# FILL MANAGEMENT STUDY — PHASE II

# INVESTIGATION AND DEVELOPMENT OF MARINE BORROW AREAS

## EAST LAMMA CHANNEL BORROW AREA

## SCOPED ENVIRONMENTAL ASSESSMENT

## EXECUTIVE SUMMARY

**JANUARY 1993**

**Binnie Consultants Limited**

**CIVIL ENGINEERING DEPARTMENT**
**GEOTECHNICAL ENGINEERING OFFICE**

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# FINAL REPORT

## EXECUTIVE SUMMARY

### Introduction

A scoped assessment has been carried out of the potential environmental effects of developing a proposed borrow area located within East Lamma Channel (G.N. No. 2480 in Gazette No. 30, 19 July 1991). The study brief was agreed with the Environmental Study Management Group.

### Scope of Assessment

The assessment involved a review of the planned project with respect to potential physical, socio-economic and ecological effects. The specific activities associated with dredging that were included in the assessment were seabed removal, sediment plumes, sediment deposition, vessel movements and noise generation. An assessment was made of the potential effects of these activities on the following aspects of the environment: water current flow, wave regime, marine traffic, utilities, anchorages, water quality, capture fisheries, mariculture, seawater intakes, Ocean Park, marine ecology (particularly coral and fish), conservation, marine parks, sound power levels and visual aesthetics.

The work included a literature review and analysis, interviews with Government departments and private companies. In addition, extensive computer modelling was undertaken to study the hydrodynamic regime, sediment transport regime and wave climate before and after the proposed dredging.

Field work included surveys and interviews with fish farmers at the mariculture zones, as well as underwater scuba surveys and photography of the both sides of the East Lamma Channel to a depth of 25 m.

### Existing Conditions in the Area

The East Lamma Channel is Hong Kong's most important shipping lane.

The East Lamma Channel, of which the borrow area is part, serves as an inshore fishing ground that produces about 540 tonnes of fish worth $6 million annually. This accounts for about 3% of all Hong Kong inshore fish catch, 9% of shrimp catch and 5% of squid catch. The area may be a spawning and nursery ground for some commercial species. Fish fry collecting zones along the channel supply Lamma Island fish farms.

Two mariculture zones located next to the Channel produce about 500 tonnes of fish worth about $30 million annually.

The marine life along the southwestern side of East Lamma Channel is diverse and abundant, particularly in soft corals, sea whips and fans below a depth of 15 m. Hard corals are abundant and diverse in shallow water along the east side of Lamma to the south of Wong Chuk Kok. Marine life, including hard corals is much less abundant along the northeastern side of East Lamma Channel.

There are popular bathing beaches at Deep Water Bay and Repulse Bay, with others at South Bay and Chung Hom Kok.

Proposed marine parks are located at Cape D'Aguilar and at Sham Wan on the southern end of Lamma Island. The beach at Sham Wan is believed to be a turtle nesting ground.
Seawater intakes along the southern Hong Kong Island coast provide air conditioner cooling water, flushing water and water for exhibits of marine life at Ocean Park.

The 75 $Mm^3$ sand resource beneath the seabed in East Lamma Channel contains approximately 6% fine sediment and is considered to be one of the purest in the Territory.

## Components of the Assumed Dredging Scenario

*Layout of Proposed Dredging Pit*

The initial stage of the assessment was based on an initial borrow pit design which maximized the use of the sand resource (Figure 1). Computer modelling of this initial pit configuration indicated that it would be likely to result in focusing of wave energy which, in turn, could have a significant impact on the long term stability of marine structures in the Aberdeen area and of beach sand in the Repulse Bay and Deep Water Bay areas. As a result, part way through the study, the pit layout was modified to a smaller pit shape ("TS" in Figure 1). A further sequence of computer modelling indicated that this modified pit would be unlikely to have a significant impact on marine structures or beaches.

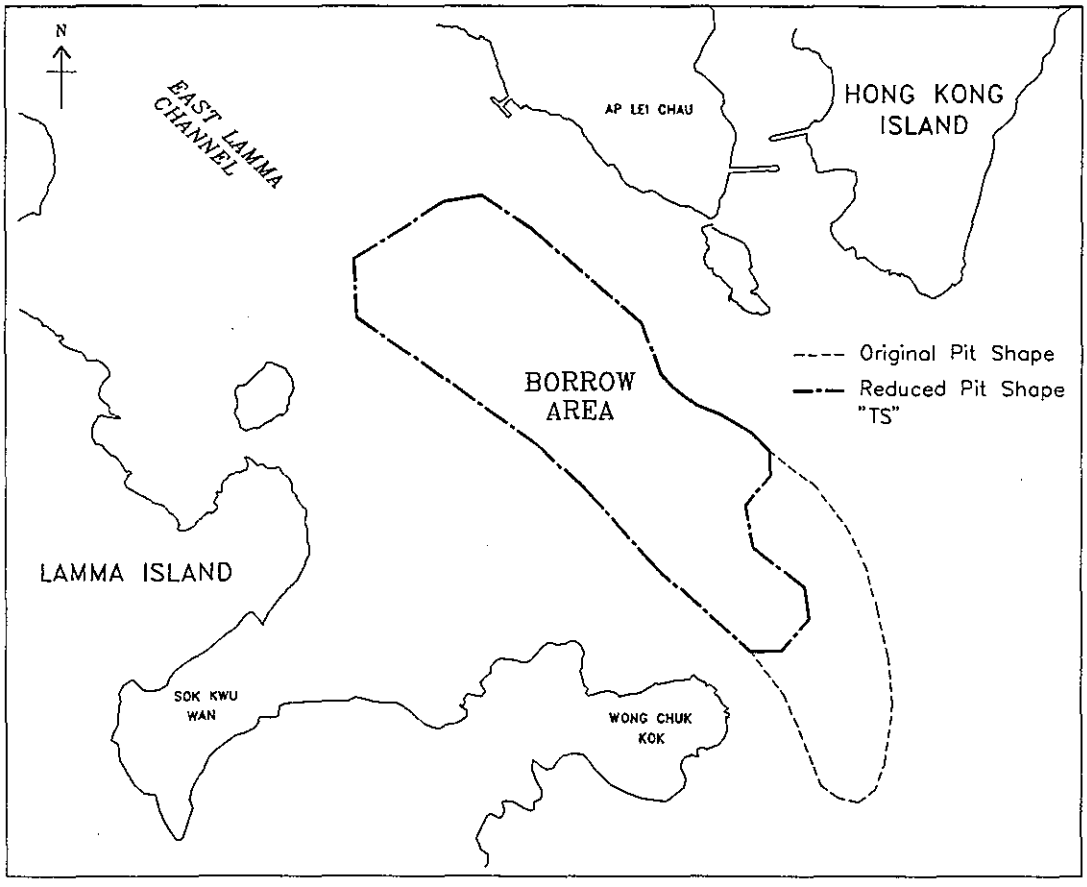


FIGURE 1 EAST LAMMA CHANNEL BORROW AREA

*Dredging Constraints*

It was assumed in the study that overflow would be prohibited during dredging of mud overburden in the borrow pit.

Following early discussions with the Marine Department, it was also assumed that the use of stationary dredgers would be prohibited in the Traffic Separation Scheme, and that the dredging operation would only involve one mobile trailer dredger in the Traffic Separation Scheme at any one time.

**Extent of Impacts**

*Seabed removal*

The effect of seabed removal on the overall water flow in the area would be minor. As discussed above, the impact of the initial borrow pit design on wave energy focusing would have been significant but adoption of the modified pit design would eliminate this potential problem.

Seabed removal would probably not affect mariculture, but would preclude the operation of capture fisheries within the borrow area for the duration of the operation. Adult fish would be expected to migrate out of the affected area and would join nearby stocks; however, this could place them out of reach of inshore fishermen. Backfilling of the pit is unlikely, and therefore the increased water depth inside the pit would permanently preclude some types of fishing activities, such as shrimp trawling, due to limitations of fishing gear. A new benthic community would probably colonize the dredged area within two to three years, but it is not known if it would support commercial fisheries (due to the lack of data on deep water marine communities in Hong Kong).

*Sedimentation*

Because of the purity of the sand, approximately four times less fine sediment would be discharged into the sea during dredging of East Lamma Channel than has been the case during dredging of other Hong Kong marine borrow areas. In the area adjacent to the dredging, increased suspended sediment would be expected to reduce the abundance of wild fish fry during the dredging operations and for about one year following project completion. Fish farmers would therefore need to collect or buy additional fry from other areas during this period.

Sedimentation would be likely to cause a moderate reduction in fish catch in an area circumscribed by a line 1 km outside the borrow area margin. However, the majority of these fish would probably join stocks in other areas, although these might be beyond the reach of coastal fishing craft.

Visible sediment plumes that contain insufficient sediment to harm mariculture species would probably reach mariculture zones and could prompt fishermen to make complaints. Adult fish and fingerlings grown at the mariculture sites would not be expected to be killed by acute exposure to sediment plumes generated at the borrow area during dredging. However, infrequently, during severe storms, it is possible that dredging plume sediment which had already settled to the seabed could be resuspended. This could temporarily result in suspended sediment levels at the mariculture sites in excess of the 80 mg/l level which the Agriculture & Fisheries Department has adopted as the target level for water quality at mariculture sites. The bulk of scientific data suggests that long term (chronic) exposure to levels below 80 mg/l would not increase disease susceptibility or decrease growth rates.

Hard corals located near Wong Chuk Kok on Lamma Island would be expected to suffer up to about 25% loss. There would also be some loss of diversity. Other sensitive marine organisms in the same area could be harmed. Although low-lying patches of soft coral and sea fan communities located along East Lamma Channel would probably be buried by sediment and killed, most communities of these organisms are located in areas swept by strong currents and would not be damaged.

Neither of the proposed marine reserves in the area are likely to be damaged by the proposed dredging. Dredging would not be expected to affect the turtle nesting ground at Sham Wan, Lamma Island.

Light brown sediment plumes might be visible from the bathing beaches at Repulse Bay and Deep Water Bay during the summer months and, although harmless to bathers, could generate public complaints.

During the wet season, an increase of about 15 mg/l above average background levels of suspended sediment concentrations would be likely to occur regularly near the Ocean Park intake. During infrequent storms, and given appropriate weather conditions, increases above the 25 mg/l design specification for the Ocean Park seawater filter could occur, but this situation would not last for more than a single tidal cycle. An increase in the frequency of cleaning of the filtration system (at an estimated cost of $100 per cleaning) would be sufficient to prevent water quality problems within Ocean Park.

*Noise*

Noise levels created by the dredging are unlikely to be significantly above background levels.

*Marine Traffic*

Crossings of the Traffic Separation Scheme by trailer dredgers would require close co-operation between the dredgers and the Marine Department's Vessel Traffic Centre.

**Mitigation Measures**

The most effective mitigation measure against the impacts of dredging in the East Lamma Channel is to restrict the amount of dredging plant and its mode and area of operation. For this reason, the conclusions reached in the study are based on the assumptions that:

(a) the modified pit shape would be adopted,

(b) only a single trailer dredger would operate within the dredging area at any one time, and

(c) overflowing would not be permitted during the dredging of overburden.

If an alternative mode of dredging operation was envisaged, then the assessment would need to be revised and further analysis undertaken as necessary.

In addition to the above, there are a number of other possible measures which could be adopted to monitor impacts and possibly further reduce them. Principal among these measures are:

(a) To divide the borrow area in half and to dredge the two halves with respect to seasonal wind patterns; this would significantly reduce the chance of wind-driven sediment plumes reaching most sensitive receivers. This measure would not affect potential impacts to the hard coral and fry collection areas near Wong Chuk Kok and Sok Kwu Wan mariculture zone and would not reduce the potential impacts of tidal transport of sediment plumes.

(b) The automatic device used by dredgers to route low density material overboard (ALMOB) during overburden dredging could be prohibited by contract specification.

(c) A significant reduction in navigational risk could be achieved by establishing a Dredging Management Co-ordinator to work in close co-operation with the Marine Department Vessel Traffic Centre.

(d) A contractual Action Plan that provided for restricting the area of operation in response to specified exceedance levels in combination with an independent monitoring programme designed to rapidly determine the movement of sediment plumes towards sensitive receivers would lower the potential for environmental damage.

Silt curtains would not be feasible at the source and similarly would not be likely to be a viable option for controlling the dispersion of sediment around the mariculture sites and at beaches affected by strong currents or waves.

**Postscript**

This report has been prepared under the auspices of the Environmental Studies Management Group (ESMG). During the course of meetings with ESMG, some members expressed their views that the potential effects of the proposed dredging would be greater than estimates made in this report.