3 EVOLUTION OF THE EIA ASSUMPTIONS

3.1 INTRODUCTION

During this study there have been a number of fundamental changes in basic assumptions for the construction and operation of the Terminals. In this section these changes are identified and analysis associated with the changes summarised. This section concentrates on two areas where there are fundamental differences from the assumptions made in the LAPH Studies, these are :

o configuration of the terminals; and

o reclamation material assumed.

The chapter concludes by identifying the construction activities envisaged for the terminal and summarises the likely operating techniques anticipated.

3.2 CONFIGURATION OF THE TERMINALS

3.2.1 INTRODUCTION AND BACKGROUND

At the outset of this study the terminal shape identified during the LAPH Studies, and endorsed by LDPC, EPCOM and the Islands District Board, was adopted. Additional engineering investigations carried out on operating terminals in Hong Kong, suggested that higher throughput and vehicle utilisation was occuring. The Steering Group for the study instructed that higher throughput levels and vehicle usage should be used for the assessment. Initial cumulative operation noise assessment, of the LAPH configuration, identified exceedences of the planning criteria at a large number of sensitive receivers. Additional mitigation in the CT10 and CT11 terminals, in the form of a second noise barrier and an increase in barrier hight, from 13.7 to 25 metres above berth level, were investigated. The additional mitigation was not sufficient to reduce impact levels to within the identified criteria. Further modifications were investigated which reduced levels of impact but these modifications were still unable to attain the identified planning criteria, for the LAPH configuration. In accordance with PELB TC2/92, the matter was referred to SPEL for a decision. Ultimately, a meeting of the Port Policy Group[1] instructed that location of the later phases of the terminals (CT12 and CT13) be amended to provide additional noise mitigation. In the following subsections the amendments to the LAPH equipment assumptions, including the sensitivity analysis carried out on the LAPH configuration is set out. The section goes on to identify the new west facing terminal configuration, the key element being the splitting of Phase III/IV into two new terminal islands, one on the site of the original phase III/IV and the second further south at Kau Yi Chau. The arrangement is recorded in Figure 3.1 and represents the configuration which is the subject of detailed assessment.

1 The Port Policy Group comprises the Secretary for Economic Services, Secretary for Planning Environment and Lands, Secretary for Works, the Director of Civil Engineering and the Secretary Port Development Board.

3.2.2 EQUIPMENT ASSUMPTIONS

The present assessment differs from the previous LAPH assessment in its underlying equipment assumptions. The assumed numbers of terminal equipment are greater in this assessment due to two significant differences in operating characteristics. In summary the changes are:

i) An increase in terminal throughout from the maximum 1.6 million Twenty Foot Equivalent Units (TEU's), per terminal (0.4 M/berth) used in the LAPH studies to maximum 2.0 million TEU's per terminal; and

ii) Reassessment of plant requirements within the terminals, confirmed during discussions with terminal operators in Hong Kong which indicated that the equipment schedules and numbers of vehicles operating within the terminals were greater than anticipated in the LAPH Studies.

Throughput Increase (2.0M TEU)

The lease conditions for CT10 & CT11 will specify that the terminals should be planned for a <u>minimum</u> throughput of 1.6 million TEU's per 4 berth terminal and this figure was adopted during the EIA in the LAPH Studies. Previous terminals (CT8 & CT9) have been designed on the basis of a <u>working</u> throughput of 1.76 million TEU's per terminal (i.e. 10% more than the minimum required by the lease). To account for efficiency improvements within the terminals (an observable phenomenon in existing HK terminals) the Steering Group directed that assessment should assume a working throughput of 2.0 million TEUs (i.e. 25% more than the lease requirement). In estimating the equipment numbers an allowance has been made for the fact that the ratio of 40' containers to 20' containers will increase in the future[2]. Uprating of equipment required for the 1.6 million TEU is by a ratio of 1.17 [from (2.0/1.6) x (1.47/1.57)], ie. 17% rather than a numeric increase of 25%.

Plant Characteristics and Utilisation in the Terminal

The equipment numbers being used here are higher than those assumed in the LAPH Studies. This study is based on equipment levels observed at the Kwai Chung terminals, which are compatible with the assumptions made in the CT8 & CT9 studies. To verify these figures a questionnaire was sent to existing operators. The information received indicated that the operators' estimates are similar to those assumed in this Study. A further deviation from the LAPH assumptions was an operator preference for rubber tyred gantry cranes (RTG) over rail mounted gantry cranes (RMG). The RMG have a lower Sound Power Level (SWL) than an equivalent RTG but the RTG offer more flexibility since they can be moved between stacks to meet demand. Should RMG be adopted there would be an increase in the number of units required, over the LAPH figures, which would offset the SWL advantage of individual elements. The equipment numbers refer to a total for each berth with the opportunity for some sharing of equipment within a terminal. A comparison of equipment used in this study and LAPH Studies is given in Table 3.1.

2 Information supplied by Plan D.

Table 3.1 Equipment Utilisation for this Study and LAPH Study

Equipment	This Study				LAPH Study			
	Day time		Night time		Day time		Night time	
	Number /berth	Utilisation	Number/ berth	Utilisation	Number /berth	Utilisation	Number /berth	Utilisation
Container Crane	3/4	100%	3/4	100%	2/3	100%	2/3	100%
RTG's	17	100%	17	75%	-	-	-	-
RMG's	-	-	-	-	9	75%	9	75%
Barges	1	100%	-	-	-	-	-	-
Internal tractors - running - idling	17	 55% 45%	17	 55% 45%	15	22%	15	22%
External tractors - running - idling - parked	105	 17% 34% 49%	59	 32% 68%				
Frontloaders - 6T - 40T	 1/2	 100%			 1	 10%	 1	 10%

Contribution from Container Backup Area (CBA) and Container Freight Station (CFS)

At the start of this study the contribution of the Container Backup Area/Container Freight Station (CBA/CFS) were found to have a significant impact on the night-time noise environment. Initial calculations assumed that there would be 100% utilisation in the CBA/CFS at night. However, there is scope within the CBA/CFS to incorporate mitigation to reduce the contribution from these activity areas. It is feasible that the CBA/CFS will be able to operate at night since it is not "no activity" that is required, but "no noise contribution". Mitigation can be achieved by barriers, lower activity levels, etc. The feasibility of this option is fully investigated in the parallel "Ancillary Works" study. For the purposes of the sensitivity analysis the Steering Group (14 January 1994) directed that it could be assumed there would be no noise contribution from the CBA/CFS at night-time.

3.2.3 SELECTION OF EQUIPMENT SOUND POWER LEVELS

Sound Power Levels for equipment

In the LAPH Studies it was concluded that a positive approach to noise mitigation would be required if the terminals were to operate within the requirements of the planning criteria. To this end it was assumed that equipment which was designed to minimise noise generation would be specified, and the term "quiet" equipment was used to describe equipment, readily available on the market and incorporating reasonable levels of noise mitigation. In this study the same approach has been adopted and the availability of equipment has been confirmed by its adoption and use at operating terminals in Hong Kong. To provide additional mitigation the available plant was reviewed in the LAPH Studies and approaches made to manufacturers on the availability of even quieter terminal equipment, termed "ultra quiet" in the LAPH Studies. Responses were favourable but the confirmation that the equipment had been manufactured and was performing within the claimed noise specification are still to be confirmed.

Due to the questions over the availability of "ultra quiet" plant this assessment has assumed "quiet" equipment when performing the noise modelling exercises. However, to provide a sensitivity analysis, runs using "ultra quiet" equipment were performed. The analysis suggested that adoption of "ultra quiet" container cranes [109.0 dB(A) to 105.0 dB(A)] and tractors [106.5 dB(A) to 105.0 dB(A)] would offer a 1.8 dB(A) improvement at the worst affected receiver - Discovery Bay (DB1) during the night-time at Phase IV.

External tractor units

One of the principal differences between the LAPH and these studies are the numbers of external tractors (normal road haulage vehicles) accessing the terminal. During the LAPH Studies and early assessment in this study a Sound Power Level (SWL) of 106.5dB(A) was used equating to a new, well maintained vehicle. Since external tractor units will not be under the direct control of the terminal operators it was proposed that a more conservative SWL would be used. This reflected a situation where the fleet of vehicles accessing the terminal are of a wider variety of ages and subject to different maintenance standards. The SWL for external tractors was therefore adjusted from 106.5 dB(A) to 110 dB(A).

A sensitivity analysis was carried out using the SWL of 110.0 dB(A) for external tractor units. The adoption of this higher SWL raised the impact at the most exposed NSR by approximately 1.1 dB(A) - Discovery Bay (DB1) during the night-time at Phase IV. Since the terminal operator has no control over the maintenance and operating characteristics of external tractors an SWL of 110 dB(A) has been adopted in this assessment.

Summary

Table 3.2 presents the terminal plant and vehicle listing with daytime and night-time utilization factors and numbers of vehicles operating at each berth. The sound power levels (SWL) of the equipment are the same as those adopted in the LAPH Studies save for the external tractor units, which have a higher SWL to reflect a less stringent maintenance programme. The "ultra quiet" equipment identified in the LAPH Studies has not been carried forward in the study due to questions over availability and "in-situ" operating characteristics.

Table 3.2 Terminal Equipment Utilization

Equipment	Utilization		Number per berth		Assumed SWL dB(A)
	Day	Night	Day	Night	Adopted
Container Cranes	100%	100%	3/4	3/4	109.0
RTGs	100%	75%	17	17	107.0
Barges	100%	-	1	0	112.0
Internal Tractors (running)	55%	55%	17	17	$106.5_{(1)}$
Internal Tractors (idle)	45%	45%	17	17	99.0
External Tractors (running)	17%	32%	105	59	110.0
External Tractors (idle)	34%	68%	105	59	99.0
External Tractors (parked)	49%	-	105	0	Nil
Forklift for Empties	100%	-	1/2	0	110.4

Notes: A. Sound Power Levels of terminal equipment obtained from the following sources:

o Container Cranes: Fax of 8 October 1993 from Hong Kong International Terminals (HIT) to Maunsell Consultants, stating "practically achievable" noise level for this piece of equipment. Matches monitored noise level obtained at HIT Terminal 7 in November 1992.

o Yard Cranes (RTGs): Fax of 8 October 1993 from HIT to Maunsell Consultants, stating "practically achievable" noise level for this piece of equipment.

o (1) Container Tractor: Derived from manufacturer's reported noise level (January 1993) of a Douglas Tugmaster NS8-220 tractor (for terminal and distribution operations) at full throttle.

o Barges/Lighters: "Technical Memorandum on Noise from Construction Work other than Percussive Piling", Table 3 (value for barge-mounted crane).

o Forklift : Derived from supplier's reported noise measurement for Boss BECH Empty Container Handler (April 1993).

3.2.4 BARRIER MITIGATION OPTIONS

Barriers in terminals CT10 & CT11

Noise attenuation barriers and bunds can provide very effective mitigation of noise by placing a physical screen between noise source and receiver. Noise barriers are effective in screening noise impact on low level sensitive receivers but less effective for elevated receivers which "look over" the barrier. The LAPH Studies identified a need to provide barriers at the western end of Phases I/II and III/IV to mitigate noise. In this study the increased activity in the terminals generate higher noise levels than those predicted in the LAPH Studies. It was therefore apparent that a taller barrier is required to provide additional mitigation. For engineering stability it is not possible to construct a noise bund higher than 25 metres above reclamation level, and this maximum barrier height has been adopted in the assessment. Early modelling indicated that a single noise barrier would not provide sufficient mitigation and a second scenario was investigated with a "second" noise bund between Terminal Phases I and II. Quantitative assessment suggested that incorporation of a second barrier has the effect of reducing the level of impact by up to 1.1 dB(A) - Discovery Bay (DB1) during the night-time at Phase IV.

Barrier in terminals CT12 & CT13

Additional barriers in Phases III/IV, of the LAPH configuration, offer additional shielding to noise sensitive receivers to the west. Though not shielding all activity the additional barrier which is assumed to be sited between berths 11 and 12, improved noise impact at the worst affected receiver by 2 dB(A) - Discovery Bay (DB1) during the night-time at Phase IV.

This study has not investigated engineering design for CT12/13. If sea bed conditions are similar to those experienced at CT10/11 additional space will be required to accommodate the noise wall. This would have the effect of reducing the number of berths and possibly creating groups of two or three berths between barriers. To simulate a worst case it was assumed that there is no reduction in the number of berths when barriers are added. Quantitative assessment suggests that the additional barriers have the effect of reducing impact at the worst affected receiver by 2 dB(A).

Summary

The EIA has carried forward the assumptions for 25 metre high bunds at the west end of CT 10, CT 11 and initially carried forward the concept of barriers at the west end and within Phases III/IV (CT12 and CT13). This assumption was modified when the alternative configuration of phases III/IV was adopted.

3.2.5 TERMINAL CONFIGURATION OPTIONS

A Re-oriented Phase III/IV

To improve the effectiveness of mitigation in phases III/IV a clockwise reorientation of the later phases of the terminals appeared to provide more effective shielding to the affected receivers in Discovery Bay. Quantitative modelling suggested that this arrangement is more effective at screening terminal noise to the NSR at Discovery Bay [upto 6.3 dB(A) at the worst affected receiver]. However, it is not as effective as the original configuration, at screening noise from the NSR at Peng Chau [impact increased by 0.8 dB(A) at Phase IV]. In addition, the arrangement of the terminal creates severe operating difficulties, the sharp turn from the dredged access channel into the berths of Phase III/IV would be difficult for ships to negotiate.

East Facing Terminal

The foregoing analysis investigated mitigation available for the west facing LAPH terminal, it is believed that the information presented has exhausted practical mitigation for a west facing terminal of this configuration. To test the effectiveness of an east facing terminal a shape was selected by the Steering Group and modelled. Adoption of an east facing terminal offered significant improvement in the noise impact on identified NSR over the west facing options. There are no exceedences of the planning criteria at Discovery Bay though the criteria was exceeded at Peng Chau in Phases III/IV and at the isolated receivers. However, the Consultants were advised by Government that this configuration raised major operational difficulties, since all container terminal traffic CT 10 - CT13, harbour and Pearl River traffic were using the same access channel with consequent congestion, safety issues and restrictions to future port development.

Reconfiguration of Phase III/IV

At this point the LAPH configuration was critically reviewed and an assessment made of the residual impact. The analysis suggested that there would be about 1773 flats subjected to noise levels in excess of the planning criteria when all four terminal phases are operating (1623 in Discovery Bay and 150 in central Peng Chau) To take full advantage of noise attenuation bunds in Phases III/IV the bund should be sited on the northern and western terminal boundary, which is not possible with the LAPH configuration. Phases III/IV were reviewed and an alternative configuration identified where Phase III occupied the position of Phases III/IV and phase IV was moved south to a position off Kau Yi Chau, identified as possible future extension in the LAPH Studies. Noise bunds were provided on the north and west edges of the terminal island, Phase III. The suggested residual impact with the amended configuration at Phase IV would be about 969 properties in Discovery Bay and 110 in central Peng Chau. In Phase III of the alternative configuration, the number of flats which would be subject to noise levels in excess of the planning criteria is estimated to be around 311 (211 in Discovery Bay and 100 in central Peng Chau). This represents a considerable improvement over the LAPH configuration under which the estimated number of affected flats is 1412 (1317 in Discovery Bay and 95 in central Peng Chau).

The layout of Phases I/II under the alternative configuration is the same as that of the LAPH configuration. The noise assessment indicated that there will be no residential properties affected in Phase I. The assessment suggested that there would be about 128 flats (118 in Discovery Bay and 10 in central Peng Chau) subject to noise levels in excess of the planning criteria in Phase II when CT 11 is in operation. Adjustment of the configuration does not influence the impact of Phases I/II (CT10 & CT11).

In both configurations there are a number of isolated properties at North Peng Chau and Fa Peng/Tso Wan which could be exposed to noise levels in excess of the planning criteria when four phases of the terminals are operating. In this study a conservative/best estimate was 6 at North Peng Chau and 35 at Fa Peng/Tso Wan. Further study is required to ascertain the exact number of properties which will be adversely affected and suitable mitigation. The exact numbers will depend on the derelict status of the properties at Fa Peng and the natural mitigation of protecting topography at north Peng Chau and Fa Peng/Tso Wan.

It should be noted that :

(i) The above is not strictly comparing like with like. The LAPH configuration differs from the adopted configuration in that the LAPH assumed no contribution from the CBA/CFS while the adopted configuration includes CBA/CFS contribution. Though the effect is small there is a notable increased impact at central Peng Chau for the alternative configuration.

(ii) The above can be considered only as a guide since it is based on interpolation of impacts predicted in a mathematical modelling exercise. At central Peng Chau this interpretation is complicated by topography and the built environment.

(iii) Though the footprint of the LAPH configuration is the one identified at the conclusion of the LAPH Studies there are a number of modifications to the terminal which has been modelled here. These changes include the increased throughput of containers, changes to the plant operating within the terminals and the incorporation of additional mitigation within the terminals (increased number and height of noise attenuation bunds).

Summary

The reconfigured Phase III/IV option was carried forward to the assessment due to operation difficulties which would be experienced with the re-orientated Phase III/IV, and the east facing terminal. The adopted configuration is shown in Figure 3.1.

3.2.6 CONCLUSION

In the operation phase assessment the following assumptions apply :

i) throughput of 2.0 million TEUs per terminal;

ii) amended numbers of vehicles at the terminals (this study);

iii) amended sound power levels for external vehicles accessing the terminals;

iv) bunds at the west end of terminals CT 10 and CT11;

v) bund height assumed to be 25 metres;

vi) reconfiguration of Phases III/IV; and

vii) noise bund assumed on the northern and western edge of Phase III.

3.3 THE RECLAMATION

3.3.1 INTRODUCTION

During the early part of this study it was assumed that the majority of material required for the reclamation of terminals would be supplied from a mega borrow area at Tsing Chau Tsai (TCT). The rate of extraction within the borrow area needed to meet programme requirements and concurrent construction activities raised air quality (dust) impacts within Pennys' Bay to levels in excess of the Air Quality Objectives (AQO). The Steering Group therefore instructed the consultants to assume that marine sand would be used for the reclamations of CT10 & CT11.

3.3.2 USE OF THE TCT MEGA BORROW AREA

The findings of the feasiblity study for the TCT Borrow Area EIA forms Volume II of this study. The conclusion of the EIA was that with concurrent operation of the TCT borrow area, ancillary works area and terminals there would be exceedence of the AQO within Pennys' Bay. The possibility of using a reduced output has been investigated and there appears to be an output level which could comply with the AQO. However, the use of mixed sources was not considered in this assessment.

Noise Issues

Use of marine sand removes the need for development of the mega borrow area at TCT. During the assessment for the TCT borrow area severe impacts were experienced at the isolated receivers identified in Fa Peng and Tso Wan. One of the basic assumptions for the borrow area was that limited 24 hour work would be required. Noise impacts are broadly similar for the land based and marine based fill options. If we consider only the peak noise levels noise impact predicted for the marine sand option are marginally higher. This is due to a larger number of vehicles being required to move surcharge material. If the TCT borrow area option is used it is envisaged that an operator would be able to make economic use of vehicles with a larger payload. Though individual vehicles have a higher sound power level, a smaller number of trucks is required.

Air Quality Issues

The key issue is that use of marine sand removes the requirement for the TCT mega borrow area where exceedence of the AQO were predicted if borrow area and terminal/backup area construction were carried out concurrently.

Water Quality Issues

The majority of the impacts from the terminal developments using rockfill from the borrow area on Lantau will be the same for reclamation using marine sand, since the basic design and layout of the terminals have not changed. The principle source of impact from the terminal developments would be suspended solids from dredging and reclamation activities, uncontrolled site runoff, sewage discharges and spillage. Impacts from dredging, sewage, contaminated mud and smothering of the benthic fauna of the area will remain the same regardless of fill source. The principal concern with the use of marine fill for the reclamation therefore, is the potential increase in suspended solids plus potential inputs from nutrients and metals.

Although the reclamation using rock fill will require a certain amount of marine fill, the volume is relatively small. Since the majority of the fines are introduced with the marine fill and the duration of fill activities is similar, the impact on suspended solids from marine fill will therefore be much greater than for the reclamation by rock fill. In the absence of modelling, our qualitative assessment of the impact from marine fill on suspended solids is that due to relatively low current velocities expected in the study area, impacts will tend to be localised at the study site. 'Acceptable' limits of increases in suspended solids are usually defined by EPD and an increase of 30% over background has been applied to other reclamation sites in Hong Kong. This performance specification is likely to be included in contract documents and it will be the contractors responsibility to maintain water quality within this limit. Other studies in Hong Kong have shown that this should not present a major hurdle to the progress of the works.

The magnitude of impacts due to nutrients and metals cannot be estimated at this stage as the physical and chemical characteristics of the marine fill are unknown. Nutrient levels were flagged as being of concern in previous studies which identified that the low current velocities and shallow waters of Discovery Bay, together with modified hydrodynamic characteristics caused by the physical barrier of the port development, left little scope for the immediate study area to assimilate additional nutrient loadings, due to accumulation of pollutants resulting from reduced flushing (WAHMO modelling runs performed for the Lantau Port and Western Harbour Development Studies EIA). Due to the lack of information on the chemical characteristics of the marine fill it has not been possible to evaluate the potential impact (if any) with respect to nutrients. If clean sand is used, it will be unlikely that there will be a problem with nutrients. However, if the fill contains a proportion of fines (mud) the potential for nutrient contamination will be dependent on the actual proportion of fines and the actual content of nutrients. It would be dangerous to assume an approximate nutrient content for the present assessment as this could lead to an erroneous conclusion, perhaps to the detriment of the project. Hence it is recommended that such information be sought once the borrow area has been decided upon.

3.4 TERMINAL CONSTRUCTION ASSUMPTIONS

3.4.1 INTRODUCTION

Construction will involve reclamation from the sea and subsequent development of the port structure and container berths. An advance works contract will provide land access to the CT10 and CT11 sites, subsequent construction of the terminals is likely to proceed simultaneously. This EIA considers a single reclamation scenario where material is sourced from a marine borrow area. The actual location of the marine borrow area is to be confirmed and would be subject to a separate EIA.

Marine mud beneath the reclamation will, for the most part, be left in-situ and its consolidation will be accelerated using wick drains. The exceptions are a dredged trench required to form the southern quay foundations and only a small part of the northern edge structure which is exactly adjacent to the access channel, which will be dredged to facilitate the early stabilisation of the slope. The average finished level of the reclamation will be +5.6mPD and it is assumed that each of the terminals will incorporate noise walls, which are required to shield sensitive receivers to thewWest.

3.4.2 CONSTRUCTION PROGRAMME

The proposed implementation programme for Stage 1 commences with the advance works contract assumed to last 18 months. CT10 and CT11 developments are envisaged to start in April 1996 subject to the completion of the necessary government and statutory procedures. Reclamation works and construction of the quay will proceed concurrently.

Commissioning of the first CT10 berth is expected in October 1998 with the other berths following at 9 month intervals. CT10 would be fully operational at the end of the year 2000. The first of the CT11 berths would be completed in August 1999, assuming that CT10 and CT11 are constructed in parallel. CT11 would be completed in March 2001.

3.4.3 CONSTRUCTION METHODOLOGY

The construction methodology identified by the design team has made a number of assumptions:

- marine mud will, as far as is possible, be left in place;
- work starts at the western end of each terminal and moves progressively to the east; and
- reclaimed access from Lantau Island to the terminal will be formed as advance works.

It is assumed that the construction of the terminals will require a 16 hour working day, 6 days per week. It is noted that construction activities after 19.00hrs and before 0700 hrs and on Sundays or public holidays will require the issue of a Construction Noise Permit (CNP). The issue of a CNP, by the Environmental Protection Department, requires that a contractor submit an application which demonstrates that the equipment proposed will meet the Noise Control Ordinance (NCO) criteria, in accordance with the methodology laid down in the Technical Memorandum (TM). The TM identifies the criteria to be adopted for evening (1900 - 2300 hrs) and night-time (2300 - 0700 hrs), with night time requirements being the most stringent. There are no daytime (0700 - 1900 hrs) criteria though advisory criteria are identified which are used in this study. The issue of a CNP allows construction activity to carry on during the evening and night-time only if precautions are taken to limit construction noise within defined limits. If the contractor violates the CNP requirements the right to work can be withdrawn. The engineering design team for this study have identified a 16-hour working day as being a reasonable basis for constructing the terminals. Restricting the contractor to a 12-hour day would result in delays to the programme at a considerable cost in terms of inefficiency and disbenefits. It is anticipated that there would be a delay in commissioning the first berth by 7 months and the first terminal by 10 months.

Advance Works

Reclamations for the advance works contract will form a 25 ha area extending south from Chok Wan Tsui and Penny's Bay providing land access to the CT10 and CT11 work sites. The CT10 and CT11 works areas will be accommodated on the advance works reclamation.

Entrustment

To support each terminal reclamation of 80 ha of land, it will be necessary to reclaim an area of 160 ha to provide for the required 1 in 15 stable slopes and temporary seawalls. It is proposed that the extended reclamations are built by the terminals developer(s).

Access To Penny's Bay

To maintain access to Penny's Bay an access channel will be left between CT11 and backup area reclamations. This will create an embayment within Penny's Bay and would be required to remain open if barge access was required to service quarry activity in the TCT borrow area. The access channel at Sz Pak Tsui will be 175 m wide and -5.0 m PD deep.

3.4.4 CONSTRUCTION TECHNIQUES

RECLAMATION

The existing sediments will be covered with a geotextile layer of matted plastic. The filling of the area will begin remote from the edge while the seawall is being built. Due to the nature of the underlying sediment, the sand will initially be pumped into the area in 1 m layers. When the fill reaches 2 m in depth, wick drains will be driven into the fill and underlying mud in a triangular grid over the whole area at distances of 1.5 m apart. The wick drains will quickly remove interstitial water expelled from the sediments during consolidation. The filling will then continue in 1 m layers until there are 4 m of fill, after which filling will progress in 2 m layers. Rainbowing will be used to infill the area once the filling is above the water level. The slopes at the edges of the layers are required to be no greater than 1:15.

The sand will be transported from the marine borrow area by trailer suction dredgers, and will be bottom dumped into rehandling basins. The cutter suction dredgers will then lower a suction head into the sediment and it will be pumped into the reclamation area to reduce disturbances to the marine foundation layer. If the sand has to be pumped further than 1.5km, boosters will be used to assist the pumping. The pumped sand will consist of 50 percent marine sediment from the marine borrow area and 50 percent water, required to liquify it so that it spreads evenly.

The trenches dredged for the seawalls will probably serve as temporary rehandling basins for the marine sediment. The trench will generally be dredged 200 m ahead of the wall construction, therefore, the rehandling basin will be moved as the wall construction advances.

Table 3.3 Marine Sand Requirements

Development Stage	Marine Sand Required for Reclamation of Entire Area (Volume-Million m^3)
Advance Works	12.1
CT10	45.0
CT11	23.61
Total	80.71

Southern Edge/Quay Wall Structure

The southern edge\main quay structure is common to both terminals and will comprise two distinct units, a seawall and an associated "deck" founded on steel piles. A cross section is shown on Figure 3.2: Southern Edge/Quay Wall Structure. For stability purposes the seawall, which forms the southern edge structure, will be constructed above a trench dredged to a firm foundation. The trench will be filled with general fill with the seaward side protected by armour material, either 12.0 tonne rock blocks or 6.0 tonne *Tetrapods*, (shaped precast concrete units), to dissipate wave energy and protect the reclamation from erosion. A vertical precast concrete block wall will be constructed to retain the reclamation material.

Tubular steel piles, driven through the sloping seawall will support a precast concrete deck. The deck will carry the container cranes which run in an east west direction, container ships will moor to the deck.

Preliminary design of CT10 and CT11 quay wall assumes removal of marine mud from the terminal access area. A 650 metres wide trench will be dredged to a minimum depth of -14.4 m CD adjacent to the southern quay wall as part of the ancillary works programme.

Western Edge Structure

The western edge structure of CT10 and CT11 will incorporate the noise and visual screening bund +30.6 m PD high. A cross section is shown on Figure 3.3 : Western Edge Structure. There will be no dredging to support these structures, a geotextile membrane will be laid on the marine mud and backfilling from marine plant and end-tipping from trucks will form the reclamation. Wick drains will be used to speed consolidation of the fill material. CT10 earth bund will be constructed behind a temporary rock wall which will be replaced by CT11 developments. The western edge of CT11 will require a permanent seawall constructed from 1.0 - 2.0 tonne rock armour.

Temporary Northern Edge Structure

The northern edge of CT11 will be built to provide temporary protection to the reclamations prior to completion of the adjacent back up area and associated works reclamations. The construction technique will be similar to that adopted for the western edge structure, incorporating geotextile, backfilling and wick drains and a rock seawall with a slope of 1 in 15. An area adjacent to the Penny's Bay access channel will be dredged to support a steeper CT11 reclamation slope.

3.5 TERMINAL OPERATION

3.5.1 GENERAL OPERATING TECHNIQUES

Tasks associated with the normal operation of the terminals are outlined in this section. Port activities are assumed to continue 24 hours a day.

- o Container ships will arrive at the berth and moor alongside.
- o Rail mounted dedicated container cranes will load and unload containers from berthed ships onto container trucks
- o Containers are stacked in lines within a holding area behind the berth. Transtainers carry out the container stacking and retrieval. In addition to the transtainers, forklifts can be used to manoeuvre empty containers in the stacks.
- o External trucks access the terminal to deposit and collect containers queuing areas will be provided at the rear of the terminal with associated security and control systems.
- o Barges working between berthed container ships may be used to ferry off-loaded containers to waiting lighters.

3.6 SUMMARY

3.6.1 INFORMATION CARRIED FORWARD TO THE EIA

Two fundamental changes have been made to the LAPH Studies output, they are :

i) adjustment of the terminal configuration; and

ii) an amended source of borrow material for reclamations.

Both adjustments have been made to mitigate environmental impacts identified during this study. At the outset amendments were made to the operating character of the terminals, based on the operating character of existing HK terminals. The changes resulted in higher levels of impact at NSR, which were deemed to be unacceptable and mitigation to the LAPH shape was pursued. Though mitigation improved impact it was unable to satisfy the required criteria and additional mitigation, in the form of an adjusted configuration was made.

This study represented the first quantitative assessment of impact of the mega borrow area on the Tsing Chau Tsai peninsula. The EIA study identified exceedence of the Air Quality and Noise criteria for the extraction rates required to meet the construction programme. Mitigation was identified but had serious programming implications and an alternative reclamation material source was identified by the Steering Group.

Terminal Information

i) The assessment will assume a west facing terminal configuration. Phases I/II (CT10 & CT11) will be in the position identified in the LAPH Studies. Phases III/IV will be adjusted, with Phase III occupying the old position of Phases III/ IV and Phase IV moved south to Kau Yi Chau, identified as possible future in the LAPH Studies.

ii) Noise bunds used in preference to structural barriers, height increased to 25 metres above berth level. An additional bund required between CT10 and CT11. Noise bund assumed on the north and west side of terminal CT12.

iii) Updated throughput of 2.0 million TEUs per terminal used and internal equipment utilisation updated to correspond to existing HK terminals. Modifications to Sound Power Levels for external tractor units accessing the terminals.

Reclamation Material

It is assumed that reclamation material will be supplied from a marine sand resource. The location is undecided and EIA investigation of the source and updating of the findings of this study will be required.

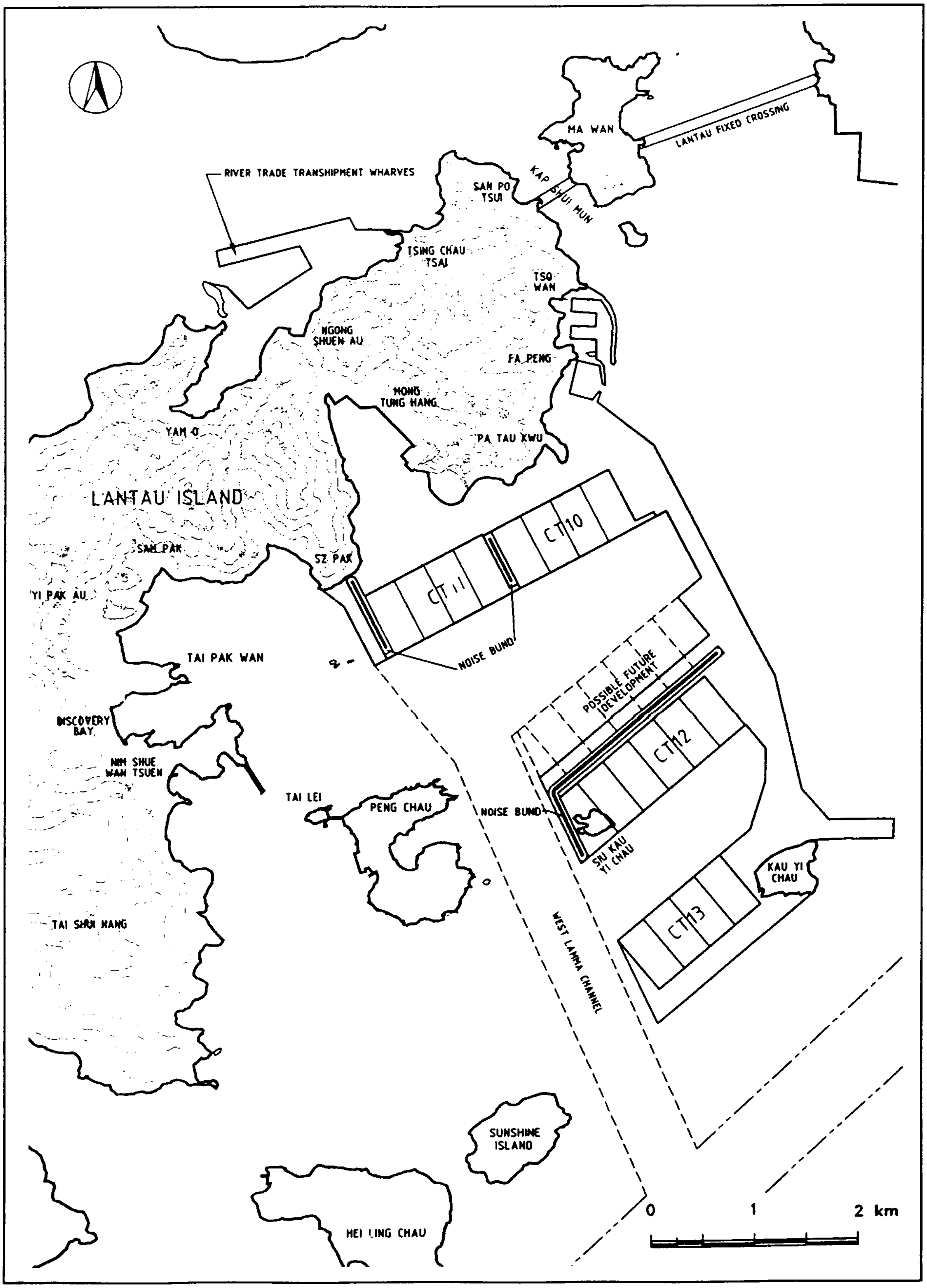

Figure 3.1 New Port Layout

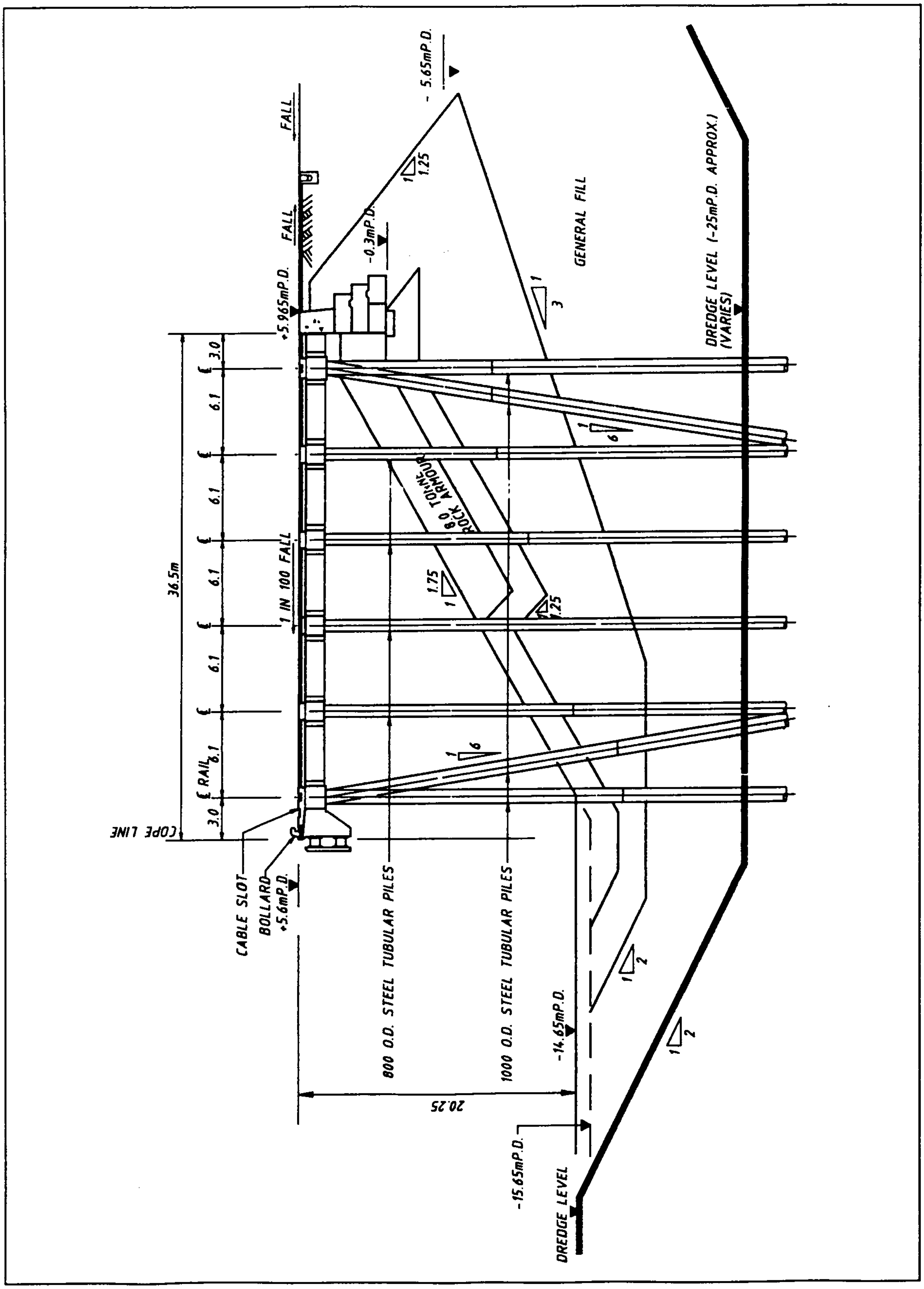

Figure 3.2 Southern Edge Structure

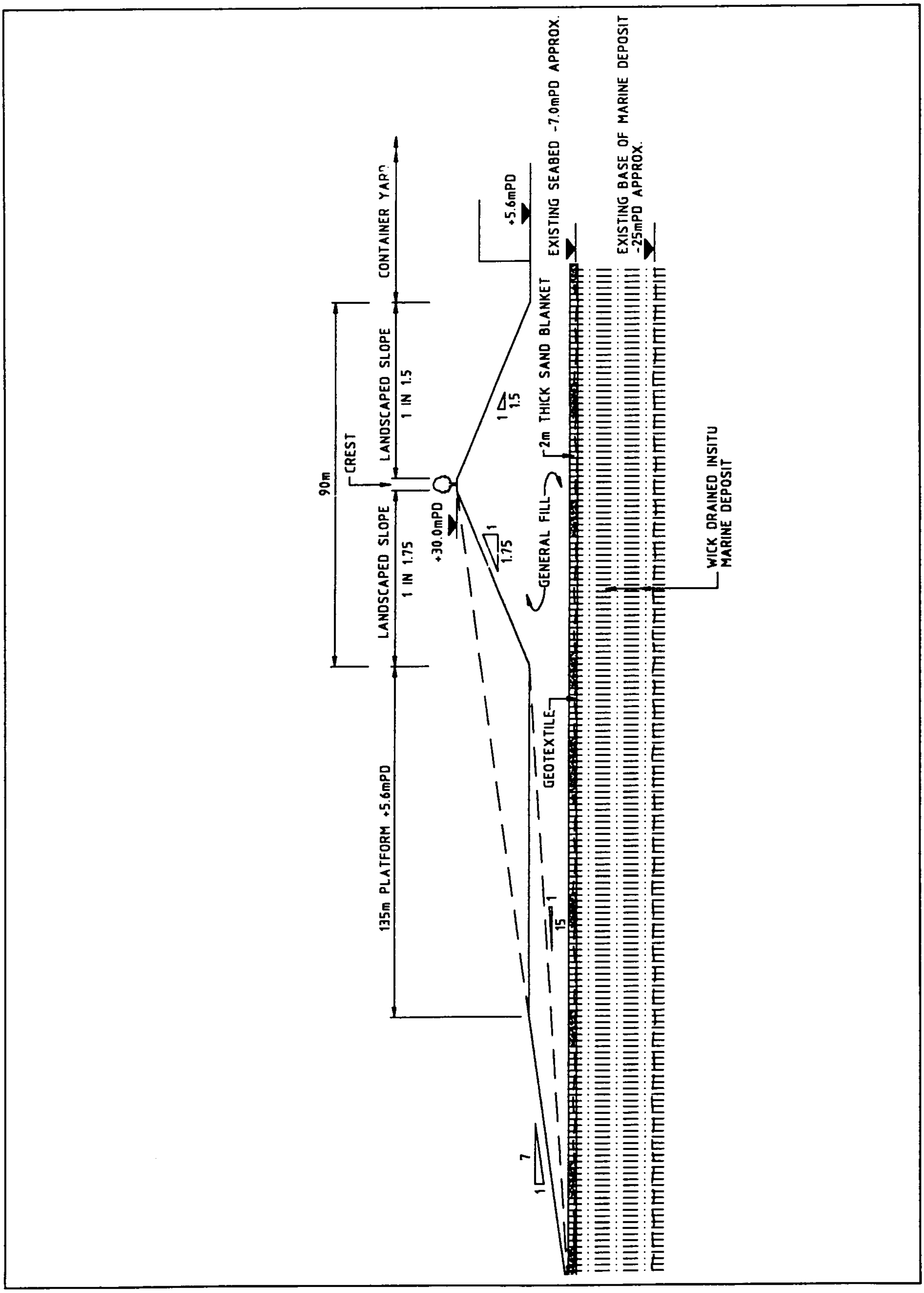

Figure 3.3 Western Edge Structure