, the EIA will consider and assess the implications of



the proposed River Trade Terminal (RTT) adjacent to the Special Industries Area in Tuen Mun Areas 38 and 47.

2

*LIAISON*

The Consultants will liaise as necessary with relevant government departments such as EPD, Agriculture and Fisheries Department, Marine Department and specifically with regard to *Section 3.6* the Planning Department, Port and Airport Development Strategy Section, District Planning Office/Tuen Mun and Yuen Long, PAA and others.

*ADDITIONAL ITEMS FOR INCLUSION IN THE DETAILED EIA SCOPE  
REQUIRED BY THE ACE*

**1**      ***ECOLOGICAL SURVEY***

Following works are to be carried out during the month of October by Prof Rudolf Wu & team of City Poly:

- Diving Survey: around Sha Chau to note underwater fauna ;
- Littoral Zone Survey: of Sha Chau and the sand bar during low tides to provide general description of the littoral community;
- Benthic Grab Survey: around Sha Chau to provide a broad description of dominant species/taxonomic groups (benthic samples will be preserved for additional detailed species identification in future, if necessary);
- Trawl Survey: around Sha Chau to provide a brief description of dominant pelagic/fish fauna in the area; and
- Data Analysis and Report Writing (a copy will be given to PAA).

ERM to QA and integrate into the EIA. The report will include the following; species list, discussion of King Crabs and other endangered/sensitive species (prawn etc) in particular as to their economic & ecological significance, an impact assessment covering both operations and construction of the AFRF.

**2**      ***WATER QUALITY/WATER MOVEMENT MODELLING AND FUEL SPILL  
PREDICTION***

Following works completed by Jim Rodger & team of HWR:

- Likely Impact of AFRF on Sand Bar Stability: Analysis by Coastal Geomorphologist inclusive of attendance of ACE presentation;
- Likely Movement of Fuel Spill: by computer modelling;

- Sediment Plume Modelling of AFRF Constructional; and
- Data Analysis

ERM to integrate analysis into EIA. *See also Appendix A*

3

### **ENVIRONMENTAL RISK**

*Objective:* To assess the likely frequency of spill travel in given directions and risk of impact on sensitive coastlines and advise on acceptability given appropriate spill response capability.

When a spill of aviation fuel does not ignite it poses an environmental risk. The environmental risk from major aviation fuel spills will be measured in terms of the likelihood of a spill reaching a given location and a profile of spill size versus likelihood (taken from the IAR and 1993 Man Wan Risk Analysis).

The assessment will include similar stages to a conventional hazard assessment: hazard identification and frequency estimation; consequence analysis; risk summation and qualitative consideration of mitigation measures. This will link in with the risk to life assessment (below) and spill movement predictions given by HWR.

The outputs of the study will provide an indication of the scale of potential impacts on the Hong Kong shoreline and the scale of the activities likely to be required to clean up spills. Resources will be appropriately focused on the scenarios which are most significant and on providing estimates of the largest credible significant spills which could occur, thus placing an upper limit on the scale of the clean up facilities required.

Specific scenarios to be considered will include spills from:

- Pipeline rupture – pumped release
- Mooring incidents – various spill sizes
- Vessel incidents (collision, grounding, foundering, fire etc) in North Lantau waters

The spill scenarios will cover the likely worst case and be fully explained and justified in the report.

The modelling will provide information of the expected progress of the spill and the extent of coastline that could be affected. *See also Appendix A*

4

***RISK TO LIFE HAZARD ASSESSMENT***

An account will be given of the Ma Wan Studies completed for PAA in 1993 and this will be integrated with the work completed for the IAR such that, an account is given of the risk of the whole operation.

The hazard posed by major aviation fuel spills is the risk of death due to engulfment in or thermal radiation from burning pools of fuel or pool fires.

5

***SCREENING OF 8 SITES NOT IN IAR***

PAA will provide a draft screening analysis for review and incorporation in the EIA by ERM.

6

***CUMULATIVE IMPACTS***

ERM Environmental Input into Cumulative Impact Assessment of Non-PAA Sha Chau Developments and Generic Environmental Assessment in Detailed EIA based on information made available by government.

Annex B

## Site Selection Study



Annex B

## Site Selection Study

# 1 INTRODUCTION

## 1.1 PURPOSE OF THE STUDY

A key environmental concern associated with the facility is the influence of construction and operation on the Chinese White Dolphin (*Sousa chinensis*). This study was conducted in order to provide additional information on the utilization of marine habitat around Sha Chau by *Sousa chinensis*, hereafter referred to as *Sousa*, for use in the gazettal decision-making process. An infinite number of locations around and at various distances off the shore of Sha Chau are possible. Of these, six indicative sites have been selected for illustrative purposes, and are shown in *Figures 4.2b to 4.2g*.

This report comprises a Site Selection Study to assess potential indicative sites for the facility around Sha Chau with regard to impacts on *Sousa*.

An EIA will be undertaken to assess the potential scale, extent and severity of impacts on *Sousa* resulting from construction and operation of the facility at the site advanced for further consideration.

## 1.2 LITERATURE AND FIELD SURVEYS

This Site Selection Study presents the findings of a literature survey and a one-month, field survey designed to describe the presence and habitat utilization of *Sousa* around Sha Chau. These findings can be used to assist in selection of a site for the AFRF from among the six indicative locations. The field survey consisted of daily ship and land-based surveys of *Sousa* conducted over an approximately one-month period around Sha Chau, Lung Kwu Chau, and Pak Chau. Incidental sightings were also recorded in the vicinity of the Brothers Islands, Castle Peak Power Station and northwest waters. In conjunction with this effort, a literature survey on the locational, feeding and breeding preferences of *Sousa* was also conducted. The products of these two surveys provide an indication of which areas are likely to contain preferred habitats for *Sousa*.

## 1.3 ON-GOING CONSULTATION

Consultation with concerned parties has taken place throughout this study. Consultation with dolphin researchers performing a study for the Hong Kong Government Agriculture and Fisheries Department (AFD) on the establishment of survey methodologies and data collection procedures (described in *Section 2*) has occurred with a view to facilitating comparison with AFD study results.

Following this introductory section, this report is organized as follows:

- Section 2 describes the field work methodology;
- Section 3 summarizes the results of the international literature survey;
- Section 4 presents the results and discusses the findings of the field surveys;
- Section 5 discusses other PAA considerations in locating the AFRF; and
- Section 6 summarizes the study conclusions.

## 2

### FIELD WORK METHODOLOGY

#### 2.1

##### INTRODUCTION

Survey vessels generally departed Queens Pier, (Central, Hong Kong Island) between 7:30am and 7:50am. Transit time to the study area required 2.0 – 3 hours depending on prevailing weather conditions and vessel performance. The route to the Sha Chau and Lung Kwu Chau study areas was designed to transit the areas of Castle Peak Power Station and the Brothers Islands, both of which are known areas of *Sousa* habitat. Thus, observation for incidental sightings began once the survey vessel reached Tsing Yi Island and continued until the vessel reached the southeast end of Sha Chau where the vessel would pause for a 30 minute rest period (*Figure 2.1a*).

After the rest period, the survey vessel proceeded at a speed of approximately 10 kn along the transects shown in *Figure 2.1b*. The transects, designed in consultation with the AFD researchers, generally run perpendicular to depth contours to minimise survey bias by maximizing coverage by depth. The transects were designed to provide data on each of the six indicative locations on Sha Chau as well as Lung Kwu Chau and Pak Chau for the purposes of comparison to Sha Chau. During the course of each survey day between 1 and 4 transects were conducted depending on weather conditions and vessel performance. Each transect required 1–1.5 hours to conduct and was followed by a 30 minute rest period. The first and second transects were usually punctuated by a 1–1.25 hour lunch period required by the boat operators. Generally, on arrival at Sha Chau, during the initial rest period, the land-based observation team was dispatched to Sha Chau. Generally, the observers remaining on the vessel numbered two or more, whereas the land-based team was composed of one or more observers. The land-based survey team returned to the survey vessel upon completion of the final transect.

On the return journey, the survey vessel again passed as close as possible to the Brothers Islands and Castle Peak Power Station, subject to boat traffic and

weather conditions, in order to record any incidental dolphin sightings in the vicinity of the islands. Observations ceased once the boat reached the western edge of Tsing Yi Island.

## 2.2

### *VESSEL-BASED OBSERVATIONS*

Transect observations were conducted by dividing the 360 degree view field into equal portions and assigning these portions to members of the survey team. Observation posts were reassigned approximately every 30 minutes to reduce eye strain. When an individual or pod of *Sousa* was observed the survey vessel slowed or stopped in order to allow better observation. The observation process continued as long as was necessary to determine the size of the pod and the direction the pod was moving. These and other details of the sighting, including estimation of the distance between the dolphins and the survey vessel and the nearest shoreline and the exact location of the sighting, were discussed among the observation team. Because a global positioning system was not available during this field survey, the recorded sighting position represented a point agreed upon by all observers and wherever possible sightings locations were made relative to coastal landmarks wherever possible. At times it was necessary to follow the individual or pod, but the survey vessel aimed not to deviate more than ten minutes travelling time from the standard transect and returned to the transect as soon as possible after the sighting. A sighting record was filled out immediately after the sighting. Sighting forms include data on date, time, sea state and location of dolphin sightings as well as notes on dolphin appearance, behaviour and movement. A sample sighting form is attached at the end of this Annex.

## 2.3

### *LAND-BASED OBSERVATIONS*

Land-based survey were conducted from the triangulation point at a height of 62 m on the top of Sha Chau (*Figure 4.2a*). As for the vessel-based observations the view field was divided between observers at the top of the hill with position reallocation every 30 minutes. On the limited occasions when only one land-based observer was undertaking the land-based survey, the observer would systematically survey the whole (360°) area. However, in order to reduce fatigue and to be consistent with the land-based sighting protocol the observer would rotate orientation every 30 minutes. The sightings forms used in the vessel-based surveys were also used for the land-based surveys.

A theodolite was used to take visibility and tide height readings and to determine the location of observed dolphins. The protocol for use of the theodolite was coordinated with and is fully compatible with the protocol used in the AFD study. Theodolite readings were made by the same person on any given day to ensure minimum variability in theodolite readings. However, approximations for sea state and weather condition readings were discussed among the observation team members. Records of weather conditions were taken on an hourly basis and included cloud cover, wind direction, sea state and wind speed.

## 2.4 DATA MANAGEMENT

Completed sightings forms were compiled and subjected to a quality control review before being entered into a FileMaker Pro database. The database fields generally correspond to the data fields on the sightings form but also included fields used to assign the dolphins to particular areas or indicative sites. A complete list of sightings data from the database is attached at the end of this Annex. This database was used to tally results provided in Section 3. Figures were produced by transposing annotated maps of individual sightings, drawn by the survey team at the time of sighting, to a master map which was used to produce the figures in this report.

## 2.5 METHODOLOGICAL LIMITATIONS

In view of the limited total duration available for field study, necessitated by the overall AFRF programme, and the concern to maximise available time spent around, the area of interest, Sha Chau strict timed quantification of "sighting effort" was not included in the field survey methodology established. However, care was taken throughout the survey to ensure that coverage of all locations around Sha Chau by numbers of transect and survey duration was equal for all areas, in order to maximise the comparative value of the field survey results. This form of temporal "standardisation" was not possible for incidental sightings.

## 3 LITERATURE REVIEW

### 3.1 INTRODUCTION

A comprehensive international and local literature review has been undertaken with regard to the locational, feeding and breeding site preferences of the *Sousa*, including the Indo-Pacific Humpback Dolphin, the objective being to obtain a background knowledge of the *Sousa* to supplement the field surveys around Sha Chau. The full list of the references consulted are attached at the end of this Annex.

Due to a lack of knowledge about the *Sousa*, background is first given on the Indopacific Humpback Dolphin of which the *Sousa* are thought to be related. Research is currently being undertaken by Agricultural and Fisheries Department (AFD) to identify the taxonomic status of the *Sousa*.

### 3.2 HISTORICAL

Records of dolphins in the estuary of the Canton River (Pearl River) date back as early as 1637 when they were described by Mundy (The Travels of Peter Mundy, in Europe and Asia, Vol.III Part I) as "smalle sword Fish: And the Porpoises here are as white as Milke, some of them Ruddy withall". These dolphins were also reported by Osbeck in 1751 (Voyage to China, II.27): "Snow-white Dolphins ... tumbled about the ship; but at a distance they



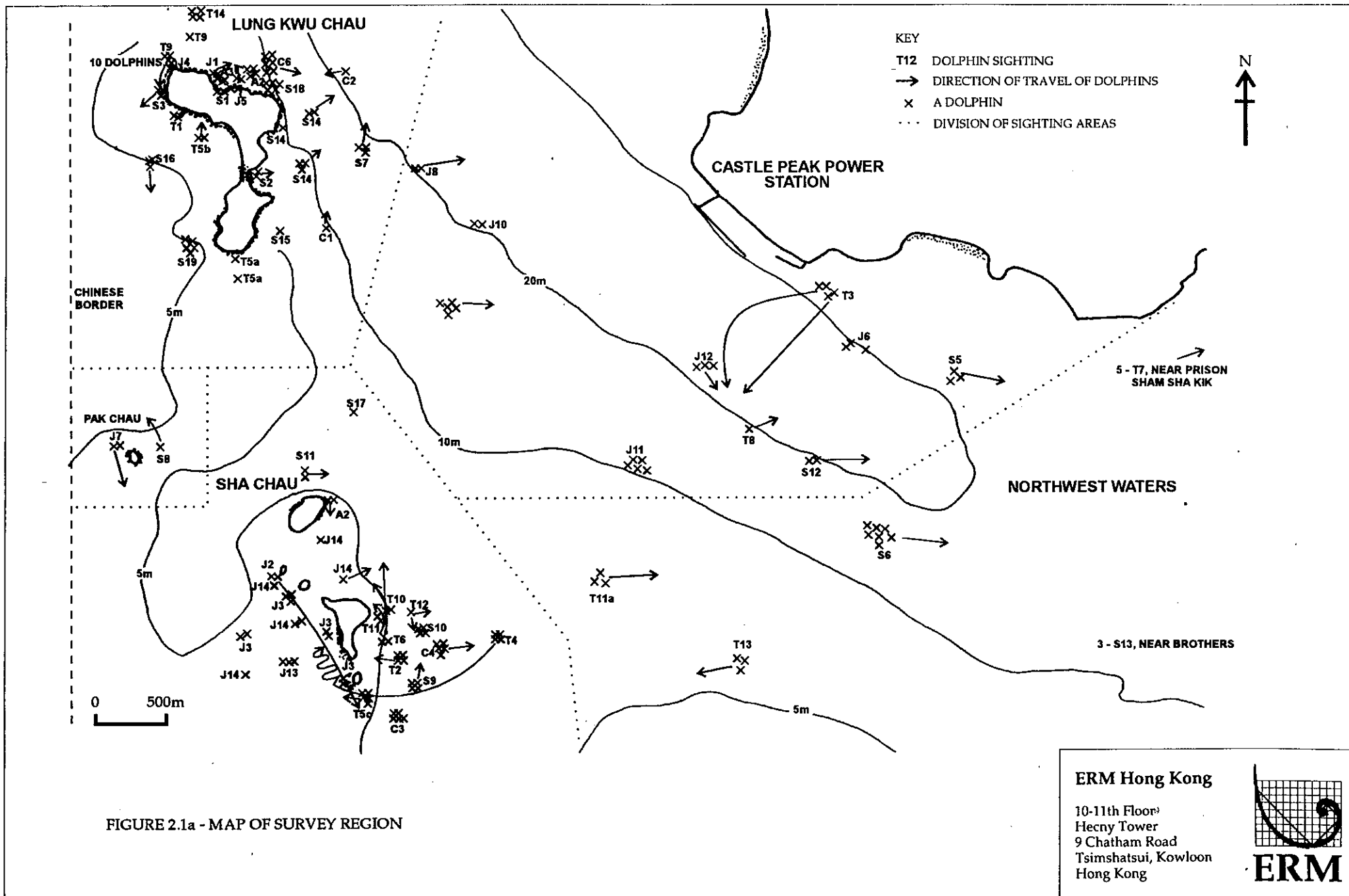


FIGURE 2.1a - MAP OF SURVEY REGION

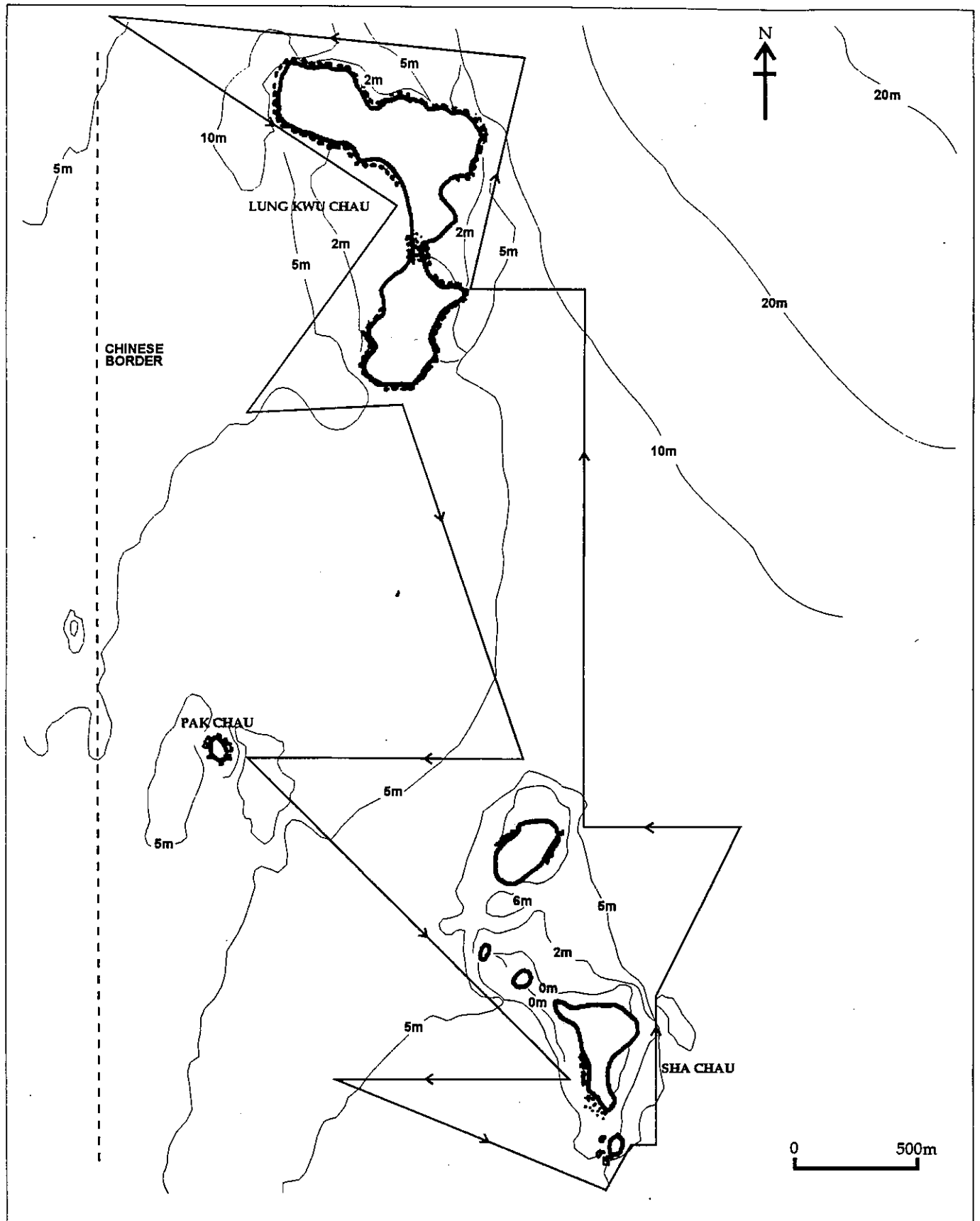


FIGURE 2.1b - MAP SHOWING TRANSECT ROUTE

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10-11th Floor  
 Hecny Tower  
 9 Chatham Road  
 Tsimshatsui, Kowloon  
 Hong Kong



seemed in nothing different from the common species, except in the white colour." In view of the characteristic coloration it is considered that these dolphins in the Pearl River Delta are likely to be *Sousa* (Ruxton 1992).

Little has been published about the *Sousa* in Hong Kong, although records of sightings since the early 1960's including those of carcasses have been made by the AFD (Ruxton 1993).

### 3.3 *INTERNATIONAL LITERATURE REVIEW*

#### 3.3.1 *Species Characteristics*

The Indo-Pacific Humpback Dolphin is readily distinguished by its small, rounded pectoral fins; long, slender snout; and low, triangular dorsal fin. The 'hump' is the most characteristic morphological feature from which the common name 'humpback' is derived. However, the 'hump' is actually obvious only in animals from the Indian Ocean. Those from the Pacific Ocean either have an indistinct or no hump (Nowak 1991).

Sylvestre (1993) reports that the animal has an average length of 2m but can reach 3.2m. The average weight is 85kg, with a maximum of 139kg. Colouring varies with age and geographic distribution, ranging from ivory white with a white stomach to dark grey. The usual social unit is a group of 2-10 (average 8 or 9), which moves together in an orderly way. Sometimes a mother and nursing calf are found on their own and, occasionally, a solitary adult, usually a male, can be seen (Watson 1981).

#### 3.3.2 *Habitat*

The humpback dolphin is coastal, preferring areas in which there are lagoons, estuaries or mangrove swamps (Watson 1981). In addition, Nowak (1991) reports that these dolphins are also found in the mouths of rivers, sometimes ascending rivers and was reported 1,200km up the Yangtze River in China.

The animal is seldom seen more than 20km out to sea and there is no evidence of migration (Watson 1981). Saayman and Taylor (1979) observes that in the majority of cases the dolphins remain close inshore within 250m of Robbe Berg (a steep-cliffed peninsula at Plettenberg Bay, South Africa). In other areas of Plettenberg Bay, as well as in Algoa Bay where the seabed is sandy with outcrops of isolated reefs, humpback dolphins move systematically from one outcrop to the next. They display a tendency to frequent specific areas and have a relative restriction of their range close inshore.

It is noted that the restriction of group movements of the humpback dolphin to within 1 km of the shore is a striking feature of their behaviour (Saayman & Taylor).

### 3.3.3

#### *Feeding Habits*

The feeding habits of the humpback dolphin is poorly researched (Barros and Cockcroft 1991). The animal apparently takes mostly reef fish (Saayman & Taylor and Irvine *et al.* cited in Corkeron 1990).

Saayman (1973) notes that in South Africa, humpback dolphins characteristically follow habitual routes close inshore, along sandy coastal stretches on route to isolated reefs and rocky feeding grounds, where they disperse to hunt. Fish species frequenting reefs appear to form the major prey of humpback dolphins (Saayman & Taylor 1973 and 1979). Ross (1984) also makes similar observations and notes that humpback dolphins in Algoa Bay appear to feed near reefs along rocky coastal areas.

The humpback dolphins, South Africa, favour estuarine associated prey (Barros and Cockcroft, 1991). Stomach contents of stranded dolphins in the eastern Cape Province, South Africa have been examined and prey species retrieved were common inhabitants of inshore waters of eastern Cape Province, often being associated with brackish waters of estuaries (van der Elst, 1981).

Sylvestre (1993) reports that the animal feeds on various species of fish, molluscs, and crustaceans, which it catches in shallow waters including rocky areas, in proximity to reefs and often among mangroves.

### 3.3.4

#### *Breeding*

The breeding period of the humpback dolphin, as reported by Sylvestre (1993), varies in different areas. Specimens collected in the area surrounding Xiamen, China indicate the mating season takes place between May and June, and that births occur between March and May, after a gestation period estimated at 10 to 11 months. Newborn calves have been observed in March and April north of the equator. In other areas births occur year-round, although at a peak rate during the summer months.

### 3.3.5

#### *Conclusions*

From the above review, conclusions may be drawn that the Indo-Pacific Humpback Dolphin is coastal within 1km of the coast, preferring lagoon, estuary or mangrove areas. It appears that the dolphins feed on fish, molluscs and crustaceans, which they catch in shallow waters including rocky areas, in proximity to reefs and often among mangroves. The breeding period seems to vary in different areas with the peak mating season generally from late spring to summer.

## 3.4

### *LOCAL KNOWLEDGE*

### 3.4.1

#### *Species Characteristics*

Scientists believe that *Sousa* is a previously unrecorded species of estuary dwellers that may be related to Indo-Pacific Humpback Dolphins. However,

they differ because of their colouring, which can vary from white to pink, grey and speckled, and their lack of a distinctive hump (Godfrey 1993).

The HK Marine Conservation Society (cited in Godfrey 1993) believes that the *Sousa* can only survive in the estuary waters of the Pearl River Delta. They are unique because of their geographical isolation from other similar species. Such separation and lack of inter-breeding may mean these dolphins have evolved to be perfectly suited to the specific and unique habitat of the estuary waters of the Pearl River Delta. The initial results from the first nine months of the AFD study by AFD dolphins researchers suggest that Hong Kong comprises a very small part of the potential range of the dolphins within the Pearl River Delta (Porter 1994 *pers comm*).

#### 3.4.2

#### *Habitats*

According to the *North Lantau Development: Detailed Study of Potential Impact of the Sewage Outfall on Sousa* Topic Report (TR22) (TDD 1993), *Sousa*, occurring frequently in the waters of western Hong Kong, are often located close to shore in small groups. They travel through, feed, socialize, rear young, and rest in waters immediately adjacent to north and west Lantau Island including the immediate vicinity of the Brothers, Sha Chau and Lung Kwu Chau Islands. The number of animals using the habitats and feeding within the area close to Lantau Island is reported by AFD Researchers to be approximately 60. However, the exact food preferences of the *Sousa* and the importance of this area for the survival of the dolphin is not known and comprises one objective of the AFD research study.

Ruxton (1993) reports that as the work on the new airport has progressed, there has been a noticeable change in the *Sousa* feeding grounds, and no pods of the dolphins have been reported in the Brothers Islands since January 1993 but other pods have been spotted to the west and southeast of Lantau where sightings were previously rare. This report, however, is contradicted by both numerous PAA sightings in the vicinity of the Brothers Islands (up to May 1994) and by the results of the field survey which, as described in *Section 4* observed *Sousa* in the vicinity of the Brothers Island on one occasion.

Records of general observations by the World Wide Fund for Nature (WWFHK) since 1990 indicates that the *Sousa* may move down the Pearl estuary in the early morning to feed in HK waters and return in the early evening, while others appear to stay within HK waters permanently (Ruxton 1993).

It may be that the *Sousa* use the North Lantau area as a "nursery ground" for their young, as they have been spotted with calves in the area, and it is known that many near-shore dolphins seek shallow, relatively weather-protected waters for rearing their young (Ruxton and Pryke 1993, *pers. comm.*).

WWF estimates that the *Sousa* have a breeding cycle of three years producing one calf per birth. Each calf is anticipated to require two or three years of nursing (Tam 1993). Initial results from the first nine months of the AFD study by AFD dolphins researchers suggest, from an increase in certain behavioural



patterns associated with courtship and mating, that *Sousa* mating seemed to occur during the month of September although conclusions can not be drawn until at least a full cycle of seasons has been studied. (Porter and Parsons 1994 *pers comm.*)

### 3.4.3

#### *Conclusions*

All the recent observations indicate that the *Sousa* inhabit the waters immediately adjacent to north, west and southeast of Lantau Island including the immediate vicinity of Sha Chau, Lung Kwu Chau Islands and the Brothers; although initial results from the first nine months of the AFD study by AFD dolphins researchers suggest that Hong Kong comprises a very small part of the potential range of the dolphins within the Pearl River Delta (Porter 1994 *pers comm.*). They travel through, feed, socialize, rear young, and rest in these waters. The number of animals using the habitats and feeding within the area close to Lantau Island is reported by the AFD Researchers to be approximately 60.

## 4

### *RESULTS AND DISCUSSION*

#### 4.1

##### *REGIONAL DISTRIBUTION*

Surveys were conducted on 29 days between 4 June 1994 and 5 July 1994 (as indicated on a list attached to end of this Annex). Surveys were not conducted on 12 and 13 June 1994 due to the unavailability of suitable vessels due to the public holidays and on 7 June 1994 due to typhoon signal 3 conditions which prevented the safe performance of transects in the study area. Vessel transects were conducted along the route shown in *Figure 2.1b*. Land based observations were conducted on 13 of the 29 survey days. However, very few dolphin sightings were observed during the land-based surveys, despite the rigorous adherence to the land based survey protocols, described in *Section 2.3*.

During the survey period, dolphins were sighted on 20 of the 29 survey days. A total of 61 sightings comprising 201 dolphins were recorded during these 20 days. Thus, dolphin pods observed during the survey averaged about 3 individuals. The survey transects were designed to focus on the waters surrounding Sha Chau, Lung Kwu Chau and Pak Chau. However, incidental sightings were also recorded from the vicinity of the Brothers Islands, the Castle Peak Power Station, and the northwestern waters. *Table 4.1a* shows the distribution of dolphins in terms of number of times dolphins were sighted and the total number of dolphins sighted throughout the survey area. *Figure 2.1a* illustrates the location of dolphin sightings throughout the study region.

**Table 4.1a. Number of Sightings and Number of Dolphins Sighted in Six Areas of the Study Region**

	Sha Chau	Lung Kwu Chau	Castle Peak Power Station	Northwest Waters	Pak Chau	Brothers Islands
Number of Sightings	18	25	10	5	2	1
Number of Dolphins Sighted	64	79	30	22	3	3

The majority of the sightings and number of dolphins were recorded from Lung Kwu Chau and Sha Chau. This result is attributable to the fact that the survey transects were designed to focus observation efforts on these two areas. However, the area around Pak Chau was also intensively surveyed but recorded a much lower number of sightings and dolphins. Because of the proximity of Pak Chau to waters of the People's Republic of China, only the eastern coast of the island could be surveyed.

The areas surrounding the Castle Peak Power Station and in Northwest waters were not intensively surveyed but recorded a number of dolphin sightings. The waters around the Brothers Islands were also not intensively surveyed. Only one sighting of three individuals was recorded from this area.

#### 4.2

##### **DISTRIBUTION AROUND SHA CHAU**

Sightings and numbers of dolphins in waters around Sha Chau are shown in *Figure 4.2a*. Due to the mobility of *Sousa* and the inherent variability in observer position estimation, dolphin observations in the vicinity of the six indicative sites were evaluated to determine if those observations represent dolphin habitat usage which is likely to be affected by the AFRF. This evaluation resulted in each of the six indicative sites being assigned observations representing habitat usage. The number of sightings and number of dolphins observed within or in the vicinity of the six indicative sites for the AFRF are represented by the observations shown in *Figures 4.2b-g*.

Plotting of all Sha Chau dolphin observations resulted in tallies for each of the six indicative sites (*Table 4.2a*.) It should be noted that where a dolphin or pod of dolphins travelled through several indicative sites, sightings are recorded at each of the indicative sites.

KEY

- T12 DOLPHIN SIGHTING
- DIRECTION OF TRAVEL OF DOLPHINS
- x A DOLPHIN
- ROCKY AREAS

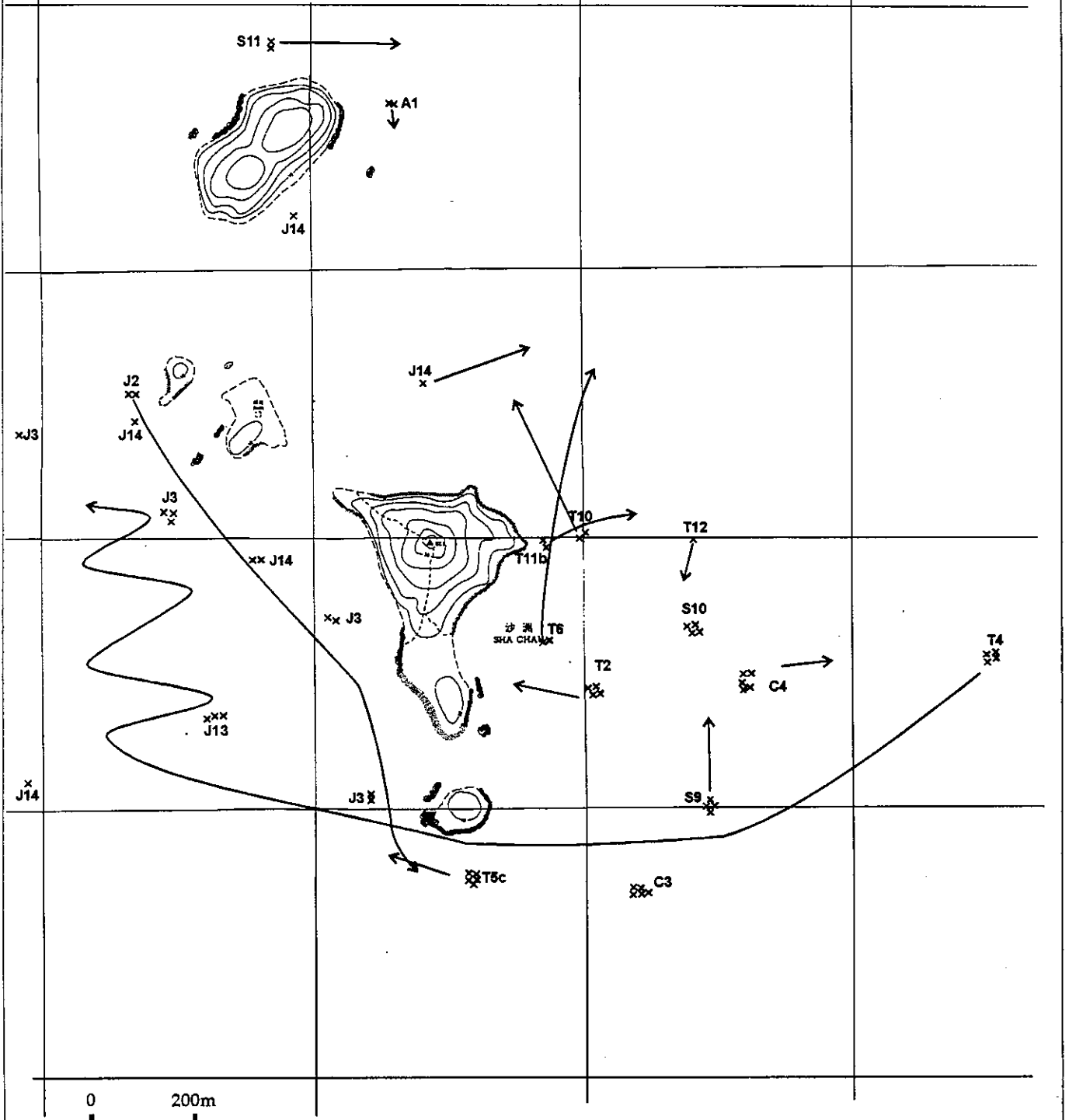


FIGURE 4.2a - MAP OF SHA CHAU SHOWING DOLPHIN SIGHTINGS

ERM Hong Kong

10-11th Floor  
 Hecny Tower  
 9 Chatham Road  
 Tsimshatsui, Kowloon  
 Hong Kong



- KEY
- T12 DOLPHIN SIGHTING
  - DIRECTION OF TRAVEL OF DOLPHINS
  - x A DOLPHIN
  - \* A DOLPHIN THAT WOULD BE IMPACTED BY DEVELOPMENT OF SITE

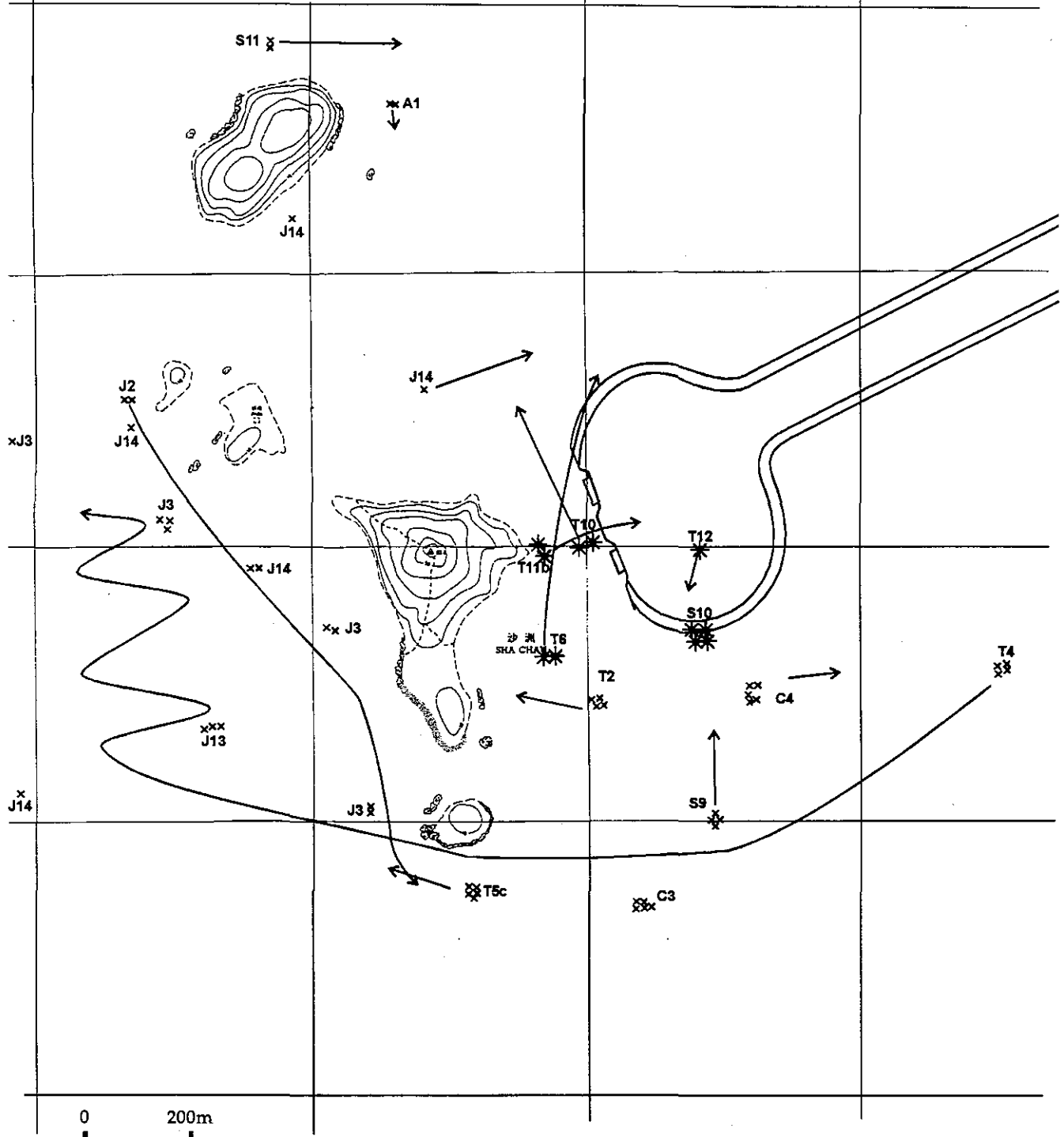


FIGURE 4.2b - ALTERNATIVE SITE A

ERM Hong Kong

10-11th Floor  
 Hecny Tower  
 9 Chatham Road  
 Tsimshatsui, Kowloon  
 Hong Kong



- KEY
- T12 DOLPHIN SIGHTING
  - DIRECTION OF TRAVEL OF DOLPHINS
  - x A DOLPHIN
  - \* A DOLPHIN THAT WOULD BE IMPACTED BY DEVELOPMENT OF SITE

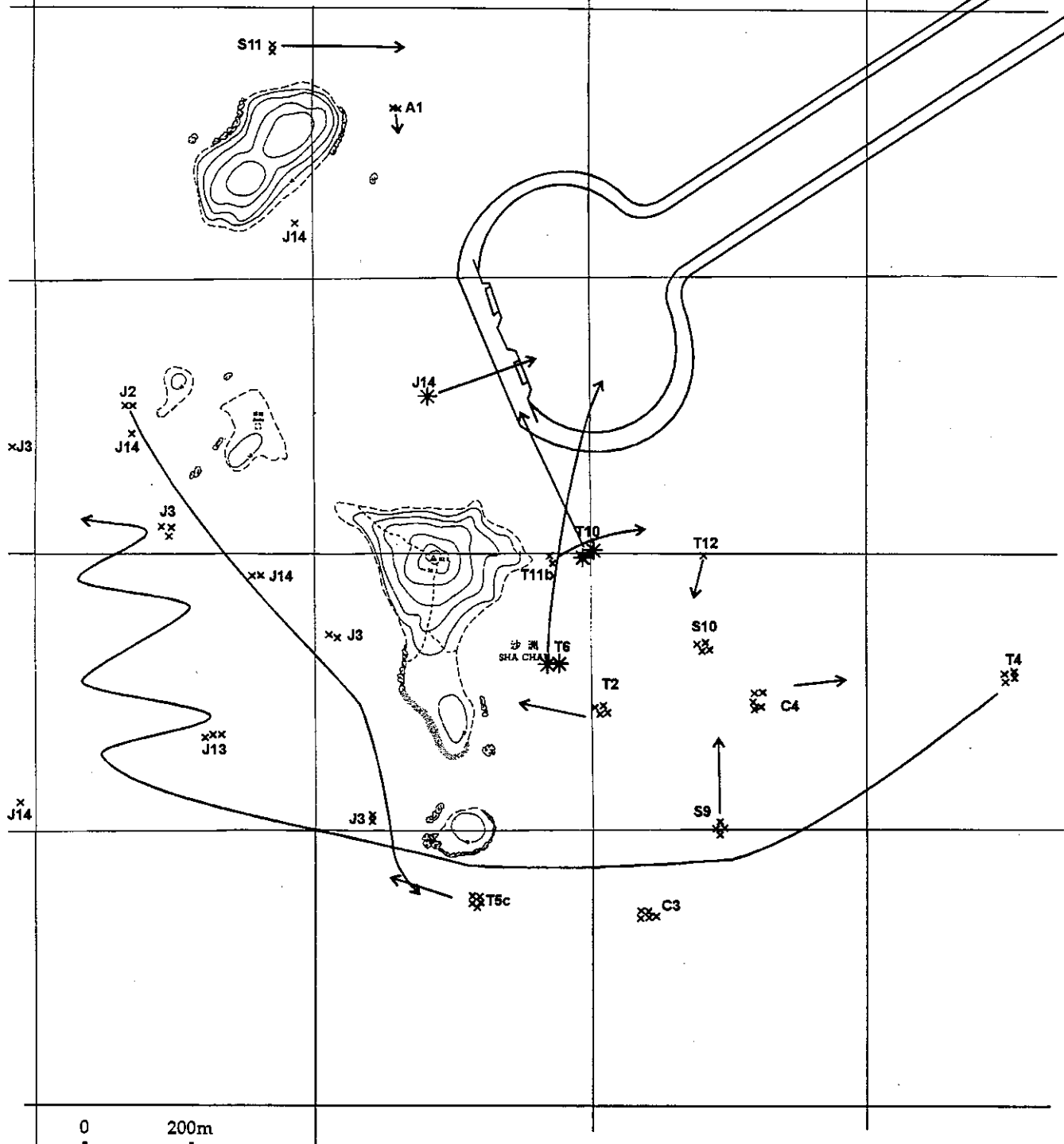


FIGURE 4.2c - ALTERNATIVE SITE B

ERM Hong Kong

10-11th Floor  
 Hecny Tower  
 9 Chatham Road  
 Tsimshatsui, Kowloon  
 Hong Kong



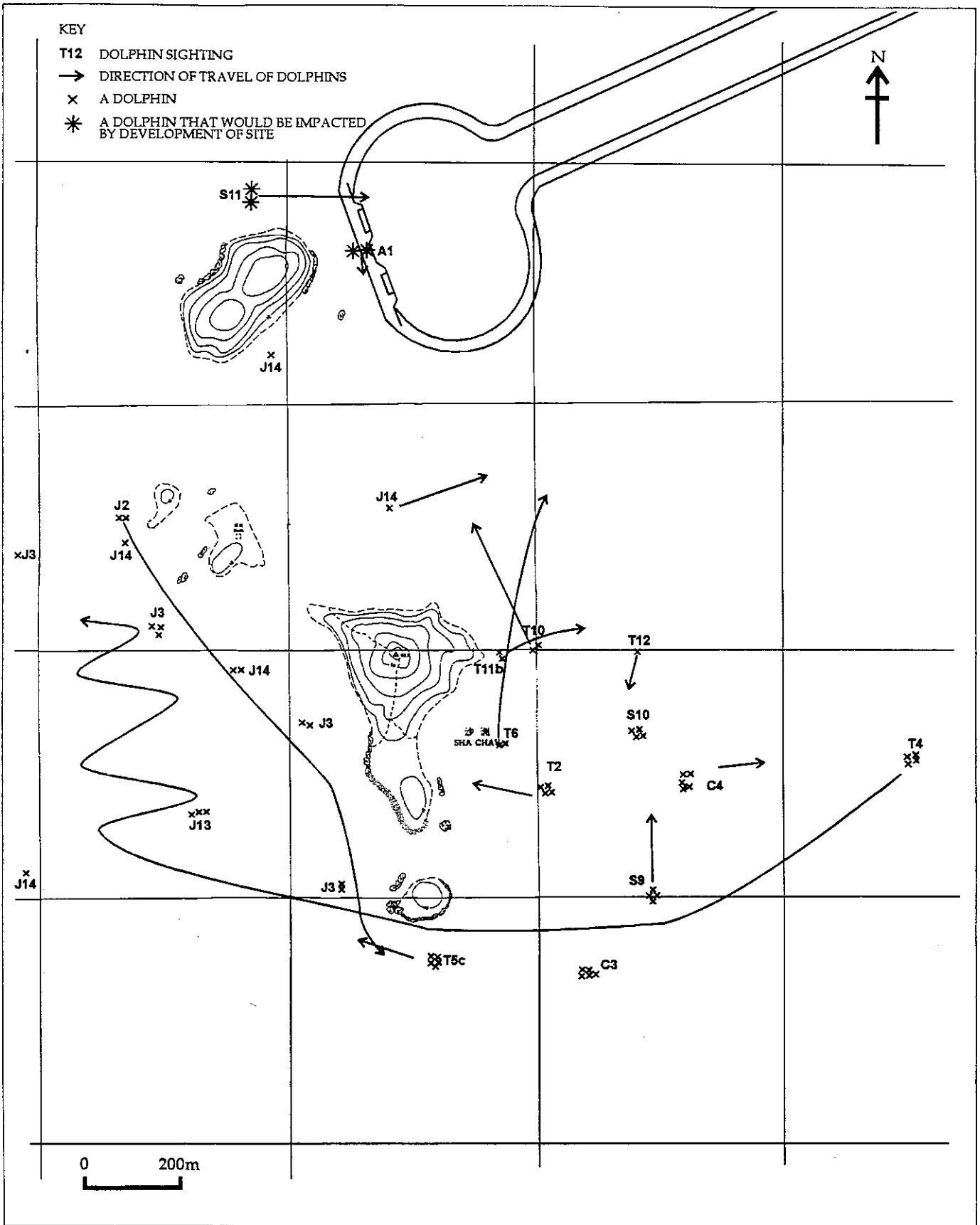


FIGURE 4.2d - ALTERNATIVE SITE C

ERM Hong Kong

10-11th Floor  
 Hecny Tower  
 9 Chatham Road  
 Tsimshatsui, Kowloon  
 Hong Kong



- KEY
- T12 DOLPHIN SIGHTING
  - DIRECTION OF TRAVEL OF DOLPHINS
  - x A DOLPHIN
  - \* A DOLPHIN THAT WOULD BE IMPACTED BY DEVELOPMENT OF SITE

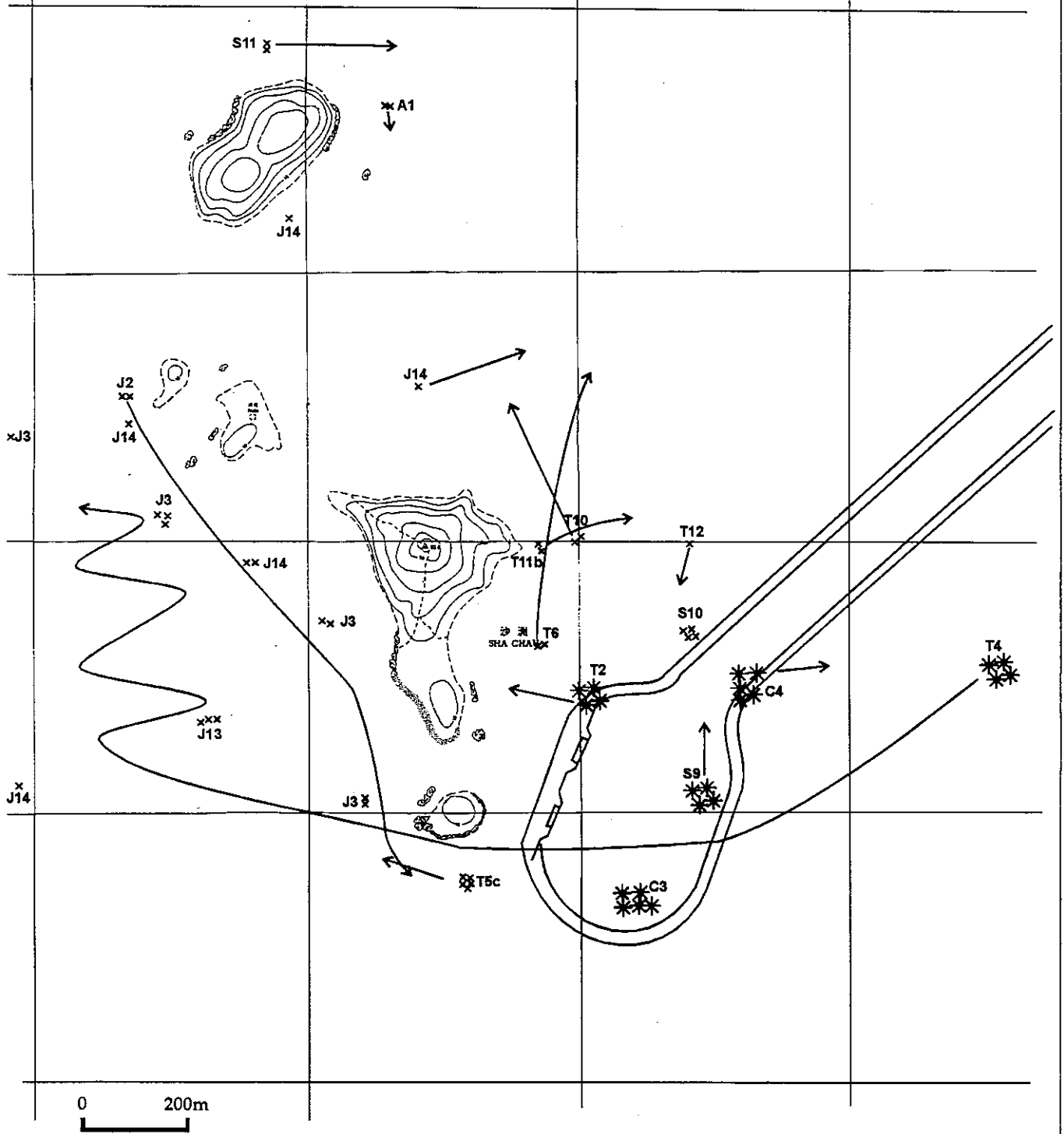


FIGURE 4.2e - ALTERNATIVE SITE D

ERM Hong Kong

10-11th Floor  
 Hecny Tower  
 9 Chatham Road  
 Tsimshatsui, Kowloon  
 Hong Kong









Table 4.2a Number of Sightings and Number of Dolphins Sighted in the Six Indicative AFRF Sites

	Ind. Site A	Ind. Site B	Ind. Site C	Ind. Site D	Ind. Site E	Ind. Site F
Number of Sightings	5	3	2	5	1	9
Number of Dolphins Sighted	11	5	4	22	2	36

The majority of the sightings and number of dolphins observed were located around southern Sha Chau (Sites A, D and F) with the northern Sha Chau sites (E, C and B) recording a relatively lower number of sightings. The total number of dolphins observed in indicative Sites A, D and F varies from 11 to 36.

#### 4.3 DISTRIBUTION AROUND LUNG KWU CHAU

Location of dolphin sightings and the number of dolphins observed in the waters off Lung Kwu Chau are illustrated in *Figure 4.3a*. These data indicate *Sousa* is distributed around the entire circumference of the island, but particularly utilizes the sheltered, rocky bay along the north coast. However, dolphins were also noted farther offshore and some groups were observed to move from one side of the island to the other (see Observation S18).

#### 4.4 SEA STATE AND WIND CONDITIONS

Several factors appear to influence the observed presence or absence of dolphins within the survey area. One of the most important influences on the observed presence or absence of dolphins was the sea state at the time of observation. *Table 4.4a* shows the number of sightings relative to sea state.

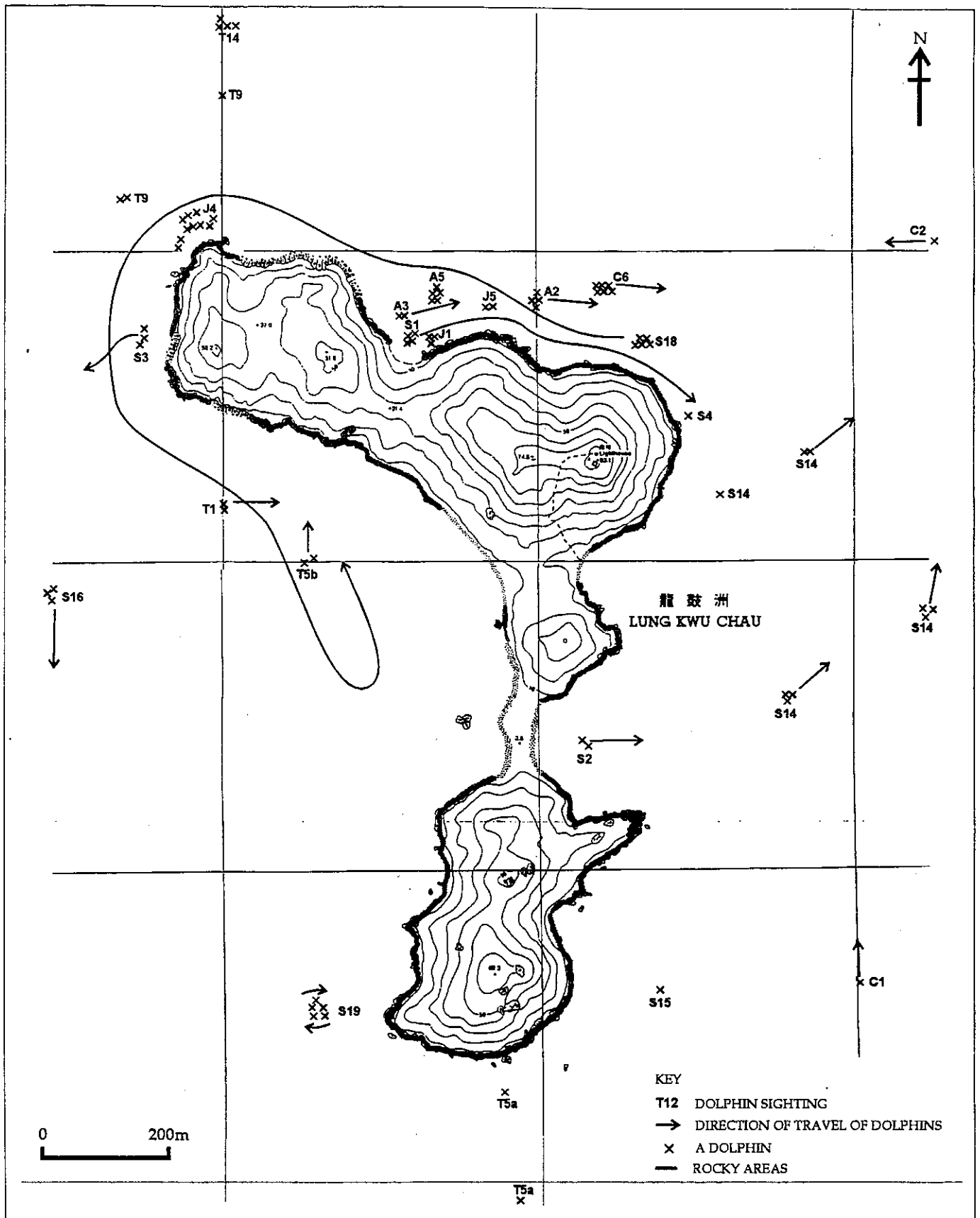


FIGURE 4.3a - MAP OF LUNG KWU CHAU SHOWING DOLPHIN SIGHTINGS

ERM Hong Kong

10-11th Floor  
 Hecny Tower  
 9 Chatham Road  
 Tsimshatsui, Kowloon  
 Hong Kong



**Table 4.4a. Number of Sightings and Number of Dolphins Sighted by Sea State**

Sea State	Number of Sightings	Number of Dolphins Sighted
Calm	40	130
Slight Swell	17	63
Moderate Swell	2	4
Heavy Swell	2	4

According to these data, most dolphins were observed during calm or slight swell conditions. Since the literature survey identified that dolphins prefer calmer waters, rougher sea states may affect the presence of dolphins in the area. Rougher sea states are also known to decrease an observer's ability to detect dolphins since the presence of white wavecrests interferes with an observer's ability to positively identify dolphins. The decrease in dolphins observed during the rougher sea state conditions may be attributable to either or both of these factors. No distinct correlation between either wind speed or direction was observed.

**4.5**

***PRESENCE OF JUVENILES***

The number of sightings of juvenile dolphins and the total number of juvenile dolphins observed in the six areas of the study region are given in *Table 4.5a*.

**Table 4.5a** *Number and Percentage of Juvenile Sightings, and Number and Percentage of Juvenile Dolphins Sighted in the Six Areas of the Study Region*

	Sha Chau	Lung Kwu Chau	Castle Peak Power Station	North-west Waters	Pak Chau	Brothers Islands
Number of Sightings in Area with Juveniles	7	9	2	1	0	0
Percent of Sightings in Area with Juveniles	38%	36%	22%	17%	0	0
Number of Juvenile Dolphins Observed in Area	17	15	3	3	0	0
Percentage of Dolphins in Area which were Juveniles	26%	19%	11%	13%	0	0

The percentage of total sightings containing juveniles and the percentage of dolphins observed which were juveniles for each of the six areas is also shown. For these analyses, juvenile dolphins were assumed to be those less than 2 m in length. Field survey data indicate that the Sha Chau and Lung Kwu Chau areas recorded both the highest number of sightings of juveniles and the highest number of juveniles observed. The percentage of observed dolphins which were juveniles in these two areas ranged from 19 to 26 percent. Although the scope of this study does not allow a definitive conclusion regarding the importance of various locations as nursery areas, data presented in *Table 4.5a* suggest that Sha Chau may represent more important habitat for juveniles than does Lung Kwu Chau.

Castle Peak Power Station and Northwestern waters also recorded a number of sightings of juvenile dolphins. The number of sightings of juveniles and number of juveniles observed is lower in these two areas than in Sha Chau and Lung Kwu Chau. However, the percent of total sightings and percent of dolphins observed which were juveniles at Castle Peak Power Station and Northwestern waters are comparable to the percentages at Sha Chau and Lung Kwu Chau. Due to the incidental nature of sightings at the Castle Peak Power

Station and Northwestern waters, it is difficult to draw any conclusions regarding the utilization of these areas as habitat for juvenile dolphins.

No juveniles were observed at either Pak Chau or the Brothers Islands. It cannot be assumed, however, that juveniles are not present in these areas. The lack of juvenile observations may be attributable to the incidental nature of the surveys of the Brothers Islands and the lower number of dolphins observed at both the Brothers Islands and Pak Chau.

#### 4.6

#### BEHAVIOURAL OBSERVATIONS

Dolphins engaged in presumed feeding generally exhibit behaviour characteristic of this activity. These behaviours may include circling patterns followed by rapid, synchronous diving by all individuals within the pod. Each dolphin observation recorded during the survey included notes on any apparent behaviour patterns.

Sighting records where presumed feeding behaviours were observed have been categorized into the six areas of the study region and are presented in *Table 4.6a*.

*Table 4.6a. Number and Percentage of Sightings Exhibiting Presumed Feeding Behaviour in the Six Areas of the Study Regions*

	Number of Sightings Exhibiting Presumed Feeding Behaviour	Percent Sightings Exhibiting Presumed Feeding Behaviour
Sha Chau	2	12
Lung Kwu Chau	6	24
Castle Peak Power Station	0	0
Northwest Waters	1	17
Pak Chau	0	0
Brothers	1	100

The number of sightings with indications of dolphin feeding behaviour in each area is low and there is no apparent pattern in the location of the sightings with indications of dolphin feeding behaviour since 3 of the 6 observations occurred near rocky coasts (S1, S4 and S19) whereas 3 of the 6 observations occurred farther offshore (S14, S16 and C1) (*Figure 4.3a*).

Although *Table 4.6a* indicates that 17 percent of the sightings in Northwestern waters exhibited feeding behaviour, this result may be attributable to the small number of sightings in this area rather than the importance of this area as feeding habitat.

An assessment of feeding behaviour observed within the six indicative AFRF sites was also conducted. The results of this assessment indicate that feeding behaviours observed within the six indicative sites during the study period are relatively limited as feeding behaviour was identified only at Indicative Sites A and D.

Although a direction of movement was noted for each dolphin sighting, the survey was not designed to identify large-scale movements of dolphins between areas within the survey region. As a result, indicative directions of individuals and groups were noted. Several of the individual sightings within the Sha Chau, Lung Kwu Chau and Pak Chau transect area were tracked for considerable distances around the island groups (see Figures 4.2a and 4.3a). These data suggest that dolphins easily range over areas larger than the indicative AFRF sites and that recorded dolphin observations should be considered as marking a range of habitat rather than a particular occupation point. This possible observation is supported by initial results from the first nine months of the AFD study by AFD dolphins researchers, as these studies consider that Hong Kong comprises a very small part of the potential range of the dolphins within the Pearl River Delta (Porter 1994 *pers comm*).

In addition, the results also indicated, that on occasions dolphins appeared to move inshore and offshore of Sha Chau from various directions, possibly from other areas. The adherence to the survey methodologies and protocols prevented tracking of dolphins away from Sha Chau to ascertain if dolphins were travelling to other locations or wider areas. This possible movement behaviour has also been observed, during the first nine months of land based surveys by AFD dolphins researchers (Parsons 1994 *pers comm*).

#### 4.7

#### *HABITAT PREFERENCES*

Two habitat preferences cited in the literature survey are also supported by the field survey data. Review of research conducted on *Sousa* indicates that preferred habitat is usually within 1 km of shore. Because this field survey focused on the AFRF indicative sites, which are all located within several hundred meters of shore, most of the survey effort, and hence most of the dolphin observations occurred within shore. Therefore, although the results of this field survey cannot provide a definitive statement concerning the preferences of dolphins for various water depths, it does indicate that dolphins frequent inshore waters within the study areas. Table 4.7a provides the number of sighting and number of dolphins observed within 100 m intervals of the coast within the study region.

**Table 4.7a Number of Sightings and Number of Dolphins Sighted at 100m Intervals from the Coast**

Distance from Coast (m)	Number of Dolphin Sightings	Number of Dolphins Sighted
0 - 100	21	75
101 - 200	10	28
201 - 300	4	14
301 - 400	4	15
401 - 500	2	2
501 - 600	2	6
601 - 700	2	6
701 - 800	2	6
801 - 900	1	2
901 - 1000	4	17
>1000	8	26

Table 4.7a indicates that dolphins were more commonly sighted within 200m of the coast, although sightings located at over 900m were also observed.

The literature survey performed for this project also indicated that rocky areas represent preferred feeding habitat for *Sousa chinensis* in other areas of its range. Figures 4.2a and 4.3a illustrate the areas of rocky coast and the results of the field survey also generally support the theory that rocky areas represent preferred habitat for *Sousa* although the role of these rocky areas in feeding has not been established by this study.

#### 4.8 LAND-BASED OBSERVATIONS

Despite strict adherence to the methodologies laid out in Section 2.3, the land-based teams (and AFD researchers) met with little success, with regard to sightings throughout the survey period. Dolphins were observed from the land only on 1 July 94. (Sighting Reference J14 presented in Annex B).

#### 5 OTHER CONSIDERATIONS

It is proposed to construct a fuel receiving facility at Sha Chau, an island located approximately 3.5 km north of the New Airport Platform. Six indicative locations around the shores of Sha Chau, Sites A to F, are possible for this receiving facility, indicated in Figures 4.2b-4.2g. Brief descriptions of the technical advantages and disadvantages of each of these options are provided below. These factors exclude any environmental considerations such as potential impacts on the *Sousa*.



## **5.1 SITE A (FIGURE 4.2B)**

### **5.1.1 Dredging**

A scour hole, located just east of the main island, minimises the quantity of dredging required for this location because the required depth of material to be removed is never more than 2m deep. Dredging volume for access and turning circle is around 300,000m<sup>3</sup>.

### **5.1.2 Collision Risk**

The risk of collision from marine traffic passing the facility is relatively low because the edge of the main traffic lane (at say 10m depth) in Urmston Road is approximately 1,500m distant. In addition, collision from traffic using East West routes is prevented by the presence of the islands themselves.

### **5.1.3 Marine Aspects**

The location is fully feasible from a marine operations perspective including alignment to prevailing currents and protection from SW waves. Winds from the NE tend to pin vessels to the berth but this can be met by design of suitable shuttle service vessels, or use of tugs for other vessels.

### **5.1.4 CAD Radar**

The alignments to suit the prevailing ebb and flood tides also aligns with the direction that achieves the minimum projected area as 'viewed' by the CAD radar on Lung Kwu Chau.

### **5.1.5 Foundations**

Rock is exposed at this location so that bored piles would be short and keyed into rockhead. Some piles would require a tensile capacity.

### **5.1.6 Pipeline Route**

The obvious pipeline route lies to the south through a thin layer of marine mud and thence following just west of the boundary of the East Sha Chau gazetted marine dump and borrow area.

### **5.1.7 Cost**

This location probably offers the minimum cost of all the options available.

### **5.1.8 Fung Shui**

The main berths would not point towards Lung Kwu Tan and there are no obvious effects on the Tin Hau Temple.

### **5.1.9 CAD Jetty**

A 50m clearance is required to allow access to the proposed CAD Jetty.

**5.2**            **SITE B (FIGURE 4.2C)**

**5.2.1**          **Dredging**

An increased volume of dredging over that at Site A arises. The appropriate volume is 600,000m<sup>3</sup> but the access channel is slightly shorter, at about 1,400m.

**5.2.2**          **Collision Risk**

Site B is slightly more exposed than Site A because the distance to Urmston Road main channel is shorter and the facility lies in the bay between the two main islands.

**5.2.3**          **Marine Aspects**

See comment for Site A.

**5.2.4**          **CAD Radar**

See comment for Site A.

**5.2.5**          **Foundations**

A relatively thin layer of marine mud is present. However foundations will essentially be the same as those Site A.

**5.2.6**          **Pipeline Route**

A similar route is proposed but it is about 500m longer than the pipeline length required for Site A.

**5.2.7**          **Cost**

The cost slightly higher than that for Site A because the dredging volume is greater and the pipeline is longer.

**5.2.8**          **Fung Shui**

Similar to that for Site A although the visual impact of the receiving facility from a standpoint by the temple would be rather greater.

**5.2.9**          **CAD Jetty**

No conflict with the CAD jetty occurs.

**5.3**            **SITE C (FIGURE 4.2D)**

**5.3.1**          **Dredging**

A similar scour hole than that which occurs at the location of Indicative Site A is located at the site of Site C. The volume of dredging is thus only slightly greater than that at Site A at about 460,000m<sup>3</sup>. The access channel is about 1,100m long.

**5.3.2 Collision Risk**

Site C is slightly more exposed than Site B to Urmston Road traffic because the distance to Urmston Road main traffic lane is shorter. However it lies very close to the North Island of Sha Chau which provides protection.

**5.3.3 Marine Aspects**

See comment for Site A.

**5.3.4 CAD Radar**

See comment for Site A.

**5.3.5 Foundations**

See comment for Site B.

**5.3.6 Pipeline Route**

Two pipeline routes are possible, one to the East and the other to the west of the south island. The western route is slightly larger than the Eastern and both are 500m or so longer than the pipeline length required for Site B.

**5.3.7 Cost**

The cost would be approximately the same as that for Site B because a trade off between the volume of dredging and length of pipeline occurs between the two options.

**5.3.8 Fung Shui**

See comments for Site A.

**5.3.9 CAD Jetty**

See comments for Site B.

**5.4 SITE D (FIGURE 4.2E)**

**5.4.1 Dredging**

Volume of dredging is about 560,000m<sup>3</sup> (slightly less than the volume for Site B). The access channel is however longer at about 2,000m.

The risk of collision from Urmston Road traffic is less than that for Site A because this location is protected by shallows to the north of the berths. It is however more exposed to the traffic passing to the south of Sha Chau.

#### **5.4.3**      *Marine Aspects*

The location is fully feasible from a marine operations perspective including alignments to the prevailing currents. Dominant north-east wind would have less tendency to pin vessels onto the berth than that for Sites A, B and C but any (less frequent) strong south east winds would have the same effect. However, again shuttle service vessels can be designed to accommodate these conditions during unberthing.

#### **5.4.4**      *CAD Radar*

The location is largely obscured from the line of vision from Lung Kwu Chau. Hence interference with the CAD Radar is expected to be insignificant.

#### **5.4.5**      *Foundations*

See comments for Site B.

#### **5.4.6**      *Pipeline Route*

This location offers the shortest pipeline route.

#### **5.4.7**      *Cost*

The cost would be approximately the same as that for Site B because a trade off between the volume of dredging and length of pipeline occurs between the two options.

#### **5.4.8**      *Fung Shui*

Whilst there appears to be no likely effect on the temple, it is possible that the berths may point towards Lung Kwu Tan.

#### **5.4.9**      *CAD Jetty*

See comments for Site B.

#### **5.4.10**     *Contaminated Mud Pits*

This option is the nearest to the contaminated mud pits to the north of the airport platform.

### **5.5**        *SITE E (FIGURE 4.2F)*

#### **5.5.1**     *Dredging*

A significantly greater requirement for dredging (about 800,000m<sup>3</sup>) occurs at this location because the water depth is generally only around 6m. The access channel is relatively short at about 1100m.

**5.5.2**      *Collision Risk*

The projected width of the berths, across the direction from which errant ships are likely to approach the facility, is greater than other options. Collision risk at this location is therefore considered to be the highest of all options.

**5.5.3**      *Marine Aspects*

See comments for Site D except that berth alignment is such that vessels would have no difficulty in leaving berthing under all the most frequently occurring winds.

**5.5.4**      *CAD Radar*

The full width of the berth would be 'seen' by the CAD Radar installation on Lung Kwu Chau. This is understood to be likely to cause significant difficulties or inefficiencies in operation of the radar. The location would therefore be strongly opposed by CAD on these grounds.

**5.5.5**      *Foundations*

See comments for Site B.

**5.5.6**      *Pipeline Route*

The route for the pipeline would probably run to the west of the islands, and would be about equal in length to that for Site C.

**5.5.7**      *Cost*

The cost would be higher than that for Site C because the volume of dredging would be greater.

**5.5.8**      *Fung Shui*

The facility would be largely hidden from view behind the northern island from a standpoint near the temple. However the main berths would point almost directly towards Lung Kwu Tan.

**5.5.9**      *CAD Jetty*

See comments for Site B.

**5.6**        *SITE F (FIGURE 4.2G)*

**5.6.1**     *Dredging*

With water depths of less than 4m this location would require a large volume of dredging, estimated to be about 2,100,000m<sup>3</sup>. A significant part of this arises from the length and depth of dredging required in the access channel, which is approximately 3,000m long. Significant siltation could be expected at this location.

#### **5.6.2**      *Collision Risk*

The risk of collision from marine traffic is the lowest of any location because the facility is well protected by the islands from traffic in Urmston road and also west-east traffic both north and south of the island.

#### **5.6.3**      *Marine Aspects*

Berthing and unberthing operations are fully feasible at this location in terms of prevailing conditions. However the access channel is tortuous and undesirable from a navigational perspective. The location is exposed to waves from the south-west. These may affect the operation of smaller craft on a few annual occasions.

#### **5.6.4**      *CAD Radar*

The location is shielded from 'view' of the CAD Radar on Lung Kwu Chau by the north island.

#### **5.6.5**      *Foundations*

See comments for Site B.

#### **5.6.6**      *Pipeline Route*

A relatively short pipeline route is offered by this option but the length would be a few hundred metres greater than the length of pipeline to Site D.

#### **5.6.7**      *Cost*

The large volume of dredging would dominate other differences between the costs of the various options, making Site F the most costly of all options.

#### **5.6.8**      *Fung Shui*

This option lies the closest of any of the Tin Hau Temple and as such some Fung Shui issues could arise. The main berths would be effectively shielded from the line of sight from Lung Kwu Tan by the main island.

#### **5.6.9**      *CAD Jetty*

See comments for Site B.

### 6.1 SURVEY CONSTRAINTS

This survey was designed to investigate the presence, distribution and habitat usage of *Sousa* in six indicative AFRF sites located around Sha Chau. The timeframe of the survey conformed to the AFRF project schedule which allowed for only a one-month intensive field survey. Resulting survey data can be used to determine which of the six indicative AFRF sites represented the least preferable habitat for *Sousa* during the study period and hence to choose a preferred indicative AFRF site for immediate gazettal. Surveys conducted over longer periods may indicate that *Sousa* exhibits other patterns of habitat usage under different seasonal or other conditions.

Surveys conducted at Lung Kwu Chau were conducted in order to place the habitat value for *Sousa* of Sha Chau in the context of another area which will not be impacted by the proposed project. However, a systematic survey of the entire region of potential habitat for *Sousa* was beyond the scope of the present field survey. Therefore, whilst comparisons with Lung Kwu Chau are made, it is not possible to evaluate the importance of habitat at Sha Chau in terms of the entire range of habitat available in Hong Kong waters.

The purpose of this study was to reduce potential impacts to *Sousa* by locating the AFRF in an area of apparent low habitat usage and value for dolphins. Although this study can assist in selecting the indicative site with the least direct impact on *Sousa*, it was not designed to determine the acceptability of the environmental impacts of AFRF construction and operation on *Sousa*. Assessment of the potential impacts of the construction and operation of the AFRF with regard to the scale, extent and severity will be undertaken under a subsequent EIA of the PAA preferred site.

### 6.2 LITERATURE SURVEY

The findings of the literature survey indicate *Sousa* have a preference for habitat within 1 km of the coast, and for rocky areas sheltering reef-dwelling fish prey. Information from Hong Kong waters confirms that *Sousa* frequent areas close to shore in small groups. Previously collected data show that *Sousa* travel through, socialize, rear young, and rest in waters immediately adjacent to north and west Lantau Island including the immediate vicinity of the Brothers, Sha Chau and Lung Kwu Chau Islands. AFD Researchers studying the *Sousa* population in Hong Kong waters estimate their numbers as approximately 60.

### 6.3 FIELD SURVEY

The field survey results indicated that, during the survey period, marine waters around Sha Chau showed similar numbers of sightings and numbers of dolphins as the waters surrounding Lung Kwu Chau. Both of these areas recorded higher numbers of sightings and numbers of dolphins than areas

around Pak Chau. Although the Northwest waters, Brothers Islands and Castle Peak Power Station recorded incidental sightings of *Sousa*, these areas were not systematically surveyed and therefore cannot be directly compared to the data from Sha Chau, Lung Kwu Chau and Pak Chau. In addition, the results also indicated, that on occasions dolphins appeared to move inshore and offshore of Sha Chau from various directions, possibly from others areas, although the adherence to the survey methodologies and protocols prevented tracking of dolphins away from Sha Chau to ascertain if dolphins were travelling to other locations.

Dolphin observations from waters around Sha Chau were further classified, depending on location, within one or more of the indicative AFRF sites. The results of this analysis are as follows:

During the study period, the majority of dolphins located in the vicinity of Sha Chau were observed within Sites D and A. These data indicate that these sites could contain valuable habitat for *Sousa* and are thus not recommended as sites for the AFRF. Site F is also not recommended as a site for the AFRF because its vessel access channel passes through a region where a substantial number of dolphins were observed.

Although relatively few dolphins were seen in the area representing Site B, the numbers of dolphins spotted in Sites A and D may indicate that Site B could provide a "buffer" area between areas more intensively used by *Sousa* and areas which less intensively used by *Sousa*. The relatively close proximity of Site B to the sites more intensively used by *Sousa* may indicate that Site B may represent more valuable habitat for *Sousa* than, for example Site E. Therefore, Site B is not recommended due to its proximity to areas intensively used by dolphins.

Although the difference in number of dolphins observed at Sites C and E is small, the relative proximity of Site C to areas of observed dolphin habitat usage (eastern and southern Sha Chau) suggest that Site C could provide a reduced buffer, between areas of relatively higher and lower usage, compared to that provided by Site E and may thus represent a marginally more valuable habitat for *Sousa*. It should also be noted that movements of high speed ferries to and from Zhuhai occur north of Site E, in the water between Sha Chau and Lung Kwu Chau, and this may comprise a reason for the relatively lower intensity usage of the Site E.

#### 6.4

#### OVERALL CONCLUSIONS

Based on the data collected during the survey period, areas contained within Sites C and E have the lowest observed dolphin habitat usage of the six indicative AFRF sites. Therefore, of these six indicative sites, based on the one-month intensive survey, Sites C and E are preferred sites (Figure 6.4a) for the location of the AFRF.

Based on the field survey results Site C could provide a reduced buffer, between areas of relatively higher and lower usage, compared to that provided



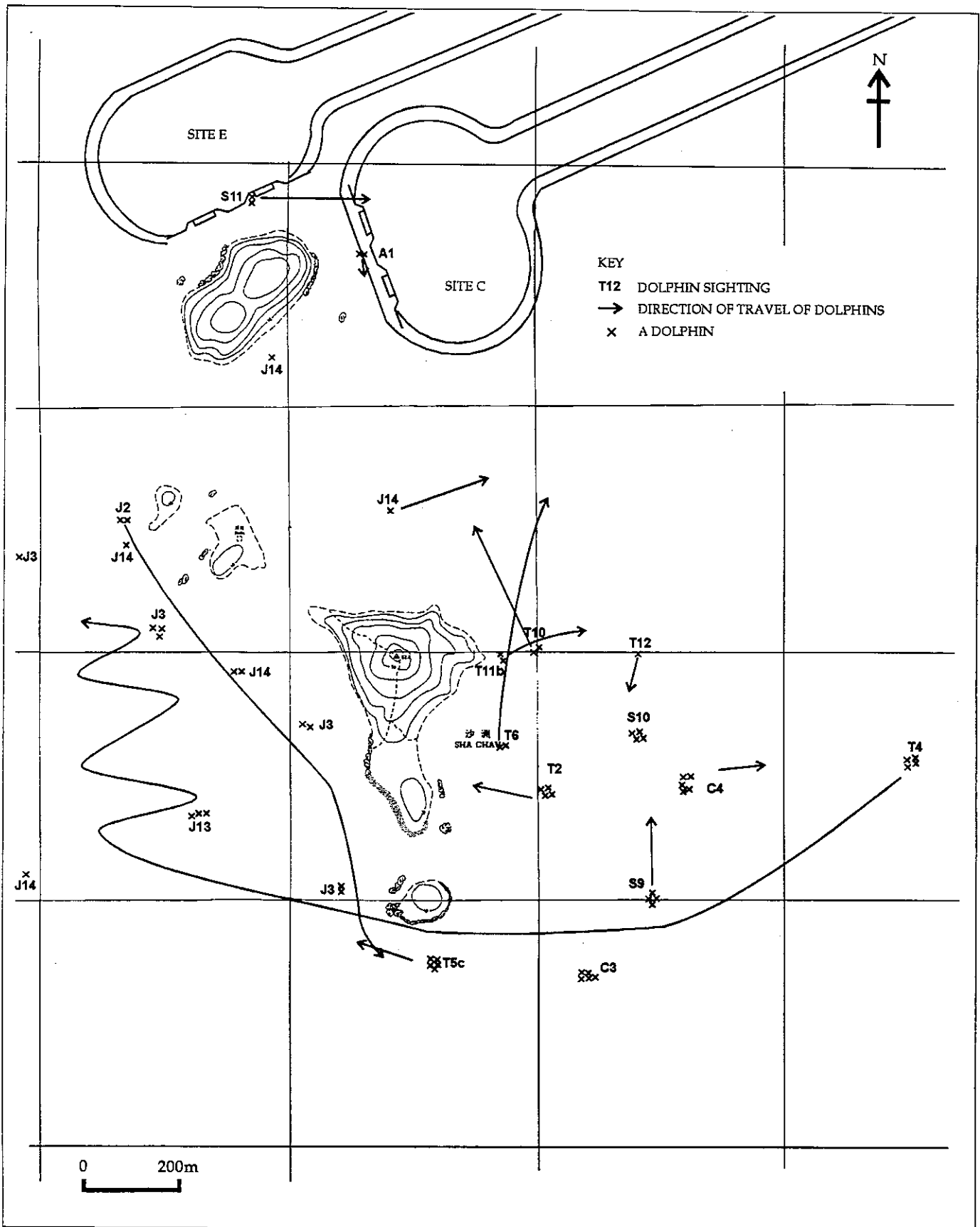


FIGURE 6.4a - PREFERRED SITES C AND E

ERM Hong Kong

10-11th Floor  
 Heony Tower  
 9 Chatham Road  
 Tsimshatsui, Kowloon  
 Hong Kong



by Site E and for this reason Site E was marginally recommended over Site C for the AFRF location.

The selection of the preferred AFRF sites around Sha Chau, as discussed in this report is based on the fundamental premise that the location of the AFRF should be located as remote as possible from areas where *Soussa* has been sighted in significant numbers or frequency in order to minimise direct or indirect negative impacts on *Soussa*. However, it must be emphasised that other non-locational impact-related considerations may also influence the selection of the ultimately preferred site. The other considerations will be addressed in an EIA of the PAA preferred site.

Sample Sighting Form

### Dolphin Sighting Record

The Chinese White Dolphin *Sousa chinensis* is an Estuarine Species and in Hong Kong is usually seen in areas to the North of Lantau Island.



Chinese White Dolphin

Date : 19/6/94 Time : 2:40pm

Number of Dolphins Observed : 4

Location : Sha Chau (Mark on Map Overleaf)

Distance between the Observer and the Dolphin : 150 metres

Colour : (Please Tick) White :  Others (eg Striped, speckled) :   
Grey : 1 - (very dark tail)  
Pink : 3

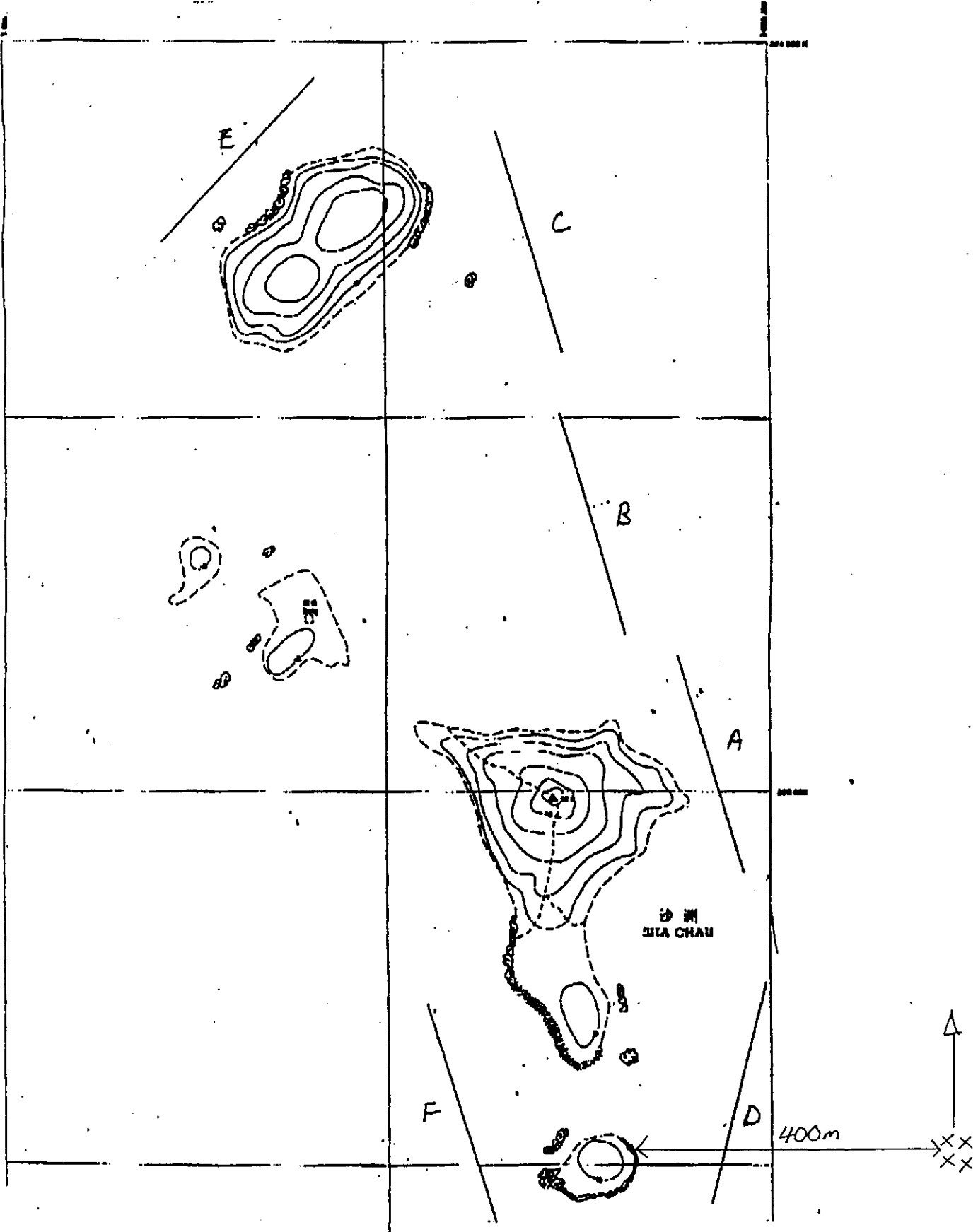
Body Length : Below 1 metre:   
1-2 m :   
2-3 m : 4  
above 3 m :

Direction Heading : North :  South :  East :  West :

Sea State : Calm :  Slight swell :  Moderate swell :  Heavy Swell :

Other Remarks (notes on behaviour etc) :

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



Dolphin Database

Date 05 June, 1994

Ref# T3

Filed by Tim

Time 11:45 AM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: Direction NE

Site Options  A  B  C  D  E  F  NA

Speed 7

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

less than 1m.

Distance from: One to two m 2  
Coast 100 2-3m 2  
Observer 100 >3m

White

Grey

Pink 4

Num Juveniles 2

No of Dolphins

Date 05 June, 1994

Ref# T4

Filed by Tim

Time 12:25 PM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: Direction NE

Site Options  A  B  C  D  E  F  NA

Speed 7

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

less than 1m

Distance from: One to two m 2  
Coast 1000 2-3m 2  
Observer 50 >3m

White

Grey 4

Pink

Num Juveniles 2

No of Dolphins

Grand Totals:

Total Juveniles 38

Total No of Dolphins: 201

Date 04 June, 1994

Ref# T1

Filed by Tim

Time 11:30 AM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: Direction E

Speed 25

Site Options  A  B  C  D  E  F  NA

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from:		less than 1m		
Coast	100	One to two m		White 1
		2-3m	2	Grey
Observer	35	>3m		Pink 1

Num Juveniles No of Dolphins 2

Date 04 June, 1994

Ref# T2

Filed by Tim

Time 02:55 PM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: Direction ENE

Speed 14

Site Options  A  B  C  D  E  F  NA

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from:		less than 1m	2	
Coast	150	One to two m		White
		2-3m	2	Grey 2
Observer	10	>3m		Pink 2

Num Juveniles 2 No of Dolphins 4



Date 05 June, 1994

Ref# T5c

Filed by Tim

Time 02:17 PM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: Direction E

Speed 19

Site Options  A  B  C  D  E  F  NA

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from: less than 1m  
Coast 65 One to two m  
Observer 30 2-3m 2  
>3m

White  
Grey  
Pink 5

Num Juveniles

No of Dolphins

Date 05 June, 1994

Ref# T6

Filed by Tim

Time 02:45 PM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: Direction E

Speed 19

Site Options  A  B  C  D  E  F  NA

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from: less than 1m  
Coast 200 One to two m  
Observer 100 2-3m 2  
>3m

White  
Grey  
Pink 2

Num Juveniles

No of Dolphins

Date 05 June, 1994

Ref# T5a

Filed by Tim

Time 01:25 PM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: NE  
Direction

Site Options  A  B  C  D  E  F  NA

Speed 7

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from: less than 1m  
Coast 120 One to two m  
Observer 25 2-3m 2  
>3m

White  
Grey  
Pink 2

Num Juveniles

No of Dolphins 2

Date 05 June, 1994

Ref# T5b

Filed by Tim

Time 01:50 PM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: NE  
Direction

Site Options  A  B  C  D  E  F  NA

Speed 7

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from: less than 1m  
Coast 200 One to two m  
Observer 25 2-3m 2  
>3m

White  
Grey  
Pink 2

Num Juveniles

No of Dolphins 2

Date 14 June, 1994

Ref# T8

Filed by Tim

Time 10:00 AM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: Direction SW

Speed 14

Site Options  A  B  C  D  E  F  NA

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

			less than 1m		
Distance from:		One to two m		White	
Coast	1500	2-3m	1	Grey	1
Observer	100	>3m		Pink	
		Num Juveniles		No of Dolphins	<input type="text" value="1"/>

Date 14 June, 1994

Ref# T9

Filed by Tim

Time 11:05 AM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: Direction SW

Speed 14

Site Options  A  B  C  D  E  F  NA

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

			less than 1m		
Distance from:		One to two m		White	
Coast	200	2-3m	3	Grey	
Observer	100	>3m		Pink	3
		Num Juveniles		No of Dolphins	<input type="text" value="3"/>

Date 05 June, 1994

Ref# T7

Filed by Tim

Time 04:45 PM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: Direction E

Site Options  A  B  C  D  E  F  NA

Speed 19

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from: less than 1m  
Coast 2000 One to two m 5  
Observer 60 2-3m 5  
>3m

White  
Grey 2  
Pink 3

Num Juveniles

No of Dolphins 5

Date 11 June, 1994

Ref# A1

Filed by Andy

Time 11:30 AM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: Direction S

Site Options  A  B  C  D  E  F  NA

Speed 7

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from: less than 1m  
Coast 20 One to two m 2  
Observer 15 2-3m 2  
>3m

White 1  
Grey  
Pink 1

Num Juveniles

No of Dolphins 2

Date 14 June, 1994

Ref# T11b

Filed by Tim

Time 2:20 PM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: Direction W

Site Options  A  B  C  D  E  F  NA

Speed 7

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from:

less than 1m

One to two m

White

Coast 20

2-3m 2

Grey 2

Observer 50

>3m

Pink

Num Juveniles

No of Dolphins

Date 14 June, 1994

Ref# T12

Filed by Tim

Time 3:55 PM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: Direction W

Site Options  A  B  C  D  E  F  NA

Speed 7

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from:

less than 1m

One to two m

White

Coast 300

2-3m 1

Grey

Observer 200

>3m

Pink 1

Num Juveniles

No of Dolphins

Date 14 June, 1994

Ref# T10

Filed by Tim

Time 2:05 PM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: Direction W

Site Options  A  B  C  D  E  F  NA

Speed 7

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from: less than 1m  
Coast 100 One to two m 2  
Observer 100 2-3m  
2-3m  
>3m

White  
Grey 1  
Pink 1

Num Juveniles 2

No of Dolphins

Date 14 June, 1994

Ref# T11a

Filed by Tim

Time 2:10 PM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: Direction W

Site Options  A  B  C  D  E  F  NA

Speed 7

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from: less than 1m  
Coast 2000 One to two m  
Observer 1000 2-3m 3  
2-3m  
>3m

White  
Grey  
Pink 3

Num Juveniles

No of Dolphins

Date 15 June, 1994

Ref# A4

Filed by Andy

Time 02:35 PM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: Direction W

Site Options  A  B  C  D  E  F  NA

Speed 7

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from: less than 1m  
Coast ? One to two m 4  
Observer 10-50 2-3m  
>3m

White  
Grey 2  
Pink 2

Num Juveniles

No of Dolphins 4

Date 16 June, 1994

Ref# T14

Filed by Tim

Time 11:30 AM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: Direction S

Site Options  A  B  C  D  E  F  NA

Speed 22

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from: less than 1m 1  
Coast 400 One to two m  
Observer 20-200 2-3m 3  
>3m

White  
Grey 1  
Pink 3

Num Juveniles 1

No of Dolphins 4

Date 14 June, 1994

Ref# T13

Filed by Tim

Time 04:55 PM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: Direction W

Speed 7

Site Options  A  B  C  D  E  F  NA

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from: less than 1m  
Coast 3000 One to two m 3  
Observer 30 2-3m 3  
>3m 3

White  
Grey 2  
Pink 1

Num Juveniles

No of Dolphins

3

Date 15 June, 1994

Ref# S1

Filed by Shiv

Time 12:30 PM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: Direction SW

Speed 14

Site Options  A  B  C  D  E  F  NA

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from: less than 1m  
Coast 15 One to two m 3  
Observer 20 2-3m 1  
>3m 3

White  
Grey  
Pink 4

Num Juveniles 3

No of Dolphins

4



Date 17 June, 1994

Ref# A5

Filed by Andy

Time 12:35 PM

Location  SC  PC  PowerStation

LKC  Brothers  Northwest waters

Wind:

Direction SSW

Site Options  A  B  C  D  E  F  NA

Speed 19

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from:

Coast

50

less than 1m

One to two m

2-3m 2

White 1

Grey

Observer

25

>3m

Pink 1

Num Juveniles

No of Dolphins

Date 18 June, 1994

Ref# S2

Filed by Shiv

Time 12:20 PM

Location  SC  PC  PowerStation

LKC  Brothers  Northwest waters

Wind:

Direction W

Site Options  A  B  C  D  E  F  NA

Speed 7

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from:

Coast

60

less than 1m

One to two m

2-3m 2

White 2

Grey

Observer

60

>3m

Pink

Num Juveniles

No of Dolphins

Date 16 June, 1994

Ref# A2

Filed by Andy

Time 2:40 PM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: Direction S

Site Options  A  B  C  D  E  F  NA

Speed 19

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

			less than 1m		
Distance from:			One to two m		White
Coast	50		2-3m	4	Grey 3
Observer	15		>3m		Pink 1

Num Juveniles

No of Dolphins

Date 17 June, 1994

Ref# A3

Filed by Andy

Time 12:35 PM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: Direction SSW

Site Options  A  B  C  D  E  F  NA

Speed 19

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

			less than 1m		
Distance from:			One to two m		White 2
Coast	50		2-3m	2	Grey
Observer	20		>3m		Pink

Num Juveniles

No of Dolphins

Date 19 June, 1994

Ref# S5

Filed by Shiv

Time 10:05 AM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: Direction W

Speed 4

Site Options  A  B  C  D  E  F  NA

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from:		less than 1m		
Coast	800	One to two m	3	White
Observer	20	2-3m		Grey 1
		>3m		Pink 2

Num Juveniles

No of Dolphins

Date 19 June, 1994

Ref# S6

Filed by Shiv

Time 10:25 AM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: Direction W

Speed 4

Site Options  A  B  C  D  E  F  NA

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from:		less than 1m		
Coast	1000	One to two m	3	White
Observer	10 to 100	2-3m	4	Grey
		>3m		Pink 7

Num Juveniles 3

No of Dolphins

Date 18 June, 1994

Ref# S3

Filed by Shiv

Time 12:50 PM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: Direction W

Speed 7

Site Options  A  B  C  D  E  F  NA

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from: less than 1m  
Coast 40 One to two m 2  
Observer 30 2-3m 1  
30 >3m

White  
Grey  
Pink 3

Num Juveniles 2

No of Dolphins

Date 18 June, 1994

Ref# S4

Filed by Shiv

Time 03:00 PM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: Direction ENE

Speed 7

Site Options  A  B  C  D  E  F  NA

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from: less than 1m  
Coast 20 One to two m  
Observer 20 2-3m 1  
20 >3m

White  
Grey  
Pink 1

Num Juveniles

No of Dolphins

Date 19 June, 1994

Ref# S9

Filed by Shiv

Time 02:40 PM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: WSW  
Direction

Speed 4

Site Options  A  B  C  D  E  F  NA

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from: less than 1m  
Coast 400 One to two m 2-3m 4  
Observer 150 >3m

White  
Grey 1  
Pink 3

Num Juveniles

No of Dolphins

Date 19 June, 1994

Ref# S10

Filed by Shiv

Time 02:50 PM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: WSW  
Direction

Speed 4

Site Options  A  B  C  D  E  F  NA

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from: less than 1m  
Coast 400 One to two m 2-3m 1  
Observer 20 >3m 1

White  
Grey 1  
Pink 3

Num Juveniles 2

No of Dolphins

Date 19 June, 1994

Ref# S7

Filed by Shiv

Time 11:20 AM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: Direction W

Speed 4

Site Options  A  B  C  D  E  F  NA

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from: less than 1m  
Coast 700 One to two m 2-3m 3  
Observer 200 >3m

White  
Grey  
Pink 3

Num Juveniles

No of Dolphins

Date 19 June, 1994

Ref# S8

Filed by Shiv

Time 11:50 AM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: Direction W

Speed 4

Site Options  A  B  C  D  E  F  NA

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from: less than 1m  
Coast 200 One to two m 2-3m  
Observer 20 >3m 1

White  
Grey  
Pink 1

Num Juveniles

No of Dolphins

Date 20 June, 1994

Ref# J1

Filed by June

Time 03:45 PM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: Direction E

Speed 7

Site Options  A  B  C  D  E  F  NA

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from:		less than 1m		
Coast	40	One to two m	1	White 1
Observer	20	2-3m	2	Grey
		>3m		Pink 2
		Num Juveniles	1	No of Dolphins <input type="text" value="3"/>

Date 21 June, 1994

Ref# J2

Filed by June

Time 01:45 PM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: Direction E

Speed 14

Site Options  A  B  C  D  E  F  NA

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from:		less than 1m		
Coast	60	One to two m		White
Observer	35	2-3m	2	Grey
		>3m		Pink 2
		Num Juveniles		No of Dolphins <input type="text" value="2"/>

Date 19 June, 1994

Ref# S11

Filed by Shiv

Time 04:02 PM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: WSW  
Direction

Speed 4

Site Options  A  B  C  D  E  F  NA

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

			less than 1m		
Distance from:		One to two m	2	White	
Coast	200	2-3m		Grey	1
Observer	50	>3m		Pink	1
		Num Juveniles	2	No of Dolphins	<input type="text" value="2"/>

Date 19 June, 1994

Ref# S12

Filed by Shiv

Time 04:20 PM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: WSW  
Direction

Speed 4

Site Options  A  B  C  D  E  F  NA

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

			less than 1m		
Distance from:		One to two m		White	
Coast	900	2-3m	1	Grey	
Observer	75	>3m	1	Pink	2
		Num Juveniles		No of Dolphins	<input type="text" value="2"/>



Date 25 June, 1994

Ref# S14

Filed by Shiv

Time 01:30 PM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: Direction S

Site Options  A  B  C  D  E  F  NA

Speed 14

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from:

less than 1m

One to two m

White

Coast 200

2-3m 5

Grey

Observer 40

>3m 1

Pink 6

Num Juveniles

No of Dolphins

Date 25 June, 1994

Ref# S15

Filed by Shiv

Time 01:40 PM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: Direction S

Site Options  A  B  C  D  E  F  NA

Speed 14

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from:

less than 1m

One to two m

White

Coast 150

2-3m

Grey 1

Observer 900

>3m 1

Pink

Num Juveniles

No of Dolphins

Date 21 June, 1994

Ref# J3

Filed by June

Time 03:30 PM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: Direction E

Speed 12

Site Options  A  B  C  D  E  F  NA

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from: less than 1m  
Coast 50 One to two m 2-3m 10  
Observer 50 >3m

White  
Grey 4  
Pink 6

Num Juveniles

No of Dolphins

Date 22 June, 1994

Ref# J4

Filed by June

Time 03:25 PM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: Direction ESE

Speed 12

Site Options  A  B  C  D  E  F  NA

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from: less than 1m  
Coast 20 One to two m 2-3m 8  
Observer 20 >3m

White  
Grey 2  
Pink 8

Num Juveniles 2

No of Dolphins

Date 26 June, 1994

Ref# C3

Filed by Claire

Time 04:20 PM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind:

Direction S

Site Options  A  B  C  D  E  F  NA

Speed 12

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from:

Coast 300

Observer 20

less than 1m  
One to two m 5  
2-3m  
>3m

White  
Grey 4  
Pink 1

Num Juveniles 5

No of Dolphins

Date 26 June, 1994

Ref# C4

Filed by Claire

Time 04:40 PM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind:

Direction S

Site Options  A  B  C  D  E  F  NA

Speed 12

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from:

Coast 600

Observer 200

less than 1m  
One to two m 2  
2-3m 1  
>3m

White  
Grey 2  
Pink 3

Num Juveniles 2

No of Dolphins

Date 26 June, 1994

Ref# C1

Filed by Claire

Time 11:30 AM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: Direction SSE

Site Options  A  B  C  D  E  F  NA

Speed 12

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from:

Coast 500  
Observer 200

less than 1m  
One to two m  
2-3m 1  
>3m

White  
Grey  
Pink 1

Num Juveniles

No of Dolphins

Date 26 June, 1994

Ref# C2

Filed by Claire

Time 03:30 PM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: Direction S

Site Options  A  B  C  D  E  F  NA

Speed 12

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from:

Coast 500  
Observer 500

less than 1m  
One to two m  
2-3m 1  
>3m

White  
Grey  
Pink 1

Num Juveniles

No of Dolphins

Date 27 June, 1994

Ref# J6

Filed by June

Time 03:27 PM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: Direction E

Site Options  A  B  C  D  E  F  NA

Speed 14

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from: Coast 1000  
Observer 20

less than 1m  
One to two m 3  
2-3m 3  
>3m

White  
Grey 2  
Pink 1

Num Juveniles

No of Dolphins 3

Date 28 June, 1994

Ref# S16

Filed by Shiv

Time 01:45 PM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: Direction E

Site Options  A  B  C  D  E  F  NA

Speed 19

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from: Coast 700  
Observer 50

less than 1m  
One to two m 3  
2-3m 3  
>3m

White  
Grey  
Pink 3

Num Juveniles

No of Dolphins 3

Date 26 June, 1994

Ref# S13

Filed by Shiv

Time 05:40 PM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: Direction S

Speed 12

Site Options  A  B  C  D  E  F  NA

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from:

Coast 800 less than 1m  
2-3m 2  
Observer 30 >3m 1

White

Grey

Pink 3

Num Juveniles

No of Dolphins

Date 27 June, 1994

Ref# J5

Filed by June

Time 11:35 AM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: Direction ESE

Speed 12

Site Options  A  B  C  D  E  F  NA

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from:

Coast 25 less than 1m  
2-3m 2  
Observer 15 >3m

White

Grey 2

Pink

Num Juveniles

No of Dolphins

Date 29 June, 1994

Ref# J9

Filed by June

Time 12:05 PM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind:

Direction E

Speed 14

Site Options  A  B  C  D  E  F  NA

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

less than 1m

Distance from: 2000  
Coast 100  
Observer

One to two m 1  
2-3m 4  
>3m

White  
Grey 2  
Pink 3

Num Juveniles 1

No of Dolphins

Date 01 July, 1994

Ref# C5

Filed by Claire

Time 11:30 AM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind:

Direction WSW

Speed 14

Site Options  A  B  C  D  E  F  NA

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

less than 1m

Distance from: 250  
Coast 60  
Observer

One to two m 2  
2-3m  
>3m

White  
Grey  
Pink 2

Num Juveniles 2

No of Dolphins

Date 29 June, 1994

Ref# J7

Filed by June

Time 11:25 AM

Location  SC  PC  PowerStation

Wind:

LKC  Brothers  Northwest waters

Direction E

Site Options  A  B  C  D  E  F  NA

Speed 14

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

less than 1m

Distance from:

One to two m

White

Coast 50 2-3m 1

Grey 1

Observer 105 >3m

Pink 1

Num Juveniles

No of Dolphins

Date 29 June, 1994

Ref# J8

Filed by June

Time 11:45 AM

Location  SC  PC  PowerStation

Wind:

LKC  Brothers  Northwest waters

Direction E

Site Options  A  B  C  D  E  F  NA

Speed 14

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

less than 1m

Distance from:

One to two m

White

Coast 2000 2-3m 2

Grey

Observer 55 >3m

Pink 2

Num Juveniles

No of Dolphins



Date 02 July, 1994

Ref# J10

Filed by June

Time 10:25 AM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: SE  
Direction

Site Options  A  B  C  D  E  F  NA

Speed 7

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from: 1700  
Coast  
Observer 115

less than 1m  
One to two m  
2-3m 2  
>3m

White  
Grey 2  
Pink

Num Juveniles

No of Dolphins

Date 02 July, 1994

Ref# J11

Filed by June

Time 10:30 AM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: SE  
Direction

Site Options  A  B  C  D  E  F  NA

Speed 7

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from: 2000  
Coast  
Observer 10-80

less than 1m  
One to two m  
2-3m 5  
>3m

White  
Grey  
Pink 5

Num Juveniles

No of Dolphins

Date 01 July, 1994

Ref# C6

Filed by Claire

Time 11:45 AM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: WSW  
Direction

Site Options  A  B  C  D  E  F  NA

Speed 14

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

less than 1m

Distance from:

One to two m 2

White

Coast 100

2-3m 4

Grey 3

Observer 25

>3m

Pink 3

Num Juveniles 2

No of Dolphins

Date 01 July, 1994

Ref# J14

Filed by June

Time 11:50 AM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: WSW  
Direction

Site Options  A  B  C  D  E  F  NA

Speed 14

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

less than 1m

Distance from:

One to two m

White 4

Coast 300

2-3m 6

Grey

Observer 500

>3m

Pink 2

Num Juveniles

No of Dolphins

Date 03 July, 1994

Ref# S17

Filed by Shiv

Time 01:10 PM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: Direction ENE

Speed 25

Site Options  A  B  C  D  E  F  NA

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from: less than 1m  
Coast 600 One to two m 1  
Observer 60 2-3m 1  
>3m 1

White  
Grey  
Pink 1

Num Juveniles

No of Dolphins 1

Date 03 July, 1994

Ref# S18

Filed by Shiv

Time 02:30 PM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: Direction E

Speed 22

Site Options  A  B  C  D  E  F  NA

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from: less than 1m  
Coast 100 One to two m 1  
Observer 60 2-3m 3  
>3m 1

White  
Grey 1  
Pink 4

Num Juveniles 1

No of Dolphins 5

Date 02 July, 1994

Ref# J12

Filed by June

Time 10:50 AM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: SE  
Direction

Site Options  A  B  C  D  E  F  NA

Speed 7

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from: less than 1m  
Coast 1000 One to two m 2-3m 3  
Observer 50 >3m

White  
Grey 3  
Pink 3

Num Juveniles

No of Dolphins

Date 02 July, 1994

Ref# J13

Filed by June

Time 02:30 PM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind: N  
Direction

Site Options  A  B  C  D  E  F  NA

Speed 4

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from: less than 1m  
Coast 400 One to two m 2-3m 3  
Observer 80 >3m

White  
Grey  
Pink 3

Num Juveniles

No of Dolphins

Date 03 July, 1994

Ref# S19

Filed by Shiv

Time 03:05 PM

Location  SC  PC  PowerStation  
 LKC  Brothers  Northwest waters

Wind:  
Direction E

Site Options  A  B  C  D  E  F  NA

Speed 22

Sea State  Calm  
 Slight Swell  
 Moderate Swell  
 Heavy Swell

Behaviour  feeding  
 moving  
 unknown

Direction Heading  N  
 S  
 E  
 W

Distance from:

less than 1m  
One to two m 1  
2-3m 3  
>3m 1

White  
Grey 1  
Pink 4

Coast 130

Observer 30

Num Juveniles 1

No of Dolphins

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Survey Log

## Survey Log

Date	Boat	Dolphins sighted	Land	Dolphins sighted
Sat 04 June	Yes	Yes	Yes	No
Sun 05 June	Yes	Yes	No*	No
Mon 06 June	Yes	No	Yes	No
Tue 07 June	No	NA	NA	NA
Wed 08 June	Yes	No	No*	No
Thu 09 June	Yes	No	No*	No
Fri 10 June	Yes	No	No*	No
Sat 11 June	Yes	Yes	No*	No
Sun 12 June	No	NA	NA	NA
Mon 13 June	No	NA	NA	NA
Tue 14 June	Yes	Yes	Yes	No
Wed 15 June	Yes	Yes	Yes	No
Thu 16 June	Yes	Yes	Yes	No
Fri 17 June	Yes	Yes	No*	No
Sat 18 June	Yes	Yes	No*	No
Sun 19 June	Yes	Yes	No*	No
Mon 20 June	Yes	Yes	No*	No
Tue 21 June	Yes	Yes	Yes	No
Wed 22 June	Yes	Yes	No*	No
Thu 23 June	Yes	No	Yes	No
Fri 24 June	Yes	No	Yes	No
Sat 25 June	Yes	Yes	No*	No
Sun 26 June	Yes	Yes	Yes	No
Mon 27 June	Yes	Yes	Yes	No
Tue 28 June	Yes	Yes	Yes	No
Wed 29 June	Yes	Yes	No*	No
Thu 30 June	Yes	No	Yes	No
Fri 01 July	Yes	Yes	Yes	Yes
Sat 02 July	Yes	Yes	No*	No
Sun 03 July	Yes	Yes	No*	No
Mon 04 July	Yes	No	No*	No
Tue 05 July	Yes	No	No*	No

\* External constraints (Typhoon weather conditions, boat unavailable, public holiday, difficulties with passage from boat to land etc.)

Annex C

A Preliminary Marine  
Baseline Study and Impact  
Assessment

A PRELIMINARY MARINE BASELINE STUDY  
AND  
IMPACT ASSESSMENT  
FOR THE AVIATION FUEL RECEIVING FACILITY  
AT SHA CHAU, HONG KONG



## Materials and Methods

A marine baseline study was carried out in late September 1994, to identify key habitats and species and provide a brief description on the marine faunal and floral communities in the area. The marine baseline study consisted of four surveys, namely, a diving survey, an intertidal survey, a trawl survey and a grab survey. Since the time was extremely tight, the surveys were meant to be cursory and semi-quantitative in nature, and efforts were concentrated in defining the dominant ecological components of the area. Seasonal variations, which are known to be significant, could not possibly be considered in the present study.

### 1.) Trawl survey

The trawl survey aimed at providing a semi-quantitative description on the large invertebrates (i.e. shrimps, crabs, urchins and snails etc.) and fish in the area. Six Stations were established around Sha Chau (Fig. 1). Invertebrates and fish were sampled by a local shrimp trawl [3 m in width with a trawl net of 1.8 cm mesh size (knot to knot) at the cod end]. Four trawls were taken from each of the six stations. Sampling time was five minutes per trawl and the distance covered was about 500 m, covering an area of approximately 1,200 m<sup>2</sup>. Animals caught were preserved in 70% alcohol and were identified, counted and weighted.

### 2.) Grab survey

Animals living on the sea bottom (for example, clams, sand worms, sea cucumbers etc. ) are called "benthos", and community of these animals is hence called "benthic community". The grab survey sampled these animals and aimed at providing a general description on the benthic infauna near Sha Chau. Twelve stations were established near Sha Chau (Fig. 2). Two replicate samples of benthos were collected by a van Veen grab (0.05 m<sup>2</sup>) from each of the twelve stations. Benthos collected from the sea bottom were sieved through a 0.5 mm sieve and those retained on the sieve were sorted and preserved in 5% neutralized formalin for identification in the laboratory.

### 3.) Intertidal survey

There are three types of intertidal habitats at Sha Cha, namely, rocky shores, boulder shores and sandy shores. A general survey was carried out on these intertidal habitats during low tides (0.6 m above chart datum) to provide a semi-quantitative description on animals living in these habitats. Species on rocky shores and boulder shores were recorded during the survey and the general abundance of each species noted and assigned to one of the following arbitrary scales:

<u>Scale</u>	<u>Abundance</u>
1	Very few
2	Few
3	Common
4	Very common
5	Abundant

Stratified random sampling was used in the sandy shore survey. Eight random quadrat samples (area : 0.5 m x 0.5 m; depth : 20 cm) of sand were collected from the upper tidal zone and eight from the lower tidal zones of sandy shores (including the sand bar). Sand samples were sieved and animals retained on a 3 mm sieve were identified and counted. Particular attention was given to the eggs of the Chinese king crabs.

### 3.) Diving survey

A diving survey was carried out by SCUBA divers around Sha Chau. Underwater fauna and flora encountered in the diving survey were recorded to provide supplementary information to the trawl survey results. Particular attention was given to search for Chinese king crabs in the area. Biological specimen were collected for further identification as appropriate.

## Results

### 3.1 Trawl Survey

Species recorded at the six stations are shown in Table 1. A total of 65 species were recorded in the trawl survey. This comprises of :

- 4 species of sea pens
- 1 species of sea anemones
- 1 species of coral
- 8 species of snails
- 2 species of clams
- 1 species of octopus
- 1 species of cuttle fish
- 7 species of shrimps
- 7 species of crabs
- 1 species of sea urchin
- 1 species of sea cucumber and
- 31 species of fish.

Occurrence and abundance of each species and total biomass of each trawl sample are given in Tables 2 to 7.

### 3.2 Grab Survey

Benthic species found in the grab survey, together with their numbers, are given in Table 8. A total of 24 species was found in the surveys. Species included :-

- 1 species of sea pen
- 8 species of sand worms
- 1 species of mantis shrimp
- 1 species of crab
- 8 species of snails
- 1 species of clams
- 2 species of scaphopods and
- 2 species of fish

### 3.3 Intertidal survey

#### 3.3.1 Rocky shores

A total of twelve species was found during the survey. Species identified and their general abundance are given in Table 9. Species included :

- 1 species of sea anemone
- 1 species of oyster
- 1 species of mussel
- 5 species of snails
- 2 species of barnacles
- 1 species of shrimp and
- 1 species of sea slater

These species typically distributed in two distinct zones on the shore, which comprised of :-

A Periwinkle Zone :

Dominated by the periwinkle *Littorina scabra*

A Barnacle and Oyster Zone :

Dominated by the barnacle *Tetraclita squamosa* and the oyster *Saccostrea cucullata*. The barnacle *Pollicipes mitella* was occasionally found. Newly settled oyster spat was common.

The snail *Nerita albicilla* was very common. Limpets and algae were however, not found in the survey.

**3.3.2 Boulder shores**

Boulder shores at Sha Chau typically composed of boulders resting on a clean coarse sand bed. A total of twelve species was found during the survey. Species identified and their general abundance are given in Table 10. Species identified included :

- 1 species of sea anemone
- 1 species of oyster
- 5 species of snails
- 1 species of barnacles
- 2 species of crabs
- 1 species of ribbon worms and
- 1 species of sea slater

**3.3.3 Sandy shores**

Sandy shores at Sha Chau typically composed of clean and coarse sand. Only five species were recorded and all species occurred in very low numbers. Indeed, no animal was found in 9 out of 16 quadrat samples (Table 11). Species found included:

- 2 species of snails
- 1 species of clams
- 1 species of sand worms and

1 species of sipunculid worm

The Chinese king crabs and their eggs were not found in all intertidal habitats.

### 3.4 Diving survey

Corals (Family Faviidae and Family Gorgonacea) and sea pens were commonly noted at the sub-tidal. The sabellid polychaetes were also common. The Chinese king crab was not encountered during the diving survey.

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## Figures and Tables

### **Figures**

Fig 1 Trawl Stations near Sha Chau

Fig 2 Grab Stations near Sha Chau

### **Tables**

Table 1 Species recorded in the trawl survey near Sha Chau (September 1994)

Table 2 Species caught from Station 1 in the trawl survey near Sha Chau (September 1994)

Table 3 Species caught from Station 2 in the trawl survey near Sha Chau (September 1994)

Table 4 Species caught from Station 3 in the trawl survey near Sha Chau (September 1994)

Table 5 Species caught from Station 4 in the trawl survey near Sha Chau (September 1994)

Table 6 Species caught from Station 5 in the trawl survey near Sha Chau (September 1994)

Table 7 Species caught from Station 6 in the trawl survey near Sha Chau (September 1994)

Table 8 Species and abundance of benthos recorded in the grab survey near Sha Chau (September 1994) (2 replicates pooled)

Table 9 Species recorded on rocky shores at Sha Chau during the survey

Table 10 Species recorded on boulder shores at Sha Chau during the survey

Table 11 Species recorded on sandy shores at Sha Chau during the survey





龍鼓洲  
LUNG KWU CHAU

URMSTON ROAD

白洲  
TREE ISLAND  
(Pak Chau)

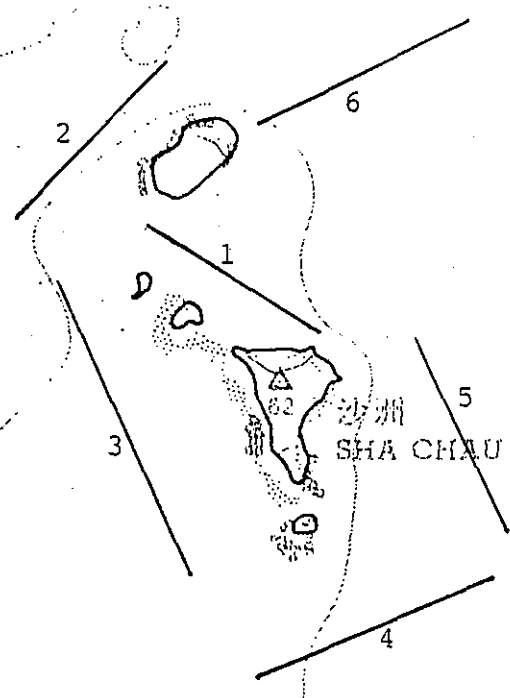
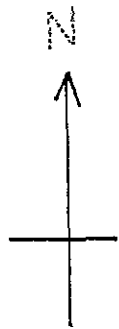


Fig. 1 Trawl Stations near Sha Chau



龍鼓洲  
LUNG KWU CHAU

URMISTON ROAD

白洲  
TREE ISLAND  
(Pak Chau)

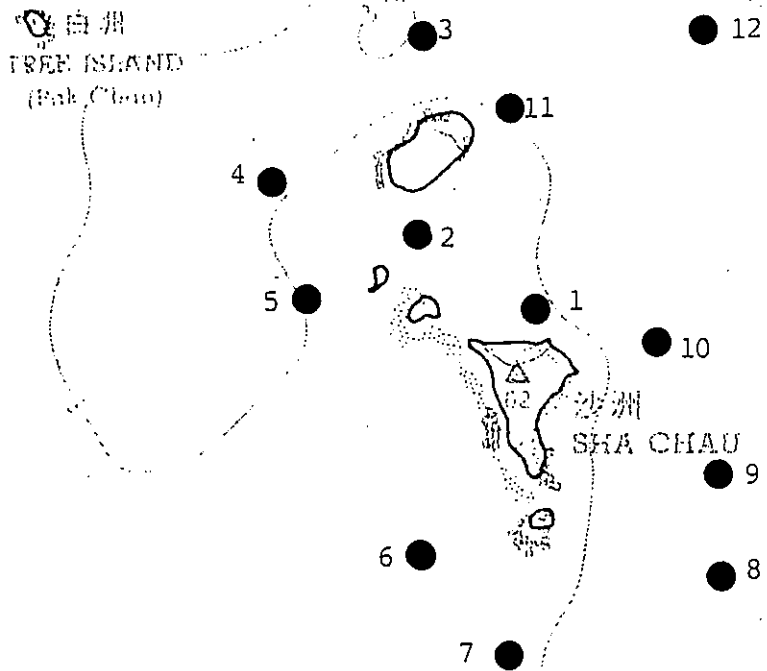


Fig. 2 Grab Stations near Sha Chau

**Table 1 Species recorded in the trawl survey near Sha Chau (September 1994)**

**Sea pens, anemones and corals**

*Pteroides esperi*  
*P. sparmanni*  
*Sclerobelemnon burgeri*  
*Virgularia gustaviana*  
Unidentified anemones  
Gorgonacea

**Snails**

*Babylonia areolata*  
*Bursa rana*  
*Fulgoraria* sp.  
*Murex trapa*  
*Nassarius crematus*  
*Thais* sp.  
*Turritella terebra*  
Unidentified sea slug

**Clams**

*Anadara broughtonii*  
*A. granosa*

**Octopus and Cuttle fish**

*Octopus aeginea*  
*Sepia* sp.

**Shrimps & Mantis shrimp**

*Metapenaeus ensis*  
*Oratosquilla oratoria*  
*Parapenaeopsis hungerfordi*  
*Parapenaeopsis* sp.  
*Penaeus latisulcatus*  
*P. pencillatus*  
*Penaeus* sp.

**Crabs**

*Charybdis cruciata*  
*Charybdis variegatus*  
*Portunus pelagicus*  
*Portunus hastatoides*  
*Thalamita picta*  
Unidentified crab sp.  
Unidentified hermit crab

Cont'd

**Sea urchin***Temnopleurus toreumaticus***Sea cucumber***Paracaudina* sp.**Fish***Arius sinensis**Chaeturichthys hexanema**Collichthys lucida**Cynoglossus macrolepidotus**C. melanpetalus**Dasyatis* sp.*Eleutheronema* sp.*Fugu* sp.*Gerreomorpha japonica**Gerres filamentosa**Gymnothorax* sp.*Hapodon nehereus**Inimicus japonicus**Johnius belengeri**Leiognathus brevivostris**Muraenox cinereus**Oxyurichthys tentacularis**Paralichthys olivaceus**Platycephalus indicus**Sardinella* sp.*Sciaena* sp.*Siganus oramin**Silago sihama**Solea orata**Syngnathus acus**Tetrodon* sp.*Trypauchen vagina**Vespicula boltac**Zebrias zebra*

Unidentified gobbies

Unidentified fish sp.

Table 2 Species caught from Station 1 in the trawl survey near Sha Chau (September 1994)

	Trawl 1	Trawl 2	Trawl 3	Trawl 4
<b>Sea pens, anemones, corals</b>				
<i>Pteroides esperi</i>	3	1	2	2
<i>P. sparmanni</i>	1			2
<i>Sclerobelemnon burgeri</i>		3		1
<i>Virgularia gustaviana</i>	8	1	3	
Unidentified anemones				1
Gorgonacea	1			
<b>Snails</b>				
<i>Turritella terebra</i>	4			
Unidentified sea slug		1		1
<b>Shrimps &amp; Mantis shrimp</b>				
<i>Metapenaeus ensis</i>	1	2		
<i>Oratosquilla oratoria</i>	1		2	4
<i>Parapenaeopsis hungerfordi</i>	1	2	4	
<i>Penaeus latisulcatus</i>			1	3
<i>Penaeus sp.</i>				6
<i>Parapenaeopsis sp.</i>	2		1	
<b>Crabs</b>				
<i>Charybdis cruciata</i>				
<i>Charybdis variegatus</i>	4		2	2
<i>Portunus pelagicus</i>				
<i>Portunus hastatoides</i>		1		
<b>Sea cucumber</b>				
<i>Paracaudina sp.</i>	1		1	2
<b>Fish</b>				
<i>Arius sinensis</i>	4			
<i>Collichthys lucida</i>				2
<i>Cynoglossus macrolepidotus</i>		1		
<i>Eleutheronema sp.</i>	1			
<i>Fugu sp.</i>	8	4	2	5
<i>Gerreomorpha japonica</i>				1
<i>Gerres filamentosa</i>				1
<i>Johnius belengeri</i>	2	1	3	7
<i>Leiognathus brevirostris</i>	32	9	25	48
<i>Platycephalus indicus</i>	3	2	1	2
<i>Sciaena sp.</i>				1
<i>Siganus oramin</i>				1
<i>Trypauchen vagina</i>	3	3	3	16
Unidentified gobies	1	1		7
Unidentified fish sp.		3	1	1
<b>Total no. of sp.</b>	19	15	14	22
<b>Total no. of individuals</b>	81	35	51	116
<b>Total biomass (Kg)</b>	3.4	1.3	1.5	2.5

Table 3 Species caught from Station 2 of the trawl survey near Sha Chau (September 1994)

	Trawl 1	Trawl 2	Trawl 3	Trawl 4
<b>Sea pens, anemones, corals</b>				
<i>Pteroides esperi</i>		1		
<i>Sclerobelemnon burgeri</i>		1	3	
Unidentified anemones			1	
Gorgonacea	1			
<b>Snails</b>				
<i>Babylonia areolata</i>		1		
<i>Murex trapa</i>	22	18	39	24
<i>Turritella terebra</i>	115	214	520	490
<b>Clams</b>				
<i>Anadara broughtonii</i>			2	
<i>A. granosa</i>	1			
<b>Octopus</b>				
<i>Octopus aeginea</i>	1			
<b>Shrimps &amp; Mantis shrimp</b>				
<i>Metapenaeus ensis</i>	6	2		1
<i>Oratosquilla oratoria</i>	3		3	7
<i>Parapenaeopsis hungerfordi</i>	1	1	4	2
<i>Parapenaeopsis</i> sp.	1			
<b>Crabs</b>				
<i>Charybdis variegatus</i>	1	4		10
Unidentified crab sp.	1		1	
<b>Sea cucumber</b>				
<i>Paracaudina</i> sp.			2	2
<b>Fish</b>				
<i>Collichthys lucida</i>				1
<i>Cynoglossus macrolepidotus</i>	1	1		1
<i>Johnius belengeri</i>		1	5	2
<i>Oxyurichthys tentacularis</i>	3	2	4	
<i>Solea orata</i>				1
<i>Syngnathus va acus</i>				1
<i>Trypauchen vagina</i>		8	4	3
<b>Total no. of sp.</b>	13	12	12	13
<b>Total no. of individuals</b>	157	254	588	545
<b>Total biomass (Kg)</b>	1.9	2.6	5.4	5.2

**Table 4 Species caught from Station 3 in the trawl survey near Sha Chau (September 1994)**

	Trawl 1	Trawl 2	Trawl 3	Trawl 4
<b>Sea pens, sea anemones</b>				
Sclerobelemnon burgeri		3	1	
Unidentified anemones	1	3	1	
<b>Snails</b>				
Bursa rana	1			
Murex trapa	357	233	268	289
Turritella terebra	1580	1024	1400	1100
<b>Shrimps &amp; Mantis shrimp</b>				
Metapenaeus ensis	4	7	6	8
Oratosquilla oratoria				1
Parapenaeopsis hungerfordi	3	2	3	3
Penaeus latisulcatus				1
<b>Crabs</b>				
Charybdis variegatus	7		5	1
Ceratoplax sp.	1			
Eucrate sp.	2			
Porcellana sp.	1		2	
Portunus hastatoides	1		1	
P. pelagicus				1
Unidentified crab sp.	1			
<b>Sea urchin</b>				
Temnopleurus toreumaticus			3	
<b>Sea cucumber</b>				
Paracaudina sp.				1
<b>Fish</b>				
Arius sinensis				1
Chaeturichthys hexanema	1			
Cynoglossus macrolepidotus	1	1		
Fugu sp.	1	2	2	
Inimicus japonicus				1
Johnius belengeri		1	1	1
Leiognathus brevivostris		3	3	
Muraenox cinereus		1		
Oxyurichthys tentacularis				1

Cont'd

Table 4      Cont'd

Paralichthys olivaceus	1	1		1
Platycephalus indicus	1	1	4	3
Silago sihama	1			1
Solea orata		1		
Syngnathus vaacus	4	2	2	3
Trypauchen vagina	4		1	
Zebrias zebra		1		
Unidentified gobbies				1
Unidentified fish sp.		3		
<b>Total no. of sp.</b>	21	18	18	21
<b>Total no. of individuals</b>	1973	1289	1703	1418
<b>Total biomass (kg)</b>	20.8	14.3	18.2	15



**Table 5 Species caught from Station 4 in the trawl survey near Sha Chau (September 1994)**

	Trawl 1	Trawl 2	Trawl 3	Trawl 4
<b>Sea pens, sea anemones</b>				
Sclerobelemnon burgeri	2		1	1
Unidentified anemones			1	3
<b>Snails</b>				
Fulgoraria sp.			1	
Murex trapa	117	34	95	156
Turritella terebra	756	675	820	1560
<b>Octopus</b>				
Octopus aeginea	1			
<b>Shrimps &amp; Mantis shrimp</b>				
Metapenaeus ensis	4	1	2	1
Oratosquilla oratoria	7		2	1
Parapenaeopsis hungerfordi			1	1
<b>Crabs</b>				
Charybdis cruciata				1
Charybdis variegatus	11		6	
Thalamita picta		1		2
<b>Fish</b>				
Cynoglossus macrolepidotus	1	1	1	
Johnius belengeri		3		
Oxyurichthys tentacularis			1	
Paralichthys olivaceus			1	
Platycephalus indicus	2		2	
Syngnathus va acus	1		2	
Trypauchen vagina	1	1	1	1
Unidentified gobies			1	
<b>Total no. of sp.</b>	<b>11</b>	<b>7</b>	<b>16</b>	<b>10</b>
<b>Total no. of individuals</b>	<b>903</b>	<b>716</b>	<b>938</b>	<b>1727</b>
<b>Total biomass (Kg)</b>	<b>24.6</b>	<b>7.9</b>	<b>11.2</b>	<b>18.2</b>

**Table 6 Species caught from Station 5 in the trawl survey near Sha Chau (September 1994)**

	Trawl 1	Trawl 2	Trawl 3	Trawl 4
<b>Sea pens, anemones</b>				
<i>Pteroides esperi</i>		1		
<i>P. sparmanni</i>			1	
<i>Sclerobelemnon burgeri</i>	2	1	2	
<i>Sclerobelemnon sp.</i>	2		2	
Unidentified anemones			1	1
<b>Snails</b>				
<i>Murex trapa</i>	8	39	45	8
<i>Turritella terebra</i>	40	46	80	20
<b>Shrimps &amp; Mantis shrimp</b>				
<i>Metapenaeus ensis</i>	4	1		
<i>Oratosquilla oratoria</i>	2	3	5	3
<i>Parapenaeopsis hungerfordi</i>	2	2	3	3
<i>Penaeus latisulcatus</i>			2	
<i>P. pencillatus</i>			2	
<i>Penaeus sp.</i>		4	3	3
<i>Parapenaeopsis sp.</i>	3			
<b>Crabs</b>				
<i>Charybdis variegatus</i>	7	6	1	
<b>Sea urchin</b>				
<i>Temnopleurus toreumaticus</i>		1		2
<b>Fish</b>				
<i>Collichthys lucida</i>	1	1		1
<i>Cynoglossus macrolepidotus</i>		1		
<i>Harpodon nehereus</i>		1		
<i>Johnius belengeri</i>	8	6	4	2
<i>Leiognathus brevivostris</i>			1	
<i>Oxyurichthys tentacularis</i>	9	5	2	6
<i>Platycephalus indicus</i>		1		
<i>Solea orata</i>	1			
<i>Trypauchen vagina</i>	5	4	4	5
Unidentified gobbies			2	
<b>Total no. of sp.</b>	14	17	17	11
<b>Total no. of individuals</b>	94	123	160	54
<b>Total biomass (Kg)</b>	0.7	0.9	1.4	0.6

**Table 7 Species caught from Station 6 in the trawl survey near Sha Chau (September 1994)**

	Trawl 1	Trawl 2	Trawl 3	Trawl 4
<b>Sea pens, anemones</b>				
<i>Pteroides esperi</i>			1	
<i>Sclerobelemnon burgeri</i>	4	6	3	13
<i>Virgularia gustaviana</i>		1		
Unidentified anemones				1
<b>Snails</b>				
<i>Bursa rana</i>	1	2		
<i>Fulgoraria</i> sp.	1	1	1	2
<i>Murex trapa</i>	21	10	12	20
<i>Nassarius crematus</i>	1	3	2	2
<i>Thais</i> sp.	2			
<i>Turritella terebra</i>	80	128	40	42
<b>Clams</b>				
<i>Anadara granosa</i>	1			
<b>Cuttle fish</b>				
<i>Sepia</i> sp.	1	1		
<b>Shrimps &amp; Mantis shrimp</b>				
<i>Oratosquilla oratoria</i>	5		1	2
<i>Parapenaeopsis hungerfordi</i>	1	3	1	
<i>Parapenaeopsis</i> sp.	1	1	2	
<i>Penaeus latisulcatus</i>			1	3
<i>P. pencillatus</i>	1	2		
<i>Penaeus</i> sp.				
<b>Crabs</b>				
<i>Charybdis variegatus</i>	5	3	2	6
<i>Portunus hastatoides</i>	1			4
<i>Thalæmita picta</i>			1	
Unidentified hermit crab	3	3		3
<b>Sea urchin</b>				
<i>Temnopleurus toreumaticus</i>				1
<b>Sea cucumber</b>				
<i>Paracaudina</i> sp.	1			

cont'd

Table 7 Cont'd

Fish				
Chaeturichthys hexanema	3	3	3	1
Collichthys lucida			2	
Cynoglossus macrolepidotus	1			
Dasyatis sp.		1		
Fugu sp.	1			
Gymnothorax sp.	1			
Johnius belengeri	1			2
Leiognathus brevivostris	1		2	1
Platycephalus indicus	1	2		2
Tetrodon sp.	1			
Trypauchen vagina	2	3	3	8
<b>Total no. of species</b>	<b>26</b>	<b>17</b>	<b>17</b>	<b>19</b>
<b>Total no. of individuals</b>	<b>142</b>	<b>173</b>	<b>77</b>	<b>113</b>
<b>Total biomass</b>	<b>2</b>	<b>3.2</b>	<b>1.6</b>	<b>1.5</b>

**Table 8 Species and abundance of benthos recorded in the grab survey near Sha Chau (September 1994) (2 replicates pooled)**

	STATION											
	1	2	3	4	5	6	7	8	9	10	11	12
<b>Sea pen</b>												
<i>Virgularia gustaviana</i>		1									1	
<b>Sand worms</b>												
<i>Cirriformis tentaculata</i>			1									
<i>Glycera chiori</i>	1					1						
<i>Marphysa stragulum</i>				1								
<i>Notomastus latericeus</i>		1							2			
<i>Terebellides</i> sp.		1										
Unidentified errantia										2		1
<i>Sedentaria</i> sp. 1					1							
<i>Sedentaria</i> sp. 2					1							
<b>Mantis shrimp</b>												
<i>Oratosquilla oratoria</i>											1	
<b>Crab</b>												
Unidentified crab larvae										2		
<b>Snails</b>												
<i>Cancellaria</i> sp. ?				1								
<i>Cerithidea</i> sp.					1							
<i>Nassarius succinatus</i>			2		1	2	1		3		1	1
<i>Nassarius</i> sp.							1					
Neridae			1			2	1	1				
<i>Turbo reeves</i>							1					
<i>Turitella terebra</i>	1						1			1		
<i>Umbonium</i> sp.							1		1	2		
<b>Clams</b>												
<i>Anomalocardia squamosa</i>				1								
<b>Scaphopods</b>												
<i>Dentalium</i> sp. 1					1	1	1				1	
<i>Dentalium</i> sp. 2						1		1				
<b>Fish</b>												
<i>Trypauchen vagina</i>			1									
Unidentified juvenile fish								1				
<b>Total no. of species</b>	2	3	4	3	5	5	7	3	3	4	4	2
<b>Total no. of individuals</b>	2	3	5	3	5	7	7	3	6	7	4	2

**Table 9 Species recorded on rocky shores at Sha Chau during the survey**

	<b>General Abundance</b>
<b>Sea anemones</b>	
<i>Haliplanella luciae</i>	2
<b>Oyster</b>	
<i>Saccostrea cucullata</i>	5
<b>Mussel</b>	
<i>Barbatia obliquata</i>	3
<b>Snails</b>	
<i>Littorina scabra</i>	5
<i>Monodonta australis</i>	1
<i>Nerita albicilla</i>	4
<i>Nerita chameleon?</i>	2
<i>Thais clavigera</i>	2
<b>Barnacles</b>	
<i>Pollicipes mitella</i>	2
<i>Tetraclita squamosa</i>	4
<b>Shrimp</b>	
<i>Alpheus</i> sp.	1
<b>Sea slater</b>	
<i>Ligia exotica</i>	5

Note:

- 1 Very few
- 2 Few
- 3 Common
- 4 Very common
- 5 Abundant

**Table 10 Species recorded on boulder shores at Sha Chau during the survey**

**General Abundance**

**Sea anemones**

*Haliplanella luciae* 2

**Oyster**

*Saccostrea cucullata* 3

**Snails**

*Littorina scabra* 3

*Monodonta australis* 1

*Nerita albicilla* 4

*Thais clavigera* 2

Unidentified sea slug 1

**Barnacle**

*Tetraclita squamosa* 2

**Crabs**

*Hemigrapsus sanguineus* 4

*Parasesarma pictum* 1

**Ribbon worm**

Unidentified nemertean 1

**Sea slater**

*Ligia exotica* 5

**Note:**

1 Very few

2 Few

3 Common

4 Very common

5 Abundant

**Table 11 Species recorded on sandy shores at Sha Chau during the survey**

	Quadrat															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
<b>Snails</b>																
Nerita albicilla				1	5	1				1			3	4		
Nassarius sp.														4		
<b>Clams</b>																
Tapes philippinarium									1	1				1		
<b>Worms</b>																
Nephtys sp.														1		
<b>Sipunculid worm</b>																
Phascolosoma scolops									1							
<b>Total no. of species</b>	0	0	0	1	1	1	0	0	2	2	0	0	1	4	0	0
<b>Total no. of individuals</b>	0	0	0	1	5	1	0	0	2	2	0	0	3	10	0	0

Note: Quadrat No 1 to 8 : Upper tidal Qaudrat No. 9 to 16 : Lower tidal



which has been carried to the south of Lung Kwu Chau by the ebb tide. The subsequent ebb tide, after 36 hours, carries the remaining fuel northwards until it is positioned 5km south of Shekou. After 48 hours the spill has ebbed southwards and is now south of Lung Kwu Chau. The next flood tide, after 60 hours, carries the spill northwards again to be 8km south of Shekou. The spill is no longer present in significant concentrations after 72 hours.

Based upon the above results it is thought unlikely that any expected spill, up to the magnitude of that for Scenario 4, will have any impact on Deep Bay beyond the entrance at the Black Point power station.

The WAHMO random walk sediment plume model was used to investigate the fate of sediment plumes generated by the dredging works for the proposed fuel receiving facility at

Annex D

## Sha Chau Sediment Plume and Spill Modelling

There are several existing models within the WAHMO suite of models developed for the Hong Kong Government which could have been applied in this study and the most suitable are described below.

### 1.1

#### *TIDAL FLOW MODEL*

In order to simulate the transport by tidal currents of either sediment in suspension or a fuel spill, it is first necessary to simulate the tidal flows. As a result of recent studies for the PAA and the Government, the WAHMO two-dimensional two-layer model of wet and dry season spring and neap tides has been used to simulate the future reclamation layout with the airport in place. Tidal flow simulations for two reclamation layouts are available: all planned reclamations to the year 2003; the airport reclamation with the 1990 reclamation layout in Victoria Harbour and the Western Harbour. In the area of interest, it is not thought that the reclamations in the Western Harbour and Victoria Harbour will have a large impact and it was therefore proposed that the 2003 layout be used for all simulations.

This model has a 250m resolution in the horizontal and uses two layers over the vertical to represent that stratified flow conditions found in the wet season. With the Government's permission, the existing results from this model were used directly as the basis for further simulations of sediment plumes and fuel spills and no further tidal flow modelling was required.

The available flow model results are based on the existing bathymetry in the area which is directly relevant for the simulation of sediment plumes at the commencement of the dredging. Without re-running the model to simulate the increased depths over the dredged areas, it must be assumed that, following completion of dredging, flow fields are not changed significantly by the increased water depths. In reality, flows over the dredged area and very local to the dredged areas will change slightly. However, remote from the dredged areas, water velocities will remain unchanged by the limited local area dredging which will be carried out and, for the simulation of the sediment plumes and fuel spills, future dredged depths were not simulated. Considering the relatively small area to be dredged, the model's 250m horizontal resolution would not be suitable for a detailed simulation of the water velocities following dredging and, without setting up a higher resolution model, it is considered that the present flow model results are the most suitable available for use in this study.

### 1.2

#### *SEDIMENT PLUME MODELLING*

The WAHMO sediment plume model was used to simulate the fate of sediment lost to suspension during dredging. This model uses a large number of discrete particles to simulate the transport and dispersion of a continuous plume and can use a higher horizontal resolution than the tidal flow model to ensure that relatively narrow plumes are represented accurately. In order to simulate turbulent mixing processes, each particle is given a random displacement at every model timestep (of the order of 50-

60 seconds). In its basic form, the model can be used to simulate the transport and dispersion of a neutrally buoyant parameter.

When simulating sediment transport, the model includes the processes of settling, deposition and re-erosion based on the physical properties of a large sediment sample collected over Chek Lap Kok Bank and tested in the laboratory.

In previous studies of sediment plumes, for the dredging equipment commonly available in Hong Kong, it has been assumed that 5% of the dredged mud is lost to suspension near the water surface. Previous studies in Europe have indicated potential losses to lie in the range 3% to 5% and the figure of 5% has been adopted as the worst case. Assuming all spoil losses enter the water column at the surface also ensures minimum re-settlement locally and it is thought that the simulated plumes should not, therefore, be an underestimate of the possible dredging plumes which might be generated.

Some processes, such as the rate of settling of suspended mud, depend on the suspended sediment concentration when concentrations become sufficiently high. The model assumes zero natural background sediment concentrations and simulates the additive impact of the dredging losses. For the relatively low background and spoil generated concentrations involved, however, assuming zero background concentration will not have an impact on the settling velocity.

The results from this model would be presented as plan contour plots of suspended sediment concentrations in the surface and bed layers and of net bed deposits generated by settling of the spoil losses. The variation in suspended sediment concentrations over the tidal cycle at a number of individual points can also be produced.

### 1.3

#### *FUEL SPILL MODELLING*

In order to simulate a buoyant fuel spill, the plume model was applied using buoyant particles to simulate a surface layer. The model includes a 'decay' rate which can be set to simulate the process of evaporation and emulsification.

In this application, rather than simulating a point source such as a dredger, information on the extent of the initial spread of a spill of a given size was used to define the starting area over which the particles representing the spill would be distributed. This initial impact area was provided by the ERM spill model.

Having set up the initial spill area, the model was run to simulate the transport, dispersion and degradation of the fuel spill. Any coastal areas impacted by the spill were identified by examining plan contour plots at frequent times throughout the simulation.

### 1.4

#### *TIDES TO BE MODELLED*

In the time available, it was necessary to limit the number of simulations carried out. For the simulations of sediment plumes generated by dredging

activities, it is the model was used to simulate wet and dry season large amplitude spring tides. Water velocities are generally larger on the larger amplitude tides and, from previous studies of sediment plumes in the Urmston Road area, use of the spring tides minimised initial settling of the spoil losses to the sea bed and indicated the larger area which might be impacted by sediment losses. (Smaller amplitude neap tide simulations would probably generate higher suspended sediment concentrations close to the dredger but much of the initial losses would settle to the sea bed locally with a resulting smaller sediment plume or lower concentration plume).

For the fuel spill modelling, wet and dry season spring tides were simulated. The spring tides would transport the spill further than the smaller amplitude tides and so give a better indication of the overall length of coastline which could be impacted by a spill.

## 1.5

### *WIND EFFECTS*

The most accurate way to simulate the impact of winds on plume movements is to include the wind stress in the simulation of tidal flows. However, simulating many different combinations of winds and tidal types can be time consuming. As a result, the plume model can accept a specified wind speed and use analytical methods to move the plume according to the tidal and estimated wind induced water velocities. For the range of wind speeds of interest (up to Typhoon Signal No. 3 say (17.2m/s)), wind induced water speeds near the surface should be of the order of 1½%-3% of the wind speed (up to 0.05m/s say). Compared to the typical tidal currents (typically 10 to 30 times larger in the area of interest), in the first instance, it was proposed that the impact of winds was not simulated.

## 1.6

### *AREA TO BE MODELLED*

The attached *Figure D.1* shows the area for plume modelling, and the locations of monitoring stations/sensitive receivers. The model in fact covers the whole of the Pearl Estuary and waters to the south of Hong Kong and as large an area as necessary to contain the sediment and fuel plumes wa modelled. However, in the interests of fast model simulation times, the area indicated was used.

## 1.7

### *SEDIMENT PLUME METHODOLOGY*

The proposed locations of the sediment release points for the sediment plume modelling simulations, of the dredging activities associated with the proposed AFRF, are indicated on *Figure D.2*.

The dredging activities for the access channel & turning circle and pipeline trench were each simulated by two sediment release points. This is based on there being two grab dredgers working at the same time for each activity. The locations of the release points have been chosen so that the sediment plumes cover the largest possible area thus indicating the maximum possible extent of sediment. It is believed to be a reasonable scenario as separate dredgers will work on the access channel and on the turning circle and the dredgers on the pipeline trench would start at either end and move inwards towards each other. If, as seems likely, time for

construction is short then all dredging activities would happen simultaneously.

Hydrodynamic data was provided by the 250m Extended WAHMO flow model with only the airport platform reclamation in place, rather than the model with reclamations up to 2003. Although the airport platform case does not include such reclamations as North Lantau, Black Point and Tung Chung it is believed to be the best representation of the flow regime at the time of construction of the fuel facility. This is because the reclamations which are not included have little or no effect on the flow field in the area of interest. It was proposed that SEDPLUME simulations be carried out for the wet and dry season spring tides as these conditions give the worst impacts from the plumes generated by the dredging activities. The sediment plume model then uses a finer grid of 125m in order to give a better resolution of the plumes.

Based upon dredging details supplied, the maximum likely dredging rate for the access channel, turning circle and pipeline trench will be 8,333 m<sup>3</sup>/day for each activity. Therefore, each dredger will dredge at a rate of 4,166.5 m<sup>3</sup>/day which is equivalent to 0.048 m<sup>3</sup>/s. Assuming a loss to suspension of 5% and a dry density of 488 kg/m<sup>3</sup> for the fines material lost to suspension gives a loss rate of 1.2 kg/s/dredger. As each sediment release point in the SEDPLUME model represents a dredger this was the loss rate employed in the model.

## 1.8

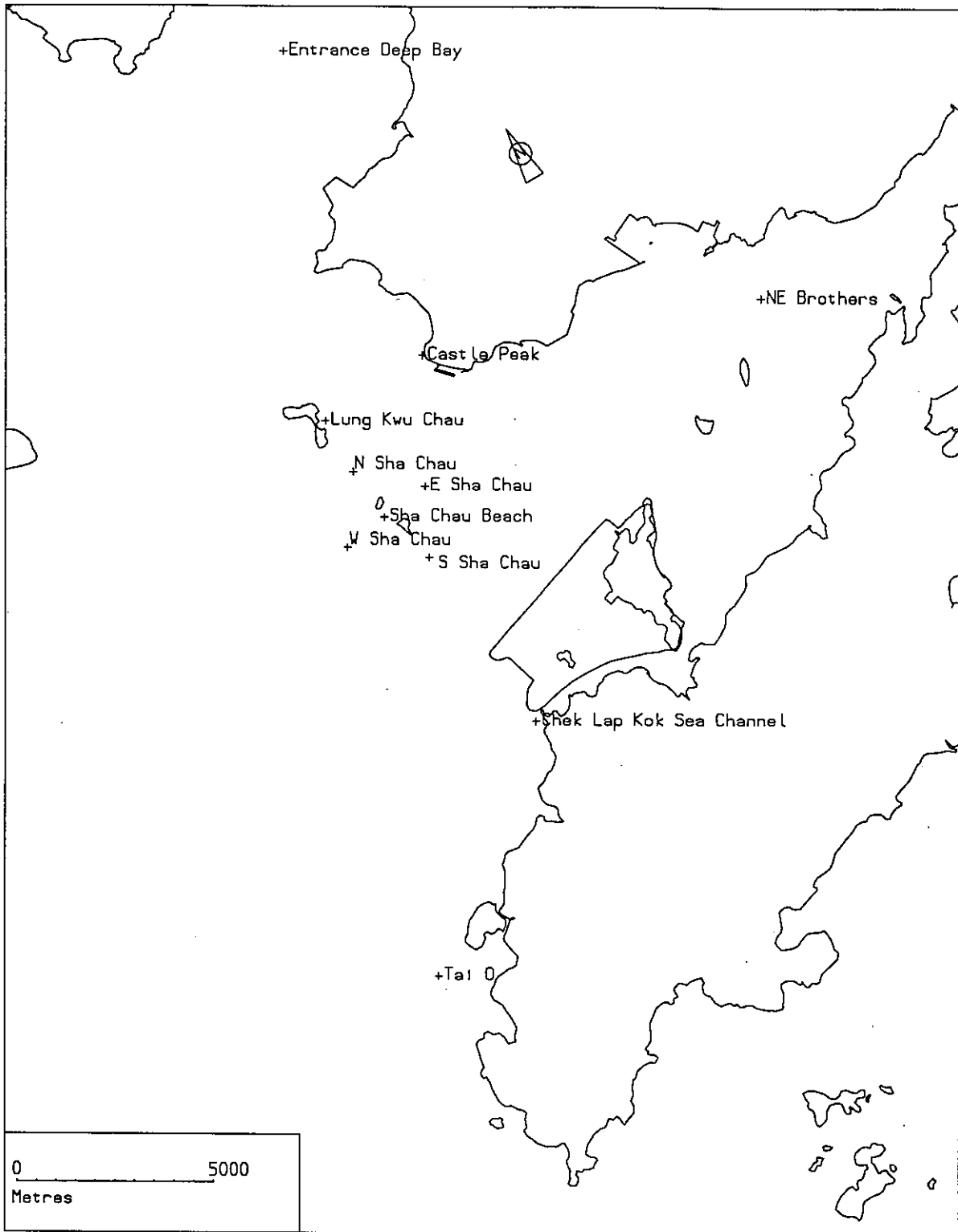
### *RESULTS OF SEDIMENT PLUME SIMULATIONS*

#### **Wet Season Spring Tide**

The results of the sediment plume simulations are indicated on *Figures 4.1j* and *4.1k*. The contours of suspended sediment concentration for peak flood show the maximum flood extend of the plume to be to the west of the mid-point of the entrance to Deep Bay. The sediment concentrations are mostly within the range of 1–5ppm in the surface layer, with isolated spots in the range of 5–10ppm. The plots of the bed layer show high localised concentrations, greater than 15ppm, along the western edge of the Urmston Road and off the south western coast of Lantau Island. This is due to erosion of bed material which has been deposited during the course of the model simulation. This material will remain within the bed layer and be redeposited at slack water.

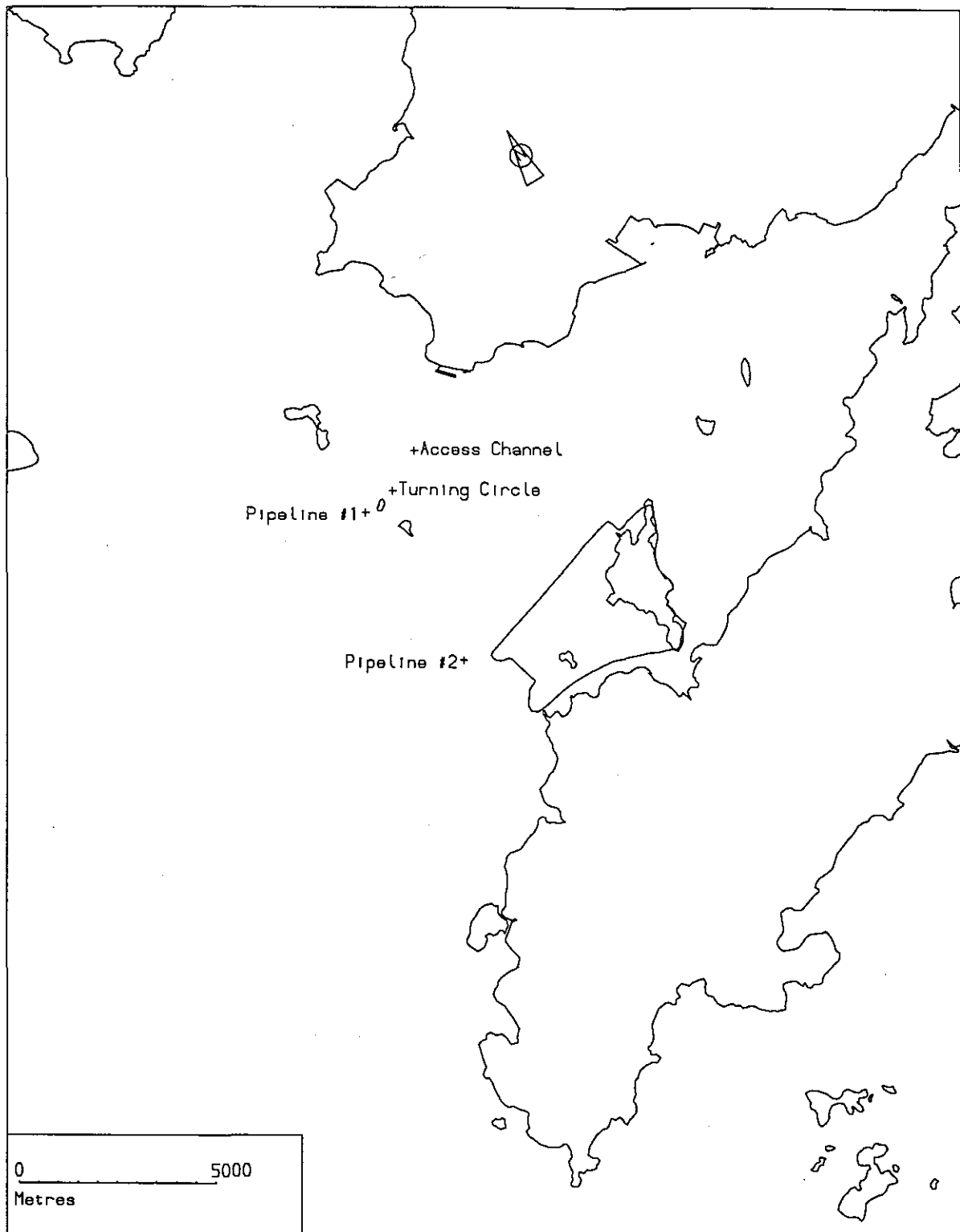
The plot of suspended sediment for peak ebb show the maximum extent of the ebb plume to be to the to beyond the south western tip of Lantau Island. There is also a very narrow plume to the east extending to the Brothers. The surface layer plume is mostly in the range 1–5ppm, with small areas in the range 5–10ppm. Again there are regions within the bed plume of greater than 15ppm, which are due to erosion of recently deposited material. These high concentration regions are more extensive than for the peak flood plume. This is due to the ebb currents being of a 2higher magnitude than for the flood. The behaviour of this eroded m222aterial will be as described above for the peak flood.

For both the peak flood and ebb plots of the suspended sediment concentration, the plume is shown to be mostly constrained by the



AFRF at Sha Chau  
Sediment Losses from Dredging Activities  
Locations of Monitoring Stations/  
Sensitive Receivers

*Figure D1*



AFRF at Sha Chau  
Sediment Losses from Dredging Activities  
Locations of Sediment Sources

*Figure D2*



dominant north-south current direction in the area to the west of Sha Chau. The plume does not cross the Urmston Road but remains on the western side of the channel and hence does not enter Deep Bay. The plume is shown not to impact anywhere along the Lantau coast.

The contours of mud deposits show that mud is spread over a large area covering the maximum extent of the suspended sediment plumes. There are no significant differences between the deposits as high and low water. The majority of the deposits are low, in the range  $0.01-0.1\text{mg}/\text{m}^2$ . However, larger deposits are shown along the outer western edge of the Urmston Road and off the south western coast of Lantau Island. These deposits correspond to the regions of high suspended sediment concentration in the bed layer which shows that this material is in fact re-deposited at slack water.

The time history plots show the peak concentration to be at Station N Sha Chau and is of the value 13ppm. In general the time history plots show higher concentrations around Sha Chau with much lower concentrations away from Sha Chau. There is no impact at either Deep Bay or at Castle Peak Power Station intake.

#### Dry Season Spring Tide

The plots of suspended sediment concentration for peak flood show the maximum flood extent of the plume to be past the entrance to Deep Bay to the west of Shekou. The sediment concentrations, in the surface layer, are mostly in the range 1-5ppm with isolated areas in the range 5-10ppm. As for the wet season spring tide, there are areas of high concentration greater than 15ppm in the bed layer. This is again due to erosion of recently deposited material and the sediment will remain in the bed layer and be re-deposited at slack water.

On the contour plots for peak ebb the maximum ebb extent of the plume is shown to be south past Tai O and east to the vicinity of the Brothers. In the surface layer the majority of the plume is in the range 1-5ppm, with smaller areas in the range 5-10ppm. As previously there are areas of high concentration, greater than 15ppm, due to erosion of the recently deposited bed material.

As for the wet season spring tide the flood plume is constrained by the dominant north-south tidal currents in the vicinity. However, the extent of the flood plume is greater than for the wet season. This has resulted in sediment being further to the north and west. On the ebb ride this material has not only then been carried to the south but to the east as it meets the flows to the east of Sha Chau. Again the plumes are not shown to enter Deep Bay or to impact on the Lantau coastline.

The contours of mud deposits show that mud is spread over a large area covering the maximum extent of the suspended sediment plumes. The high water deposits are more extensive than the low water deposits along the western edge of the Urmston road. The low water deposits cover a large area off the south western coast of Lantau. As for the wet season tide the majority of the mud deposits are in the range of  $0.01-0.10\text{kg}/\text{m}^3$ . Higher deposits are shown along the outer western and southern edges of the

Urmston Road and off the south western coast of Lantau which corresponds to the high suspended sediment concentrations in the bed layer.

The peak values on the time history plots are generally lower than for the wet season with the maximum being 7ppm at N Sha Chau. The average concentrations at the stations are generally higher than for the wet season which is a result of the larger spread of the dry season plume. As before there is no impact at either Deep Bay or at Castle Peak Power Station intake.

## 1.9 *RESULTS OF FUEL SPILL MODELLING*

### 1.9.1 *Scenario 1*

#### **Flood Release**

The initial spill is mid-way between Sha Chau and Chek Lap Kok along the route of the proposed pipeline and simulates a leak in the pipeline. After 12 hours the spill is carried north of Lung Kwu Chau by the flood tide. The spill has remained coherent with some spreading laterally but with no sections breaking off. Following the ebb phase of the tide, 26 hours, the majority of the spill has been carried south to Sha Chau, with a smaller portion remaining around Lung Kwu Chau. After 48 hours the spill has greatly reduced in extent due to dispersion and decay. The spill is now situated immediately north of Lung Kwu Chau. Over the next 24 hours the spill reduces greatly with a small area ebbing to the south of Sha Chau and flooding to north of Lung Kwu Chau. After 72 hours the spill is no longer evident at significant concentrations.

#### **Ebb Release**

The spill rapidly moves southwards following release and within 8 hours is carried beyond the southern boundary of the model area and into the open waters to the south of Lantau. It is not expected that the spill will return to the vicinity of Lantau on the subsequent flood tide but will remain in open water to be rapidly dissipated.

### 1.9.2 *Scenarios 2, 3 & 6*

The release of fuel for Scenarios 2, 3 and 6 all occur at the AFRF jetty at Sha Chau. The only difference between the scenarios is the quantity of fuel released and the initial radius of the spill. Only Scenarios 6 will be described here as it is largest spill and will have the greatest impact. The behaviours of the spills for Scenarios 2 and 3 will be similar but the concentrations will be lower and over a smaller area and so the relative dissipation and decay will appear more rapid.

#### **Flood Release**

After 12 hours the flood tide has carried the spill to North of Lung Kwu Chau. The majority of the spill is situated in the slower moving waters between Lung Kwu Chau and Sha Chau. The spill is spread further by the ebb tide and after 24 hours is situated to the west of the airport platform, extending from just south of Sha Chau a distance of 6km. The concentrations of fuel within the plume have been reduced by dissipation

and decay. After 36 hours the spill has moved northwards to Lung Kwu Chau with its southern tip 2 km to the south of Sha Chau. Over the next 36 hours the spill oscillates in the area between Sha Chau and Chek Lap Kok, with its extent and concentration reducing throughout until after 72 hours is no longer present in significant concentrations.

#### **Ebb Release**

The initial ebb tide carries the spill southwards until, after 12 hours, it is spread along a distance of 9km off the south western coast of Lantau Island. A small portion of the spill has broken off and is situated west of Chek Lap Kok. After 24 hours the spill has moved north to lie in an east-west direction with the majority of the spill concentrated off the western tip of Chek Lap Kok. The subsequent ebb tide carries the bulk of the plume into the coast of Lantau, with very small areas of the spill breaking off and moving around the southern tip of Lantau. After 48 hours the spill is situated south of the entrance to the Chek Lap Kok sea channel. The plume is no longer present in significant concentrations after 72 hours.

### **1.9.3**

#### ***Scenario 4***

#### **Ebb Release**

The initial release of fuel is into the fast moving waters to the east of the Brothers. After 12 hours the ebb tide has carried the spill through Kap Shui Mun and along the northern edge of the Port Peninsular. The fuel has also spread into CT10, along the eastern coast of Ma Wan. An area of high concentration has been broken off by the fast currents and is situated to the east of the Port Peninsular and extends northwards to the Green Island reclamation. Following the flood tide, after 24 hours, the separated area has impacted on the south west coast of Hong Kong Island extending from Ap Lei Chau to Green Island. The fuel within CT10 has remained due to the low current speeds. A portion of the spill has been carried back through Kap Shui Mun almost back to the Brothers and has also been carried up to the Ma Wan Channel. After the next ebb tide, 36 hours after release, the spill has been spread over a very large area and as such the concentrations are much reduced due to this dissipation. The fuel covers an area south to Cheung Chau and along the East Lamma Channel, north to Ma Wan and extends a short distance into Victoria Harbour. After 48 hours the spill is much reduced with only small areas remaining along the northern coast of Lamma Island, along the Central-Wan Chai reclamation and south beyond the Chi Ma Wan Peninsular on Lantau. After 72 hours the fuel is no longer present in significant quantities.

### **1.9.4**

#### ***Scenario 5***

#### **Flood Release**

The initial release of fuel is at the seaward boundary of Area 38. The initial flood tide, after 12 hours, carries the spill along the coast to the Black Point power station and from there it extends a short distance westwards across the mouth to Deep Bay. An area of higher concentration has become separated and is spread further across the mouth to Deep Bay to the south west of the rest of the spill. After 24 hours a single mass of fuel remains

which has been carried to the south of Lung Kwu Chau by the ebb tide. The subsequent ebb tide, after 36 hours, carries the remaining fuel northwards until it is positioned 5km south of Shekou. After 48 hours the spill has ebbed southwards and is now south of Lung Kwu Chau. The next flood tide, after 60 hours, carries the spill northwards again to be 8km south of Shekou. The spill is no longer present in significant concentrations after 72 hours.

Based upon the above results it is thought unlikely that any expected spill, up to the magnitude of that for Scenario 4, will have any impact on Deep Bay beyond the entrance at the Black Point power station.

#### 1.10

#### SUMMARY

The WAHMO random walk sediment plume model was used to investigate the fate of sediment plumes generated by the dredging works for the proposed fuel receiving facility at Sha Chau. Hydrodynamic data was provided by the 250m extended WAHMO tidal flow model with the airport platform in place, which gave the best representation of the tidal flow conditions for the estimated time of construction.

The dredging for the access channel and turning circle and the pipeline trench to Chek Lap Kok were simulated using wet and dry season spring tides. The modelling showed that a plume with concentrations of 1-5ppm in the surface layer would be generated covering a large area of the waters to the north and west of the Lantau coast. Within the surface plume there were small isolated areas with concentrations in the range 5-10ppm. In the bed layer there were small regions of high suspended sediment concentration, greater than 15ppm, which were due to erosion of the recently deposited bed material. These regions were along the southern edge of the Urmston Road and off the north Lantau coast to the west of Chek Lap Kok. The majority of the bed deposits were in the range of 0.01-0.10 kg/m<sup>2</sup>. Regions of higher bed deposits were present in the areas corresponding to high suspended sediment concentrations in the bed layer showing that the sediments were settling out and then being eroded.

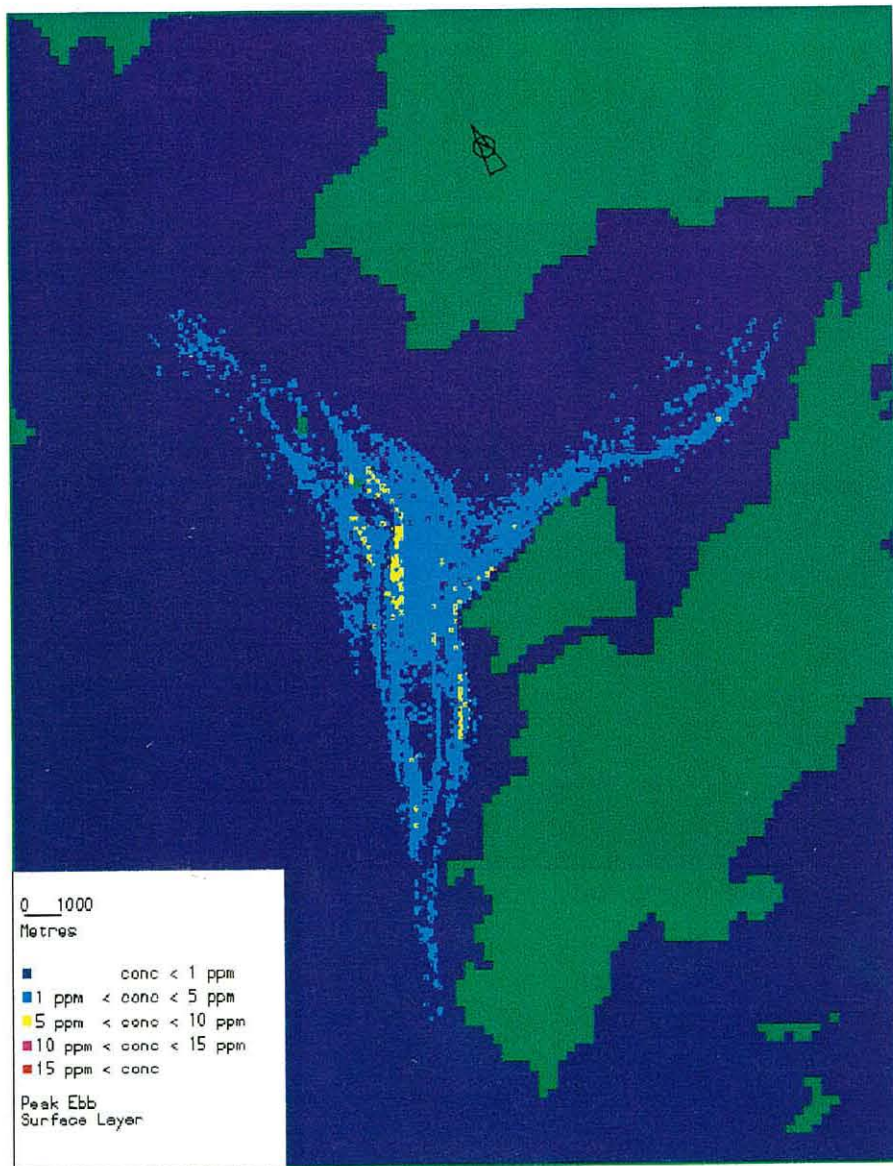
The WAHMO sediment plume model was further developed to be able to simulate the behaviour of fuel spills associated with the proposed fuel receiving facility at Sha Chau, although the process of buoyant spreading well after the release was not simulated. Hydrodynamic data was provided by the 250m extended WAHMO tidal flow model with all reclamations in place to the year 2003, which gave the best representation of the tidal flow conditions during the operational life of the fuel facility.

Six different scenarios were simulated with four spills in the vicinity of the fuel facility and Chek Lap Kok, one spill north east of the Brothers and one adjacent to the Area 38 reclamation. Release on the ebb and flood phases of the tide were simulated for the four spills in the proximity of the fuel facility. The release near the Brothers was simulated for an ebb release and the one at Area 38 for a flood release.

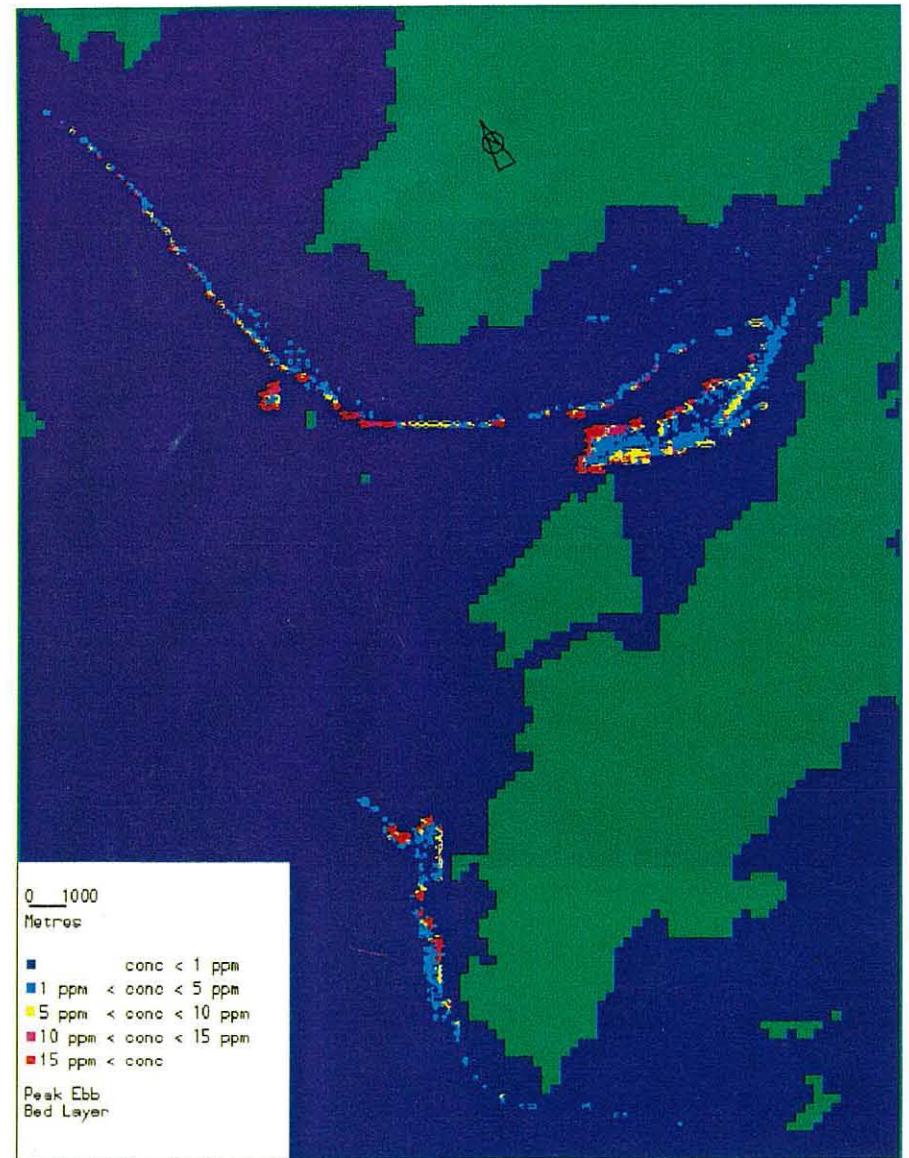
The simulation of the spills in the vicinity of the fuel facility showed that fuel would travel over the area to the north of Lung Kwu Chau and to beyond the southern tip of Lantau with the ebb and flood of the tide over

the 3 tidal cycle simulation period. After 72 hours the fuel was no longer present in significant concentrations. The release to the north of the Brothers quickly travelled through Kap Shui Mun to cover a large area of the Western Harbour where it generally remained throughout the simulation. The spill at Area 38 was carried along the coast to the mouth of Deep Bay but was subsequently transported to the south west away from Deep Bay and was not shown to enter the bay throughout the 3 tidal cycles.



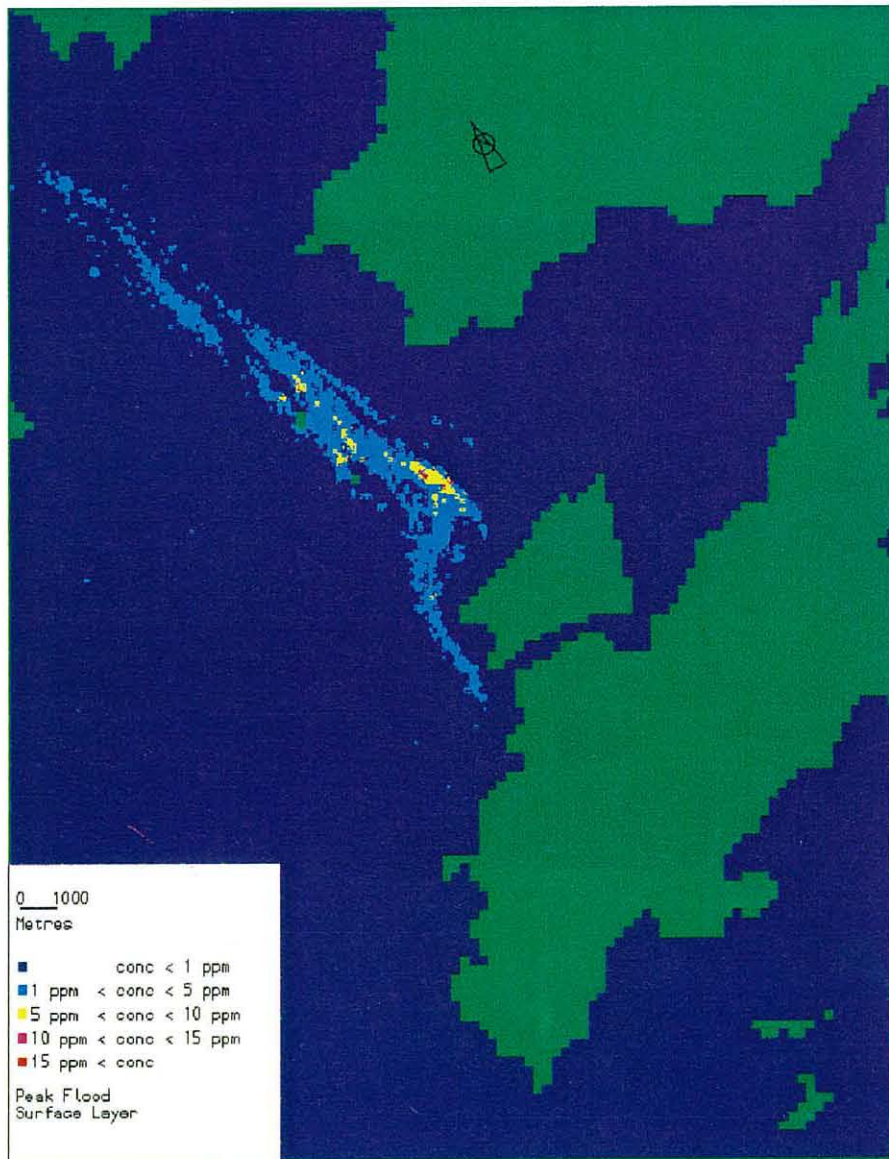


AFRF at Sha Chau  
Sediment Losses from Dredging Activities  
Suspended Sediment Concentrations  
Dry Season Spring Tide

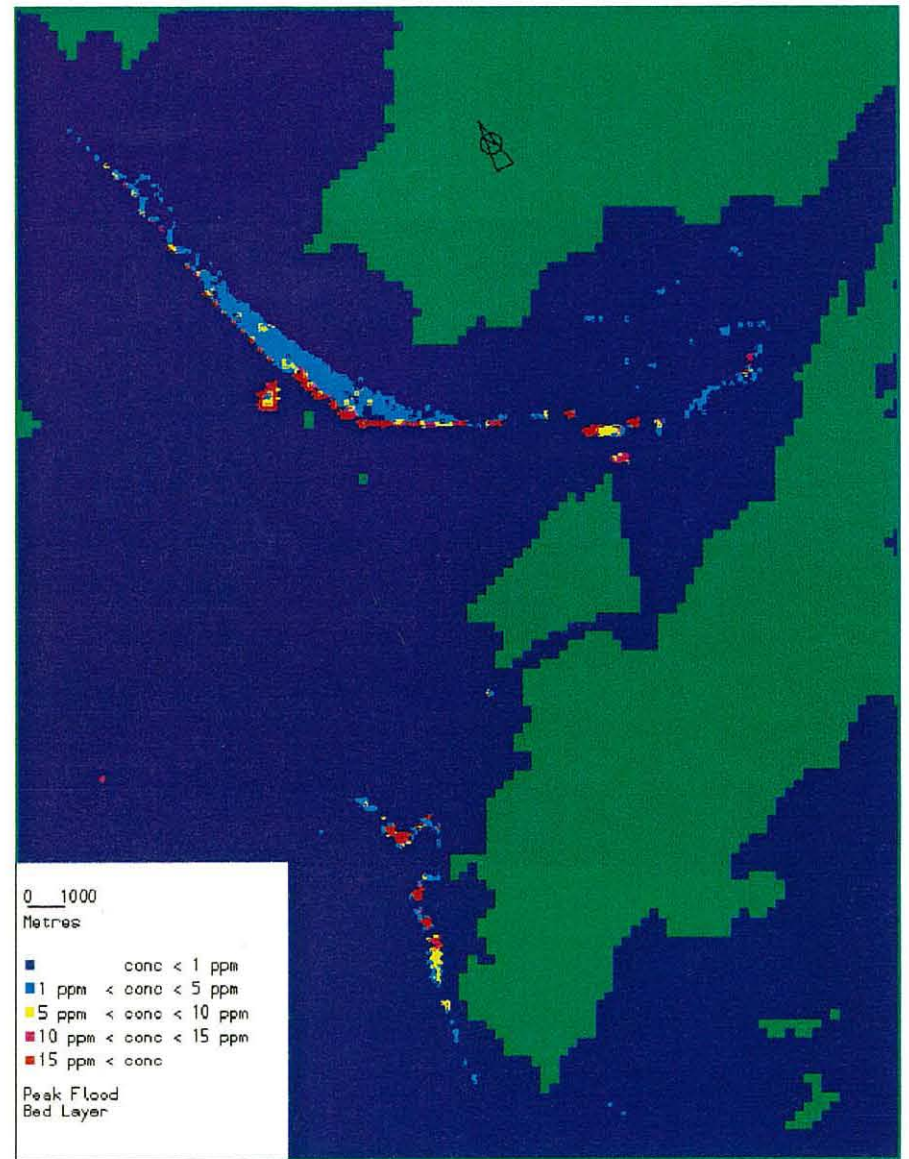


AFRF at Sha Chau  
Sediment Losses from Dredging Activities  
Suspended Sediment Concentrations  
Dry Season Spring Tide



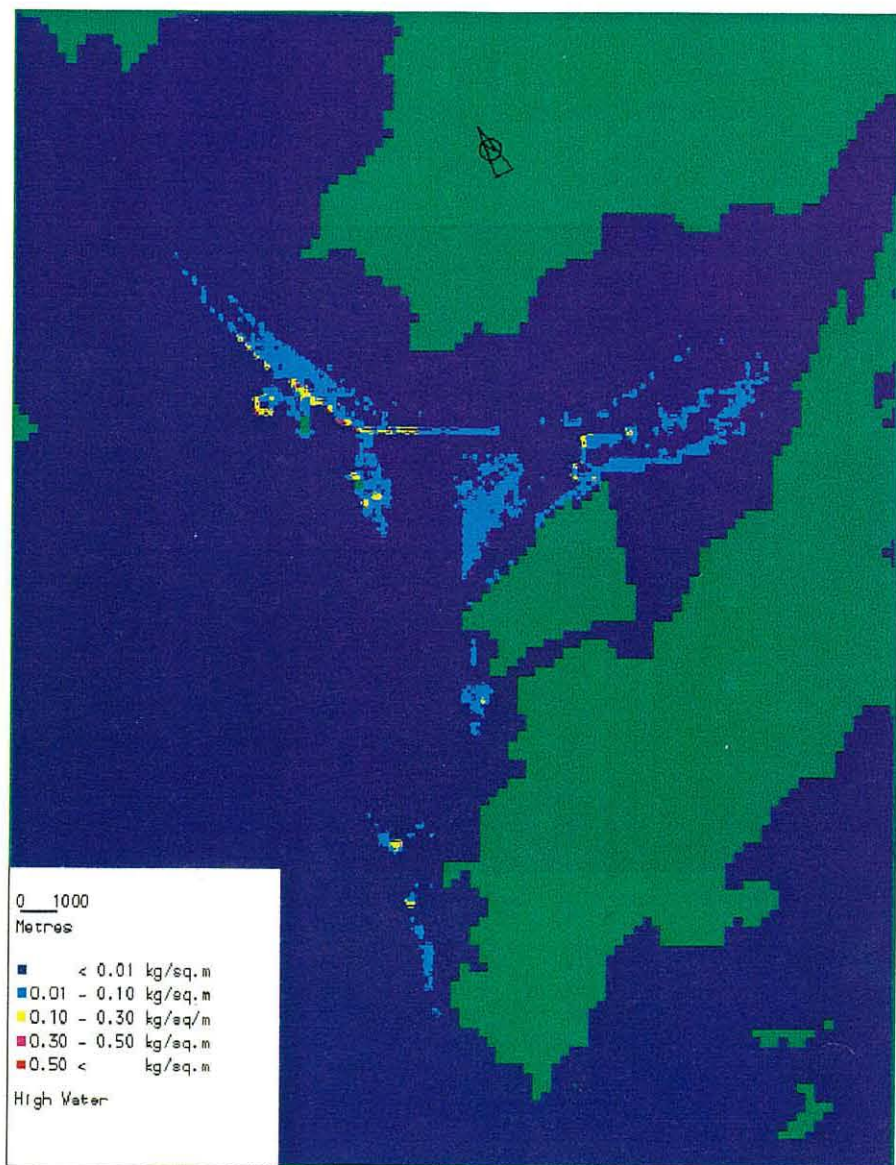


AFRF at Sha Chau  
Sediment Losses from Dredging Activities  
Suspended Sediment Concentrations  
Dry Season Spring Tide

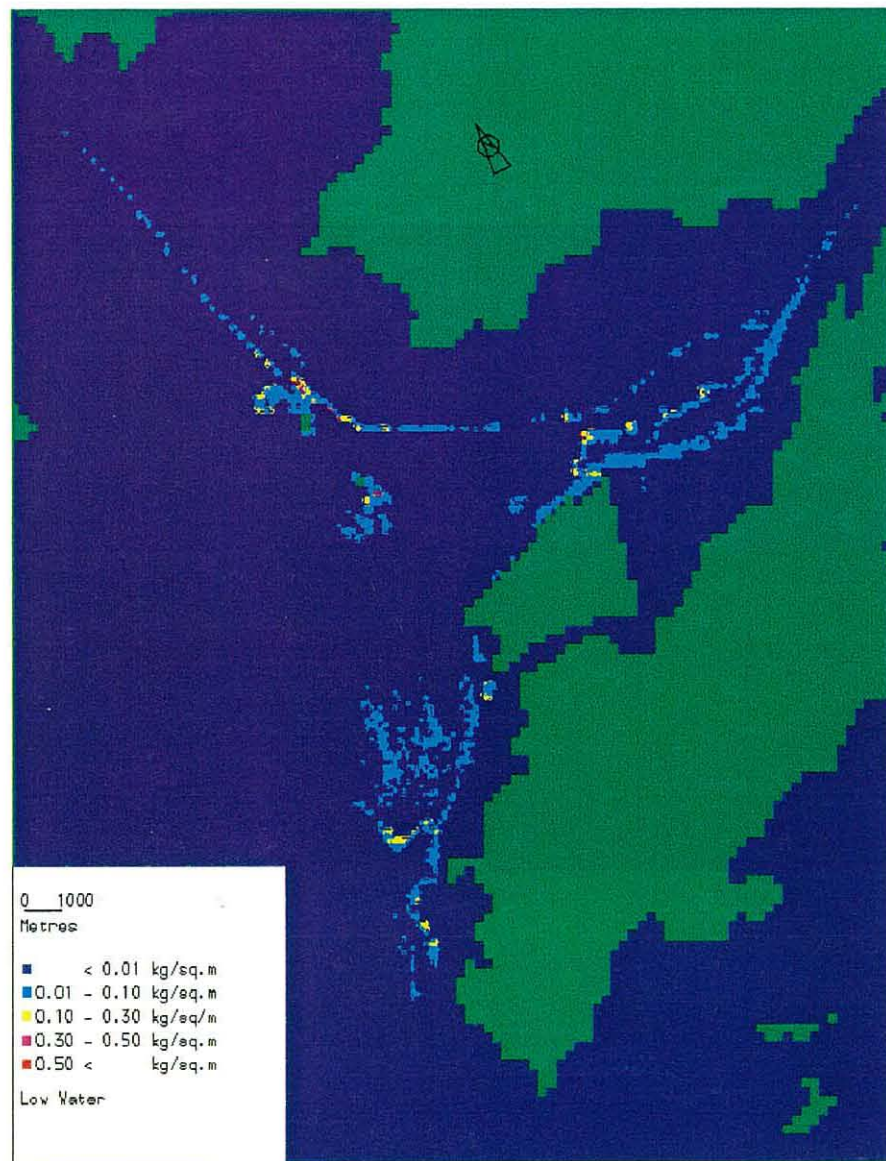


AFRF at Sha Chau  
Sediment Losses from Dredging Activities  
Suspended Sediment Concentrations  
Dry Season Spring Tide



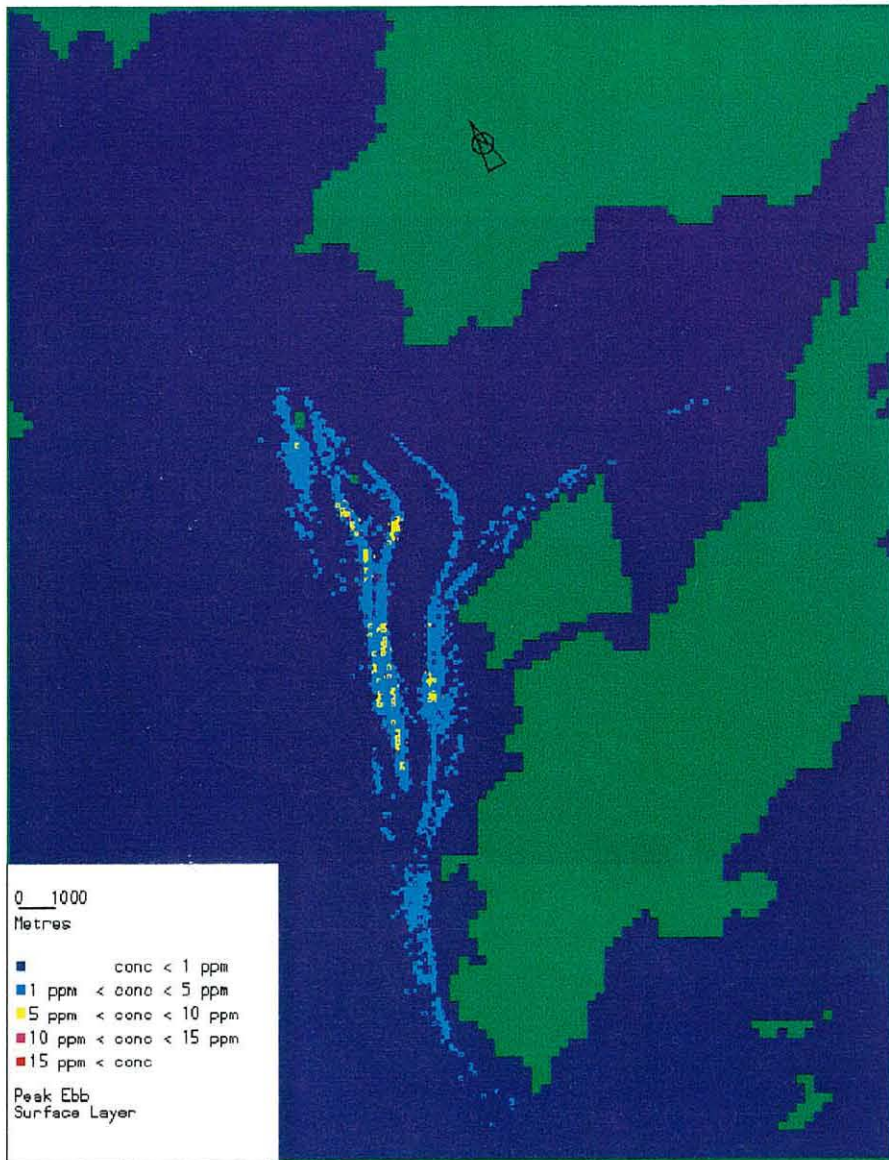


AFRF at Sha Chau  
Sediment Losses from Dredging Activities  
Mud Deposits after 3 Tides  
Dry Season Spring Tide

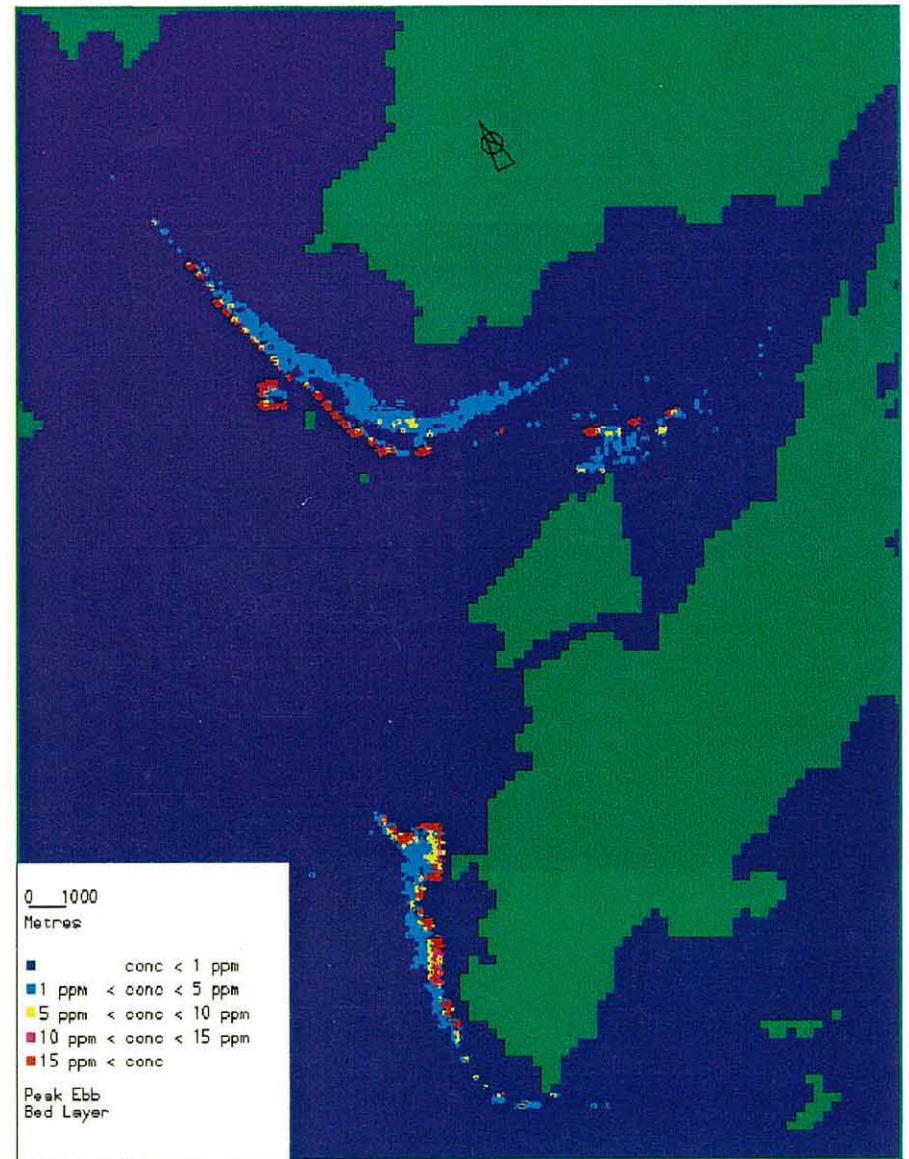


AFRF at Sha Chau  
Sediment Losses from Dredging Activities  
Mud Deposits after 3 Tides  
Dry Season Spring Tide



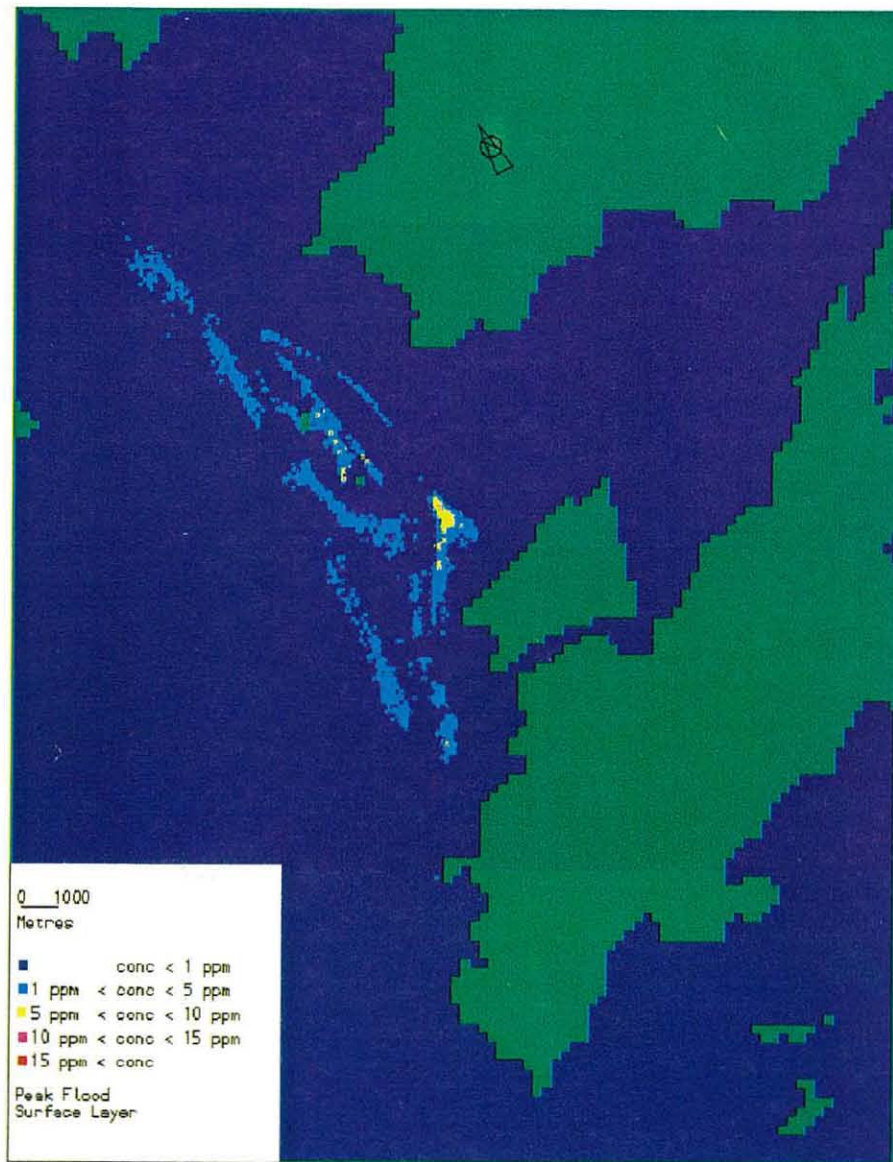


AFRF at Sha Chau  
Sediment Losses from Dredging Activities  
Suspended Sediment Concentrations  
Wet Season Spring Tide

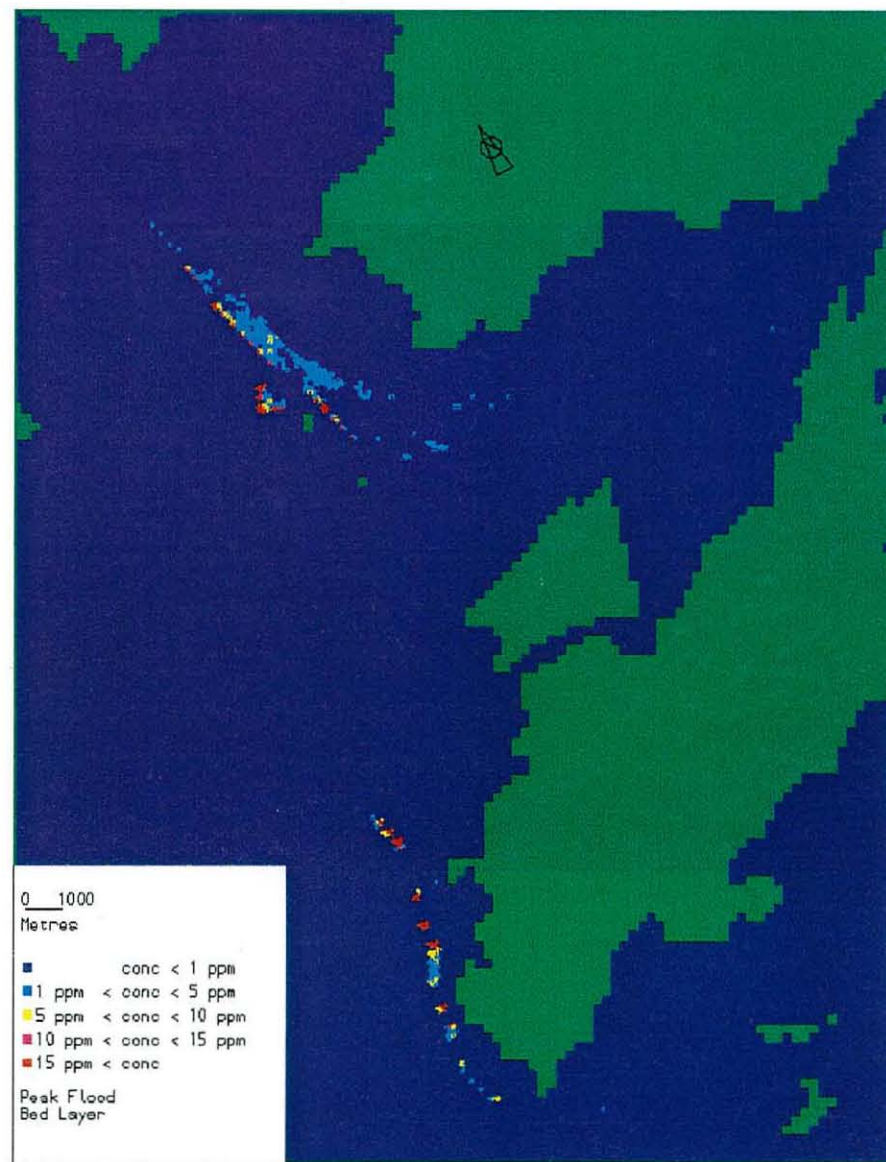


AFRF at Sha Chau  
Sediment Losses from Dredging Activities  
Suspended Sediment Concentrations  
Wet Season Spring Tide



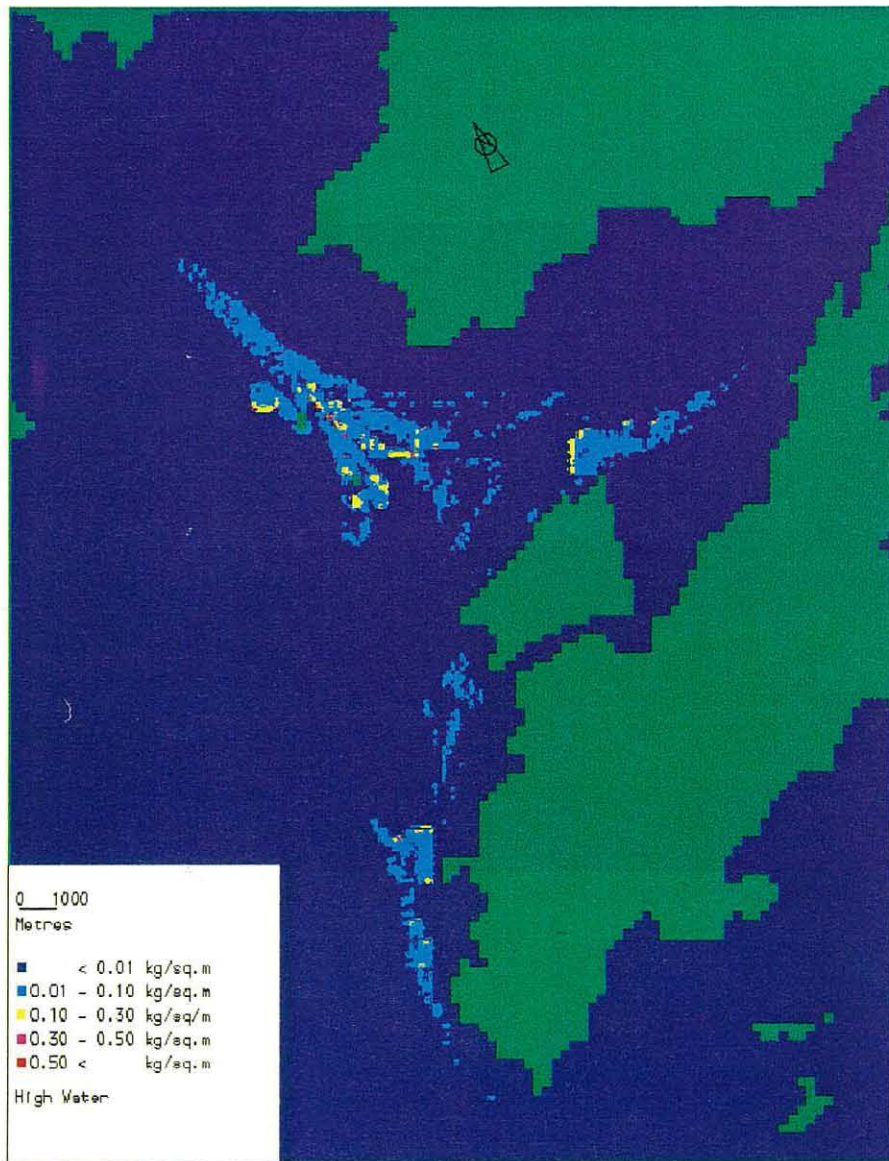


AFRF at Sha Chau  
Sediment Losses from Dredging Activities  
Suspended Sediment Concentrations  
Wet Season Spring Tide

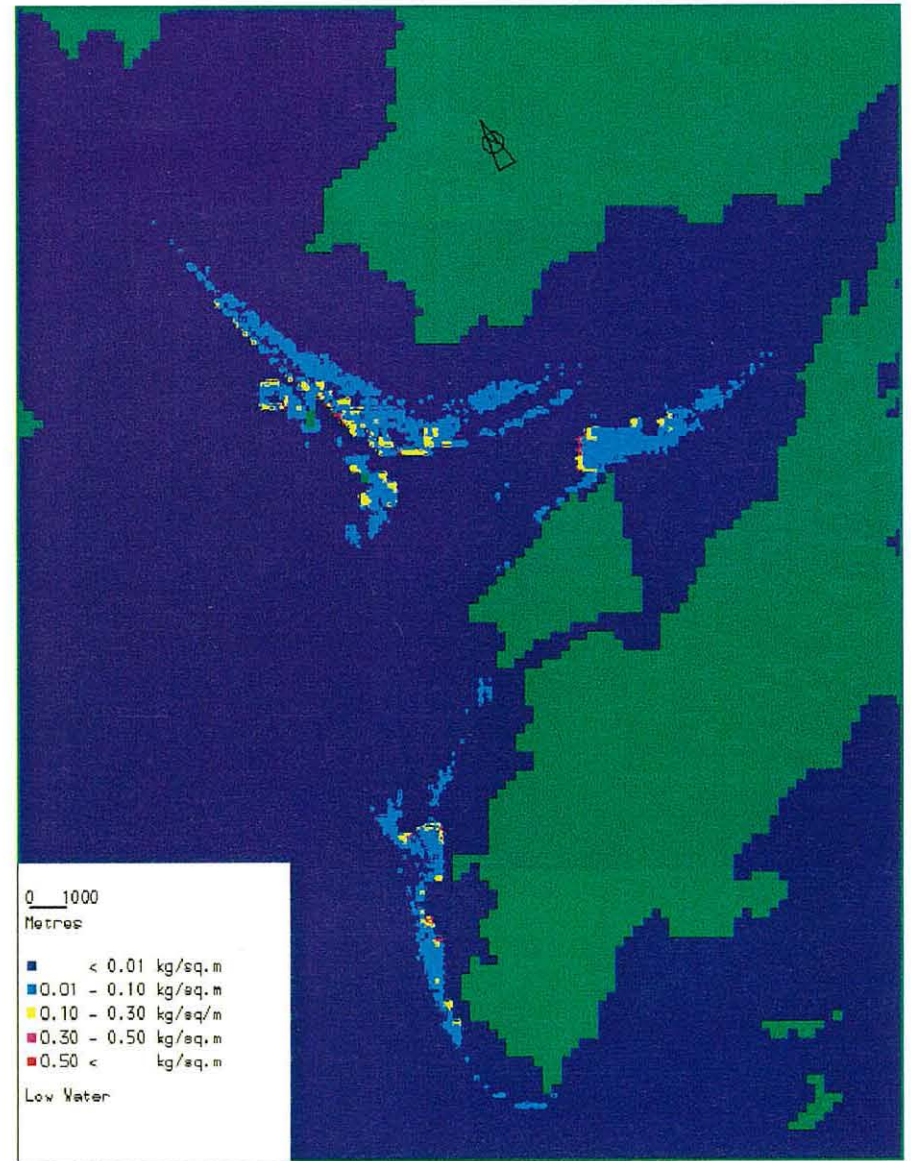


AFRF at Sha Chau  
Sediment Losses from Dredging Activities  
Suspended Sediment Concentrations  
Wet Season Spring Tide





AFRF at Sha Chau  
Sediment Losses from Dredging Activities  
Mud Deposits after 3 Tides  
Wet Season Spring Tide



AFRF at Sha Chau  
Sediment Losses from Dredging Activities  
Mud Deposits after 3 Tides  
Wet Season Spring Tide



Annex E

Marine Department:  
Conditions for Pipelaying  
Operations

Marine Department  
Requirements for  
(Tankers/Barges) Carrying  
Aviation Fuel through the  
Ma Wan Channel

Marine Department  
Conditions for Pipelaying Operations

1. Marine Impact Assessment Study

- (a) Prior to the commencement of marine works a report addressing the marine aspects of the proposed pipeline routing, laying operations and emergency procedures to be adopted in the event of pipeline damage or leak shall be prepared by the principal or their consultants for consideration by the Marine Department. Comprehensive details of the scope of the works, methodology, plant, timing and interface with other works shall be provided.
- (b) The Marine Impact Assessment Report shall address marine issues relating to both existing and planned marine operations and facilities in the area including but not limited to:-
- (i) Ocean-going, river trade and local craft presently transiting the area;
  - (ii) borrow and dumping area utilisation including associated site investigation works, dredging and dumping;
  - (iii) aids to navigation, navigable channels anchorages and obstructions;
  - (iv) the existence routing and precautionary measures necessary in relation to outfalls, cables and other services in the area. In this respect it shall be necessary for the principal or their consultants to establish a pipeline routing acceptable to all concerned parties for consideration and agreement by Marine Department.

- (v) the pipeline laying procedures should be presented in detail with particulars of type and number of craft to be employed, trenching and backfilling methods, landfall arrangements etc.,
  - (vi) consideration of meteorological and sea conditions; and
  - (vii) facilities in the vicinity of landfalls including existing and planned developments.
- (c) The Marine Impact Assessment Study will be acceptable as part of a detailed engineering study provided it is presented as a self contained section.

2. Regulations

All vessels and craft provided or used for the construction of the Works shall comply with all the relevant regulations and requirements of the Marine Department, including the following:-

- (a) The Shipping and Port Control Ordinance (Cap 313);
- (b) The Shipping and Port Control Regulations 1978;
- (c) The Merchant Shipping (Miscellaneous Craft) Regulations;
- (d) The International Regulations for Preventing Collisions at Sea;
- (e) The Dangerous Goods Ordinance (Cap 295);
- (f) The Dangerous Goods (Shipping) Regulations (Cap. 295);

/...

- (g) The Merchant Shipping (Launches and Ferry Vessels) Regulations (Cap 281);
- (h) The Pilotage Ordinance (Cap 84);
- (i) The Merchant Shipping Ordinance and Regulations (Cap 281).

3. Communications

The Contractors shall maintain communication with the Vessel Traffic Centre (V.T.C.) network at all times and in a manner to be previously agreed.

4. Requirements Prior to Commencement of Pipeline Trenching, Laying and Backfilling Operations

- (1) Prior to commencement of the marine works, including Site Investigation Works, the Contractor shall submit to the Marine Department for approval the following information:-
  - (a) details of proposed temporary marine facilities to be provided at landfall sites such as jetties, mooring dolphins, anchor blocks, caissons, bunds and the like;
  - (b) a plan of the marine works indicating the proposed overall limits of the working areas and the space requirements of each of the operations;
  - (c) full information, including schematic layouts, of buoyage and other aids to navigation to be provided by the Contractor to demarcate working areas;
  - (d) information of the type and operating frequency of all proposed electronic positioning systems;

- (e) proposed means of communication to be established between Marine Department V.T.C. and marine plant;
  - (f) name of the 24 hour contact procedure for the individual charged with relations with Marine Department.
- (2) In addition the Contractor shall submit to the Marine Department for their information the following details of the proposed marine works areas for Site Investigation, Trenching, Pipelaying and Backfilling:-
- (a) proposed schedule of all marine works including marine works to be carried out by sub-contractors indicating the different types of operations, their number, duration, space requirements and phasing;
  - (b) a complete list of vessels and craft to be used for site investigation and construction;
  - (c) details of weather conditions in which operations would cease and all working craft removed from the area;
- (3) The Contractor shall be responsible for obtaining all necessary consents and licenses in relation to any dumping and borrowing operations.

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5. Requirements During Site Investigation Works, Pipeline Trenching,  
Laying and Backfilling Operations

- (1) The Contractor shall at all times during the marine activities comply, and shall be responsible for ensuring that his sub-contractors comply, with any directions which may from time to time be issued by the Marine Department. In this respect marine activity means the use of any craft or carrying out of any operation which could cause an obstruction in the area or affect the navigation of craft through the area in the vicinity of the works.
- (2) Prior to the commencement of each and every separate marine activity, the Contractor shall give one month's notice to the Marine Department and shall liaise with the Marine Department to give all information on working areas, types of craft and durations of activities necessary for the Marine Department to issue the appropriate Notices to Mariners and Marine Department Notices. The Contractor shall also advise the Marine Department on completion of each and every separate marine construction activity.
- (3) The Contractor shall ensure that the pipeline is laid in a trench below existing bed level at a depth which will provide adequate protection for the pipeline installation. On completion of laying operations the pipeline trench shall be backfilled so as to reinstate the seabed and provide water depths of no less than those which existed prior to commencement of the works or as otherwise required by the Director of Marine.

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- (4) The Contractor shall provide install and maintain approved temporary marker buoys, or such other marks as may be acceptable to the Marine Department, to delineate the approved works areas. No temporary marks whatsoever shall be laid without the prior approval of the Marine Department and the issue of an appropriate Notice to Mariners or Marine Department Notice in accordance with condition 4(2) above. On completion of works the Contractor shall be responsible for the removal of all temporary marks and any such other marks as may have been provided. The removal of such marks shall be to the requirements of the Marine Department.
- (5) The Contractor shall if so required, attend regular liaison meetings with the Marine Department to coordinate the activities of all operators and other contractors using the areas in the vicinity of the works. The Contractor shall comply with any requirement or instruction regarding navigation which may be issued by the Marine Department as a result of such meetings.
- (6) Guard boats shall be provided by the Contractor during all marine activities to safeguard both the Works and vessels transiting the area of the works. The deployment of these boats shall be to the agreement of the Marine Department.
- (7) In respect of underwater blasting of rock, the Contractor shall provide to the Marine Department, prior to commencement, evidence of permission from the Commissioner of Mines for the blasting operation together with any condition thereof. Details on depth of holes, weight of explosive charges and any other relevant information shall also be provided. The Contractor shall obtain permission from Marine Department prior to performing any underwater blasting. The Contractor shall provide information on the anticipated effects of the blasting on adjacent structures and other craft in the vicinity.

The Contractor may be required to carry out monitored tests at the direction of the Marine Department. The Contractor shall provide staff, labour and craft to cordon off blasting areas as directed by Marine Department.

- (8) The Contractor shall comply with the Marine Department General Conditions for Dredging and Backfilling at Marine Borrow Areas and shall be responsible for obtaining all other necessary consents in relation to borrowing and dumping operations.
- (9) The Contractor shall liaise with the Marine Department and Environmental Protection Department, in respect of all marine disposal of spoil. The routes for vessels and craft in transit between the Works Areas and dumping grounds shall be to the approval of the Marine Department.
- (10) The Contractor shall carry out regular bathmetric surveys of the Works Areas and any spoil dumping grounds as relevant, in accordance with Marine Department and Civil Engineering Services Department requirements. Any areas which do not comply with the terms for the use of such dumping grounds shall be rectified, to the satisfaction of the above Department.
- (11) Areas for temporary anchorage of Contractor's marine craft shall be agreed with the Marine Department.
- (12) All vessels and craft to be used by the Contractor during the marine works and the use of such craft shall comply with the relevant requirements of the Marine Department, including the following:-

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- (a) they shall be required to seek channel clearance and pilotage exemption as appropriate for navigating in the compulsory pilotage area;
- (b) any vessel or craft in control of a construction activity shall be equipped with VHF radio operating on a specified channels for direct contact with the Marine Department's Vessel Traffic Centre (VTC);
- (c) they shall display the appropriate day marks and lights and all anchor positions shall be marked in accordance with Marine Department's requirements;
- (d) they shall have on board experienced and qualified local persons, approved in accordance with Marine Department's requirements, who will be responsible for the navigation.

6. Requirement on Completion of the Works

- (1) The Contractor shall carry out monitoring surveys of the sea bed on completion of all marine works. The surveys shall be independently certified and a copy provided to the Marine Department.
- (2) Any obstruction caused by the works shall be removed to the satisfaction of the Marine Department and in such a manner as agreed by the Marine Department.

Marine Department  
Hong Kong  
May 1992

Marine Department Requirements for (Tankers/Barges)\* carrying Aviation Fuel which Pass Through The Ma Wan Channel

Establishment of a Marine Traffic Control Station

1. Prior to the first shipment of aviation fuel by tankers/barges through Ma Wan, a Marine Traffic Control Station (MTCS) will require to have been established in the Ma Wan area. The improved control measures introduced under the MTCS must be implemented at least two years before the first shipment of fuel. This is to ensure that the system is tried and tested such that local craft and PRC river trade operators are familiar with it and have learnt to obey it.
2. The establishment of a MTCS in the Ma Wan area is necessary to maintain safe navigation by traffic control of All vessels and is not limited to the control of vessels carrying aviation fuel.

Marine Traffic Control Requirements

3. Control measures which are to be implemented by the MTCS or other relevant sections of the Marine Department will include but not be limited to:-
  - (i) The presence of a patrol launch under the direction of the MTCS;
  - (ii) A requirement that all (tankers/barges)\* shall be fitted with VHF radio communications with full maritime frequencies particularly VTS frequencies. The master or person in charge of each tanker/barge shall be required to keep a continuous listening watch on the appropriate VHF channels when underway;
  - (iii) (Tankers/Barges)\* must obtain permission from the MTCS prior to entering the transit control area of the Ma Wan Channel;
  - (iv) (Tankers/Barges)\* will only be permitted to transit the Ma Wan Channel during working hours on working days. No transits will be permitted during hours of darkness.

N.B.: (Tankers/Barges)\* - These include any vessels engaged in/intended for aviation fuel delivery to the new Airport.



- (v) (Tankers/Barges)\* will not have priority of movement and shall proceed to designated Ma Wan waiting/emergency anchorages when directed to do so;
- (vi) The franchisee will require to submit to the Vessel Traffic Section Centre of the Marine Department an advance monthly transiting schedule;
- (vii) Persons in charge of (tankers/barges)\* shall familiarize themselves with the standing instructions, guidelines and emergency procedures under the MTCS and shall be competent to deal with shipboard emergencies;
- (viii) (Tankers/Barges)\* shall be required to comply with provisions contained in the Shipping and Port Control Ordinance (Cap. 313), the Shipping and Port Control Regulations, the Merchant Shipping Ordinance (Cap. 281), subsidiary legislation and any subsequent addition or amendment to marine legislation in force at the time; and
- (ix) (Tankes/Barges)\* shall exhibit the appropriate signals for vessels carrying Dangerous Goods and any other special signals prescribed or may be required by the MTCS.
- (x) Due to constraints imposed by operational factors such as (but not be limited to) extreme weather conditions (tropical cyclone warning signals, poor visibility etc), traffic density, major site investigation or construction projects, (tankers/barges)\* may be delayed for prolonged periods. It will therefore be necessary to ensure that an adequate aviation fuel storage facility is provided at Chek Lap Kok, to cover such eventualities.

#### General Requirements

- 4. Prior to use, all (tankers/barges)\* shall be approved by the Director of Marine. Towed barges will not be acceptable. Barges will not be considered unless they are self-propelled or are moved by pusher tugs.
- 5. The maximum size of (tankers/barges)\* shall be ascertained by the franchisee who should carry out a simulator study which shall show that:-
  - (i) the (tankers/barges)\* are capable of using the channel at any state of the tide;

- (ii) the (tankers/barges)\* can safely pass a Class B vessel. (30,000 - 80,000 tonnes) anywhere in the Ma Wan Channel at any stage of the tide; and
- (iii) the (tankers/barges)\* can abort the transit of the Ma Wan Channel and can manoeuvre 'short round' to return at any state of the tide.
6. (Tankers/Barges)\* shall comply with the relevant provisions prescribed for Type III vessels contained in Parts IV and V of the Dangerous Goods (Shipping) Regulations, Cap. 295 and any subsequent addition or amendment to these Regulations.
7. (Tankers/Barges)\* shall meet the requirements of MARPOL<sup>73/78</sup> and other relevant international marine conventions as may be in force at the time. Convention
8. (Tankers/Barges)\* shall be provided with appropriate moorings for use when tropical cyclone warning signals are hoisted (Marine Department Notice No. 83 of 1987 is relevant).
9. All design standards, including alternative tanker design standards, such as the use of double hull (Tankers/Barges)\*, shall be considered for the carriage of aviation fuel provided that any such vessel type shall, before use, be subject to the approval of the Director of Marine and shall meet the requirements or recommendations of the International Maritime Organization as may be prescribed at the time.
10. Coxswains, engineers and other crew members employed on vessels engaged in carrying aviation fuel may be required to undergo specialized training and where appropriate be in possession of certificates commensurate with the size and type of vessel.
11. (Tankers/Barges)\* shall be fitted with radar and such other aids to navigation as may be required by the Director of Marine. Training approved by the Director of Marine shall be provided to competent crew members in the operation and use of radar and such other aids to navigation as may be required.
12. Contingency plans, covering emergency situations likely to be encountered by (Tankers/Barges)\* shall be prepared by the franchisees and submitted to the Director of Marine for approval.

13. The foregoing requirements relate to present and presently planned conditions for the Ma Wan area. Such requirements will almost certainly be expanded to include further restrictions due to changing circumstances particularly in response to future demand relating to the size and type of vessels navigating in the Ma Wan area.

11 October 1994  
Port Services Branch.  
Marine Department



**BASIC REQUIREMENT FOR A SELF-PROPELLED OIL TANKER APPLYING FOR H.K. LOCAL LICENCE**

The following requirements are relevant for the proposed vessel(s) to be licensed as an Oil Tanker under the Merchant Shipping (Miscellaneous Craft) Regulations and Part IV of the Shipping & Port Control Ordinance, Chapter 313 of the Laws of Hong Kong:-

1. Hong Kong or Foreign Registry;
2. International Tonnage Certificate;
3. International Load Line Certificate issued by Hong Kong Marine Department or by a recognised classification society or maritime authority.
4. Vessel(s) to be classed with a recognized classification society with continuous Hull & Machinery survey.
5. Safety Equipment - Record of Inspection (Survey 183) in compliance with the relevant sections if registered in Hong Kong:-
  - a) The Merchant Shipping (Fire Protection) Regulations 1991;
  - b) The Merchant Shipping (Life-Saving Appliances) Regulations 1991;
  - c) The International Regulations for Prevention Collisions at Seas 1972;
  - d) The Merchant Shipping (Cargo Ship Construction) Regulation 1991.
6. Certificate of Inspection (Western Type Vessel);
7. Declaration of Fitness for vessel to carry petroleum product in bulk (Dangerous Goods Regulations);
8. IOPP or HKOPP Certificate to comply with the M.S.(Prevention of Oil Pollution) Regulations 1984 & 91/92 Amendments to Annex I of MARPOL 73/78;
9. Radiotelephony Certificate;
10. All electrical installations and equipment to comply with the relevant sections of the latest edition of the "Regulations for the Electrical and Electronic Equipment of ships" published by the Institution of Electrical Engineers, U.K.;
11. Crew accommodation to comply with the International Labour Organisation (I.L.O.) Conventions No. 92 of 1949 & 133 of 1970;

Prior to commencement of construction of the vessel(s), drawings & document listed below should be submitted in duplicate to this office for approval:

- a) Shipboard Oil Pollution Emergency Plan (SOPEP);
- b) General Arrangement;
- c) Midship Section;
- d) Construction profile & deck;
- e) Shell expansion;
- f) Bulkheads plan;
- g) Lines;
- h) Hydrostatic curves;
- i) Cross curves of stability;
- j) Stability information booklet including damage stability;
- k) Rudder & stern frame;
- l) Engine room arrangement;
- m) Propeller shafting & stern tube;
- n) Oil fuel tanks;
- o) Pumping & piping arrangement;
- p) Electrical wiring diagram;
- q) Air receivers (if fitted) including certificates and particulars;
- r) Prevention of Oil Pollution Installations;
- s) Fire fighting & life saving plan;
- t) Fixed flooding installation & fire fighting system;
- u) Accommodation plan;
- v) Ventilation plan;
- w) Any other plans deemed necessary in view of any special construction or intended service of the vessel(s).

Relevant fees are to be paid in advance & in accordance with the Merchant Shipping (Fees) Regulations.

**Remarks:** Tankers for the conveyance of aviation fuel (Cat.5 Class 2) to the new airport and pass through Ma Wan Channel on regular basis, in addition to the latest requirement of MARPOL, we strongly recommend these vessels be equipped with:-

- (a) Double Hull construction;
- (b) Twin screw propelling system;
- (c) Bow thruster(s).

6.10.1994

Local Craft Safety Section,  
Local Craft and Marine Industrial Safety Branch,  
Shipping Division, Marine Department.

Manning Requirements for Locally Licensed Tankers for  
Chek Lap Kok Core Project

Assumptions :

1. For not more than 5,000 dwt motor product tankers with bridge control and centralized engine control room.
2. Loading and discharging operations are to be carried out by shore gang personnel including the operation of cargo pumps in engine room. Tanker crews are only responsible for navigation, no involvement in cargo handling operation.
3. Approval from Port Services Branch on the safe operation of these size of product tankers for this project has been obtained.

Minimum Manning Scale per shift/watch : (Maximum working time to be not more than 12 hours per day)

1. Two coxswains holding local certificate as master of 300 tons vessel with tonnage endorsement. At least one of the certificated coxswains should also hold a Certificate of Competency in Radiotelephony Restricted (Hong Kong Waters).
2. One Engineer holding a local certificate as engineer of over 150 BHP.
3. At least 4 seamen (may require more depending on mooring arrangement) are required for berthing.
4. One engine room mechanic.

Training Requirements :

1. All certificate deck officers/coxswains and engineers are required to attend the following courses at the Seamen's Training Centre (STC) :

Basic sea survival  
First aid at sea  
Fire-fighting  
Tanker familiarization

If the vessel is required to equip with radars and/or ARPA the certificated deck officers/coxswains are also required to attend radar and/or ARPA training courses.

2. All crew members (officers and ratings) are required to attend a vessel familiarization course provided by the ship owner/management company. An assessment will be carried out by Marine Department after completion of the training.

3. All personnel involved in cargo handling operation should also attend a tanker safety course.

Other information

If foreign crews are to be employed, or in case ship owner applies exemptions for officers not holding local certificates of competency as master or engineer, then the following condition are to be satisfied :

- i) For Deck officers - valid STCW certificate (as Master, or Chief Officer with 1 year experience) with dangerous cargo endorsement + Local Knowledge
- ii) For Engineer officers - valid STCW certificate (Class 1, or Class 2 with 1 year experience) with dangerous cargo endorsement (petroleum)

\*\*\*\*\*

October 1994

Examination Section  
Crews Branch  
Shipping Division  
Marine Department

Manning Requirements for Locally Licensed Tankers for  
Chek Lap Kok Core Project

Assumptions :

1. For size of 5,001 dwt to 10,000 dwt motor product tankers with bridge control and centralized engine control room.
2. Loading and discharging operations are to be carried out by shore gang personnel including the operation of cargo pumps in engine room. Tanker crews are only responsible for navigation, no involvement in cargo handling operation.
3. Approval from Port Services Branch on the safe operation of these size of product tankers for this project has been obtained.

Minimum Manning Scale per shift/watch : (Maximum working time to be not more than 12 hours per day)

1. Two deck officers/coxswains holding local certificate as master of 300 tons vessel with tonnage endorsement. At least one of the certificated deck officers/coxswains should also hold a Certificate of Competency in Radiotelephony Restricted (Hong Kong Waters) and a Foreign-going Class 2 Certificate of Competency/Hong Kong Class 2 Licence with dangerous cargo endorsement (petroleum).
2. One Engineer holding a local certificate as engineer of over 150 BHP together with a Foreign-going Class 3 Certificate of Competency/Hong Kong Class 3 Licence PLUS dangerous cargo endorsement (petroleum).
3. At least 6 seamen (may require more depending on mooring arrangement) are required for berthing.
4. At least one engine room mechanic (one more mechanic/engineer depending on the complexity of engines and control system).

Training Requirements :

1. All certificate deck officers/coxswains and engineers are required to attend the following courses at the Seamen's Training Centre (STC) :

- Basic sea survival
- First aid at sea
- Fire-fighting
- Tanker familiarization

If the vessel is required to equip with radars and/or ARPA the certificated deck officers/coxswains are also required to attend radar and/or ARPA training courses.

2. All crew members (officers and ratings) are required to attend a vessel familiarization course provided by the ship owner/management company. An assessment will be carried out by Marine Department after completion of the training.
  
3. All personnel involved in cargo handling operation should also attend a tanker safety course.

Other information

If foreign crews are to be employed, or in case ship owner applies exemptions for officers not holding local certificates of competency as master or engineer, then the following condition are to be satisfied :

- i) For Deck officers - valid STCW certificate (as Master, or Chief Officer with 1 year experience) with dangerous cargo endorsement + Local Knowledge
  
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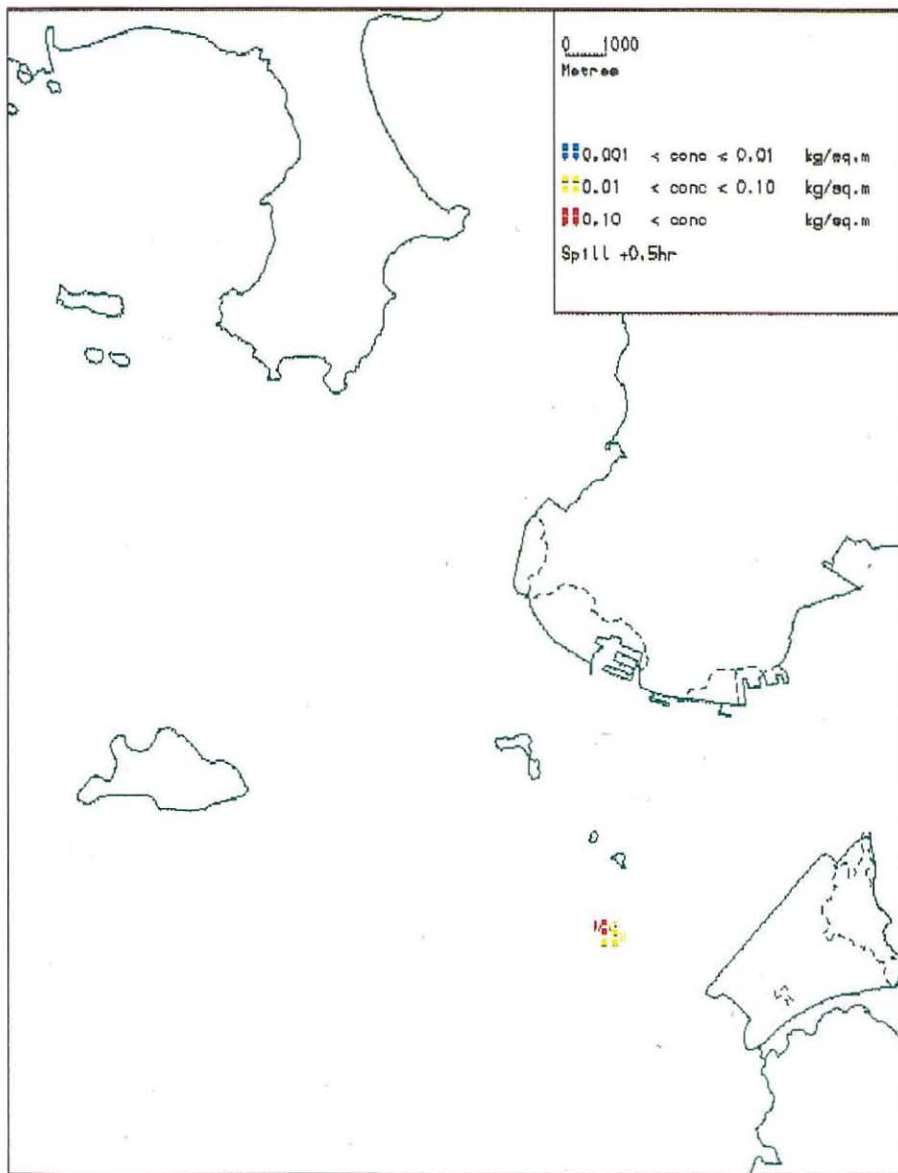
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October 1994

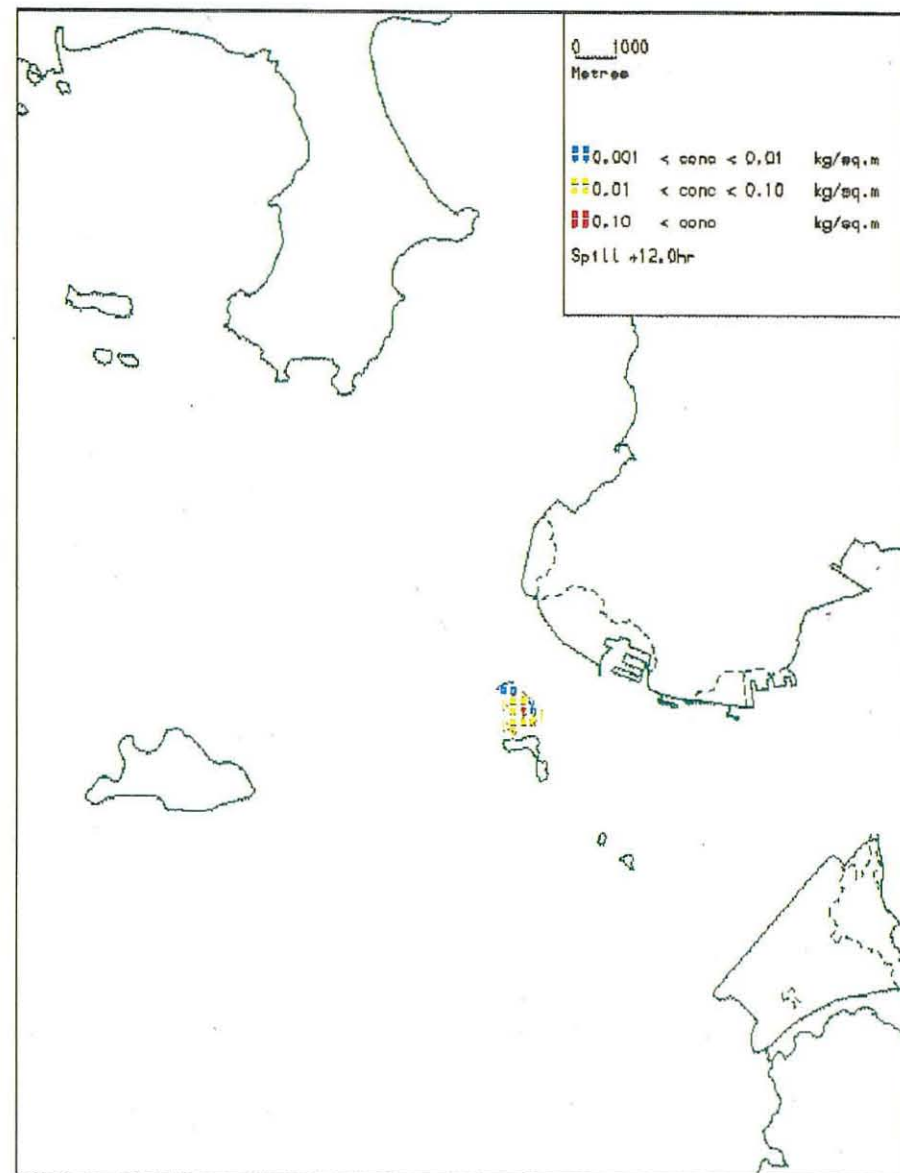
Examination Section  
Crews Branch  
Shipping Division  
Marine Department

Annex F

## Fuel Spill Modelling

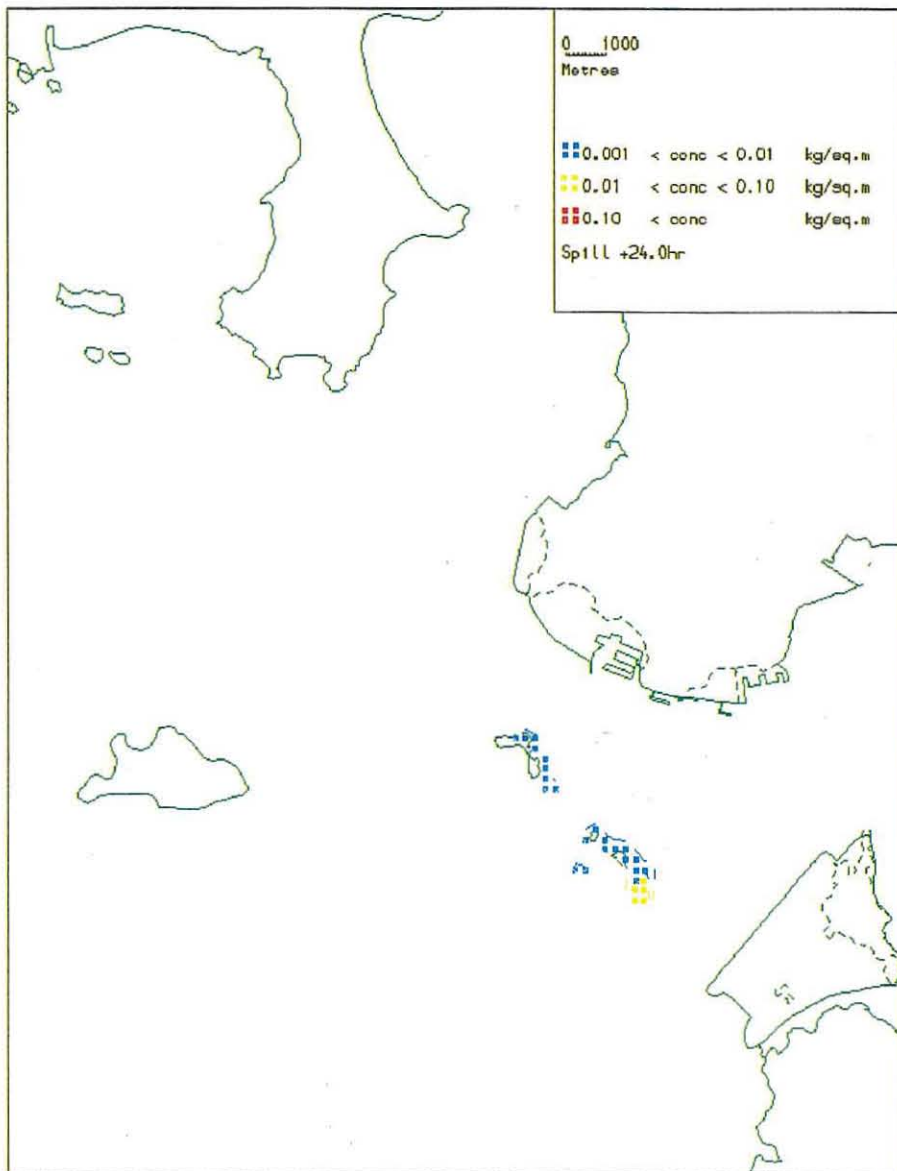


AFRF at Sha Chau  
 Simulation of Fuel Spills - Scenario 1  
 Surface Concentration of Fuel  
 Flood Release of Fuel

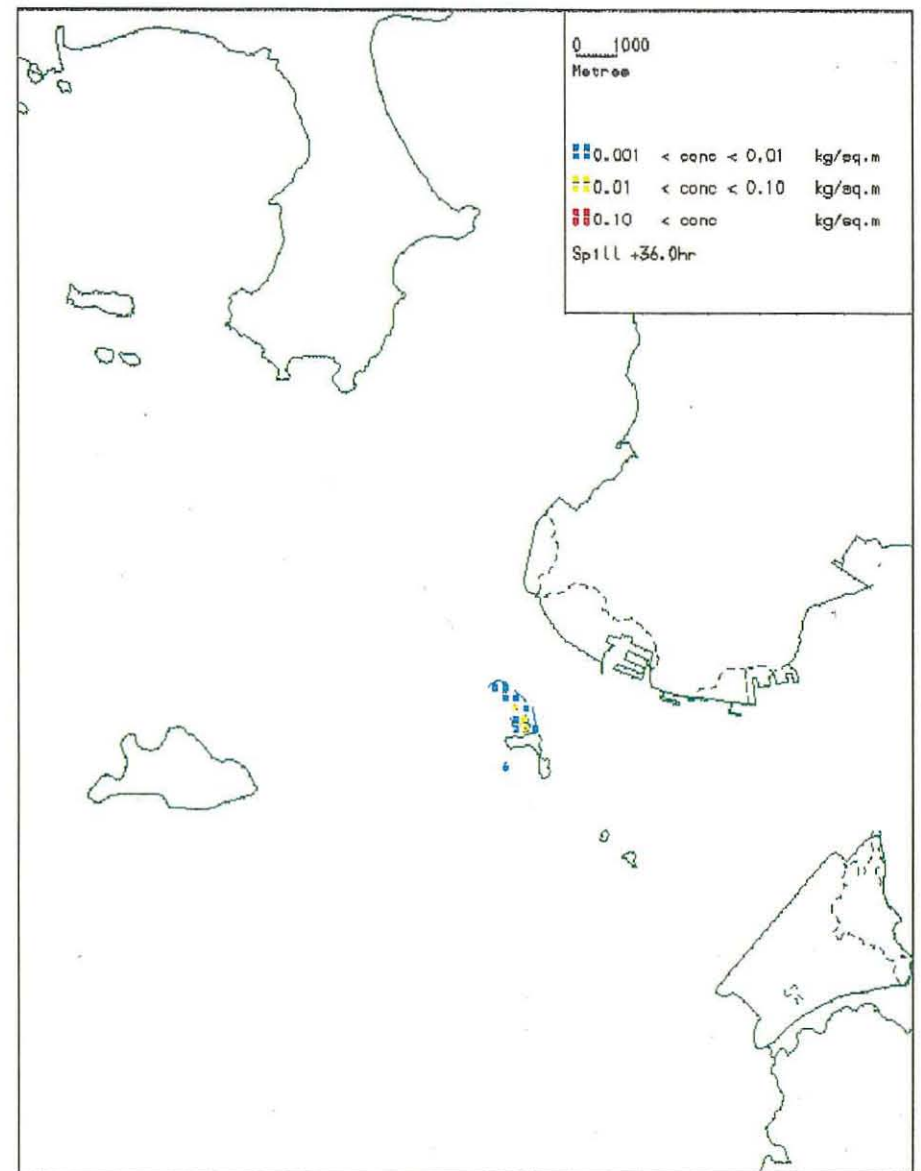


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 Surface Concentration of Fuel  
 Flood Release of Fuel



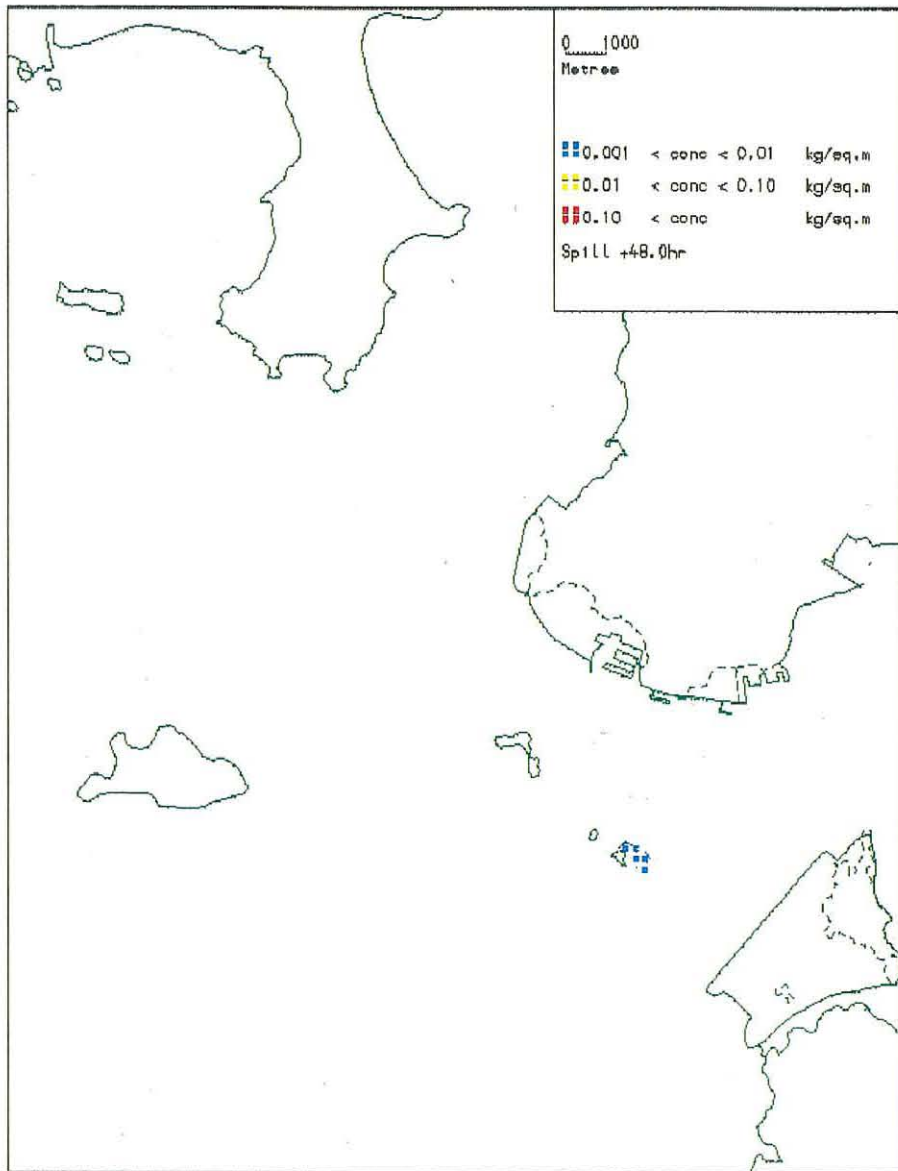


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 Flood Release of Fuel

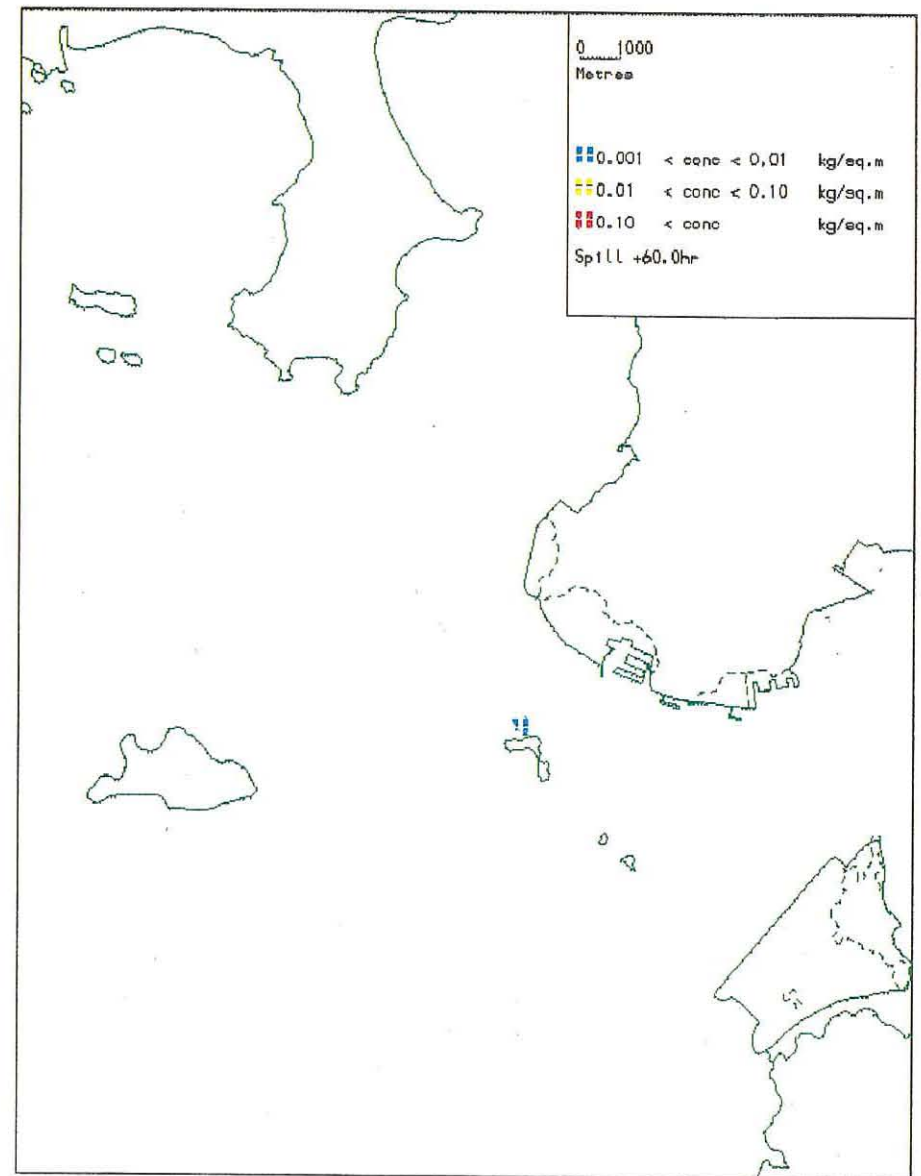


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 Flood Release of Fuel

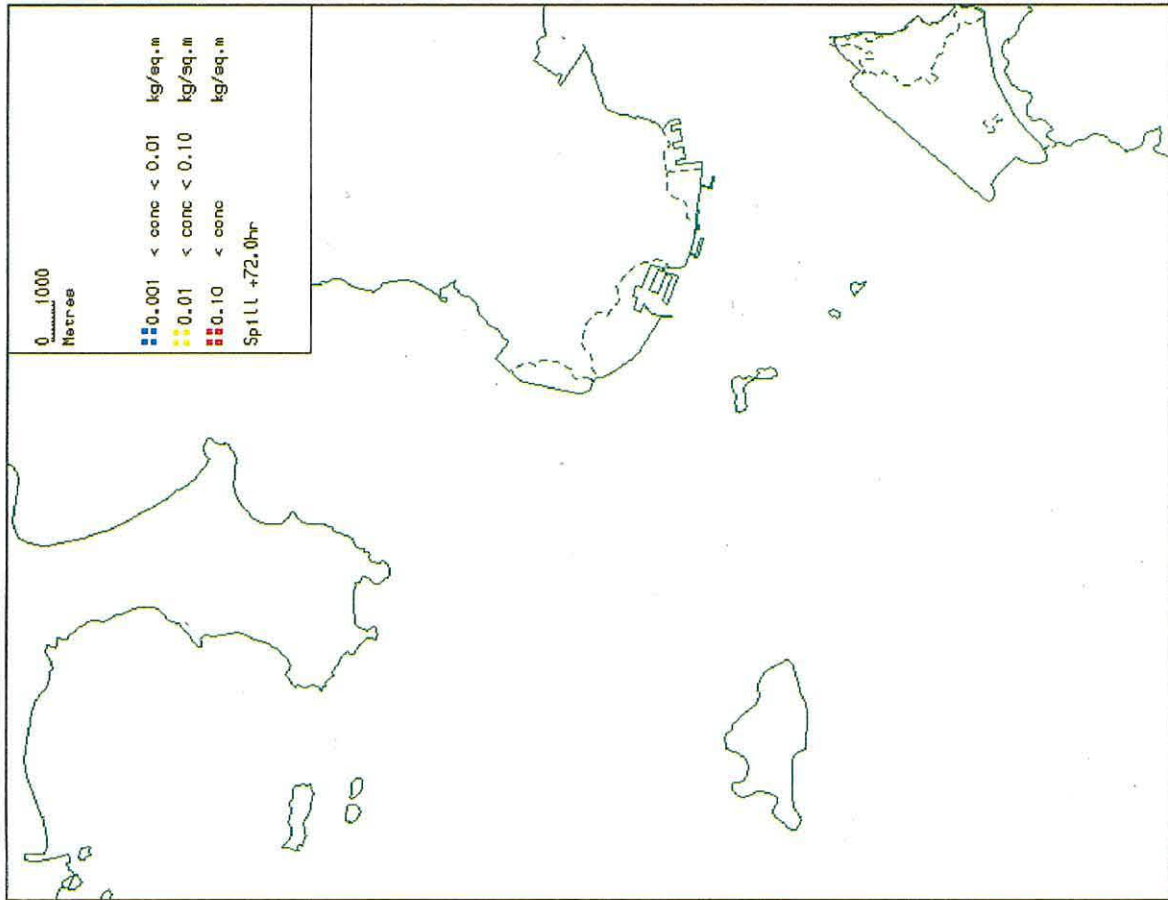




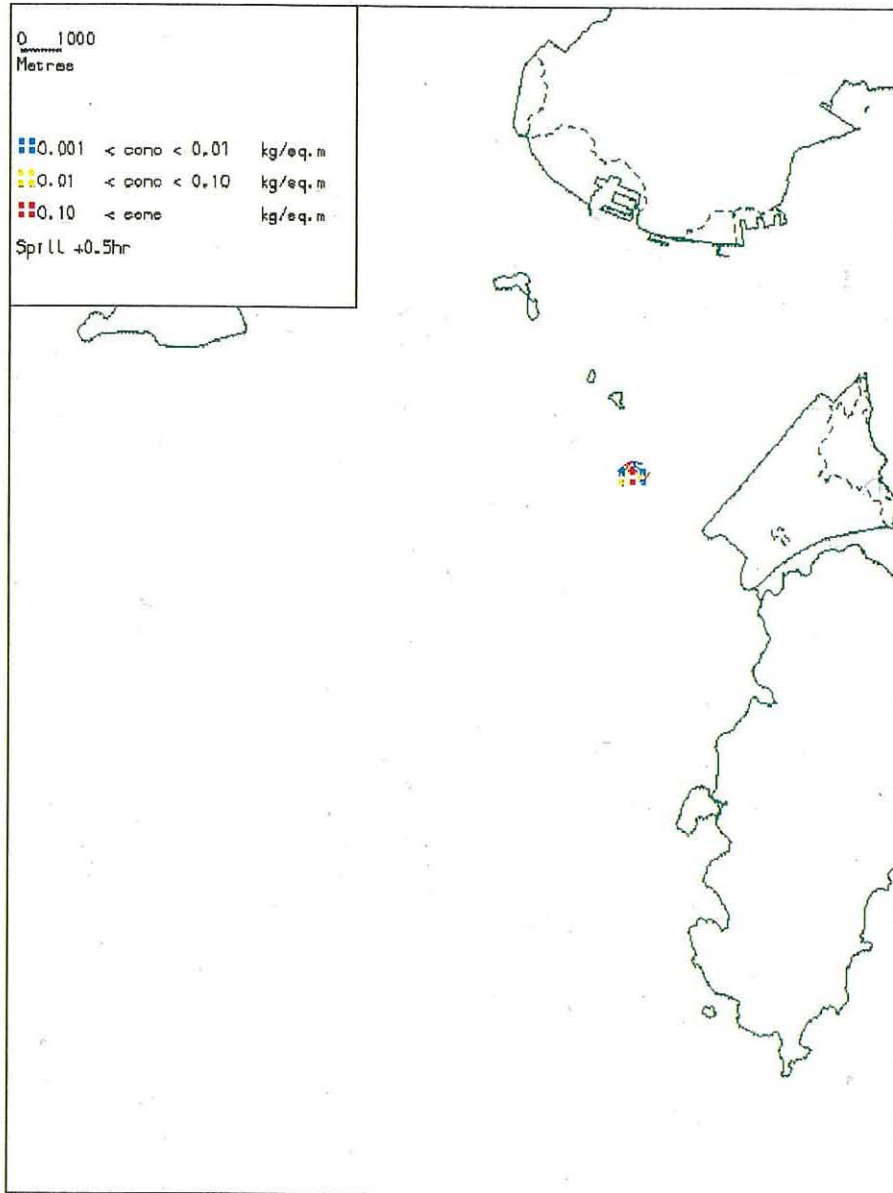
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 Flood Release of Fuel



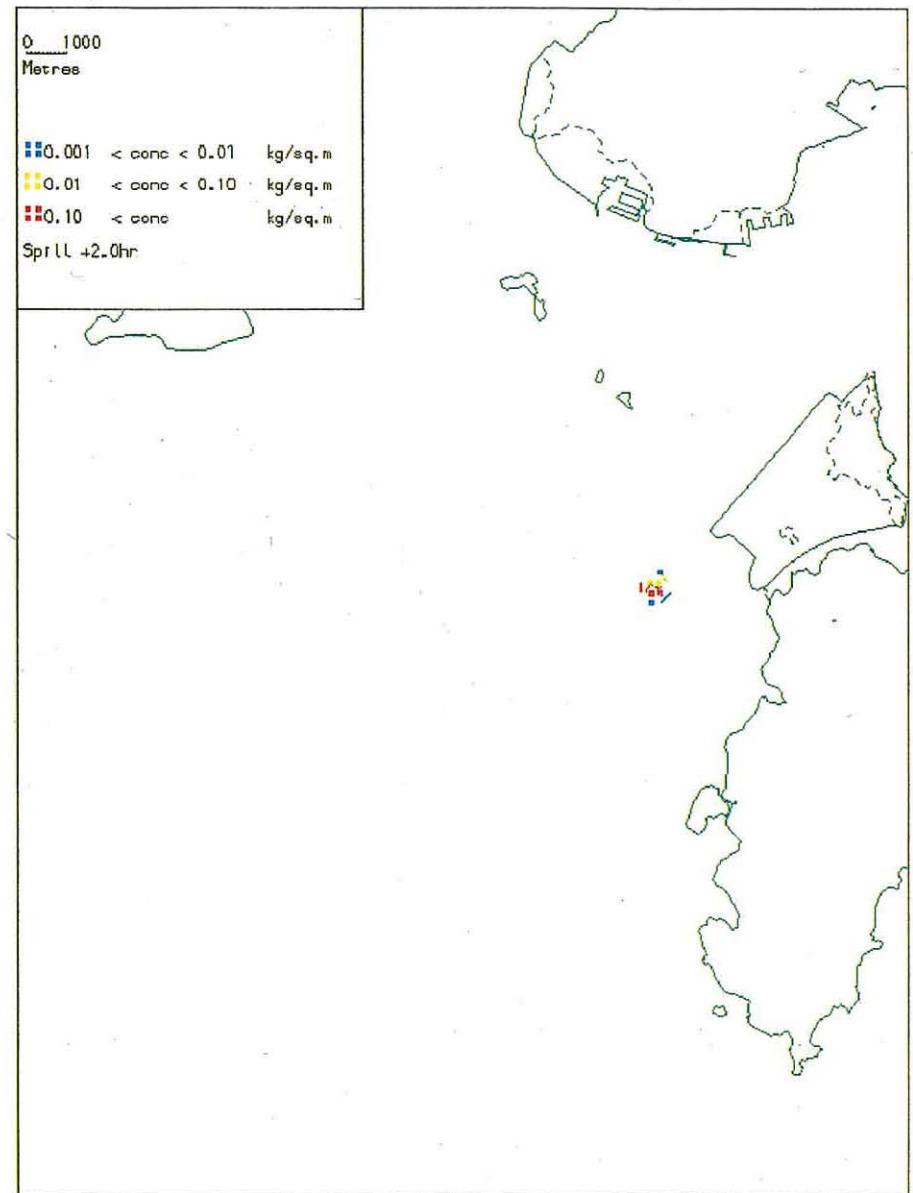
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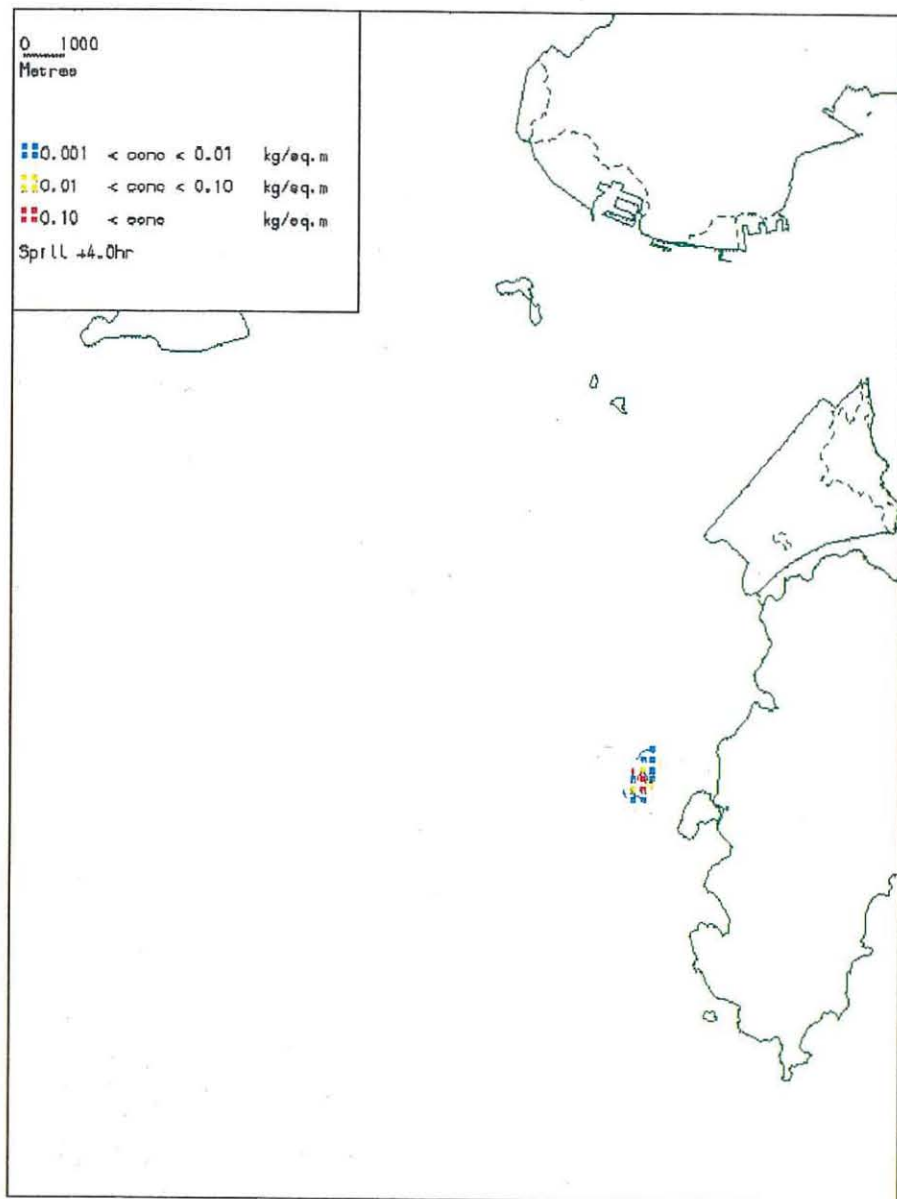
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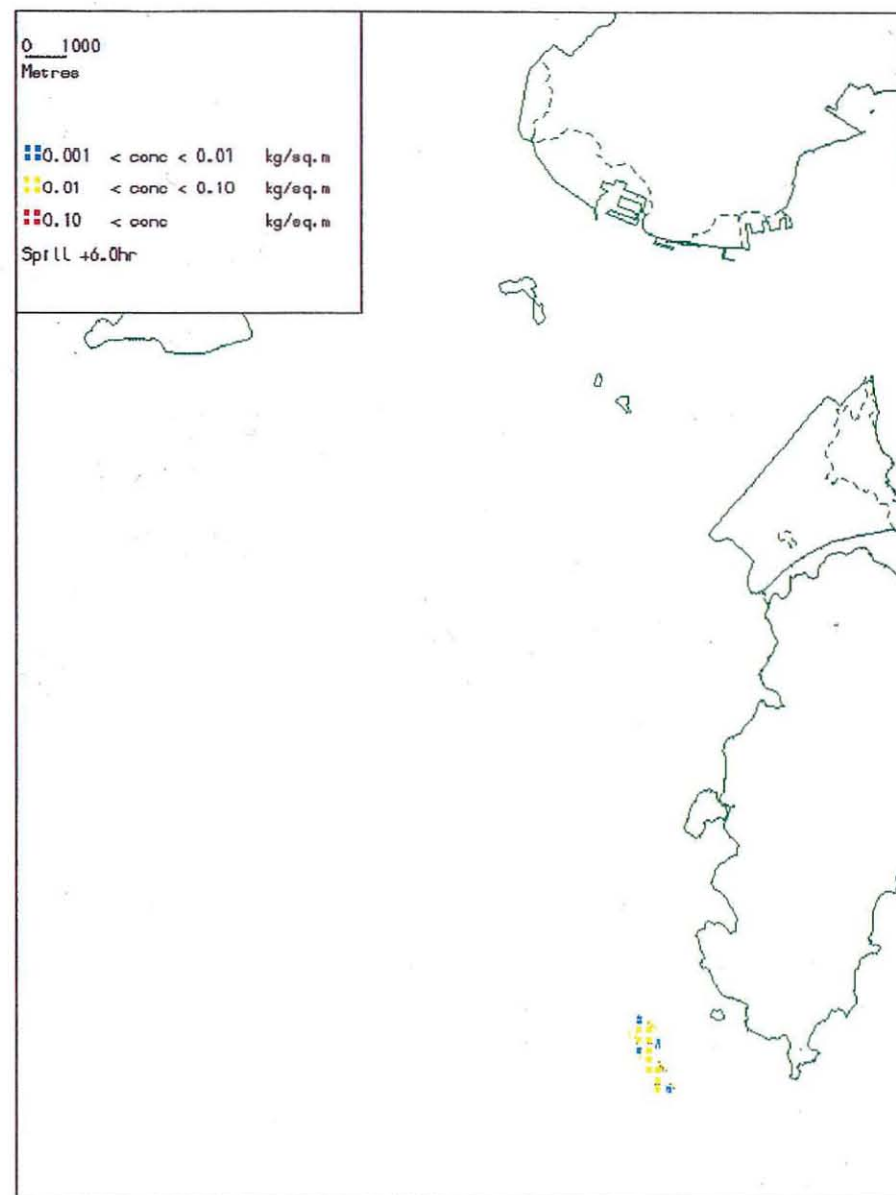
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Surface Concentration of Fuel  
Ebb Release of Fuel



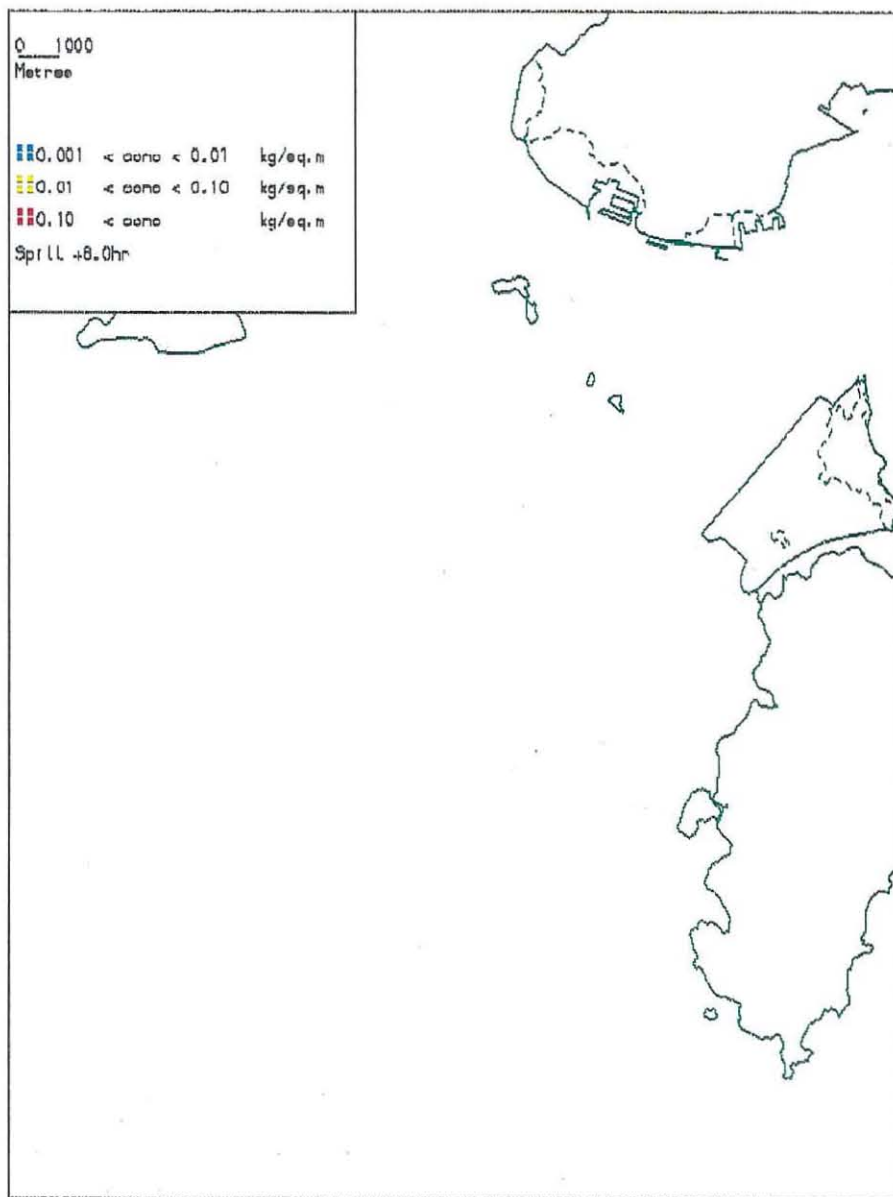
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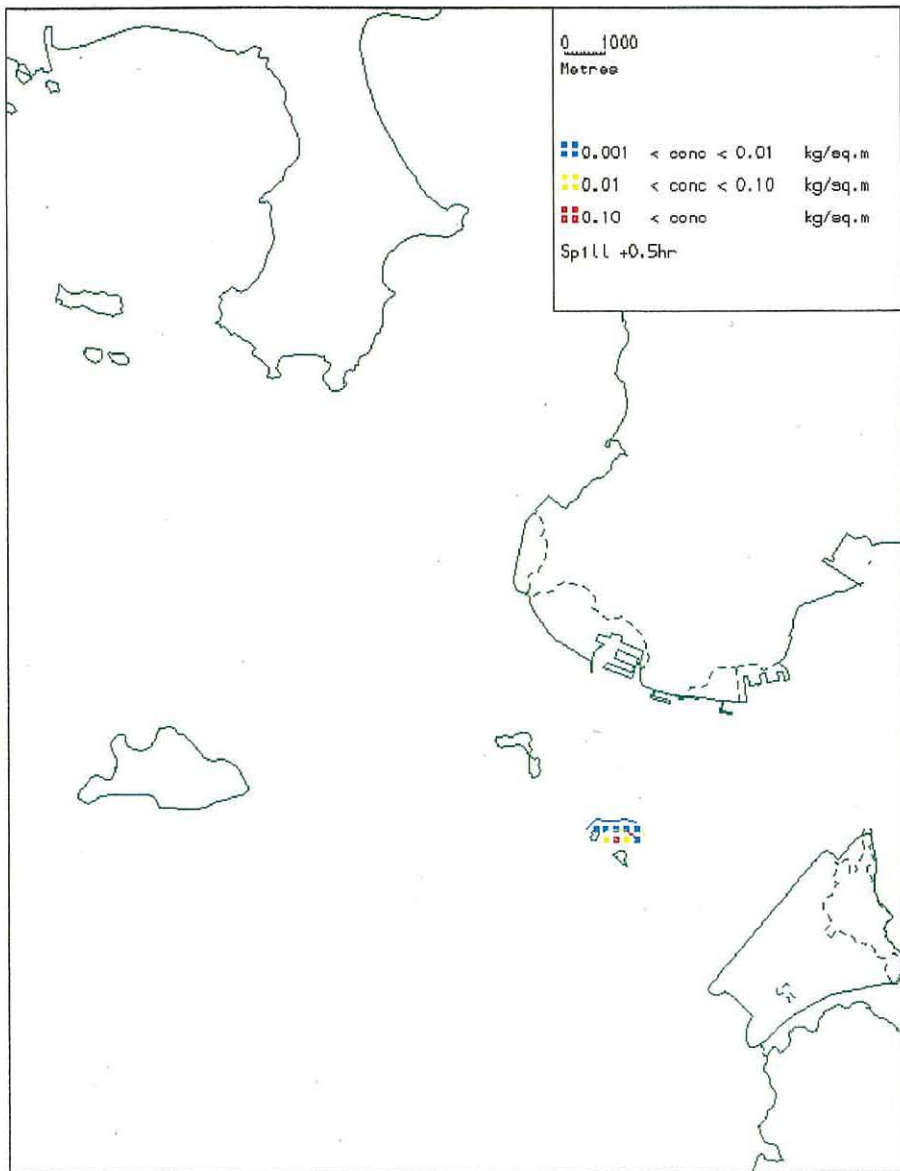
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Surface Concentration of Fuel  
Ebb Release of Fuel



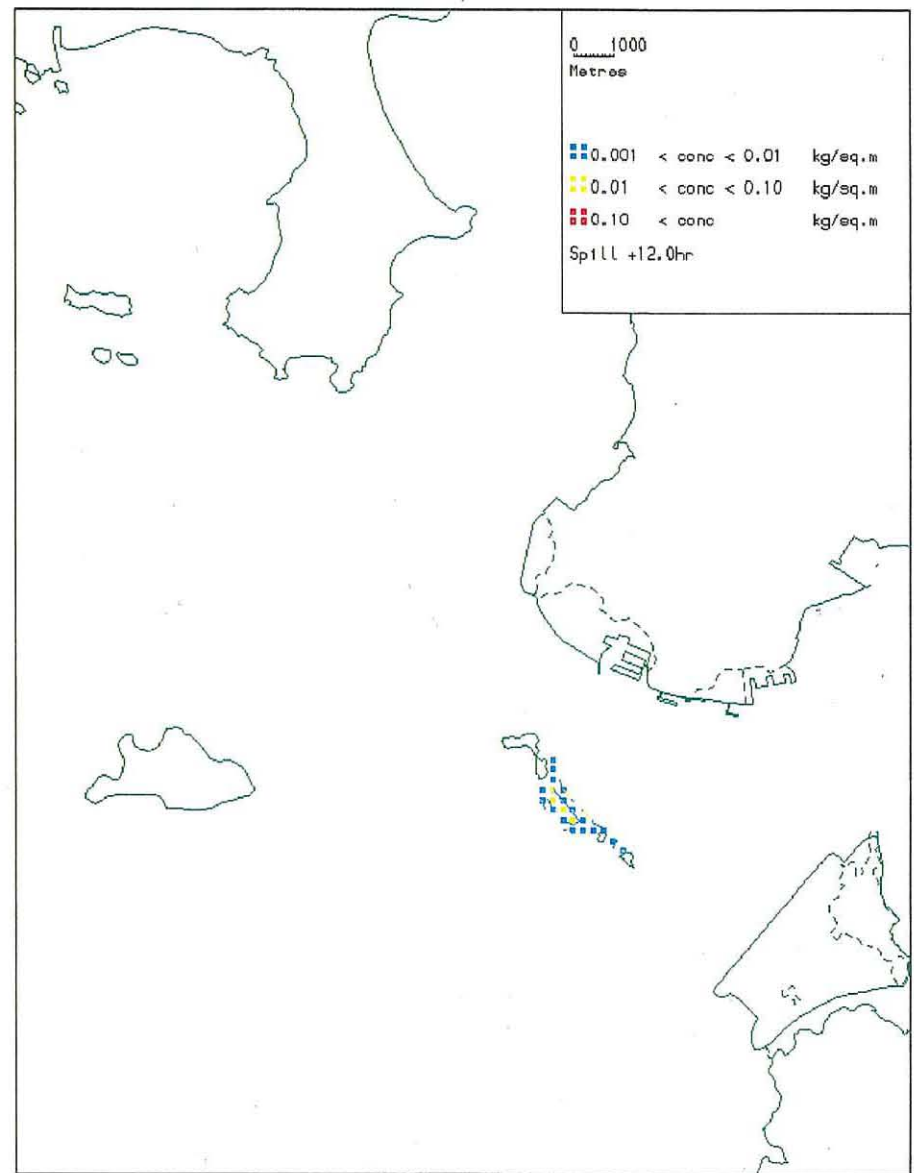
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Surface Concentration of Fuel  
Ebb Release of Fuel



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Surface Concentration of Fuel  
Ebb Release of Fuel

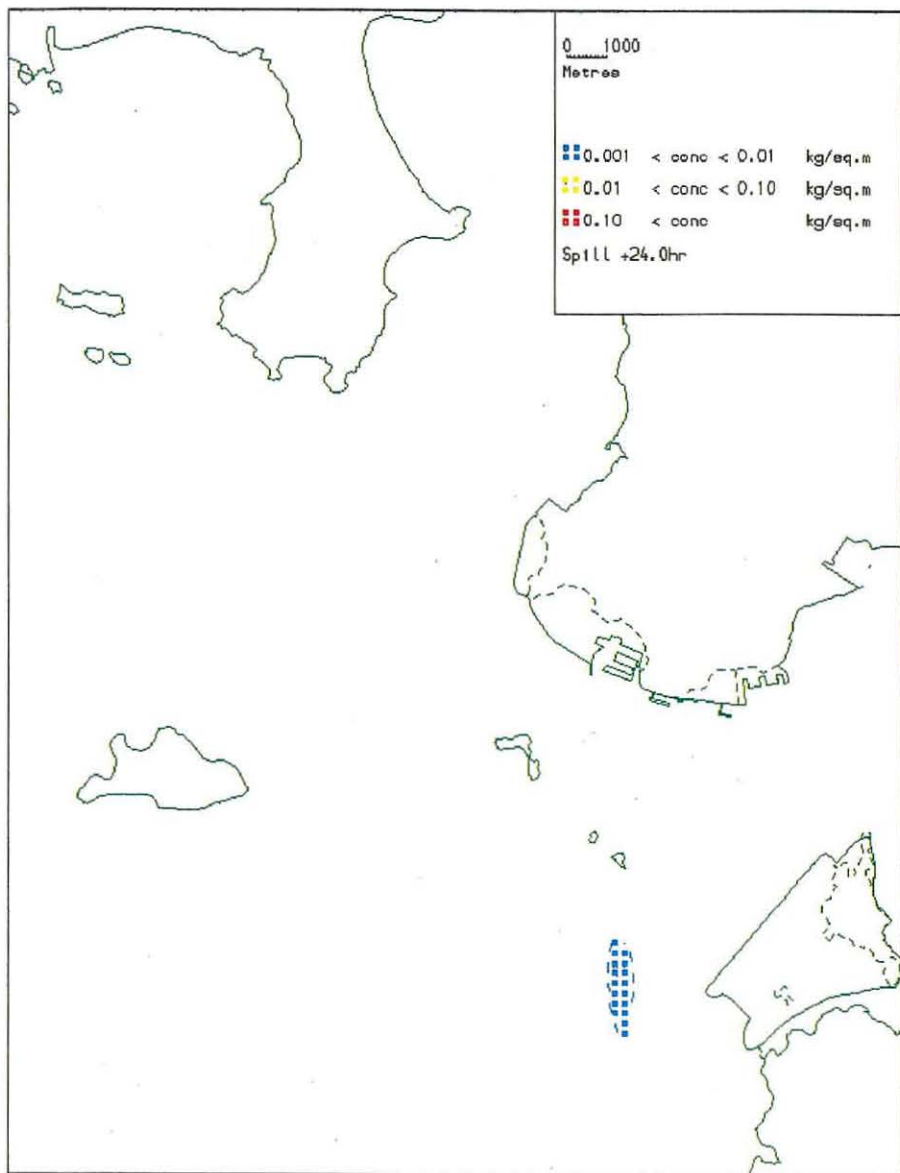


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Surface Concentration of Fuel  
Flood Release of Fuel

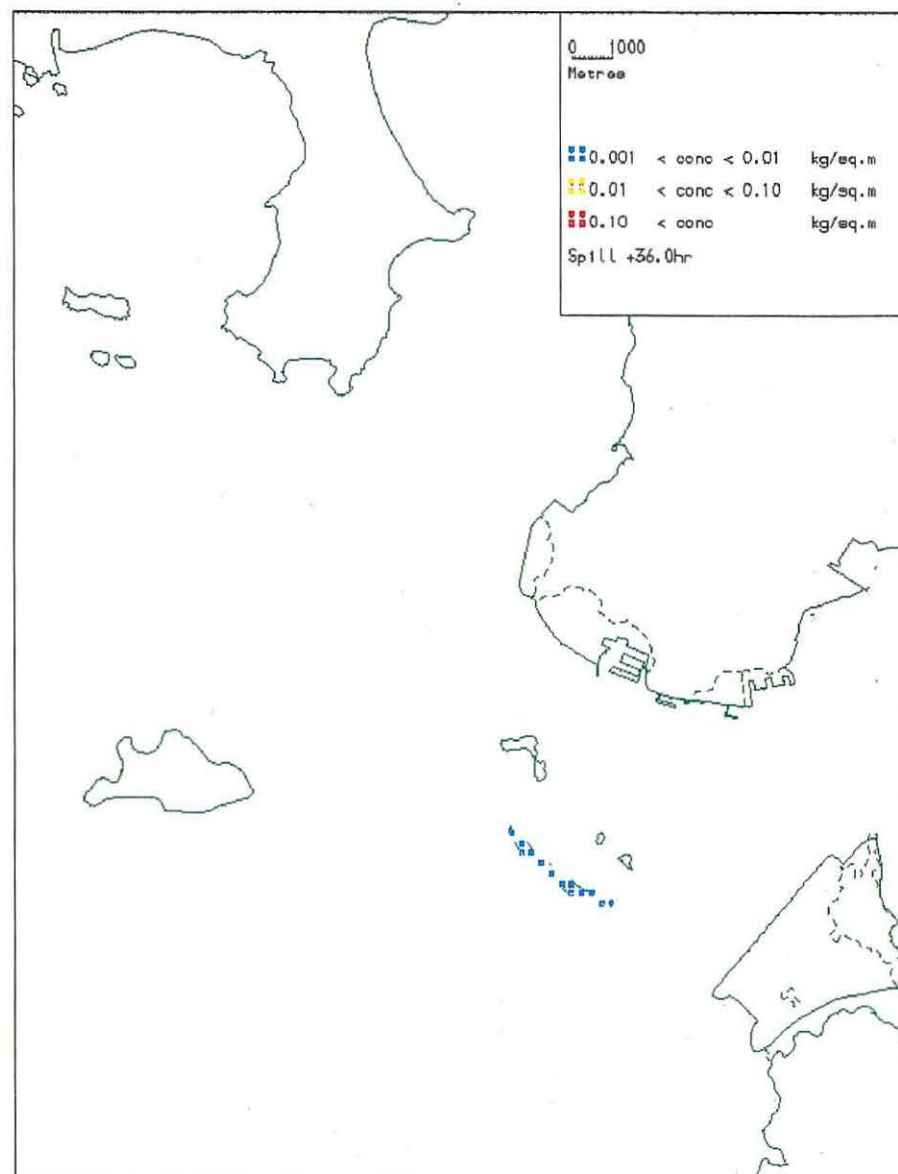


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Surface Concentration of Fuel  
Flood Release of Fuel

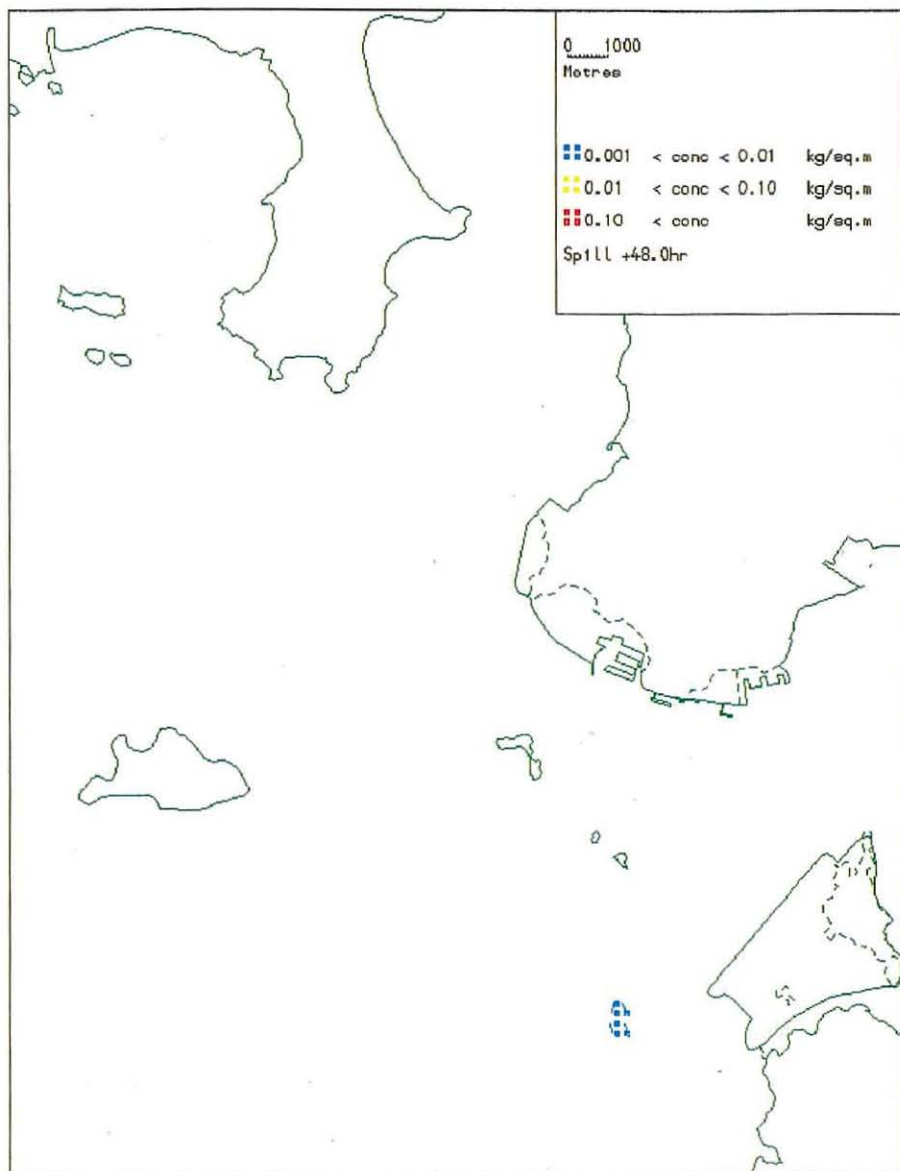




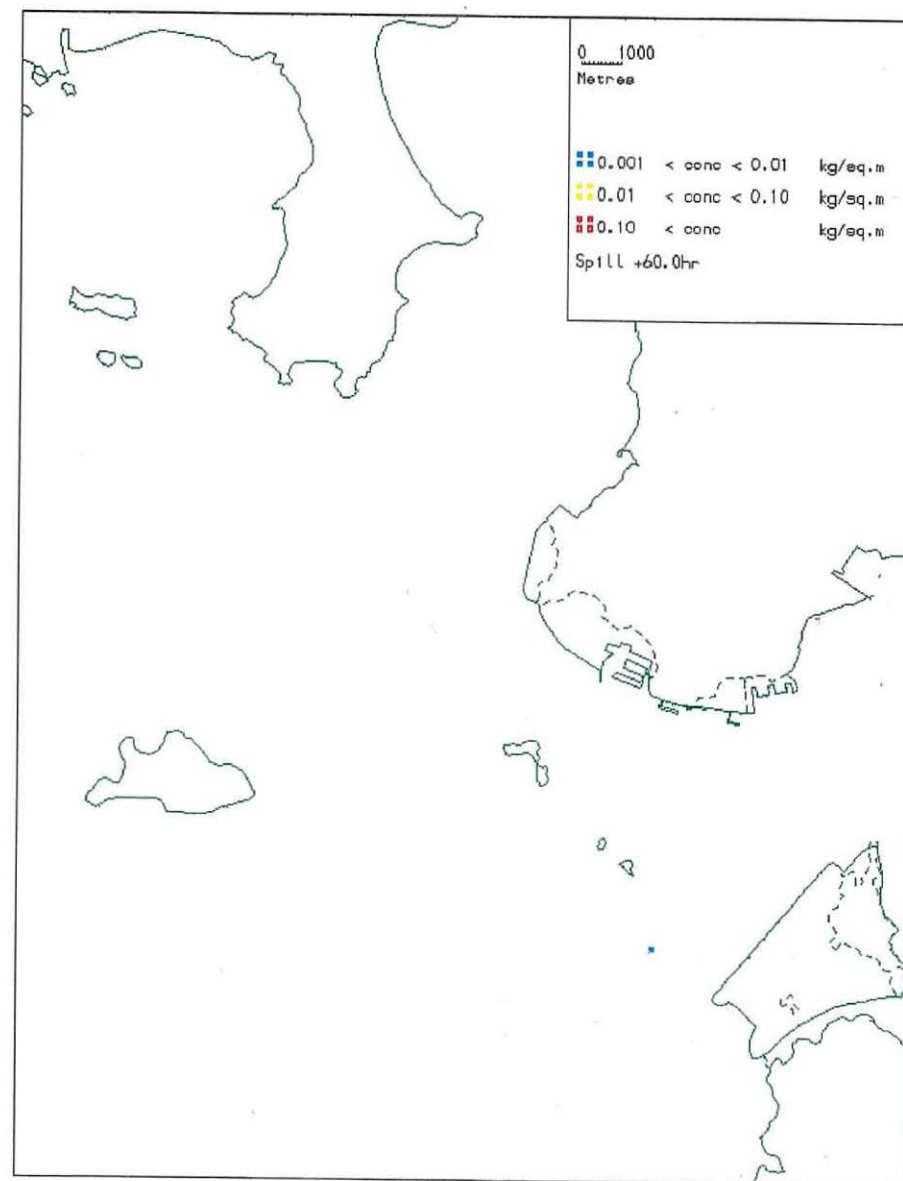
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Surface Concentration of Fuel  
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AFRF at Sha Chau  
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Surface Concentration of Fuel  
Flood Release of Fuel

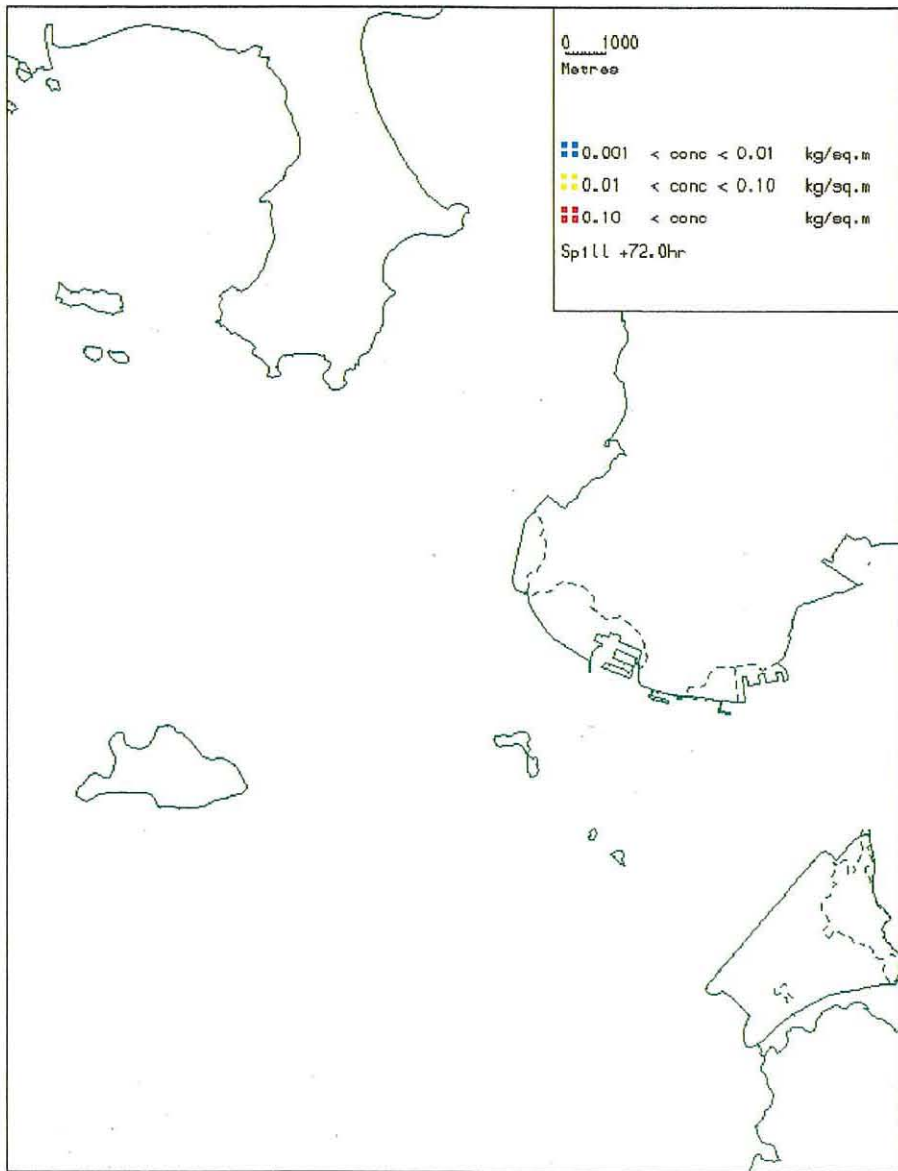


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Surface Concentration of Fuel  
Flood Release of Fuel

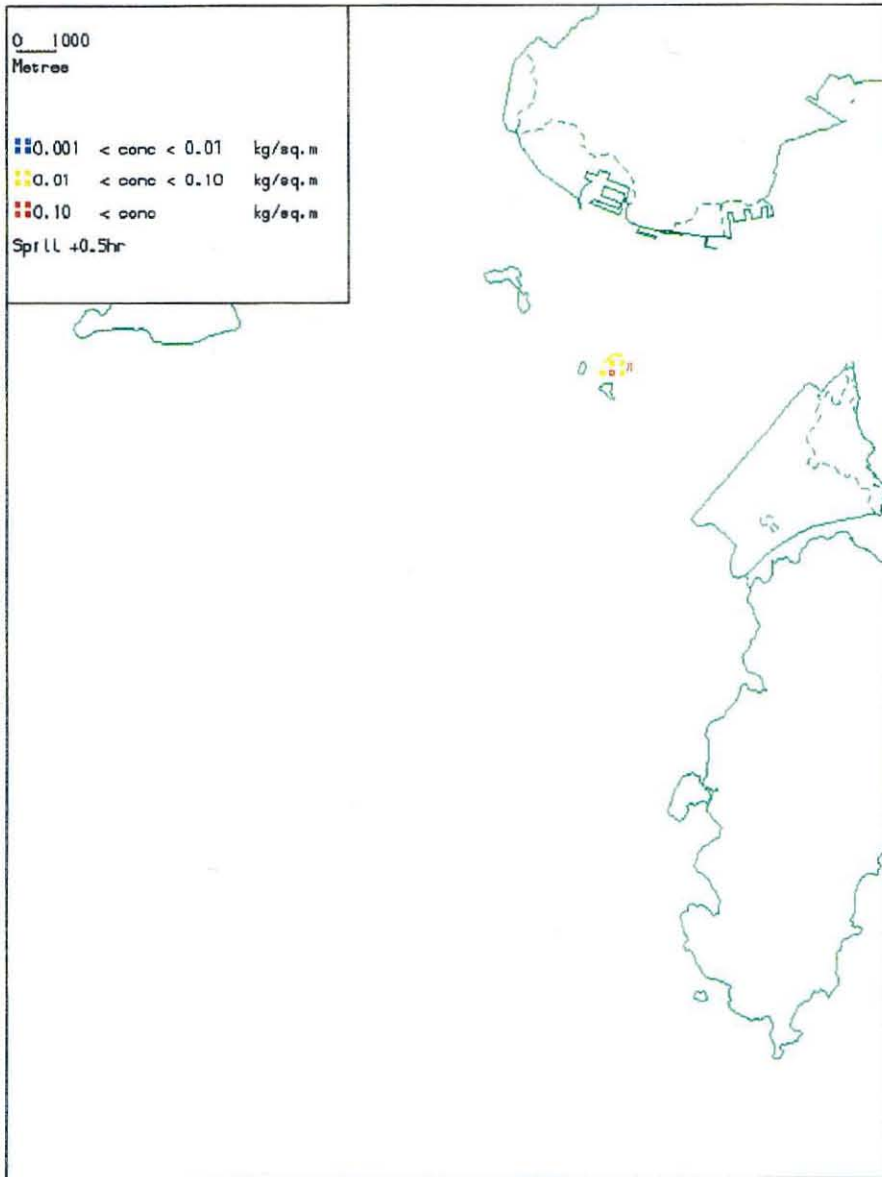


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Surface Concentration of Fuel  
Flood Release of Fuel

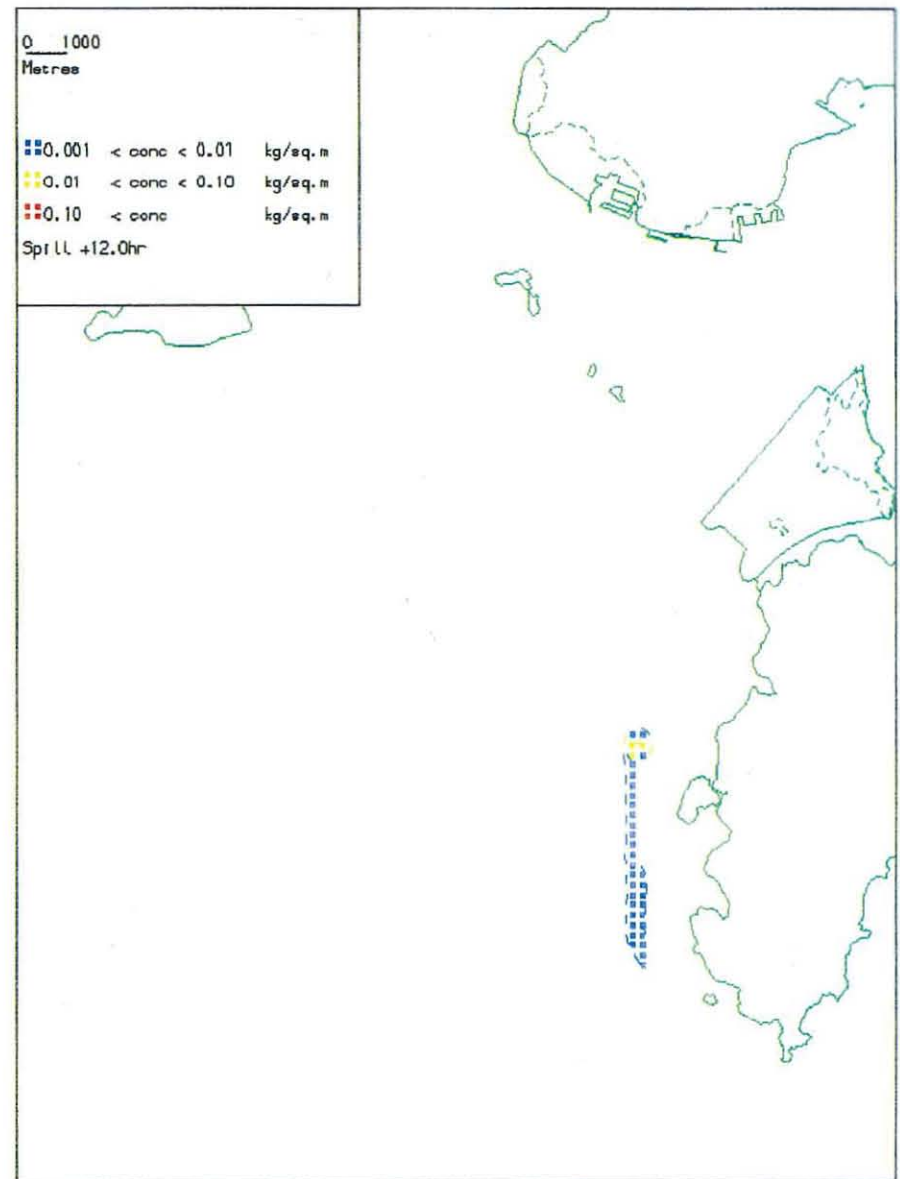




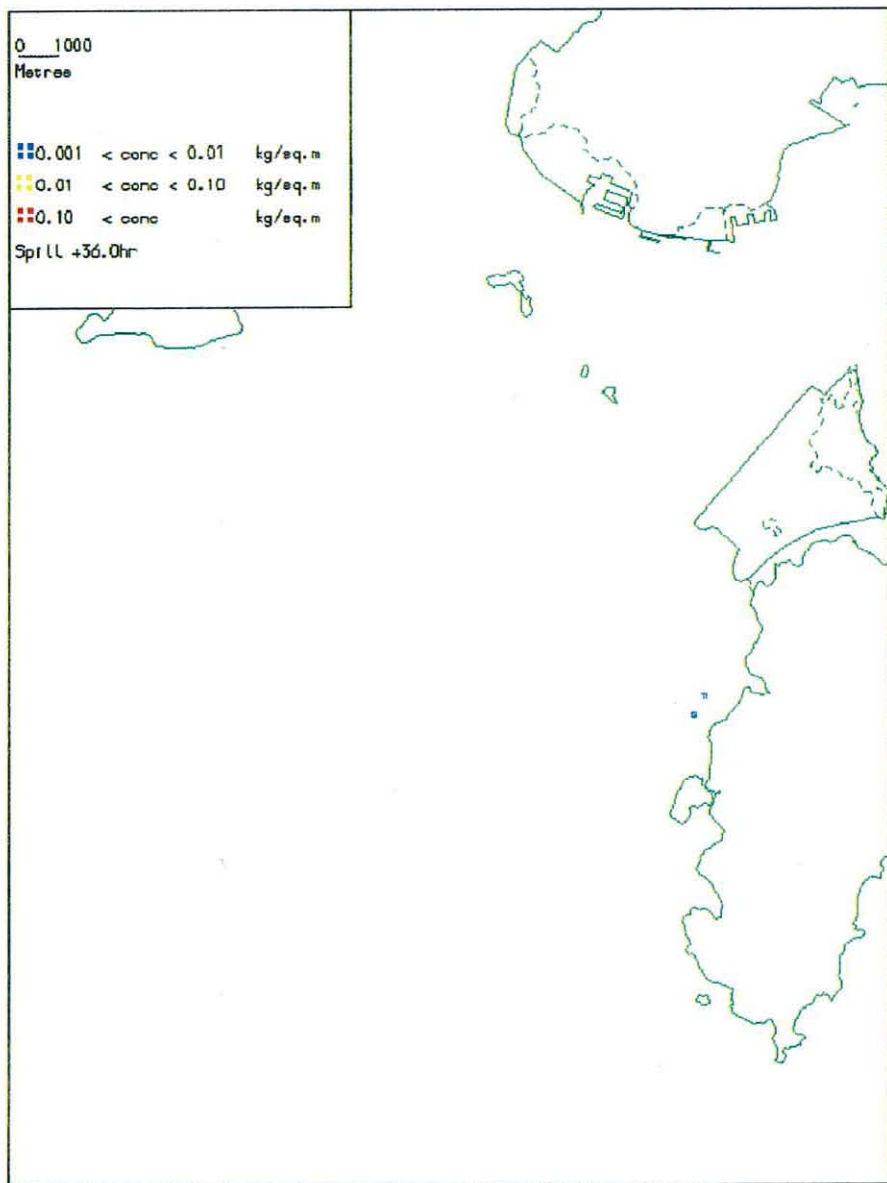
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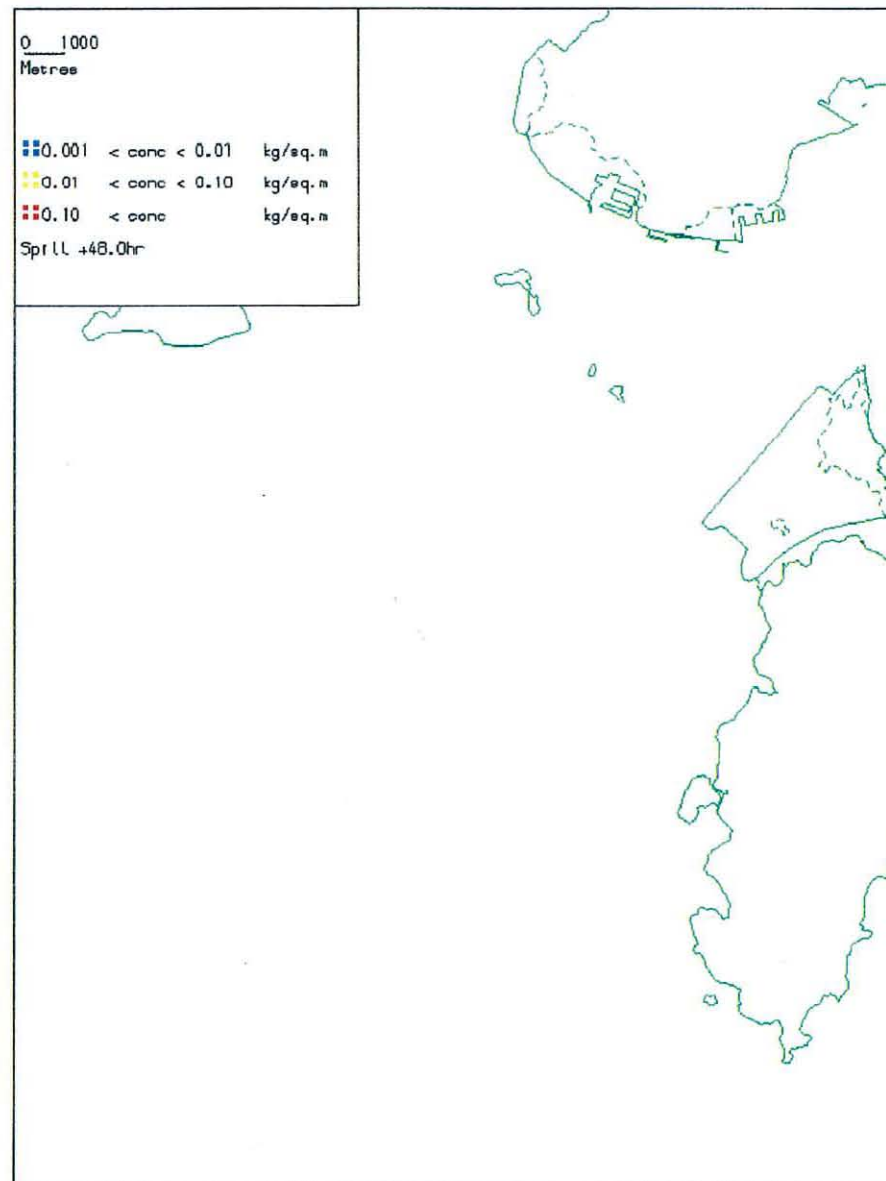
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Ebb Release of Fuel



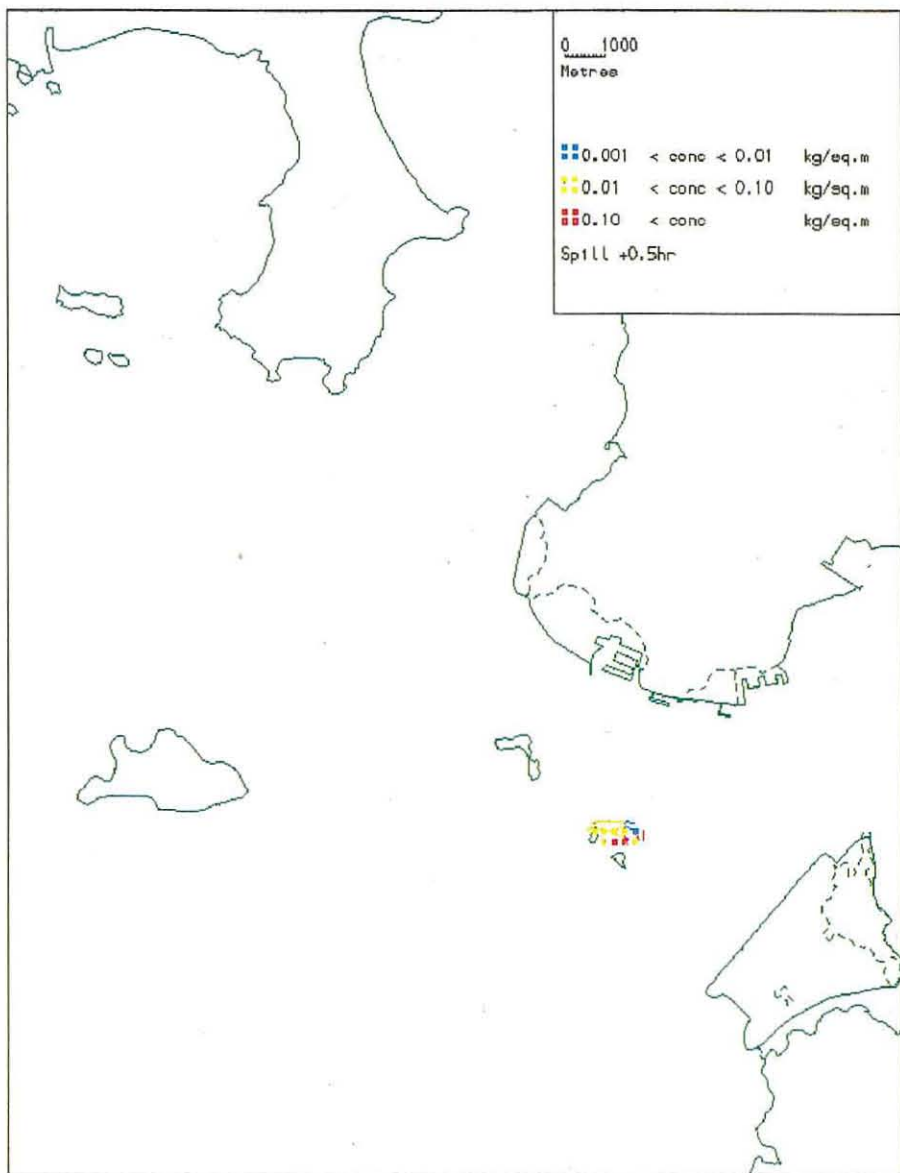
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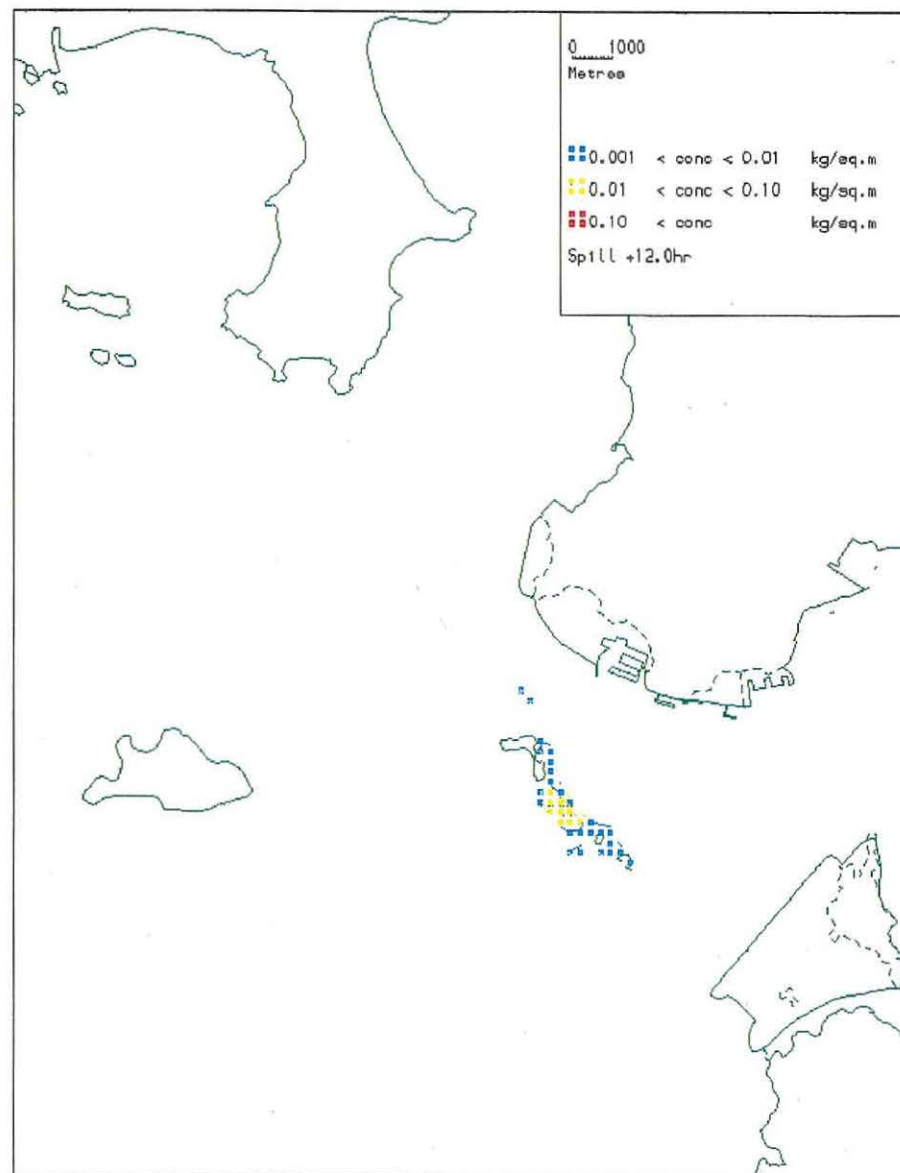
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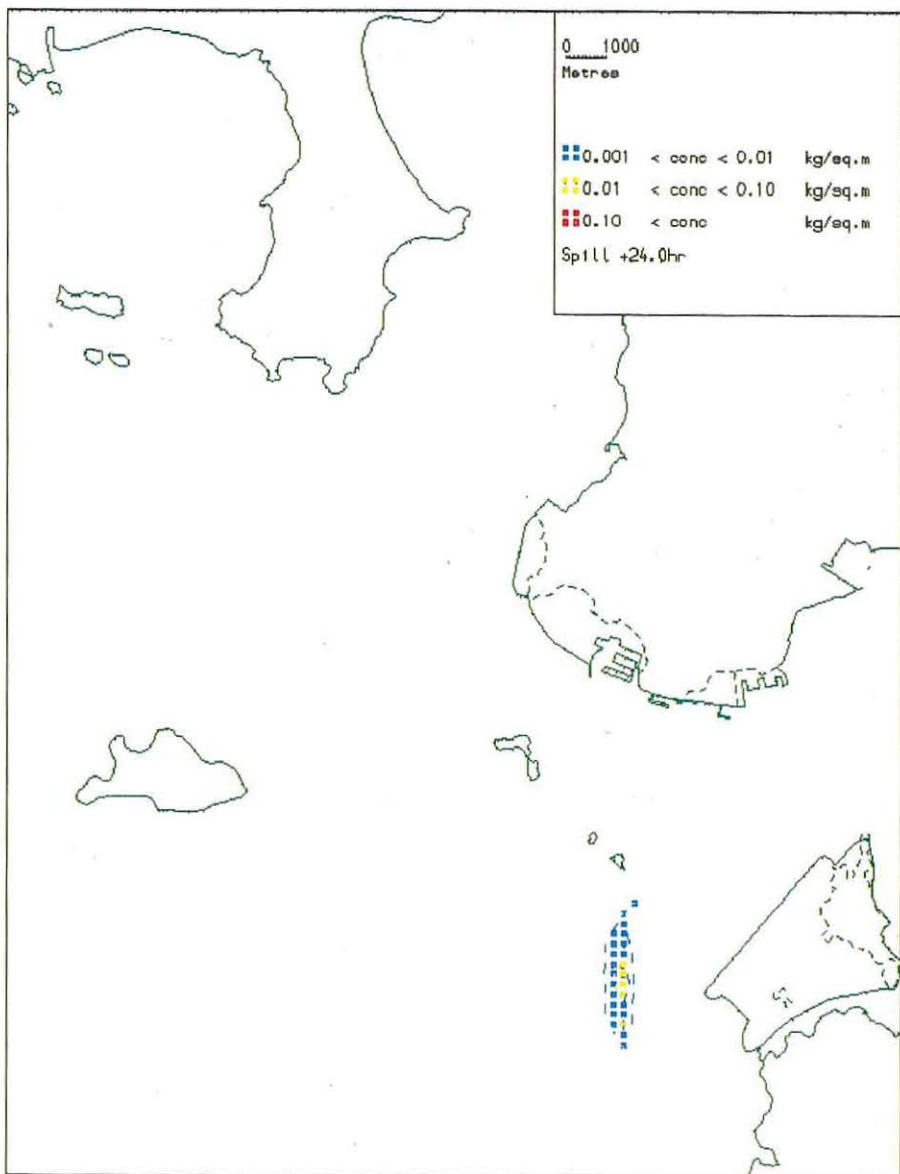
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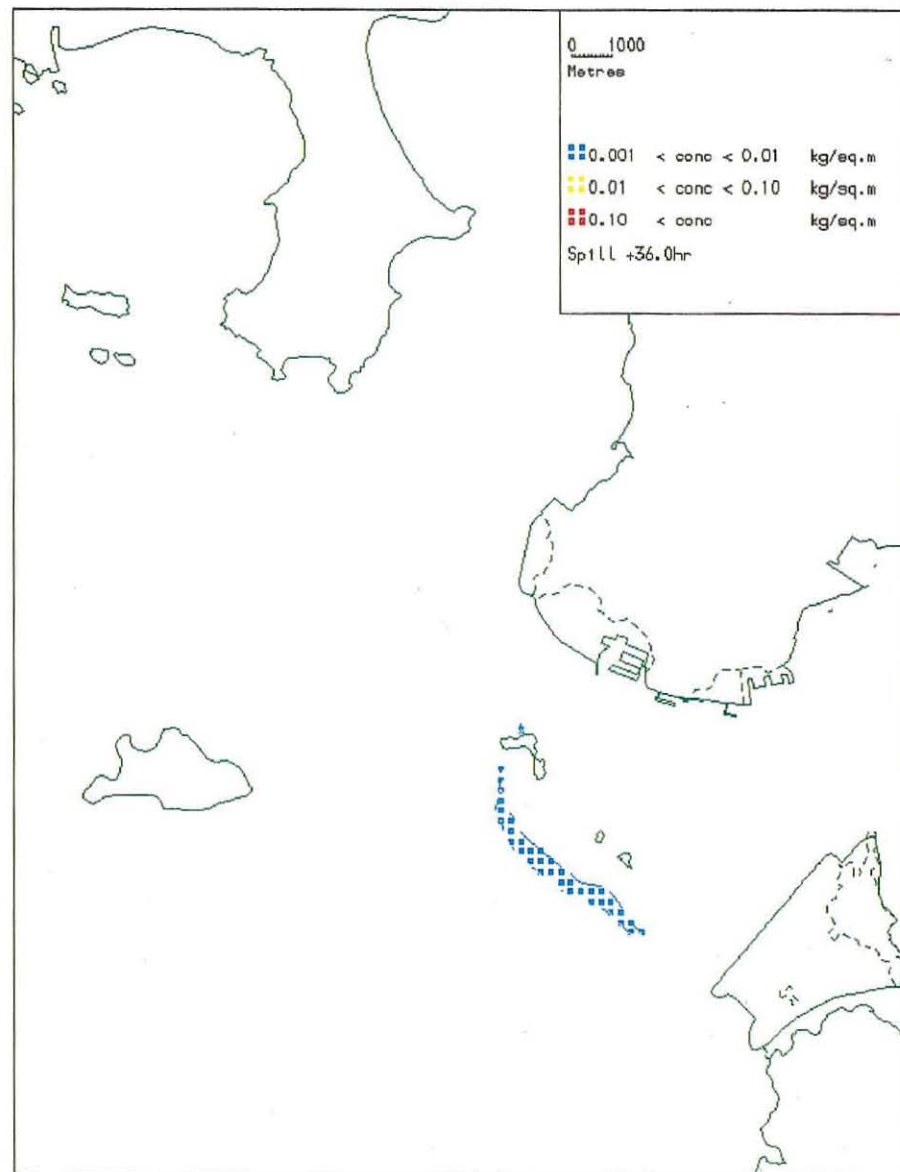
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Surface Concentration of Fuel  
Flood Release of Fuel



AFRF at Sha Chau  
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Flood Release of Fuel

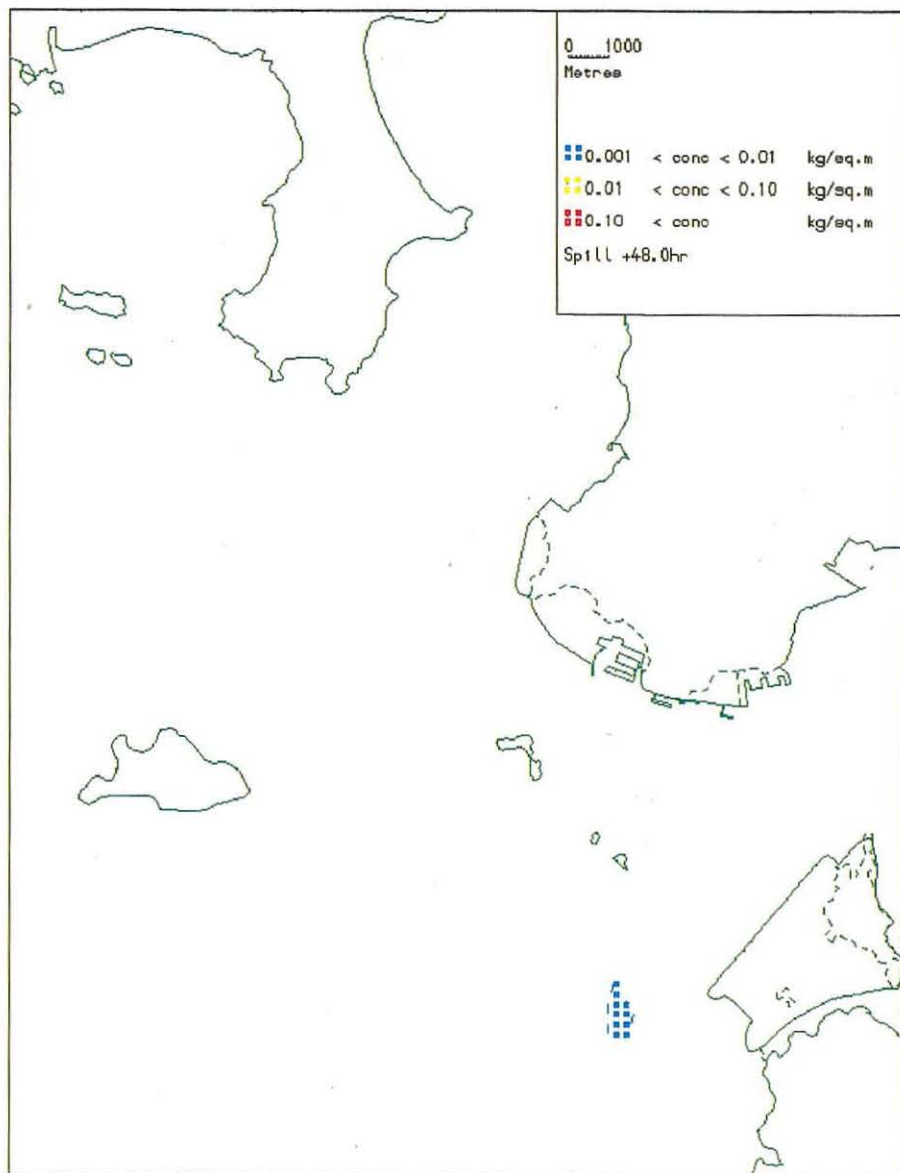


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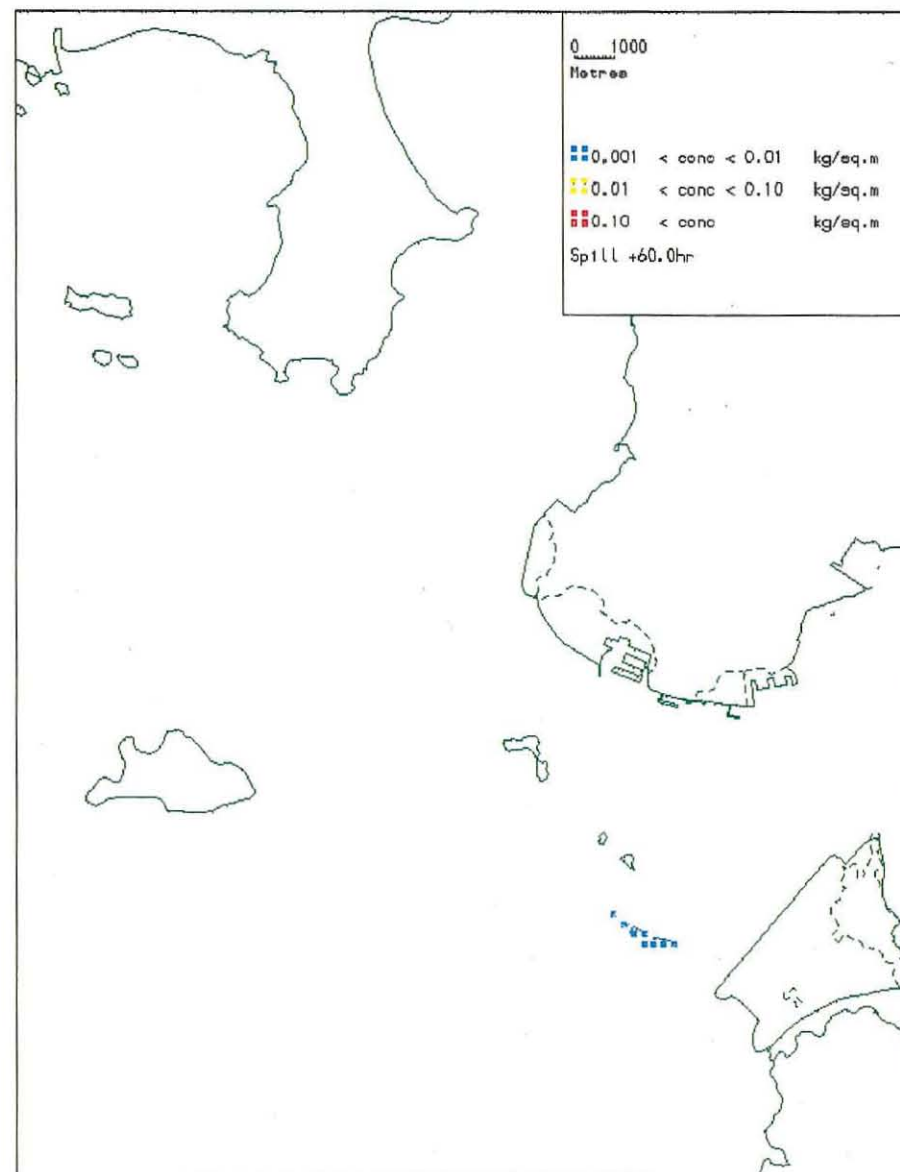


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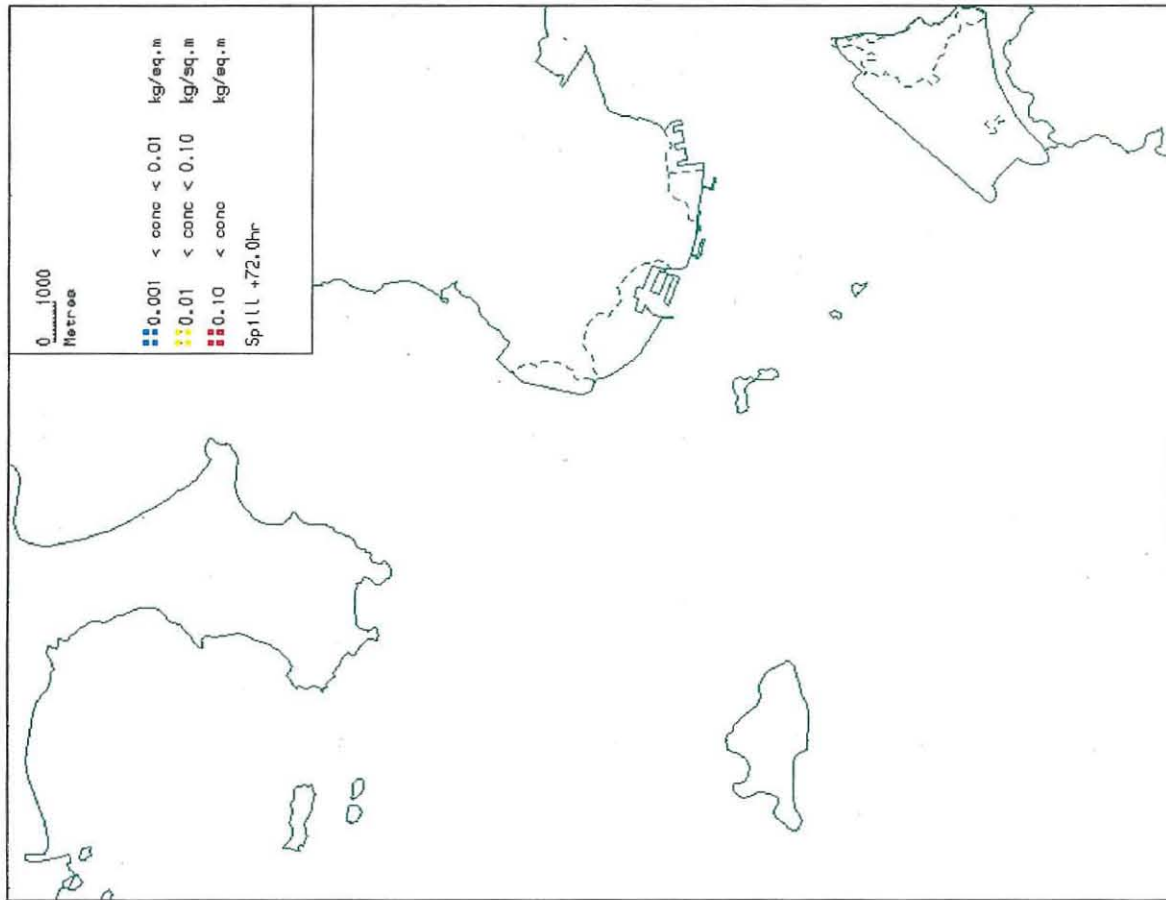




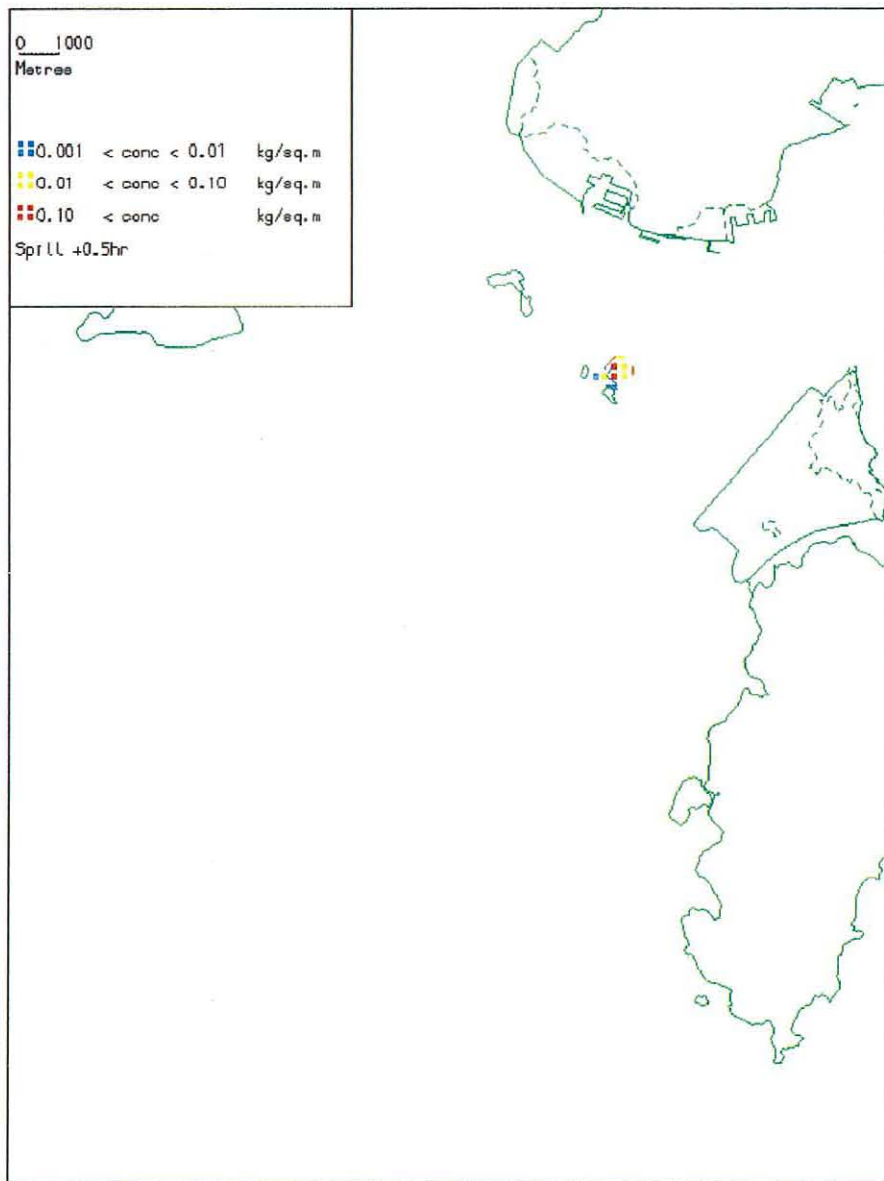
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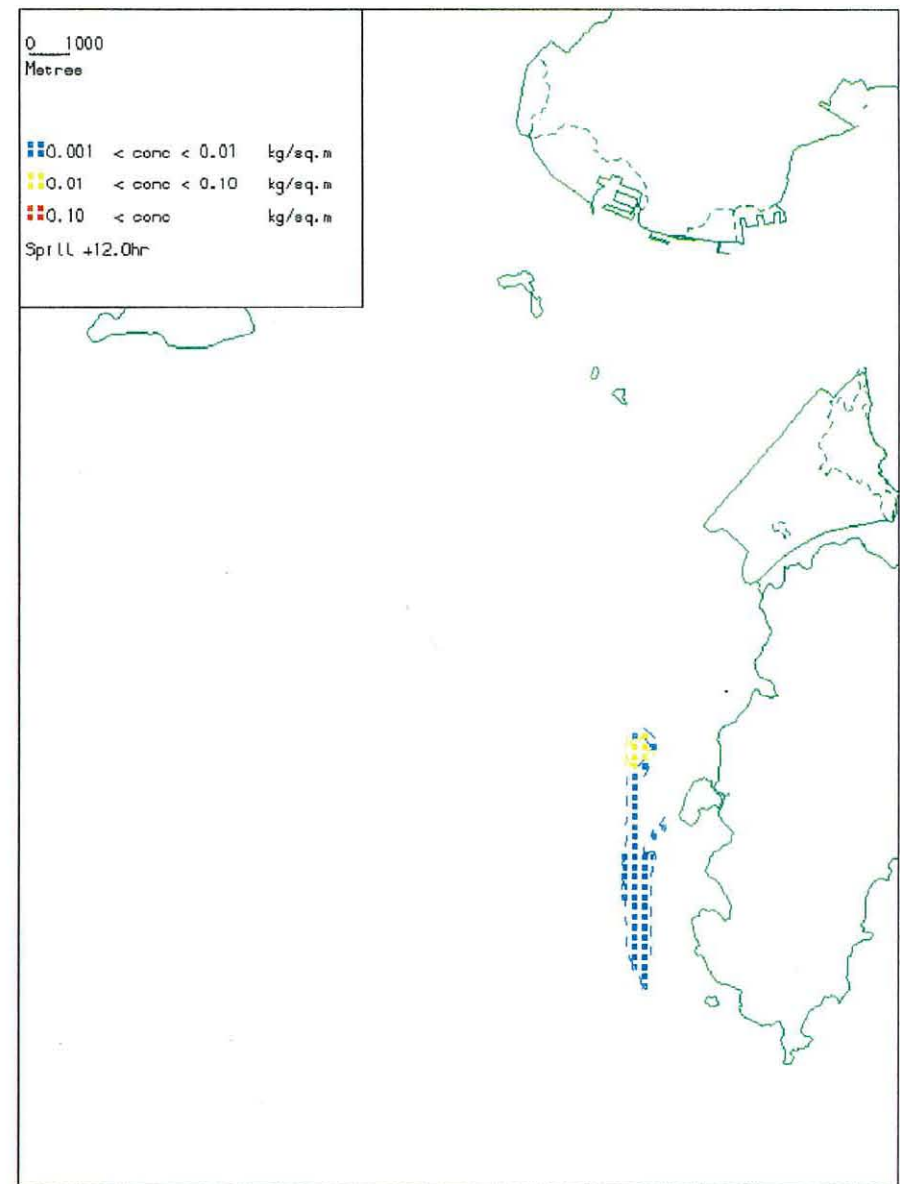
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Flood Release of Fuel



AFRF at Sha Chau  
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 Flood Release of Fuel

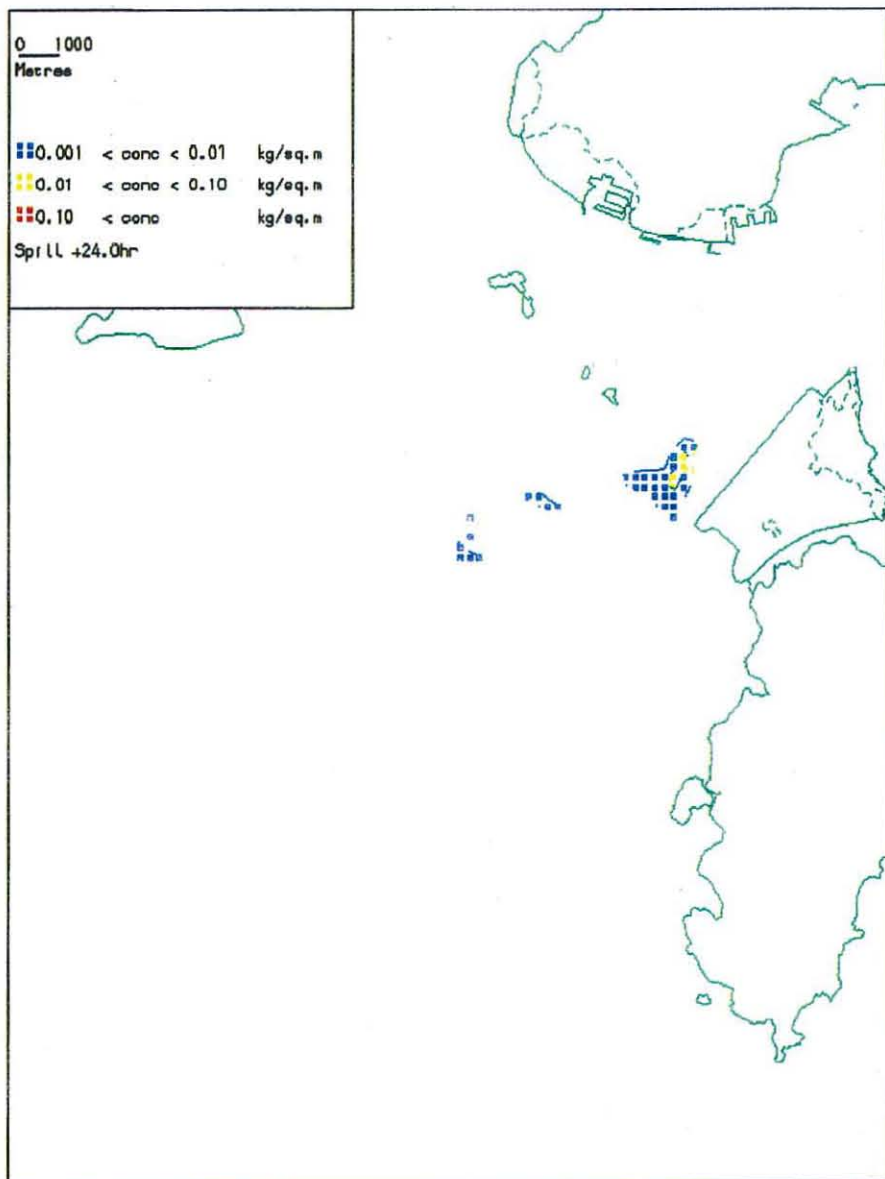


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Simulation of Fuel Spills - Scenario 3  
Surface Concentration of Fuel  
Ebb Release of Fuel

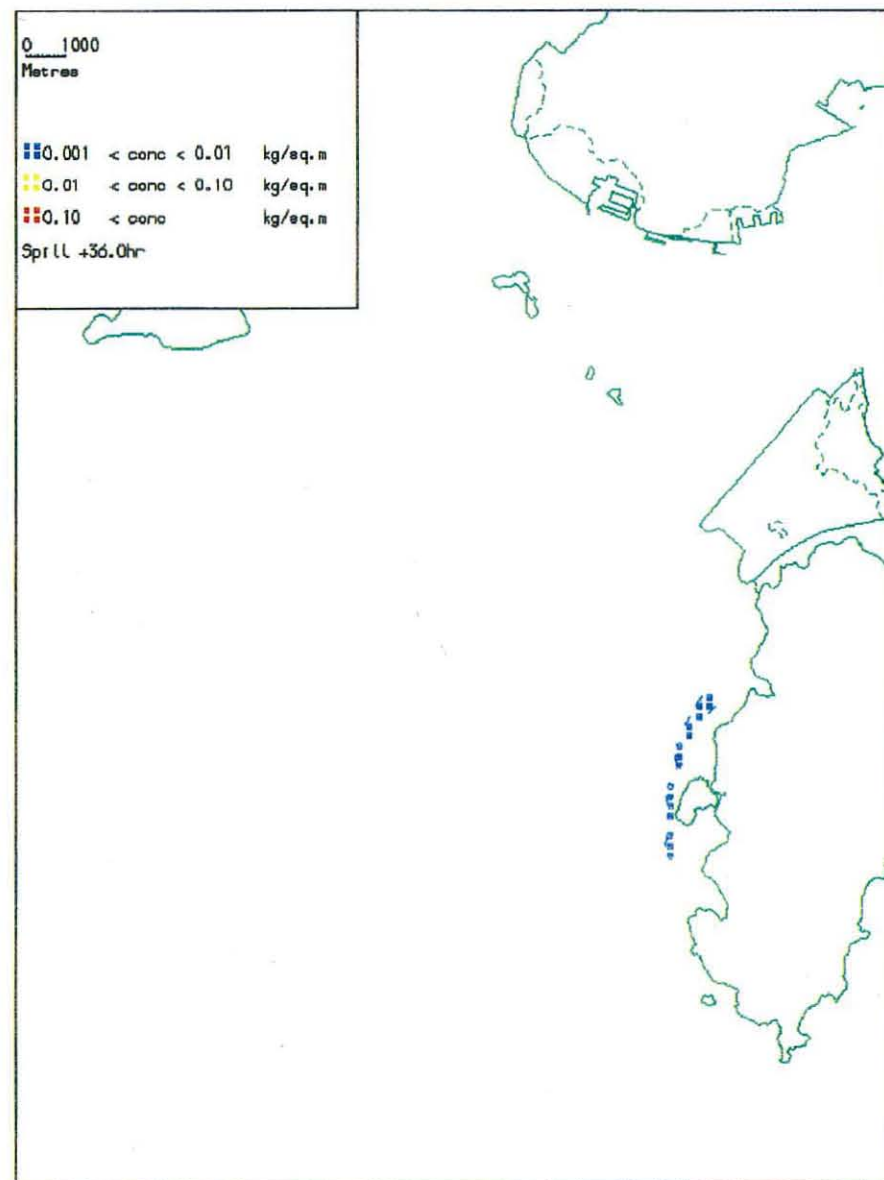


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Surface Concentration of Fuel  
Ebb Release of Fuel

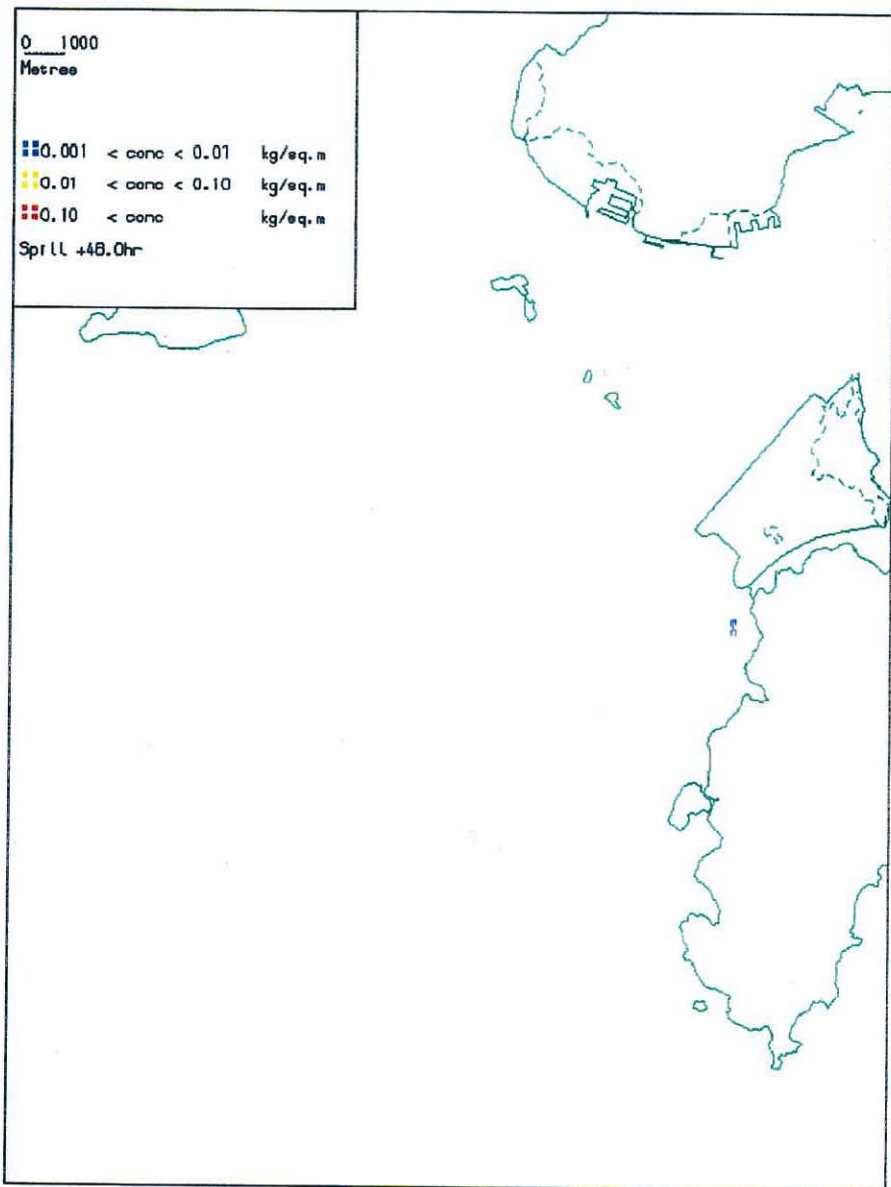




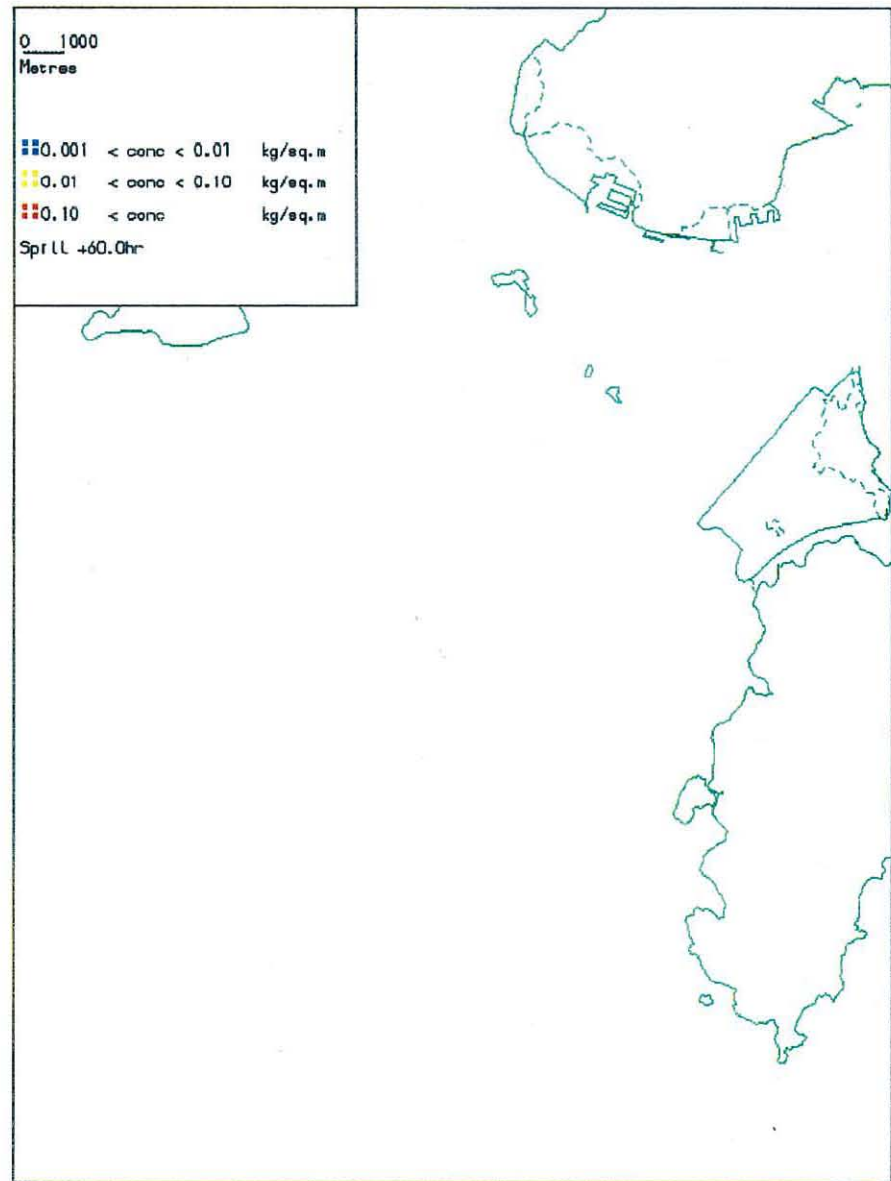
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Ebb Release of Fuel



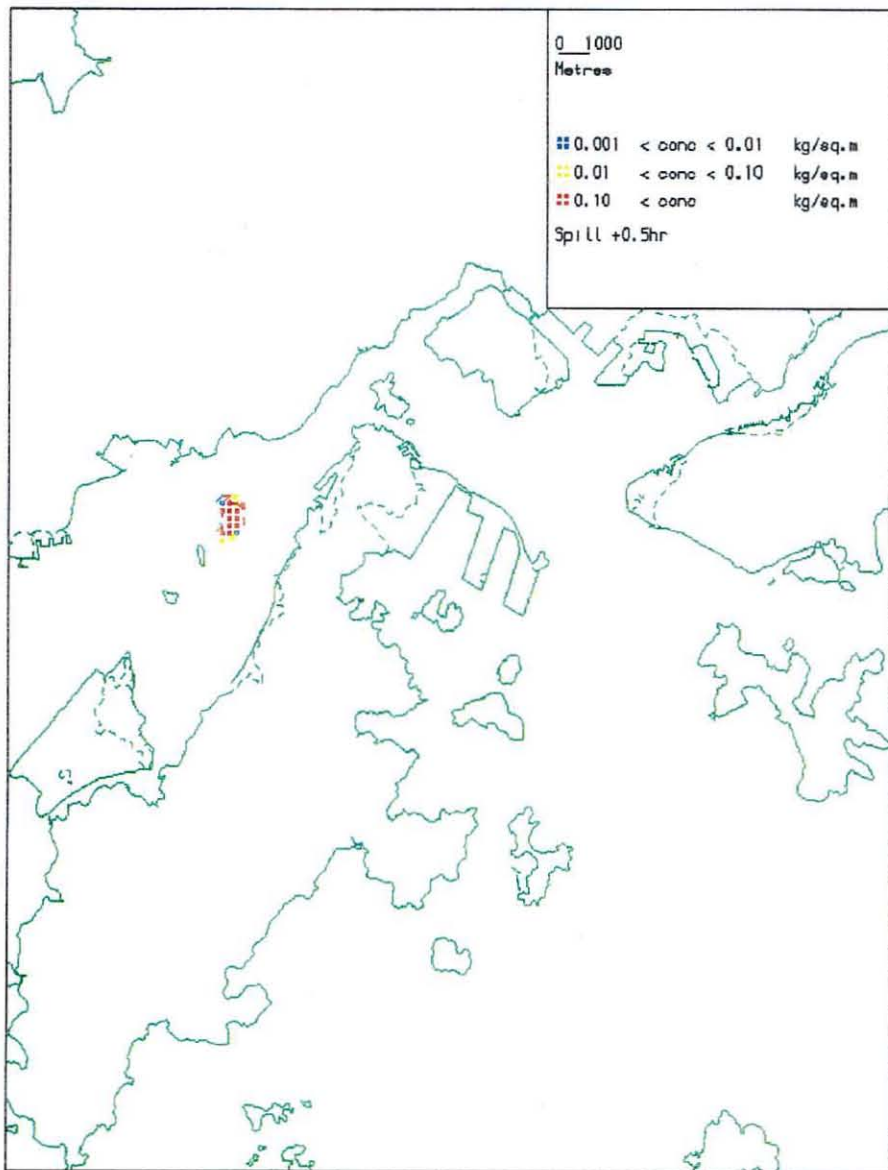
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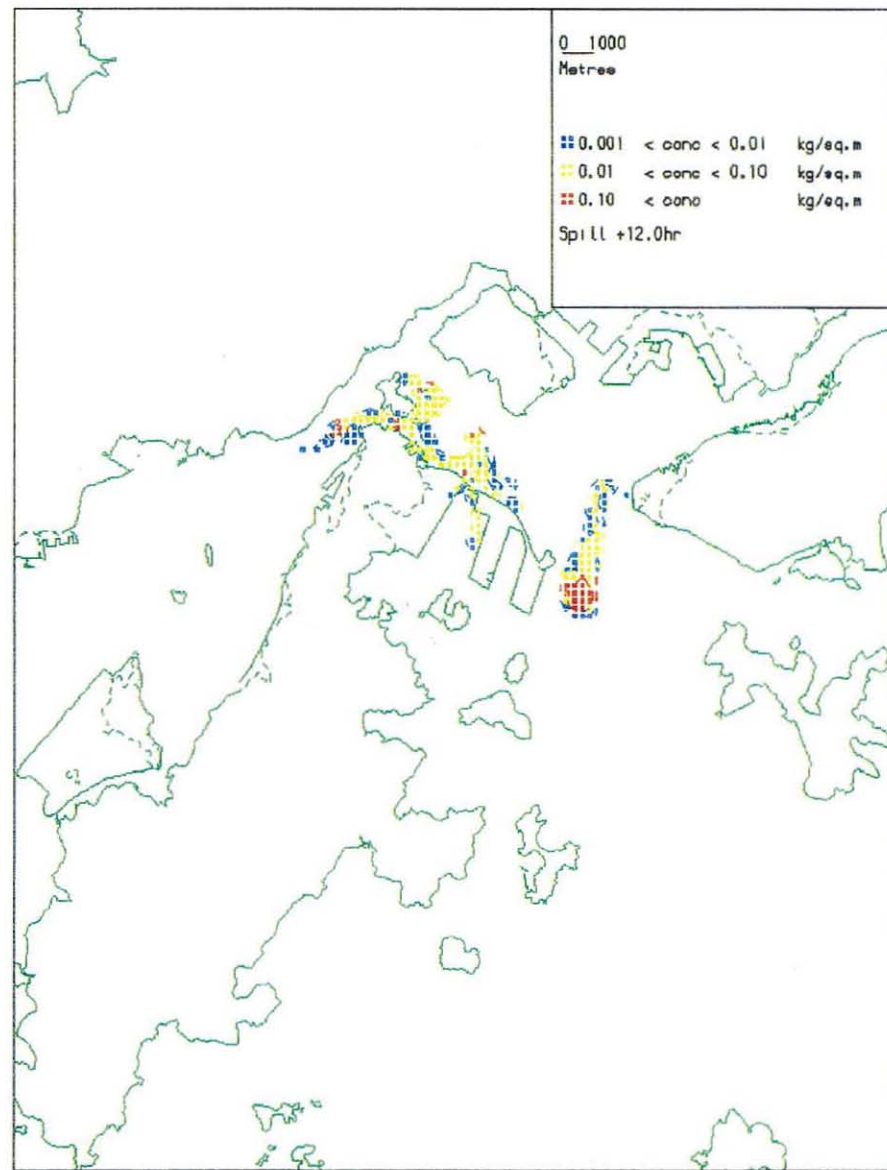
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Surface Concentration of Fuel  
Ebb Release of Fuel



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Ebb Release of Fuel

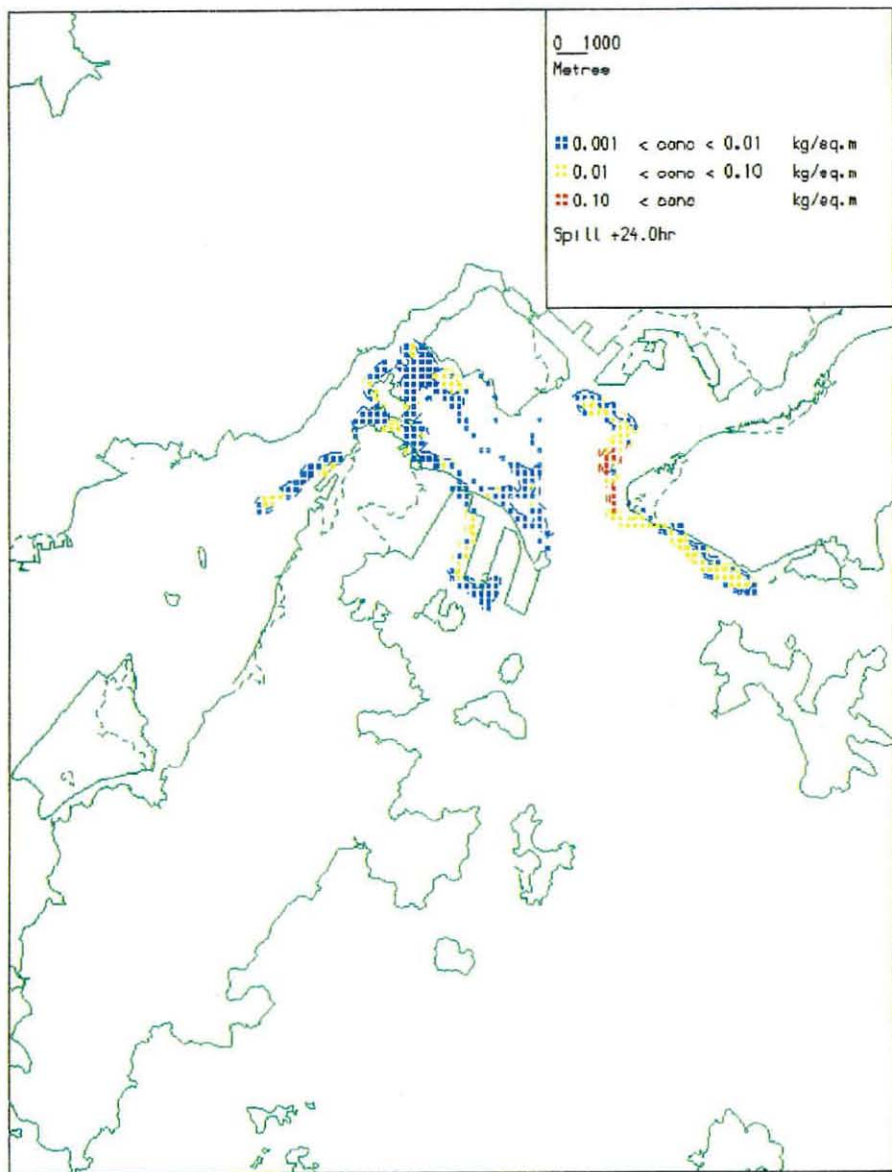


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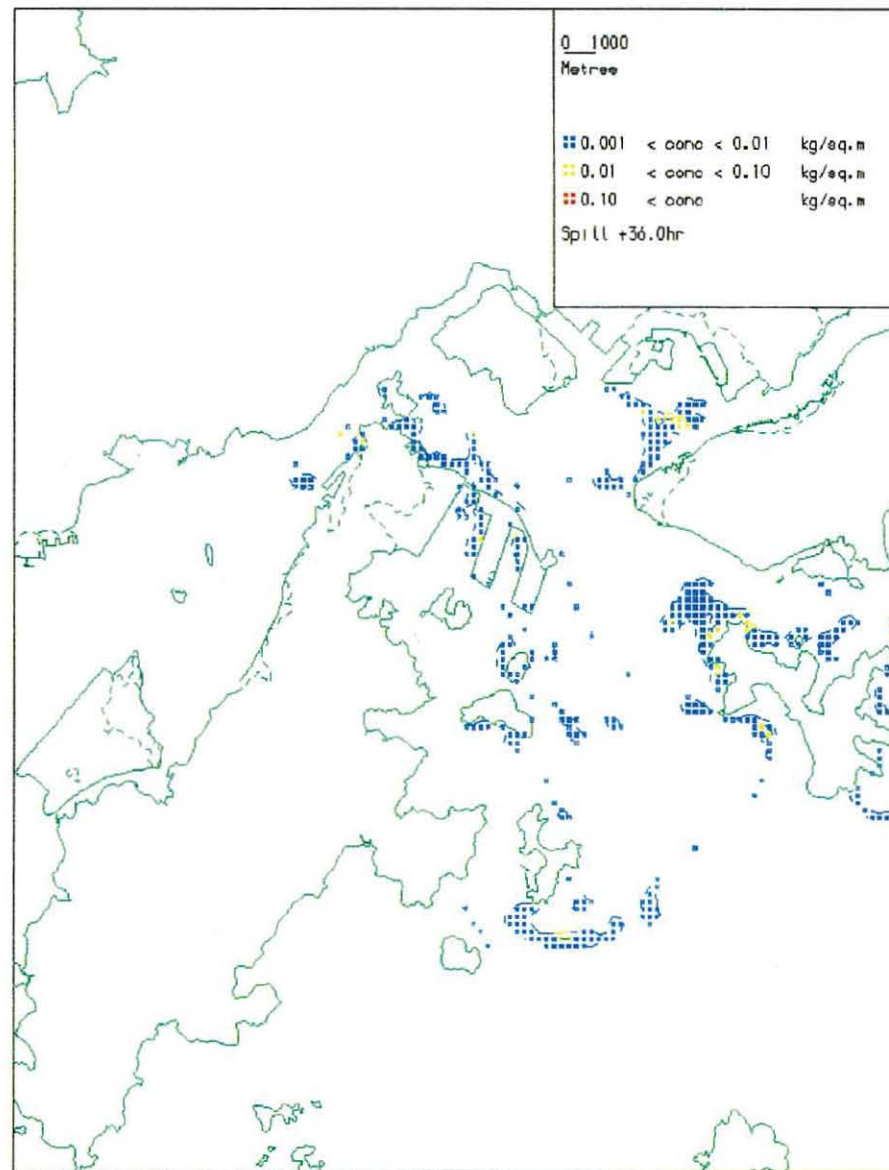


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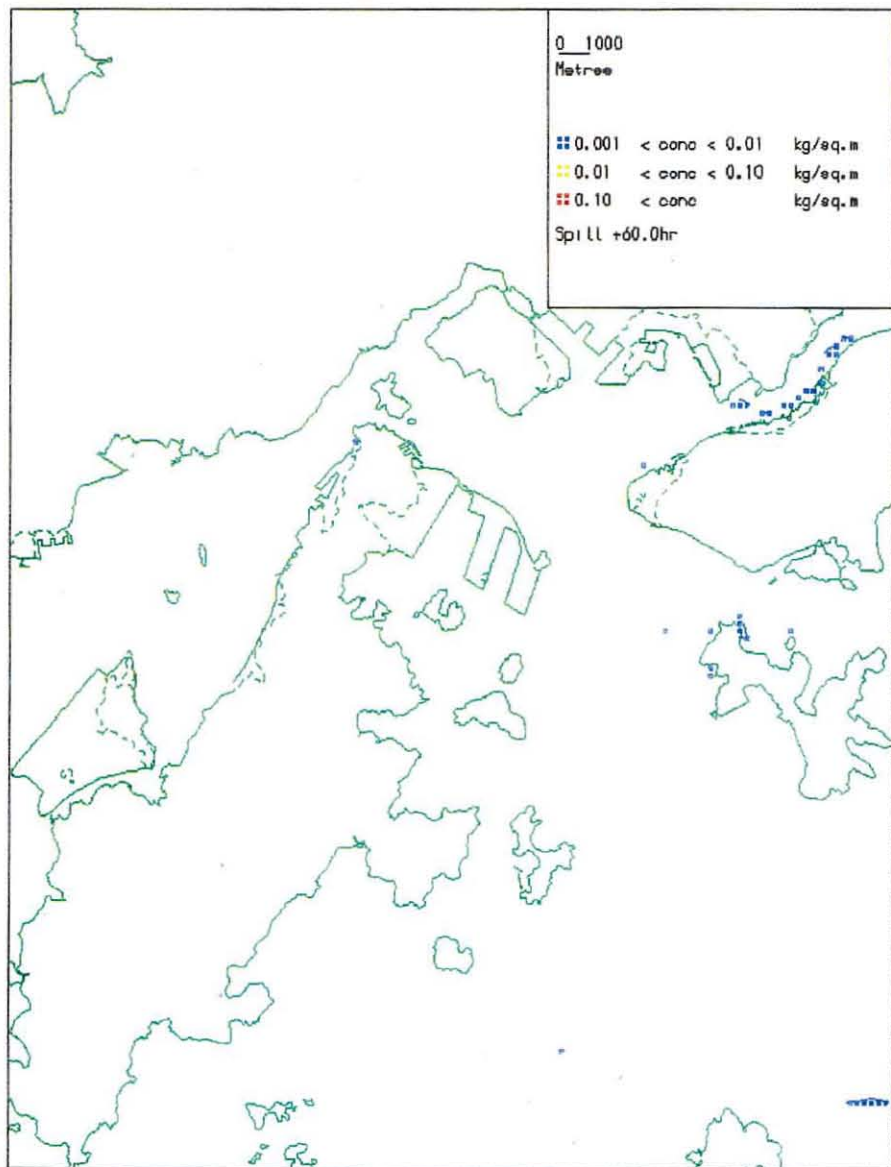




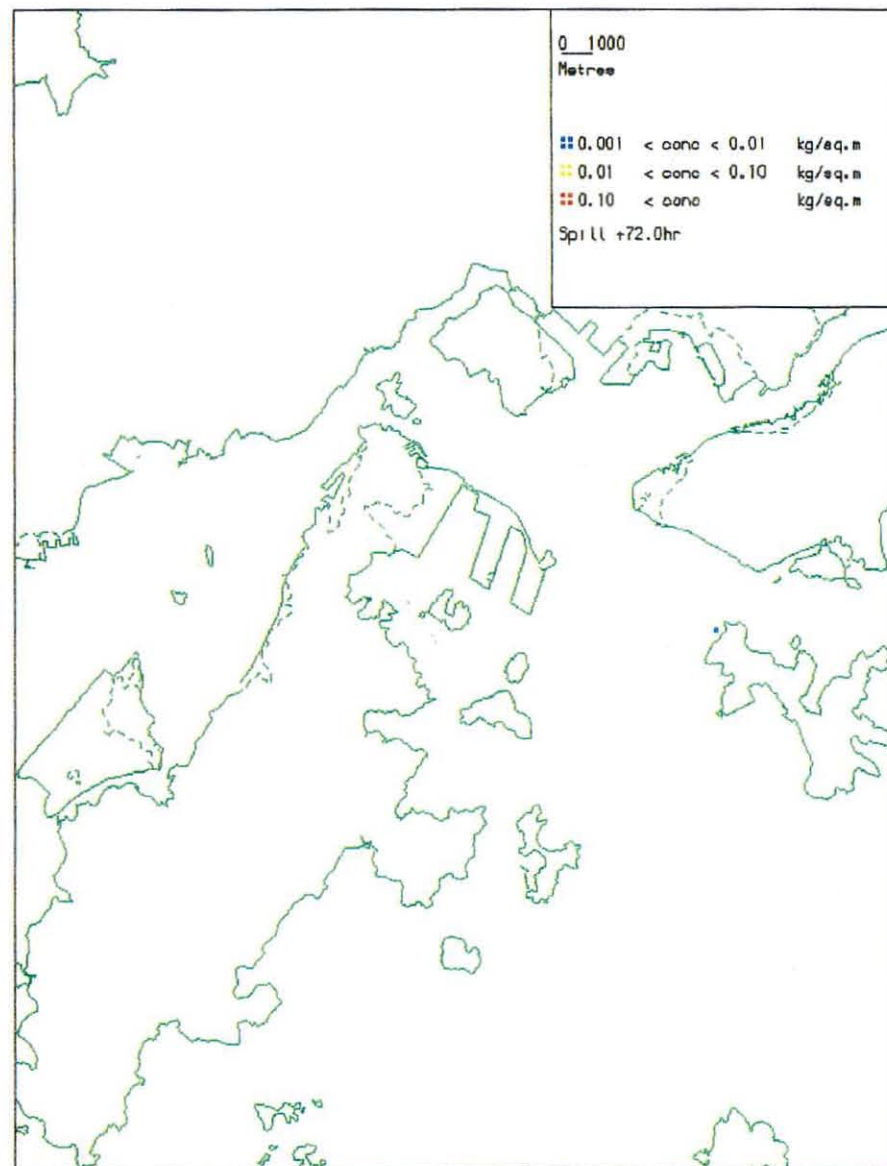
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Surface Concentration of Fuel  
Ebb Release of Fuel



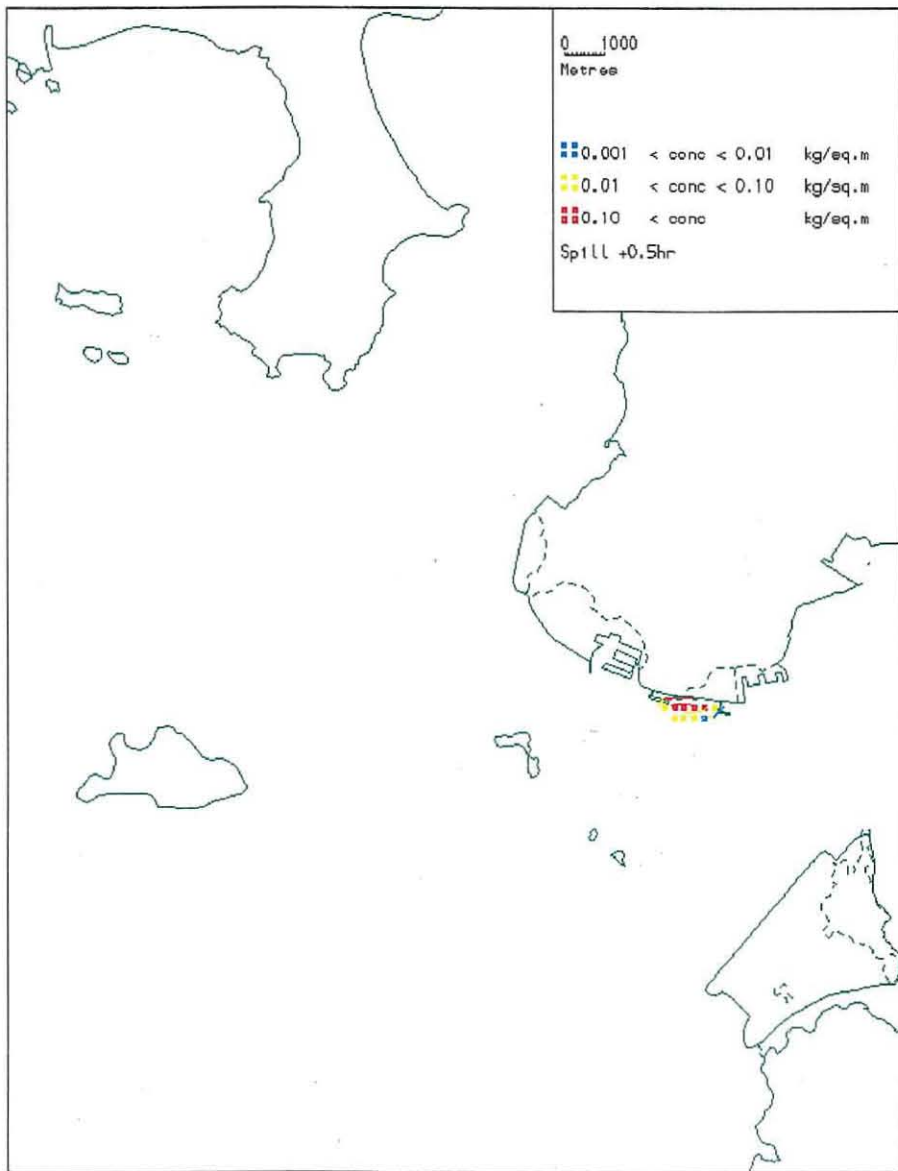
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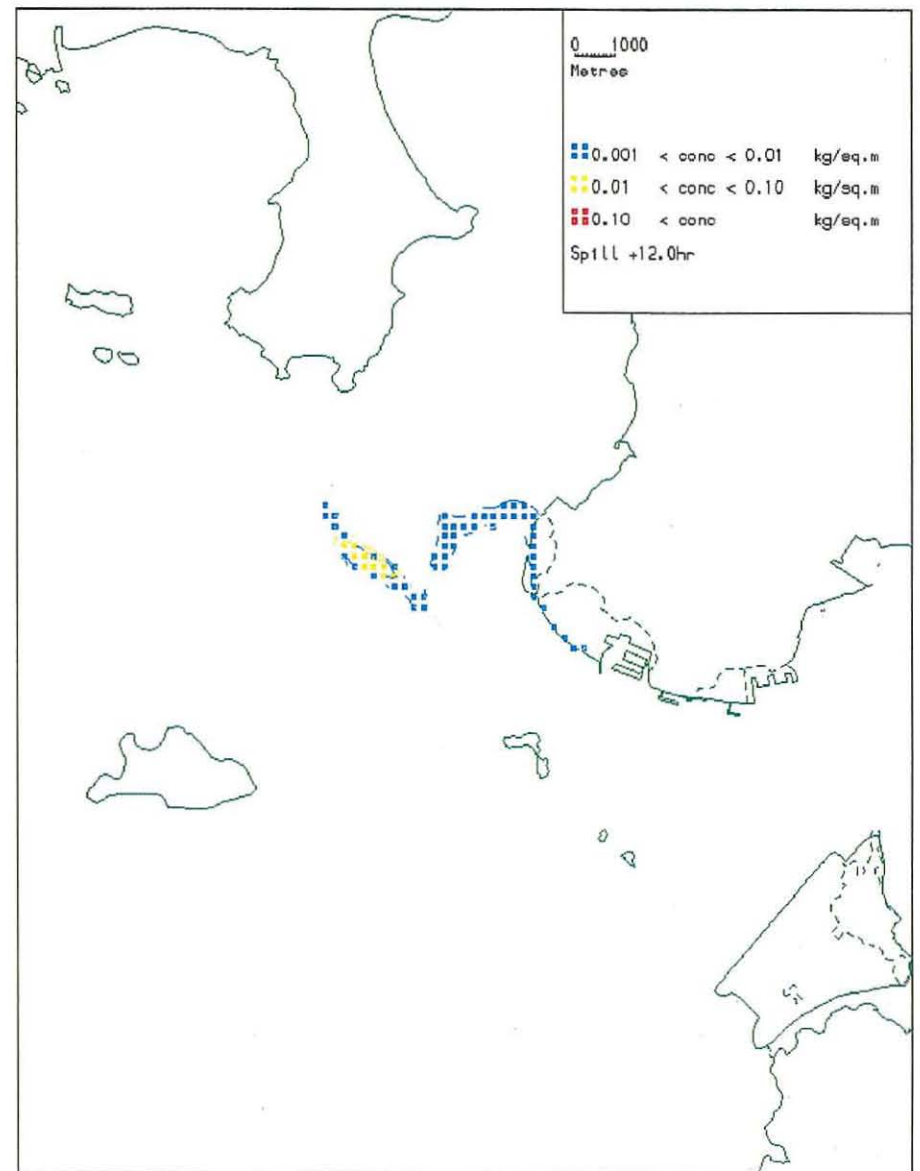
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Ebb Release of Fuel



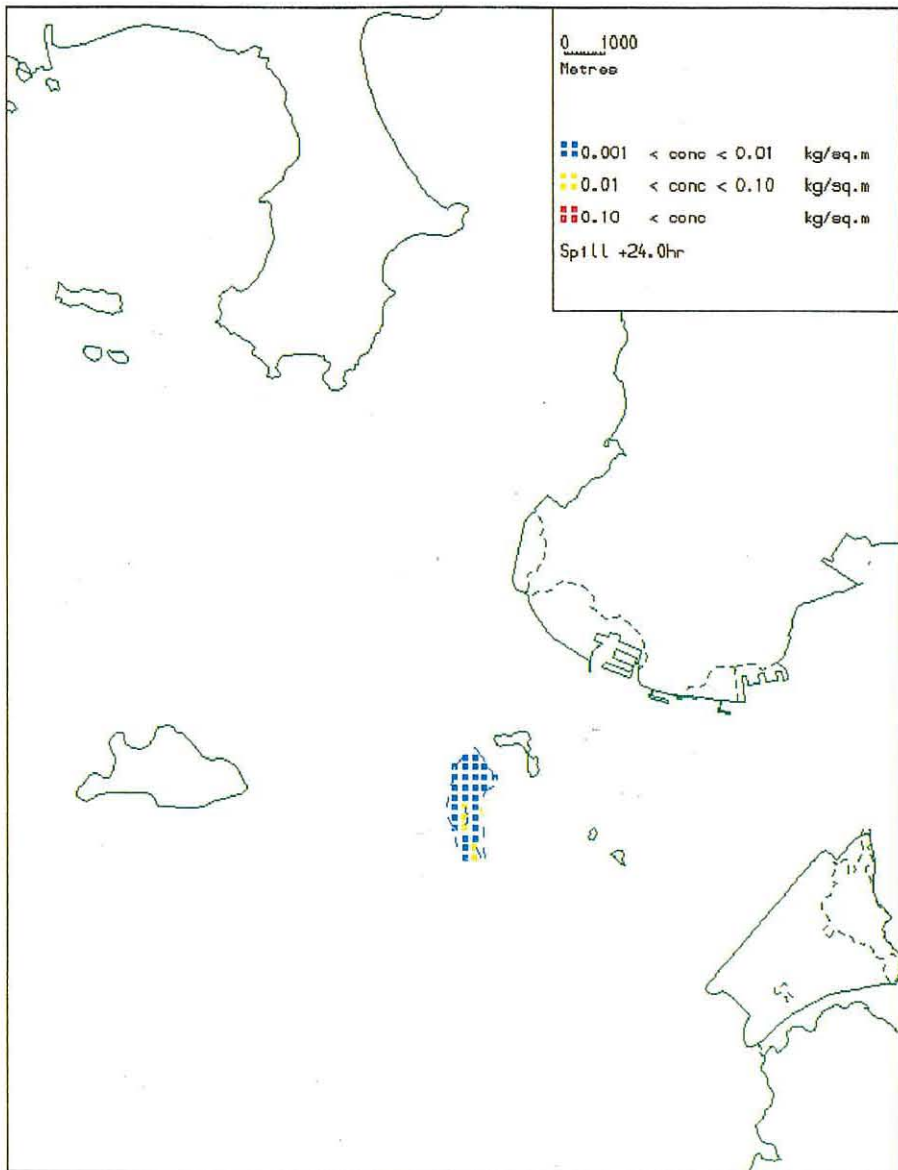
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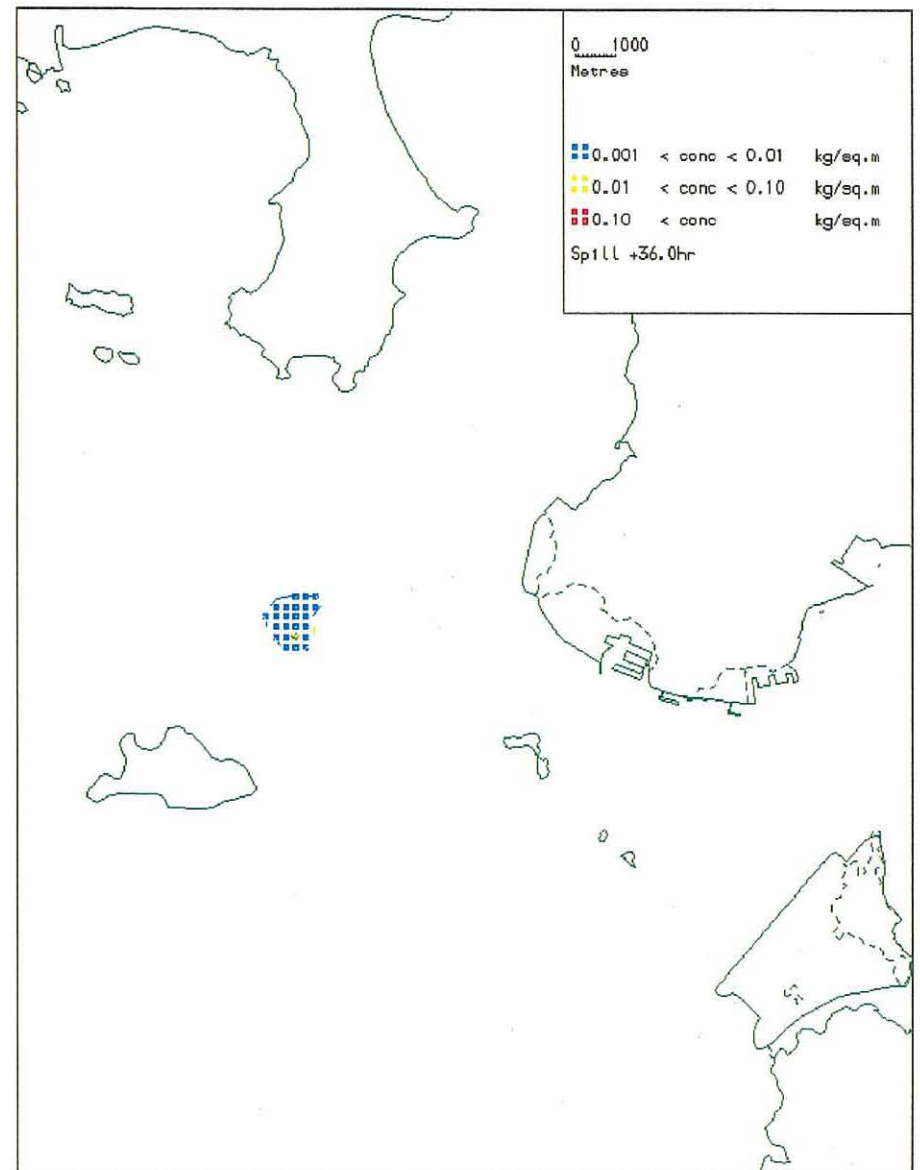
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Surface Concentration of Fuel  
Flood Release of Fuel



AFRF at Sha Chau  
Simulation of Fuel Spills - Scenario 5  
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Flood Release of Fuel

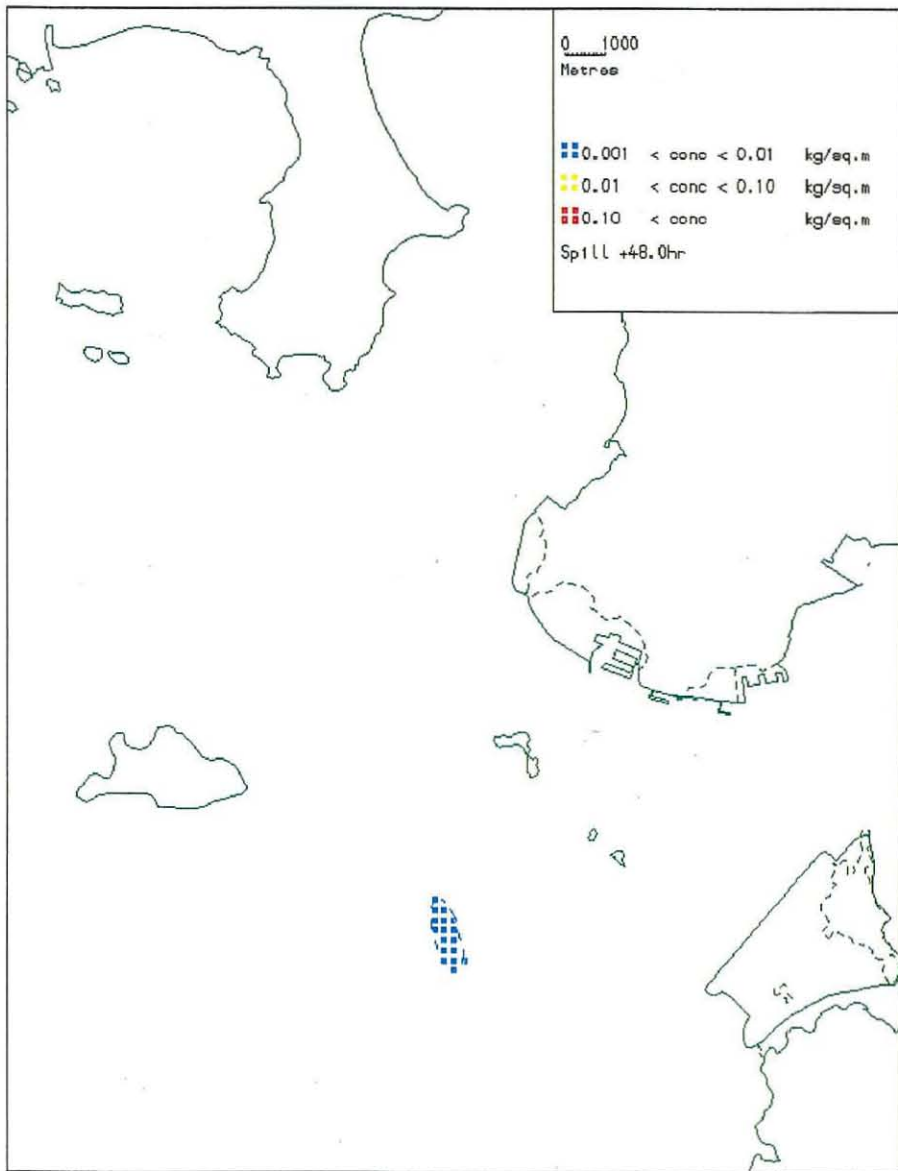


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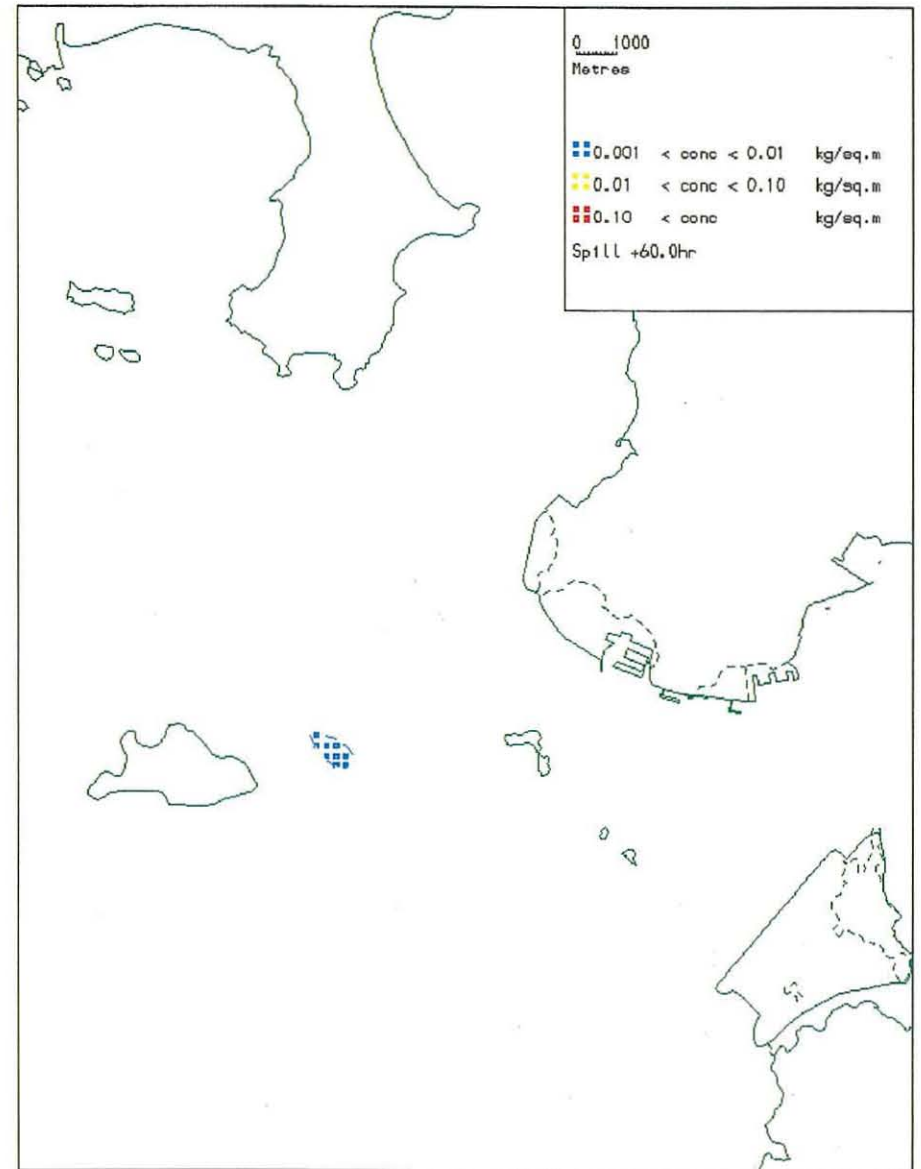


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Flood Release of Fuel



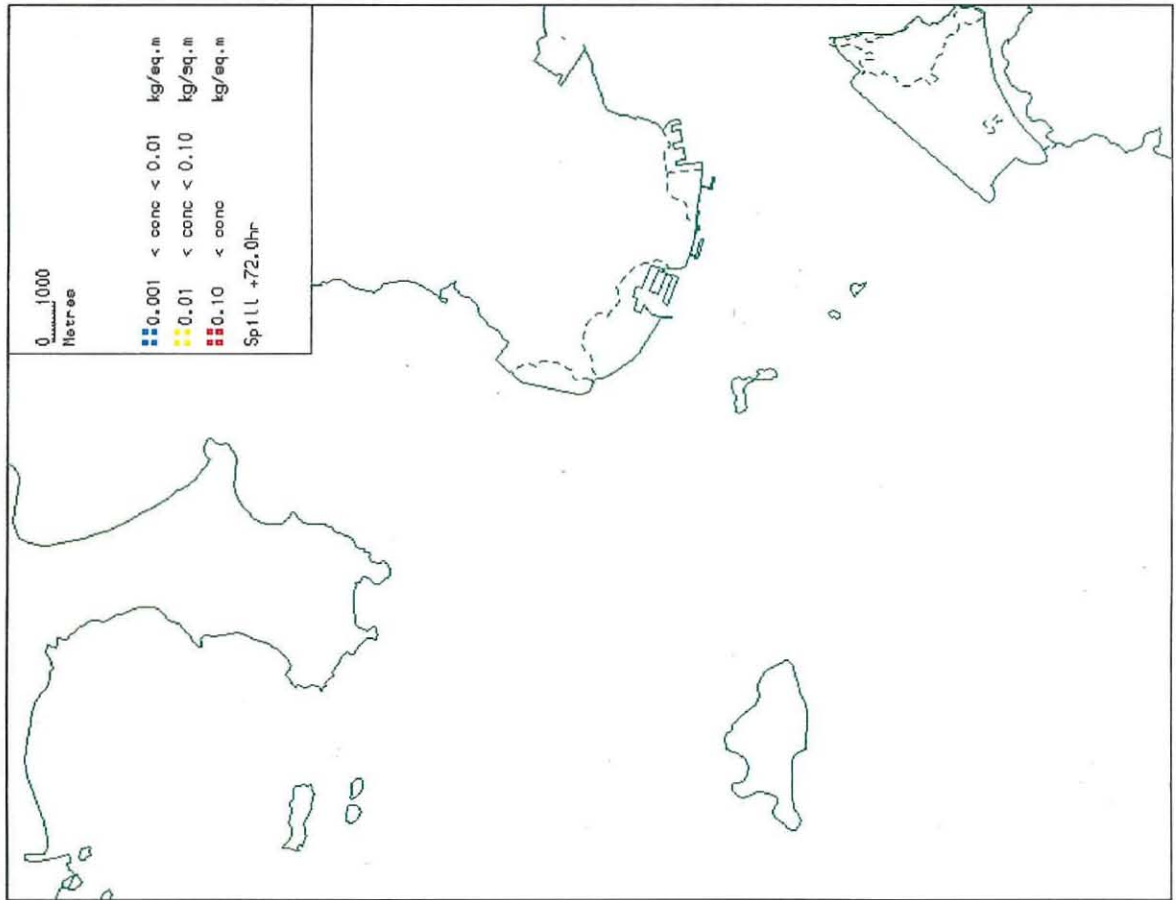


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Flood Release of Fuel

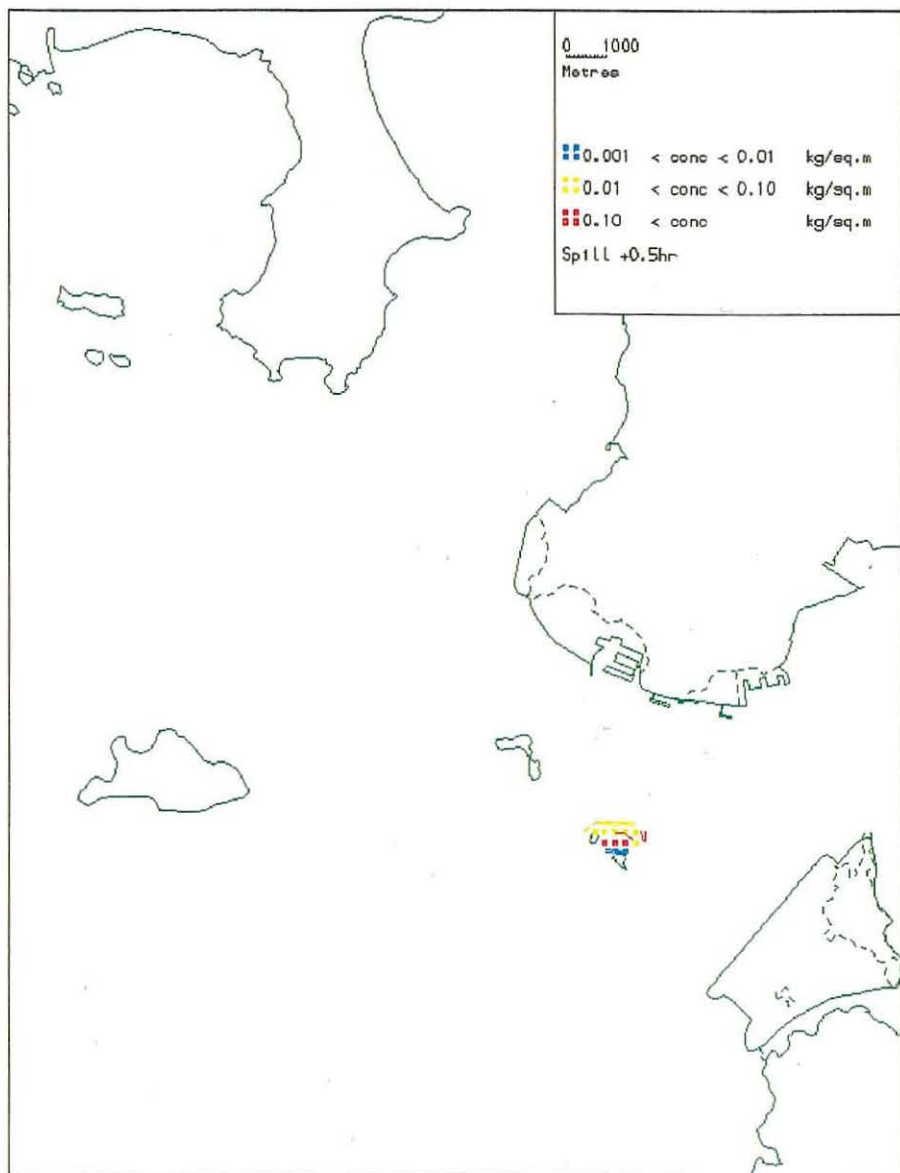


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Flood Release of Fuel

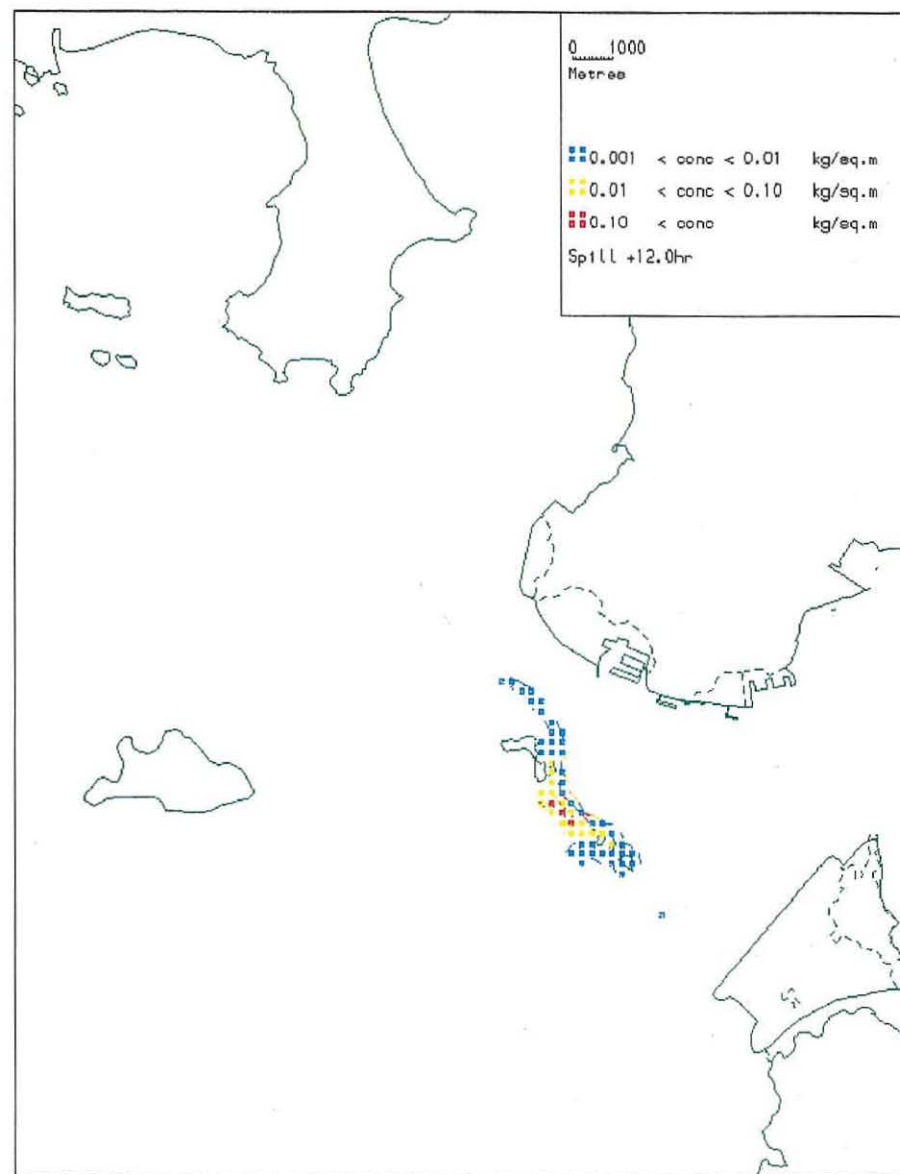




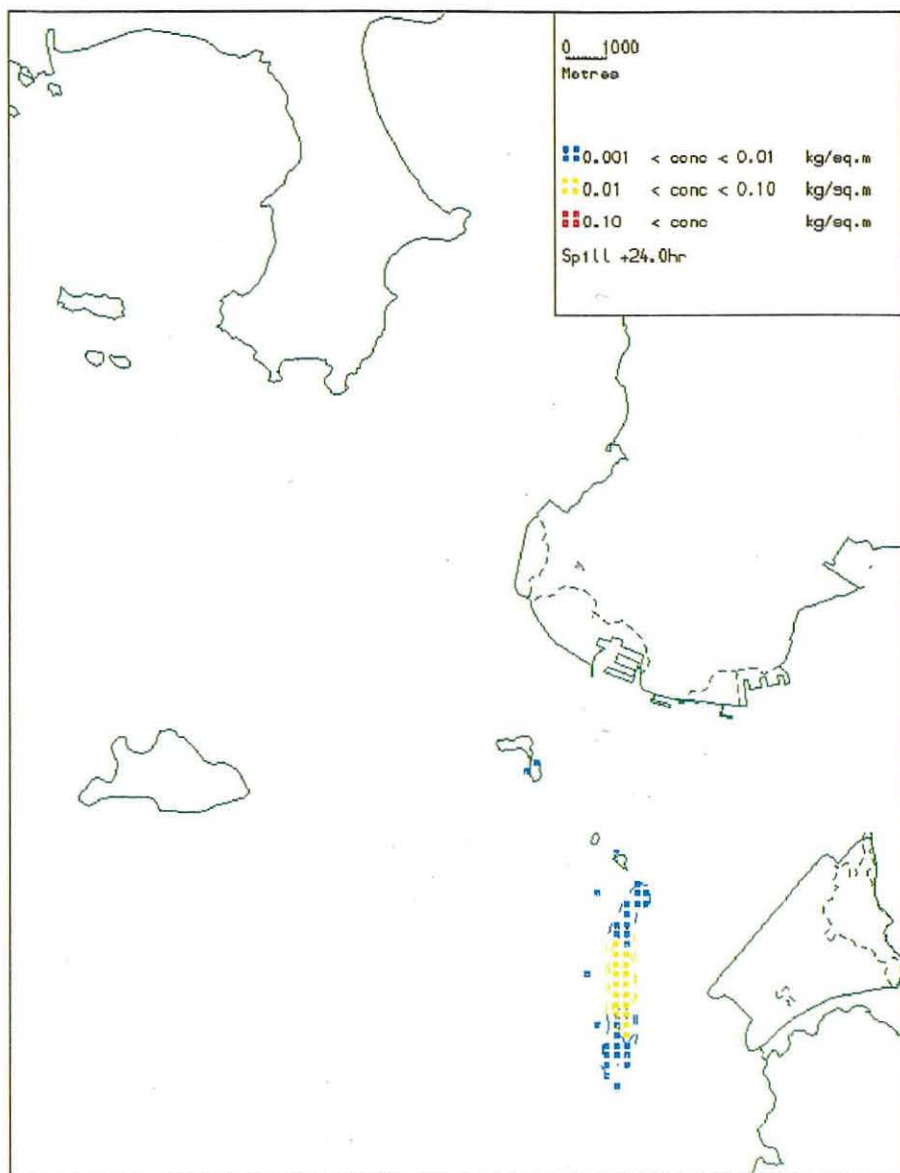
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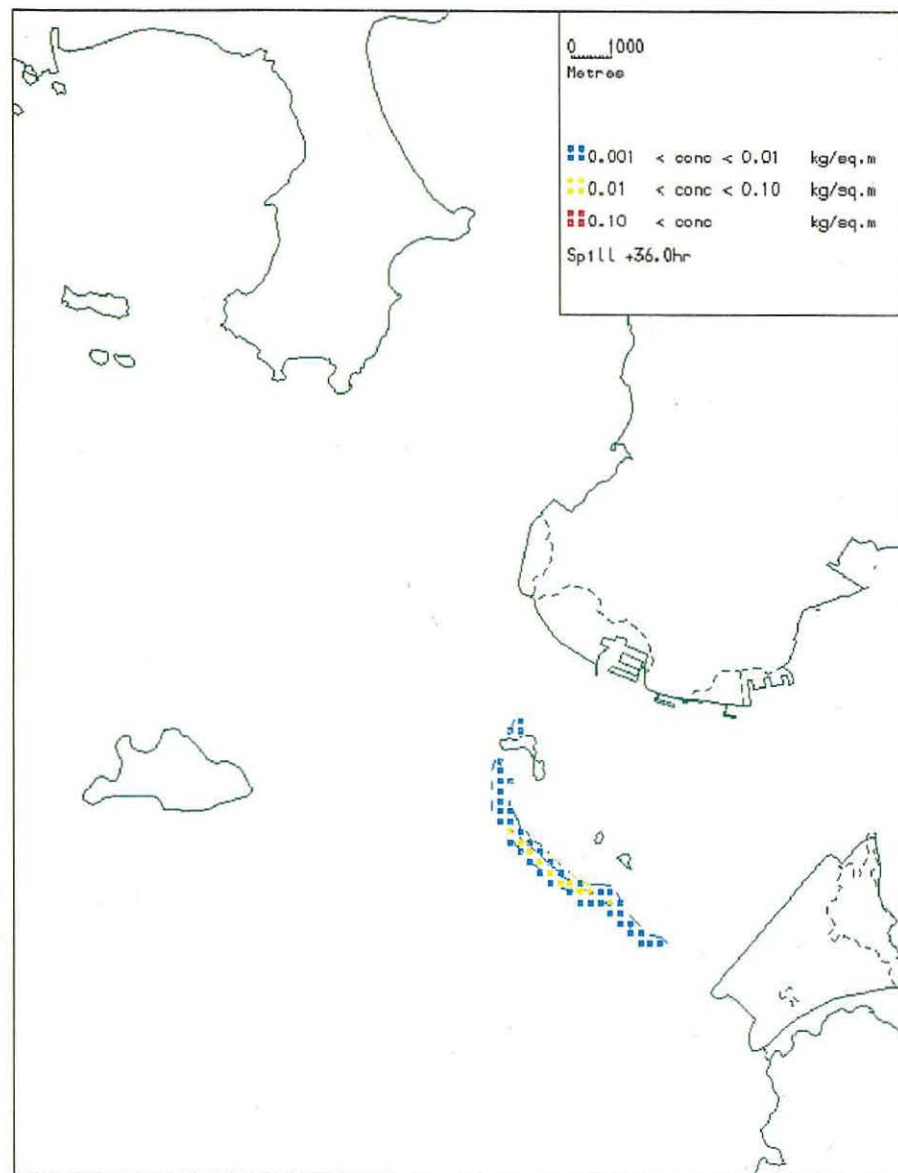
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Simulation of Fuel Spills - Scenario 6  
Surface Concentration of Fuel  
Flood Release of Fuel



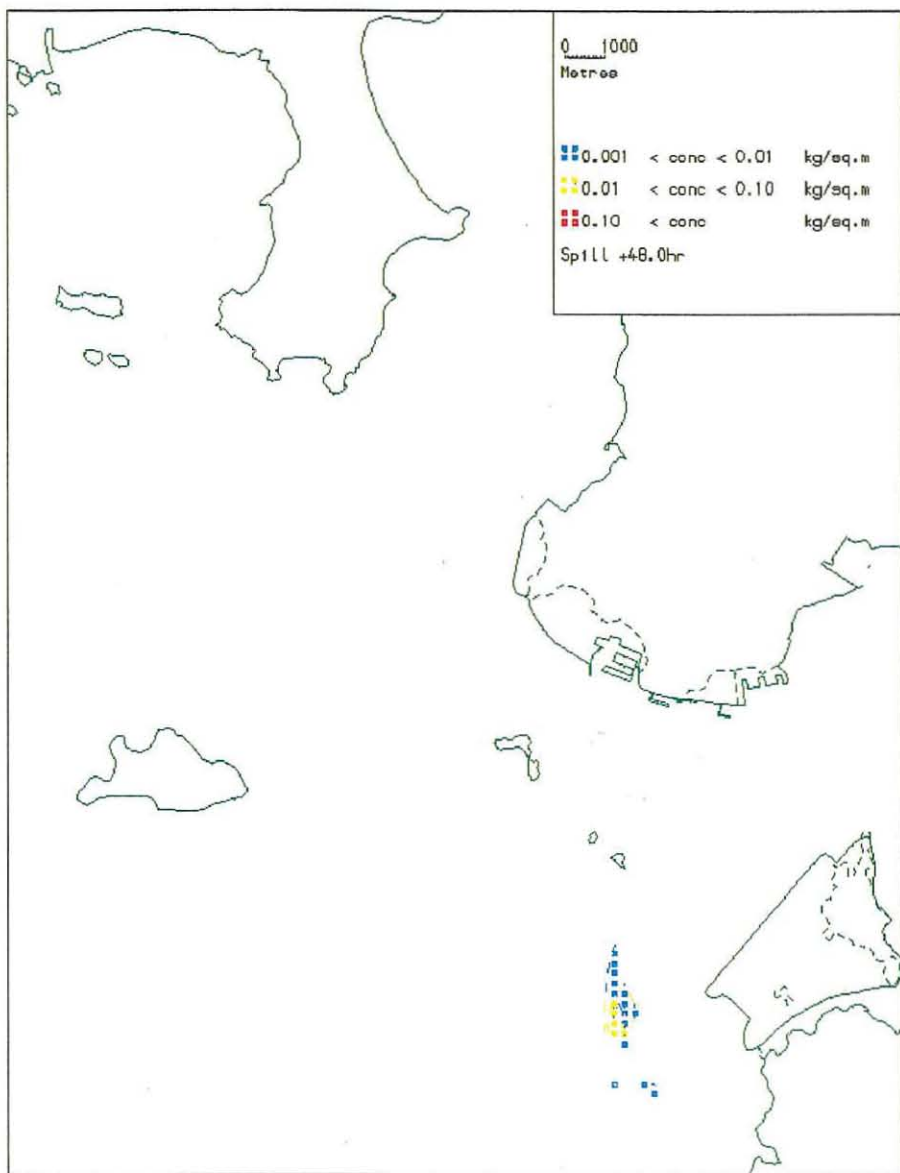
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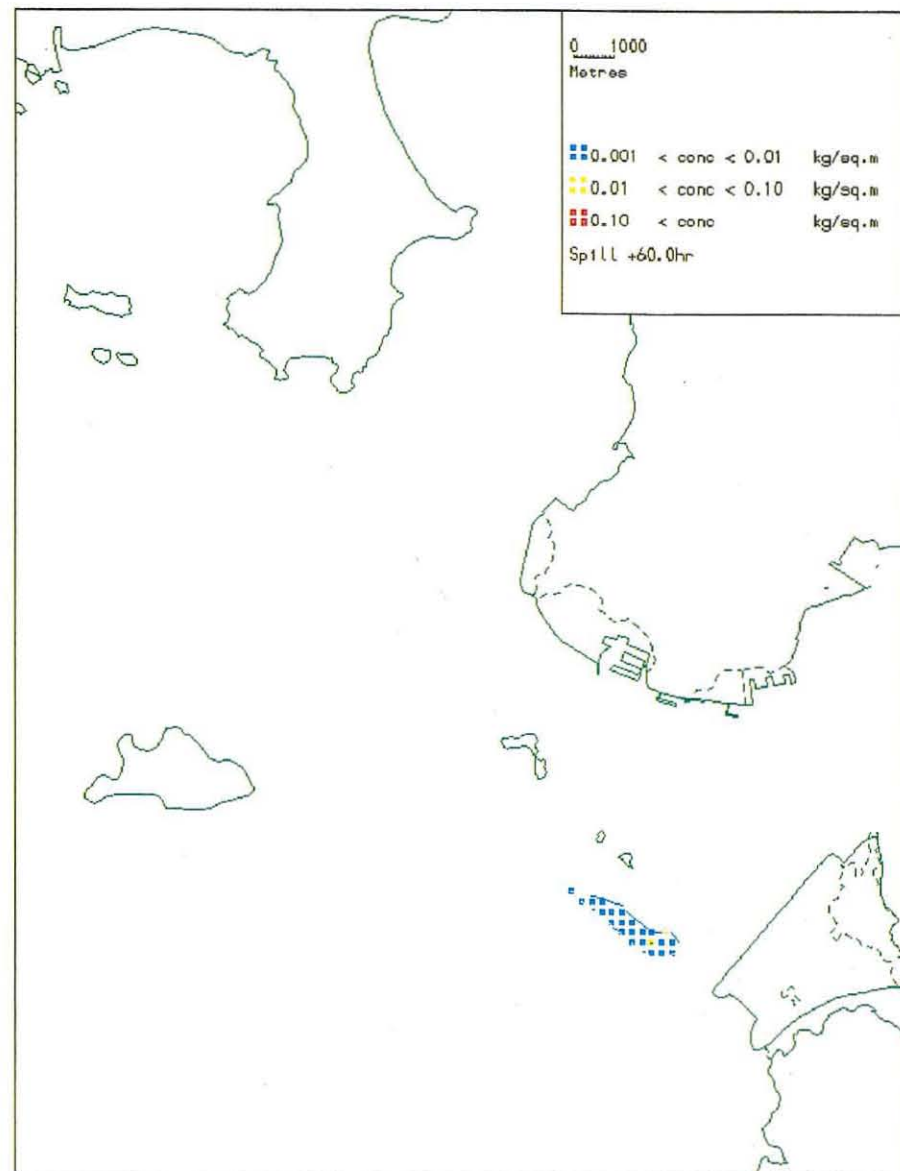
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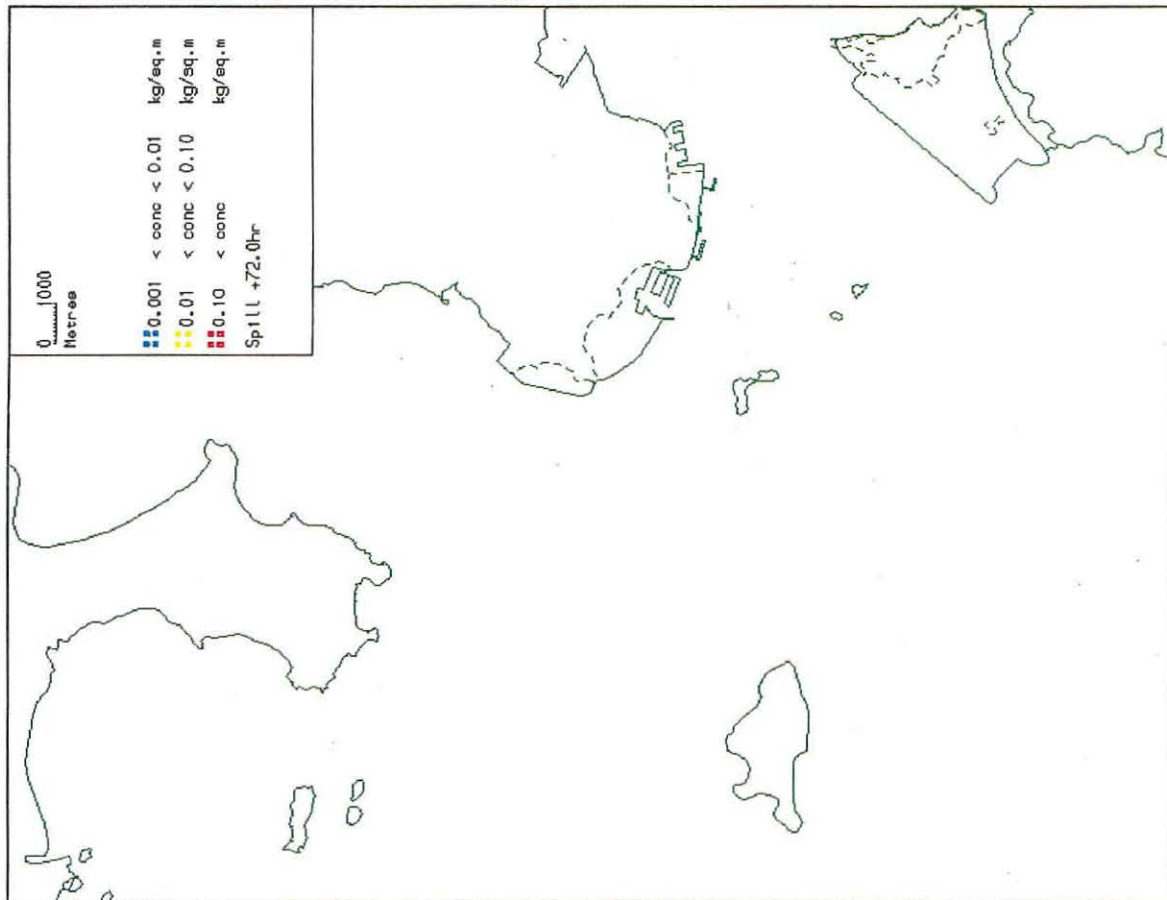
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AFRF at Sha Chau  
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 Flood Release of Fuel

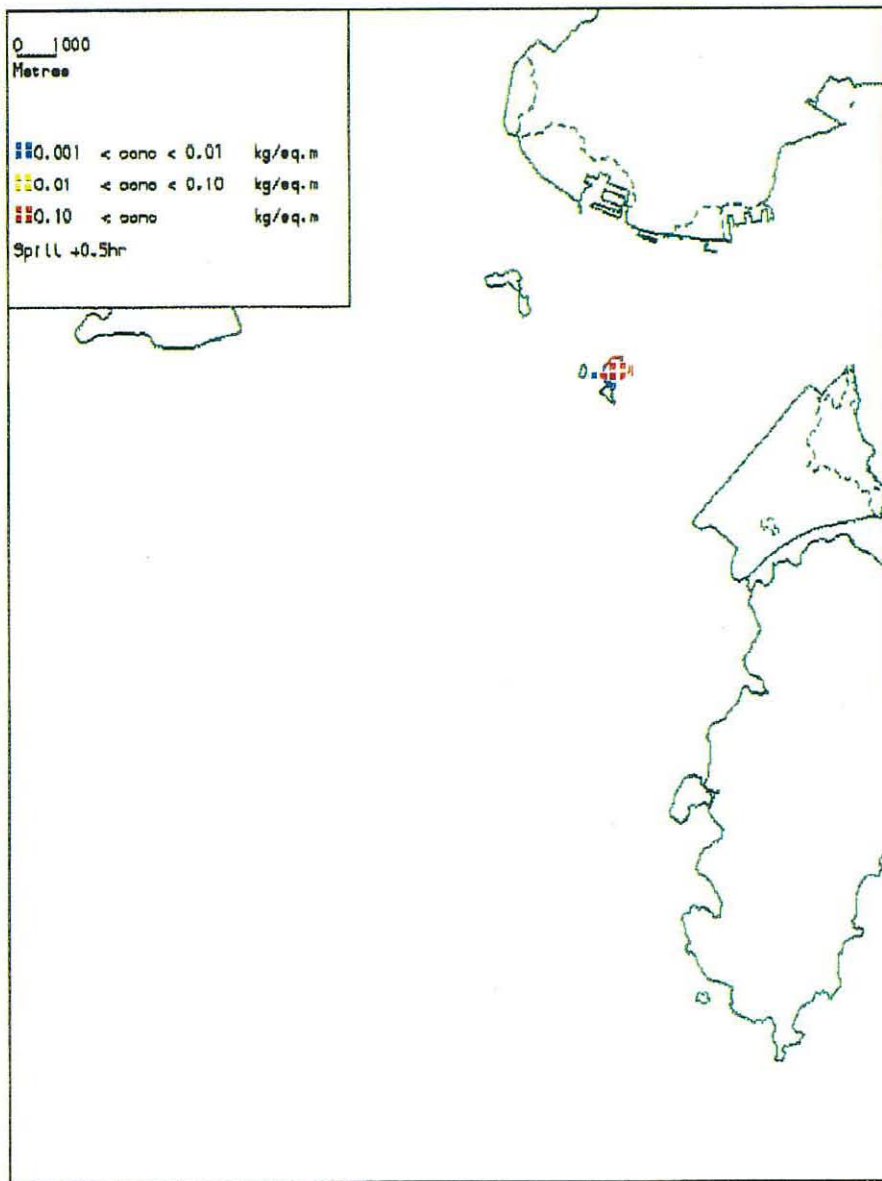


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 Simulation of Fuel Spills - Scenario 6  
 Surface Concentration of Fuel  
 Flood Release of Fuel

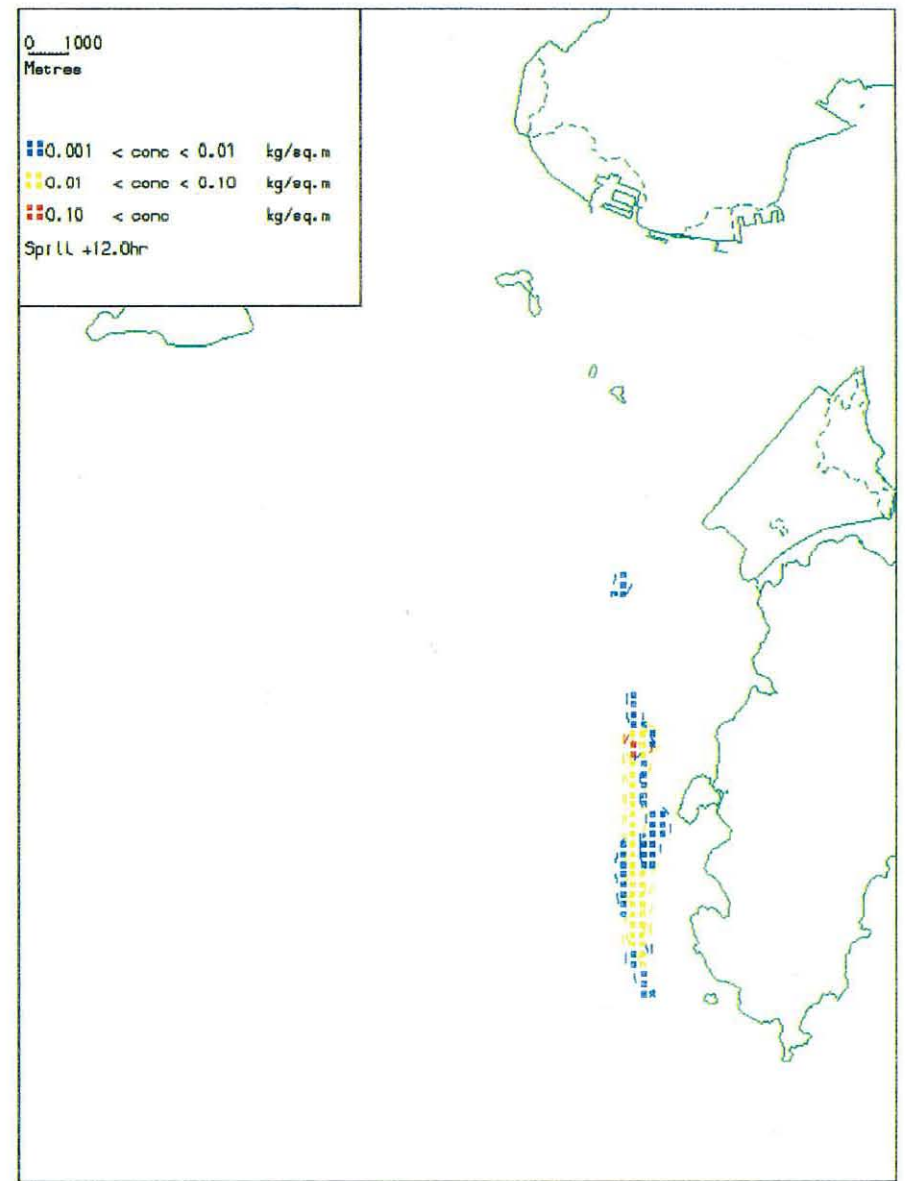


AFRF at Sha Chau  
 Simulation of Fuel Spills - Scenario 6  
 Surface Concentration of Fuel  
 Flood Release of Fuel

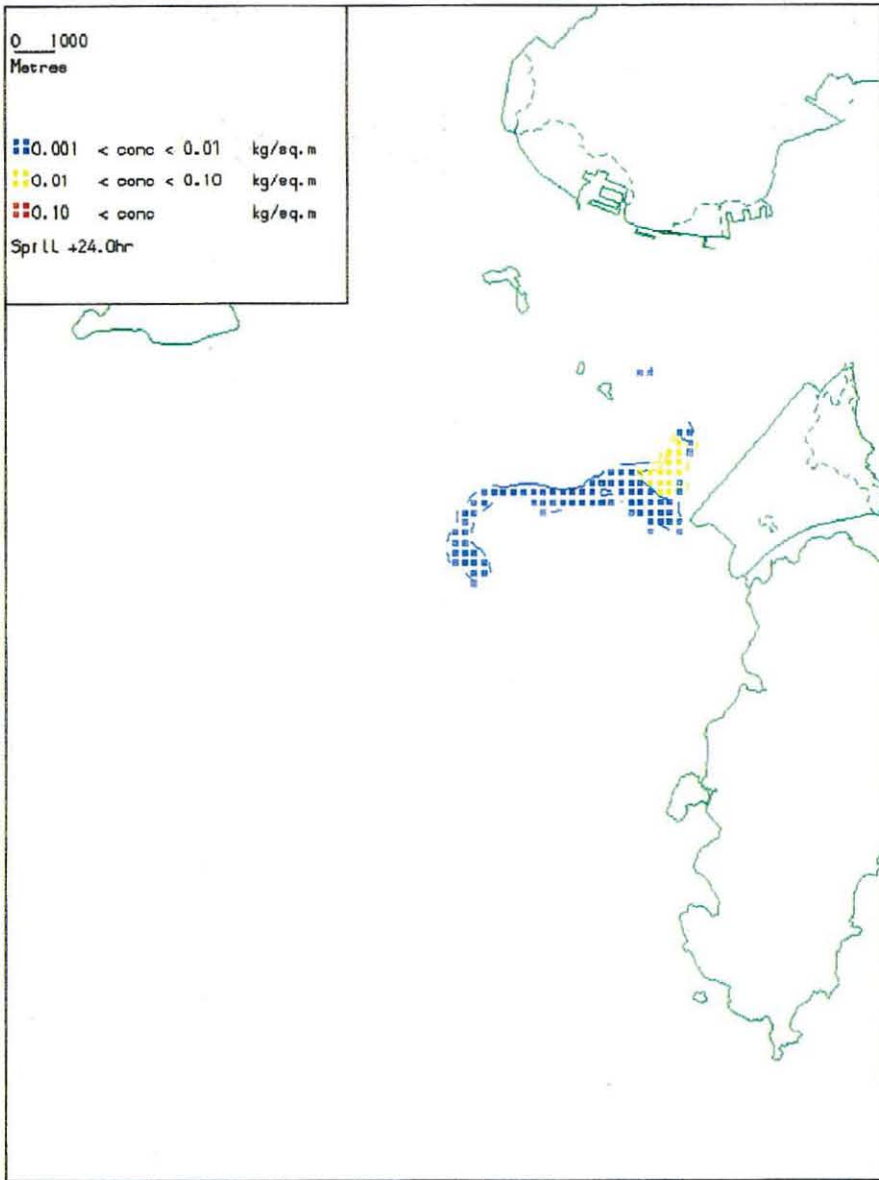




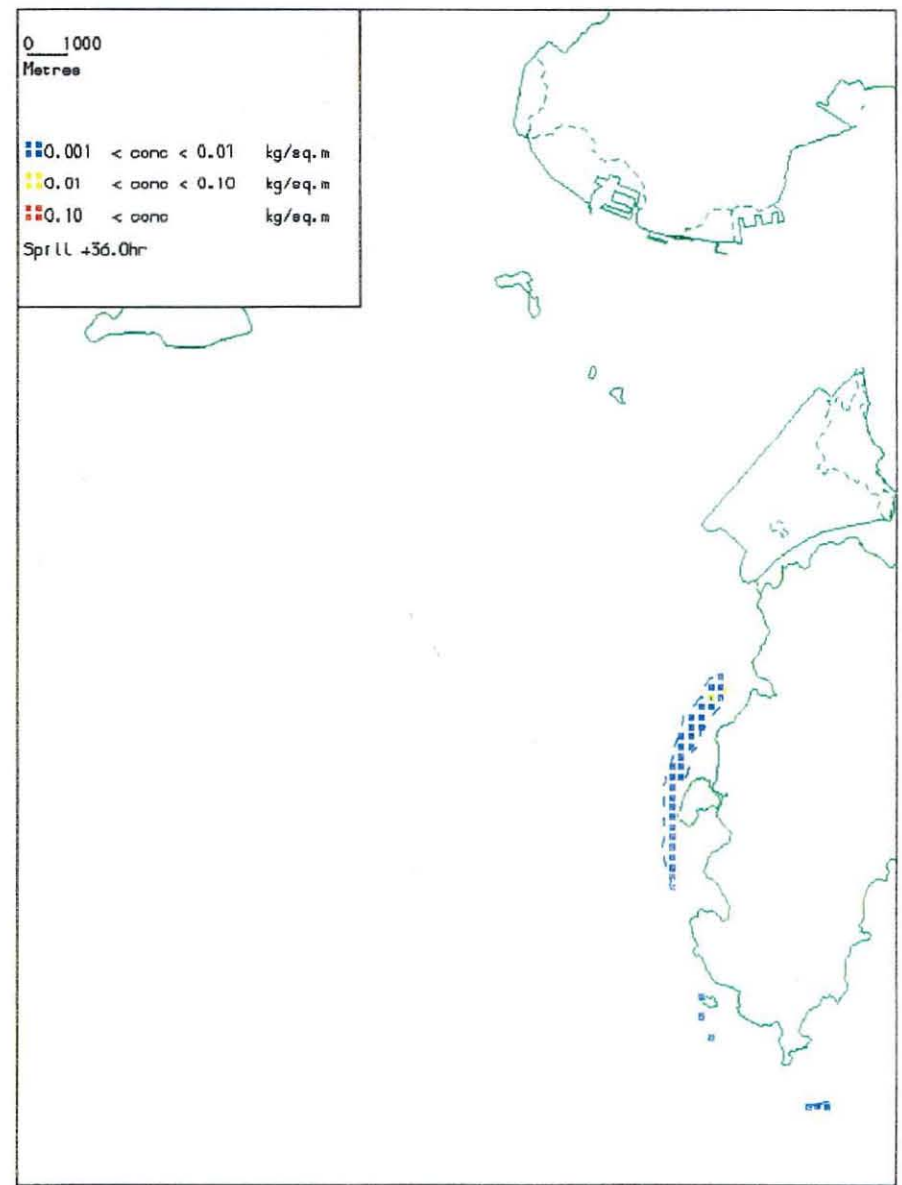
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 Simulation of Fuel Spills - Scenario 6  
 Surface Concentration of Fuel  
 Ebb Release of Fuel



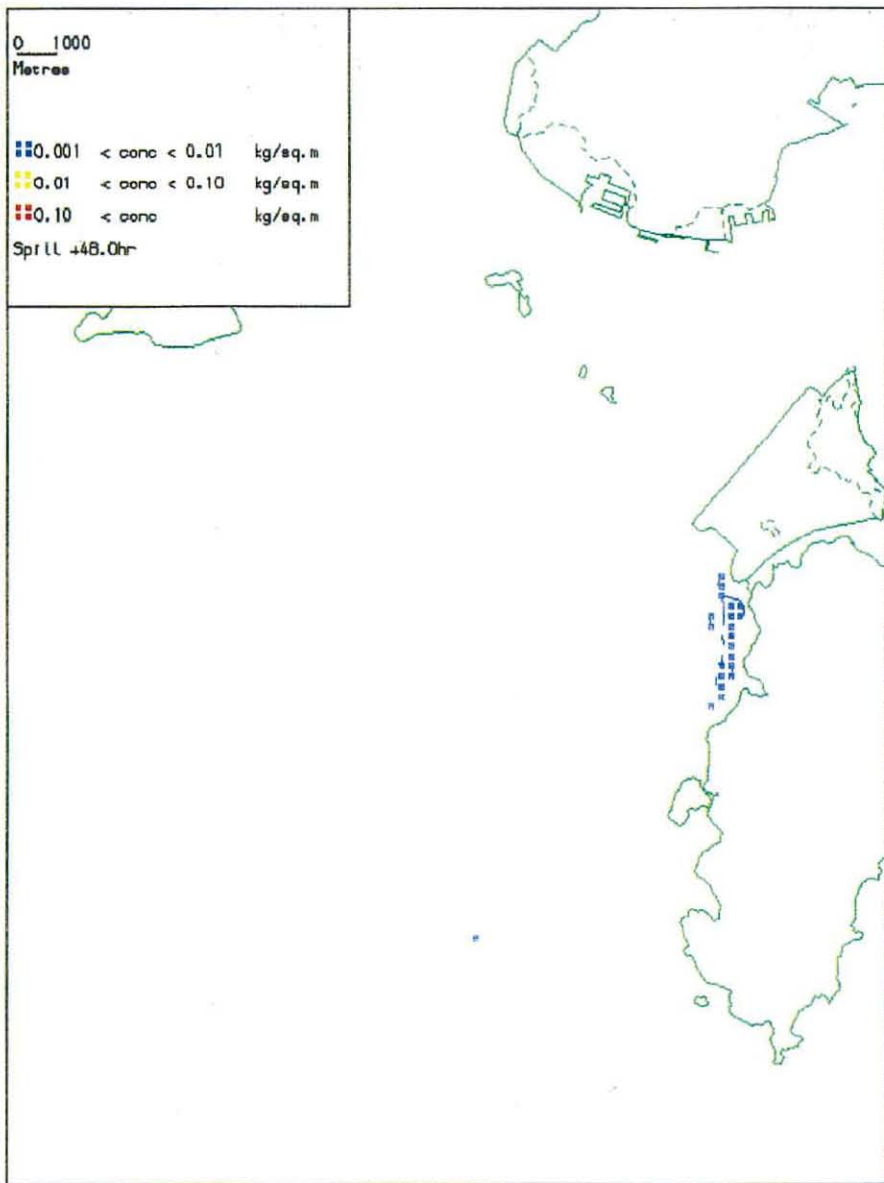
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 Ebb Release of Fuel



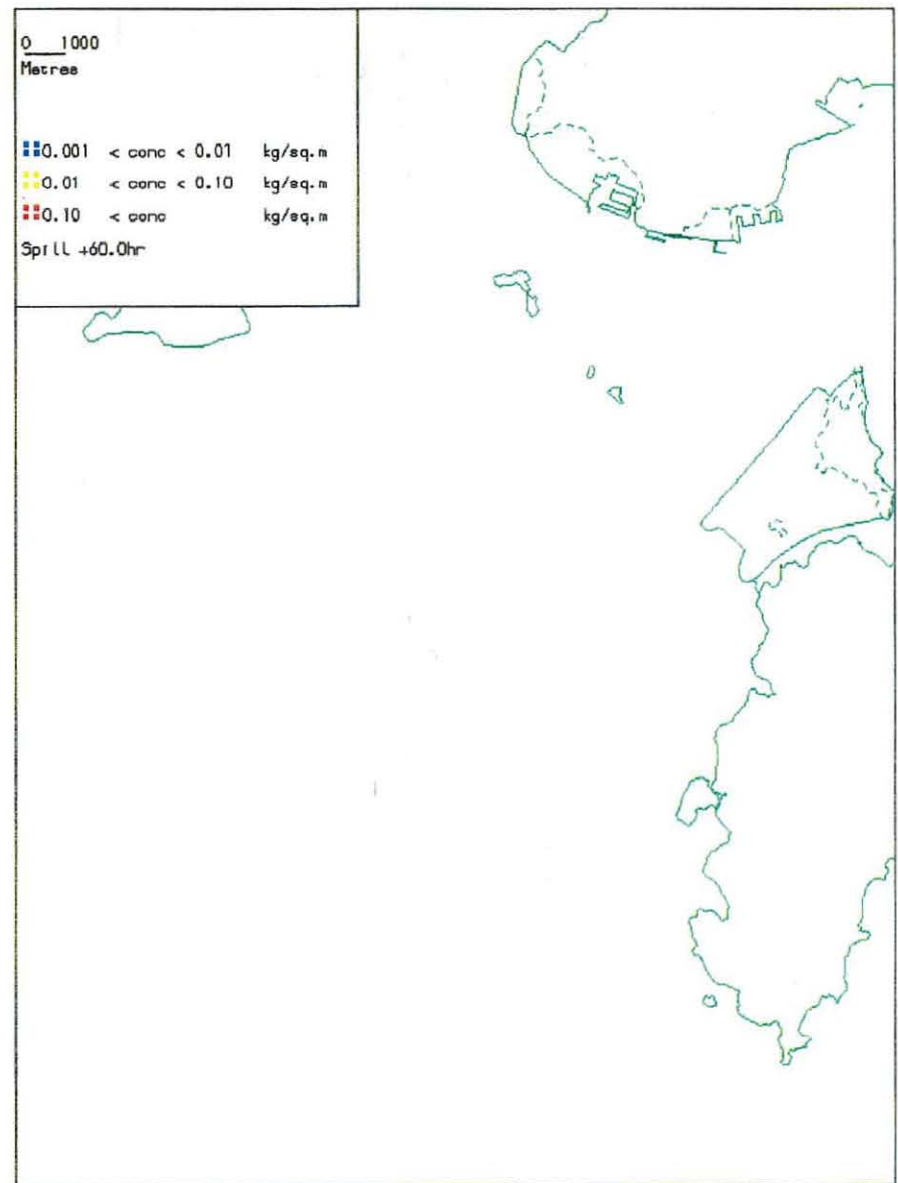
AFRF at Sha Chau  
Simulation of Fuel Spills - Scenario 6  
Surface Concentration of Fuel  
Ebb Release of Fuel



AFRF at Sha Chau  
Simulation of Fuel Spills - Scenario 6  
Surface Concentration of Fuel  
Ebb Release of Fuel



AFRF at Sha Chau  
Simulation of Fuel Spills - Scenario 6  
Surface Concentration of Fuel  
Ebb Release of Fuel



AFRF at Sha Chau  
Simulation of Fuel Spills - Scenario 6  
Surface Concentration of Fuel  
Ebb Release of Fuel



Annex G

## 'Schilling' Rudder Details

## *THE 'SCHILLING' RUDDER*

### *Concept*

A highly manoeuvrable one-piece design rudder comprising a high lift blade profile, fish-tail trailing edge anti-yaw device with boundary plates to contain and control the propeller slipstream.

Unlike a normal rudder which operates only to about 35 degrees the Schilling hydrodynamic balanced shape allows it to operate to helm angles of up to 70 degrees, at which angle a vessel smoothly and rapidly is brought to rest to spin on its own axis. The rudder has no moving parts. Furthermore, the MonoVec installation will, at the full helm position of around 70 degrees, divert the entire propeller slipstream at right angles to the hull and is equivalent to a tunnel thruster having up to 60% of the main engine bollard thrust. A stern thruster is therefore unnecessary with such an installation and owners have confirmed vessels fitted with a Schilling rudder have better, and therefore safer, sideways berthing capability than ships fitted with a stern thruster.

The trailing edge geometry inherently acts as an anti-yaw device. The high lift profile requires very small helm angles for course correction, hence the course keeping qualities are excellent. With the MonoVec rudder a ship may be stopped at full service power by using full helm alone. In practice a vessel can be stopped by this method with 50% less head reach and lateral deviation than by reversing the engine.

### *I.M.O Requirement For Manoeuvrability*

As from 1 July 1994 I.M.O. are to implement a set of minimum manoeuvring standards. These standards are to be used with the aim of improving ship manoeuvring performance and with the objective of avoiding ships that do not comply with the criteria. The standards are considered interim for a period of 5 years and apply to ships of all rudder and propulsion types, of 100m in length and over, and chemical tankers and gas carriers regardless of length which were constructed on or after this date.



Annex H

## Marine Mammal Hearing References

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Annex I

Marine Department  
General Conditions for  
Dredging and Backfilling at  
Marine Borrow Area

Marine Department

General Conditions for Dredging and  
Backfilling at Marine Borrow Area

(1) GENERAL

- 1.1 The requirements set out below apply to all marine activities directly connected with the execution of the Works and in addition to all marine activity generated by the Contractor as general logistical support to Works Sites and Works Areas. The Contractor shall liaise closely with and comply with the requirements of the Marine Department in respect of such traffic.
- 1.2 The Contractor shall maintain communication with the Vessel Traffic Centre (VTC) network at all times.

(2) REGULATIONS

- 2.1 All vessels and craft provided or used for the construction of the Works shall comply with all the relevant regulations and requirements of the Marine Department, including the following :
- (a) The Shipping and Port Control Ordinance (Cap. 313);
  - (b) The Shipping and Port Control Regulations 1985 (Cap. 313);
  - (c) The Merchant Shipping (Miscellaneous Craft) Regulations (Cap. 281);
  - (d) The International Regulations for Preventing Collisions at Sea;
  - (e) The Dangerous Goods Ordinance and Regulations (Cap. 295);
  - (f) The Merchant Shipping (Launches and Ferry Vessels) Regulations (Cap. 281);
  - (g) The Pilotage Ordinance (Cap. 84); and
  - (h) The Merchant Shipping Ordinance Cap. 281.

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(3) REQUIREMENTS PRIOR TO COMMENCEMENT OF CONSTRUCTION

3.1 Prior to commencement of the marine works the Contractor shall submit to the Marine Department for approval the following information :

- (a) a plan of the marine works indicating the proposed overall limits of the working areas and the space requirements of each of the operations;
- (b) information of the type and operating frequency of all proposed electronic positioning systems;
- (c) proposed means of communication to be established between Marine Department VTC and marine plant; and
- (d) name of person(s) in charge of the works who can be contacted by Marine Department on a 24-hour basis and means and procedure for contact.

3.2 In addition the Contractor shall submit to the Marine Department for their information the following details of the proposed marine works :

- (a) proposed schedule of all marine works, including marine works to be carried out by subcontractors, indicating the different types of operations, their number, duration, space requirements and phasing;
- (b) a complete list of vessels and craft to be used for all marine works; and
- (c) details of weather conditions in which operations would cease and all working craft removed from the working area.

(4) REQUIREMENTS DURING CONSTRUCTION

4.1 Prior to the commencement of each and every separate marine activity, the Contractor shall give one month's notice to the Marine Department and shall liaise with the Marine Department to give all information on working areas, types of craft and durations of activities necessary for the Marine Department to issue the appropriate Notices to Mariners and Marine Department

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Notices. The Contractor shall also advise the Marine Department on completion of each and every separate activity.

- 4.2 Claims for delay made by the Contractor due to failure to secure the necessary written approval of the Director of Marine will not be accepted.
- 4.3 The Contractor shall at all times during the marine activities comply, and shall be responsible for ensuring that his sub-contractors comply, with any directions which may from time to time be issued by the Marine Department. In this respect marine activity means the use of any craft or carrying on of any operation which could obstruct any waterway or affect the navigation of craft through any waterway.
- 4.4 During the working period the Contractor shall be responsible for the provision, installation, maintenance and removal on completion of all temporary buoyage and aids to navigation as required by the Marine Department.
- 4.5 Areas for temporary anchorage of Contractor's marine craft shall be agreed with the Marine Department, shall be outside any permanent or temporary navigation channel and shall be clearly marked with marker buoys or other system to the satisfaction of the Marine Department.
- 4.6 All vessels and craft to be used by the Contractor and the use of such craft shall comply with the relevant requirements of the Marine Department, including the following :
  - (a) they shall be required to seek channel clearance and pilotage exemption as appropriate for navigating in the compulsory pilotage area;
  - (b) any vessels or craft shall be equipped with VHF radio operating on specified channels for direct contact with the Marine Department's Vessel Traffic Control (VTC); and
  - (c) they shall have on board experienced and qualified local persons, approved in accordance with Marine Department's requirements.
- 4.7 All vessels, working craft and other floating plant shall display appropriate international and local signals to indicate the nature of their work.

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4.8 The Contractor shall carry out regular hydrographic surveys of the marine works, marine borrow areas and any spoil dumping grounds. Results of the initial and final surveys of all dredged areas in the form of sounding plans shall be provided to the Director of Marine. Additional up-to-date sounding plans shall also be provided if and when specifically requested by the Director of Marine. Any areas which do not comply with the terms for the use of marine borrow areas and spoil dumping grounds shall be rectified to the satisfaction of the Marine Department.

(5) REQUIREMENTS ON COMPLETION OF CONSTRUCTION

The Contractor shall carry out monitoring surveys of the sea bed on completion of all marine construction. The surveys shall be independently certified and a copy provided to the Marine Department.

✓(6) The Grantee shall provide the Director of Marine with detailed plans showing the proposed works area(s), a working schedule, and a full description of the method of dredging and backfilling, including the number and type of craft to be employed, at least one month in advance of the commencement date of the works. No marine work shall be commenced without the written approval of the Director of Marine.

(7) The Grantee shall carry to the works in all respects in conformity with all conditions which may be imposed by, and to the entire satisfaction of the Director of Marine.

✓(8) The Grantee shall ensure that the works of excavation and backfilling of the seabed shall be planned and carried out in the closest liaison with the Vessel Traffic Centre so that any interruption to marine traffic passing through the works area shall be reduced to a minimum.

(9) The Grantee, his agents, workmen and contractors shall observe and carry out any directions given by the Director of Marine in connection with the control and

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safety of marine traffic in the vicinity of the works area, or any other area.

- ✓(10) Markers buoys shall be positioned at or adjacent to the works area(s) in accordance with the requirements of and to the satisfaction of the Director of Marine.
- ✓(11) All working craft shall carry appropriate signals to indicate the nature of their work.
- ✓(12) The Director of Marine shall have the right to require all working to cease and all working craft to be removed whenever he deems it necessary.
- (13) The Grantee shall provide all reasonable facilities for representatives of the Director of Marine to be present during the work and shall take such precautions as such representatives may recommend to avoid any damage to the property of the Government of Hong Kong which in the opinion of such representatives are likely to arise as a result thereof.
- (14) The Grantee shall institute a system of monitoring, using either suitably qualified supervisors and/or appropriate instrumentation, to ensure that all surplus material is dumped only in the designated areas.
- (15) All materials are to be dumped in uniform layers over the designated areas such that no high spots are formed.
- (16) The Grantee shall operate only one and highly manoeuvrable self-propelled dredgers within navigation channels. If anchored dredgers are used elsewhere within the works area, no positioning of anchors or mooring lines will be permitted within the navigation channels or traffic lanes.
- ✓(17) Continuous communications shall be established by the working craft on a dedicated frequency with the Vessel Traffic Centre of the Marine Department. A listening watch shall be maintained by the working craft at all times so that instructions can be given to vacate the works area at short notice.
- ✓(18) The Grantee shall ensure that the Contractor nominates a responsible person or persons on site to be in overall

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control of all his marine craft movements. Such person or persons shall closely liaise with the Vessel Traffic Centre, Hong Kong Pilots Association and other operators that the Director of Marine may specify to ensure that the working craft will not cause obstruction to vessels passing through the works areas.

- (19) Upon completion of the project, the Grantee shall restore the seabed to its original levels, or to such other levels as may be specified by the Director of Marine.
- (20) The Grantee shall carry out regular sounding surveys at the works areas and submit the survey plans to the Director of Marine as follows :
- (i) a base-line survey before the commencement of dredging or backfilling;
  - (ii) intermediate surveys at 2-monthly intervals from the date of commencement of dredging or backfilling until completion of all works;
  - (iii) When dredging or backfilling works are carried out in or adjacent to the navigation channels, the Grantee shall submit monthly detailed up-to-date sounding plans of the affected area to the Director of Marine; and
  - (iv) a final survey within two weeks upon completion of all operations within the works areas.
- (21) The Grantee shall be responsible for the placement, removal and/or relocation of navigation buoys at suitable positions to mark the navigation channel as and when required by the Director of Marine. Upon completion of all dredging and backfilling operations within the works areas, the Grantee shall ensure that all navigation buoys are replaced in their original positions unless agreed otherwise by Marine Department.
- (22) The dredger, while engaged in dredging operations and making way in a traffic lane in the Tathong Traffic Separation Scheme, shall proceed in the appropriate traffic lane in the general direction of traffic flow for that lane.

Confirmed

1.11.94

Port Operations Section

Port Services

Marine Department.

Annex J

## Response to Comments

Proposed Aviation Fuel Receiving Facility at  
Sha Chau, Draft EIA

Department	Reference	Comments	Responses
AFD	(35) in AF DVL 01/103 dated 28 October 1994	<p><i>General Comments</i></p> <p>Owing to tight schedule of the overall construction programme of the proposed AFRF, the duration of ecological studies is short and seasonal changes cannot be taken into account. As a result, the report recommends that further studies be carried out to supplement this EIA study. Under these circumstances, we note that results of the surveys or studies so far are only indicative rather than conclusive.</p>	Agreed.
		<p><i>Specific Comments</i></p> <p>1. <i>Section 1.1 Background to the Study (para 5 on page 1)</i> Please add the following sentences at the end of para 5 on page 1: "AFD has great reservation on Area 10 "in their opinion" as the proposed AFRF is likely to have significant impact on the dolphin population around Kung Kwu Chau and Sha Chau areas. AFD has therefore requested that he detailed EIA should carefully assess the ecological impacts on the dolphin population."</p>	Noted, the EIA will be amended accordingly with the words 'in their opinion' inserted between 'Area 10 as' and 'the proposed' for clarity. Further PAA note that AFD has previously endorsed the two staged Dolphin Studies (see attached letter from AFD to ERM dated 2 September 1994) and the Gazettal of the AFRF only proceeded with AFD's approval (see also attached letter from ERM to EPD dated 28 October 1994, Attachment 2).
		<p>2. <i>Section 1.2 Purpose of this Environmental Impact Assessment (page 2)</i> The purpose of the EIA should not exclude the possibility of a "no-go" alternative in case insurmountable environmental problems are identified in the study.</p>	Section 1.2 has been amended as follows: "AFD have stated that in thier view the purpose of the EIA should not exclude the possibility of a "no-go" alternative in case insurmountable environmental impacts are identified in the study."



Department	Reference	Comments	Responses
		<p>3. <i>Section 2.4.4 Conclusion and Recommendations (page 14)</i>  The site selection is based upon the sighting records obtained in the one-month survey. It would seem necessary to carry out further data analysis and the analysed results should be presented in the report. (please refer to my further comments on Vol.2 – Dolphin Database (Annex B)).</p>	<p><i>Section 2.4.4</i> the first sentence of para one has been amended as follows: "Based upon the sighting records obtained in the one-month <i>Site Selection Study</i> survey, the majority of <i>Sousa</i> ..."</p> <p><i>Section 2.4.4</i> the second sentence of para one has been amended as follows: "Based upon the sighting records obtained in the one-month <i>Site Selection Study</i> survey, areas contained within Sites C..."</p> <p>See also response to AFD comment on Vol 2 – Dolphin Database, Annex B.</p>
		<p>4. <i>Section 2.4.3 Results of the Study (page 13)</i>  The time scale of the survey (29 survey days) is short if considering the duration of the proposed development. Natural seasonal changes, such as fish stock distribution, water flow, weather conditions and tidal cycles, all of which may influence the occurrence of <i>Sousa</i>, cannot, therefore, be taken into account.</p>	<p>Noted and Agreed. Annex B, Section 6.1 stated that "The timeframe of the survey conformed to the AFRF project schedule which allowed only one-month for intensive field survey. Surveys conducted over longer periods may indicate that <i>Sousa</i> exhibits other patterns of habitat usage under different seasonal or other conditions. The relevant text in Section 2.4.3 has been supplemented accordingly.</p>
		<p>5. <i>Section 4.4.3 Existing Ecological Environment</i>  (i) Diving survey (page 79) – It was stated that Favidae spp. were recorded by the diving survey, but they were not recorded in the species listing. As it is unlikely that favids are found (and not previously recorded in that area, further clarification and investigation is required. Please also note that the family Gorgonacea is a not stony coral as stated in the report.</p>	<p>Noted re: Faviidae we will provide further clarification on this point where possible. Please note that the recommended further ecological studies will provide further information on this matter. It is noted that Gorgonacea is not a stony coral; the report will be amended accordingly.</p>
		<p>(ii) Species Characteristics (page 80) – The first sentence under "Species Characteristics" which states that "Scientists believe that <i>Sousa chinensis</i> is a previously unrecorded species ..... related to Indo-Pacific Humpback Dolphin" need to be qualified and reference is needed.</p>	<p>Noted. The report will be amended accordingly.</p>
		<p>(iii) Please replace "AFD" in the last sentence of the first paragraph on page 80 with "AFD's Dolphin Research Team".</p>	<p>Noted. The report will be amended accordingly.</p>

Department	Reference	Comments	Responses
		<p>6. <i>Section 4.4.3 Existing Ecological Environment and Section 4.4.4 Evaluation Criteria</i>  Under these sections, contradiction occurs twice in rating the significance of the area for fisheries, namely in P.78 (2nd para) and P.83 (2nd and 3rd paras). AFD considers the area moderately productive and no longer uses the unpublished assessment of richards (1980) based upon 1970's sources. Mariculture would have continued near Chek Lap Kok but for the airport works. Therefore, on P.78 the last two sentences of the 2nd para and the whole of the 3rd para on P.83 should be deleted.</p>	<p>Noted. The report will be amended accordingly.</p>
		<p>7. <i>Section 4.4.6 Marine Manuals (page 90)</i>  This section addresses that the selection of site for the AFRF location has been chosen to minimise direct impact or harm on Sousa. It should also comment on the likely adverse impact on the dolphin population in the area. The effect of the project on the dolphin population in the Pearl River estuarine areas as a whole should also be considered.</p>	<p>Consideration of the likely adverse impacts on the dolphin population in the area were detailed in Section 4.4.6 (construction) and Section 5.4.2 (operation). The effect of the project on the dolphin population in the Pearl River Delta (PRD) areas as a whole can not, at present, be addressed in view of the absence of PRD dolphin data., although we understand that the AFD Dolphin Research Team (DRT) have recently been granted PRC permission to conduct dolphin survey work in the PRD and we look forward to receiving this data. However, the results of the first nine months of the AFD DRT suggest that Hong Kong comprise a very small part of the potential range of the dolphins within the PRD. The report Section 4.4.6 (Introduction) has been supplemented by the addition of the following text: "Potential sources of impacts on marine mammals are listed below, although it should be noted that the effect of the project on the dolphin population in the Pearl River Delta (PRD) areas as a whole can not, at present, be addressed in view of the absence of PRD dolphin data."</p>
		<p>8. <i>Section 4.4.5 Potential sources of Impact (pages 84-85)</i>  The potential decrease in food sources available to the dolphins (due to dredging and effect of ship manoeuvres) should be more carefully assessed within the scope of this EIA.</p>	<p>Noted. This will be addressed during the detailed design basis EIA using the results of the proposed further ecological studies.</p>
		<p>9. <i>Section 4.4.6 Evaluation of Impacts (page 89)</i>  The judgement of the 2nd sentence in 5th para of P.89 cannot be based upon the previous sentence which is factual information better placed elsewhere.</p>	<p>Noted. The report will be amended accordingly.</p>

Department	Reference	Comments	Responses
		<p>10. <i>Marine Manual Hearing: Potential Impact (pages 94–95)</i>  The report points out that high level noise can cause hearing damage to dolphins. Some researches, however, has already shown that long term increases in sub-lethal levels of noise also cause chronic damage to the hearing of odontocetes. The report should also take account of impacts on the dolphins due to loss of feeding grounds around Sha Chau as the dolphins are expected to avoid disturbances in this area (para. 4 of page 94 refers).</p>	<p>The duration of the combined AFRF construction and commissioning periods will be about 22 months. The AFRF construction activities will not affect all feeding grounds around Sha Chau. The report will be amended to take account of this AFD comment.</p>
		<p>11. <i>East Sha Chau Contaminated Mud Pits (page 96)</i>  Further CMPs are proposed to the NW of those marked upon Fig 4.1a.</p>	<p>Agreed. These proposed CMPs were shown in the AFRF Initial Assessment Report and these will be added to the revised report.</p>
		<p>12. <i>East Sha Chau Contaminated Mud Pits (page 96)</i>  (i) Presumably the proposed ecological studies are part of this detailed EIA, and the project proponent, ie PAA, is responsible for its implementation.</p>	<p>As described in Section 4.4.7 the proposed ecological studies should be carried out, in parallel with the facility design. PAA assumes responsibility for implementing these ecological studies.</p>
		<p>(ii) Presumably PAA is also responsible to implement the proposed restocking of penaeid shrimps, sea pens and commercial fish species if the recommendation is accepted as a mitigation measures. PAA as the project proponent should provide funds needed.</p>	<p>Noted. PAA inform us that if this proposed mitigation is found to be necessary a review of the various options for acceptable funding responsibilities will have to be reviewed with Government.</p>
		<p>(iii) The consultants should provide cost estimation and detailed implementation plans for these recommendations.</p>	<p>Provision of cost estimates and detailed implementation plans for these recommendations is beyond the scope of the present EIA. In addition, as details of certain specific mitigation measures will depend on the results of the further studies it is considered appropriate to formulate details in the detailed design stage EIA.</p>
		<p>(iv) The identified further ecological studies should form part of the EIA study rather than being treated as mitigation measures.</p>	<p>Noted. These studies will be undertaken in the detailed design basis EIA in parallel with the detailed design.</p>



Department	Reference	Comments	Responses
		<p>13. <i>Section 6.3.5 Potential Ecological Impact (of spills) (page 151)</i> The first bullet is alarmist. Following paragraphs should indicate the general degree of risk that these toxic effect would occur.</p>	<p>The first bullet is correct. Risks of the spills occurring are given on page 145. These indicate risks of a major spill are low. For toxic effects to be seen in fish also requires the spill to drift over their waters, further reducing the risks. However, as required the following paragraphs will be amended to indicate the general degree of risk at which these toxic effects could occur.</p>
		<p>14. <i>Section 6.3.6 Oil Spill Modelling (page 162)</i> Scenario 4 or any to the east would impact on Ma Wan FCZ. This needs more detailed consideration.</p>	<p>See response to EPD Water Quality Section comment 4(b).</p>
		<p>15. <i>Section 6.3 Environmental Monitoring (pages 171-172)</i> The scope may need to be expanded subject to the recommended detailed ecological surveys.</p>	<p>Agreed, the EM&amp;A scope could require expansion pending the results of the recommended detailed ecological surveys.</p>
		<p>16. <i>Section 7.4 Details of Dolphin Monitoring Data Gathering (page 173)</i> It is well documented that the biggest source of error in marine manual census work is the inability of experienced observers to locate dolphins (Hiby &amp; Hammoud, 1989). Therefore, it is essential that staff employed for dolphin monitoring work should have previous experience.</p>	<p>Noted.</p>
		<p>17. <i>Section 7.5 Dolphin Impact Monitoring (page 174)</i> Apparently, we do not have accurate and reliable baseline Sousa number in the area. Furthermore, due to the lack of year-round surveys, we are uncertain if there are any seasonal variations. As such, it would be difficult to work out a monitoring programme to accurately monitor the impact of the project on the dolphins.</p> <p>Having said these, this department and our DRT would certainly try our best to ensure a dolphin impact monitoring programme to be conducted if the AFRF is to be constructed at Sha Chau. In this regard, I would like to know if a stop clause would be incorporated in the construction contract to enable effective monitoring on the impact of the project in case damage level beyond recovery is detected during the course of monitoring.</p>	<p>Noted, we agree that formulation of a monitoring programme to accurately monitor the impact of the AFRF on dolphins will be a complex process as they must take into account any possible seasonal variations in dolphin numbers. In this regard we consider it would useful for both AFD and their DRT to be consulted in the process of formulation of the dolphin monitoring programme.</p> <p>PAA inform us that the economic and political ramifications will have to be discussed further with Government</p>

Department	Reference	Comments	Responses
		<p>18. <i>Section 8.5 Final Considerations (page 189)</i></p> <p>(i) The accuracy of assessment on the impacts and the extent of effectiveness of the mitigation measures depend very much on availability of ecological baseline information at the time when the predictions were made. In view of the compressed programme of the project, a comprehensive baseline data is not available in this EIA study and thus the assessment of ecological impacts cannot be fully evaluated. Under the circumstance, please clarify the last paragraph of this section.</p>	<p>Noted. It is considered that the penultimate paragraph of Section 8.5 reflects AFDs comment and concern.</p>
		<p>(ii) Recently there have been proposals from the Dolphin Research Team that the area around Sha Chau be designated SSSI as an interim until the government identification of it as a marine reserve (dolphin sanctuary) can be legislated. This new development should also be taken into account when considering the acceptability of the project.</p>	<p>The Consultants are surprised to learn of this tentative interim AFD proposal as the AFD did not provide this information to the EIA Consultants during the course of the EIA Study. The Consultants are also unaware of that AFD raised any formal mentioned of this proposal during the AFRF gazettal process. Nevertheless, the Consultants could be grateful to directly receive from AFD further details of this tentative interim proposal and in particular the proposed location, programme etc. Assuming that AFD can provide such information directly the Consultants will note this "new development" in the revised text.</p>
		<p>19. <i>Volume 2 Dolphin Database (Annex B)</i></p> <p>(i) Information of the surveys such as the number of observers per survey, the duration of their shifts, time spent on survey rest periods and total distances covered should be given. All of these factors are important when determining effort and error in the analysis of the data.</p>	<p>AFD are referred to Section 25. of Annex B which stated that "strict timed quantification of "sighting effort" was not included in the field survey methodology established".</p>
		<p>(ii) Certain data seems erroneous. Comparison of data from the DRT collected in the same period shows several discrepancies, eg the survey data obtained from the 22 June bear little resemblance to data recorded by RST. Some data is also missing, eg according to collection of data by the RST on the 16 and 22 June, when dead animal sighting occurred, there is no note of this in consultants' survey data. Please verify the accuracy of survey data present in the report.</p>	<p>The Consultants would be grateful to receive data recorded during the site survey by DRT including their details of "sighting effort". On receipt of this data the database will be cross-checked. We note that both the 17 June and 22 June sighting were located at Lung Kwu Chau.</p>

Department	Reference	Comments	Responses
		(iii) Data analysis is incomplete. Further analysis of data obtained from the dolphin surveys based on the Line Transect Methodology should be carried out to determine the distribution and abundance of individuals.	Where possible this further Line Transect Methodology data analysis will be undertaken to determine the distribution and number of individuals, although please note response to AFD comment 19(i).
		20. <i>Draft Executive Summary</i> The Draft Executive Summary should be amended taking into consideration of our comments stated in this letter.	Noted. The Draft Executive Summary will be amended accordingly.

Department	Reference	Comments	Responses
EPD	(8) in EP2/N9/19 Annex(5) dated 28 October 1994	<p><i>Overall</i></p> <p>The consultants have not provided adequate information to address on the key issues as requested by the ACE EIA Subcommittee. The conclusions on potential impacts of AFRF project on the Chinese white Dolphins and marine resources have to be substantiated by quantitative data and scientific evidence. It is necessary to estimate and quantify the extent of damage to the marine ecological habitats. The consultants are requested to confirm with AFD on the ecological criteria to be adopted for the monitoring programme.</p> <p>In addition, the pipeline option would substantially reduce risks to life and risks to environment. A pipeline is required to comply with the ALARP principle (Section 6). Although it is stated that the pipeline option remains as PAA's <u>long term</u> preferred option, there is no explanation of why the pipeline could not be a <u>short-term</u> option, ie why is the AFRF required as an interim option? A convincing explanation is required to demonstrate compliance with the ALARP principle.</p>	<p>See attached letter from ERM to EPD dated 28 October 1994.</p> <p>PAA inform that they in consultation with the Government and interested Franchisees, initially in 1993 investigated numerous possible sites for locating off-airport fuel receiving facility which could be linked by pipelines to the airport at Chek Lap Kok. By a process of elimination the Tsing Yi and Guishan sites were left as possible options for providing a secure, assured aviation fuel supply from an off-airport depot by pipeline to the new airport.</p> <p>In the case of Tsing Yi, the position is that there already exist five separately owned and independently operated fuel receiving facilities, none of which is capable of providing large scale storage of aviation fuel. The existing consortium at Tsing yi has no plans to expand the aviation fuel receiving facilities at Tsing Yi except to link the existing fuel tanks operated by the five companies by a land pipeline. Such a pipeline does not have Government approval. In addition, the submarine pipeline route running from the depot to Chek Lap Kok presents environmental and engineering programme and cost difficulties which have yet to be resolved. Guishan on the other hand does not yet have any facilities for storing aviation fuel and the construction of a pipeline from Guishan to the airport would require more detailed site and environmental investigation. In Guishan's case, a further uncertainty would be that these studies would need to take place in waters under two separate jurisdictions, those of the Hong Kong and Zhuhai authorities.</p> <p>Against this background and in close consultation with the</p>

Department	Reference	Comments	Responses
			identified offshore facility sites of the pipeline routes had a sufficient degree of certainty to guarantee that an adequate fuel delivery system to the new airport would be in place by the time of airport opening.
		<p><i>Specific Comments</i>  <i>Risk Assessment</i></p> <p>(1) <i>Section 6.2.1 Line 10, p.125</i>  The consultants should amend "low volatility and flash point" to "low volatility and high flash point".</p>	Noted & agreed.
		<p>(2) <i>Section 6.2.2, Line 11, p.126</i>  The consultants should replace "Note this study removed, as permanent supply options, any" by "The conclusions of this study eliminated as unacceptable, any permanent supply options, involving.....";</p>	Noted & agreed.
		<p>(3) <i>Section 6.2.4, 2nd para, p.127</i>  The consultants should reword the paragraph "the level of Societal Risk .... to 2004", with explanation of the phrase 'qualitatively adjusted';</p>	Noted. 'Qualitatively adjusted' means we have taken the level for demand in 2040 and factored the risk to account for the lower fuel demand in 2004. Detailed quantified risk assessment will be undertaken during detailed design.
		<p>(4) <i>Section 6.2.4, 4th para, p.127</i>  The consultants should elaborate how the risk level from 10% of fuel supplied from vessels is qualitatively assessed;</p>	The contribution from the 10,000 dwt vessel is qualitatively assessed via interpolation from the results of the 1993 study which looked at various vessel sizes between 1,000 and 50,000 dwt.
		<p>(5) <i>Section 6.2.5, Last para, p.128</i>  Please confirm if "the largest tank size being 1000 tonnes" is correct;</p>	It is believed to be true, but will be confirmed prior to construction of the AFRF.
		<p>(6) <i>Section 6.2.6, Line 21-22, p.132</i>  Please delete "(equivalent to half the lifetime of planet earth)";</p>	Noted & Agreed
		<p>(7) <i>Section 6.3.6, Last para, 1st Sentence, p.132</i>  Please delete "Both sets of guidelines ..... available risk guidelines";</p>	Noted & agreed

Department	Reference	Comments	Responses
		(8) <i>Section 6.2.7, Line 28, p.133</i> Would the consultants please quantify the percentage, (ie the quoted 60%) by means of the number of D.G. vessels being used by the Chinese side via Ma Wan Channel;	Figures given in the 1993 Study indicate the following vessel numbers destined to PRC ports: 440 Class D (5,000 < Class D < 30,000 dwt), 1106 Class C (5,001 < Class C < 30,000 dwt) and 1233 Class B (30,001 < Class B < 80,000). This suggests that DG vessel numbers would be as follows: Class D 264, Class C 664 & Class B 740.
		(9) <i>Section 6.2.7, Penultimate Line, p.133</i> Would the consultant elaborate how the factor 1 and 354 are derived;	4,000 fatalities are predicted with a frequency of 1E-9/yr - i.e. 1 * 1E-9 and 1,000 fatalities are predicted with a frequency of 3.54E-7 - i.e. 354 * 1E-9/yr.
		(10) <i>Section 7.2.7, Last line, p.133</i> Please replace "some" by "should";	Agreed
		(11) <i>Section 6.2.7, Figs 6.2d,e</i> The consultants should explain why the F-N curve for 'total 5000 te case 2040' crosses with that of the '2004 estimate' at N=10. We would expect the F-N curve for 2040 to be above that for 2004 for all values of N;	The F-N Curve for the AFRF in 2004 includes populations west of Ma Wan whereas that for 2040 includes only populations in the Ma Wan area. This will be made clear on the figure legend.
		(12) <i>Section 6.2.7, Line 8-9, p.134</i> The consultant should reword the sentence "Risk at sea is mainly due to .... Ma Wan Channel.";	Sentence will be reworded as follows: 'Risks arising from vessels whilst at sea is mainly to ... Ma Wan Channel'.
		(13) <i>Section 6.2.7, Line 30, p.134</i> Please amend "unpopulated" to 'sparsely populated";	Agreed
		(14) <i>Section 6.2.7, Penultimate para, p.134</i> The consultants should insert at the 1st sentence to 'The risks to life due to operations at the AFRF are negligible due to its separation distance from the shoreline population. Therefore Figure 6.2d & 6.2e show ..... operation in 2004'. The "qualitative estimate" should be replaced by "quantitative estimate";	Agreed

Department	Reference	Comments	Responses
		(15) <i>Section 6.2.7, Line 16, p.135</i> The consultants should justify how he would derive the "four times" as quoted for the Ma Wan Channel;	This estimate is essentially the consultants professional judgement. The Ma Wan Channel is a constricted fast flowing channel with a 90 degree turn. Groundings (a major accident mechanism) with potential to cause fatalities can occur on 3 out of the four sides of the channel, whereas this reduces to 1 side west of Ma Wan. Further detailed study is recommended to evaluate these assumptions.
		(16) <i>Section 6.2.7, Line 18, p.135</i> The consultants should elaborate how the 75% is derived;	The area is assumed to be three times more significant in terms of population at risk and incidents four times less likely to occur. this give a factor of 3/4 or 75%.
		(17) <i>Section 6.2.8, Lie 18. p.137</i> Please amend "Relocation of proposed Potentially Hazardous Installations west of Ma Wan" to " Restrictions on the proposed Potentially Hazardous Installations in Tuen Mun Port";	Agreed
		(18) <i>Section 6.2.8, Line 23, p.137</i> Please amend "oil spills" to spills";	Agreed
		(19) <i>Section 6.2.8, Line 24, p.137</i> Comment same as (18);	Agreed
		(20) <i>Section 6.2.8, Line 5-15, p.138</i> Please delete the section headed 'Background Risks';	Agreed
		(21) <i>Section 6.2.8, 6th para, p.138</i> The consultants should provide a clear and detailed explanation of the reasons behind using AFRF as an interim solution before constructing a pipeline. A convincing argument is essential to demonstrate that AFRF complies with the ALARP principle;	See response to EPD overall comment on page 7
		(22) <i>Section 6.2.8, Penultimate Line, p.138</i> The consultants should elaborate further on the meaning of "Non-Dedicated vessels";	Dedicated vessels are taken to be 5,000 dwt vessels of the eventual licensee that meet Marine Dept. conditions ( <i>Annex E</i> ) and are for the sole uses of the AFRF, double hulled and of modern safe design. Non-dedicated vessels are any seaworthy craft of up to 10,000 dwt coming direct to the AFRF from international waters. Up to 10% of supply may be in vessels of this type to allow air carriers the opportunity to bring in larger competitively priced fuel parcels.

Department	Reference	Comments	Responses
		(23) <i>Section 6.2.8, 3rd para, p.139</i> The consultants should amend "will virtually eliminate the risk of death" to "will significantly reduce the risk of death";	Agreed
		(24) <i>Section 6.2.9, Line 11, p.139</i> "semi-quantitatively" should be deleted;	Agreed
		(25) <i>Section 6.2.9, Line 14, p.139</i> Please replace "These are not strictly applicable." by "It is noted that transport risk guidelines may be proposed in the near future.";	Noted, however it is proposed not to change the report since this is not relevant to the current study.
		(26) <i>Section 6.2.9, 2nd para, p.140</i> The consultants should provide a <u>full</u> text of the 1993 Study conclusions rather than an audit version. The last sentence requires further elaboration to show the connection between AFRF and ALARP principle;	Noted, the text will be strengthened to ensure all relevant points are included in the EIA.
		(27) <i>Section 6.2.9, 6th para, p.140</i> The consultants should elaborate further why the risks to populations west of Ma Wan etc would be 0 higher consequence on one hand and lower frequency on the other;	See responses 15 and 16 above. The population at risk west of Ma Wan is greater but the likelihood of incidents is less due to the greater ease of navigation.
		(28) <i>Section 6.2.9, Line 8-9, p.141</i> The consultants should delete and re-word the sentence "The AFRF .... the ALARP principle," requires a good justification for the AFRF facility as an interim solution.;	See response to EPD overall comment on page 7.
		(29) <i>Section 8.3.5, Line 3, p.186</i> Please refer to previous comment of (24);	See response 24
		(30) <i>Section 8.3.5, Line 6.7, p.186</i> Please refer to previous comment of (25);	See response 25
		(31) <i>Section 8.3.5, Last para, Line 186</i> Please refer to previous comment of (27);	See response 27



Department	Reference	Comments	Responses
		<p><i>Noise</i></p> <p>(1) <i>Section 1.2.1, Operational Phase</i> To be consistent with the EIA scope given in Annex A, please add a new bullet as follows, "Noise: Assessment of AFRF operational noise impacts."</p>	<p>Agreed the recommended addition will be included in the revised EIA text.</p>
		<p>(2) <i>Figure 4.2</i> The location of Butterfly Garden should be at the western side of Ten Man rather than the eastern side.</p>	<p>Noted. The text and figure have been amended to reflect Butterfly Garden's location west of Tuen Mun.</p>
		<p>(3) <i>Table 4.2b</i> The noise criteria for the two time periods of restricted hours should be "LAeq5min 60 dB(A)" and "LAeq5min 45 dB(A)" respectively according to TM1.</p>	<p>Noted. Both the text and Table 4.2b have been corrected accordingly.</p>
		<p>(4) <i>Section 4.2.6 last para</i> "Table 3.3b" in the first line should read Table 4.2b".</p>	<p>Noted. The Table number has been corrected to read Table 4.2b.</p>
		<p>(5) <i>Table 4.2f</i> Based on the noise impacts given in Tables 4.2d and 4.2e, the cumulative construction noise levels at San Tau and Butterfly Garden should be 42 dB(A) and 37 dB(A) respectively.</p>	<p>Noted. The cumulative noise levels should have read 41 and 37 at San Tau and Butterfly Garden and have been corrected in the light of these comments.</p>
		<p>(6) <i>Section 4.2.8</i> "no percussive pilling activities" in the last line should be replaced by "no construction noise problem".</p>	<p>Noted. The text has been revised.</p>
		<p><i>Chapter 8 - Conclusions</i></p> <p>(1) <i>Section 8.2.1, 2nd para - Contaminated Mud Pits (CMPs)</i> The consultants should specify the width of buffer zone. Please confirm if 150 metre away from the gazetted boundary of the CMPs is required to avoid any associated contaminant release.</p>	<p>As stated in Section 4.1.12 "It has been recommended that a safety zone of 15x10=150m from the west of contaminated mud pit slopes is maintained .... for planning purposes.... Therefore, the construction (AFRF) pipelines would be outside the 150m safety zone, and would not affect the CMP's integrity. The location of the buffer was indicated on Figure 4.11 and can be seen the width varies although the minimum width is greater than 150m. As the construction of pipelines will be outside this 150 safety zone it is considered that no unacceptable environmental impacts will result from the location of the pipeline corridor in the proximity of the CMPs. The text of Section 8.2.1 has been supplemented to clarify this point.</p>

Department	Reference	Comments	Responses
		<p>(2) <i>Section 8.2.1, 4th para - EM&amp;A</i>            Have the consultants made any practical recommendations on the existing PAA procedures for water quality? Any specific environmental parameters would be required for the protection of Chinese White Dolphins and other endangered species eg stony coral.</p>	<p>PAA's existing monitoring programmes will be expanded to incorporate EM&amp;A of the AFRF construction.</p> <p>Noted, Section 7 details the required Chinese White Dolphin monitoring details and Section 8.2.4 summarises these requirements. Section 8.2.3 summarises construction impacts on marine ecology.</p>
		<p>(3) <i>Section 8.2.3, 1st and 2nd para - Marine Ecology</i>            Please quantify the number of endangered species and estimate the percentage of population would be affected in the construction phase. Would the consultants confirm whether the so called "dui-xiao" is a special prawn species found in the vicinity of Sha Chau. If yes, is it classified as an endangered species by the international criteria or PRC's legislation.</p>	<p>It is not possible at this time, to provide this information due to ecological data deficiencies highlighted in the EIA. However, this will be addressed during the detailed design basis EIA using the results of the proposed further ecological studies.</p> <p>Section 4.4.6 stated that preliminary ecological survey results of "the trawl survey indicated that the area around Sha Chau supported a high diversity and abundance of invertebrates and fish fauna that are of both fisheries and biological interest. Many fish and invertebrate species recorded in the trawl survey are common, local food species. This included the penaeid shrimps <i>Penaeus spp.</i>, <i>Metapenaeus ensis</i>, <i>Parapenaeopsis spp.</i>, the mantis shrimp <i>Oratosquilla oratoria</i>, the crab <i>Portuns pelagicus</i>, the cuttle fish <i>Sepia sp.</i>, the sole <i>Cynoglossus spp.</i> and <i>Solea orata</i>, the flounder <i>Paralichthys olivaceus</i>, the croaker <i>Johnius belengeri</i>, the lion head <i>Collichthys lucida</i>, the conger pike eel <i>Muraenox cinereus</i> and the flat head <i>Platycephalus indicus</i>. Amongst the above mentioned species, the penaeid shrimps (shrimps belonging to the Family Penaeidae, or "Dui xiao" in Chinese)... are of particular interest, since they are commercial species with high market value and were abundant in the area". We understand that "dui xiao" is not classified as an endangered species by the international criteria or PRC's legislation but we would be grateful for AFD to provide relevant information if this is not correct.</p>
		<p>(4) <i>Section 8.2.3, 4th para - Seasonal Consideration</i>            It would be useful to show the occurrence of the Chinese King Crab on a map based on the published documents.</p>	<p>The occurrence of the Chinese King Crab, based on published documents will be graphically illustrated in the revised EIA using data to be provided by the AFD.</p>

Department	Reference	Comments	Responses
		Additional comments on Water Quality and Waste Management would be sent to you in due course. In the meantime, please prepare written responses to EWG's comments for discussion on 2 November 1994.	Noted.
EPD	(9) in EP2/N9/19 Annex(5) dated 29 October 1994	<p><b>Water Quality - major issues</b></p> <p>(1) One of our major concern on this EIA is the proposed use of jetting/ploughing for the pipeline installation. This method is recommended on the basis of the shorter construction period, smaller trench width and no sediment disposal requirements. However <u>there is no evidence information provided to substantiate the recommendation and in particular the claim of lower overall water quality impacts.</u> Furthermore, the relative advantages and disadvantages of these two methods are not compared. Does it mean that the water quality impacts brought about by these two methods are similar?</p>	Noted. Please see response to EPD comment 2(e) Ref. ( ) in EP2/N9/19 Annex(5).
		(2) The consultants are requested to clarify the possible water quality impacts induced by these two methods, such as the proposed trenching rate, the extent of sediment release into the water column and any other negative effects on water quality etc, wit supportive evidence for our comment.	Please see response to EPD comment 2(e), ( ) in EP2/N9/19 Annex(5).
		(3) Since the sediment plume modelling for the subject study was only conducted on the assumption that grab dredgers working at a rate of 8,333 m <sup>3</sup> /day would result in 5% dredging material loss and, the consultants should confirm whether or not the result of this model run will also be adequate to cover the water quality impacts caused by the recommended jetting/ploughing pipelaying techniques.	Please see response to EPD comment 2(e), ( ) in EP2/N9/19 Annex(5).

Department	Reference	Comments	Responses
		<p>(4) The modelling results of the following two scenarios have been rise to our concerns.</p> <p>(a) <u>Sediment Plume Model Scenario – Dry Season Spring Tide During Peak Ebb at Bed Layer</u></p> <p>The contour plot obviously shows that the sediment plume under this scenario will be widely spread. High concentration plume (&gt;15ppm) will reach East Sha Chau which may encroach upon the area of the Contaminated Pits. However no mitigation measures to tackle the problem are proposed. Since the high concentration plume encroaching upon East Sha Chau Area is considered to be most undesirable on the basis of the modelling (there is also a similar but less severe situation during the ebb tides in Wet Season Spring Tide), the consultants are advised to consider proposing restricting dredging activities to period of slack tides as to minimise the cumulative impacts associated with the contaminated mud pits.</p>	<p>We are unable to understand why a &gt;15ppm sediment plume encroaching upon the East Sha Chau Area is considered to be "most undesirable on the basis of the modelling". The high concentrations in the bed layer are as a result of re-suspension of recently deposited material. The re-suspended material will remain confined to the bed layer, in all likelihood very close to the seabed, and will be transported a short distance before settling on the bed again at slack water. The high suspended sediment concentrations are of very short duration, only around peak ebb velocities which is approximately 6 hours after high water, and will not be present at any other time during the tide. This is because the tidal currents are not high enough to erode the recently deposited sediment except at peak ebb.</p> <p>Restricting dredging to only slack water will certainly limit the spread of the plume as any suspended sediment will settle out in the area local to the dredging activities but the restriction of AFRF construction to minimize cumulative impacts appear to be restrictive and would only increase the duration of marine works which would be undesirable in terms of both direct impacts on marine ecology, indirect impacts on <i>Sousa</i> and on PAA's AFRF construction programme.</p> <p>PAA inform us that any restrictions on dredging activities will have to be reviewed in terms of political and economic considerations.</p>

Department	Reference	Comments	Responses
		<p>(b) Fuel Spills Model Scenario 4 – Ebb Release of Fuel</p> <p>We notice that under Scenario 4, Fuel Spills will extend into the Kap Shui Mun Channel and even the East and West Lamma Channel after 24 and 36 hours of Spillage respectively. Although the concentration of fuel plume range from moderate (0.01 &lt; conc. &lt; 0.10 kg/sq.m) to low (0.001 &lt; conc. &lt; 0.01 kg/sq.m), the Consultant should not that there are two sensitive receivers located within these areas which are very vulnerable to the impact of fuel spills. One is the Ma Wan Fish Cultural Zone, the model predicts that a fuel plume of moderate conc will reach it after 24 hour of spill. The other is the Sok Kwu Wan Fish Cultural Zone adjacent to East Lamma Channel. In addition, some of the gazetted/ungazetted beaches are also susceptible to the fuel impacts. The consultants has to propose effective mitigation measures or PAA has to ensure an efficient spill response action plan will be developed so that the impacts on the above sensitive receivers could be minimised to the largest extent whenever there is a fuel spill outbreak.</p>	<p>The event modelled as scenario 4 is very unlikely with an estimated frequency of 1.4E-5/yr or roughly a once in 70,000 year event. It is included to ensure the spill response plan can be designed such that even very rare events can be prepared for. The presence of the Fish Culture Zones is noted.</p>
		<p>(5) Based on the results obtained from the sediment plume model, the consultants should also be able to quantify the impacts of the proposed dredging and backfilling activities on the water quality in terms of <b>D.O. and Nutrient Levels</b>. Please be advised that quantified figures of these water quality parameters provide the best indications on how the receiving waters will be affected while the qualitative assessment tend to be too general and could be subject to different interpretation. The consultants are requested to quantify the water quality impacts on those water quality parameters based on the modelling results.</p>	<p>The EIA Consultants would have been prepared to quantitatively model both DO and nutrient levels by WAHMO modelling if phase had been requested by the EPD during their consideration of the brief. In the absence of such EPD direction at the scope formulation stage the EIA Consultants require the EPD to directly provide a method acceptable to EPD to quantify the impacts of the proposed dredging and backfilling activities on DO and nutrient levels based on the results obtained from the sediment plume model. On receipt of such direction the EIA will be supplemented.</p>
		<p>(6) Although the consultants have proposed to use <u>closed grab dredgers</u> for the dredging of turning basin and access channel for the AFRF, we suggest that <u>silt curtains</u> should also be installed whenever possible for prevention of widespread sediment dispersion in water column.</p>	<p>Noted PAA inform us that, if practical, it will be considered.</p>

Department	Reference	Comments	Responses
		<p><b>Chemical Waste Disposal</b></p> <p>(1) <i>Section 4.1.14, p.58</i>  The compositions of dewatered liquids/test waters shown in Table 3.5a indicates that the waste will not be classified as chemical waste and thus not be accepted into the CWTC for treatment. The waste producer should make alternative arrangements.</p> <p>p.73, Chemical waste – please note that the chemical waste charging scheme is expected to be implemented soon, which is likely to be in early 1995.</p> <p>Regarding storage facilities, the CWTC operator will only supply standard containers no larger than 200 litre. Other storage facilities have to provided by the contractor.</p>	<p>Noted. The report will amended to reflect EPDs direction in this regard.</p> <p>Noted. The report will amended to reflect EPDs direction in this regard.</p> <p>Noted. The report will amended to reflect EPDs direction in this regard.</p>
		<p>(2) <i>Section 5.3.3, p.114</i>  As the Marpol waste storage capacity at the CWTC is rather limited, it is recommended to contact the CWTC operator to discuss aspects of Marpol waste disposal.</p>	<p>Noted. The report will amended to reflect EPDs direction in this regard.</p>
		<p>(3) <i>Section 5.3.4, p.115, Commercial/Industrial waster</i>  Please delete the last sentence which is relevant to construction waste.</p>	<p>Noted. The text will be amended accordingly.</p>
		<p>(4) <i>Section 5.3.4, p.115, marpol waste</i>  "solid water" should read "solid waste" in the last sentence of first paragraph. The licensee should arrange collection of marpol waste with the CWTC operator where necessary.</p>	<p>Noted. The text will be amended accordingly.</p>

Department	Reference	Comments	Responses
		<p><b>Marine Dumping</b></p> <p>(1) <i>Section 4.3.5, p.72, 2nd para</i>  It was mentioned that there would be a "Tenderer (detailed designed stage)". Based on the assumption that the Tenderer is responsible for the design of the works, the last sentence should be revised as: "It will be the <u>Tenderer's (detailed design stage)</u> responsibility to ensure that all dredging and disposal methods are in compliance with the guidelines specified in WBHTC No. 22/92.</p> <p>The consultants should clarify whether they are proposing to let the successful Tenderer to conduct a sediment analysis through a supplementary EIA. The consultants should be aware of the necessary timing required by the WBTC No. 22/92.</p>	<p>Noted. The text will be amended accordingly.</p> <p>The WBTC No 22/92 required sediment analysis will be undertaken the Tenderer (detailed design stage), though the detailed design stage EIA.</p>
		<p>(2) <i>Section 4.3.5, p.71, 2nd para</i>  "It is the responsibility of the <u>Licensee</u>...."</p> <p>What is this referring to ? The term Licensee should better be replaced by "successful Tenderer (detail design stage)", please clarify.</p>	<p>The text has been clarified as suggested by EPD.</p>
		<p>(3) <i>Section 4.1.13, p.55 top</i>  "...., the <u>Contractor</u> would be required to undertake a detailed sediment quality assessment to identify...."</p> <p>What is this referring to? The term Contractor should better be replaced by "successful Tenderer (detail design stage)".</p>	<p>Noted. The text will be amended accordingly.</p>
CED	(18)NA 7/8/4 dated 27 October 1994	<p><b>Draft Final Report</b></p> <p><i>Section 1.1</i>  I suggest the phrase "in the interim term" should be deleted from the 1st sentence of the 1st para. The 1st sentence of the 2nd para mentions this is an interim arrangement and the likely time period.</p>	<p>Noted. The text will be amended accordingly.</p>
		<p><i>Section 1.2.1 Dolphin Studies</i>  There is a typo on line 3 "to4" should be "to".</p>	<p>Noted. The text will be amended accordingly.</p>

Department	Reference	Comments	Responses
		<p><i>Figure 3.4b</i> I suggest the wording "IEGULAR UNDARY" is deleted from the middle of the plan.</p>	<p>Noted. The text will be amended accordingly.</p>
		<p><i>Figures 3.4b, 4.1a, 4.1b &amp; 4.1l</i> A note should be added where Gazettal plans or areas are shown to say "Draft for Indication only".</p>	<p>Noted. The text will be amended accordingly.</p>
		<p><i>Section 3.7.5</i> Does the 2nd sentence imply that there would be no need for maintenance dredging during the 5-7 year period or that it would not be on a programmed basis?</p>	<p>This indicates that it is considered that there would be no need for maintenance dredging during the 5-7 year period.</p>
		<p><i>Figures 4.1a &amp; 4.1l</i> To avoid confusion I suggest the title of the purple area i amended to "IMPINGEMENT ON AREA RESERVED FOR CMPs". As yet I understand there is not a CMP in that corner.</p>	<p>Noted. The text will be amended accordingly.</p>
		<p><i>Figures 4.1b &amp; 4.1c</i> It is impossible to differentiate the legends.</p>	<p>Noted. The text will be clarified accordingly.</p>
		<p><i>Section 4.2.6</i> As a point of information I understand that San Tau and Sea Lo Wan have already been provided with air conditioners as mitigation measures to cater for construction noise and 24hr working on CLK.</p>	<p>Noted. The text will be amended accordingly.</p>
		<p><i>Section 6.2</i> I understand Marine Department are considering a "traffic management scheme" for Ma Wan; would this help decrease the accident risk when it is implemented?</p>	<p>Yes, this would. The Traffic Management Scheme is accounted for in this and the 1993 risk assessment Studies and compliance with its requirements by AFRF vessels is part of Marine dept's conditions included as <i>Annex E</i>.</p>
		<p><i>Section 8.5</i> I am concerned at the last 2 words "<i>wherever practical</i>". The report should have identified practical mitigation measures where there is likely to be a significant environmental impact. Those items for which there is not a practical mitigation measure should be clearly stated. From glancing through the report I could not identify those items for which practical mitigation measures had not been identified.</p>	<p>Noted, but PAA inform that the practicality of mitigation cannot always be determined until more advanced stages of a project. This was the experience of the New Airport Master Plan. The relevant text will be clarified accordingly.</p>



Department	Reference	Comments	Responses
		<p><i>Volume 2: Annexes</i>  The following are mentioned but not shown on plan:  CAD jetty at Sha Chau  Other proposed Government facilities  Lung Kwu Tan</p>	Noted. These facilities will be shown on the relevant plan.
		<p><b>Draft Executive Summary</b></p> <p><i>Section 1</i>  The whole Executive Summary comes under the single main heading INTRODUCTION. I would suggest that either 1 INTRODUCTION is deleted or it is broken down into at least 3 sections viz. INTRODUCTION, FINDINGS OF THE EIA, CONCLUSIONS.</p>	Noted. The Executive Summary will be re-ordered as suggested.
		<p><i>Section 1.1</i>  Similar comment to DRAFT FINAL REPORT.</p>	Noted.
		<p><i>Sections 1.2.2 &amp; 1.2.5</i>  Whilst information may be available in the main report the following having been mentioned as issues do not appear to receive further mention in the EXECUTIVE SUMMARY.  "Cultural", "Other Considerations", "justification for screening out the other alternatives", "an assessment of what other government departments of agencies are or are proposing to build on Sha Chau".  The EXECUTIVE SUMMARY should answer the issues raised at the start.</p>	Noted. The Executive Summary will be amended accordingly.
		<p><i>Sections 1.3.6 &amp; 1.4</i>  I would suggest that the last part of the report should be the CONCLUSIONS which should list those items that require further consideration.</p>	Agreed. The Executive Summary will be amended accordingly.
		<p><i>Section 1.4</i>  Similar to my comment on 8.5 of the DRAFT FINAL REPORT.</p>	Noted.

Department	Reference	Comments	Responses
		<p>I would appear that rather than being a summary of the main report this is just a selection of excerpts and may need revising to ensure all salient points are covered. Based on the main report the consultant appears to have carried out a comprehensive and detailed review but this is not reflected in the EXECUTIVE SUMMARY which appears to concentrate on certain issues.</p> <p>I also suggest a table is included in the EXECUTIVE SUMMARY listing each environmental issue, the proposed mitigation measures, and any relevant comment such as ease of implementation. This should be in a form and use terms that a relative layman could understand.</p>	<p>These points are noted and the Executive Summary will be amended accordingly.</p> <p>These points are noted. The Executive Summary already succinctly summarizes proposal mitigation measures and PAA note that they cannot determine ease of implementation at this early stage of the project.</p>
NTW	(49) in NTW/TM 2/0/82 dated 28 October 1994	I refer to you above referenced memo, your Consultant's letter reference C1253/L-527/CN/sh dated 19.10.94 and have no comment on the captioned EIA report.	
Plan D	PADS G/AIR/13	<p>I refer to your letter of 19 October 1994 addressed to the EPD and copied to me, among others.</p> <p>I have no major comments on the DFR and Executive summary, noting the recommended mitigation measures and need to carry out further studies into marine ecology aspect. I would however, appreciate your clarification on a point in chapter 6 of the DFR. For the areas of population on the mainland coast along Urmston Road, has the risk assessment taken into account the worker population at the Special Industries Area and River Trade Terminal in Area 38, Tuen Mun? If the answer is affirmative, this should be clearly spelt out in the relevant section on page 128. If otherwise, will this affect the conclusions of the risk assessment, and to what extent?</p> <p>This is a coordinated reply from Planning Department.</p>	The risk assessment has taken into account all current and planned developments up to 2006. This includes the SIA at Area 38 and this will be stated clearly in the report.
NAPCO	NAP/T 3/2/13(2)	Please note that NAPCO have no significant comments on the captioned topic, but reserve the right comment at the EIA Study management Group meeting on 2.11.94 on any outstanding environmental issues.	

Department	Reference	Comments	Responses
EPD	(14) in EP2/N9/19 Annex(5) dated 1 November 1994	<p><b>Water Quality</b></p> <p><i>Vol 2: Annex D Sediment Plume and Spill Modelling</i></p> <p>(1) <i>Section 1.2</i></p> <p>The consultants need to state how shear dispersion is accounted for in the model. This type of dispersion is more important than turbulent mixing process.</p>	<p>The sediment plume model uses the results from the two-layer tidal flow model. The sediment model then applies a vertical profile to the layer averaged flow results for both upper and lower layers. By this treatment of the vertical distribution of flow, shear dispersion is simulated in the sediment plume model.</p>

Department	Reference	Comments	Responses
		<p>(2) <i>Section 1.3</i></p> <p>The report gave no information on ERM spill model. Specifically,</p> <ul style="list-style-type: none"> <li>(a) detailed description of the underlying theory and assumptions for the model;</li> <li>(b) theoretical basis of buoyancy effect and how it is incorporated into the model.</li> </ul> <p>before we can assess the appropriateness and applicability of the model for this study.</p>	<p>As described, Section 6.3 examines the environmental risks and includes assessment of likely spill scenarios and their frequency of occurrence, the potential ecological impacts to marine and coastal ecology, preliminary oil spill modelling and an assessment of the means of minimising the effects of the oil spills in respect of spill clean up technology and response planning. Ultimately to determine the appropriate level of spill response capability, detailed modelling of all likely spill outcomes using dedicated oil spill trajectory modelling techniques will be required in the detailed design stage EIA. This will take several months and hence was not fully completed in this study. However, in this conceptual design stage EIA by integrating risk to life spill spreading models with tidal models already configured for Hong Kong waters, the Consultants have been able to obtain limited quantitative data on the likely spill development scenarios: The data however should be only taken as indicative and subject to more detailed evaluation during detailed design.</p> <p>The approach to the assessment of environmental risk from major aviation fuel spills has been to develop a range of spill scenarios, determine their likely frequency of occurrence and then to model the likely travel of each spill under different tidal conditions over its expected duration as a surface based environmental hazard.</p> <p>Resources for this preliminary assessment were focused on scenarios which are most significant and on providing estimates of the largest credible significant spills which could occur, thus placing an upper limit on the scale of the clean up facilities required.</p> <p>The assessment draws on, and includes, similar stages to a conventional risk to life hazard assessment i.e. hazard identification and frequency estimation; consequence analysis; and</p>

Department	Reference	Comments	Responses
			<p>movement predictions given by WAHMO computer modelling which were described in Annex D.</p> <p>The outputs of this assessment serve to provide an indication of the scale of potential impacts on the Hong Kong shoreline and the scale of the activities likely to be required to clean up spills.</p> <p>However, as described in Section 6.3, in order for a comprehensive and effective SRP to be formulated, further studies to forecast the extent of potential fuel spills during the operation of the AFRF are considered necessary and should be conducted prior to commissioning. Such studies should indicate probable spill movements under a wide range of environmental conditions and pinpoint all the corresponding areas of particular high risk to impacts from potential fuel spills. Such predictions should also be made for different seasons.</p> <p>A description of the theoretical basis of buoyancy effect and how it was incorporated into the model was described in the Annex D. Section 6.3.6 of the EIA text described further detail of the fuel spill modelling.</p>
		<p>(3) <i>Section 1.7</i></p> <p>The assumed daily dredging rate must be specified in the contract and must not be exceeded to guard against violation during construction.</p> <p>The consultants assumed an uniform sediment release rate throughout the day, ie 24 hour working pattern. This is unrealistic. The consultants must review the modelling assumptions on sediment release rates by assuming a more realistic working pattern (eg 12 hrs/day at most).</p>	<p>Noted. The assumed dredging rate is based on the presently envisaged amount of material to be dredged and the presently assumed dredging duration. The purpose of the design stage EIA will be to verify/refine the Tenders envisaged method of working.</p> <p>See above comment.</p>

Department	Reference	Comments	Responses
		<p>(4) <i>Results of sediment plume simulations</i></p> <p>Concentration against time results at the selected station shall be plotted and presented in the report.</p>	<p>Concentration against time results at the selected station were plotted and presented in the draft EIA report, Figures 4.1j and 4.1k.</p>
		<p>(5) <i>Section 1.8</i></p> <p>Section 1.8 of Annex D is missing.</p>	<p>The section entitled "Results of the Sediment Plume Simulations" was the missing and untitled Section 1.8. The EIA will be amended accordingly.</p>

Department	Reference	Comments	Responses
		<p>(6) <i>Section 1.9</i></p> <p>Which season is used for model simulation?</p> <p>The model results indicated that scenario 4 will have water quality impact over a very large area in the harbour area. The environmental consequences of the fuel release must be stated together with the emergency measures/spillage detection device to minimise/avoid this.</p> <p>The last paragraph of section 1 that this report is incomplete.</p>	<p>As described in Section 6.3.6 for the fuel spill modelling, wet and dry season spring tides were simulated. The spring tides will transport the spill further than the smaller amplitude tides and thus provide a better indication of the overall length of coastline which could be impacted by a spill.</p> <p>The environmental consequences of the fuel release together with the emergency measures/spillage detection measures to minimise/avoid spills are clearly stated in the text section of the report nineteen pages between page 151 and 170.</p> <p>Noted. There was a problem with the file transfer and the last paragraph of Annex D, Section 1.9.4 was erased. The following comprises the "missing text":</p> <p><i>Scenario 5</i></p> <p><b>Flood Release</b></p> <p>The initial release of fuel is at the seaward boundary of Area 38. The initial flood tide, after 12 hours, carries the spill along the coast to the Black Point power station and from there it extends a short distance westwards across the mouth to Deep Bay. An area of higher concentration has become separated and is spread further across the mouth to Deep Bay to the south west of the rest of the spill. After 24 hours a single mass of fuel remains which has been carried to the south of Lung Kwu Chau by the ebb tide. The subsequent ebb tide, after 36 hours, carries the remaining fuel northwards until it is positioned 5km south of Shekou. After 48 hours the spill has ebbed southwards and is now south of Lung Kwu Chau. The next flood tide, after 60 hours, carries the spill northwards again to be 8km south of Shekou. The spill is no longer present in significant concentrations after 72 hours.</p> <p>Based upon the above results it is thought unlikely that any expected spill, up to the magnitude of that for Scenario 4, will have any impact on Deep Bay beyond the entrance at the Black Point power station.</p>

Department	Reference	Comments	Responses
			<p><i>Summary</i></p> <p>The WAHMO random walk sediment plume model was used to investigate the fate of sediment plumes generated by the dredging works for the proposed fuel receiving facility at Sha Chau. Hydrodynamic data was provided by the 250m extended WAHMO tidal flow model with the airport platform in place, which gave the best representation of the tidal flow conditions for the estimated time of construction.</p> <p>The dredging for the access channel and turning circle and the pipeline trench to Chek Lap Kok were simulated using wet and dry season spring tides. The modelling showed that a plume with concentrations of 1-5ppm in the surface layer would be generated covering a large area of the waters to the north and west of the Lantau coast. Within the surface plume there were small isolated areas with concentrations in the range 5-10ppm. In the bed layer there were small regions of high suspended sediment concentration, greater than 15ppm, which were due to erosion of the recently deposited bed material. These regions were along the southern edge of the Urmston Road and off the north Lantau coast to the west of Chek Lap Kok. The majority of the bed deposits were in the range of 0.01-0.10 kg/m<sup>2</sup>. Regions of higher bed deposits were present in the areas corresponding to high suspended sediment concentrations in the bed layer showing that the sediments were settling out and then being eroded.</p> <p>The WAHMO sediment plume model was further developed to be able to simulate the behaviour of fuel spills associated with the proposed fuel receiving facility at Sha Chau, although the process of buoyant spreading well after the release was not simulated. Hydrodynamic data was provided by the 250m extended WAHMO tidal flow model with all reclamations in place to the year 2003, which gave the best representation of the tidal flow conditions during the operational life of the fuel facility.</p> <p>Six different scenarios were simulated with four spills in the vicinity of the fuel facility and Chek Lap Kok, one spill north east of the Brothers and one adjacent to the Area 38 reclamation. Release on the ebb and flood phases of the tide were simulated for the four spills in the proximity of the fuel facility. The release</p>



Department	Reference	Comments	Responses
			<p>near the Brothers was simulated for an ebb release and the one at Area 38 for a flood release.</p> <p>The simulation of the spills in the vicinity of the fuel facility showed that fuel would travel over the area to the north of Lung Kwu Chau and to beyond the southern tip of Lantau with the ebb and flood of the tide over the 3 tidal cycle simulation period. After 72 hours the fuel was no longer present in significant concentrations. The release to the north of the Brothers quickly travelled through Kap Shui Mun to cover a large area of the Western Harbour where it generally remained throughout the simulation. The spill at Area 38 was carried along the coast to the mouth of Deep Bay but was subsequently transported to the south west away from Deep Bay and was not shown to enter the bay throughout the 3 tidal cycles.</p>
		<p><b>Environmental risk</b></p> <p>(1) <i>Section 6.3.3, Line 8, p.143</i></p> <p>"spilt" should reads "spills";</p>	<p>Noted.</p>
		<p>(2) <i>Section 6.3.3, Last Line, p.143</i></p> <p>"threading" should read "threatening";</p>	<p>Noted.</p>
		<p>(3) <i>Section 6.3.3, Line 18, P.144</i></p> <p>The Consultants should amend "the frequency of ..." to "the frequency and size of".</p>	<p>Agreed, the report will be amended accordingly.</p>
		<p>(4) <i>Section 6.3.3, Line 19–22, p.144</i></p> <p>The Consultants should amend "Table 6.3a shows .... specific Scenario. "to" Table 6.3a shows the estimated frequency and size of spills across the whole transport operation and Table 6.3b shows the frequency and size of unignited releases for each location specific Scenario.";</p>	<p>Agreed, the report will be amended accordingly.</p>

Department	Reference	Comments	Responses
		<p>(5) <i>Section 6.3.3, Line 24, p.144</i></p> <p>The Consultants should amend "750" to "760";</p>	<p>Agreed, the report will be amended accordingly.</p>
		<p>(6) <i>Section 6.3.3, Line 26, p.144</i></p> <p>The Consultants should amend "5.4E-3/yr (one chance in 1850) per year" to "5.17E-4/yr (one chance in 1930 per year)";</p>	<p>Agreed, the text and table will be amended accordingly.</p>

Department	Reference	Comments	Responses
		<p>(7) Section 6.3.3, Last para, p.144</p> <p>Based on the historical data of Wu and Tupper, the frequency of aviation fuel spill is only 1 in 20 years as compared with the frequency of 1 of 760 years as suggested by the Consultant. Thus the theoretical frequency of oil spill is about 27.5 times higher than that of historical data. The Consultant should provide a detailed explanation on this anomaly between historical and theoretical calculation.</p>	<p>There are several reasons for this anomaly including:</p> <ul style="list-style-type: none"> <li>• The study assumes vessels of 5,000 dwt with double hulls and this was estimated to reduce the likelihood of a spill following a grounding or collision by a factor of three in the 1993 Study. Wu and Tupper's data indicates that 10 out of the 12 major spills (from vessels) were due to these mechanisms.</li> <li>• This study is looking at shipping only through the Ma Wan Channel and up Urmston Road and not in HK harbour as a whole. It is assumed in the study that MD's vessel traffic management system would be in operation. This was estimated to reduce the likelihood of incidents by a factor of 2 in the 1993 study.</li> <li>• The AFRF would receive no more than about 1000 loaded vessels per year. This should be seen in the context of a total of the over 120,000 vessels (1987 data) that visit HK harbour every year (a factor of 120). Wu and Tupper's data indicate that 6 of the major spills were from ships' fuel tanks not from DG vessels.</li> </ul> <p>Note also the report indicated only one of the spills was of aviation fuel. This was incorrect and should have read a two aviation fuel spills – see Attachment 5 attached. However you will note from the discussion above that the theoretical figures derived by the consultants are likely to err on the conservative side – vis 2 aviation fuel spills in 20 years gives a frequency of 1E-1 this can then be factored down by roughly 3, 2 and 120/2 for the factors given above to yield a frequency of 2.7E-4 or once in every 3,600 years for the AFRF.</p> <p>Finally the historical data was included to emphasise that whilst the likelihood of a major spill was remote, there was precedent for such spills occurring and as such a robust and comprehensive spill response plan would be required.</p>

Department	Reference	Comments	Responses
		(8) <i>Table 6.3a, Line 33, p.145</i> "above waterline" should read "below waterline";	Agreed, the report will be amended accordingly.
		(9) <i>Table 6.3a, Last line, p.145</i> "7.92E-4" should read "1.31E-3";	Agreed, the report will be amended accordingly.
		(10) <i>Table 6.3b, Line 8</i> "1.40 x 10-5 & 71,500 " should read "8.4 x 10-6 & 119,000";	Agreed, the report will be amended accordingly.
		(11) <i>Table 6.3b, Line 9</i> "2.45 x 10-5 & 41,000" should read "2.73 x 10-5 & 37,000";	Agreed, the report will be amended accordingly.
		(12) <i>Table 6.3c, Line 2</i> "Volume Spilt" should reads "spill Volume".	Agreed, the report will be amended accordingly.

Department	Reference	Comments	Responses
AFD	AF DVL 01/103 V dated 4 November 1994	<p>2. <i>Your response to our Specific Comments (4):</i></p> <p>Please note that this department was informed by the DRT that the most recent land-based sightings of dolphins were recorded in area C and E (Figure attached), which contradict the conclusions of the Stage 1 Report. As such, conclusions of the Stage 1 Report can no longer be established, and hence it is not possible to use its analysis and conclusions in the Stage 2 Report.</p>	<p>Please note that conclusions of the Site Selection Study (Annex C of the EIA) which you refer to clearly stated that "Surveys conducted over longer periods may indicate that <i>Sousa</i> exhibits other patters of habitat usage under different seasonal and other conditions."</p> <p>We note, from <i>Attachment 3</i>, that the 65 minutes of sightings were observed from over 4 km from Sha Chau and that sightings were taken at a time after the construction of the CAD jetty at Sha Chau was underway and thus are unlikely to reflect an unimpacted site condition. Please also note that AFRF construction and the CAD jetty construction programmes are not programmed as simultaneous and the CAD jetty will have been completed prior to the commencement of the AFRF construction. We would also be interested to learn if these were the only dolphins sighted by DWT at this location since the PAA sighting survey (finished in early July 1994) as this comprises a time period of approx 2688 hours (between July and November 1994). We would be grateful to receive at AFDs earliest convenience DWT sightings data to date.</p>
		<p>3. <i>Your response to our Specific Comments (7):</i></p> <p>DRT has not yet been granted PRC permission to conduct dolphin survey works in Pearl River Delta.</p>	<p>This information was provided by the DWT (pers comm) and its erroneusness is noted.</p>

Department	Reference	Comments	Responses
		<p>4. <i>Your response to our Specific Comments (18, ii):</i></p> <p>Please note that our comments stated that these are DRT's proposal rather than being a tentative interim AFD proposal. At the present stage, AFD requires more details of the proposal from DRT for further consideration.</p>	<p>PAA note that location for the "dolphin sanctuary" was <b>not</b> initially proposed by the AFDs DRT but by Mr Stu Pryke, then of the Marine Conservation Society of Hong Kong. PAA also note that these initial proposals did <b>not</b> recommend the Sha Chau/Lung Kwu Chau environs but instead recommended a location on the south side of Lantau.</p>
Marine Dept	(5) in PA/S909/21/4(4) dated 1 November 1994	<p><i>Para 2.2.2 and 2.2.3</i></p> <p>Mention should be made about the effects of tidal stream as a factor taken into account in the Area Selection criteria. Reference is made in Table 2.2a to currents without defining what this includes.</p>	<p>PAA inform that around the borrow pit areas, currents rotate with ebb and flow such that it is impossible to align a berth with the current. On Page 8, 5th bullet point, this criterion is included under technical feasibility.</p>
		<p><i>Para 2.2.3</i></p> <p>It should be noted that during extreme weather conditions there can be no guarantee that a large vessel will not be within 3 miles of the Terminal Doppler Weather Radar (TDWR).</p>	<p>This, PAA assume, is a misunderstanding. RO does not require a guarantee for a large vessel <u>not</u> to be within 3 nautical miles of TDWR. It prefers that a large vessel does not berth within a rectangle made of 3 nautical miles to the east and west of the ends of the runway and 0.5 nautical mile to the north of the centreline of the runway. (See attached diagram from Ambidji, Attachment 4).</p>
		<p><i>Para 3.2.2</i></p> <p>The berths should be aligned in a NE/SW direction to allow berthing head to wind in the prevailing winds in winter and summer.</p>	<p>The alignment as shown in EIA is based on PAA's conceptual design studies. PAA inform that during detailed design stage, the design consultant would investigate aligning the berth in NE/SW direction taking other constraints into account.</p> <p>ERM note that the risk aspects associated with the alignment selected in the detailed design will be addressed in the Detailed Design Basis – Risk Assessment (DDB-QRA).</p>

Department	Reference	Comments	Responses												
		<p><i>Figure 3.29</i></p> <p>Berthing is only provided on one side of the dolphins with no explanation as to why this is the best and safest arrangements.</p>	<p>Similarly, PAA inform that during detailed design stage, the consultant would investigate berthing on two sides of the dolphin(s).</p>												
		<p><i>Table 3.3a</i></p> <p>The channel widths are insufficient, the International Association of Ports and Harbours (IAPH) recommend that channels should be 5 times the breadth of the vessels using it. The channel will have to be marked with aids to navigation and additional aids may be required to mark the two islets (rock outcrops).</p> <p>The turning circle appears very restricted for the size of vessel envisaged. What standards have been used?</p> <p>The depths of water envisaged do not seem practical bearing in mind it is the intention not to use tugs to assist in berthing and unberthing.</p>	<p>The turning circle is not restrictive. PAA has discussed this with Marine Department frequently. The turning circle is based on up to 3 times the maximum ship length. The standard referred to was BS 6349.</p> <p>* Table 3.3a had errors and will be amended as follows:</p> <table border="1"> <thead> <tr> <th>Barge Size (dwt)</th> <th>3,000</th> <th>5,000</th> <th>10,000</th> </tr> </thead> <tbody> <tr> <td>Required depth (m)</td> <td>9</td> <td>9.5</td> <td>11</td> </tr> <tr> <td>Channel width (m)</td> <td>65</td> <td>75</td> <td>100</td> </tr> </tbody> </table> <p>* In line with this, "...10 or..." will be deleted under 3.4.1 on page 17.</p> <p>ERM can confirm that the EIA was based on a channel width of 100m and that the table is in error. It will be corrected.</p>	Barge Size (dwt)	3,000	5,000	10,000	Required depth (m)	9	9.5	11	Channel width (m)	65	75	100
Barge Size (dwt)	3,000	5,000	10,000												
Required depth (m)	9	9.5	11												
Channel width (m)	65	75	100												
		<p><i>Paras 3.3, 3.72, 6/25 and Annex E</i></p> <p>The criteria for the Oil Fuel Tankers/Barges is incorrect. Please see updated versions attached.</p>	<p>The updated criteria will be incorporated into the report.</p>												
		<p><i>Para 3.4.3</i></p> <p>The depth of the pipeline should be at least 3 metres below the seabed so as to allow CEPW to dredge if necessary and to provide a tolerance in addition to the dropping or dragging of ships anchors in the vicinity. CEPW should be consulted.</p>	<p>Noted the text will be amended and CEPW will be consulted as to the required depth during detailed design.</p>												
		<p><i>Para 6.2.7 pages 135 &amp; 138</i></p> <p>Risk for more frequent movements of 10,000 dwt tankers/barges needs to be addressed.</p>	<p>The DDB-QRA will quantify the risks associated with the likely worst case (in respect of risk) supply scenario including that from 10,000 te tankers.</p>												

Department	Reference	Comments	Responses
		<p><i>Para 6.3.1 page 141</i></p> <p>The cumulative effects of oil fuel barging from Tsing Yi to Wong Tien (Shenzhen Airport and Pearl River delta destinations currently transiting Ma Wan has not been taken into account nor the possibility that this will rapidly grow.</p>	<p>Noted. Your point will be noted in the text and the DDB-QRA will account for this activity. Note also that based on information supplied by MD during the 1993 study almost 1,700 PRC DG vessels are estimated to be passing through the Ma Wan Channel in 2006 (See response 8 to EPD comments on page 9 of responses to comments on the AFRF).</p>
		<p><i>Para 7.6 page 177</i></p> <p>The speed monitoring requirement mentioned needs explaining.</p>	<p>As discussed in the meeting vessel tracking systems could be used to monitor compliance with these recommendations. These will be investigated in detail in the DDB-QRA.</p>
		<p><b>General</b></p> <p>(i) No mention or recognition is given in the report to oil fuel barging from other sources such as Guishan which is a possibility some consortiums interested in fuel delivery are exploring.</p>	<p>The report clearly states that there will be dedicated fuel vessels from Tsing Yi and non-dedicated vessels from other sources. This is based on current depots at Tsing Yi. PAA does not yet have any assurance that Guishan or other places in Pearl River Delta will develop aviation fuel depots and would capture some of the market share to deliver fuel to Sha Chau. In the event this happens, there will clearly be a reduction in deliveries from Tsing Yi.</p>
		<p>(ii) Pre and post sounding surveys should be carried out of the whole area under consideration.</p>	<p>A site investigation around Sha Chau hydrographic and geophysical surveys was carried out in May 1994. Further surveys and soundings of the whole area will be carried out during design and construction periods.</p>
		<p>(iii) Fire Services Department should be consulted.</p>	<p>Noted FSD will be consulted as to fire fighting requirements during detailed design.</p>
		<p>(iv) Marine Department's General Conditions for dredging and backfilling will have to be complied with (copies attached).</p>	<p>Noted, these will be added to Annex E</p>
		<p>(v) I suggest for easy reference the report sub-paragraphs are numbered.</p>	<p>Noted, but unfortunately ERM's software macro's do not facilitate this without considerable effort that is unlikely to be possible in the short time available to finalise the report.</p>



Department	Reference	Comments	Responses
Marine Dept	(11) in PA/S909/21/4(4) dated 5 November 1994	<p>Thank you for responding to my comments so promptly. In general I agree with the responses subject to definition on precise details.</p> <p>As I said at the meeting I give my endorsement tot the report subject to responses from our Pollution Control Unit which will be writing direct as soon as possible. If you require further details on this process please contact Mr M J Wareham Senior Marine Officer Port Operation Tel No 852-4454.</p>	Noted.
EPD	() in EP2/N9/19 Annex(5)	<p>I refer to your written comments tabled at the 2nd EW6 meeting on 2 November. Our comments are as follows:</p> <p><b>Water Quality</b></p> <p>(1) The major concerns are water quality impacts due to dredging and accidental oil spill during construction and operation of the facility.</p>	Noted.
		<p>(2) As far as dredging is concerned, I cannot agree with the evaluation and findings of the consultants on pgs 49 and 59 that no exceedance of WQO is expected to result from the dredging activities even assuming a highly conservative worst-case scenario and that jet/ploughing is the preferred method of pipeline installation. My arguments against these are summarised as follows:-</p>	Noted.
		<p>a) Prediction of the fate and extent of sediment lost to suspension during dredging is carried out by assumes the use of grab dredgers working at a total rate of approx. 8,000 cum/day with a resulting loss of 5% of dredged sediment to the water column. The time history plots show that maximum predicted increase in suspended solid is a peak of 13ppm above ambient levels at South Sha Chau. On the basis that the ambient level would range up to 100mg/l as claimed by the consultants, it is concluded by the consultants that the increase above ambient levels are minimal.</p>	Noted. The text has be revised in accordance with the EPD comments re: the relevant baseline SS concentration in the vicinity of the proposed AFRF location.

Department	Reference	Comments	Responses
		<p>b) It is however doubtful that the assumptions used are those for the worst case scenario. Based on the consultants' proposed programme it is anticipated that the dredging programme will be for a period of approximately 2-3 months and the dredging requirements for construction of the turning basin and the twin pipeline are estimated to be 500,000 cum each, giving a total dredged mud quantity in the order of 1M cum. Assuming that dredging is carried out continuously throughout a 3-month period, the daily dredging rate will be 11,000 cum/day which is greatly in excess of that assumed in the modelling. Besides, it may be too optimistic to assume dredging on a round-the clock basis and a 16hr/day or 12hr/day dredging time is a more realistic assumption. It is also necessary to confirm that the estimation of the quantity of dredged mud has taken into consideration Marine Department's requirements and is conservative enough to cover any variations of the design requirements of the pipeline, which according to the consultants, may need to be adjusted as a result of the findings of the sedimentation study presently being undertaken. Overall, it cannot be concluded at this stage a highly conservative worst-case scenario has been assumed in the modelling. Depending on the variations of these assumption, the suspended solid rise could be greater than that predicted by the model.</p>	<p>The assumed dredging rate is based on the presently envisaged amount of material to be dredged and the presently assumed dredging duration. The purpose of the design stage EIA will be to verify/refine the Tenderers envisaged method of working.</p>

Department	Reference	Comments	Responses
		<p>c) It is not considered appropriate and acceptable to use the upper range measurement recorded at the periphery of the contaminated mud pits as the upper limit of the ambient level nor is it understood why the lower and average ambient levels have been ignored in the evaluation of the dredging impacts. The high readings recorded at CMPs could be the result of dredging and dumping activities at CMPs and the PAA working area and should not be based on. Measurements carried out at the EPD stations at NM6, NM3 and NM5 during the period 1993-94 all give similar average values with magnitude in the order of 20 mg/l. The lower angle value is as low as 7 mg/l. Although NM6 records a maximum of 75 mg/l, a closer examination of the raw data reveals that it is an odd event which should be discarded. All other measurements at this station during the period are below 25 mg/l and are in close agreement with those recorded at stations NM3 and NM5. The fact that coral community exists in the area also indicates that high and persistent SS ambient level in the area is unlikely. On the basis of the foregoing, it can hardly be agreed that evaluation should be based on an upper range ambient level of 100 mg/l and that no exceedance of WQO will result from dredging.</p>	<p>The Consultants were not cognizant of the "odd event" which EPD consider it appropriate to disregard but have noted that this value is erroneous and should be disregarded in the text. The Consultants will review their results on the basis of the results from stations NM3 and NM5 and will not use the upper range measurement recorded at the periphery of the CMPs, as directed by EPD; although we should note that this station is located to provide a control station for the CMP monitoring and thus as such should not be impacted by the CMP works. The baseline average values against which the impacts will be evaluated will be a SS concentration of about 20mg/l as stated by EPD in their comment. On this basis the impact compliance with the WQOs will be appraised.</p>
		<p>d) The cumulative effect of the dredging and dumping activities has not been considered. As pointed out in my previous comment, under some conditions, the sediment plume can encroach upon the contaminated mud pits, inversely, it can be anticipated that the dredging site could be affected by dumping at the CMPs. It is therefore necessary to confine the sediment plume within the close vicinity of the site by suitable measures eg silt curtain.</p>	<p>Noted. See previous response to EPD's previous comment on the application of silt curtains which will be further evaluated in the detailed design stage EIA. In addition, cumulative impacts will be further evaluated in the detailed design stage EIA.</p>

Department	Reference	Comments	Responses
		<p>e) Jet/ploughing techniques are recommended by the consultants for installation of the twin pipeline and cable. The advantages claimed by the consultants as opposed to grab dredging method are: shorter construction period, no requirement for mud disposal, more localised sediment resuspension close to the seabed, less disturbance to seabed and narrower trench widths. However, these advantages are more apparent than real if one examines these techniques more closely.</p>	<p>Noted. As described in the Environmental Management Group the Consultants will review their text based on EPD's comments and will state that EPD's preferred method of dredging would be the closed grab method, although the report will be revised to state that the final dredging method may be different from this eg: jet/ploughed etc although any such variation from closed grab methods would require determination to prove that the impacts would not lead unacceptable water quality impacts during the detailed design and reported in the detailed design basis EIA (DDB-EIA) prior to construction.</p>

Department	Reference	Comments	Responses
		<p>f) Jet/ploughing systems form trenches essentially by mud displacement. The effect is to put most of the dredged sediment into suspension. While the suspended sediment will eventually settle out on the seabed, because of its unconsolidated state, it can be easily eroded and re-suspended into the water column. The result is a persistent density flux at the lower layer of the water column and its effect is detrimental to the benthic communities, in particular corals which, to my surprise, are found in abundance in the area. It is also not true to say that mud disposal is not required as dredged mud is disposed of alongside the trench in-situ, the impacts of in-situ disposal of the mud in such a sensitive area is more harmful than disposing of the mud in designated mud disposal grounds. While the area of the trenches would be reduced because of the narrower trenches required, this does not follow that the disturbance of seabed would be less as the displaced mud would affect a large seabed area probably even greater than the trenches required by pretrenching technique. A shorter impact duration with greater intensity of the impact in terms of SS is not an advantage as I am more concerned about the increase of SS over the ambient level than the duration of the construction period which by any scale is short anyway. It appears therefor that the only advantage of the jet/ploughing is the less requirement for dredging but since at least three trenches have to be formed for the twin pipeline and cable if jet/ploughing is used, its advantage over the pretrenching method is, in my view, very minimal. Overall, jet/ploughing is not to be preferred. Besides, the impacts of grab dredging can be further minimised by measures such as restricting the lifting speed and the enclosure by silt curtains, which cannot be achieved by jet/ploughing system. As a conclusion, grab dredging with totally enclosed clamshell is the preferred dredging method and should be adopted.</p>	<p>Noted. As described in the Environmental Management Group the Consultants will review their text based on EPD's comments and will state that EPD's preferred method of dredging would be the closed grab method, although the report will be revised to state that the final dredging method may be different from this eg: jet/ploughed etc although any such variation from closed grab methods would require determination to prove that the impacts would not lead unacceptable water quality impacts during the detailed design and reported in the detailed design basis EIA (DDB-EIA) prior to construction.</p>

Department	Reference	Comments	Responses
		<p>g) To summarise, while it can be concluded that a wide spread and significant rise in suspended solid resulting from construction of the facility alone is unlikely, localised impacts in exceedance of WQO could be anticipated in areas at and close to the dredging sites. In view of the numerous sensitive receivers in the Sha Chau area which is also an important siting for the Sousa, it is necessary to implement all practicable measures to minimise the impacts. For this reason, grab dredging with totally enclosed clamshell is the preferred method and silt curtains should be employed as far as possible to contain the solid dispersion. As recommended by the consultants, additional baseline survey should be carried out to identify all the benthic communities in the area, to ensure that they will not be impacted by dredging and to avoid using these areas as work site. With regard to jet/ploughing system, it is not preferred for the above stated reasons. Due to the different SS release mechanism, it is also not considered that the model results can be used for evaluation of the impact due to this system. However, if the consultants take a contrary view and intend to pursue this option further, they must provide us with sufficient information and assessment, and possibly with field trial results, to demonstrate its environmental acceptability to my satisfaction before acceptance can be granted. As a related issue, I would also like to point out that the tolerable level of a seawater intake for cooling water system can be much lower than 150 mg/l, though in this particular case the impact of dredging on the power station cooling water intake is minimal. I suggest the consultants to delete the reference to 150 mg/l as the tolerance limit.</p>	<p>Noted. See above response.</p>

Department	Reference	Comments	Responses
		<p>(3) The other major concern is water quality impact due to accidental oil spill. The accidental frequency analysis concludes that the chance of any major spill is about once in 750 year. Thus the chance is quite remote. However, based on the historical data, the consultants suggest that in the operational life of the facility a total of five major releases might be expected anywhere in Hong Kong and that one major release might be expected anywhere in Hong Kong and that one major release in the lifetime of the facility might occur. This risk is much higher than that predicted by frequency analysis and gives rise to concern. The consultants use model to simulate the transport and dispersion of the fuel spills and evaluate the degree of ecological impact resulting from the spill. However, the impact of the spill on the water quality is not evaluated. It is necessary for the consultants to evaluate the extent of the waterbodies that will be effected, and the effects of the spill and the use of spill treatment agents on the water quality and sediment. The consultants should quantify these impacts and advise that mitigation measures can be provided and how effective they are, and conclude whether or not the overall water quality impact is acceptable.</p>	<p>The report will be expanded to include consideration of generic fuel spill impacts on water quality, although detailed description will be included only in the detailed design stage EIA.</p>
		<p>(4) The following are other comments that I need the consultants to consider:-</p> <p>a) The "zero discharge" strategy during the construction and operation of the facility is appreciated and strongly supported. However, it is not easy to achieve zero discharge in practice and full consideration must be given during the detailed design stage. EPD should be consulted. This must form one of the conditions for giving approval to the project.</p>	<p>Agreed. This will be addressed in the DDB-EIA.</p>
		<p>b) There is no evaluation of the water quality impact arising from piling activities. This should be addressed by the consultants and included in the report.</p>	<p>The potential impacts from the proposed in-situ bored piling will be generically described in the EIA although this will only be addressed in the subsequent DDB-EIA.</p>

Department	Reference	Comments	Responses
		c) Mitigation measures proposed should include the use of silt curtain, reducing the dredging rate and temporary suspension of dredging work in the event of exceedance of TAT levels.	Noted. The engineering feasibility of all mitigation measures will be required of the detailed design stage and the results of the feasibility analysis these will be reported in the detailed design EIA.
		d) Further evaluation and analysis of the dredging and reclamation impacts will be required at the detailed design stage. Sediment and elutriate tests will be needed to quantify the potential release of pollutants during these construction activities.	Noted, although no reclamation is proposed.
		e) Since every project has its specific concerns and problems, it may not be appropriate to incorporate the facility into the on-going monitoring programme and therefore I have reservation on the overall monitoring and audit proposal. However, it is not intended to go into great details of the monitoring and auditing requirements at this stage. Detailed monitoring and auditing manual will need to be submitted for EPD's consideration during the detailed design stage.	Noted.
		f) The overall conclusions in Section 8 do not address the water quality impacts and whether mitigation measures can be implemented to minimise these impacts to an acceptable level. Clarification on the lack of the overall recommendation is sought from the consultants.	The conclusions will be amended based on all EPD's foregoing comments.
		g) The consultants' modelling experts should liaise with our modelling section on the information and clarification with respect to the ERM spill model and the sediment plume model. Our comments have been forwarded to you on 1.11.94.	Agreed.



Department	Reference	Comments	Responses
		<p><b>Risk Assessment (Responses to Overall Comment (p.7))</b></p> <p>(1) The consultants have only briefly described the history of PAA's long-term pipeline options and has not answered the question. The consultants should provide information of the pipeline programme (ie timing of decisions, engineering design, details of the construction &amp; commissioning of AFRF) to justify the 5-7 years operation of the AFRF.</p>	<p>The Consultants Scope of Work in this study only covers decisions on the AFRF from the time that PAA, in consultation with government departments had already narrowed down the options to two i.e. Areas 1 and 10 shown on Figure 2.2a of the Report.</p> <p>The PAA has proposed temporary method for providing fuel to the new airport via barging from Tsing Yi through the Ma Wan Channel for a period not expected to exceed 5-7 years. During this time the Authority has stated its commitment to work with Government and commercial interests to implement a permanent pipeline fuel supply system. The Authority's proposal was based on the findings of the PAA commissioned 1993 study on options for marine transport of aviation fuel through the Ma Wan Channel (The 1993 Study).</p> <p>The 1993 Study determined that technically feasible and cost effective alternatives (ie pipelines) to the permanent barging of fuel through the Ma Wan Channel were preferable and should be pursued by the Authority. In this regard preliminary cost estimates demonstrated the pipeline option from Tsing Yi to be a cost effective alternative to permanent barging. Given the existence of this practicable alternative to permanent barging, it was concluded that permanent marine transport through the Ma Wan Channel is not ALARP and it is therefore not acceptable in the context of Hong Kong Risk Guidelines. Only if alternative options were later found not to be feasible, was it recommended that permanent marine transport methods through the Ma Wan Channel be reconsidered.</p> <p>However, the study also noted that temporary barging was not unacceptable while a permanent alternative transport method (ie pipeline) was developed. This finding was based on the fact that in the early years of airport operation, fuel demand would be low and risks from other potentially hazardous cargoes would not have arisen since the facilities they serve will not have been constructed, eg at Tuen Mun Port.</p>

Department	Reference	Comments	Responses																
			<p>PAA have provided the explanations as to the earlier decisions made in consultation with Government, on policy as well as technical grounds, which conclude that a permanent pipeline cannot <i>now</i> be in place for airport opening.</p>																
		<p>To comply with the ALARP principle, it is necessary to show:</p> <p>(a) It is not practicable to construct a pipeline by airport opening date (ie the AFRF is needed); and</p>	<p>The programme for construction of a permanent pipeline has been supplied by PAA as follows:</p> <table border="0"> <thead> <tr> <th><i>Activity</i></th> <th><i>Duration (Months)</i></th> </tr> </thead> <tbody> <tr> <td>· Gazettal</td> <td>9</td> </tr> <tr> <td>· EIA</td> <td>(9) - in parallel with Gazettal</td> </tr> <tr> <td>· Licence</td> <td>(9) - in parallel with Gazettal</td> </tr> <tr> <td>· Design/Tender</td> <td>12</td> </tr> <tr> <td>· Construction of Pipeline</td> <td>32</td> </tr> <tr> <td>· Testing, Commissioning &amp; Trials</td> <td>6</td> </tr> <tr> <td><b>Total time required</b></td> <td><b>59 (4.9 years)</b></td> </tr> </tbody> </table> <p>Even if a go-ahead were given immediately PAA could not have a pipeline in place until late 1999 or 2000. Given the above, and that other issues still need to be resolved prior to a go-ahead, it was concluded that an interim facility was required. (Note that planning of Gas Supply and Water Supply Pipelines to CLK commenced in 1990 in order for them to be complete for the envisaged airport opening in 1997.)</p>	<i>Activity</i>	<i>Duration (Months)</i>	· Gazettal	9	· EIA	(9) - in parallel with Gazettal	· Licence	(9) - in parallel with Gazettal	· Design/Tender	12	· Construction of Pipeline	32	· Testing, Commissioning & Trials	6	<b>Total time required</b>	<b>59 (4.9 years)</b>
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Department	Reference	Comments	Responses
		<p>(b) The pipeline will be constructed as soon as is reasonable practicable (ie pipeline ASARP = risk ALARP).</p>	<p>EPD are also referred to the minutes of the ACE meeting on 12 September 1994 where PAA provided further explanation of the required 5 - 7 year operation (para 26) where it was pointed out that further time was needed in order that fuel demand would increase to a level that an operator would wish to build a permanent pipeline. PAA have repeatably indicated that the maximum extent of this period would be 5 - 7 years, but that they will work closely with government and private sector parties to ensure that the permanent facility is brought on-line as soon as reasonably practical (ASARP) after airport opening.</p> <p>Compliance with the ALARP principle centres on the definition of 'reasonably practical'. It is acknowledged by the Consultants that this definition is usually expressed in terms of the technical feasibility and costs of a mitigation measure, in this case the permanent pipeline, versus its benefits on risk grounds. Since there are a wide range of reasons, some of which are technical, which lead PAA and the Government to the conclusion that a permanent pipeline might not be able to be constructed for up to 5 - 7 years after airport opening the AFRF is not strictly ALARP. However, clearly if these reasons are 'insurmountable' - i.e. there is no viable alternative - then the construction of a permanent pipeline is not a 'practical' mitigation option at this time.</p> <p>The report will be amended to reflect this situation <i>vis</i> ALARP and of the other comments made on risk grounds.</p>

Department	Reference	Comments	Responses
EPD		<p>I refer to your draft meeting minutes and have the following comments/amendments.</p> <p>On water quality issues, I pointed out that most of our concerns were not serious and could be resolved with the consultants through discussions outside this meeting. There were, however, two major issues which I needed to raise and require the consultants to respond and clarify in this meeting.</p> <p>The first issue was related to the use of jet/ploughing technique on which the draft minutes has recorded the discussions and my view adequately. The second issue was about the impacts of oil spill on the water column and sediment on the seabed. What I pointed out was that while the consultants had modelled the transport and fate of the oil spill and evaluated its impact on the ecosystem, there was no evaluation on the impacts of the spilled oil on the water and sediment quality. The consultants should address the effects of the oil spill and the use of treatment chemicals, and confirm the environmental acceptability of their impacts on water column and seabed sediment.</p> <p>For details, please refer to the comments on the above two major issues and other aspects of the report faxed to you on 4.11.94.</p>	Noted. See responses to EPD's faxed comments dated 4 November 1994.
AFD	<p>( ) in AF DVL 01/103V dated 9 November 1994</p>	<p>I refer to you facsimile message on 8 November 1994 and your response to our comments. Please note that the idea of "dolphin sanctuary" was first proposed by Mr Stu Pryke and the location is on the south side of Lantau. The DRT's proposal is different and more recent which, based on information gathered from their surveys so far, favours a "dolphin sanctuary" near Lung Kwu Chau and Sha Chau. At the present stage, AFD requires more details of the proposal from DRT for the further consideration.</p>	Noted.

Department	Reference	Comments	Responses
EPD	Fax from K F Tang, EPD WWSG dated 9 November 1994	<p>Re: ERM responses to EPD's comments ( ) in EP2/N9/19 Annex 5 on Water Quality (1) - (4)</p> <p>In your responses, all our captioned comments have been noted or agreed, and most of the issues will be further addressed in accordance with our advice in the detailed design EIA. Provided that all your undertakings in the responses will be reported in the coming EIA Reports, we have no further comments to offer.</p>	Noted.
AFD	Fax from C C Lay dated 11 November 1994	<p>(1) <i>Section 2.4.4 "Conclusion and Recommendations" and last paragraph on page 90 under "Marine Mammals"</i></p> <p>Please re-write comments with regard to the selection of preferred sites for the location of the AFRF in accordance with my previous comments made in my letter dated 28.10.94.</p>	Where appropriate, and as indicated in our responses to your comments, ERM have revised the AFRF EIA text. In this regard you will also note our responses to your comments in your letter dated 28 October Nos. 3, 4, 19 and our response to your comment No. 2 of your letter dated 4 November.

Department	Reference	Comments	Responses
		<p>(2) <i>Section 2.4 "Site Selection at Sha Chau"</i></p> <p>It was previously suggested to locate the AFRF at a distance of 1 km offshore at Sha Chau to reduce disturbance to the dolphins and their habitat. Please elaborate and address the feasibility of this suggestion as a mitigation measures.</p>	<p>PAA respond AFD have suggested that the AFRF should be located at a distance of 1 km offshore Sha Chau in the current location Site C proposed in EIA. The feasibility of this mitigation measure has been examined with the following results:</p> <ol style="list-style-type: none"> <li>1. The gazetted area for marine borrow and dumping East at Sha Chau. The AFRF cannot be located in this area and the interaction of marine plant undertaking dredging or dumping operations with aviation fuel vessels whilst manoeuvring close by is not desirable.</li> <li>2. The safety of personnel is compromised when the protection afforded by proximity to an island is removed, in two ways: <ul style="list-style-type: none"> <li>- The risk of collision by other marine traffic is increased (The Marine Department have indicated a strong preference for this AFRF to be close to land for this reason.)</li> <li>- The possibility of providing emergency evacuation to land is eliminated. Such an evacuation method is desirable to cover incidents in which evacuation by other means is impossible or dangerous.</li> </ul> </li> <li>3. It would be very difficult to orientate the jetty such that the following constraints can be met simultaneously: <ul style="list-style-type: none"> <li>- Orientation to the prevailing current direction</li> <li>- Orientation to point towards the CAD radar on Lung Kwu Chau</li> <li>- Avoidance of Fung Shui issues.</li> </ul> </li> </ol>
		<p>(3) <i>Last paragraph of Section 4.4 (p.102)</i></p> <p>Please clarify if PAA is prepared to undertake practical and cost-effective mitigation measures identified for minimising impacts on the Chinese White Dolphins.</p>	<p>PAA has stated both in writing and in meetings that it is committed to implementing practical mitigations to reduce impacts to Chinese White Dolphins. If during the course of their work the AFD-DRT develop mitigation proposals the Authority will consider them and, the authority will commit to implementing these measures if practical.</p>

Department	Reference	Comments	Responses
		<p>(4) <i>Section 7.5 "Construction Stage Impact Monitoring"</i></p> <p>It is agreeable then an intensive pre-construction intensive survey is necessary to provide a baseline population estimate. However, a continuous monitoring programme of land and boat surveys conducted on a fortnightly basis could better monitor changes in dolphin abundance than an intensive survey being conducted during the first month of the construction.</p> <p>The 10% response level is only tentative and should only be determined when the dolphin monitoring program is finalised in the detailed design phase of the AFRF.</p> <p>Radio-tagging of individual dolphins should be considered in the monitoring program.</p> <p>The importance of helicopter survey to determine dolphin population estimate should be highlighted in the report.</p> <p>Further mitigation measures and monitoring programme to minimise impact on the dolphins should be identified and considered for implementation in the detailed design studies of the AFRF.</p>	<p>PAA has committed to conducting a dolphin monitoring programme during the construction of the AFRF. In the Draft EIA report it was proposed that an intensive dolphin monitoring programme be undertaken during the first month of construction, following by a tentative frequency of every three months.</p> <p>This proposal was qualified only by the proviso that it must prove to be practical and that it was to be "discussed, agreed and finalised with the AFD". We will be pleased to discuss modifications to this proposed monitoring with the AFD during the detailed design process response levels and consideration of advanced monitoring techniques which have been proposed such as radio-tagging, and helicopter surveys.</p>
		<p>(5) <i>Section 8.5 Final Consideration</i></p> <p>This section should include a brief summary of findings and recommendations with regard to the Chinese White Dolphins.</p> <p>I would assume that my previous comments made in my letter dated 28.10.94 and in the 2nd EWG meeting will also be taken into consideration in finalising the present draft detailed EIA Report. Upon receipt of your response, we shall be in a better position to determine whether the report should be endorsed.</p>	<p>Agreed, amendments have been made as per ERM's letter to EPD dated 28 October (see <i>Attachment 2</i>)</p> <p>Noted. Revised text will be shown to you prior to issue of the Finalised Reports</p>

Department	Reference	Comments	Responses
EPD	(34) in EP2/N9/19 Annex(5) dated 14 November 1994	<p><i>Section 6.3.3 Last para, P.144</i></p> <p>Based on the Consultants' written responses, the historical data for the frequency of aviation fuel spill in Hong Kong between 1968 to 1988 is 1 in 10 years instead of 1 in 20 years. Presumably that the aviation fuel is only used by Kai Tak air traffic, then to factor down the frequency to 1 in 760 years seems inappropriate. Moreover, the increase in traffic from Chek Lap Kok will undoubtedly increase the risk of oil spill in future. The Consultants should supplement the theoretical frequency data by the local frequency data in oil spill risk calculation. Please amend the report accordingly and also append Table 1 in the report.</p> <p>Please note that our comments on Water Quality issues have been sent on 9 November 1994.</p>	<p>As discussed at a meeting between J Wrigley (EPD), R. Morse and T Walsh on 13/11/94 the implications of your comments, if justified, would not change the conclusions of the report which note that an oil spill could occur in the operational life of the AFRF in ecologically sensitive waters and hence, that a well equipped, well planned, state of the art spill response capability is required. Hence, it was agreed at the meeting with EPD to revise the text to account for the possible applicability of either set of data so as to reinforce the conclusions already made.</p> <p>Noted.</p>



*Aviation Fuel Receiving Facility  
Final Report and Executive Summary of EIA Study  
Response to Comments*

Department	Reference	Comments	Responses
Marine Dept	Memo dated 17.11.94 Ref: in EP2/N9/19	The FR and ES are acceptable provided that the following comments plus the comments of our pollution control unit are addressed satisfactorily.	Noted.
	Volume 1: Report Page 7, Para 2.2.2	Maintaining an access from the west to Sha Chau is important in view of potential public objections to fuel vessel movements through the Ma Wan Channel.	ERM assessed the worst case which was via Ma Wan. In terms of risk, initial consideration indicates that Ma Wan presents the greatest risk to life and the southern route the greatest risk to environment. This will be considered in a Further Study to be undertaken following the direction of SPEL.
	Page 16, Para 3.3 Fuel Vessel	With regard to designing and building the fuel vessels envisaged, advice should be sought as to whether this is feasible in the time remaining before the new airport starts operating. If there is some doubt about this what are the alternatives and should these be considered in the EIA report?	PAA have stated that the Licensees have advised that there is sufficient time remaining before the new airport starts operating for the vessels to be designed and built.
	Page 18, Para 3.4.3 and Page 47, Para 4.1.11	Regarding the depth of the pipeline installation a marine impact assessment will probably be needed to address the issues mentioned and the following:-	
		(i) Depths required in order for fuel deliveries to be maintained to Sha Chau by aviation fuel tankers up to 10,000 dwt in the event that passage from the eastern approaches is not possible or has to be discontinued. 11m water depth required.	PAA have stated that a Marine Impact Assessment will be undertaken in subsequent AFRF design stages and this will address this concern.
		(ii) Depths required for cross Pearl River marine traffic serving the airport such as passenger ferries and vessels carrying cargo for export by air. Estimated maximum 8m water depth required.	PAA have stated that a Marine Impact Assessment will be undertaken in subsequent AFRF design stages and this will address Marine Department this concern.
		(iii) Depths required for general marine traffic across the Pearl River noting that the pipeline alignment crosses the deepest water available in the area. Estimated maximum 9m water depth required.	PAA have stated that a Marine Impact Assessment will be undertaken in subsequent AFRF design stages and this will address this concern.

Department	Reference	Comments	Responses
	Page 24, Para 3.7.2 Vessels	It is doubtful that the low speeds of approach (0.6 knots envisaged), are operationally feasible for the fuel vessels given that at times prevailing wind conditions (North East or South West monsoon) may be strong and tugs will not be available.	Noted. PAA have stated that marine safety will be the prime consideration. However, the risk assessment assumed slow speeds and thus the impacts of higher speeds on the AFRF risk assessment will be reviewed in subsequent risk to life and environmental risk/assessment to be undertaken following the direction of SPEL.
	Page 25, Para 3.7.2	A request to reconsider the requirements stipulated by Marine Department has not been received nor is this in hand.	PAA. The implications of double or single hulls on the AFRF risk assessment will be reviewed in subsequent risk to life and environmental risk/assessment to be undertaken following the direction of SPEL.
	Page 120, Para 5.4.2 Vessel Noise	It is not intended that there will be speed restrictions in the area for fuel delivery vessels or other vessels some of which are currently operating in excess of 40 knots.	This reference was made concerning possible vessel speed restrictions in the AFRF access channel and vessel turning circle. See also response to comment on Page 24, Para 3.7.2 Vessels.
	Page 123, Para 5.4.3 Minimisation of Noise	Speed restrictions are not being contemplated see comment above.	See response to comment on Page 120, Para 5.4.2 Vessel Noise.
	Page 125, Para 6.1.1. Introduction	<p>It is noted that the EIA integrates risks to life associated with supply of aviation fuel through the Ma Wan Channel. I agree that this a wise approach and strongly suggest that the EIA should now be completed by incorporating the risks to life created by the movement of aviation fuel from the point it enters Hong Kong to the point of consumption. This should cover the complete movement route. The section prior to the Ma Wan Channel has been omitted. Involved would be the movements of large ocean going tankers past population concentrations on Hong Kong Island and the interrelated movements with smaller aviation fuel barges in the vicinity of the storage tanks on Tsing Yi.</p> <p>The EIA should also address risks to life, if any, posed by fuel deliveries via the western approaches to Sha Chau.</p>	<p>Your concerns are noted, however the issue raised by ACE was the risks in the Ma Wan Channel area as it was considered to represent the worst case re: risk to life. The comprehensive studies discussed are considered to be outwith the scope of the present EIA.</p> <p>This will be undertaken in a separate study as directed by SPEL.</p>

Department	Reference	Comments	Responses
	Page 126, Para 6.2.1 Risks to life - The Risks	The "worst case" is presumed to be if all fuel is shipped through the Ma Wan Channel. Until a risk assessment is carried out on aviation fuel deliveries by large ocean going tankers transiting the Ma Wan Channel passing population concentrations on Hong Kong Island, we cannot be sure that this is really the case.	Noted but it is considered to be outwith the scope of the present EIA. See also response to comment on Volume 1: Report, Page 7, Para 2.2.2.
	Page 129, Para 6.2.5 Urmston Road	Mention should be made of the passenger traffic to the Pearl River Delta ports which is growing at of approximately 17% per annum and future ferry passenger traffic between the airport and Pearl River Delta population centre (including Macau).	Noted the report will be amended and these accounted for in the Detailed Design Basis (DDB) EIA.
	Page 137, Para 6.2.8 Mitigation Background from 1993 study	There is a hint that there might be temporary usage of 1,000 dwt barges for a period of a few years. A marine impact assessment should be conducted if there is a possibility that this might be the case, otherwise this reference should be omitted.	The reference to the temporary usage of 1,000 dwt barges for a period of a few years was in the context of the 1993 Ma Wan Channel Study and not in the context of the PAAs AFRF operation. The EIA report will be amended to clarify this further.
	Page 139, Risk Mitigation and the ARF - Use of Non-dedicated vessels	If there is an intention to use non-dedicated foreign-going vessels, the Hong Kong Pilots Association will need to be consulted. Depending on size, pilots and tugs will be needed.	Noted, if non-dedicated vessels are to use the facility then they will have to use both pilots and tugs. The report will be supplemented accordingly.
	Page 139, Risk Mitigation - Other Routes	Examination of other routes has been dealt with too superficially and discarded as, "may not be cost effective". This aspect has not been properly considered, a true cost comparison between the different routes should be made, taking into account the cost of risk to life of aviation fuel shipments passing Hong Kong Island population centres.	Noted.
	Page 140, Para 6.2.9 Principal Findings	Again it is noted that the possibility of temporary use of 1,000 tonnes fuel barges is not ruled out.	The reference to the temporary usage of 1,000 dwt barges for a period of a few years was in the context of the 1993 Ma Wan Channel Study and not in the context of the PAAs AFRF operation. The EIA report will be amended to clarify this further.

Department	Reference	Comments	Responses
	Page 140, Risk Mitigation	The report notes that, "where the alternative options (ie pipeline) were later found not to be feasible then permanent marine transport methods through the Ma Wan Channel be reconsidered". Since permanent marine transport of aviation fuel through the Ma Wan Channel has been objected to by the Marine Department, it will be very important to define what "found not to be feasible" means.	Permanent pipeline cannot be constructed in time. Therefore an interim barging option is being considered.
	Page 141, This Study	The report should contain a reference as to why alternative routes to the Ma Wan Channel for fuel deliveries to the new airport from Tsing Yi, are not feasible on a temporary basis until the pipeline is constructed. The indirect dismissal on page 143 does not address this properly.	Noted. We are now conducting studies of a route south of Lantau.
	Page 143 Other Relevant Points	There is a reference that the use of double hulled tankers is recommended if practical, cost effective and meet Marine Department conditions.  I have to make it clear that where safety is involved it is not possible to compromise Marine Department conditions on the basis that they are not cost effective.	Noted. The reference re: the use of double hulled tankers was recommended on environmental risk grounds and will be amended in view of Marine Departments comment on Page 25, Para 3.7.2.  Noted.
	Page 143, Further Study	Add for further study. Alternative Routes.	Noted. See above responses including response to Marine Departments on Volume 1: Report, page 7, Para 2.2.2.
	Page 143, Para 6.4 Conclusion	The levels of risk could also be minimised by temporarily using alternative routes to the Ma Wan Channel.	Noted, see above responses including response to Marine Departments on Volume 1: Report, page 7, Para 2.2.2.
	Page 179, Para 7.3	If monitoring of proposed speed restrictions is intended with a view to exercising control, some authority will have to enforce this, resources will have to be made available and legal powers will have to be provided.	Noted.
	Page 184, Para 7.6 Operational Stage Monitoring Vessel Crew Training and Speed Restriction	These issues are somewhat conceptual and need to be framed in more practical terms see previous comment about speed restrictions and monitoring.	These will be addressed in the Detailed Design Basis EIA.

Department	Reference	Comments	Responses
	Page 195, Para 8.3 Risks to Life	Again there is an omission of alternative routes for the fuel barges as an ALARP measure.	Noted, see above response including response to Marine Departments on Volume 1: Report, page 7, Para 2.2.2.
	Page 197, Para 8.3.6 Environmental Risk	The statement that "Marine Department will retain authority over spill clean up" should be understood to mean nothing different in terms of relationship and responsibility than the current role. The licensee will need to submit an oil spill contingency plan demonstrating a satisfactory response in the event of a spill.	Noted, it will be the Licensees responsibility to deal with spill clean up, not Marine Department. This will be further clarified in the revised EIA report.
	Page 199, Para 8.4.3 AFRF Risks	The study has not addressed the risk of a major spill along the shipping route in Hong Kong waters prior to passage through the Ma Wan Channel.	Noted, see response to comment on Page 125, Para 6.1.1, Introduction. .
	Page 199, Para 8.5 Final Considerations	From a marine point of view Sha Chau is not the only viable site, there are more preferable alternatives.	Site selection process was undertaken in consultation with Government Departments, including Marine Department, and concluded that Sha Chau was the only viable site.
	Executive Summary		
	Page 13-15, Para 3.5.5 Risks to Life	Risks to life should be quantified for fuel movement from the point of entry in Hong Kong to entry into the Ma Wan Channel.  Risks to life should also be quantified for comparative purposes for the South Lantau route and the western approaches to Sha Chau.	Noted, see responses above, including to the comment on Page 125, Para 6.1.1, Introduction.  Noted, see responses above including response to Marine Departments on Volume 1: Report, page 7, Para 2.2.2.
	Page 18, Para 4.2 AFRF Risks	A risk assessment should be conducted at Sha Chau taking into account the population at the airport, ferry passengers on ferries operating between the China Ferry Terminal and Pearl River Delta ports and ferries operating between the airport the Pearl River Delta ports and Macau.	Noted, see responses above. This will be addressed in the Detailed Design Basis EIA.
	Page 18, Para 4.3 Final Considerations	Sha Chau is not the only viable site from as marine operational point of view.	See response at P.199, Para. 8.5.
	Page 19, last paragraph	This conclusion depends on the two berths and the fuel vessels being designed, built and brought into operation in a very short time frame. Is this possible in respect of the vessels?	Noted, see responses to comment on Page 16, Para 3.3 Fuel vessel.

Department	Reference	Comments	Responses
Marine Dept	(8) in PA/S909/21/4(5) dated 24.11.94	<p><i>Page 24, Para 3.7.1 Operation of the Facility – General Activities</i></p> <p>The report has addressed that during typhoon no fuel will be delivered to the facility. Moreover, in view of exposure of the AFRF, the report should also address under certain adverse whether situation, no loading and unloading operation should be conducted at the AFRF:</p>	This will be undertaken in the detailed AFRF design.
		<p><i>Page 113, Para 5.3.3 Potential Source of Impact and their Significance</i></p> <p>Hong Kong is not a signatory to all MARPOL Conventions. At the present time, only Annex I &amp; II of MARPOL 73/78 are applied to HK. MARPOL waste would mean any waste generated on board ships, the word "MARPOL waste" is not properly used in the report.</p>	Noted, text will be amended.
		<p><i>Page 164, Para 6.3.8 Mitigation and Emergency spill Response Planning</i></p> <p>The AFRF shall be regarded as associated works of an oil storage installation although the oil storage tanks are located at a long distance. Therefore, the AFRF shall comply with the requirements of the Building (Oil Storage Installations) Regulations, especially the requirements of Operation Instructions including a contingency plan and marine pollution equipment specified in Code of Practice for Oil Storage Installations 1992.</p>	Noted.
		<p><i>Annex E, Para 7 of MD requirements of Barging aviation fuel through the Ma Wan Channel, the word "MARPOL" should be elaborated as "MARPOL 73/78 Convention".</i></p>	Noted and report amended.

Department	Reference	Comments	Responses
Agriculture & Fisheries Dept	Memo dated 23.11.94 Ref: (63) in AF DVL 01/103/V	Please refer to your MUR and the Final Report (FR) which we received from the consultants in the late afternoon on 17 November 1994.	The report was issued because of pressing time constraints. We need under the Sino-British MOU and Agreed Minute to move forward on the completion of the New Airport. The Authority has, throughout, this process (beginning with the NAASLIC meetings in which AFD participated) maintained a good faith effort to work with all agencies to resolve issues of concern. In particular the Authority has made a major effort to take into account all AFD's concerns from the very start and throughout the AFRF planning process.

Department	Reference	Comments	Responses
		<p>(iii) On 26.10.94, AFD received new findings and information from the DRT that there were numerous dolphin sightings at Sites C and E. The new findings were found to be in contradiction with the consultants' findings. To explore measures to mitigate the impacts on the dolphins, AFD proposed that the AFRF should be located at least 1 km offshore of Sha Chau to avoid direct impact on the dolphin usage area. No formal response from the consultants had been received until the receipt of the FR wherein it was stated that the consultants had found the proposal unacceptable largely for safety and technical reasons (p.50 of Annex J refers). While we appreciate the reasons advanced by the consultants, this has regrettably led to the added problem of identification of a suitable site for the AFRF from ecological point of view.</p>	<p>It has been acknowledged by all parties from the very start of the planning process for the AFRF at Sha Chau, that time was short and there was a lack of detailed information on Chinese White Dolphins. It has also been acknowledged by the AFD that there are no available criteria for evaluating dolphin impacts nor can any time frame be provided by AFD for when such criteria may be available. In an effort to obtain the maximum amount of information within the available time, the Authority commissioned a one month dolphin survey as part of the Sha Chau site selection process. This effort was closely coordinated with the AFD and the DRT. The Authority has always acknowledged that a one month survey does not provide a complete picture of dolphin habitat usage within the study area and has agreed to continue with dolphin surveys during the construction of the AFRF.</p> <p>The DRT's additional sightings (12 October) were apparently based on a one day sample and arguably provide no more complete a picture of dolphin habitat preferences than the Authority's month long survey (maybe even less). All the two surveys indicate that dolphin sighting data is variable while the Authority is forced to plan for the New Airport's AFRF within a very limited time frame. Given this time constraint it is not possible to constantly alter the location of the facility after each new survey is completed.</p>



Department	Reference	Comments	Responses
		<p>(2) Consultants's response to our Specific Comment 12(ii) dated 28.10.94 (p.4 of Annex J):</p> <p>We are disappointed with the Consultants's response which is based on PAA's advice. Related to this point, AFD has been in correspondence with PAA. We are disappointed to learn from PAA's letter dated 18.11.94 (copies of correspondence attached) that PAA cannot be more committal in undertaking the implementation of all the mitigation measures and monitoring and audit requirements which are considered practicable and cost-effective. It should be noted that these measures are necessary to minimise and closely monitor the impacts of the AFRF on the environment. It should also be noted that there is the generally accepted principle that project proponents should be responsible for mitigating impacts on the environment and undertaking compensation for environmental degradation due to their works. In view of the compressed programme of the AFRF and the consultants' admission of lack of sufficient information on ecological aspects in the FR, AFD is of the view that it is particularly important for the project proponent to demonstrate full commitment to undertake remedial measures arising from the project.</p>	<p>The Authority is a publicly funded statutory corporation charged with building the New Airport within a government approved budget. Our costs are monitored by both our Board of Directors and Government and we are simply not in a position to agreed with AFD on a carte blanche commitment to all forms of mitigation. However, the Authority fully appreciates its responsibility to construct and operate the New Airport in an environmentally sensitive manner and, as an expression of good will, has repeatedly committed o support the implementation of practicable and cost effective mitigation measures. We continue to stand by this commitment.</p>
		<p>(3) Consultants's response to our Comment 2 referenced AF DVL 01/103V dated 4.11.94 (p.33 of Annex J):</p> <p>(i) Consultants's correlation of the sighting of dolphin at sites C &amp; E with the construction of the CAD jetty Sha Chau was only a speculation and was not substantiated by any scientific data. Please see my comments at point (4) below.</p> <p>(ii) We note the consultants' wish to have additional information on up-to-date data on dolphin sightings by the DRT. AFD understands that such information is being prepared by the DRT.</p>	<p>Agreed. This is why the report states that it <u>may</u> indicate that the dolphins were influenced by the construction of the CAD jetty at Sha Chau. Similar speculation has been made by others concerning airport construction and dolphin sightings near The Brothers Islands.</p> <p>Noted.</p>
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Department	Reference	Comments	Responses
	(4) Section 2.4.4, page 14	<p>Conclusion and Recommendations</p> <p>I wish to reiterate our view that the effect of the construction of the CAD jetty at Sha Chau on the distribution of the dolphins is only a speculation without scientific substantiation. Indeed, the contradiction between the findings of the consultants and that of the DRT does suggest that the ecological aspects of the EIA should deserve more careful examination. Having said that, and as pointed out in the FR, the EIA study was required to be completed on a compressed programme to enable the AFRF to be in place for the airport opening.</p>	Noted. See response to 3(i) and (iii) above.
	Executive Summary	<p>Dolphin Studies</p> <p>1st bullet on p.4 – Please see my comments (4) above.</p> <p>2nd bullet on p.4 – The last sentence is no more than a speculation by the consultants without scientific substantiation and should be deleted.</p>	Noted. See responses to 3(i) and 1(iii) above.
	(5) Section 2.1		
AFD	Memo dated 25.11.94 Ref: ( ) in AF DVL 01/103/V	Thank you for your MUR and the draft paper to SPEL for resolution under Section 15 of PELB Technical Circular No. 2/92.	
	Para 11(a)	This seemed to have overtaken by events. As reflected in sub-para 4 of Section 8.5 (Final Considerations) of the Final Report, a comprehensive package of practical and cost-effective mitigation measure and controls for both the construction and operation stages will be incorporated in the detailed design of the AFRF. To this end, it has also been agreed with PAA that further surveys would be needed during the course of development and that such surveys may identify areas where additional mitigation measures may be required. As such, this is no longer a sticking point.	Noted.
	Para 11(c)	This has now been resolved with PAA upon their agreement to insert "by PAA or other parties under PAA supervision" after the word "implementation" in the second sentence of sub-para 4 of Section 8.5 (Final Considerations) of the Final Report.	Agreed. The text of the FR and ES have been amended.

Department	Reference	Comments	Responses
	Para 11(d)	In the letter PEV/60.42/1209 dated 23.11.94, PAA has indicated their agreement with AFD that the consultants' correlation of the sighting of dolphin at the recommended site (C) with the construction of the CAD jetty at Sha Chau was only a speculation and not substantiated by any scientific data. This has removed our concern.	Noted.
		<p>AFD's remaining concern is Para 11(b) which incidentally is not a new proposal. Assuming that PAA does not disagree with my comments at Para 2 above, para 11 of the draft paper to SPEL should be rewritten as follows:</p> <p>"AFD is very concerned that a lot of dolphins have been sighted foraging around the recommended site (C). As impacts on these dolphins feeding around site C have not been fully addressed in the Final Report, AFD considers that top priority should be given to conducting studies with input of cetacean experts with a view to finding out as soon as possible, alternative ways to minimise the impacts on dolphins feeding in the area. Subject to PAA's agreement to the above, AFD would be prepared to endorse the report."</p>	Noted.
	Memo dated 28.11.94 Ref: ( ) in AF DVL 01/103/V	In view of the compressed programme of the AFRE, the time constraint of the dolphin study has been noted by members of the SMG. The consequence of this is that it would be difficult for any firm conclusion to be drawn on the acceptability of the ecological impacts arising from the captioned project. Nevertheless, I wish to stress our concern as conveyed vide my memo dated 25.11.94 that a lot of dolphins have been sighted foraging around the recommended site (C), and that we would like to see priority given to further studies to be conducted with a view to finding out as soon as possible alternative ways to minimise the impacts on dolphins feeding in the area.	Noted.
AFD	Dated 29.11.94 Ref: (85) in AF DVL 01/103V	<p>I refer to your letter dated 23.11.94. I understand that PAA has agreed to our request that the Final Report (FR) will be reprinted taking into consideration of AFD's comments in our memo dated 23.11.94 addressed to DEP and copied to you.</p> <p>To this end, please amend the FR as follows:</p>	Noted.

Department	Reference	Comments	Responses
	Point (2) in my memo dated 23.11.94	<p>The 2nd line of the 4th paragraph should be amended to read " ... operation stages will be incorporated ..."</p> <p>The 5th line of the 4th paragraph should be amended to read "... implementation by PAA or other parties under PAA supervision of the recommended ..."</p>	<p>Noted. The Annex has been amended accordingly.</p> <p>Noted. The FR has been amended accordingly.</p>
	Point (3)(i), (4) and (5)	We note your agreement to our comment that the consultants's correlation of the sightings of dolphins at Sites C and E with the construction of the CAD jetty was only a speculation and was not substantiated by any scientific data. As such, please <i>delete</i> all such speculations made by the consultants in the FR and the Executive Summary with regard to the correlation of the sightings of dolphin at Sites C and E with the construction of the CAD jetty.	Noted. The Final Report and Executive Summary have been amended to reflect that the assertion was only speculation and could not be substantiated by scientific data at the present time.
AFD	Dated 10.12.94 Ref AF DVL 01/103V	I refer to my facsimile message of 28.11.94 addressed to you and the accompanying information on dolphin sightings. I presume that you would incorporate the information into the final report.	The information has been included as Annex J of the Final Report.
CE/NALT CED	Memo dated 22.11.94 Ref: (85) in NA 7/8/4		
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Department	Reference	Comments	Responses
		(a) The text has not been "amended accordingly" in response to some of my previous comments.	The text has generally been amended in line with CE/NALTs comments, within the constraints of the Consultants report format and other government comments.
	Page 142, para 6.2.9	(b) I note that Lands Department, who handled the circulation of the Tsing Yi Consortium's pipeline submission by their consultant SWK, are not a member of the EWG and have not therefore received this report. From my discussions with Paul Clift (CES/NA(NT)) and looking at the comments received on that circulation it appears that there are many issues relating to alignment and risk to other facilities, with risk to life implications, to be resolved before zero date (the date Government commences Gazettal and Licence procedures). This together with the programme on page 142 which estimates 59 months from zero date, would appear to indicate that the Tsing Yi pipeline could not be available until 2000 at the earliest (over 2 years after Airport opening). This would appear to endorse the need for an interim barging facility, a need that was appreciated when NAAFSLIC, of which your department was a member, held its first meeting on 25 April 1994.	Noted.
	Para 8.2.6	(c) With regard to the Submarine Power Cable I understand that CLP have dropped the Lung Kwu Tan to Lung Kwu Chau option because of routing problems near Lung Kwu Tan. As such Lung Kwu Chau will be served from Sha Chau. I do not have details of the exact alignment or timing, however as the route still needs to be gazetted a commencement in September 1995 appears too optimistic.	Noted. The FR and ES have both been amended accordingly to reflect this recent SPC routing change.
	Page 195, Para 8.3.5, 6th line	(d) "company" should read "comply"	Noted the report has been amended accordingly.
	Executive Summary		
	(3a) Para 3.2.6	Amendment (of ES) may be required in line with my comment (c) above.	See response to CE/NALTs comment (c) above.

Department	Reference	Comments	Responses
	(3b) Para 3.3.5	As noted in my comment (b) above it would appear that even 1999 may be too optimistic for the Tsing Yi pipeline option.	Noted.
	(4) Para 3	I consider that the FR and ES are acceptable though I would suggest minor amendments in line with the above before submission to ACE.	Noted.
EPD	Letter dated 2.12.94 Ref. (68) in EP2/N9/19 Annex (5)		
	Page 15 of ES and Page 196 of FR	The following sentence should be deleted: "The AFRF is an interim solution and the temporary risk levels are in accordance with the ALARP principle"  The following statement appearing on page 14 of the ES is considered as more appropriate:  "Since the reasons .... the AFRF is not strictly ALARP"	Noted. The ES and FR have both been amended accordingly.
	Page 14 of the ES and Page 195 of the FR	To replace "However, given that these reasons are unsurmountable .... at this time "by" However, if there are insurmountable reasons for the 5 - 7 years timescale of AFRF operation, clearly a pipeline is not a practicable mitigating measure at the present time"	Noted. The ES and FR have both been amended accordingly.
	Comment (25), Page 11, Annex J	Our previous comment has not been incorporated in the Final Report.	The Annex J has been amended accordingly.
	Comment (30), Page 11, Annex J	Please refer to Comment 3(a).	The Annex J has been amended accordingly.
	Comment (3), Page 28, Annex J	Please refer to Comment 3(a).	The Annex J has been amended accordingly.
	Comment (6), Page 29, Annex J	Please refer to Comment 3(a).	The Annex J has been amended accordingly.
	Page 66, 1st Para.	Noise  "Table 3.3b" should be amended to "Table 4.2b".	The FR has been amended accordingly.

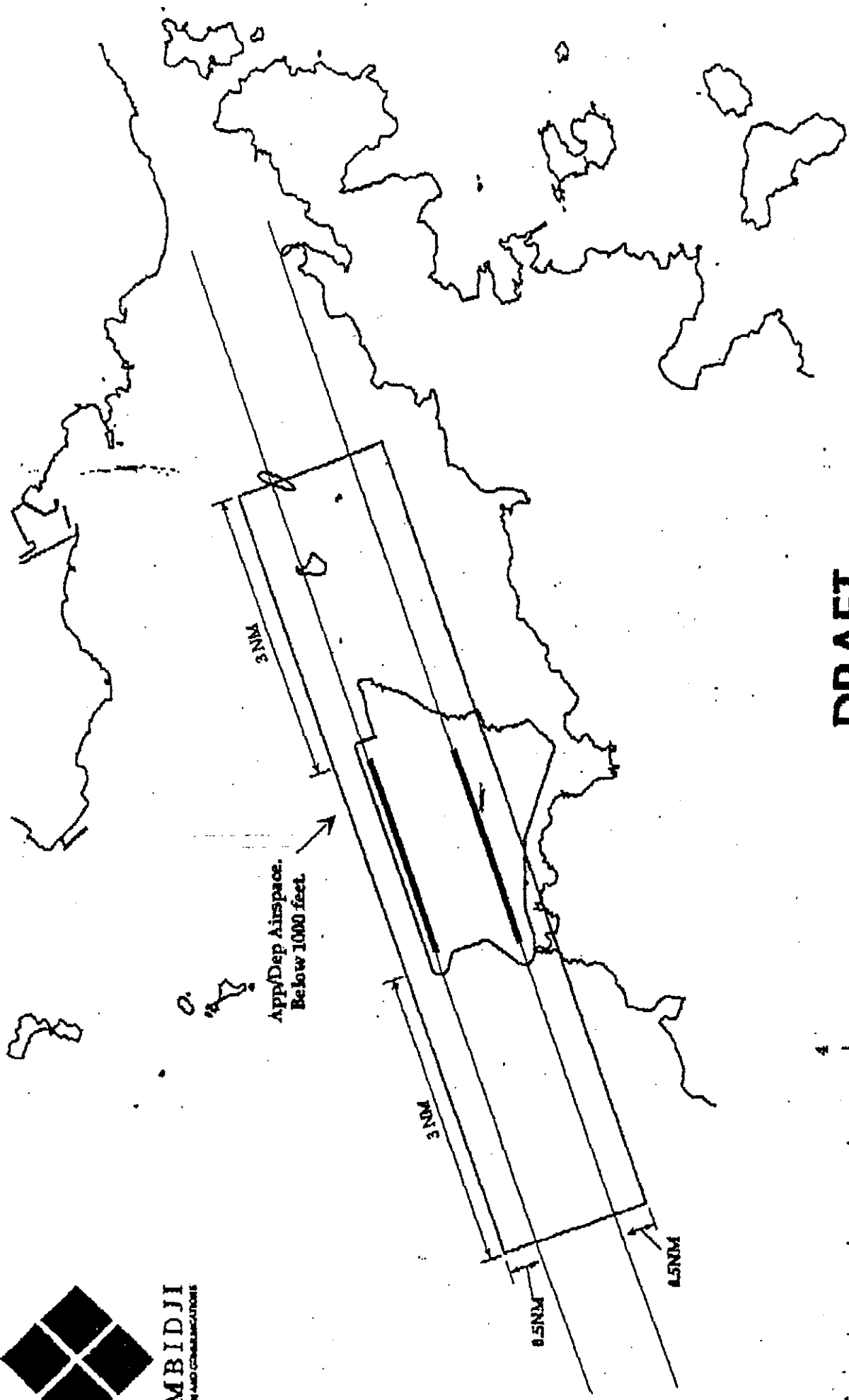
Department	Reference	Comments	Responses
	Page 73, Chemical Waste, 2nd Para.	<i>Waste Management</i> please replace "a registration fee of \$200. "by" a registration fee of \$240."	The FR has been amended accordingly.
	last para.	please include "The CWTC operator will only supply standard containers no larger than 200 litres. Other storage facilities have to be provided by the contractor."	The FR has been amended accordingly.
	Page 115, 7th Para. Section 5.3.4	Commercial/Industrial waste – Amend the first sentence to "Commercial/Industrial waste: collect for disposal at landfill using separate containers."	The FR has been amended accordingly.
	Page 13 of ES, Section 3.3.4, 2nd Para.	<i>Chinese White Dolphins</i> "Further operational impacts will be minimised with the implementation of practical measures detailed below", please clarify what are the details, any lists of key mitigation measures.	The ES has been amended accordingly.
Planning Dept	25.11.94 Ref_m PADS G/AIR/13 III	My two main points of concern have actually been spelt out in your draft paper to SPEL circulated under separate cover. The first one relates to the impacts on the Chinese White Dolphins. I suggested, and the consultants agreed, at the SMG meeting on 2 November 1994 that the Final Report and executive Summary should make it clear that it is not possible to conclude whether the proposed mitigation measures could reduce the construction impacts to an acceptable level or not. This has not been included in the reports.	Both the Final Report and Executive Summary have been amended to make it clear that it is not possible to conclude whether the proposed mitigation measures could reduce the construction impacts to an acceptable level or not.
		The second point relates to the operational period of the AFRF. Given PAA's construction programme now incorporated in the reports, I find it hard to accept an operational period of 5 to 7 years as an "ALARP" measure to minimise risk.	Section 3.3.5 of the ES explains the consultants position on the ALARP principle. Note this wording has been agreed with the EPD.
		The Final Report and Executive Summary should be further revised to take the above points into account. These reports, in their present form, are not acceptable to me. This is a coordinated reply from PlanD.	Noted.







**AMBIDJI**  
 TELECOMUNICATIONS



**DRAFT**

**HONG KONG AIRPORT**  
 FUEL TETHERING STUDY

The Ambidji Group Pty Ltd  
 Suite 1, Argyle Centre, 92-94 Wykes St

Date	5 May 1994	Drawn	P. Wilson
Drawn No	9402-1/1	APPROVED	

**AIRPORT APP/DEP AIRSPACE**

Attachment 5

Table 1. Major oil spills in Hong Kong since 1968.

<u>YEAR</u>	<u>CAUSE</u>	<u>QUANTITY SPILT</u>
1968	Grounding of the vessel "Columbia Trader"	190 t. heavy marine diesel
<del>1973</del>	Accidental spill from an oil storage tank at Ap Lei Chau	4,000 t. heavy marine diesel
1973	Collision of the vessels "Eastgate" and "Circea"	200 t. aviation fuel
1974	Grounding of the vessel "Korea Hope"	160 t. aviation fuel
1976	Grounding of the vessel "Oriental Financier" at Tathong Channel	400 t. fuel oil
1977	Grounding of the vessel "Adrian Maersk"	1,100 t. bunker oil
1979	Sinking of the oil barge "Cheung Shing No. 1" at Pun Shan Shek	150 t. waste oil
1980	Sinking of the oil barge "Cheung Shing No. 5" at Rambler Channel Typhoon Shelter	200 t. waste oil
<del>1982</del>	Accidental discharge from a burst pipe at Repluse Bay	2,000 t. fuel oil
1983	Grounding of the vessel "Zim Manila II" at Silvermine Bay	140 t. fuel oil
1985	Grounding of the vessel "Forta Durban"	60 t. bunker
1988	Grounding of the vessel "Euplecta" at Tathong Channel	300 t. diesel oil
1988	Grounding of the vessel "Tetsushin Maru 7" at Tathong Channel	60 t. diesel oil
1988	Grounding of the vessel "Ervillea" at Eastern Fairway	100 t. diesel oil

Annex K

Latest Chinese White  
Dolphin Sighting Report  
Around Lung Kwu Chau  
and Sha Chau (14.9.94-  
9.11.94)

Here is a summary map of dolphin sightings made during the weekly land-based surveys at Castle Peak, which allows observation in the vicinity of Sha Chau and Lung Kwo Chau. Dolphin pods sighted just offshore of Castle Peak / Tap Shek Kok have not been included on the map for sake of clarity.

Details of the sightings are as follows:

Sighting No.	Date Observed	Time of Initial Sighting	Number of Dolphins	Behaviour
1	14/9/94	10.34	10	Foraging
2	14/9/94	13.22	11-15	Foraging
3	14/9/94	14.09	2-3	Foraging
4	19/10/94	9.47	1	N/A
5	19/10/94	9.54	1	N/A
6	19/10/94	9.59	2	Traveling
7	26/10/94	9.51	1	N/A
8	26/10/94	10.05	2	N/A
9	26/10/94	11.34	2	Feeding
10	26/10/94	12.13	1	N/A
11	2/11/94	9.49	10-15	Foraging
12	2/11/94	10.41	2-3	Traveling
13	9/11/94	11.18	3-5	Foraging
14	9/11/94	11.45	11-15	Foraging
15	9/11/94	1.08	1	N/A

: INITIAL POSITIONS AND MOVEMENTS OF DOLPHINS SIGHTED DURING LAND BASED SURVEYS (14.9.94 - 8.11.94)

