



2/020.2/92

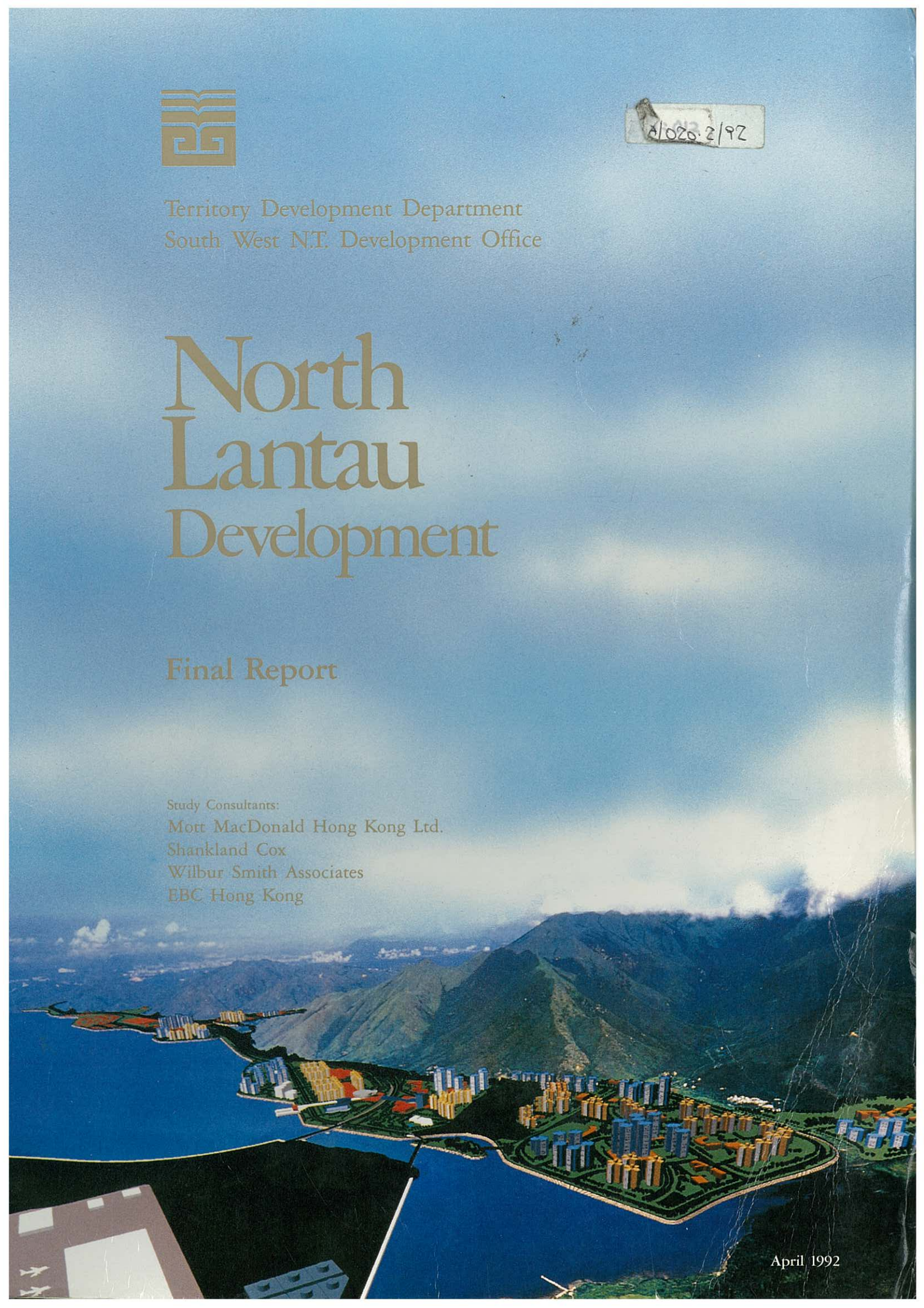
Territory Development Department
South West N.T. Development Office

North Lantau Development

Final Report

Study Consultants:
Mott MacDonald Hong Kong Ltd.
Shankland Cox
Wilbur Smith Associates
EBC Hong Kong

April 1992





Territory Development Department
South West N.T. Development Office

North Lantau Development

Final Report



Preface

The North Lantau Development Consultancy commenced on 1 August 1990. The principal strategic objectives were to plan a New Town to fill the role of an airport support community, to ensure it was provided with adequate road and rail links, and if necessary, to provide facilities to meet territory wide land-use requirements for housing and industry. The area of North Lantau within which these facilities were to be provided was clearly defined (as shown in Figure 1.3 of this Final Report) although this was considered as providing a guideline boundary only. The more detailed goals and objectives of this study and the way in which they were appraised and evaluated are summarised in the main body of this report. They cover planning, environmental, transport and engineering issues.

The Study has developed a Recommended Outline Development Plan for the New Town on North Lantau, together with detailed layout plans for the works required in the First Phase of development, up to 1997. By late March 1992, detailed design of the First Phase was well advanced and the initial land formation contracts let. The overall timetable for creating the Airport Core Facilities on North Lantau has meant that detailed engineering design has taken place for certain facilities (particularly the North Lantau Expressway and proposed Airport Express Line) in parallel with the development of final town plans. In the vast majority of cases the Hong Kong Planning Standards and Guidelines have been fully met in order to ensure the New Town will have a design layout and environmental conditions compatible with its importance as the 'Gateway to Hong Kong'.

This summary gives a brief synopsis of the main aspects of the Study and sets out the principal findings and recommendations. Much greater detail can be found in the following Final Report and in the wide range of supporting documents produced during the course of the Study. In conclusion, the summary provides a list of the major on-going issues which may have an impact on the recommendations given in this report. These issues are still under discussion within Government and further assessment of their implications on the RODP may be necessary at the appropriate time.

1. The Main Findings of the Study

The realisation of the development potential of North Lantau is proposed by the development of a new town in Tung Chung and Tai Ho with a total population of 200,000 at 2011. There is potential for further urban growth beyond 2011 to a population of 260,000.

This population would be supported by the proposed external transport infrastructure comprising the North Lantau Expressway (NLE), the Airport Express Line (AEL) and Lantau Line (LAL) providing efficient transport links to main urban areas of Hong Kong and the New Airport and possible upgraded road links to South Lantau.

A programme of implementation is recommended to ensure the first phase development population of 20,000 is accommodated within both public and private housing. Later stages of development are proposed in an on-going development programme which allows for the progressive build-up of population.

The total cost, at December 1991 prices, of formed and serviced land is estimated to be HK\$15,552 million and the revenue from the sale of land to

be HK\$22,344 million, that is a surplus of HK\$ 6,800 million. This provides serviced land for the residential, employment and social requirements for the New Town up to the year 2011.

Parts 2, 3 and 4 of this Summary cover the Recommended Outline Development Plan, the supporting plans and implementation requirements respectively. Part 5 outlines on-going issues which may affect the RODP at some future time.

2. Recommend Outline Development Plan

2.1 Development Requirements

The North Lantau Development is planned to accommodate 200,000 people together with the provision of jobs and appropriate community facilities by the year 2011. Beyond 2011, eventual expansion to a population of 260,000 is envisaged. The population would comprise residents of permanent high and low density housing, government quarters, institutional and community accommodation and existing village settlements and would be accommodated in two discrete urban development areas at Tung Chung and Tai Ho within the Recommended Outline Development Plan (RODP) area shown in Figure 7.1.

The distribution and subsequent land requirements for housing have been based on an assessment of affordability and demand. In the New Town about 54 percent of the population would live in public rental and Home Ownership Scheme housing. The remainder of the population would live in private housing. A total of 216 ha is provided for all forms of housing in the RODP.

The industrial strategy for North Lantau aims to satisfy, as far as possible, the demand for airport-related

industrial and commercial activity and is based principally on the findings of the Study of Industrial and Commercial Enterprises Needing Relocation at the Airport (SICENRA). It is considered undesirable to provide for other industrial activity on North Lantau as this would compete with airport-related uses for transport capacity and labour. Four development projects are proposed to satisfy airport-related industrial and commercial demand. The first of these, the office/hotel complex would be located in the Town Centre in Tung Chung. The Industrial Park would be located at Tai Ho East. The location of the Cargo Village (28 ha in 2011) and Business Park (27 ha in 2011) at Chek Lap Kok has been considered further in the Study of Airport Related Activities (SARA) by the Provisional Airport Authority.

Estimates of the land requirements for all other uses, including community facilities, open space, recreation and utility infrastructure have been determined and provided for in the RODP.

The required retail floorspace for the planned 2011 population of 200,000 has been estimated at 320,000m² gross floorspace. This would be distributed approximately 30 percent in the Town Centre, 20 percent between the two District Centres and 50 percent within local residential areas.

2.2 Urban Form

The town would comprise two discrete urban development areas. These are at Tung Chung and Tai Ho, with proposed populations of 150,000 and 50,000 respectively by 2011 and the capacity to expand to about 180,000 and 80,000 respectively post 2011. All residential areas in the town include a range of housing types comprising public, private and Home Ownership

Scheme housing. The main industrial area would be located at Tai Ho East, with the Cargo Village and Business Park located at Chek Lap Kok.

To reduce the impact of the NLE/AEL corridor on the New Town, the road and rail infrastructure will be kept at grade, where practicable, and incorporated within a landscaped reserve. Three interchanges are provided to the development areas, one at Tai Ho and two at Tung Chung. The main distributor road network would be kept to the periphery of the town to minimise the effects of major roads on residential areas. The route of the LAL through the New Town and the number of stations would aim to maximise rail usage. The LAL is proposed to run at-grade (or depressed) through the town with adequate measures adopted to minimise visual and noise impacts.

Development areas not close to the LAL stations would be served by public transport in the form of buses, green mini buses and taxis. Public transport termini would be located in the Town Centre, the District Centres, and at the edge of the town to serve the hinterland and South Lantau. Ferry services would provide links between the New Town and other urban areas.

The distribution of land uses should be planned to ensure that facilities in the Town Centre and District Centres, which incorporate the LAL stations, would be within easy walking distance by the maximum population of the town. Roads serving the districts should be designed to restrict unnecessary traffic movement in residential areas. Industrial areas would be located on the periphery of the town so as not to compromise the environmental quality of residential areas or generate industrial traffic movements through residential areas.

Private RI housing and commercial developments in Tung Chung and Tai Ho are concentrated in the Town Centre and District Centres, each incorporating a LAL station and public transport terminus. Housing development adjacent to the LAL stations in the Town Centre and District Centres would be developed to higher densities than comparable housing elsewhere in the New Town. The four public housing estates proposed for the town are sited adjacent to either the Town Centre or one of the District Centres. Sites for Home Ownership Scheme housing are proposed adjacent to public housing estates. Low density R2, R3 and R4 housing areas would be located on the edge of the urban development area and be served by buses.

The existing village settlements directly affected by development of the New Town would be relocated to the periphery of the proposed urban areas with buffer zones of open space provided between these settlements and the proposed urban developments.

The retail and commercial uses would be distributed in a hierarchy of centres comprising a Town Centre, District Centres serving Tung Chung and Tai Ho and local centres within housing areas. The Town Centre provides the retail, commercial and cultural core of the New Town.

The main industrial area is located at Tai Ho East and is planned to accommodate the Industrial Park, the railway depot and a solid waste transfer station. A site is included for a possible aviation fuel storage facility. The location of the Cargo Village and Business Park at Chek Lap Kok is considered further in SARA.

A comprehensive pedestrian and cycle network would link the main

development areas with the seafront areas and the rural hinterland and pass through public open space. A visual corridor of open space would be created in Tung Chung focusing on a new Tung Chung Bay to the east of Chek Lap Kok to avoid the New Airport visually dominating the landscape of the town. This would have a secondary function of allowing a breezeway through the town. The recreational and amenity potential of the seafront would be enhanced by extending the seafront promenade through the town along the major drainage channels. The integrity of the urban area in Tung Chung has been reinforced by providing a physical buffer in the form of a Sea Channel between the New Town and the New Airport.

The open space for the town would comprise a hierarchy of town, district and local open spaces, all easily accessible to the residents by a system of traffic free pedestrian routes developed through the town to the rural hinterland areas. The Town Park of 19.3 ha comprises the three retained Tung Chung knolls, the Sea Channel island and the waterfront promenade below the Tung Chung Battery as well as a major recreational complex on Government/Institutional and Community (G/IC) land and adjoining district open space adjacent to the Town Centre. Grade separated footpaths and cycleways link the Town Park to the central spine of open space through the New Town, adjacent housing developments and the Town Centre. A man made island in the Sea Channel would form part of the Town Park and would be connected to it by pedestrian footbridges. An artificial lake, formed by retaining the embayments created by reclamation works for the NLE at Tai Ho and a seafront park, would provide the major open space at Tai Ho.

G/IC facilities have been provided for a wide range of community needs, including education, health, social welfare, cultural facilities, transport and recreation. Most facilities are provided in discrete G/IC zones, although some, including kindergartens, primary schools, community centres and health clinics are located in public housing estates.

2.3 Land Budget

The Recommended Outline Development Plan comprises a land area of 3895 ha of which 815 ha is required for the New Town. Of the total land area in the town, 26 percent is for residential use including village developments, 13 percent for industrial, 11 percent for open space, 4 percent for G/IC uses, 26 percent for roads and the NLE/ARL reserve, 6 percent for drainage channels and the sea channel and 14 percent for other specified uses. Outside the New Town, the existing and proposed uses are covered by separate urban fringe proposals.

2.4 Urban Design

The urban design principles used in preparing the RODP aim to establish a sense of order to the future built environment and ensure that this form respects and responds to the natural setting and reinforces the planning structure of the New Town.

These principles, have been applied at two levels. Those that impact on the physical structure of the New Town and those that determine the physical form of buildings and spaces, and the relationship between buildings and spaces, within the various development zones of the New Town.

The main urban design considerations used in developing the RODP were:

- o Siting the town in two separate valleys leading down into bays which will be reclaimed to contain the two main urban development areas linked by a narrow strip of coastal reclamation.
- o Retaining important landmarks to provide the framework for an attractive urban form.
- o Creation of visual corridors to maintain visual separation between the New Airport and the New Town;
- o The incorporation of the NLE/AEL corridor as an integral part of the development of the New Town by placing it in an at-grade landscaped corridor through the town and the creation of a strong visual element spanning it.
- o The provision of a comprehensive and convenient pedestrian and cyclist network segregated from vehicular traffic.
- o Maximising population within easy walking distance of LAL stations with greatest density of development located adjacent to these station areas,
- o Creation of “activity nodes” at the Town Centre and District Centres.
- o The recommendation that buildings should be point blocks rather than slab form to facilitate air movement and retention of views, and be varied in height and setback from development boundaries in order to minimise the potential “tunnel” or “wall” effect in these areas.

3. Supporting Plans

3.1 Environmental Considerations

Many of the direct environmental impacts of the NLD have been overcome as a result of ongoing interface with the requirements of planning and engineering design.

Detailed environmental impact assessments for each component of the RODP are strongly recommended in order to minimise the overall impact of the New Town development and to maintain the high standards required.

The primary objective of producing a high quality living environment while minimising the impact on the natural environment has largely been achieved.

3.2 Engineering

The majority of materials required for land formation will go into reclamation. Consequently, methods of reclamation which leave the marine mud in place will be adopted wherever possible. This will be cost effective and will help to reduce problems of marine mud disposal. Establishment of separate disposal zones for mud and public dumping within the areas designated for long term development will offset demand for filling materials. The adoption of PFA in landfill will further conserve filling resources.

Wave climate and the latest findings from Royal Observatory on extreme water levels were used in determining a minimum crest height of seawall of 5.5m PD. Taking into account the rise in sea level due to the greenhouse effect, the minimum reclamation level was also set at 5.5m PD.

The large catchment areas to be drained through the New Town are efficiently

collected into a number of main channels and box culverts. The main channels have been incorporated in to the town plans to achieve a high quality recreational amenity whilst reclamation areas have been kept free of obstructions by the use of underground box culverts. A Sea Channel preserves the tidal flow through the strait between the New Airport and Tung Chung forming a buffer between airport related development and the New Town.

The optimum arrangement of road and rail design considered the most cost effective balance of land use, engineering and environmental factors. Significant issues were the form of the Tai Ho interchange, the LAL alignment and the alignment of the access to the New Airport.

The New Town will be fully supported by utilities and public service facilities including a sewage treatment plant and refuse transfer station.

3.3 Transport Issues

The main access routes to North Lantau Development incorporate road, rail and ferry services. The North Lantau Expressway (NLE) and Road P1 provide a total of dual five-lane capacity between the New Town and external Lantau crossings. The Lantau Line (LAL) will provide rail access to the New Town via stations in Tung Chung and Tai Ho. A Ferry service will also be provided in Tung Chung.

The NLD is linked to the Airport via Roads P1 and P2. No local traffic travelling to/from the New Airport can use the NLE. This is to eliminate any weaving sections on the NLE and to maintain high traffic standards on this important strategic route. It is assumed that Road P1 will ultimately extend to the Port Peninsula, thereby

providing, in the event of a major incident on the NLE, a parallel "relief" road.

Three key public transport stations are proposed within the North Lantau Development to give residents maximum accessibility to commercial/ industrial areas and external transport modes. A network of pedestrian ways and cycle tracks is planned to provide convenient access to prominent recreational features, ensure pedestrian safety and facilitate vehicular traffic movements. All facilities are grade-separated across all primary, distributor roads and most district and local distributors.

The new development is to be linked to South Lantau by public transport services on an upgraded Tung Chung Road. A lay-by area is planned at the Tung Chung Road entrance to the Country Park to accommodate weekend recreational travellers.

3.4 Landscape

The proposed Landscape Master Plan comprises a landscape framework embracing the New Town open space areas, urban fringe, major transport corridors and the rural hinterland. Landscaped footpaths and cycleways would link these open spaces and provide ready access to the extensive seafront promenade. The existing coastal knolls at Tung Chung and Tai Ho as well as lowland woodland particularly Fung Shui woodland associated with existing villages, are important landscape elements. These will be retained within the urban fabric of the New Town. A comprehensive planting scheme is proposed to supplement and extent the upland, urban fringe and knoll woodland by reforestation into and throughout the urban area with structure planting along major roads and pedestrian/cyclist routes.

3.5 Recreation

The recreation facilities in the RODP have been provided in accordance with the provisions of the Hong Kong Planning Standards and Guidelines. These include indoor and outdoor sports facilities, and passive recreation areas in the town and hinterland areas.

A number of indoor recreation centres are located central to population catchments either within public housing areas or in G/IC or open space areas adjacent to housing developments. Outdoor sports facilities have been allocated to district parks. Other smaller facilities are distributed between district parks and local open spaces in housing areas. Passive recreation facilities are proposed throughout the town and in rural hinterland areas.

Major recreational facilities include a sports stadium located adjacent to the Town Park in the central open space spine which runs through Tung Chung, and a swimming pool complex near the Town Centre.

3.6 Rural Hinterland

The rural hinterland is expected to come under considerable pressure from New Town residents for passive recreation pursuits. Proper management and legislative controls are required to prevent misuse of the urban fringe and eventual deterioration of the rural and upland areas. Proposals include the extension of the existing Country Park boundaries, zoning of urban fringe areas as Greenbelt, Rural Protection Area, Conservation Area or Urban Fringe Park and inclusion of a Recreation Priority Area at the head of the Tung Chung valley for a future golf course development. Improved access to the Country Parks will be necessary and the provision of a cable car link from the Town Centre to Ngong Ping is proposed. Both the golf course and

cable car proposals would be subject to further detailed study. Village concept plans have been prepared to allow for village expansion and provision or improvement of basic infrastructure.

3.7 Existing Settlements

In developing the RODP, the principle of retaining as many as possible of the existing villages in-situ has been adopted. Villages and other settlements directly affected by development are recommended to be re-sited to the periphery of the planned urban area into designated village re-site areas. These settlements include Tai Po (affected in the early stages of development by the North Lantau Expressway Phase 2), Wong Nai Uk, Ma Wan, Ma Wan Chung, Sha Tsui Tau and Fong Yuen.

Where existing settlements are not affected by New Town developments, and in areas designated as village resites, concept plans have been prepared to allow for future village expansion requirements and upgrading of infrastructure. Identification of village expansion areas and village re-site areas has taken account of land tenure, geotechnical constraints, land gradient, accessibility, Fung Shui requirements and villager preferences, where known.

4. Implementation

Land formation and the provision of infrastructure will be implemented in accordance with the development programme prepared by the South West New Territories Development Office. Open space and community facilities will be constructed by the appropriate government offices on the basis of their relevant programmes. Public rental and home ownership housing schemes together with their associated facilities will be built by the Housing Department in accordance with the Public Housing Development Programme.

Private development will be regulated by the Buildings and Lands Department's Land Sales Programme. Detailed layouts and, if required, control drawings will be prepared for the major residential and industrial sites to facilitate the drawing up of lease conditions and disposal of sites.

Implementation of the development of North Lantau Development is co-ordinated by the South West New Territories Development Office and is grouped into a number of packages so that each package or stage of development of the New Town is a balanced development in terms of the provision of major facilities and infrastructure.

The development of the town is proposed in four phases which relate to population thresholds. The First Phase of the New Town is at Tung Chung and accommodates a population of 20,000 in a mix of public rental, home ownership scheme and private housing developments. Community facilities including primary and secondary schools, a community centre, a health clinic and active and passive open spaces are provided. Facilities for police and emergency services are also provided. Infrastructure to support the population includes roads, a transport interchange and utility installations. The timing of part of Phase II may be advanced, pending agreement between Government and MTRC to allow a comprehensive development of Tung Chung Town Centre.

5. Further Actions

On completion of the North Lantau Development Study, a number of issues were ongoing which may have impact on the form of the RODP.

Tung Chung Town Centre Study

Negotiations between the MTRC and government about the form of the LAL (Tung Chung section) railway and associated property development package has led to an agreement by MTRC to undertake the Tung Chung Town Centre Study. The output of this study may impact on the RODP.

Phase I and II Public Housing Development

A draft planning brief for Phase I public housing development was approved by Housing Department's Project Design and Review Committee. Consideration is being given by Housing Department to advancing Phase II public housing developments by two years. Detailed planning layouts should be prepared to facilitate preparation of planning briefs to allow the advancement of Phase II public housing developments.

Interface with the Study of Airport Related Activity (SARA)

The demand for, and distribution of industrial land on the North Lantau as shown on the RODP is based on the findings of SICENRA and the Industrial Land Development Strategy (ILDS). This may be affected by the recommendations of SARA. Following endorsement of the SARA Final Report, further study of industrial land requirements and distribution on North Lantau should be undertaken.

Aviation Fuel Pipeline

The Provisional Airport Authority (PAA) has confirmed their preference for supplying aviation fuel to the New Airport by pipeline running through North Lantau Development. This may pose severe physical planning and environmental constraints on future new town developments.

NORTH LANTAU DEVELOPMENT STUDY

FINAL REPORT

VOLUME I

CONTENTS

	Page
PART 1 BACKGROUND	
1. INTRODUCTION	
1.1 Background to the Study	1-1
1.2 The Study Area	1-1
1.3 The Overall Scope of the Study	1-2
1.4 Other Studies	1-2
2. CONTEXT 2.1	
2.1 Introduction	2-1
2.2 Development Opportunities	2-1
2.3 Future Population and Employment Base	2-1
2.4 Transport Issues	2-1
2.4.1 General	2-1
2.4.2 Road Network	2-1
2.4.3 Rail Transport	2-2
2.5 Interface with the New Airport	2-2
2.6 Relationship to the Rest of Lantau	2-3
PART 2 DEVELOPMENT FRAMEWORK	3-1
3. GOALS AND OBJECTIVES	3-1
3.1 Introduction	3-1
3.2 Goals	3-1
3.3 Objectives	3-1
4. CONSTRAINTS	4-1
4.1 Introduction	4-1
4.2 Topographical	4-1
4.3 Geotechnical	4-1
4.4 Existing and Committed Development	4-1
4.5 New Airport Aspects	4-2
4.6 Environmental Constraints	4-2
4.6.1 Introduction	4-2
4.6.2 Environmental Standards and Guidelines	4-2
4.7 Noise	4-4
4.8 Water Quality	4-5
4.9 Air Quality	4-6
4.10 Sewage Arisings	4-7
4.11 Solid Waste Disposal	4-8
4.12 Landscape and Visual Issues	4-8
4.13 Ecology	4-9
4.14 Winter Shadow	4-9
4.15 Classification of Constraints and Opportunities	4-9

	Page
5. DEVELOPMENT REQUIREMENTS	5-1
5.1 Introduction	5-1
5.2 Housing	5-1
5.2.1 Initial Population Targets	5-1
5.2.2 Affordability Analysis	5-1
5.2.3 Land Requirements	5-3
5.3 Employment	5-3
5.3.1 Employment Structure	5-3
5.3.2 Employment Distribution and Land Requirements	5-4
5.4 Commercial Requirements	5-4
5.4.1 Method of Assessment	5-4
5.4.2 Commercial Facilities	5-5
5.5 Government/Institutional and Community Uses	5-5
5.5.1 Overall Requirements	5-5
5.5.2 Education Facilities	5-5
5.5.3 Medical and Health Facilities	5-5
5.5.4 Police, Fire and Ambulance Services	5-6
5.5.5 Community and Social Welfare Facilities	5-6
5.5.6 Cultural and Government Administration	5-7
5.5.7 Recreation	5-7
5.5.8 Parking	5-7
5.5.8 Other Requirements	5-7
5.6 Open Space	5-7
6. DEVELOPMENT CONCEPTS	6-1
6.1 Introduction	6-1
6.2 Potential Development Areas	6-1
6.3 Land Use Strategy	6-2
6.3.1 General Approach	6-2
6.3.2 Transport Infrastructure	6-2
6.3.3 Land Drainage System	6-3
6.3.4 Land Use Strategy	6-3
6.4 Initial Concept Plans	6-3
6.4.1 Derivation of the Plans	6-3
6.4.2 The Plans	6-3
6.5 Concept Evaluation	6-4
6.5.1 Evaluation Method	6-4
6.5.2 Evaluation Summary	6-8
6.6 The Preferred Concept Plan	6-9
6.6.1 Introduction	6-9
6.6.2 Residential Development	6-9
6.6.3 Town Centre	6-10
6.6.4 Town Park	6-10
6.6.5 Industrial Development	6-10
6.6.6 Drainage	6-10
6.6.7 North Lantau Expressway/Airport Express Line	6-10
6.6.8 Lantau Line	6-11
6.6.9 Rail Depot	6-11
6.6.10 Major Utilities	6-11

	Page	
6.7	Refinement of the Preferred Concept Plan into the RODP	6-11
6.7.1	General Approach	6-11
6.7.2	The NEF 25 Contour	6-11
6.7.3	NLE/AEL Corridor and Primary Distributor	6-12
6.7.4	Form of the Expressway Interchanges	6-12
6.7.5	Traffic Noise Considerations	6-12
6.7.6	Town Centre and Commercial Development Issues	6-12
6.7.7	Lantau Line	6-12
6.7.8	Airport-Related Development	6-13
6.7.9	The Sea Channel	6-13
6.7.10	Drainage	6-13
7.	RECOMMENDED OUTLINE DEVELOPMENT PLAN	7-1
7.1	Introduction	7-1
7.2	Planning Principles	7-1
7.2.1	Land Use	7-1
7.2.2	Landscape and Open Space	7-1
7.2.3	Movement	7-2
7.2.4	Urban Design	7-2
7.3	Transport	7-3
7.3.1	Road Network	7-3
7.3.2	Rail	7-3
7.3.3	Other Public Transport	7-4
7.4	Residential Areas	7-4
7.4.1	General Approach	7-4
7.4.2	Tung Chung	7-4
7.4.3	Tai Ho Wan	7-6
7.5	Industrial Areas	7-7
7.6	Open Space	7-7
7.7	Government/Institutional and Community Uses	7-8
7.8	Land Use Budget	7-8
7.9	Town Centre	7-10
7.10	District Centres	7-10
7.10.1	Tung Chung West District Centre	7-10
7.10.2	Tai Ho Wan District Centre	7-11
7.11	Town Park	7-12
PART 3	SUPPORTING PLANS	8-1
8.	ENVIRONMENTAL CONSIDERATIONS	8-1
8.1	Introduction	8-1
8.2	Existing Conditions	8-1
8.2.1	Topography	8-1
8.2.2	Water and Sediment Quality	8-1
8.2.3	Air Quality	8-1
8.2.4	Noise Levels	8-2
8.2.5	Ecological Concerns	8-2
8.3	General Approach to Assessments	8-2

	Page	
8.4	Water Quality	8-2
8.4.1	Method of Assessment	8-2
8.4.2	Drainage at Siu Ho Wan and Tai Ho Wan	8-3
8.4.3	Sewage Treatment and Disposal	8-4
8.4.4	Drainage into East Tung Chung Bay	8-4
8.4.5	Construction Impacts and Progressive Developments	8-5
8.4.6	Water Catchment Areas	8-5
8.5	Air Quality	8-5
8.5.1	Approach to Assessment	8-5
8.5.2	Industrial Development	8-6
8.5.3	High Rise Buildings	8-6
8.5.4	Sewage Treatment Works and Refuse Transfer Station	8-6
8.5.5	Road and Rail Traffic	8-6
8.5.6	The New Airport	8-7
8.5.7	Construction Impacts	8-7
8.5.8	Conclusions	8-7
8.6	Noise	8-7
8.6.1	Method of Assessment	8-7
8.6.2	Industrial Park and Railway Depot	8-8
8.6.3	New Airport	8-8
8.6.4	Road Traffic	8-8
8.6.5	Railways	8-9
8.6.6	Construction Impacts	8-11
8.7	Visual Impact	8-11
8.7.1	General Approach	8-11
8.7.2	Potential Impacts	8-11
8.8	Waste Disposal	8-12
8.8.1	Arisings	8-12
8.8.2	Construction Spoil	8-12
8.8.3	Solid Waste	8-13
8.8.4	Chemical, Radioactive, Animal and Clinical Wastes	8-13
8.9	Hazardous Materials	8-13
8.10	Ecology	8-14
8.11	Environmental Mitigation Measures	8-15
8.12	Environmental Monitoring and Audit	8-15
8.13	Conclusions	8-18
9.	ENGINEERING CONSIDERATIONS	9-1
9.1	General	9-1
9.2	Engineering Geology of the Study Area	9-1
9.2.1	Onshore Area	9-1
9.2.2	Offshore Area	9-2
9.3	Seawalls	9-3
9.3.1	General Comment	9-3
9.3.2	Background Data	9-3
9.3.3	Seawall Crest Level	9-4
9.3.4	Seawall Design	9-5
9.3.5	Forms of Seawall	9-5
9.3.6	Cost of Conventional Seawalls	9-7

	Page	
9.4	Land Formation	9-8
9.4.1	General	9-8
9.4.1	Excavation	9-8
9.4.2	Reclamation	9-11
9.4.4	Public Dumping Material	9-13
9.4.5	Possible Use of Pulverised Fuel Ash	9-14
9.5	Stormwater Drainage and the Sea Channel	9-15
9.5.1	Introduction	9-15
9.5.2	Stormwater Drainage	9-16
9.5.3	Open Drainage Channels	9-16
9.5.4	Water Features	9-17
9.5.5	Box Culverts	9-17
9.5.6	Sand/Boulder-Traps	9-17
9.5.7	The Sea Channel	9-17
9.6	Transport Infrastructure	9-18
9.6.1	Roads	9-18
9.6.2	Interchanges	9-18
9.6.3	Links to the Rest of Lantau	9-19
9.6.4	Access across the Sea Channel	9-20
9.6.5	Railways	9-20
9.6.6	Ferries	9-21
9.7	Provision of Utilities	9-22
9.7.1	General	9-22
9.7.2	Water Supply	9-22
9.7.3	Electricity	9-22
9.7.4	Gas	9-24
9.7.5	Telephone	9-24
9.7.6	Aviation Fuel	9-24
9.8	Public Service Facilities	9-24
9.8.1	Sewerage and Sewage Treatment	9-24
9.8.2	Refuse Transfer Station	9-28
10.	TRANSPORT ISSUES	10-1
10.1	General Approach	10-1
10.1.1	Background	10-1
10.1.2	Boundary Conditions	10-1
10.1.3	Land Use Assumptions	10-2
10.1.4	Other Studies	10-3
10.2	Road Network	10-3
10.2.1	Principal Features	10-3
10.2.2	North Lantau Expressway	10-5
10.2.3	Primary Distributors	10-5
10.2.4	District Distributors	10-6
10.3	Traffic Conditions	10-7
10.3.1	Introduction	10-7
10.3.2	The Expressway	10-7
10.3.3	Tung Chung	10-8
10.3.4	Tai Ho Wan	10-8

	Page
10.4 Public Transport	10-8
10.4.1 General Structure	10-8
10.4.2 Rail Stations	10-9
10.4.3 Bus and Public Light Bus Provisions	10-10
10.4.4 Transport Interchange	10-10
10.4.5 Other Termini Provisions	10-10
10.4.6 Ferry Pier	10-11
10.4.7 Other Considerations	10-11
10.5 Impacts on the Rest of Lantau	10-11
10.6 Construction Traffic Impacts	10-12
11. LAND USE	11-1
11.1 Introduction	11-1
11.2 Commercial Facilities	11-1
11.3 Community Facilities	11-1
11.3.1 Overall Needs	11-1
11.3.2 Schools	11-1
11.3.3 Police Facilities	11-2
11.3.4 Fire Stations	11-3
11.3.5 Market Areas	11-3
11.3.6 Community Centres	11-3
11.3.7 Social Welfare Facilities	11-3
11.3.8 Recreation	11-3
11.3.9 Other Uses	11-3
12. LANDSCAPE	12-1
12.1 Landform	12-1
12.1.1 Terrain Patterns	12-1
12.1.2 Vegetation	12-1
12.1.3 Village Settlements, Ancient Monuments and Fung Shui Features	12-1
12.2 Landscape Framework	12-1
12.2.1 General	12-1
12.2.2 Woodland Areas - General Comment	12-1
12.2.3 Woodland Areas - Landscape Guidelines	12-3
12.2.4 Structural Landscape Areas - General Comment	12-5
12.2.5 Structural Landscape Areas - Landscape Guidelines	12-5
12.2.6 Centres of Activity, Special and Major Open Space Areas-General Comment	12-6
12.2.7 Special Areas - Landscape Guidelines	12-6
12.2.8 Hard Landscape Materials	12-7
12.3 Open Space	12-8
12.4 Recreation	12-10
12.5 Footpath and Cycleway Network	12-10
12.6 Town Art	12-10

	Page
13. URBAN FRINGE	13-1
13.1 Rural Hinterland Strategy	13-1
13.1.1 Role of the Hinterland	13-1
13.1.2 Specific Objectives of the Strategy	13-1
13.1.3 The Strategy	13-1
13.1.4 Conservation	13-1
13.1.5 Recreation	13-6
13.1.6 Development Control	13-8
13.2 Village Development	13-9
13.2.1 Existing Position	13-9
13.2.2 Village Expansion	13-10
13.2.3 Village Resite	13-11
13.2.4 Sites of Scientific, Archaeological and Historical Interest	13-12
13.2.5 Burial Grounds	13-13
14. DEVELOPMENT PROGRAMME AND IMPLEMENTATION	14-1
14.1 Initial Population Targets	14-1
14.2 Development Packages and Programme	14-1
14.3 Implementation	14-1
14.3.1 Revised Population Build-up	14-1
14.3.2 Phase 1 - 1997	14-1
14.3.3 Phase 2 - 2001	14-5
14.3.4 Phase 3 - 2006	14-5
14.3.5 Phase 4 - 2011	14-5
14.3.6 Phase 5 - Post 2011	14-6
14.4 Other Aspects of Implementation	14-6
14.4.1 Housing Provision	14-6
14.4.2 Privatisation of Development	14-6
14.4.3 Implementation Procedures	14-7
14.5 Provision of Supporting Infrastructure	14-7
14.5.1 Land Formation	14-7
14.5.2 Land Formation Strategy	14-8
14.5.3 Provision of Utilities	14-8
15. FINANCIAL IMPLICATIONS	15-1
15.1 Assumptions	15-1
15.2 Contract Packages and Costs and Government Expenditure Forecasts	15-1
15.3 Revenue	15-1
15.3.1 Introduction	15-1
15.3.2 Assumptions	15-3
15.3.3 Land Sales Revenue	15-4
15.4 Cash Flow Analysis	15-4

Tables

	Page
2.1 Proposed Population/Employment Targets for North Lantau	2-2
3.1 Goals and Objectives	3-2
4.1 Summary of Noise Standards	4-5
4.2 Constraints and Opportunities in Potential Development Areas	4-10
5.1 Initial Population Targets and Housing Distribution	5-1
5.2 Projected Average Household Size by Tenure	5-1
5.3 Housing Demand - Proportion of Households by Housing Type	5-2
5.4 Gross Residential Density Assumptions by Housing Types	5-3
5.5 Land Requirements by Housing Type	5-3
5.6 Employment Distribution and Land Requirements	5-6
5.7 Government Institutional and Community Uses Requiring Discrete Sites	5-6
5.8 Government Institutional and Community Facilities in other Land Use Zones	5-8
5.9 Open Space Standards	5-8
5.10 New Town Open Space Requirements (2011)	5-8
6.1 Variables in Initial Concept Plans	6-4
6.2 Revised Framework of Goals, Objectives and Evaluation Criteria	6-7
6.3 Evaluation Summary	6-8
7.1 Tung Chung West : Residential Development and Population (2011)	7-5
7.2 Tung Chung Central : Residential Development and Population (2011)	7-5
7.3 Tung Chung East : Residential Development and Population (2011)	7-6
7.4 Tai Ho Wan : Residential Development and Population (2011)	7-6
7.5 Land Use Budget	7-9
8.1 Setback Distances(m) from Nearside Edge of the Carriageway (With and Without Mitigation)	8-8
8.2 Setback Distances(m) Required to Satisfy the HKPSG Criteria for Rail Noise (No Mitigation)	8-9
8.3 Rail Setback Distance(m) Required to Satisfy the NCO Criteria (No Mitigation)	8-9
8.4 Setback Distances(m) Required to Satisfy the NCO Nighttime Criteria With 1.5m Trackside Barriers	8-9
8.5 Rail Setback Distances(m) Required to Satisfy the NCO Criteria 80m Above Ground for a '89 dB(A) Train' (No Mitigation)	8-11
8.6 Potential Visual Impacts of Preferred Concept Plan	8-12
8.7 Ecological Features and Conservation Measures Proposed	8-14
8.8 Environmental Mitigation Measures	8-16
8.9 Trigger, Action and Target Levels Proposed for Dust, Noise and Water	8-18
8.10 Construction Dust Action Plan	8-19
8.11 Construction Noise Action Plan	8-19
8.12 Construction Water Quality Action Plan	8-20

Tables (Cont'd)

	Page
9.1 Summary of Existing Site Investigations	9-2
9.2 Return Periods of the model estimated still water levels, wave heights and coincidental still water levels and wave heights at Chek Lap Kok East	9-4
9.3 Return Periods of the model estimated still water levels, wave heights and coincidental still water levels and wave heights at Sham Shui Kok	9-4
9.4 Factors of Safety Blockwork Seawalls	9-5
9.5 Costs of Seawalls (HK\$/lin.m)	9-8
9.6 Volume of Topsoil Yielded in Tung Chung	9-8
9.7 Fill Available From Possible Land Borrow Areas	9-9
9.8 Beneficial Mud Disposal Capacities (m ³)	9-14
9.9 Total Flows and Loads	9-27
9.10 Total Forecast Waste Arisings (tonnes/day)	9-30
10.1 External Boundary Conditions	10-2
10.2 Land Use Assumptions	10-2
10.3 Predicted New Airport Throughput	10-3
10.4 Predicted Lantau Port Facilities	10-3
10.5 NLE Traffic Conditions (2011)	10-7
10.6 Public Transport Routes and Daily Patronage (2011)	10-12
12.1 Plant Selection Matrix	12-2
12.2 Shrub Species for Amenity, Ornamental and Slope Planting Mix	12-3
12.3 List of Native Species for Upland Slope Planting on North Lantau	12-4
13.1 Estimated Demand for Small Houses in Retained Villages to 2011	13-10
13.2 Village Resite Requirements	13-12
14.1 Initial Population Targets	14-1
14.2 Development of Planning Areas by Package	14-4
14.3 Population Build-up by Housing Type by Design Year	14-4
14.4 Formation Quantities in Mm ³	14-8
15.1 Tung Chung Development Costs (HK\$ Millions - 1991 prices)	15-2
15.2 Tai Ho Development Costs (HK\$ Millions - 1991 prices)	15-2
15.3 North Lantau Development - Estimated Land Sales Revenue	15-5
15.4 Estimated Cash Flow 1992 - 2011 (HK\$ Millions - 1991 prices) (HK\$ Millions - 1991 prices)	15-5

Figures

	Page
1.1 Port and Airport Development Strategy (PADS)	1-1
1.2 North Lantau Layout Plan (from NORLANS 1983)	1-2
1.3 The Study Area	1-2
4.1 Existing and Committed Development	4-1
4.2 Land Tenure	4-1
4.3 Airport Height and Safeguarding Restrictions (under review)	4-3
4.4 External Environmental Constraints	4-3
4.5 NEF Noise Contours for Year 2030	4-4
4.6 Constraints on Water and Air Quality	4-6
4.7 Constraints on Sewage Outfall Location	4-8
4.8 Landscape and Ecology	4-9
5.1 Income Profile for North Lantau	5-2
6.1 Potential Development Areas	6-1
6.2 Land Use Strategy	6-2
6.3 Initial Concept Plan 1	6-5
6.4 Initial Concept Plan 2	6-5
6.5 Initial Concept Plan 3	6-6
6.6 Initial Concept Plan 4	6-6
6.7 Preferred Concept Plan	6-9
7.1 Recommended Outline Development Plan	7-1
7.2 District Areas of Tung Chung	7-5
7.3 Town Centre Components	7-10
7.4 Tung Chung West District Centre Components	7-11
7.5 Tai Ho Wan District Centre Components	7-11
7.6 Town Park	7-12
8.1 Air and Noise Sensitive Receivers for Phase I	8-2
8.2 Baseline Water quality and Sediment Sampling Locations	8-3
8.3 Valleys and Potential Recirculation Zones	8-6
8.4 Noise Constraints on the RODP - Tung Chung Area (With Noise Mitigation)	8-10
8.5 Noise Constraints on the RODP - Tai Ho Wan Area (With Noise Mitigation)	8-10
8.6 Visual Characteristics	8-12
9.1 Mud Thickness Contours	9-3
9.2 Conventional Forms of Seawall	9-6
9.3 Alternative Forms of Seawall	9-7
9.4 View of Armour Units	9-7
9.5 Possible Land Borrow Area	9-9
9.6(a) Wong Kung Saddle Borrow Area	9-10
9.6(b) Wo Liu Tun Hill Borrow Area	9-10
9.7 Primary Settlement Prediction	9-12
9.8 Beneficial Mud Disposal Zones	9-14

Figures (Cont'd)

	Page	
9.9	Drainage Layout - Tung Chung Area	9-15
9.10	Drainage Layout - Tai Ho Area	9-16
9.11	Drainage Channel - Fluvial Sections	9-17
9.12	Sea Channel Crossing	9-21
9.13(a)	Utilities Layout - Tung Chung	9-21
9.13(b)	Utilities Layout - Tai Ho	9-21
9.14	Ground Water Levels at Tung Chung Knoll	9-24
9.15	Sewage Treatment Works Layout	9-26
9.16	Sewerage Layout - Tung Chung Area	9-28
9.17	Sewerage Layout - Tai Ho Area	9-29
9.18	Refuse Transfer Station Layout	9-30
10.1	External and Internal Transport Infrastructure for North Lantau	10-1
10.2	Land Use Areas and Population Zones	10-3
10.3(a)	Proposed Road Network for the New Town at Tung Chung Area	10-4
10.3(b)	Proposed Road Network for the New Town at Tai Ho Area	10-5
10.4(a)	Midday Peak Hour : Traffic Conditions on NLE and P1 at Tung Chung Area	10-6
10.4(b)	Midday Peak Hour : Traffic Conditions on NLE and P1 at Tai Ho Wan Area	10-7
10.5(a)	Tung Chung Area : AM Peak Hour PCU's and Reserve/Capacity (2011)	10-8
10.5(b)	Tai Ho Wan Area : AM Peak Hour PCU's and Reserve/Capacity (2011)	10-9
10.6(a)	Public Transport Plan for the New Town at Tung Chung Area	10-10
10.6(b)	Public Transport Plan for the New Town at Tai Ho Wan Area	10-11
10.7(a)	Possible Road Links to the Rest of Lantau	10-13
10.7(b)	Detail of Possible Link to Sham Wat	10-13
11.1(a)	Community Facilities at Tung Chung	11-2
11.1(b)	Community Facilities at Tai Ho	11-2
12.1	Master Landscape Plan - Tung Chung Area	12-2
12.2	Master Landscape Plan - Tai Ho Wan Area	12-3
12.3	The Open Space System of the New Town	12-9
13.1	Conservation Proposals	13-2
13.2	Rural Hinterland Strategy - Tung Chung and Tai Ho Areas	13-3
13.3	Villages in the Study Area	13-9
13.4	Village Resite Areas	13-12
13.5	Burial Grounds	13-13
14.1	Sequence of Development - Tung Chung	14-2
14.2	Sequence of Development - Tai Ho	14-2
14.3	Master Development Programme - Tung Chung	14-3
14.4	Master Development Programme - Tai Ho	14-3
14.5	Residential Completions by Target Year/Type	14-5
15.1	Government Expenditure Forecast	15-4

NORTH LANTAU DEVELOPMENT STUDY

FINAL REPORT

VOLUME 2 : APPENDICES

Contents

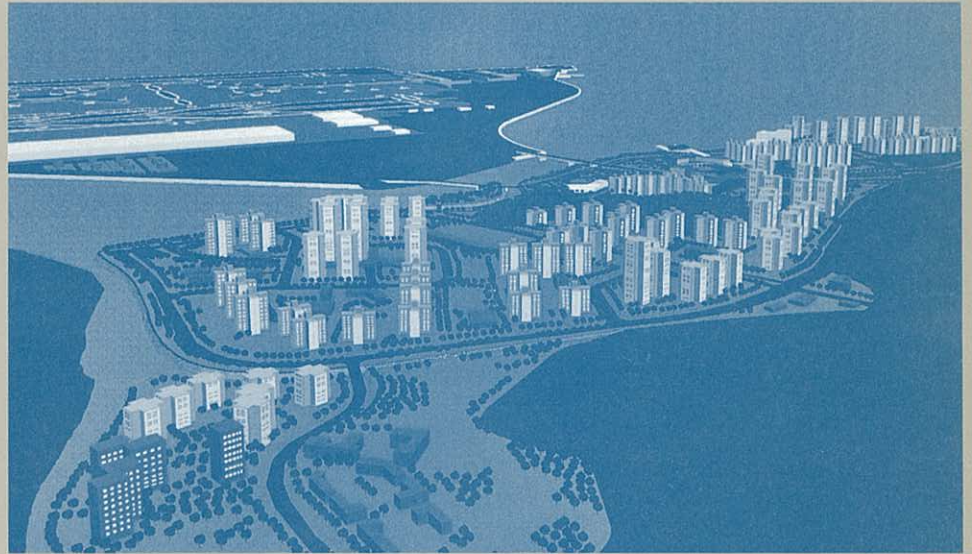
	Page
APPENDIX A - The Study Brief	A1
APPENDIX B - Supporting Documents Produced for the Study, Consultation Arrangements, and Study Organisation	B1
APPENDIX C - Consumer Expenditure Analysis	C1
APPENDIX D - Concept Plan Evaluation	D1
APPENDIX E - Environmental Assessment	E1
APPENDIX F - The Sea Channel	F1
APPENDIX G - Transport Planning Analyses	G1
APPENDIX H - Village Expansion and Village Resite Plans	H1
APPENDIX I - The Recommended Outline Development Plan, Development Schedule, Unit Rates and Supporting Plans	I1

VOLUME 3 : COMMENTS AND RESPONSES ON DRAFT FINAL REPORT

Contents

35 Sets of Comments as Listed in Volume 3

North Lantau Development



PART 1 : BACKGROUND

1. Introduction

1. INTRODUCTION

1.1 Background to the Study

Following the completion of the Port and Airport Development Strategy (PADS), the Government of Hong Kong decided, in October 1989, to proceed with the construction of a new international airport at Chek Lap Kok, off the northern coast of Lantau. The PADS Study had set out in broad terms the scale and extent of the new infrastructure which would be required both for and to support the New Airport. This is shown in Figure 1.1, taken from PADS.

In addition to high speed rail and road transport links (which include the construction of major bridges between Tsing Yi and North Lantau) the PADS Recommended Strategy envisaged the construction on North Lantau of a New Town to provide a supporting community for the new airport. The New Town was proposed to be a fully comprehensive development incorporating residential, industrial and

commercial activities and with all the necessary infrastructure required for both the New Town and to serve, where practicable, the new airport. The residents of the New Town would provide a significant proportion of the large labour force required both to operate the New Airport and to man the wide range of airport related activities which would be necessary. The concept of such a New Town was initially put forward in earlier studies (1979-83) which had investigated the siting of the new airport at Chek Lap Kok and associated development on North Lantau. Figure 1.2 indicates the extent of development envisaged in these earlier studies.

In July 1990 Mott MacDonald Hong Kong Ltd as lead consultants, supported by Shankland Cox Associates, Wilbur Smith Associates and EBC Hassell were appointed by the South West New Territories Development Office of the Territory Development Department to carry out the planning of the New

Town and the outline design of its first phase of construction. This report represents the culmination of the Preliminary Report Stage of that project, which has been carried out over a period of twenty months since August 1990. It should be noted that the North Lantau Development Phase 1 scheduled for completion by 1997, is designated as an Airport Core Project.

1.2 The Study Area

The extent of the Study Area is shown in Figure 1.3. The area extends west from Ta Pang Po to encompass all of the North Lantau coastline (including the Brothers islands offshore) to a point just west of Sham Wat. To the north, the island of Chek Lap Kok, together with Lam Chau and a small section of coastline between San Tau and Sha Lo Wan are excluded, while to the south, the area extends to the country park boundary and further east the main ridgeline which separates North Lantau from Discovery Bay.

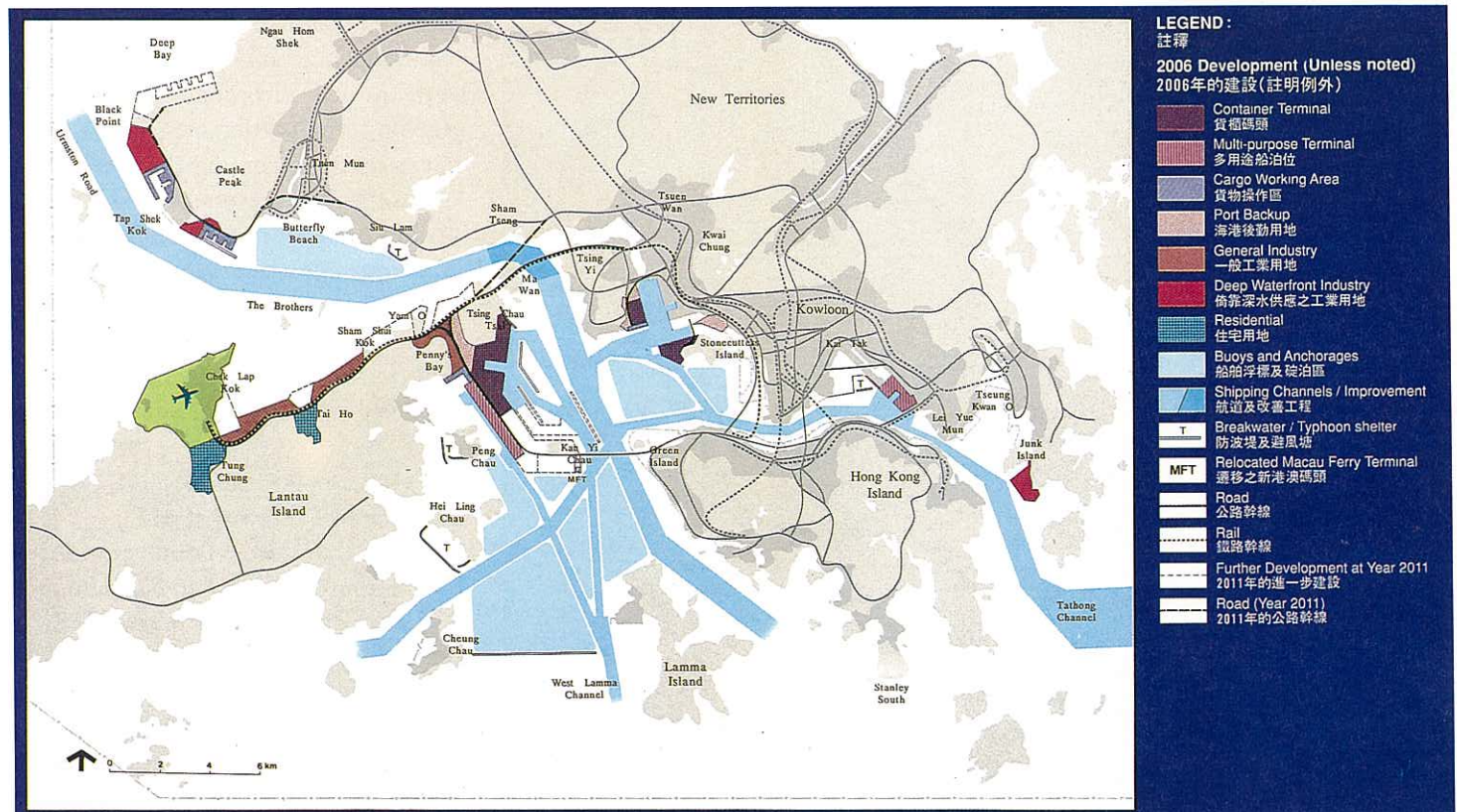


Figure 1.1 Port and Airport Development Strategy (PADS)

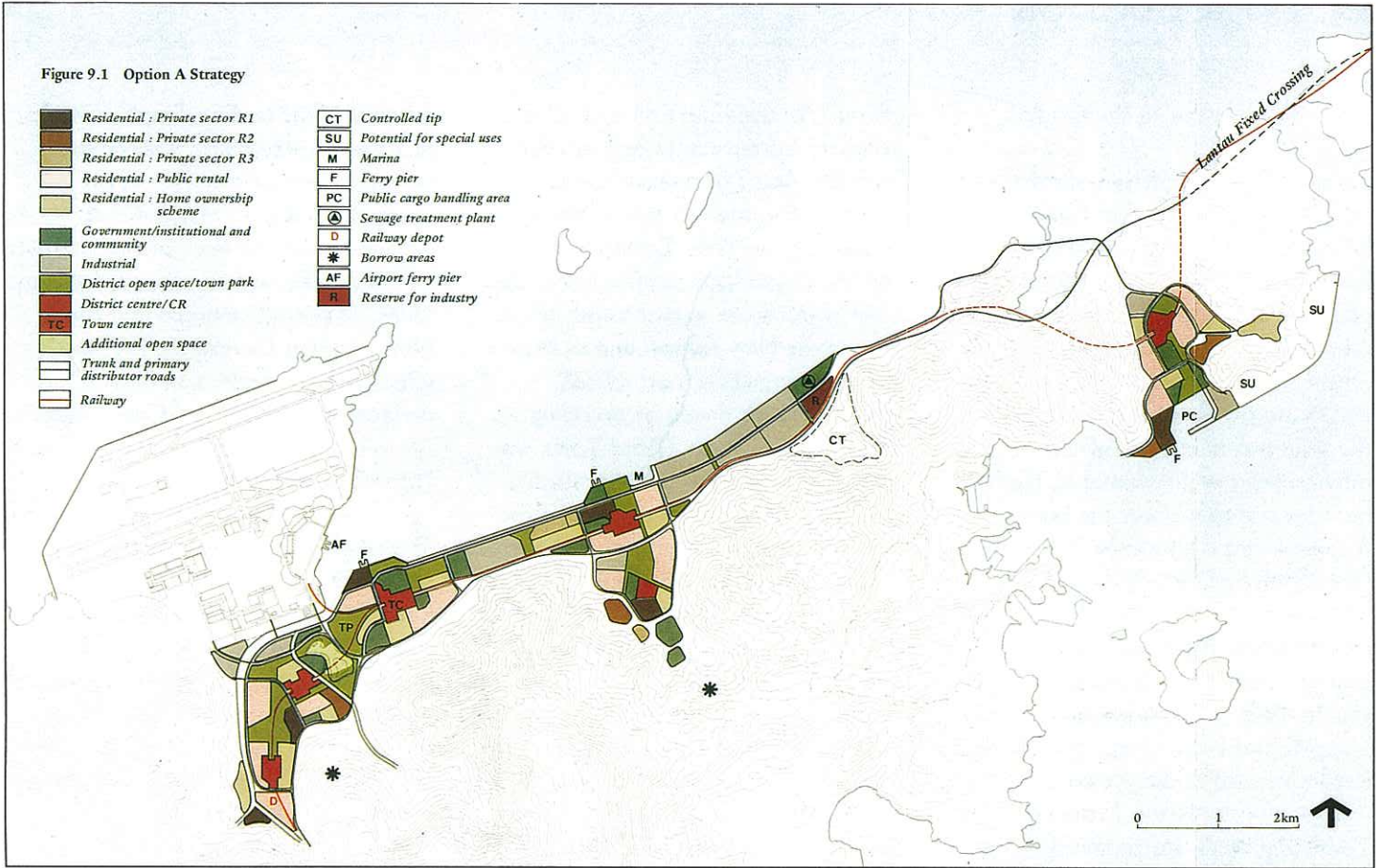


Figure 1.2 North Lantau Layout Plan (from NORLANS 1983)

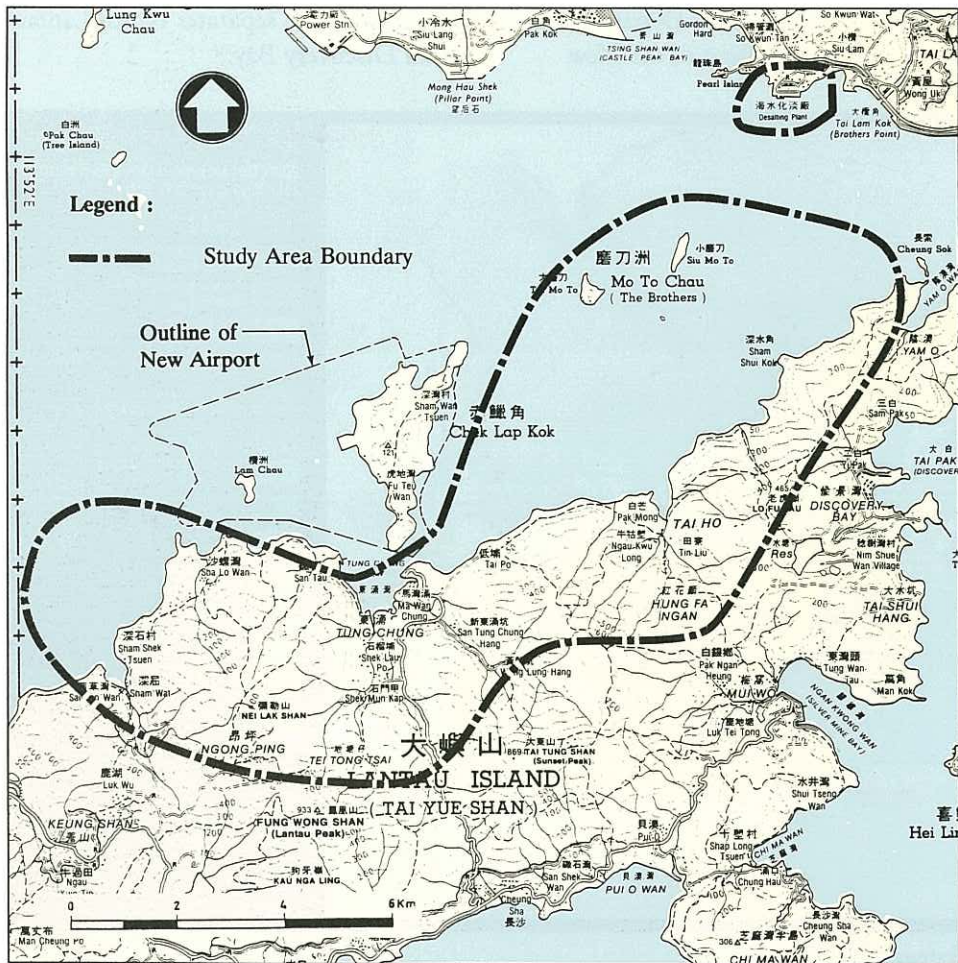


Figure 1.3 The Study Area

1.3 The Overall Scope of the Study

The Study Brief sets out a wide range of tasks and considerations which have required a multi-disciplinary approach to the project, incorporating town planning, engineering feasibility, transportation planning and the environmental assessment of impacts. Within these four broad disciplines, numerous important specialist skills have also been required, in particular landscape planning, geotechnical engineering, financial analysis, and specialist environmental assessments.

As noted, the Port and Airport Development Strategy (PADS) indicated that the development of the New Airport at Chek Lap Kok and its associated high capacity road and rail connections would generate the need for urban development on North Lantau. Specifically the PADS Study indicated three strategic purposes for urban development on North Lantau. These were:-

- o to accommodate an airport support community for airport-related activities and housing for the labour force;
- o to accommodate the required road and rail links; and
- o to accommodate strategic (territory-wide) land use requirements for housing and industry.

The Study Area designated for these purposes has been defined and described in section 1.2 above, and the overall objectives of the work required were:-

- o to study the planning and development of the area referred to as the North Lantau Study Area and make proposals for implementing works in phases; and to note that
- o the Study Area may extend beyond the boundaries shown on the Study Area Plan in respect of considering interfaces with adjacent developments and the wider impacts of Study Area developments.

The more detailed goals and objectives of the Study are described in Part II of this report - the Development Framework, and the full Study Brief is reproduced as Appendix A of this report.

1.4 Other Studies

As a result of the Government's decision to implement the New Airport at Chek Lap Kok and develop the port peninsula at the eastern extremity of Lantau Island, a number of other 'core' projects have been initiated. These range from feasibility studies to detailed design and construction projects, including the Lantau Fixed Crossing, the West Kowloon Reclamation, the North Lantau Expressway, the Airport Express Line and the Airport Master Plan as well as this project.

Clearly the implementation of such a large and complex project requires frequent liaison between individual project teams and essential overall co-ordination in order to prevent both duplication of effort and incompatibilities of planning, environmental and engineering design criteria.

In this connection, the study team was instructed to pay close attention to a number of earlier project reports (copies of which were provided to the study team) and to liaise closely with other on going projects. These include:

- o the PADS Study
- o the PADS Development Statements Nos. 2 (Lantau Port Peninsula) and 3 (North Lantau)
- o the Sewage Strategy Study
- o the Second Comprehensive Transport Study (CTS-2) and
- o the LDPC Paper 'Development Assumptions for North Lantau'

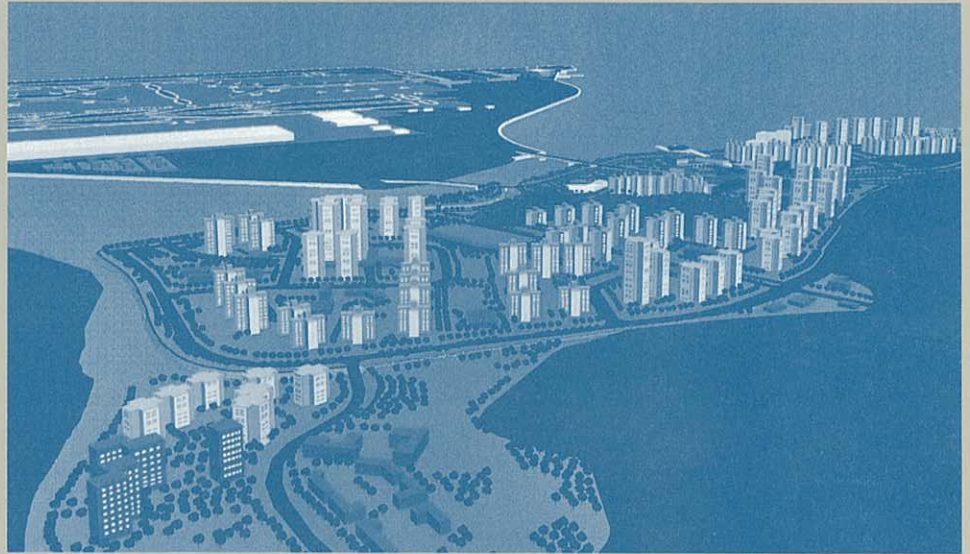
Parallel on-going projects with which liaison has been kept include:-

- o The 'Territorial Development Strategy Review' (TDSR)
- o The 'Study of Industrial and Commercial Enterprises that need Relocation with the Airport' (SICENRA)
- o The 'Airport Railway Feasibility Study' (ARFS)
- o The 'Airport Master Plan Study' (AMPS)
- o The detailed design progress of the 'North Lantau Expressway' (NLE)
- o The 'Study of Airport Related Activities' (SARA).

- o The South West New Territories Development Strategy Review and
- o The New Airport at Chek Lap Kok, Geotechnical Investigation (1990) Volume 4 - Underground Space at Chek Lap Kok.

All of these projects have provided background data and necessary interface co-ordination and have been drawn upon as appropriate in the preparation of the North Lantau Development Plan and the detailed design for Phase I of the development.

North Lantau Development



2. Context

2. CONTEXT

2.1 Introduction

The Study was commissioned to plan a comprehensive urban development which would ensure that the requirements of the Port and Airport Development Strategy (PADS) for residential, commercial and industrial development on North Lantau would be met.

PADS envisaged that the Study Area would accommodate strategic land use requirements for housing and industry, as well as new transport links to the New Airport. It also envisaged that the Study Area would accommodate an airport support community providing residential, commercial and industrial opportunities close to the New Airport. As noted, this concept was a development of plans prepared in the early 1980's as part of the North Lantau Development Investigation. These were carried out in a number of phases between 1979 and 1983 both in-house by Government and by consultants.

The North Lantau Development is likely to be the last of the second generation new towns. It will provide the opportunity to create a well-planned, high amenity living environment which will serve as an important "gateway" for air travellers to and from Hong Kong.

2.2 Development Opportunities

The New Airport at Chek Lap Kok will generate substantial initial employment and create a sound base for further employment growth. This would provide the impetus for urban development on North Lantau. The New Airport, however, may create environmental conditions that would constrain the extent of urban development.

Based on an analysis of physical and introduced constraints on North Lantau and opportunities arising from them, Potential Development Areas (PDAs) in Tung Chung, Tai Ho and Tai Ho East were proposed for urban development. These PDAs form the basis of development of Initial Planning Concepts and the subsequent Recommended Outline Development Plan.

2.3 Future Population and Employment Base

Clearly, Lantau does not have an adequate existing population and economic base on which to create new employment to support sustainable urban development. Conversely, the New Airport will immediately provide substantial employment to support major urban development on North Lantau.

Previous studies, including the "North Lantau Development Investigation, Further Studies Phase 2" indicated that build-up of population and ultimate population capacity of urban development on North Lantau would be limited by the capacity of the road and rail crossings to be provided between Lantau and the rest of the Territory.

Within this framework, population, housing and employment targets were established by LDPC Paper 20/90 "Development Assumptions for North Lantau". These are set out in Table 2.1. As indicated, the initial population targets established by this Paper and the Study Brief were 20,000 by 1997, rising to 200,000 by 2011 with the potential, in the longer term, of rising to 260,000. The upper range of employment envisaged by LDPC, distributed through five categories, was 143,800 jobs. The lower range was that required

for balanced development in relation to the New Town population. These figures were taken as a starting point and were subsequently reviewed during the study as more relevant information became available as can be seen in Section 5, Table 5.2. Outputs of the "Territorial Industrial Land Development Strategy" (ILDS), the "Study of Industrial and Commercial Enterprise that need Relocation with the Airport" (SICENRA) and a survey of the income profile of airport workers were used to review these targets.

2.4 Transport Issues

2.4.1 General

The PADS proposals for Lantau envisaged development on North Lantau to provide a resident labour force to balance the employment potentials of the planned New Airport and Port developments. In this context, a principal function of the transport system is to connect the New Town development to the New Airport, as well as to the Port Peninsula. These transport links are components of a wider regional network, and their capacity is, in part, determined by the ability of the strategic system to "feed" traffic to the system on North Lantau. Therefore, the relationship of the NLD transport system to the strategic network, and the interface of the NLD system with airport access have been the two key transport issues influencing proposed highway and railway development in North Lantau.

2.4.2 Road Network

The North Lantau Expressway (NLE) will connect the Study Area to the strategic road network thus linking Lantau with other parts of the Territory. The planning of interchanges within the Study Area must balance the need for local accessibility with the need to maintain high-standard expressway conditions on the trunk route.

Table 2.1 Proposed Population/Employment Targets for North Lantau

Item	Year			
	1997	2001	2006	2011
A. Population by Housing Type				
(i) Public Rental	10,000	20,000	30,000	40,000
(ii) HOS/PSPS	5,000	20,000	40,000	60,000
(iii) Private/Others	5,000	20,000	50,000	100,000
(iv) Total	20,000	60,000	120,000	200,000
B. No. of Households by Housing Type				
(i) Public Rental	3,800	6,470	10,230	14,200
(ii) HOS/PSPS	1,670	7,010	14,770	23,060
(iii) Private/Others	1,760	7,380	19,440	40,460
(iv) Total	6,510	10,860	44,440	77,720
C. Jobs				
1. Airport Related				
E1 - General Industry	11,500	12,600	14,600	16,800
E2 - Transport/Utilities	13,700	15,100	17,400	20,200
E3 - Retail/Wholesale	1,000	1,100	1,200	1,400
E4 - Finance/Banking	150	150	200	200
E5 - Personal Services/Others	2,400	2,600	3,100	3,600
Total	28,750	31,550	36,500	42,200
2. Port Related				
E1 - General Industry	600	1,800	3,600	5,900
E2 - Transport/Utilities	1,000	3,300	6,300	12,300
E3 - Retail/Wholesale	0	0	0	0
E4 - Finance/Banking	0	0	0	0
E5 - Personal Services/Others	300	900	1,800	3,500
Total	1,900	6,000	11,700	21,700
3. General Industry				
E1	500	17,200	32,300	41,300
4. Population Related Employment				
E1 - General Industry	400	1,100	230	3,800
E2 - Transport/Utilities	750	2,300	4,500	7,500
E4 - Finance/Banking	100	100	200	200
E5 - Personal Services/Others	2,600	7,900	15,800	26,300
Total	3,850	11,400	22,800	37,800
5. Hotels				
E5 (Rooms) Jobs	100	800	1,000	800
	(250)	(1,500)	(2,500)	(2,500)
6. Total Employment (C1-C5)				
E1 - General Industry	12,600	31,600	50,400	64,100
E2 - Transport/Utilities	15,100	19,500	26,100	36,300
E3 - Retail/Wholesale	1,750	3,300	5,700	8,900
E4 - Finance/Banking	250	300	400	400
E5 - Personal Services/Others	5,400	12,200	21,600	34,100
Total	35,200	67,100	104,400	143,800

Source: LDPC Paper 20/90"

Note: Figures may not totalize due to rounding

2.4.3 Rail Transport

The Tung Chung and Tai Ho communities which will make up the New Town will also be served by the Lantau Line (LAL) railway. The Airport Railway Feasibility Study (ARFS) assumed this rail line would terminate at Tung Chung. The future concentration of employment at the New Airport suggests that the alignment of the LAL in west Tung Chung should not preclude the future extension of the rail line into the Airport complex to serve employee-related travel needs.

Even with three road links (Lantau Fixed Crossing, Green Island Link and Ma Wan - Sham Tseng Link) connecting Lantau to the rest of Hong Kong, there will be competition for the limited road space between the Port Peninsula, the New Airport and local New Town traffic. The external traffic demand associated with local developments can be minimised by locating LAL stations so as to provide maximum accessibility to local residents. For Tung Chung, this has translated into the need for two rail stations to maximise rail usage and to provide the overall accessibility necessary to attract residents to live in the New Town.

2.5 Interface with the New Airport

The planning of the New Town would be fundamentally affected by its proximity to the New Airport at Chek Lap Kok. Interface issues could only be finalised once the Airport Master Plan had determined the functional arrangement of airport-related facilities and the constraints to New Town development imposed by the Noise Exposure Forecast (NEF) 25 contour, height restrictions, safeguarding zones and obstacle limitation surfaces.

In the initial stages of concept plan development, the following assumptions were adopted although they were subject to review during the course of the study:-

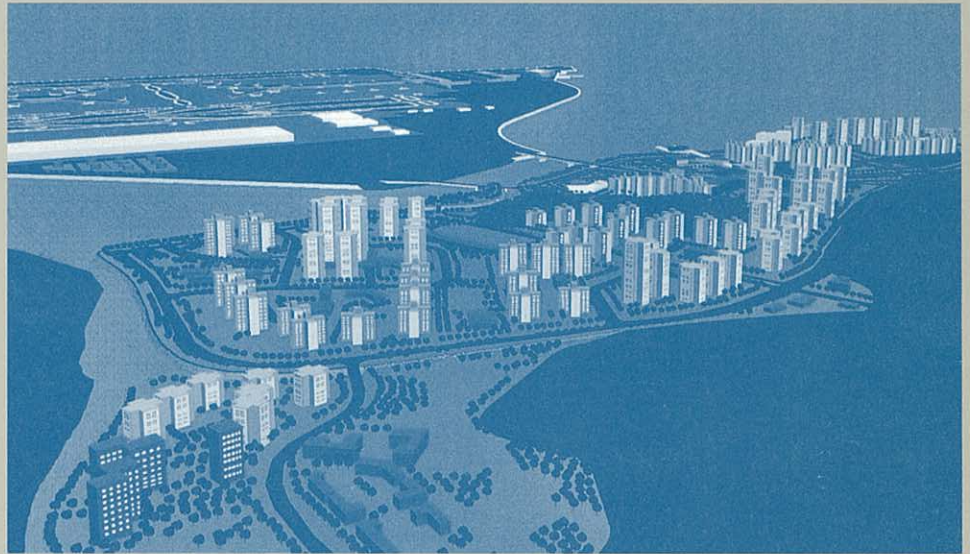
- o the northern boundary of the New Town would be that of the boundary of the 1983 Chek Lap Kok Master Plan Study; and
- o the preliminary NEF 25 contour, height restrictions, safeguarding zones and obstacle limitation surfaces provided by the AMP consultants in the Environmental Impact Assessment First Interim Report have been taken as constraints in determining the distribution of land uses along the north coast of Lantau.

2.6 Relationship to the Rest of Lantau

It is expected there will be great pressure from the private sector to integrate developments on North and South Lantau so that North Lantau residents can take advantage of the recreational amenities provided in South Lantau and, in turn, South Lantau residents can use the new road system to travel to the New Airport, the New Town and off Lantau.

Currently, there is restricted usage of the Tung Chung Road which is the only existing road link between North and South Lantau. The implications of changes in development levels in other parts of Lantau and in transport policy concerned with any future linkages to the planned North Lantau transport system have been assessed in order to help guide the planning of an overall development strategy for Lantau. The actual development of the strategy is an objective of the South West New Territories Development Strategy Review.

North Lantau Development



PART 2 : DEVELOPMENT FRAMEWORK

3. Goals and Objectives

3. GOALS AND OBJECTIVES

3.1 Introduction

Goals and objectives were developed and agreed at the beginning of the Study to guide formulation and evaluation of planning concepts.

Goals express, with a high level of generality, the broad planning aims to be incorporated into the development. As such, they cannot be used directly in the evaluation of options. They simply provide the framework for the formulation of more specific objectives upon which option evaluation may proceed.

Objectives can be more precisely stated than goals and deal with the way in which goals may be achieved. Wherever possible, objectives should be capable of expression in quantifiable terms as they can be used to evaluate alternative proposals and different courses of action.

3.2 Goals

The following goals are listed without regard to order of priority.

A. Cost Effectiveness

Development proposals should aim to achieve a high level of cost effectiveness in the use and deployment of resources.

B. Cost and Convenience in Use

The pattern of development should achieve a convenient and economical distribution of land uses in relation to movement networks and provide the basis for an efficient airport support community.

C. Environmental Quality

The proposals should aim to achieve a high quality urban environment and seek to minimise the impact on the natural environment.

D. Programming

Development should be capable of easy implementation.

E. Flexibility

Planning proposals should be able to respond to changes and be able to function in a self contained manner at various levels of population build up.

3.3 Objectives

Table 3.1 sets out the objectives required to achieve the above goals and the stage in the study process at which they are relevant. Data used in the evaluation process will be either quantitative or qualitative.

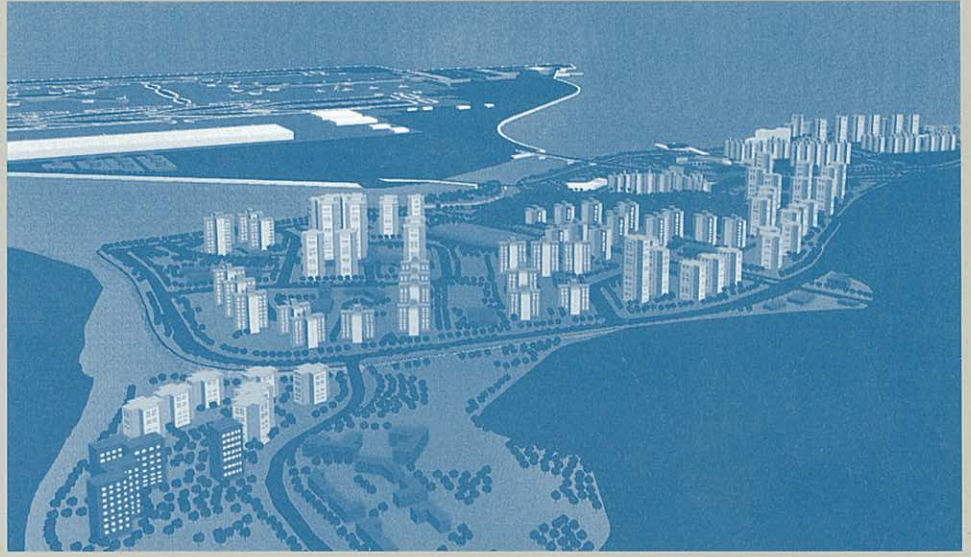
Table 3.1 Goals and Objectives

Objectives	Stages (1)		
	1	2	3
GOAL A - Cost Effectiveness			
A.1 Minimise capital cost of development per head (including land formation, infrastructure and land acquisition)	*	*	*
A.2 Maximise opportunities for the generation of revenue from land sales	*	*	*
A.3 Secure early and reasonable return on public investment (front end costs and cash flow)	*	*	*
GOAL B - Cost and Convenience in Use			
B.1 Distribute land use to minimise demand for vehicular movement	*	*	
B.2 Distribute land uses to maximise use of public transport especially rail transport	*	*	
B.3 Provide maximum accessibility for local residents to places of employment, services and other facilities		*	*
B.4 Optimise opportunities for pedestrian and cycle movements		*	*
B.5 Minimise disturbance to development area from traffic between airport/ airport related uses and new town residential areas	*	*	
B.6 Provide opportunity for an economical distribution of centres	*	*	
GOAL C - Environmental Quality			
C.1 Minimise disturbance to natural landscape features and ecological systems	*	*	
C.2 Minimise amount and impact of air pollution	*	*	*
C.3 Minimise amount and impact of water pollution	*	*	*
C.4 Minimise impact of noise on sensitive uses	*	*	
C.5 Provide opportunity for an attractive visual character to the development area		*	*
C.6 Provide opportunity for attractive visual gateway to Hong Kong		*	*
C.7 Minimise disturbance to features of historical, religious and/or archaeological significance		*	*
C.8 Minimise disturbance to existing communities	*	*	*
C.9 Maximise recreational opportunities in development areas and rural hinterland		*	*
GOAL D - Programming			
D.1 Minimise risk of delay to programme targets		*	*
D.2 Development to be capable of being implemented in self contained packages		*	*
D.3 Minimise disturbance to existing and new development in subsequent construction stages		*	*
GOAL E - Flexibility**			
E.1 Ensure plan can function effectively at each stage of development	*	*	
E.2 Minimise impact on plan of a decision not to construct or significantly delay the Airport Railway as a separate public rail service		*	*
E.3 Flexibility to accommodate additional population or employment beyond levels forecast for 2011	*	*	
E.4 Ensure plan can function effectively with changes to design assumptions	*	*	*

Source : Consultants Assessment and Topic Report TR1 'Plan Objectives and Study Parameters'

Note (1) Study Stage 1 - Concept Plans
 Study Stage 2 - Recommended Outline Development Plan
 Study Stage 3 - Detailed design and implementation

North Lantau Development



4. Constraints

4. CONSTRAINTS

4.1 Introduction

Development of the Study Area is governed by topographical and geotechnical constraints. Together with the existing and planned developments, and environmental and transportation constraints, these determine the extent of the areas which could be developed. Of key importance were the environmental impacts of the New Airport and its main access corridor, encompassing the NLE and AEL.

4.2 Topographical

The Study Area is dominated by a series of peaks which fall sharply to the coast leaving limited areas of land suitable for development, predominantly in the valleys of Tung Chung, Tai Ho and Tai Ho East. Continuation of this topography is evident in the shallow foreshore which typically displays thick mud and alluvial deposits overlying deep bedrock.

4.3 Geotechnical

This study eliminates as unsuitable for development, the Class III and IV categories (high to extreme geotechnical limitations) which are classifications defined in the GCO Geotechnical Area Study Programme. This restriction applies between Tung Chung and Pak Mong and between Tai Ho and Tai Ho East. In addition to development limitations much of this area is unsuitable for use as borrow areas. Further detail of geotechnical conditions in the Study Area is given in Section 9 at this report.

4.4 Existing and Committed Development

Existing and committed development on North Lantau is shown on Figure 4.1. The Study Brief specified that the Study Area excluded the site for the New Airport. The interface between

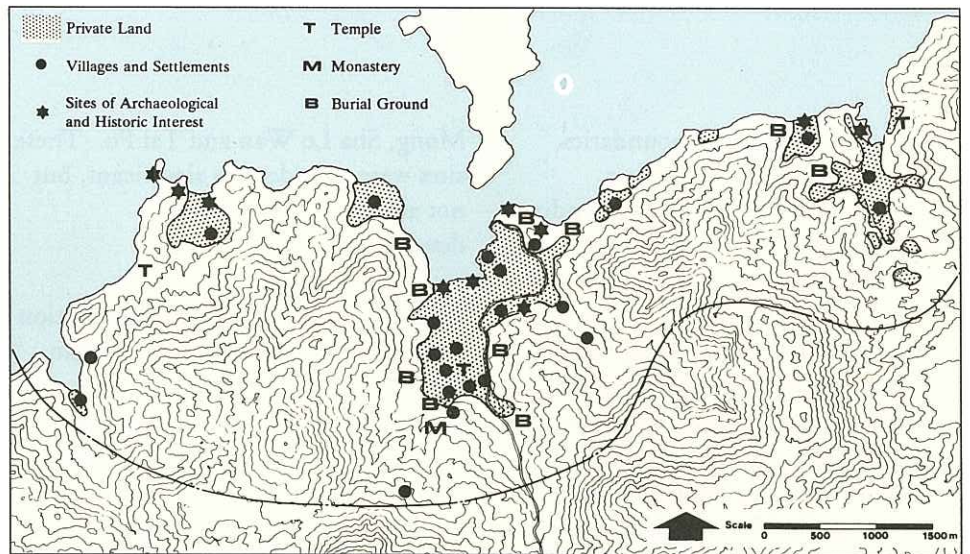


Figure 4.1 Existing and Committed Development

the New Airport and the New Town, and its impact on the distribution of land uses in the New Town, was an issue that was addressed during development of Initial Concept Plans, the Preferred Concept Plan and the Recommended Outline Development Plan (RODP).

Land tenure within the study area is shown in Figure 4.2 and comprises a mix of private land, Crown Land

licences, other permits and Crown Land. The majority of land in private ownership is concentrated in the valley floors of Tung Chung and Tai Ho. The pressure to accommodate the planned urban development would be greatest in these areas.

There are 35 villages within the North Lantau Development area, of which 21 are pre-1898 recognised villages, the majority comprising 15 groups of

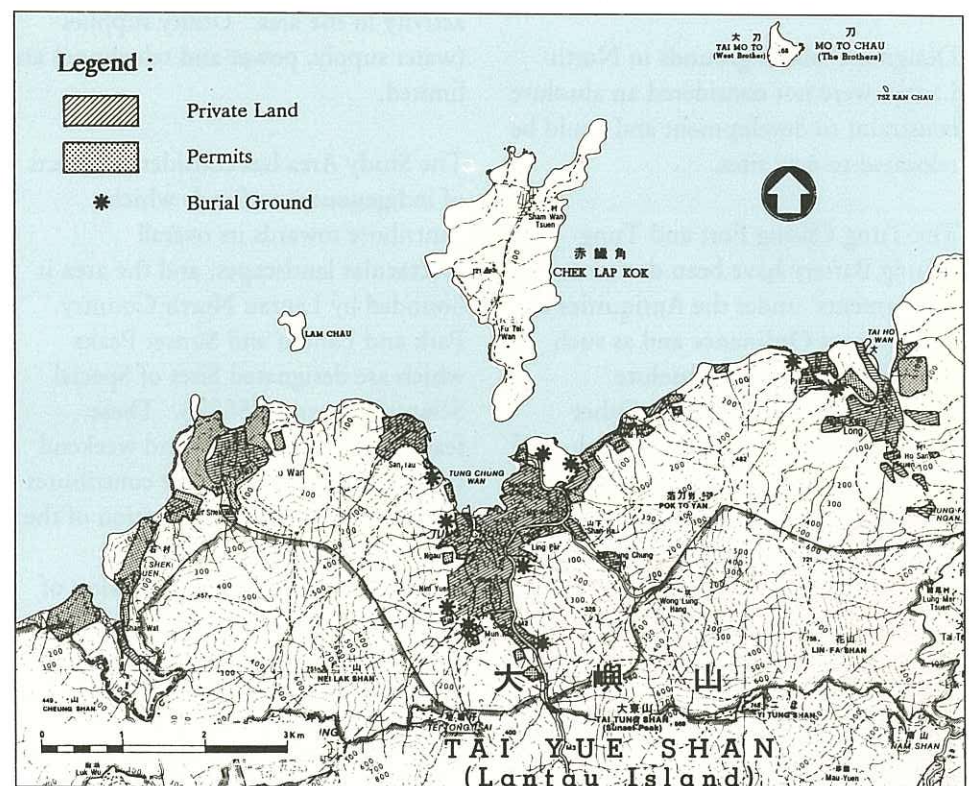


Figure 4.2 Land Tenure

villages with recognised boundaries. Existing settlements are further discussed in Section 13 and Appendix H of this report and are indicated in Figure 13.3 and Figure H1.

Given the scale of development to be accommodated within the Study Area, pressures to relocate existing settlements would be great, particularly those located in the valley floors of Tung Chung and Tai Ho. A balance would need to be struck between achieving a desirable layout for the New Town, the objective of minimising disturbance to the existing communities, and the possible programming delays and level of resources which would need to be deployed in order to achieve village removal and re-siting.

For these reasons, none of the villages within North Lantau can be regarded as an absolute constraint to development. As a general principle, however, it will be desirable to maintain as many of the villages as possible, particularly those on the slopes of the Tung Chung and Tai Ho valleys.

Designated burial grounds in North Lantau were not considered an absolute constraint to development and could be relocated to new sites.

The Tung Chung Fort and Tung Chung Battery have been declared 'monuments' under the Antiquities and Monuments Ordinance and as such were considered as an absolute constraint to development. Other important sites of special archaeological significance occur at Sha Tsui Tai, Pak



Tung Chung Fort

Mong, Sha Lo Wan and Tai Po. These sites were considered a significant, but not absolute, constraint to development.

At present the Government, Institution and Community Facilities (G/IC) in the Study Area, are limited to one police post and six primary schools. Apart from three youth hostels, there are no other public facilities or essential services in the area of any significance.

Economic activities in the Study Area are limited. Of an estimated 190 hectares of agricultural land in North Lantau almost 85 per cent is left fallow. On the land that is farmed, orchards and vegetable growing are the major activities, while there is some limited paddy growing and livestock rearing. There is, however, a gazetted Fish Culture Zone (about 2 ha) in Tung Chung Bay. This activity supports about 90 workers, while a further 230 people are involved in general offshore fishing. Shop-keeping, room letting and other ad hoc commercial activities make up the balance of economic activity in the area. Utility supplies (water supply, power and telephone) are limited.

The Study Area has considerable tracts of indigenous woodlands which contribute towards its overall spectacular landscapes, and the area is bounded by Lantau North Country Park and Lantau and Sunset Peaks which are designated Sites of Special Scientific Interest (SSSIs). These features draw in tourists and weekend trippers whose expenditure contributes to the overall economic function of the area. Natural scenic beauty is supplemented by a number of sites of Archaeological or Historic Interest, Temple and Burial Grounds which also draw in an interested public.

All in all, the area is highly attractive in scenic terms, contains features of public interest and is at present almost entirely

unspoilt in comparison to other areas of the New Territories, Offshore Islands and Hong Kong Island itself.

4.5 New Airport Aspects

The most significant constraints on development result from the noise impact of the New Airport and from restrictions on the height of development imposed by flight paths, radar and navigational and safeguarding zones. In respect of flight paths, height restrictions on the new developments proposed for North Lantau only affect the associated coastal reclaimed areas of Tai Ho marginally. Figure 4.3 indicates Airport Height and Safeguarding Restrictions as provided to the NLD Study by the Airport Masterplan Consultants. These are under review by the Provisional Airport Authority. Revised airport height restrictions will be available from the Civil Aviation Department for application within this year.

4.6 Environmental Constraints

4.6.1 Introduction

A key input to the early stages of the planning and design concepts was the results of the initial environmental assessments. This integrated approach was adopted throughout the Study allowing many environmental issues to be resolved through the planning process.

One of the fundamental design objectives of the Study was to achieve a high quality urban environment with minimal impact on the natural environment. For this to be realised a number of constraints were placed upon the development process, some of which are external to the Study such as the imposition of noise exposure forecasts from the New Airport. These are summarised on Figure 4.4.

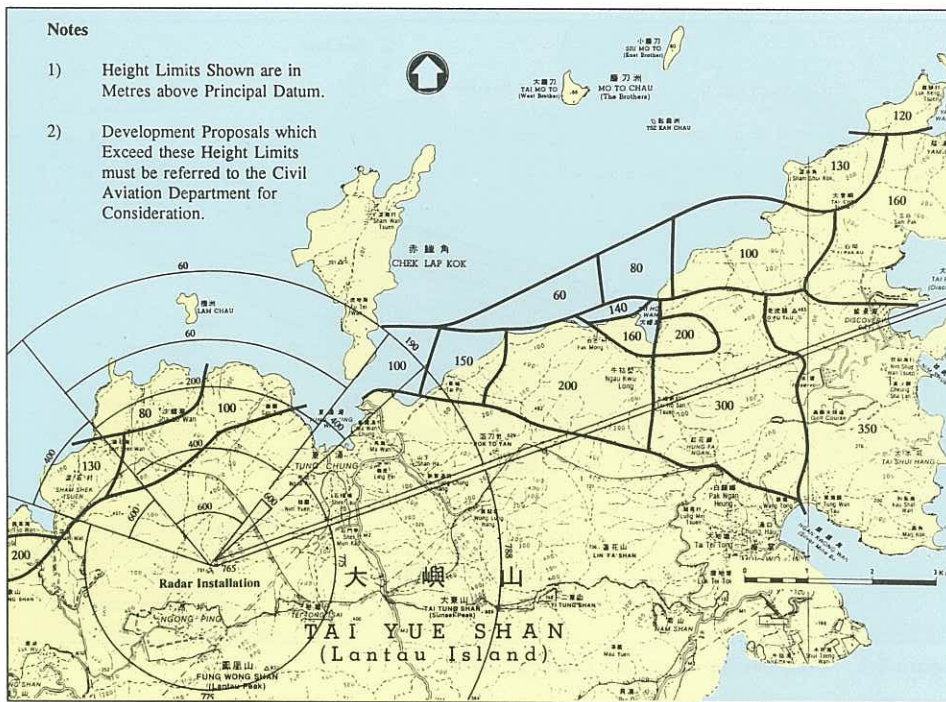


Figure 4.3 Airport Height and Safeguarding Restrictions (under review)

In many instances, physical constraints were restrictive in terms of the nature or magnitude of development rather than being site specific. Both the nature and scale of developments, spanning at least 15 years, will fundamentally alter the character of the area from one of rural tranquillity to a major airport/urban centre served by busy road and rail links. Timing is a major constraint early in the design process as road links and initial support facilities have to be in place for the New Airport to open in 1997. Combined impacts from the construction of the New Airport, NLE/AEL and first phase of the New Town could have severe environmental consequences unless the transition from the existing rural environment is carefully managed.

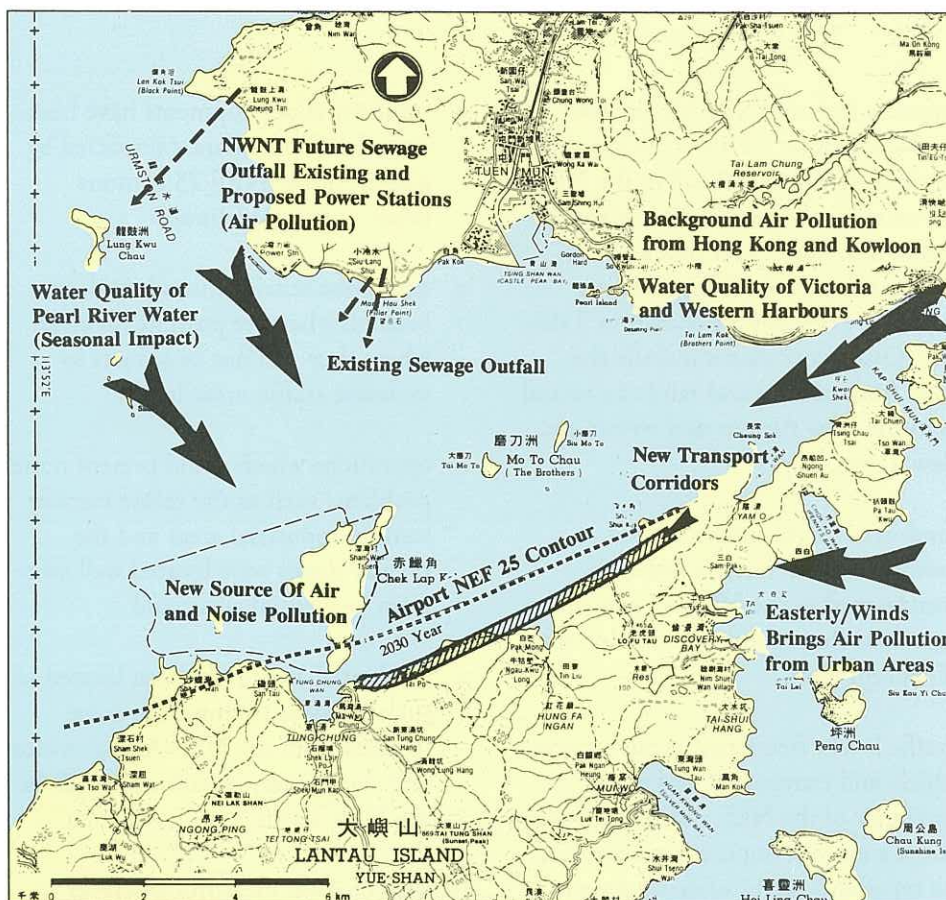


Figure 4.4 External Environmental Constraints

Appropriate responses were required to address the environmental issues and where possible to create opportunities from constraints by adopting amelioratory measures.

4.6.2 Environmental Standards and Guidelines

The principal design tool was the Hong Kong Planning Standards and Guidelines (HKPSG). This manual sets out criteria to be met with the intention of preserving, or where possible improving, existing environmental quality and ensuring that new developments are built to a satisfactory environmental standard. In addition to the HKPSG reference was made to specific environmental standards, legislation and guidelines for each of the environmental parameters.

With respect to water quality issues reference was also made to the following:

- o Water Quality Objectives for North Western Water Control Zone, Sewage Strategy Study, July 1989;

- o Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters (Water Pollution Control Ordinance, Cap. 358, S.21);
- o Interim Threshold Guidelines for Significant Sediment Contamination (Deep Bay Guidelines for Dredging, Reclamation and Drainage Works, 1989); and
- o Proposed Trigger and Action Levels for Hong Kong Sediments, Contaminated Spoil Management Study, Final Report, and Technical Note TN1, 1991.

Predicted noise levels were additionally compared with:

- o Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites, 1981;
- o Noise Control Ordinance; and
- o Technical Memorandum on Noise from Construction Other than Percussive Piling, Environmental Protection Department, January 1989.

Supplementary to the HKPSG cognisance was also given to the Hong Kong Air Quality Objectives stated in the Air Pollution Control (Air Control Zone) (Declaration Order) 1989.

In the following sub-sections each of the main environmental constraints is considered in turn.

4.7 Noise

A fundamental development constraint imposed on the New Town in the context of noise pollution was the noise

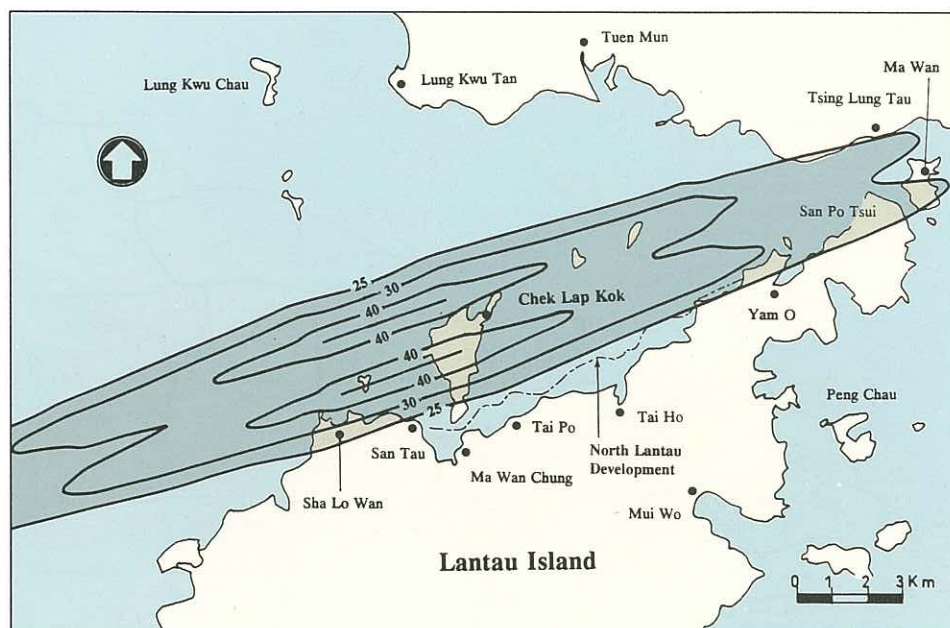


Figure 4.5 NEF Noise Contours for Year 2030

Note : The contours shown here are the final NEF contours in the Airport Master Plan Study and represent a slight northerly shift compared to those available during the assessment of constraints.

exposure forecast, NEF 25, contour for the New Airport. This is indicated on Figure 4.4. Greater detail of the NEF contours for the year 2030 is given in Figure 4.5. Land uses that are permissible within different Noise Exposure Forecasts are shown in Table 4.1. Other constraints include the noise from of road and rail links to and from the New Airport and within the New Town.

Land uses which are considered compatible with aircraft noise are documented in the HKPSG and these were used throughout the development of concept plans.

Traffic levels, frequency of rail services, vehicle and trainspeeds and close proximity of the NLE and AEL to New Town areas will impose constraints on the types and extent of development which may be accommodated alongside these transport corridors.

Therefore, in formulating development concepts the following constraints have been taken into account:

- o residential developments have been excluded from all areas impacted by aircraft noise (NEF 25 contour taken as the guideline);
- o new noise sensitive uses have been located, wherever possible, in areas where they will not be subject to excessive traffic noise levels;
- o operations which could present noise problems such as the refuse transfer station, industrial areas and the railway depot were located well away from residential areas; and
- o residential areas have been located in such a way as to minimise noise impacts from the NLE/ARL corridor and the primary distributor roads in the New Town.

Noise reduction measures wherever necessary were also considered from an aesthetic viewpoint. Noise reduction barriers on roads can be aesthetically unattractive and visual impacts may constrain the mitigation measures adopted if overall environmental quality of the area is to be maintained.

Table 4.1 Summary of Noise Standards

Noise Source Noise Standards Uses	Aircraft Noise (Noise Exposure Forecast : NEF)		Helicopter Noise Lmax dB(A)	Road traffic Noise L10 (1hour) dB(A)	Rail Traffic Noise	Fixed Noise Source
	Kai Tak Airport	New Chek Lap Kok Airport				
All domestic premises including temporary housing accommodation	30	25	85	70	(a) Leq (24 hr) = 65 dB(A) and	(a) 5 dB(A) below appropriate Acceptable Noise Levels shown in Table 3 of the Technical Memorandum for the Assessment of Noise from Places Other than Domestic Premises, Public Places or Construction Sites and (b) the prevailing background noise levels
Hotels and hostels	30	25	85	70	(b) Lmax (2300 - 0700) = 85 dB(A)	
Offices	30	30	90	70		
Educational institutions including Kindergartens, nurseries and all others where unaided voice communication is required	30	25	85	65		
Places of public worship and court of law	30	25	85	65		
Hospitals, clinics convalescences and homes for the aged - diagnostic rooms - wards	30	25	85	55		
Amphitheatres, and auditoria, libraries, performing arts centres and Country Parks	depend on use, extent and construction		depend on locations and construction			

Source : HKPSG

Notes:

1. The above standards apply to uses which rely on opened windows for ventilation.
2. The above standards should be viewed as the maximum permissible noise levels at the external facade.

4.8 Water Quality

One of the stated objectives of the Study is to minimise the amount and impact of water pollution consequent to the overall development of North Lantau as well as for each development phase. Water quality within the North Western Territorial Waters is externally

constrained by the quality of water in the Western and Victoria Harbours on the flood tide, and from the Pearl River, and to some extent Deep Bay, on the ebb tide.

Local water movements may be affected during the construction phase by dredging or land formation activities.

Phasing of reclamation and formation of temporary seawalls may also affect water movements particularly in Tung Chung Wan. Once construction is complete, factors affecting water movements include the alignment of new seawalls, jetties and piers.

During construction water quality may also be affected by dredging and land formation activities together with potential discharge of pollutants off site into receiving waters. Restricting flows may also cause a deterioration in water quality by reducing the flushing capacity of the water body concerned. Such a situation is likely to occur in Tung Chung Wan during the early phases of development, although as the formation of land progresses and the proposed drainage arrangements are completed this problem will be resolved.

East Tung Chung Bay was identified early in the Study as a water body which could be severely impacted if water exchange rates between the bay and main stream waters diminish. Water exchange rates in this area are presently considered to be slow as nearshore ambient velocities are low. Consequently any pollutants discharged to the area may take some time to be flushed out of the bay.

The response to this constraint was to consider a Sea Channel separating the New Airport and New Town. Analysis of the Sea Channel option (given in Technical Note TN5 'The Sea Channel') showed that assuming the water in the channel did not convey pollutants, this flow could be beneficial in aiding the flushing of East Tung Chung Bay thereby maintaining water quality standards. This is also discussed in Section 9 and Appendix F of this report.

Other constraints on water quality relate to the fact that the upper parts of the valleys in the Study Area are used by Water Supplies Department (WSD) as water catchments. Any development or recreational facility planned in the upper catchments was required to take account of the importance of ensuring that these water reserves did not become contaminated. The main constraints on Water Quality are shown in Figure 4.6.

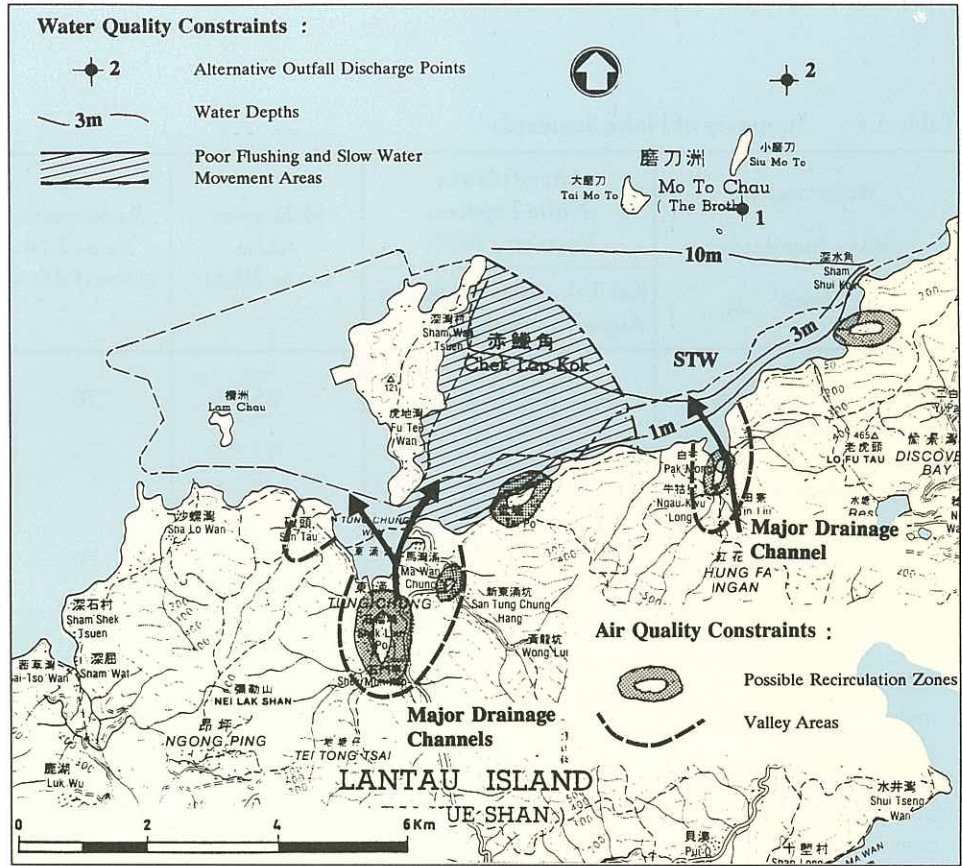


Figure 4.6 Constraints on Water and Air Quality

4.9 Air Quality

External constraints on New Town development in terms of air quality relate to the New Airport, North Lantau Expressway and background pollution levels from specific sources, such as the existing and proposed power stations west of Tuen Mun, together with general background air pollution in Hong Kong. In addition to the foregoing, the physical characteristics of North Lantau may also limit developments if the environmental objectives are to be achieved.

Specific local wind conditions can exist in the lee of mountains where air flow may reverse and wind speeds are low. Release of pollutants into such regions can result in their being 'trapped' and they may therefore build up to a relatively high level of concentration. Areas potentially affected by recirculation (as indicated in Figure 4.6) depend upon a combination of factors including the height, width, depth and particular shape of the mountain slopes.

Poor dispersion of airborne pollutants could potentially arise in Tung Chung Valley and any of the other valleys of North Lantau as well as downwind of groups of tall buildings. Such conditions could impose constraints on developments in specific areas.

Prevailing winds in Hong Kong are from the southeast to northeast in the winter months and from the southeast to southwest in the summer months, and tend to increase air pollution levels to the west of any polluting sources. Winds from compass directions 50 to 60 degrees and 150 to 160 degrees are relatively rare on North Lantau due to the topography of the western New Territories and Lantau Island. Air quality in North Lantau may thus be affected by pollution sources on Hong Kong Island in easterly winds and Tuen Mun and Tsuen Wan in northerly winds.

Taking the standards for air quality to be aimed at for all development on North Lantau (both for construction

and operational phases) into account, concept plans were conceived and developed to meet the following constraints:

- o there would be no large pollutant sources or large residential areas in the recirculation zone in the Tung Chung Valley;
- o breeze ways would be provided in Tung Chung Valley, aligned with local topography and prevailing winds;
- o a buffer zone would be provided between industrial and residential zones;
- o consideration would be given to the types of industry to be located on North Lantau with the possibility of restricting or prohibiting certain polluting industries;
- o location of industry and polluters such as the hospital would be to the west or north of residential areas if possible;
- o careful consideration would be given to the types of development to be permitted in the valleys of North Lantau; and
- o sufficient space would be provided between areas zoned for tall buildings to permit adequate dispersion of pollutants.

4.10 Sewage Arisings

Within the Study Area there are only very limited existing sewage treatment facilities. These comprise, in the main, septic tanks serving individual plots. Comprehensive sewerage, sewage treatment and disposal facilities are thus required to cater for sewage arising in connection with the New Town, New Airport and retained communities. The possibility that the proposed Port

Peninsula Development will be included in the catchment has also been taken into account.

A full analysis of the location for the Sewage Treatment Works and Outfalls can be found in Working paper WP8, Technical Note TN12 and Design Memorandum DM1. In addition full liaison with the Airport Master Plan Consultants regarding their requirements was maintained throughout the Study.

A number of options for sewage treatment were considered. These included separate treatment works for the New Airport and New Town and a combined works. It was concluded that a combined works would be most economical and a comprehensive review of suitable sites was carried out. This was reported in Working Paper WP8 (Revised). "Suggested Siting for Sewage Treatment Works and Outfall". Sites throughout the length of the North Lantau shoreline and on the New Airport reclamation were considered. Outfall locations to the west and north of the New Airport and near the Brothers were also considered.

Environmental constraints include compatibility with neighbouring land uses and, of greater significance, the availability of a suitable outfall location in terms of water depth, water movement, stratification and assimilative capacity of the North Western Territorial Waters and receiving water quality.

The Study Brief also called for possible future linking of the system to the Oceanic Outfall System envisaged in the Strategic Sewage Disposal Scheme.

The determination of locations for sewage treatment works and effluent outfalls is constrained by planning considerations, engineering feasibility and potential environmental impacts.

The main constraints on locating a sewage outfall are those in determining a suitable discharge point in terms of water depth, water movement, stratification, assimilative capacity and receiving water quality. To satisfy marine environmental constraints the discharge point should ideally be in water of sufficient depth and adequate current to afford acceptable initial dilution and dispersion of effluent. With the proximity of the New Airport it is also necessary to consider the hazard to aviation posed by sea birds which are invariably attracted to sewage outfalls. Other constraints include the need to avoid gazetted marine borrow areas and other submarine utilities.

The most important marine constraints are indicated in Figure 4.7 and these form the basis of the evaluation of outfall alternatives. Outfall locations at Chek Lap Kok, Tung Chung, Tai Ho and Ta Pang Po were considered but were eliminated for various reasons,

- o The sea to the west of Chek Lap Kok is shallow and water movement is already weak. The new airport platform is expected to decrease the already limited flows in this area.
- o An outfall to north east of Chek Lap Kok could offer reasonable dispersion into moderately deep water. However, the outfall would be uneconomically long as the discharge point would have to be located far from the airport to avoid the hazard of bird strike.
- o There are no sites in Tung Chung, nor along the coast towards Tai Ho, which offer a suitable location for a Sewage Treatment Works. In addition the shallow depth and weak currents in the coastal water make this area unsuitable for an outfall discharge.

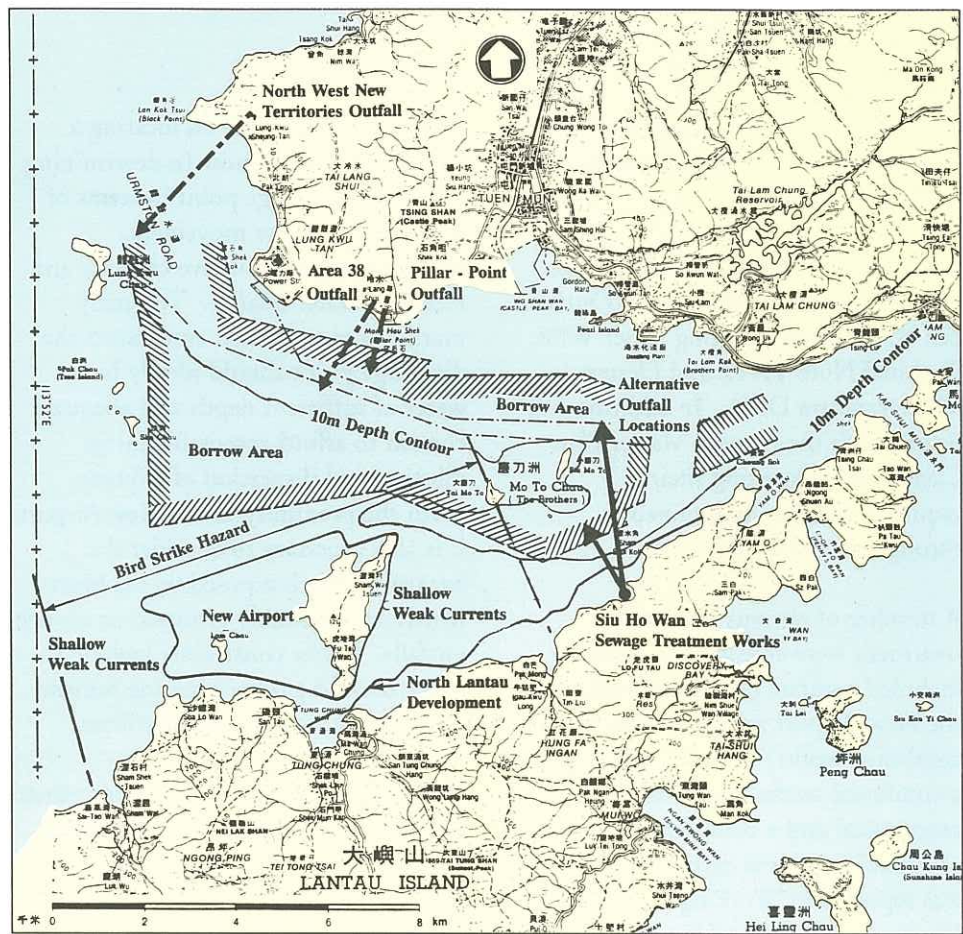


Figure 4.7 Constraints on Sewage Outfall Location

o Ta Pang Po would appear to be suitable for an outfall pipeline landfall offering the possibility of a short outfall into the deep channel between Lantau and Tai Lam. However, this area is congested with submarine utilities and is more remote from the airport and development than the preferred location at Tai Ho East.

The most suitable area for an outfall would therefore appear to be the deep area to the North West of Tai Ho East. Two possible outfall options were identified. These were;

- o a short outfall discharging into water 10m or more in depth, to the south of East Brother; or
- o a longer outfall discharging into water some 20m deep to the north of the East Brother.

Although both the preferred options encroach into gazetted marine borrow areas it has been confirmed that the yield of these areas is expected to be low. Fill Management Committee has indicated that they would raise no objection to the re-gazetting of this area for an outfall.

Water quantity impact assessments were carried out on the preferred options using procedures which included some of the WAHMO suite of mathematical water quality and bacterial dispersion models. Predictions of future water quality were assessed and recommendations were made on the necessary level of treatment. The investigations carried out have concluded that the longer outfall offered no advantage over the shorter and that the preliminary treatment of sewage is adequate to meet the initial water quality objectives.

The constraints on siting of sewage treatment works include compatibility with neighbouring land uses and minimising the length of outfall pipeline. Considering these factors the optimum site for the treatment works is at Tai Ho East adjacent to the water treatment works on the south side of the North Lantau Expressway. This site is the closest available site to the selected outfall discharge point and affords sufficient land area to meet any foreseeable future sewage treatment requirement.

4.11 Solid Waste Disposal

The quantity of wastes arising from the proposed New Town and New Airport developments on North Lantau is the main constraint. Forecasts of wastes arising from these sources (even in the early years) result in the need for off-site disposal. The distance between North Lantau and the Western New Territories (WENT) landfill imposes an additional constraint in terms of trip time and the loads able to be conveyed in the working day. A full analysis of the need for and possible locations of a Refuse Transfer Station is given in Working Paper WP5 (Revised) and Design Memorandum DM2.

A waterfront site was required to provide access for the barges conveying containerised waste from the transfer station. Taking this and other environmental considerations such as noise and odour emissions into account, the preferred site was at Tai Ho East.

4.12 Landscape and Visual Issues

Transformation of parts of North Lantau from a rural setting to an urban area with all the supporting infrastructure associated with the New Town and New Airport undoubtedly imposes a considerable constraint in

terms of landscape and visual quality. An analysis of these likely constraints (in terms of topography, ecology, fung shui and other issues) is given in Technical Note TN1, 'Landscape Issues'.

The main constraints in developing the concept plans have taken account of landscape issues. For example it is planned to retain the steep central spur of Tung Chung Valley, including the Tung Chung Battery, as a major landscape feature for passive recreation. The preservation of natural and fung shui woodland, and wherever possible its incorporation into urban parks, has also been a goal. These constraints are summarised on Figure 4.8.

4.13 Ecology

The preliminary ecological survey (as reported in Technical Note TN1 and Appendix E of this report) identified the upland valley woodlands as the most ecologically important habitats in the Study Area. The Development plans which have been conceived have avoided encroachment into these areas for this reason and because they also form a major landscape feature.

A further constraint arose in connection with tidal areas at the mouths of streams, which provide the habitat for mangrove colonies. The re-provision of such habitats in equivalent areas as demonstrated in Tin Shui Wai, was considered to be most appropriate in response to this particular constraint.

4.14 Winter Shadow

One of the findings of earlier North Lantau Development Investigations (1979-83) was that the north western slopes of the Tai Ho and Tung Chung valleys are in shadow for significant periods during the winter months.

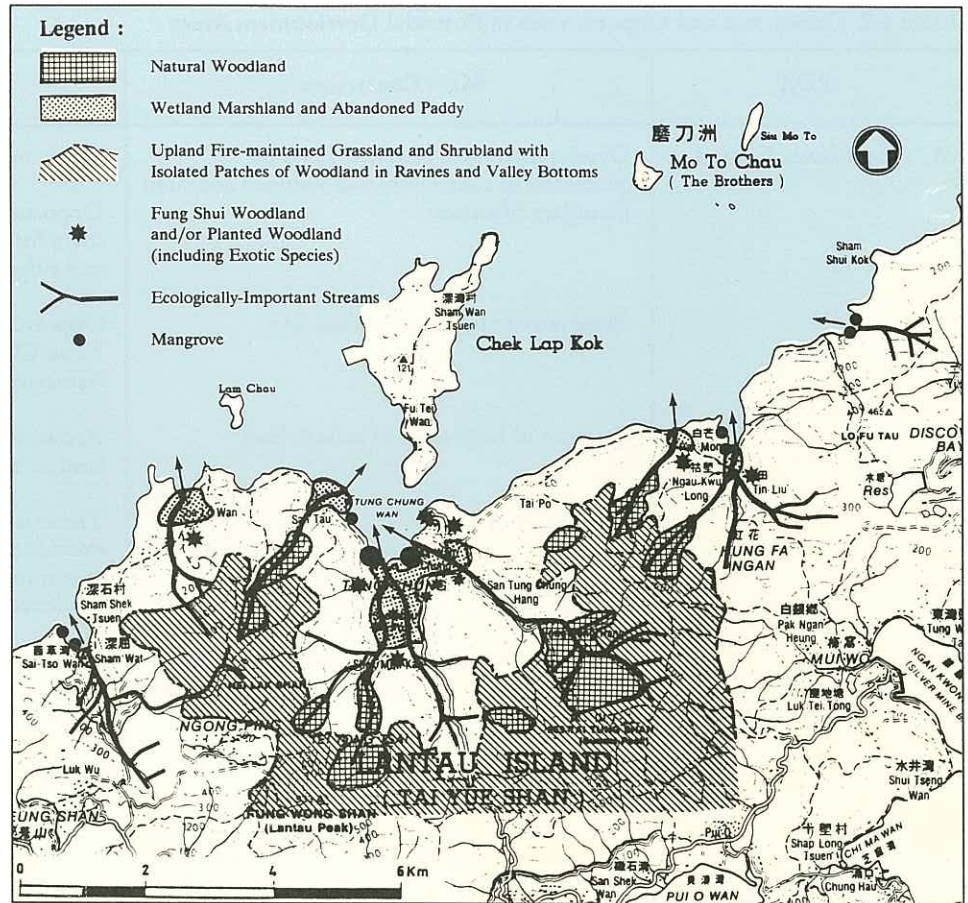


Figure 4.8 Landscape and Ecology

While this could place a serious constraint upon development, none of the affected slopes were considered suitable for urban uses.

4.15 Classification of Constraints and Opportunities

Constraints were classified as absolute, significant or minor. In the areas subject to absolute constraints, no development has been planned. Significant constraints have not precluded development but have affected the New Town plan. Minor constraints could be overcome in the detailed layout planning of the New Town development.

Opportunities were identified, primarily, as those areas where there was an absence of constraints or where the severity of a constraint did not preclude development. Opportunities were defined as Potential Development

Areas (PDAs) and there are described in Table 4.2. Six PDAs were identified and these were used as the 'building blocks' in the preparation of the Initial Concept Plans, and subsequent refinements of these plans into a Preferred Concept Plan. The location size and distribution of these areas is shown in Figure 6.1 of this report.

Table 4.2 Constraints and Opportunities in Potential Development Areas

PDA	Main Constraints	Main Opportunities
A. Tung Chung Central	<p>Development area largely defined by geotechnical constraints and assumed southern boundary of airport.</p> <p>Requirement for major nullah (s)</p> <p>Presence of large areas of private land</p> <p>Country Park</p> <p>Noise from traffic and the operations of the airport could affect development in the north of the PDA</p> <p>South and east sides of Tung Chung valley could be affected by recirculation of air pollutants</p>	<p>Attractive setting for residential development.</p> <p>Opportunities to utilise spur topography in planning town form and to maximise views of dramatic peaks and ridgelines to the south</p> <p>Opportunity to protect scenic coastline to west of Tung Chung and integrate nullah into landscape framework.</p> <p>Reclamation could limit the amount area of private land to be resumed.</p> <p>The existing Country Park boundary could be extended to control development in urban fringe and maximise recreational opportunities for New Town residents.</p> <p>Incorporation of steep central spur in Tung Chung valley and gazetted monuments into open space system of the development.</p> <p>Incorporate breezeways into urban form.</p>
B. Tung Chung Coast	<p>Alignment of NLE and railway could result in small and irregularly shaped development parcels.</p> <p>Airport height restrictions may limit development potential</p>	<p>Waterfrontage and proximity to airport provide opportunities for major 'gateway' development.</p>
C. Tung Chung East	<p>Development potential may be constrained by 60 mPD height restriction</p> <p>Polluting industry should be avoided in this location since the prevailing winds are easterly and pollutants will blow into the proposed urban areas in Tung Chung.</p> <p>Residential development unlikely to be appropriate owing to 25 NEF contour.</p>	<p>Waterfrontage affords design possibilities.</p> <p>Possible site for provision of rail depot.</p>
D. Tai Ho Central	<p>Development area largely defined by geotechnical constraints</p> <p>Large areas of private land</p> <p>Noise from road and rail may affect development in the north of the PDA.</p>	<p>Attractive setting for residential development.</p>
E. Tai Ho Coast	<p>80 mPD height restriction may affect development potential</p> <p>Noise from road and rail may affect development</p>	<p>Waterfrontage affords design opportunities.</p>
F. Tai Ho East	<p>25 NEF contour precludes residential development</p>	<p>Opportunity to develop low-rise industrial estate or science park.</p> <p>Possible location for rail depot.</p>

Source : Consultants Analysis (see Topic Report TR3)

North Lantau Development



5. Development Requirements

5. DEVELOPMENT REQUIREMENTS

5.1 Introduction

The purpose of this Section of the report is to determine the overall development requirements for the New Town, and in particular land requirements for various uses and facilities.



Tai Ho Computer Image

The social characteristics and income distribution of the population form the basis from which requirements for housing, employment, schools, shopping and community facilities provision can be determined and land requirements established.

Residential land requirements are partly determined by different population densities applied to the public and private housing sector types. The distribution of population between public and private housing sectors is, in turn, influenced by the distribution of household income.

As part of this Study, population targets and the split between public and private housing sectors, as initially established in LDPC 20/90 "Development Assumptions for North Lantau", were refined to provide a more realistic base for residential land requirements.

The distribution of household income and expenditure patterns, which are influenced by housing type, affects the shopping provision in the New Town. Characteristics such as household size

are reflected in the type of housing people live in. At the same time the overall age structure of the population is fundamental to determining the need for school places and forecasting the numbers of workers and hence employment requirements.

5.2 Housing

5.2.1 Initial Population Targets

The New Town will offer public rental housing (RS), Home Ownership Scheme (HOS) housing and private sector housing. Initial population targets and housing mix in these categories were suggested in the Study Brief (see Appendix A of this report) and by LDPC Paper 20/90 "Development Assumptions for North Lantau". These targets are summarised in Table 5.1. The population targets have been translated into households based on the projections of household size provided by the 'Working Group on Population Distribution' Paper 3/91 and the Hong Kong Housing Authority. The basis for calculating

these household projections is shown in Table 5.2.

During the development of the Recommended Outline Development Plan (RODP), analysis was undertaken to refine housing needs based on affordability, and subsequently to determine housing land requirements.

5.2.2 Affordability Analysis

This analysis was based on the findings of a Supplementary Study carried out as part of this project, namely the "Survey of Airport Employees Income and Social Characteristics". This survey determined the income distribution and social characteristics of existing airport employees likely to move to North Lantau and established the likely income distribution of airport-related employees at Airport opening. The income profile derived was assumed to represent that for North Lantau households and is shown in Figure 5.1.

The potential demand for housing was then determined using by this income profile and by:-

Table 5.1 Initial Population Targets and Housing Distribution

Housing Type	1997	2001	2006	2011	Post 2011
Public Rental	10,000	20,000	30,000	40,000	50,000
HOS/PSPS	5,000	20,000	40,000	60,000	80,000
Private/Others	5,000	20,000	50,000	100,000	130,000
Total	20,000	60,000	120,000	200,000	260,000
Households	6,150	19,580	41,930	73,130	95,060

Source : Study Brief, LDPC Paper 20/90 and "Working Group on Population Distribution Paper 3/91

Table 5.2 Projected Average Household Size by Tenure

Tenure	1997	2001	2006	2011	Post 2011
Public Rental	3.60	3.60	3.42	3.28	3.28
HOS	3.25	3.05	2.89	2.78	2.78
All Private	2.84	2.70	2.60	2.50	2.50

Source : Working Group on Population Distribution and Hong Kong Housing Authority

- o projecting household income and property prices based on 1990 values;
- o determining the minimum income required to purchase each housing type in each period based on assumed affordability criteria;
- o identifying the proportion of households that could afford to purchase private housing and those that would require public housing; and
- o applying gross densities to determine residential land requirements for the New Town.

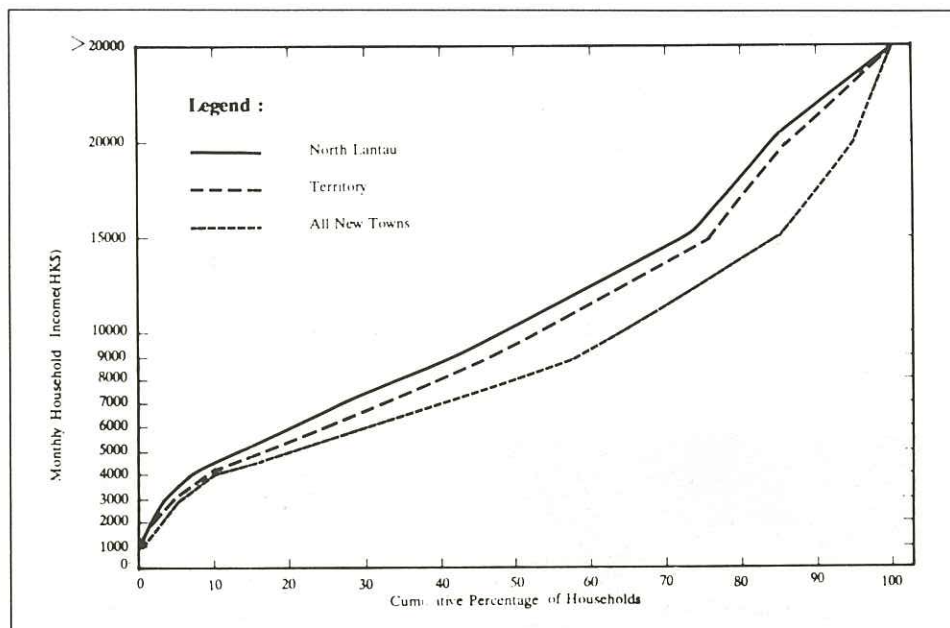


Figure 5.1 Income Profile for North Lantau

Table 5.3 Housing Demand - Proportion of Households by Housing Type

Zoning	Percentage of Households									
	1997		2001		2006		2011		Post 2011	
PRS	27	} 70%	25	} 65%	21	} 52%	19	} 50%	19	} 50%
HOS	43		40		31		31			
R1	21	} 30%	25	} 35%	36	} 48%	37	} 50%	37	} 50%
R2	3		4		4		4			
R3	3		3		4		4			
R4	3		3		4		5			
Total	100	100	100	100	100	100	100	100	100	100

Source : Consultants' Estimates

The analysis to determine the potential demand for different types of housing assumed a direct relationship between household income and the ability to purchase housing. The respective income levels required for housing purchase and the monthly income eligibility criteria of the Hong Kong Housing Authority have been applied to the household income profile (shown in Figure 5.1) to identify the proportion of households that could afford to purchase housing and those that would require public housing. The resulting potential housing demand is given in Table 5.3.

There is clearly considerable uncertainty involved in attempting to forecast housing requirements over a 20-year period. These uncertainties include not only changes in demographic trends and policy assumptions but also growth in household income, property prices, mortgage terms and repayments and demand for particular types of housing. For these reasons it is suggested that housing mix and provision should be reviewed in the New Town on a five year basis.

In the early years of the North Lantau Development, a greater proportion of

HOS housing has been proposed than initially suggested by the affordability analysis. This adjustment is suggested for two reasons:

- o requirements for HOS housing are probably understated given the presence of a 'sandwich' class neither eligible for this form of housing nor able to afford to purchase private housing; and
- o the early provision of public housing and attendant facilities will help to provide the 'critical mass' to establish North Lantau as an attractive residential community;

The split between HOS and private housing has therefore been adjusted for

1997 and 2001, reverting to that indicated by the affordability analysis for 2006 and 2011.

A decision by government not to endorse low density housing on resumed land in the Tung Chung valley in the first phase development resulted in a further adjustment to the proposed housing mix. First phase population would be accommodated only in public and HOS housing and high density R1 housing.

The affordability analysis also suggested that a greater proportion of land for R4 housing be provided than is shown on the RODP. Suitable land to provide for some of this housing is located on the fringe of the New Town in Tung

Chung valley. Demand for this form of housing is uncertain. Potential sites in the hinterland of the New Town to accommodate such demand are constrained by existing village settlements, geotechnically unstable areas and potential conflicts with recreation orientated uses more appropriate to the rural hinterland of the New Town.

5.2.3 Land Requirements

Table 5.4 establishes gross residential density assumptions by housing type.

In determining residential land requirements for public housing and HOS housing, the densities assumed are compatible with those set out in the "Review of Residential Densities in Public Housing Estates", published by the Hong Kong Housing Authority. For the private sector, the results of the affordability analysis by size of flat have

been related to the characteristics of housing within the zones R1 to R4, based on residential gross floor area per person set out in the Hong Kong Planning Standards and Guidelines and typical unit sizes in the current market. These zonings have then been converted into residential land requirements (shown in Table 5.5) based on the densities shown in Table 5.4. The requirement for R4 land calculated in this way exceeds the provision on the RODP. This lower provision of R4 land than that suggested by demand is addressed in Section 5.2.2 of this report.

5.3 Employment

5.3.1 Employment Structure

The New Town is unusual among Hong Kong's new towns in that the New Airport will provide a substantial employment base from the first phase of

development, and airport and airport-related jobs will dominate the employment structure. Data on the number and timing of employment opportunities at the New Airport was obtained from the Airport Masterplan Consultants, and in particular the paper on 'Air Services Demand Projections'.

This employment structure will undoubtedly influence the occupational composition of the resident workforce, with many households attracted because of the job opportunities coupled with the attractive environment. There is no large pre-existing workforce on the island with an established occupational profile. The build-up of job opportunities would be rapid due to the airport and would lead rather than lag behind the growth of the resident labour force. Unskilled and semi-skilled job opportunities would be available in large numbers at the airport, in population-related services and in airport-related industry. The occupational profile of the resident workforce is, therefore, likely to adjust to the available job opportunities on North Lantau.

Total labour demand from the more definite activities on North Lantau (by 2011) would be approximately as follows:

- o on-Airport jobs 34,900
- o off-Airport jobs in airport-related industrial and commercial activities 34,400
- o population-related jobs 37,800

The total labour force from a population of 200,000 in 2011 would be about 107,000 indicating a general balance between labour demand and resident workforce. Thus, there would be no strong social need to attract additional jobs in general industries to the New Town to ensure local opportunities for the resident workforce.

Table 5.4 Gross Residential Density Assumptions by Housing Type

Housing Type	Year/Persons per hectare				
	1997	2001	2006	2011	Post 2011
RS	2000	2000	1900	1800	1800
HOS	2000	2000	1900	1800	1800
R1 (PR = 8)	1,760	1,670	1,590	1,510	1,435
R1 (PR = 5)	1,460	1,390	1,320	1,255	1,195
R2 (PR = 5)	1,050	1,000	950	905	860
R3 (PR = 3)	470	450	430	410	390
R4 (PR = 0.4)	100	95	90	85	80

Source : Consultants' Estimates

Table 5.5 Land Requirements by Housing Type

Zoning	Cumulative Land Area (gross ha)				
	1997	2001	2006	2011	Post 2011
RS	3.11	8.29	15.24	24.57	30.90
HOS	4.25	11.45	19.19	34.17	44.50
R1	2.10	7.90	24.70	44.80	63.38
R2	0.50	0.80	4.60	8.10	12.98
R3	1.10	1.30	10.10	17.80	27.03
R4	5.20	16.70	48.14	114.30	114.30
Total	16.26	46.44	122.23	243.71	293.09

Source : Consultants' Estimates

5.3.2 Employment Distribution and Land Requirements

The employment strategy for North Lantau Development aimed to satisfy as far as possible the demand for airport-related industrial and commercial enterprises seeking or requiring to establish on North Lantau. The SICENRA forecasts indicated a substantial potential demand for such requirements. As such it was considered undesirable to attract other industrial activity to North Lantau as this would compete with airport-related activities both for transport capacity and labour. More recent figures from the subsequent 'Study of Airport Related Activities' (SARA) are not yet available. It is understood that these may be lower in respect of airport related industrial uses and some review of the following assumptions will be required at a later stage when this data is formally adopted by Government.

To satisfy demand for land arising from these airport-related industrial and commercial uses, a strategy was proposed by SICENRA and subsequently adopted as the basis for determination of industrial and commercial land requirements for North Lantau Development. This strategy proposed four development projects. These were :-

- o an office/hotel complex - a complex in Tung Chung Town Centre on a high profile site (see Section 5.4.2);
- o a Cargo Village - accommodating a wide range of air cargo activities;
- o a Business Park - a fully integrated, high amenity, medium density development offering airport hotels, an airport related conference facility, airport related offices and commercial space; and

- o an Industrial Park - accommodating airport related industrial uses.

Table 5.6 outlines the employment distribution and land requirements required to meet the demand of these development projects.

SICENRA identified the need to site the Cargo Village in close proximity to the on-airport cargo terminal. This requirement could be met by siting this development project at Chek Lap Kok, subject to the availability of suitable land and an adequate institutional framework to implement this project. The location of the Business Park at Chek Lap Kok, or elsewhere, is subject to similar constraints. The location strategy adopted in developing the RODP has provided for the phased development of the Cargo Village (28ha in 2011) and Business Park (27ha in 2011) at Chek Lap Kok and an

Industrial Park (52ha in 2011) at Tai Ho East.

5.4 Commercial Requirements

5.4.1 Method of Assessment

The requirements for retail facilities, in terms of floorspace, have been established for the New Town by using an expenditure-based method in which household expenditure patterns are related to the retail floorspace through sales.

The relative remoteness of North Lantau from major centres of population means that there is unlikely to be substantial leakage to other areas of expenditure on convenience goods. For consumer durables, leakage is likely to be more pronounced in the early years of the development when residents will travel to the urban area. It has

Table 5.6 Employment Distribution and Land Requirements

Activity	1997	2001	2006	2011
<u>Cargo village</u>				
- Net floor area (000m ²)	84	180	247	309
- Net site area (ha)	5	10	14	17
- Gross site area (ha)	8	16	22	28
- Employment	2,300	4,000	4,600	5,000
<u>Industrial Park</u>				
- Net floor area (000m ²)	145	344	468	573
- Net site area (ha)	8	19	26	32
- Gross site area (ha)	13	31	42	52
- Employment	5,600	13,100	16,500	18,700
<u>Business Park</u>				
- Net floor area (000m ²)	72	162	218	268
- Net site area (ha)	5	10	13	16
- Gross site area (ha)	8	16	22	27
- Employment	3,600	7,500	9,300	10,700
Total gross site area (ha)	29	63	86	107
Total employment	11400	24600	30400	34400

Source : Consultants' Estimates and the SICENRA Report (data subject to review)

been assumed that all retail expenditure generated by the town's residents that may be spent in shopping facilities outside the town would be balanced by retail expenditure attracted into the town. It is also assumed that retail expenditure by airport passengers in North Lantau is limited and will instead be spent on-airport, in airport or other hotels and in the traditional shopping areas of the Territory rather than in the New Town. Although facilities in North Lantau may serve population in the rest of Lantau, this possibility has not been specifically accounted for in the analysis. Such expenditure would however contribute to the commercial viability of the shopping centres in the New Town.

The results of the consumer expenditure analysis are summarised below and full details are given in Appendix C of this report.

Expenditure patterns have been derived from the '1988 Survey of Wholesale, Retail and Import/Export Trades,' published by Census and Statistics Department and updated to 1990 prices using the Consumer Price Index. The data was also amended to allow for an assumed 10 percent of household income allocated to savings.

Commodities/services were reclassified as convenience goods, comparison goods and retail services.

Based on a population of 200,000, the potential retail expenditure on convenience and comparison goods and retail services in the New Town would amount to HK\$700 million per month. Convenience goods account for 66 percent of this expenditure, comparison goods, including clothing and durables, account for 16 percent and retail services account for the remaining 18 percent of expenditure.

This forecast expenditure was then converted into retail gross floorspace by applying the average retail sales turnover to the potential retail expenditure for convenience and comparison goods. The required gross retail floorspace has been estimated at 320,000m² assuming an overall efficiency rate of 75 percent (ratio of net to gross floorspace)

This gross floorspace would be distributed approximately 30 percent in the town centre, 20 per cent in district centres and 50 percent within local residential areas.

5.4.2 Commercial Facilities

The proximity of the New Town to the New Airport is likely to generate a significant demand for airport-related office accommodation in the New Town. SICENRA concluded that such provision should be concentrated in two development projects. These are a Business Park and an office/hotel complex.

The Business Park has been discussed in Section 5.3. Based on a population of 200,000, the demand for gross floorspace for office and hotel uses on North Lantau has been estimated at some 49,300m². This should be accommodated in an office/hotel complex and used to anchor the town centre development in Tung Chung. The provision of this floorspace would respond to market demand, building up from about 18,000m² gross floorspace in a hotel or office development in 1997 to 49,300m² gross floorspace in two hotel and office developments by 2011.

5.5 Government/Institutional and Community Uses

5.5.1 Overall Requirements

The New Town will require a comprehensive range of local and

district level community facilities. These include educational requirements, health and welfare facilities, Government uses, community, social and cultural facilities, transport and recreational facilities.

The level of provision and range of the facilities proposed was based on the HKPSG standards, discussion with relevant government departments and recent and recommended changes in government policy. Table 5.7 shows the provision of G/IC facilities which require discrete sites. Table 5.8 shows the provision of G/IC facilities in other land use zones.

5.5.2 Education Facilities

The requirements for primary and secondary schools have been assessed in relation to the projected population of school age considered likely to settle in the New Town as advised by the Education Department. The assessment indicates that based on the new "flexi-school" design, 14 primary schools and 13 secondary schools, will be required by 2011. Where appropriate, provision would be made for primary schools to be located within Public Housing rental estates. All remaining primary schools and secondary schools would be located close to population centres. Kindergartens, where planned provision has been based on population projections according to the HKPSG standards, do not require discrete sites but can be accommodated in public or private housing blocks.

5.5.3 Medical and Health Facilities

Land requirement at the 200,000 population level (2011) for medical and health facilities is 9.5 ha. A District Hospital and Polyclinic site of 9.3ha is proposed in Tai Ho, south of the NLE. Health Clinics would be provided in

Table 5.7 Government Institutional and Community Uses Requiring Discrete Sites

Facility	Number Required	Minimum site area m ²	Area allowed (ha)	Total hectares
Education				
Primary School	7	5005	0.50	3.50
Secondary School	12	5850	0.59	7.08
Police Facilities				
District police station incorporating	1	6000	0.70	0.70
Divisional police station	1	6000	0.60	0.60
Police married quarters	1	3000	0.30	0.30
Vehicle pound				
Fire and Ambulance Services				
Divisional fire station/ambulance depot	1	2959	0.30	0.30
Sub-divisional fire station/ ambulance depot	1	2959	0.30	0.30
Medical and Health Facilities				
Hospital	1	88000	8.80	8.80
Polyclinic	1	4700	0.47	0.47
Social Welfare Facilities				
Area community centre	1	2145	0.22	0.22
Civic and Cultural Facilities				
Magistracy (2 courts))			
Town hall/cultural complex)			
Main post office) 1		3.00	3.00
Library)			
Recreation facilities				
Recreation complex (incorporating a swimming pool complex)	1	30000	3.00	3.00
Stadium	1	50000	5.00	5.00
Indoor recreation centres	5	6000	0.60	3.00
Other facilities				
Main market				
Transport Interchange	1	200000	2.00	
Multi storey car park	1	-	-	-
Bus depot	1	10000	1.00	1.00
Government depots	-	-	-	-
Funeral parlour	1	-	0.25	0.25
Sewage treatment works	1	110000	11.00	11.00
Water treatment plant	1	-	-	-
Service reservoirs	2	-	12.06	12.06
Pumping station	1	4000	0.40	0.40
Telephone exchange	1	2000	0.20	0.20
Electricity sub-station	1	1500	0.15	0.15
Refuse Transfer Station	1	20000	2.25	2.25

Source : HKPSG and Government Departments

Tung Chung and Tai Ho on sites of 0.22ha respectively. The Health Clinic in Tung Chung would be located adjacent to the first phase Public Housing rental estate.

5.5.4 Police, Fire and Ambulance Services

A District Police Headquarters incorporating a Divisional Station and other police functions would be provided in Tung Chung on a site of 0.6ha to serve the Lantau Island District. Additional requirements include a motor vehicle compound of 0.3ha (for impounded vehicles) and married staff quarters occupying a site of 0.6ha. Police facilities to serve Tai Ho would be reviewed at a later stage and could include a sub-divisional station.

A Divisional Fire Station incorporating an ambulance facility would be located in Tung Chung to provide for emergency services in Tung Chung as well as back up support for the New Airport emergency services facilities. The site requirement is 0.3ha. A Sub-Divisional Fire Station and ambulance facility is required on a 0.18ha site in Tai Ho.

5.5.5 Community and Social Welfare Facilities

Community facilities include Community Centres which would provide a focal point for the local community and social activities undertaken by all age groups. A Neighbourhood Community Centre on a site of 0.22ha would be provided in the first phase of development. Further facilities, including an Area Community Centre (0.22ha) and a District Community Centre (0.25ha),

Table 5.8 Government/Institutional and Community Facilities in other Land Use Zones

Facility	Number Required	Minimum site area m ²	Area allowed (ha)	Total hectares
Education Primary School	5	5005	0.50	2.50
Social Welfare Facilities				
Area Centre	1	2145	0.22	0.22
Neighbourhood Centre	1	2145	0.22	0.22
District Centre	1	2550	0.26	0.26
Medical/Health Facilities				
Urban Clinic	2	2220	0.22	0.44

Source : Consultants' Estimates and Departmental Advice

would be provided in later phases of development in Tung Chung. An Area Community Centre would be provided in Tai Ho. The total land requirement for community facilities is 0.91ha.

Social welfare facilities, including facilities for children, youths, the disabled and the elderly of the community can be provided in part of the Community Centres, or in residential development (which includes Public Housing Estates and private residential areas) and thus do not normally require discrete sites.

5.5.6 Cultural and Government Administration

A Cultural Complex, including a library, main post office and other government uses is proposed on a 3ha site in the Town Centre. The town centre public transport interchange and multi-storey car park would also be included on this site as part of a comprehensive development.

Judiciary requirements have been provided in accordance with HKPSG standards. Provision has been made for

two courtrooms in a Magistracy building as part of the major G/IC site of 3ha located in the Town Centre.

5.5.7 Recreation

Land requirements for recreational facilities within G/IC zones has been estimated in accordance with the provision of the HKPSG and following discussion with Regional Services Department. A total of 10ha has been allocated for a Swimming Pool Complex (2.5ha), a Sports Complex including a competition size football pitch (5ha) and five Indoor Recreation Centres (each 0.6ha). These would be distributed throughout the New Town centrally to their catchment area.

5.5.8 Parking

Provision of parking in residential areas should be in accordance with the HKPSG using mid-range requirements. All major commercial developments should have off-street parking to minimise spillover onto the local road network. A public carpark is proposed as part of the Transport Interchange. It is important that all hotel car and tour

bus parking be accommodated off-street as part of the hotel development and/or in the public carpark.

The Industrial Park should be required to have its own parking facilities including a surface lorry park for vehicles parked overnight.

5.5.9 Other Requirements

These include a Funeral Depot, a bus depot (to be located on the airport island if possible), vehicle and maintenance depots for government departments and public utility authorities and sites for utility requirements, including water, sewage treatment, gas supply, a major 132kV Electricity Sub-Station and the Telephone Exchange.

5.6 Open Space

Landscape requirements for open space in the New Town have been based on HKPSG standards. This specifies that a standard of 20ha of open space per 100,000 population is required. This encompasses both District Open Space and Local Open Space which are to be provided in a ratio of 1:1.

Since Local Open Space has been included within the gross residential areas it does not therefore require a specific land allocation. Table 5.9 illustrates the land requirements for open space, including a breakdown of both active and passive open space requirements and industrial open space.

It is intended that by the year 2011, the New Town will have a population of 200,000. Of this population, 150,000 will live in Tung Chung and the remaining 50,000 in Tai Ho. By this time, there will be an estimated 20,000 workers in the industrial area located at

Table 5.9 Open Space Standards

Type	Standard	Ratio Active : Passive
District Open Space	10ha/100,000 pop	2:1
Local Open Space	10ha/100,000 pop	2:1
Industrial Open Space	5ha/10,000 workers, or	2:1
	10ha/10,000 workers where adjacent to residential areas	2:1

Source : Hong Kong Planning Standards and Guidelines

Tai Ho. Table 5.10 indicates the total open space requirement for 2011, broken down into District Open Space, Local Open Space and Industrial Open Space and active/passive uses, based on the RODP.

The HKPSG recommends the provision of facilities for a number of core sporting and leisure activities. These include badminton, squash, table tennis and fitness training with some provision for tennis, basketball and volleyball. Such facilities can be provided within indoor recreation centres. Others can be provided in local open space or housing areas. Rather than providing a separate football stadium and sports complex, it is proposed that these facilities could be combined into one sports complex. The provision for active recreation is also given in Table 5.10.

Table 5.10 New Town Open Space Requirements (2011)

Type	Tung Chung Area	Tai Ho Area	Total
District Open Space	15ha	5ha	20ha
Local Open Space	15ha	5ha	20ha
Industrial Open Space	-	1ha	1ha
Total Open Space	30ha	11ha	41ha
of which:-			
Active	20ha	7.4ha	27.4ha
Passive	10ha	3.6ha	13.6ha

Source : Hong Kong Planning Standards and Guidelines

North Lantau Development



6. Development Concepts

6. DEVELOPMENT CONCEPTS

6.1 Introduction

Land suitable for urban development was identified by analysing the constraints to, and opportunities for development within the Study Area. These constraints and opportunities were described in Section 4 of this report.

As a first step, constraints to development were identified in three categories. These were designated as basic, environmental or local. Within each of these a further classification of absolute, significant or minor was used.

In areas subject to absolute constraints, no development could be planned. In areas where there was an absence of constraints, or where the severity of constraints did not preclude development, even though it might be provided only at a high cost, opportunities to plan urban development were considered.

These 'opportunities' were defined as Potential Development Areas (PDAs) and formed the basis of development of the land use strategy and the Initial

Concept Plans. Six PDAs were identified, as shown on Figure 6.1. The advantages and disadvantages of each of these are discussed in the following sub-section.

6.2 Potential Development Areas

Tung Chung Central (PDA-1) provided the most feasible opportunity for major urban development. This PDA, measuring about 220ha, was not constrained by the NEF 25 contour and provided extensive areas of either existing land or potential for reclamation. This combination offered flexibility in land formation phasing and could be readily and simply accessed by the proposed transport infrastructure. It also offered a physical setting where maximum potential could be made of natural features to compliment and enhance the future urban form. Tai Ho Central (PDA-4), which has an area of about 65ha, offered similar opportunities although more restricted in developable space. The opportunity to optimise these areas for housing and other noise sensitive uses was maximised in developing the Initial Concept Plans.

The NEF 25 contour set a limit to the northerly extent of noise sensitive uses and subsequent reclamation to accommodate these. The contour also resulted in a linear form to the coastal PDAs, with the exception of those areas where the demand for non noise sensitive uses, such as industry, could be located. In these non-residential areas, the extent of reclamation was determined by assessing the likely demand for industrial land and by reclamation economics related to the depth of water and sea mud.

Coastal PDAs included Tung Chung Coast (PDA-2), Tung Chung East (PDA-3), Tai Ho Coast (PDA-5) and Tai Ho East (PDA-6). Of these, PDA-2 and PDA-5 with areas of about 70ha and 50ha respectively were least constrained by the NEF 25 contour and provided an appropriate setting for a visually attractive urban form. PDA-2, in particular, with its waterfront locality, backdrop of dramatic natural landform and close proximity to the airport offered potential for prime waterfront development sites for hotels and commercial activities, as well as high quality private housing developments in areas not constrained by the NEF 25 contour.

PDA-3 with an area of about 25ha, had only limited potential for housing development. Although residential development in this PDA was possible, it was unlikely that adequate site areas for comprehensive housing developments could be made available due to the combined constraints of the NEF 25 contour, which came close to the shoreline near Kei Tau Kok, its proximity to the NLE/ARL transport corridor from which noise setback requirements would be necessary. Due to these constraints, suitable land uses for this area were limited to open space, some G/IC facilities and industry. The need to provide a primary distributor road connection between PDA-2 and PDA-5 was recognised and this further

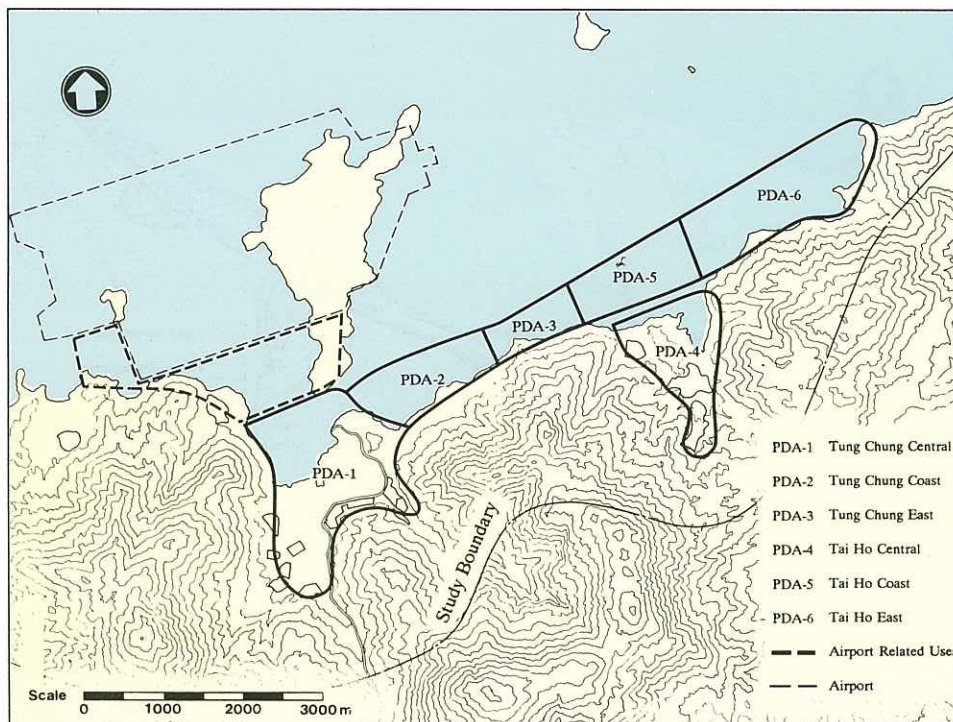


Figure 6.1 Potential Development Areas

constrained the development potential of PDA-3. Industry was considered an appropriate land use in PDA-3. It was excluded from consideration because of:

- o the likely adverse environmental impacts in Tung Chung, such as air pollution, caused by locating industrial land uses to the east of housing areas;
- o the location of the NLE interchanges at Tung Chung and Tai Ho which would route heavy industrial traffic through potential housing areas in PDA-2 and PDA-5 to access any industrial areas proposed in PDA-3;
- o the opportunity to introduce a coastal form which varied from that proposed for the rest of the New Town and was suitable for recreational uses such as beaches/ marinas in a location central to both Tung Chung and Tai Ho; and
- o the need to provide variable visual experiences for users of the NLE/ ARL corridor to achieve an attractive visual outlook and opportunity for a visual gateway to Hong Kong.

Greater flexibility for the siting of industrial land uses was provided in PDA-6 by the potential to extend the limit of reclamation to the north without causing serious environmental impact on the New Town, and by the availability of deeper water than in PDA-3, which allowed for sea borne access to future waterfront industries. Its greater distance from the major centres of population, prevailing wind direction and the air dispersal characteristics of the Tai Ho valley, favoured the location of industrial land uses in this PDA. In addition, included in its area of about 140ha, were the proposed Sewage Treatment and Water Treatment Works located south of the NLE in Tai Ho East.

Further development opportunity, (in an area varying between 120ha and 180ha), was identified north of PDA-1 and south of the operational boundary of the Airport. Possible land uses in this area would however be influenced by the 'Airport Master Plan' (AMP) and the 'Study of Industrial and Commercial Enterprises that Need Relocation with the Airport' (SICENRA) and the 'Study of Airport Related Activities' (SARA), and might include certain elements required for the overall development of North Lantau.

6.3 Land Use Strategy

6.3.1 General Approach

The identification of the PDAs provided the framework for the development of the land use distribution strategy for the proposed New Town in North Lantau, as indicated in Figure 6.2.

This strategy aimed to maximise the use of PDAs not affected by the NEF 25 contour for noise sensitive uses such as housing, commercial and G/IC

facilities, subject to land budget requirements. Distribution of major land uses between the PDAs was further influenced by the requirements of transport networks, including rail and road, and by major stormwater drainage needs.

6.3.2 Transport Infrastructure

A major transport corridor comprising the alignments of the Airport Express Line (AEL), the Lantau Line (LAL), and the North Lantau Expressway (NLE) runs along the North Lantau coast and provides the main access to the New Town. The treatment of this corridor whether elevated, at grade or in tunnel formed part of the evaluation process to determine the form of rail and road alignments which optimised the integration of trunk and local transport movements with the physical structure of the New Town.

Separation of through traffic from locally generated traffic was considered fundamental to the structure of the New Town. The strategy proposed to achieve separation of these movements is by means of interchanges at Chek

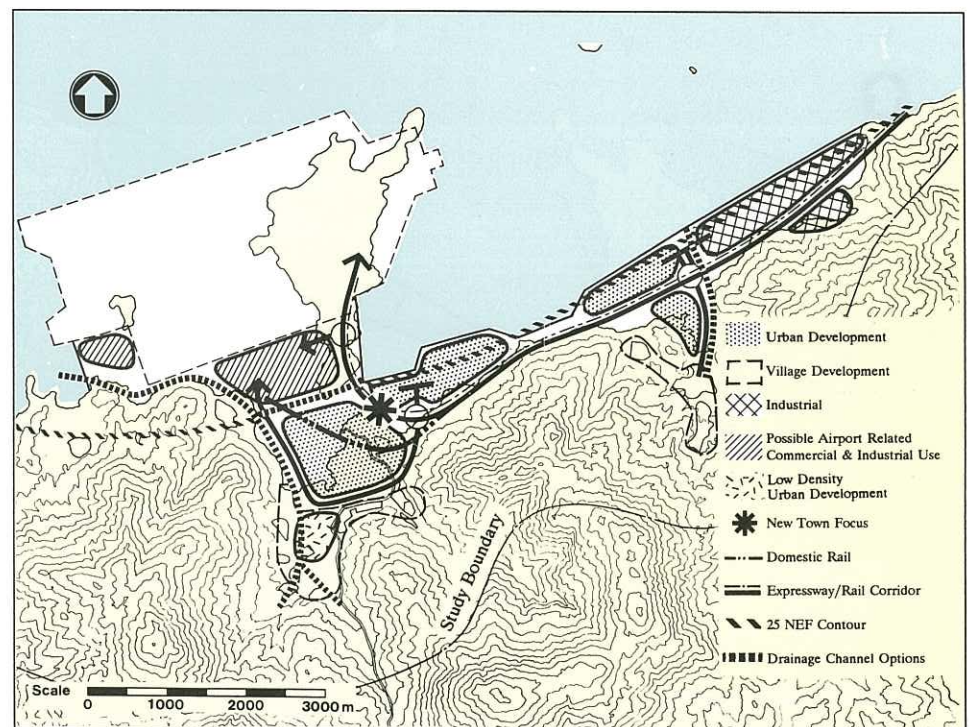


Figure 6.2 Land Use Strategy

Lap Kok, Tung Chung and Tai Ho, with local traffic catered for by a separate distributor road network along the coastal reclamation.

Alternative alignments for a domestic rail service (LAL) connecting to the Airport Express Line were developed in the preparation of Initial Concept Plans. These included alternative locations for the LAL stations and for the railway depot.

6.3.3 Land Drainage System

The configuration of each PDA was also influenced by the alignment of stormwater drainage channels in Tung Chung and Tai Ho. Drainage options in Tung Chung included a major channel discharging to the west, a major channel discharging to the east (to provide a flushing effect to waters east of Chek Lap Kok) and a “split option” which discharged both to the west and east. The latter had the effect of discharging stormwater across PDA-2 to the sea, east of Chek Lap Kok. A fourth option was to combine stormwater flows to the west with an open tidal channel at the northern limit of the New Town in order to provide an east-west tidal flushing movement. Stormwater drainage requirements in Tai Ho are located to the east of Tai Ho and provide a buffer between residential and industrial land uses.

6.3.4 Land Use Strategy

The distribution of major land uses by PDAs, which formed the Strategy is shown in Figure 6.2. The major features are as follows:

- o PDA-1 : urban development, providing a mix of residential, commercial, G/IC facilities and open space uses. Land in the head of Tung Chung valley is to be retained for low density housing, village expansion and village re-site requirements, G/IC facilities and

open space uses; options to develop or retain the Tung Chung knolls were investigated at the concept planning stage;

- o PDA-2 : urban development providing for a mix of residential, town centre, and commercial developments including hotels and offices, and for water front recreational uses.
- o PDA-4 and PDA-5 : urban development providing a mix of residential and commercial development, G/IC facilities and open space uses. Areas in the head of the Tai Ho Valley and adjacent to Pak Mong village are suitable for low density development including village housing.
- o PDA-6 : location for industrial land to satisfy North Lantau industrial demands. Sites for Sewage Treatment and Water Treatment Works are proposed in Tai Ho East. Deeper water at this site would make waterfront industries an appropriate user. This would also be a suitable site for the railway depot.

6.4 Initial Concept Plans

6.4.1 Derivation of the Plans

The basic land-use strategy underlying the Initial Concept Plans comprised:

- o residential development in the relatively unconstrained valley floors of Tung Chung and Tai Ho with the head of the valleys given over to low-density housing, open space and village expansion and re-site areas;
- o industrial development located adjacent to the New Airport and on reclamation at Tai Ho East to avoid potential land use and transport conflicts with residential areas;

- o non noise-sensitive land uses located next to the NLE/AEL corridor and within the area delineated by the NEF 25 noise contour; and
- o hotels, town centre and district centre commercial activities located on prime waterfront sites and over rail stations.

6.4.2 The Plans

Four Initial Concept Plans were developed within the framework established by the land use strategy by examining alternative ways to distribute land uses based on land budget requirements. At the same time, solutions were presented to major issues influencing land use distribution. These issues included:

- o the alignment and form of the NLE/AEL corridor;
- o the LAL alignment, station location and requirements and the potential to extend the LAL to the New Airport;
- o the drainage requirements;
- o the location of the town centre; and
- o the distribution of industrial land uses.

Each concept plan responded to these issues in a different way as indicated in Table 6.1.

A further alternative relating to the distribution of industrial land uses was proposed in the “Industrial Development Strategy for North Lantau”. This paper incorporated and interpreted the findings of SICENRA and recommended three land use options for industrial development on North Lantau. These were the two options outlined in Table 6.1 and a third option with the Cargo Village and

Table 6.1 Variables in Initial Concept Plans

Activity	Initial Concept Plans			
	1	2	3	4
Drainage at Tung Chung - west - east - 300m channel - 100m channel	x	x	x	x
Town centre - waterfront - park	x	x	x	x
Lantau Line (Rail) - 2 stations - 3 stations	x	x	x	x
NLE/AEL west of Kei Tau Kok - at grade - peripheral - depressed	x	x	x	x
Cargo village - Chek Lap Kok South - Tai Ho East	x	x	x	x
Industry/business park - Chek Lap Kok South - Tai Ho East	x	x	x	x

Source : Consultants Analysis (see Topic Report TR7 (Revised) 'Initial Concept Plans')

Business Park at Chek Lap Kok and only the Industrial Park at Tai Ho East. The latter option was not included in the Initial Concept Plans but was considered in the later concept plan evaluation exercise.

The four concept plans (shown in Figures 6.3 to 6.6) were completed in sufficient detail to allow evaluation of the plans against the agreed goals and objectives for development on North Lantau. They were subsequently formulated into a Preferred Concept Plan. They did not represent the only definitive solutions to the way in which final development could take place. They represented, in various combinations, all the major elements which would determine the form of the Preferred Concept Plan and subsequently the Recommended Outline Development Plan (RODP) for the New Town.

6.5 Concept Evaluation

6.5.1 Evaluation Method

The aim of the evaluation was to gauge the performance of the Initial Concept Plans against agreed goals and objectives for the North Lantau Development and to highlight those components of the plans which performed best. These components and their formulation into a Preferred Concept Plan reflected a reasonable measure of agreement by Government as to the basis for proceeding to the more detailed stages of the New Town planning.

The evaluation was undertaken in four stages. These were :

- o to review the objectives and refine evaluation criteria;
- o to rank the Initial Concept Plans by goal;

- o to conduct an overall evaluation; and
- o to develop a Preferred Concept Plan

The Goals and Objectives described in Section 3 of this report were reviewed to ensure that only relevant differences in the components of the Initial Concept Plans were evaluated. Where the plans performed equally against a particular objective, that objective was deleted from consideration. Similarly objectives were added where it became clear that important differences between concept plans needed to be evaluated. Suitable evaluation criteria against which the performance of the Initial Concept Plans were measured were also refined. Table 6.2 presents the revised framework of goals and objectives.

The performance of the Initial Concept Plans was then assessed against each of the five broad goals for the development and measured against the objectives and an overall rank for that goal ascribed to each. Results indicating relative performance are presented in Tables D1 to D5 of Appendix D of this report "Concept Plan Evaluation". The evaluation concentrated on those objectives against which the performance of the plans varied significantly. Wherever possible, the relative performance of the Concept Plans was assessed quantitatively. Where qualitative criteria were employed, the performance of each Concept Plan was evaluated on the basis of value judgements.

The next stage was to produce an overall evaluation of the Concept Plans against all the goals. This evaluation focussed on the real differences between the Concept Plans and involved consideration of which Concept Plan offered the best trade-off between its areas of good and poor performance and the overall potential for new combinations of advantageous components. Given the particular

- NLE/ARL is at grade through the Study Area. It intersects with the New Airport boundary at the southern tip of Chek Lap Kok. Access to urban development areas is from elevated interchanges at Tai Ho, near Tai Po and from slip roads near the southern tip of Chek Lap Kok.
- The LAL is at grade, diverging from the ARL at Kei Tau Kok to access the New Town. Three stations are located in Tai Ho, Tung Chung Town Centre and Tung Chung residential area. The alignment has the capability of extending to the New Airport.
- A stormwater channel drains Tung Chung catchment area and the development area to the west. Tai Ho valley is drained across reclamation.
- The Town Centre is located north of the NLE on a coastal site. It provides the main focus for New Town commercial and cultural uses and airport related hotels and commercial uses.
- Industry is divided between two locations. The Airport Cargo Village is located at Chek Lap Kok north of the New Town. An Industrial Park and Business Park are located at Siu Ho Wan.

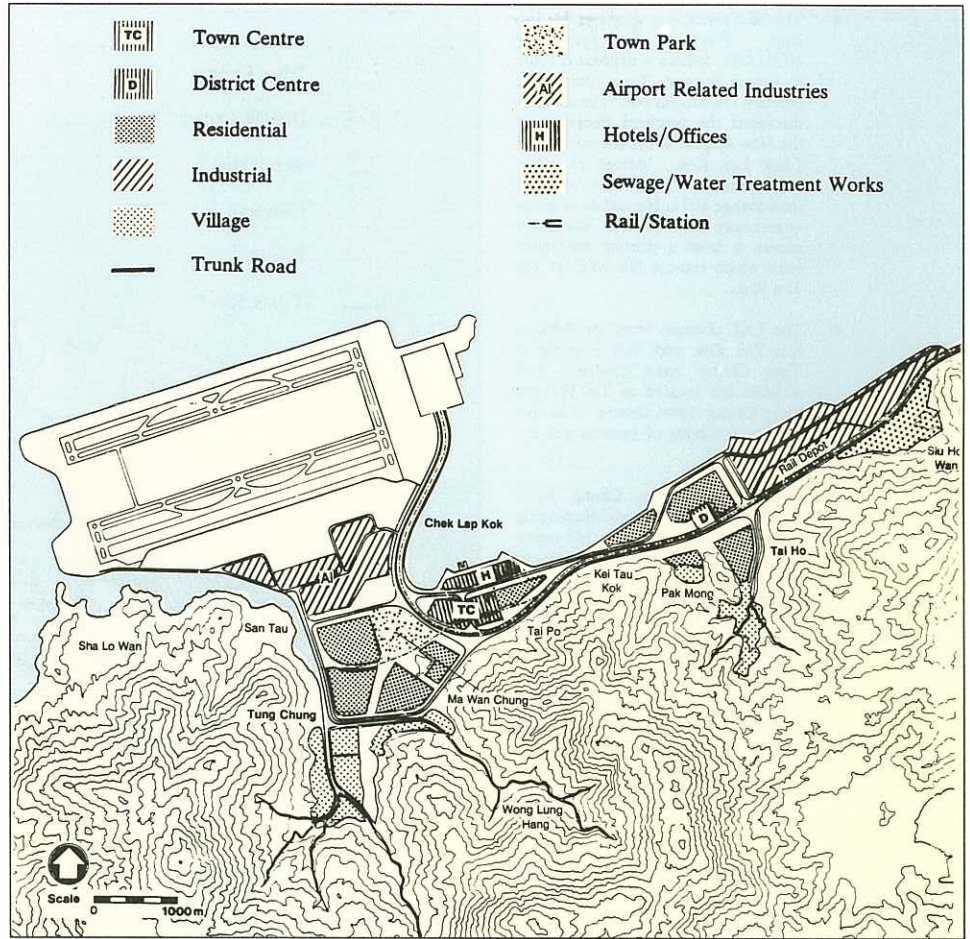


Figure 6.3 Initial Concept Plan 1

- The NLE/ARL is at grade through the Study Area. It follows a more north-easterly route than in other options. It intersects with the New Airport boundary about 1km north-east of the southern tip of Chek Lap Kok. Access to urban development areas is from elevated interchanges at Tai Ho and in Tung Chung near the drainage channel. Secondary access is from slip roads near Tai Po.
- The LAL is at grade, diverging from the ARL near Tai Po to access the New Town. Two stations are located in Tai Ho and Tung Chung Town Centre. The LAL has the capability to extend to the New Airport.
- Stormwater drainage of the Tung Chung catchment is routed to the west and north of Tung Chung development, discharging to the east to provide a flushing effect to the bay east of Chek Lap Kok. A secondary channel runs through the Town Park. Tai Ho valley is drained across the reclamation.
- The Town Centre is located south of the NLE and orientated towards the Town Park at Lau Fau Sha. Airport hotels and airport related commercial uses are located north of the NLE.
- Industry is divided between two locations. The Airport Cargo Village is located at Chek Lap Kok, north of the New Town. An Industrial Park and Business Park are located at Siu Ho Wan.

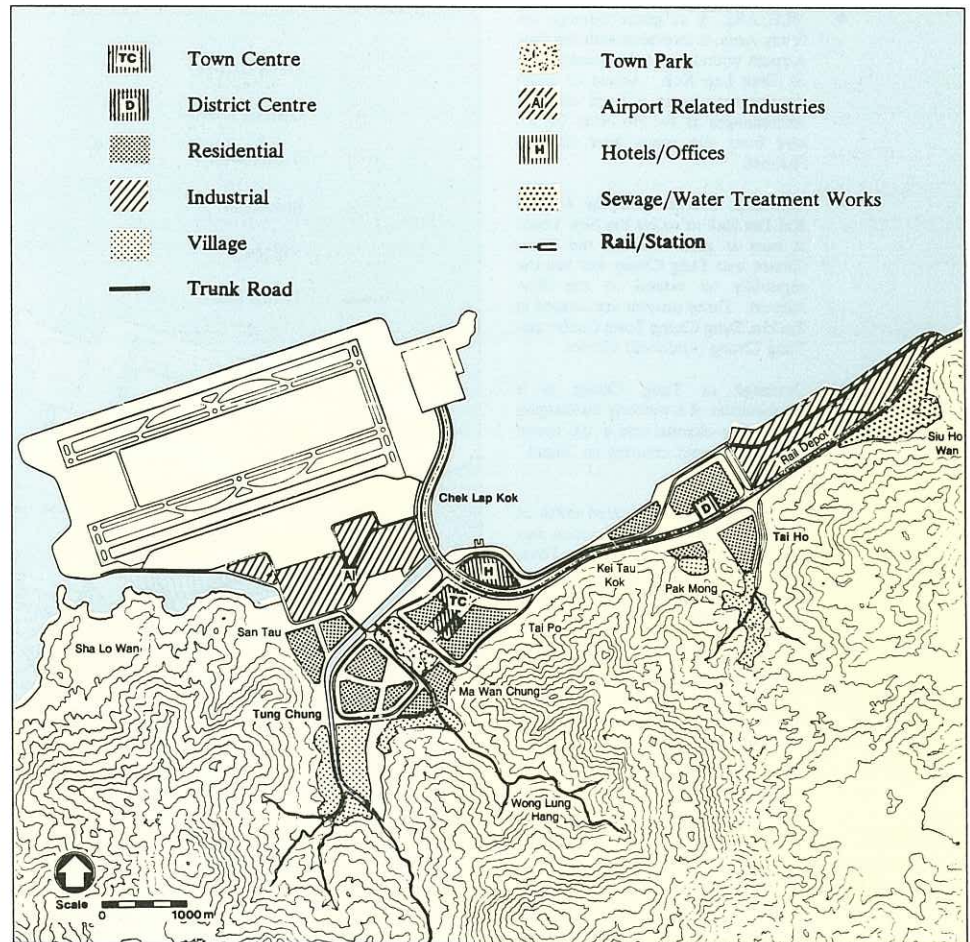


Figure 6.4 Initial Concept Plan 2

- The NLE/ARL is at grade to Kei Tau Kok. West of this point, the NLE/ARL follows a depressed route in tunnel through Tung Chung and beneath the sea channel. The corridor intersects the southern boundary of the New Airport at the southern tip of Chek Lap Kok. Access to urban development is from an elevated interchange at Tai Ho and an at-grade interchange near Tai Po. Secondary access is from a district distributor road which crosses the NLE at Kei Tau Kok.
- The LAL diverges from the ARL at Kei Tau Kok and runs at-grade to Tung Chung Town Centre. Two stations are located in Tai Ho and Tung Chung Town Centre. The line has the capability of extending to the New Airport.
- Drainage in Tung Chung is a combination of a westerly discharging stormwater channel and a 300 metre wide sea channel, creating an "island" airport site. The sea channel aims to improve water circulation in the bay east of Chek Lap Kok. Tai Ho valley is drained across reclamation.
- The Town Centre straddles the NLE/ARL corridor providing waterfront and Town Park orientation for retail, commercial and cultural facilities. Airport related hotels and commercial uses are located on a waterfront site in part of the Town Centre.
- All industrial development for the New Town, including elements of an Airport Cargo Village, Industrial Park and Business Park are located at Siu Ho Wan.

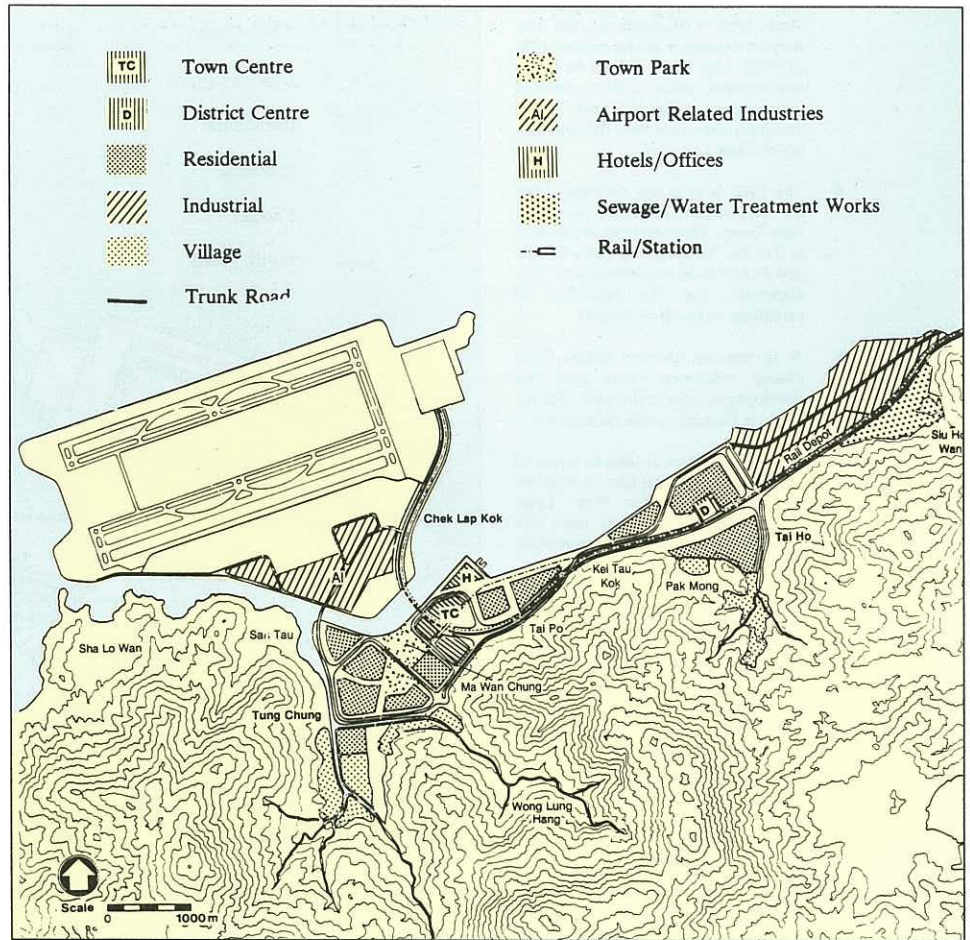


Figure 6.5 Initial Concept Plan 3

- NLE/ARL is at grade through the Study Area. It intersects with the New Airport boundary at the southern tip of Chek Lap Kok. Access to urban development areas is from elevated interchanges at Tai Ho, near Tai Po and from slip roads near the sea channel.
- The LAL diverges from the ARL at Kei Tau Kok to access the New Town. It runs at grade through the Town Centre and Tung Chung and has the capability to extend to the New Airport. Three stations are located in Tai Ho, Tung Chung Town Centre and Tung Chung residential district.
- Drainage in Tung Chung is a combination of a westerly discharging stormwater channel and a 100 metre wide sea channel, creating an "island" airport site.
- The Town Centre is located north of the NLE in a waterfront location and provides the main focus for New Town retail, commercial and cultural facilities and airport related hotels and commercial uses.
- All industrial development for the New Town, including elements of an Airport Cargo Village, Industrial Park, and Business Park, is located at Siu Ho Wan.

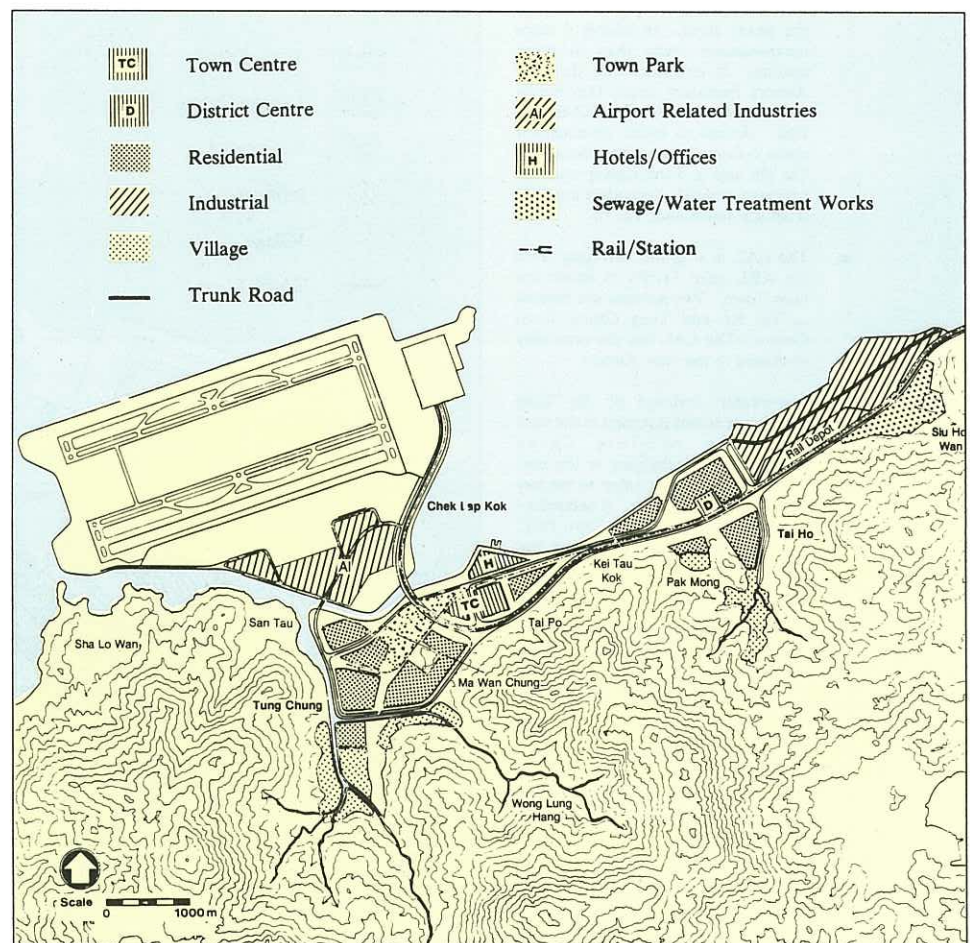


Figure 6.6 Initial Concept Plan 4

Table 6.2 Revised Framework of Goals, Objectives and Evaluation Criteria

Goal	Objective	Evaluation Criteria	
A. Cost and Convenience in Use	A1 Distribute land use to minimise demand for vehicular movement	Daily pcu hours and pcu kilometres in NLD	
	A2 Distribute land use to maximise use of public transport, especially rail transport	Percentage of daily NLD person trips by mode; number of daily NLD rail passengers	
	A3 Provide maximum accessibility for local residents to places of employment, services and other facilities	Volume-capacity ratio on approaches to NLE interchanges	
	A5 Minimise disturbance to development area from traffic between Airport/ Airport-related uses and New Town residential areas	Amount of daily Airport/Airport-related traffic passing through, as opposed to around, residential areas	
	A6 Provide opportunity for an economical distribution of centres	Ability to attract higher-order facilities	
	A7 Ensure compatibility of land use at the town/Airport interface	Qualitative assessment of land use compatibility at town/Airport interface.	
	B. Environmental Quality	B1 Minimise disturbance to natural landscape features and ecological systems	Impact on : <ul style="list-style-type: none"> o shoreline east and west of Tung Chung o woodlands o mangrove colonies, streams, freshwater wetland, marshland, abandoned paddies
B2 Minimise amount and impact of air pollution		Air pollution impact from: <ul style="list-style-type: none"> o NLE; o ARL and LAL; o industrial areas on adjacent residential areas; o the New Airport boundary from ground movements, take-off/landing and on-site aviation fuel storage odour o urban roads; o the rail depot, sewage treatment works, solid waste transfer station, and off-site aviation fuel storage; and o remotely located power stations. Benefit to sensitive uses in terms of: <ul style="list-style-type: none"> o air quality from breezeways; and o ability to locate sensitive land uses way from valley heads and possible recirculation zones. 	
B3 Minimise amount and impact of water pollution		Qualitative assessment of: <ul style="list-style-type: none"> o the effect of drainage channels on water quality; o the effect of dredging on water quality. 	
B4 Minimise impact on noise sensitive uses		Noise impact from : <ul style="list-style-type: none"> o NLE; o ARL; o industrial areas; o across airport boundary; o roads other than NLE; and o depot. 	
B5 Provide opportunity for an attractive visual character to the development area		Value judgements on: <ul style="list-style-type: none"> o retention of existing natural features; o presence of distinct edge or separation between New Town and Airport; o provision of strong visual axis in the development; and o use of potential afforded by the waterfront. 	
B6 Provide opportunity for attractive visual gateway to Hong Kong		Value judgements on: <ul style="list-style-type: none"> o potential for provision of NLE parkway; o combination of design elements including waterfrontage, town park and town centre 	
B9 Maximise recreational opportunities in development areas and rural hinterland		Qualitative assessment of recreational opportunities	
C. Cost Effectiveness		C1 Minimise capital cost of development	HK\$ (current)
		C2 Maximise opportunities for the generation of revenue from land sales	HK\$ (current)
	C3 Secure early and reasonable return on public investment	Comparison of costs and revenues	
D. Programming	D1 Minimise risk of delay to programme targets, in particular Phase I completion	Potential for programming delays to Phase I development	
	D2 Development to be capable of being implemented in self contained packages	Potential to implement development in stages related to population and employment projections	
	D3 Minimise disturbance to existing and new development in subsequent construction stages	Value judgements as to: <ul style="list-style-type: none"> o impact on water quality from phasing of reclamation; o disposal of dredging material resulting from phasing reclamation; o air and noise impacts on existing villages and new development areas. 	
E. Flexibility	E1 Ensure plan can function effectively at each stage of development	Volume - capacity ratio on: <ul style="list-style-type: none"> o combined external Lantau links o NLE east of Tai Ho o primary New Airport access 	
	E2 Minimise impact on plan of a decision not to construct or significantly delay the Airport Railway as a separate public rail service	Extent to which use of land can be modified without affecting the overall functioning of the plan	
	E3 Flexibility to accommodate additional population or employment beyond levels forecast for 2011	Hourly capacity (pcus) in 2011 available on: <ul style="list-style-type: none"> o NLE east of Tai Ho o combined external Lantau links Capacity of land to accommodate : <ul style="list-style-type: none"> o urban development beyond 2011 provision; o utility infrastructure beyond 2011 provision. 	
	E4 Ensure plan can function effectively with changes to design assumptions.	Value judgements on impact of: <ul style="list-style-type: none"> o shift of the 25NEF contour; o change to land use at Chek Lap Kok South; o change in access to the New Airport 	

Source : Consultants Analysis (see Topic Reports TR1 and TR8)

Table 6.3 Evaluation Summary

Goal	Rank Concept Plans				Comments
	1	2	3	4	
A. Cost and Convenience in Use	2	1	4	2	Concept Plan 2 combines 2 interchanges on NLD with cargo village at Chek Lap Kok and 1 LAL station in Tung Chung. Insufficient physical separation between town and Airport
B. Environmental Quality	4	3	1=	1=	The channel in Concept Plans 3 and 4 has ecological, visual and recreational opportunities and hydraulic and water quality benefits
C. Cost Effectiveness	1	1	1	1	Concepts 2 and 4 combine 1 LAL station at Tung Chung, NLE at grade, least early land acquisition cost, and large reclamation area per unit cost of infrastructure
D. Flexibility	All Plans perform equally				Concept Plans could be affected by external factors including : area of land available for industrial development at Chek Lap Kok, timing of rail link, shifts in NEF 25 contour
E. Programming	All plans perform equally				Phasing of Concept Plan 3 is best in terms of water quality impact, however, programming should be adjusted to minimise air or noise impact
Overall	4	3	2	1	

Source : Consultants' Evaluation (see Topic Report TR8)

Of the two non-depressed alignments for the NLE, the north-easterly route shown in Concept Plan 2 was preferred as this route acts to separate the NLE from residential areas and the town park and would have benefits in reducing possible noise and air quality impacts. This alignment was also preferred from the standpoint of engineering feasibility as it avoided areas with known geotechnical problems.

Main Drainage at Tung Chung

The Sea Channel at Tung Chung (Concept Plans 3 and 4) was preferred, owing to the clear separation it allows between the New Town and the New Airport. This separation would have benefits in reducing air quality and noise impacts on the town from airport operations, ground movements and on-

site aviation fuel storage odour. The wide channel would also have benefits in maximising the design opportunities afforded by the waterfront, and provision of a "gateway" development to Hong Kong. Concept Plans 3 and 4 would also minimise disturbance to the natural coastline and mangrove colonies between Tung Chung and San Tau.

The wider drainage channel would allow better water exchange between west Lantau and East Tung Chung Bay and would have a beneficial flushing effect on water quality. The narrower drainage channel would also provide benefit in terms of water exchange within East Tung Chung Bay. In terms of siltation the narrow channel was also feasible. A channel of minimum 100m top width was found to be tolerable although greater width would be preferable.

constraints of the Study Area and a common land-use strategy responding to these constraints, it was considered unlikely that any single Concept Plan would perform best against all goals.

The evaluation highlighted those components of the Initial Concept Plans which performed best against the agreed goals and objectives. These components were then re-combined to formulate the Preferred Concept Plan.

6.5.2 Evaluation Summary

Table 6.3 presents a summary of the evaluation of the Initial Concept Plans against the revised framework of goals and objectives set out in Table 6.2. The results of the exercise indicated that the Preferred Concept Plan should, in the main, combine components of Concept Plans 2 and 4. Concept Plan 4 performed best against environmental quality primarily because of the benefits of the wide sea channel at Tung Chung in terms of water quality, ecology, visual and recreational objectives. Concept Plan 2 performed well in terms of cost and convenience due to the incorporation of two interchanges on the NLE at Tung Chung. The key components of the Concept Plans outlined below comprise the physical framework upon which the Preferred Concept Plan was developed.

Alignment of the NLE West of Kei Tau Kok

In order to satisfy requirements for local accessibility and separate through and local traffic, two interchanges are required on the NLE at Tung Chung. This together with its higher costs, effectively rules out the depressed alignment for the NLE indicated in Concept Plan 3. The biggest disadvantage of not depressing the NLE would be the noise and negative visual impact of the road in the town centre area of Tung Chung.

Number of LAL stations in Tung Chung

Concept Plans 2 and 3, in which only one LAL station is located in Tung Chung were preferred. This would be a cheaper solution in capital cost terms and would result in only a marginal reduction in potential land revenues. However, this solution does not concur with the transport goal of maximizing public transport accessibility.

A two station solution would provide better public transport usage although patronage of a single station could be increased through feeder bus services and a westward movement of the station to be more centrally located in terms of its population catchment. The LAL line is capable of extension into the New Airport in all Concept Plans and additional stations could be added as and when required.

Provision of a single station in Tung Chung would encourage the concentration of commercial and retail facilities, thereby improving the chances of attracting higher-order facilities to the New Town. This was felt to be a particularly important consideration given that North Lantau is a new development area relatively remote from Hong Kong.

Location of Industrial Development

Industrial development options for North Lantau include the cargo village at Chek Lap Kok (Concept Plans 1 and 2) and the cargo village, business park and industrial park at Tai Ho East (Concept Plans 3 and 4). Transport testing showed that the single interchange at Tai Ho could not have sufficient capacity if all the airport related industry were located at Tai Ho East. Concept Plans 3 and 4 therefore also performed poorly in this regard.



Figure 6.7 Preferred Concept Plan

6.6 The Preferred Concept Plan

6.6.1 Introduction

The evaluation exercise resulted in the selection of key components of the Initial Concept Plans which performed best against the agreed goals and objectives. These components then formed the basis of the Preferred Concept Plan, shown in Figure 6.7 and described in Sections 6.6.2 to 6.6.10. The plan and some of the key components were further refined in the next stage of the study to develop the Recommended Outline Development Plan.

6.6.2 Residential Development

Residential development is located both at Tung Chung and Tai Ho with low-density housing at the head of the respective valleys and higher-density development concentrated around the two LAL rail stations. Population at Tung Chung would be about 150,000 persons by 2011 with about 50,000 persons resident at Tai Ho. Expansion

of the New Town after 2011 would be on reclaimed areas to the north-west of Tung Chung and to the west of Tai Ho. The ultimate population of Tung Chung and Tai Ho would be about 180,000 and 80,000 respectively. Phasing of residential uses would result in the development of Tung Chung first, with Tai Ho only being developed after 2006.

Residential development in Tung Chung is a mix of public, Home Ownership Scheme and private housing located both north and south of the NLE/AEL corridor. First phase housing is located between the NLE/AEL corridor and Tung Chung knolls, mainly on reclamation. Later stages of development are proposed to the west of the Tung Chung knolls and on reclamation north and east of the NLE.

Housing areas in Tai Ho are located both to the south and north of the NLE/AEL corridor. The initial residential developments in Tai Ho are located south of the NLE in a mix of public and HOS housing. Open space areas, including the retained Pak Mong

hill, G/IC uses and existing villages are also located south of the NLE.

Footbridges across the NLE/AEL corridor would link this development with a district centre and commercial/residential uses associated with the LAL station, other high density public and private housing and open space uses located north of the NLE/AEL.

Existing villages and settlements in Tung Chung have been retained in-situ whenever possible. Those directly affected by future development areas are to be resited. These include Ma Wan, Ma Wan Chung, Wong Nai Uk, Sha Tsui Tan and Tai Po. Resite areas will be integrated with low density housing and located adjacent to existing villages further up the Tung Chung valley and on the periphery of the New Town.

6.6.3 Town Centre

The Town Centre straddles the NLE/AEL corridor in Tung Chung and provides the focus for the retail, commercial and cultural activities of the town. An area for hotels, commercial offices and possible convention facilities, related to airport users, is located on a high amenity waterfront site north and west of the NLE. High density housing associated with commercial developments is also located in this area. The housing areas required by 1997 and the first phase of the Town Centre retail and commercial activity is located south of the NLE.

The Town Centre in this location provides the maximum design opportunity for a high quality urban environment capitalising on its waterfront location and accessibility to the Town Park. In developing the Recommend Outline Development Plan (RODP) careful consideration was given to the integration of land uses within this area to achieve these design objectives.

6.6.4 Town Park

The Town Park is located between the Sea Channel and the knolls west of Ma Wan Chung village and divides the town into two districts. These are the Town Centre and the Tung Chung West residential district. A linear open space system connecting the Town Park through Tung Chung West to the head of Tung Chung valley provided a visual axis and breezeway for the New Town. The waterfront Town Park and the linear open space system emanating from it provides maximum opportunities for connecting formal open space in the town with its hinterland, including the peripheral country park. It also provides the opportunity to maximise the existing landscape features of the town.

6.6.5 Industrial Development

An air cargo village of 30 ha is proposed at Chek Lap Kok. This development would include accommodation for airlines, air cargo terminal operator(s), container station operators, freight forwarders, air express companies, transport compounds and government entities.

In this location the cargo village would fulfill operators' requirements to be located as close as is practicable to air operations and, further, generate fewer trips on the NLE than alternative locations for industrial development.

About 52ha of land located at Tai Ho East and has been identified as the site for an Industrial Park, offering a high quality environment to attract airport related manufacturing and warehousing, as well as import/export enterprises.

A Business Park of 25ha will be located on the Airport Island. This will accommodate a mixture of support facilities and offices of various types of

airport-related companies including hotels, a conference centre, import/export companies and facilities for essential airport operations such as airline offices and training units.

6.6.6 Drainage

The New Airport is separated from the New Town by a Sea Channel approximately 200 metres in width. The actual final width of this channel will be determined by detailed design of bridgeworks and the adjacent interchange but will be close to this preliminary requirement. This channel will act as a flushing channel to improve water circulation and quality in the bay east of Chek Lap Kok, and to provide a high amenity buffer between the New Town and the New Airport.

Stormwater drainage channels serving the Tung Chung and Wong Lung Hang valley catchments are located to the west of Tung Chung and intersect with the Sea Channel adjacent to San Tau on the north-western edge of the New Town.

The Tai Ho valley is drained across reclamation by an open stormwater drainage channel. The channel is part of the buffer area between Tai Ho residential area and Tai Ho East industrial area.

6.6.7 North Lantau Expressway/ Airport Express Line

The major transport corridor of the NLE/AEL would run at grade through North Lantau and cross the sea channel separating Chek Lap Kok from Tung Chung by bridge. The NLE would have one junction at Tai Ho and two at Tung Chung in order to meet requirements for local accessibility. The Tung Chung interchanges are elevated in order to reduce the environmental impact of the NLE on adjacent development. The alignment of the

NLE/AEL corridor has been adjusted to swing the expressway clear of geotechnically unstable slopes at Tai Po. This adjustment is also reflected in the width of the Sea Channel which is reduced from 300m to about 200m. The primary distributor would run in the same corridor where possible and will serve the main development at Tung Chung by two "box" systems to limit through traffic passing through residential areas. A second access would be provided to the New Airport via this distributor system, again with roads routed to the periphery of the development to minimise the impact of airport traffic on residential areas.

It is proposed to construct landscaped berms adjacent to the NLE to provide a parkway environment on the airport route and reduce traffic noise impacts on the New Town. A 5m wide landscaped median strip through Tung Chung is to be provided to supplement the parkway environment and provide space for footbridge supports. At a detailed level, consideration should be given to introducing a more varied visual environment by rail and utilities alignments to facilitate the provision of substantial landscaping adjacent to the NLE.

Tung Chung and Tai Ho are connected by a dual two lane distributor road. In large part this route runs parallel to the NLE to reduce the noise impact on residential areas and facilitate pedestrian access to waterfront areas. With two major routes and rail alignments running through the Study Area between Tung Chung and Tai Ho careful consideration will have to be given to detailed design in order to avoid a monotonous townscape.

6.6.8 Lantau Line

The Lantau Line (LAL), a spur from the Airport Express Line, provides a local rail service to the New Town.

Two stations are provided within the Study Area at Tung Chung and Tai Ho. The Tai Ho LAL Station is associated with a district centre ultimately (post 2011) serving a population of approximately 80,000. The LAL alignment diverges from the AEL after Kei Tau Kok to make a perpendicular crossing under the NLE/AEL corridor in Tung Chung Town Centre. The station is located south of the NLE where it is more central to the long term (post 2011) population catchment of 180,000 persons in Tung Chung. Pedestrian access from north of the NLE to the station will be provided.

6.6.9 Rail Depot

In consultation with the potential operator, a site of about 30ha for a rail depot to cater for the operational needs of the AEL and LAL has been located at Sui Ho Wan. It may be possible, subject to further investigation to locate uses such as the Business Park, Cargo Village or industry on a depot podium. Alternatively residential development would be possible over the depot, although this would require a review of other residential distribution in the Tai Ho area. Such a development would be in close proximity to the Tai Ho railway station.

6.6.10 Major Utilities

Major utilities are to be located at Tai Ho East, relatively distant from residential development and to the east of the rail depot and industrial uses. These utilities would comprise Sewage and Water Treatment Works, Refuse Transfer Station and a Gas Reception Plant and would require landscape screening from the NLE/AEL corridor at this point.

An area potentially suitable for expansion of utilities (or for future port related uses) has been identified between Tai Ho East and Ta Pang Po.

6.7 Refinement of Preferred Concept Plan into the RODP

6.7.1 General Approach

The Preferred Concept Plan was refined into the draft RODP by an iterative process to reflect the current status of a number of technical and land use distribution issues which best responded to the goals and objectives of the study. The draft RODP was further refined following circulation within Government and discussion at the joint Working Group, into an Interim RODP. This plan was endorsed by Steering Committee on 6th September 1991. It was subsequently presented to and endorsed by DPC on 8th October 1991 subject to:

• negotiation regarding the location form and alignment of the Tung Chung LAL railway station;

• further discussion with the Housing Authority regarding its role in the development of Tung Chung; and

• other findings of the Study of Airport Related Activities (SARA) if these were available.

The technical issues which impacted on the distribution of land uses addressed in developing the Interim RODP and subsequently the RODP are discussed in the following sections.

6.7.2 The NEF 25 Contour

Refined NEF 25 contours for the year 2030 (as shown in Figure 4.5) were provided by the Provisional Airport Authority. These were found to have shifted to the north of those used in the Preferred Concept Plan as a result of refinement and new assumptions about future aircraft noise. This allowed greater flexibility in the siting of residential uses at coastal locations when refining the Interim RODP.

6.7.3 NLE/AEL Corridor and Primary Distributor

The alignment of the NLE corridor shown on the RODP has been adjusted by moving the corridor slightly north and north-east to that shown on the Preferred Concept Plan due to:

- o the need to minimise geotechnical impact on the NLE corridor of unstable coastal land formations; and
- o agreement being reached between the AMP Consultants and NLD Consultants on the precise landing point of the NLE corridor on Chek Lap Kok.

The alignment of the primary distributor road (P1) which provides secondary access to the airport and a distributor link between the New Town and the airport-related commercial and industrial area at Chek Lap Kok South, has been varied to run to the south and west of the southern tip of Chek Lap Kok. This provides a more direct link between the New Town and the airport-related commercial and industrial area.

6.7.4 Form of the Expressway Interchanges

The Preferred Concept Plan provided two interchanges at Tung Chung and one at Tai Ho in order to meet requirements for local access to and from the NLE. The Tung Chung and Tai Ho interchanges were elevated in this plan in order to minimise the visual and environmental impact of the NLE corridor on adjacent development. Subsequent examination of the form of the NLE and ARL bridges crossing the Sea Channel resulted in the NLE corridor being aligned to pass above the primary distributor road adjacent to the Sea Channel, rather than below it.

6.7.5 Traffic Noise Considerations

The environmental assessment of the Preferred Concept Plan highlighted the fact that traffic noise would be a significant development constraint unless noise mitigation measures were applied in respect of the NLE, the primary distributor roads, the AEL and the LAL. The RODP has incorporated appropriate space requirements for at source mitigation measures adjacent to noise sensitive uses. Details of these mitigation measures are shown in the Detailed Layout Plans prepared for the Phase 1 development and are summarised in Table 8.8 and are also discussed in Appendix E of this report.

6.7.6 Town Centre and Commercial Development Issues

The form of the Town Centre and the location of the core commercial area were refined in the development of the RODP as a result of:

- o a shift of the NEF 25 contour to the north and the continued refinement of the housing mix and distribution of different types of housing throughout the New Town. This allowed greater flexibility in the location of residential developments on either side of the NLE corridor adjacent to the Town Centre;
- o clarification of environmental requirements, particularly noise setbacks, of the NLE corridor. To achieve compliance with the noise setback requirements, a review of the type and detailed location of land uses adjacent to the NLE corridor was appropriate;
- o refinement and distribution of retail and commercial floorspace requirements for the town;

- o the provision of a future second LAL station in Tung Chung west to improve accessibility. This suggested that the easterly Tung Chung LAL station could be located in the Town Centre straddling the NLE corridor and in close proximity to the public transport interchange; and
- o further development of urban design principles for the Town Centre, which suggested that a comprehensive development complex encompassing the retail and commercial hub of the town be located spanning the NLE corridor to reinforce the objective of creating a strong visual identity for the Town Centre and to support the town's role as a gateway to the Territory.

Therefore, in the RODP, the Town Centre development has been centred on a comprehensive retail, office and hotel development complex incorporating the Tung Chung LAL station. This complex will span the NLE corridor and provide linkages between public and private housing developments and major government, community and recreational facilities on either side of the corridor.

6.7.7 Lantau Line

In the RODP two LAL stations are located in Tung Chung, one in the Town Centre and the second in the Tung Chung West District Centre. A further LAL station is located in the District Centre at Tai Ho.

The alignment of the LAL in Tung Chung was modified for the Interim RODP from that shown on the Preferred Concept Plan in order to take account of rail geometry requirements and to achieve a perpendicular crossing under the NLE corridor to access the Town Centre LAL stations. The Town

Centre station is located south of the NLE corridor, with platforms below ground level and the station concourse at ground level. The concept of providing an underground Town Centre LAL station was endorsed by ADSCOM on 23rd November 1991.

The decision to have only one Tung Chung station in the Preferred Concept Plan had been made on the basis of planning grounds. The two station solution in the RODP met the objective of maximising rail usage. However, the one station scheme provided better opportunities for economic distribution of centres by minimising competition between the District Centre, which would be established at the second station, and the Town Centre at the first station. The one station scheme was chosen for the Preferred Concept Plan on the basis that it would be sited as far to the west as possible to increase rail patronage.

Since then, the issue of competing centres has been resolved. Restricted commercial development levels have been incorporated into the second station development, such that there will be no competition between the two centres. This has allowed the second station to be incorporated into the RODP, providing better overall transport access for Tung Chung residents. The Tung Chung Central station is forecast to have a daily patronage of 101,000 passengers by 2011, while the Tung Chung West station will have a patronage of 85 000 per day by that year.

The form of the LAL alignment varies throughout the New Town, depending on the type of adjacent land uses. This is discussed in Section 9 of this Report.

The proposed station at Tai Ho is expected to have a patronage of 74,000 passengers per day by 2011.

6.7.8 Airport-Related Development

The Steering Group endorsed an industrial strategy for North Lantau to satisfy, as far as possible, the demand for airport-related industrial and commercial activity as proposed by SICENRA. This strategy was reflected in the Preferred Concept Plan, which provides for the phased development of the Cargo Village (28ha in 2011) and Business Park (27ha in 2011) at Chek Lap Kok and an Industrial Park (52ha in 2011) at Tai Ho East, and this was re-iterated in the RODP.

The issue of the availability of land at Chek Lap Kok for the Cargo Village and Business Park is, however, subject to finalisation of the New Airport Master Plan and the Study of Airport Related Activities (SARA). To permit a phased build up of industrial and commercial land requirements, an alternative strategy would be to locate the first phase (1997) requirements for the Cargo Village (8ha), Business Park (8ha) and Industrial Park (13ha) all at Chek Lap Kok. This would entail a later start to the build up of the Industrial Park at Tai Ho East and potential savings in initial New Town development costs. The first phase Industrial Park activities would be located at Chek Lap Kok on short term tenancies. This would allow the incremental phasing out of Industrial Park uses at Chek Lap Kok as demand grows for land for the Cargo Village and Business Park. These Industrial Park uses would then relocate to Tai Ho East and be part of the 2011 demand (52ha) for the Industrial Park in this locality.

6.7.9 The Sea Channel

Part of the drainage strategy of the Preferred Concept Plan was the incorporation of a Sea Channel between the New Town and the New Airport. The Sea Channel provides benefits in environmental, engineering, planning, airport security and cost effectiveness terms. Environmental assessment of the Preferred Concept Plan recommended that the Sea Channel have a width at land formation level of about 200 metres and the Sea Channel proposed in the RODP is about 200 metres wide. This width may be marginally reduced in places when detailed design of bridge crossings and sea walls is undertaken.

The concept of the Sea Channel was endorsed by DPC at its 107th meeting on 9th May 1991 and was then incorporated into the RODP. Further justification of and detailed data relating to the Sea Channel is given in Appendix F of this report.

6.7.10 Drainage

In the Preferred Concept Plan, the Tai Ho valley was indicated as being drained by an open stormwater channel located to the east of Tai Ho. The channel ran beneath the NLE corridor adjacent to the Tai Ho interchange and discharged into the sea. This channel formed part of the buffer area between the Tai Ho residential areas and the Tai Ho East industrial area.

The build up of population in the New Town requires the reclamation and subsequent development of land in Tai Ho only after 2006 to meet the population target of 50,000 people in Tai Ho by 2011. To meet this need, the Preferred Concept Plan shows

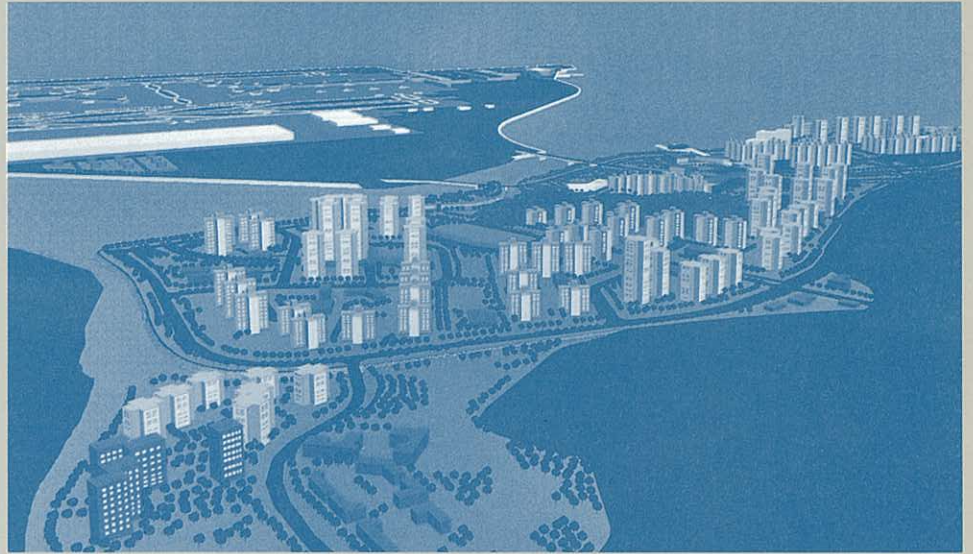


residential development south of the NLE in Tai Ho and in front of Pak Mong village.

Refinement of the housing mix has resulted in the siting of residential development in Tai Ho in two discrete areas. These are located north of the NLE on reclamation and south of the NLE in Tai Ho. The area in front of Pak Mong is not proposed for residential development in the RODP.

The need to efficiently drain the embayment of Tai Ho created by the NLE corridor (to avoid water stagnation) together with the limited development opportunity for any land formed between the NLE and Pak Mong village, enables this area to be used for an enhanced recreation facility to benefit the whole New Town. For this reason, an artificial lake can be created at Pak Mong between the NLE and the existing shoreline in front of Pak Mong village, and this is shown on the RODP.

North Lantau Development



7. Recommended Outline Development Plan

7. RECOMMENDED OUTLINE DEVELOPMENT PLAN

7.1 Introduction

The Recommended Outline Development Plan is given in Figure 7.1 and shows the proposed plan. A 1:5000 scale RODP is reproduced in Appendix I of this report. This Section summarises the planning requirements and planning principles which provide the basis for the physical form of the New Town and reflect the goals and objectives established in Section 3 of this report.

The plan shows the integration of the transport network with the land use distribution. This is described in the following sections. The land use budget is summarised in sub-section 7.8.

7.2 Planning Principles

7.2.1 Land Use

The main principle adopted in determining the distribution of land-use has been to plan facilities in the Town Centre and District Centres to be generally within an easy walking distance (say 0.5km or less) by the maximum population of the New Town. Housing developments adjacent to the LAL stations in the Town Centre and District Centres would be developed to higher densities than comparable housing elsewhere in the New Town. Low density housing areas would be located on the edge of the urban development area and would be served by buses.

Adoption of this principle has led to the creation of two distinct urban development areas focused on the LAL stations at Tung Chung and Tai Ho respectively.

Retail and commercial uses would be distributed in a hierarchy of centres comprising a Town Centre, District

Centres serving Tung Chung and Tai Ho and local centres within housing areas. The Town Centre would provide the retail, commercial and cultural core of the New Town.

Urban development, particularly at the Town Centre and District Centres, should be of an extremely high quality reflecting the town's role as a gateway to the Territory.

Opportunities should be created to give identity to different residential and commercial areas of the New Town and avoid a dense and monotonous urban environment. Reflecting this requirement, development densities for the New Town could vary to encourage greater flexibility in the urban design approach to particular development areas.

Industrial areas should be located on the periphery of the town so as not to compromise the environmental quality of residential areas or generate industrial traffic movements through residential areas.

The existing settlements directly affected by development of the New Town should be relocated to the periphery of the proposed urban areas. It would be desirable to provide buffer zones of open space between these settlements and the proposed urban developments.

7.2.2 Landscape and Open Space

The open space for the New Town would comprise a hierarchy of town, district and local open spaces, all easily accessible to the residents by a system of traffic free pedestrian routes developed through the town to the rural hinterland areas. These routes should be maintained where possible at ground level through the New Town. Disturbance of existing landforms is to be kept to a minimum.



Country Park

A visual corridor should be created in Tung Chung focusing on a new Tung Chung Bay to the east of Chek Lap Kok to avoid the New Airport visually dominating the landscape of the town. This would comprise a contiguous open space system whose secondary function would be to enhance air movement. The development of this "breezeway" corridor along open space and low rise development areas would be beneficial in terms of air quality and would additionally provide view corridors.

The recreational and amenity potential of the seafront would be realised by creating a contiguous traffic free parkway along its entire length. Appropriate land and water based recreational uses would be incorporated into this promenade which, where possible, would extend through the New Town along the major drainage channels. It is appreciated that recreational uses in the Sea Channel to the west of the New Town will be subject to New Airport security requirements.

The integrity of the urban area in Tung Chung has been reinforced by providing a physical buffer in the form of a Sea Channel between the New Town and the New Airport. This also serves to provide a clear physical edge to the southern boundary of the New Airport.

7.2.3 Movement

The transport planning principles for the New Town aim to minimise the impact of the NLE/AEL corridor on the town, minimise the need for use of vehicles and expensive road space and maximize the segregation of vehicular and pedestrian movements.

To reduce the impact of the NLE/AEL corridor on the New Town, the road and rail infrastructure will be kept at grade, where practicable, and incorporated within a landscaped reserve. Three interchanges within the development area, one at Tai Ho and two at Tung Chung, would be the maximum number of points of access to and from the NLE that would allow it to retain expressway standards of design.

The main road network should define the edges of the major district of the New Town and the connection between them. The main road network should be kept to the periphery of the town to minimise the effects of through traffic on residential areas. Roads serving district centres would be designed to restrict unnecessary traffic movement in residential areas.

The route of the LAL through the New Town and the number of stations should aim to maximise rail usage. Where practicable, the LAL network should be capable of expansion to serve the possible growth of the urban area and/or the airport-related industrial and commercial areas of the New Airport.

The LAL should run at-grade through the New Town with adequate measures adopted to minimise visual and noise intrusion. Where the LAL crosses the NLE/AEL corridor, the crossing should be beneath the NLE/AEL in tunnel. Development areas not close to the LAL stations would be served by public transport in the form of buses, green

mini buses and taxis. Public transport termini would be located in the Town Centre and the District Centres.

Ferry services would provide links between the New Town and other urban areas.

7.2.4 Urban Design

The urban design principles used in preparing the RODP aim to establish a sense of order to the future built environment and ensure that this form respects and responds to the natural setting and reinforces the planning structure of the New Town.

These principles, summarised below, have been applied at two levels. Those that impact on the physical structure of the New Town and those that determine the physical form of buildings and spaces, and the relationship between buildings and spaces, within the various development zones of the New Town.

The main urban design considerations used in developing the RODP were as follows:

- o Siting the New Town in two separate valleys leading down into bays which will be reclaimed to contain the two main urban development areas. These areas will be linked by a narrow strip of coastal reclamation.
- o Important landmarks, comprising the steeply sloping spurs, valley walls and dominant peaks, the retained southern tip of Chek Lap Kok, Tung Chung knolls and Pak Mong hill providing the framework within which an interesting and attractive urban form will be developed.
- o Creation of visual corridors to maintain visual separation between the New Airport and the New Town

and to ensure that built forms do not dominate the townscape. These corridors would be aligned to provide long distance views from peripheral areas through the New Town and focused on prominent landmarks or over water.

- o The incorporation of the NLE/ARL corridor as an integral part of the development of the New Town by placing it in an at-grade landscape corridor through the town and the creation of a strong visual element spanning it. This element would incorporate parts of the commercial requirements for the Town Centre and provide a “gateway” development project identifying the entry and exit to the New Town and New Airport.
- o The provision of a comprehensive and convenient pedestrian and cyclist network which links the main development areas and major recreational features such as the Town Park and major open spaces, the waterfront promenade, rural hinterland and fringe Country Parks. The pedestrian and cycle network should be segregated from vehicular traffic and run through open space corridors to link recreation facilities in the town with the rural hinterland.
- o Open space areas in the New Town should provide for an appropriate hierarchy of active and passive recreation areas and facilities. They should also accommodate, where appropriate, pedestrian and cycle networks and function as extensive landscape buffer zones between highways, railways, industrial areas and urban developments.

The New Town will be constructed on reclaimed and existing land within the Tung Chung and Tai Ho districts. With the exception of residential

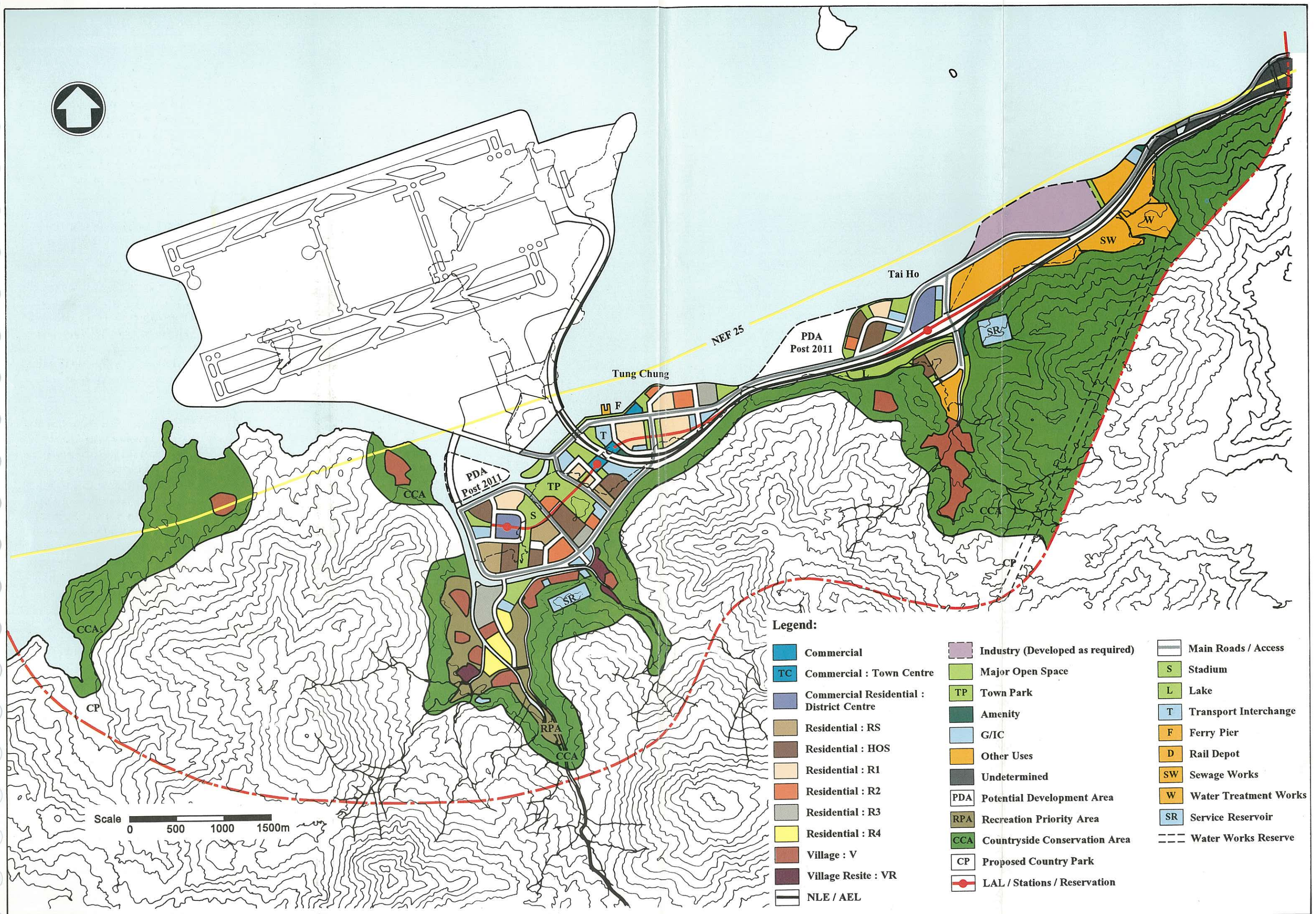


Figure 7.1 Recommended Outline Development Plan

development sites on the southern and western slopes of the Tung Chung knolls, this land will be predominantly formed at the same level. The opportunity is thus not available to vary building massing and vertical scale by using differences in the elevation of the existing topography. Other parameters to achieve variety in built form to avoid uniform and monotonous development have been adopted. These include:

- o Maximising population within easy walking distance of LAL stations. Greatest density of development is to be located adjacent to these station areas, with low density residential areas located on the periphery of the New Town.
- o Creation of “activity nodes” at the Town Centre and District Centres by allowing higher intensity of residential development and provision of higher order retail and commercial facilities.
- o Building masses in the main high density development areas to generally reflect the scale and form of the physical setting of the New Town.
- o As with the natural landform, building blocks should step down in height as they approach the North Lantau coast.
- o Buildings should be point blocks rather than slab form. This would maximise air movement and establish and maintain views from within and out of the development sites to the North Lantau coastline and beyond, and the backdrop of hills.
- o Buildings should be varied in height and setback from development boundaries, particularly on peripheral primary distributor roads, to minimise the potential “tunnel” or “wall” effect in these areas.

7.3 Transport

7.3.1 Road Network

The principal road access to the New Town will be the NLE which serves expressway functions from the Lantau Fixed Crossing to Tung Chung. Between Tung Chung to the New Airport it serves as a primary distributor, with two interchanges accommodating traffic between Tung Chung and the east. No local Tung Chung traffic travelling to or from the New Airport can use the NLE, although an access for Emergency Vehicles has been provided.

Access to the New Town’s distributor road network from the NLE will be from three interchanges, two located in Tung Chung and one located in Tai Ho. From these interchanges, traffic enters the New Town and is distributed by a hierarchy of roads comprising:

- o primary distributors;
- o district distributors;
- o local distributors; and
- o local access roads.

The road hierarchy has been designed to provide major access routes to the New Airport without penetrating residential neighbourhoods of the New Town. Three primary distributor roads are proposed from the NLE interchanges. These are:

- o Road P1, a dual two-lane primary distributor road providing for local access between the New Town and New Airport primary across the Sea Channel. It connects through an NLE interchange adjacent to the Sea Channel to run in an easterly direction connecting Tung Chung and Tai Ho and then continues onto the Port Peninsula. This road also provides a “relief” route to the NLE.



North Lantau Expressway Artist's Impression

- o Road P2 is a dual two-lane primary distributor located on the periphery of the New Town providing access to district primary distributors serving residential neighbourhoods. The road will link the NLE with the New Airport around the periphery of the town in the longer term.
- o Road P3 connects Tai Ho north and Tai Ho south via the NLE interchange at Tai Ho. The southern section of Road P3 serves both primary and distributor road functions. The road is proposed to be designed to primary distributor road standards to ensure proper operation of the interchange.

Through traffic has been kept out of local residential areas by having a well-defined primary road network supported by a district/local distributor network. There are two district distributors in Tung Chung. These are Roads D1 and D2, which serve Tung Chung Central and Tung Chung west respectively. Local distributor roads run off these providing access to local roads or directly to development sites.

7.3.2 Rail

The AEL and LAL run in the same corridor on entering North Lantau Development at Ta Pang Po before diverging near Kei Tau Kok to run on separate alignments.

Through Tai Ho the AEL and LAL run on separate alignments to allow the LAL serve the Tai Ho station and to allow access to the Rail Depot. The LAL railway again diverges from the AEL near Kei Tau Kok and runs at grade north of the NLE before descending into tunnel to pass under the NLE corridor and enter the Tung Chung Town Centre station. The station will be underground with the concourse at ground level.

Beyond the Town Centre the LAL alignment extends to a second LAL station located within the Tung Chung West District Centre. The two LAL stations in Tung Chung provide better transport accessibility for the maximum population in Tung Chung.

7.3.3 Other Public Transport

Three key public transport stations are proposed within NLD to give residents maximum accessibility to commercial/ industrial areas and external transport modes. A public transport interchange has been located just to the east of the NLE near the underground concourse to the LAL station. This places the Transport Interchange in an ideal position between the rail station and the ferry terminal. A second terminus incorporating internal and external public transport services is planned in Tung Chung West near the LAL station. The third major public transport station is in Tai Ho Area 27, located next to the Tai Ho LAL Station. These three termini provide facilities for buses, green mini-buses and taxis. A total of 16 bus routes are proposed for the New Town by 2011, details of these are given in Section 10.4 of the report. In addition to these several PLB termini are planned in major residential or industrial areas. A public carpark is to be part of the Transport Interchange and taxistands are recommended in various public transport stations.

Carparks and taxi stands will also be provided within housing and commercial/industrial developments.

The New Town will be linked to South Lantau via a public transport service using an upgraded Tung Chung Road. A lay-by area has been planned at the Tung Chung Road entrance to the Country Park to accommodate weekend recreational travellers.

A ferry terminal and pier has been proposed to cater mainly for the important weekend travel demand.

7.4 Residential Areas

7.4.1 General Approach

The New Town comprises two discrete urban development areas. These are at Tung Chung and Tai Ho, with proposed populations of 150,000 and 50,000 respectively by 2011. Possible expansion areas in Tung Chung and Tai Ho have the potential to accommodate an additional 60,000 population post 2011.

All residential areas in the town include a range of housing types comprising public, private and Home Ownership Scheme housing.

Residential land uses are distributed to allow the maximum population of the town to be within an easy walking distance of the Town Centre or District Centres and associated LAL station and public transport facilities.

Private RI housing at a Plot Ratio of 8 and commercial developments in Tung Chung and Tai Ho are concentrated in the Town Centre and District Centres, each incorporating a LAL station and public transport terminus. The four public housing estates proposed for the town are sited adjacent to either the Town Centre or one of the District

Centres to maximise accessibility to public transport, shopping and community facilities.

Sites for Home Ownership Scheme housing are proposed adjacent to public housing estates to provide flexibility in the planning of comprehensive developments and respond to changing social characteristics of the population,

Low density housing is located on the edges of the town at the mouth of Tung Chung valley and Wong Lung Hang valley. These areas are surrounded by low intensity development including existing villages and village re-site areas. They provide the transition between high density urban developments and the Country Park at the fringe of the New Town.

7.4.2 Tung Chung

At 2011, Tung Chung comprises three residential districts as shown in Figure 7.2. These are Tung Chung West, Tung Chung Central and Tung Chung East.

Tung Chung West

Tung Chung West is focused on a District Centre and linear open space which provides a breezeway and visual axis through the town. It contains three residential neighbourhoods.

These are:

- o An area of low density residential development for about 5,500 population at the mouth of Tung Chung valley, surrounded by low intensity urban fringe development including villages, village re-site areas and low intensity recreational uses.
- o A residential neighbourhood for about 48,000 population in a range of housing types located west of the

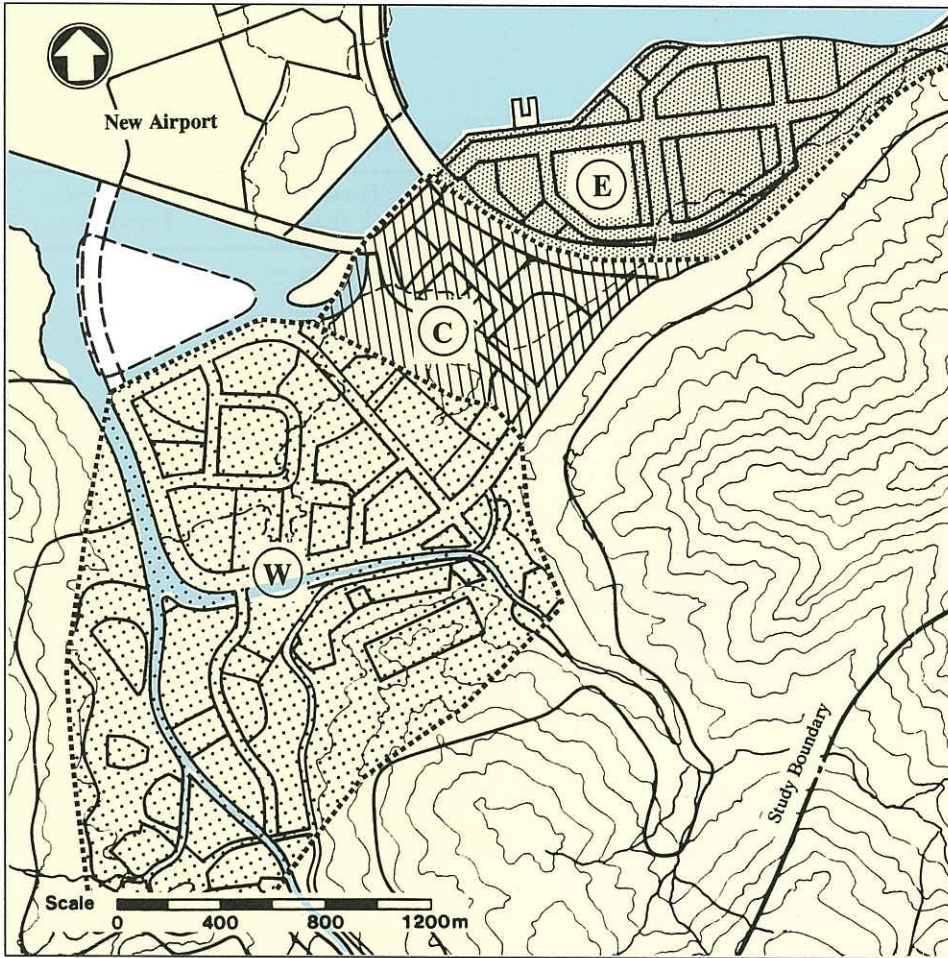


Figure 7.2 District Areas of Tung Chung

Table 7.1 Tung Chung West Residential Development and Population (2011)

Housing Type	No. of Sites	Planning Areas	Total Area (ha)	Estimated Population
RS	2	24, 35	12.13	23,560
HOS	4	23, 31, 34, 46	18.84	36,130
CR	1	36	6.90	10,970
R1	1	47	5.65	7,090
R2	2	22, 30, 48	9.55	9,250
R3	2	25, 38	11.90	5,270
R4	3	41, 42, 43	11.27	1,130
TOTAL	14	-	76.24	93,400

Source : Consultants Planning Estimates

open space spine providing the core of the open space system for the town. It is focused on a C/R site comprising residential blocks on a large commercial podium which forms the District Centre and contains the Tung Chung West LAL Station. The public transport terminus is also located within this C/R Site. A site for public housing,

two sites for HOS housing and a R1 private housing site are located adjacent to the District Centre.

- o A residential neighbourhood for about 40,000 population in a range of public, private and Home Ownership Scheme housing, located east of the open space spine. This neighbourhood is bisected by a district distributor road, Road D2, and abuts the Town Park to the north and north-east. Within the neighbourhood, low density R2 and R3 housing is located around the junction of Roads P2 and D2, at the mouth of Wong Lung Hang valley. Low density housing in this location avoids giving the visual impression of a continuous wall of massive development along the southern edge of the neighbourhood.

Tung Chung Central

This district comprises the first phase of the town. It accommodates a population of about 22,000 in a mix of high density public, private and HOS housing types and government departmental quarters. Stage 1 of the Town Centre development, incorporating the Tung Chung LAL station and community facilities, are all within convenient walking distance of residential developments (that is no more than 0.5km away).

Table 7.2 Tung Chung Central Residential Development and Population (2011)

Housing Type	No. of Sites	Planning Areas	Total Area (ha)	Estimated Population
RS	1	10	3.10	6,200
HOS	1	11	4.26	8,520
R1	1	4	3.23	5,690
Departmental Quarters	1	13	0.6	1,540
TOTAL	3	-	10.59	21,950

Source : Consultants Planning Estimates

The public housing estate and HOS housing in the south-eastern part of the district is planned as a comprehensive development for about 15,000 people. Convenient pedestrian and cycle ways connect this development with the Town Centre and LAL station, adjacent residential districts and the pedestrian and cycle network for the town.

A site for R1 residential development is located west of the Town Centre and links to the town park to the west by pedestrian footbridges across district distributors road D1. Departmental quarters for the Royal Hong Kong Police are located south of the Town Park.

Tung Chung East

This district is located to the north of the NLE/AEL Corridor and includes part of the Town Centre which spans this corridor. About 35,000 residents are planned to be accommodated in a range of private housing types.

The district is divided by a primary distributor road P1 which provides a road link eastward to Tai Ho and the eastern end of Lantau. High density R1 housing is located south of this road in two sites, through which runs the LAL. Residential development in the R1 site in Area 15 is planned at a Plot Ratio of 8 and is linked by a footbridge to the podium development planned in the part of the Town Centre located north of the NLE. The second R1 site south of road P1 is of similar size and separated from the western site by the primary distributor road linking the district to the NLE via the eastern interchange.

North of Road P1, a population of 12,000 is planned in a range of high amenity private housing, capitalizing on the waterfront location. These sites overlook the waterfront but are separated from it by a public

Table 7.3 Tung Chung East Residential Development and Population (2011)

Housing Type	No. of Sites	Planning Areas	Total Area (ha)	Estimated Population
R1	1	10	3.10	6,200
R2	1	11	4.26	8,520
R3	1	4	3.23	5,690
TOTAL	6	-	29.40	34,750

Source : Consultants Planning Estimates

promenade. The waterfront promenade extends through the length of the town, providing a waterfront connection between residential areas, the ferry pier and the Town Park.

7.4.3 Tai Ho

This area is located to the east of Tung Chung and is connected to it by the NLE/AEL corridor, the LAL rail service, the coastal primary distributor road P1 paralleling the NLE and a coastal pedestrian and cycle pathway system. Tai Ho will accommodate about 52,000 people by 2011 in two neighbourhoods, located to the north and south of the NLE corridor. These neighbourhoods connect by primary distributor roads to the NLE at Tai Ho through an elevated interchange.

The residential neighbourhood north of the NLE will accommodate a population of about 31,000 in a range of HOS and private housing and includes the District Centre

incorporating the Tai Ho LAL station and R1 residential development in a C/R site of 7.2ha. Community facilities and district open spaces are conveniently located to the housing areas.

The residential neighbourhood south of the NLE will accommodate a population of 21,000 in public and HOS housing and includes local retail and community facilities. This is linked to the northern area by both a subway and footbridge across the NLE.

A major district open space, incorporating an artificial lake, is located between the NLE corridor, the residential development and Pak Mong village. It provides the focus for active and passive recreation in this part of the New Town. Pak Mong hill is retained as a landscape feature.

Villages are retained in a low intensity urban fringe area at Pak Mong and south of Tai Ho and provide the

Table 7.4 Tai Ho Residential Development and Population (2011)

Housing Type	No. of Sites	Planning Areas	Total Area (ha)	Estimated Population
RS	1	14	9.33	16,800
HOS	3	15, 19, 22	11.08	19,940
CR	1	27	7.20	9,800
R1	1	21	3.25	4,080
R2	1	18	1.60	1,450
TOTAL	7	-	32.46	52,070

Source : Consultants Planning Estimates

transition between the urban development area and the Country Park at the fringe of the urban area.

7.5 Industrial Areas

The industrial area for the New Town is located at Tai Ho East, east of Tai Ho. It extends on reclamation north of the NLE/AEL corridor to Sham Shui Kok. The area between Sham Shui Kok and Ta Pang Po accommodates a number of future landings of major utility cables and pipelines.

The industrial area is accessed from the Tai Ho interchange and the primary distributor road P1. This road runs parallel to the NLE and connects Tai Ho with Tai Ho East. Road P1 provides access to future local distributor roads which in turn provide access to the industrial development sites.

The Tai Ho East industrial area is planned to accommodate the Industrial Park (52ha in 2011), the AEL/LAL railway depot (30ha) to the east of the Tai Ho interchange and a solid waste transfer station (2ha). A further area of 11ha is included in the Tai Ho East reclamation for a possible aviation fuel storage facility, if required. Industrial open space would be provided in this area on the basis of the HKPSG standard of 5ha per 100,000 employees.

The industrial strategy for North Lantau aims to satisfy, as far as possible, the demand for airport-related industrial and commercial activity. Other industrial activity in North Lantau would compete with airport-related uses for transport capacity and labour. Four development projects are proposed to satisfy airport-related industrial and commercial demand. The first of these, the office/hotel complex is located in the Town Centre. The Cargo Village (28ha in 2011) and the Business Park (27ha in 2011) are

located at Chek Lap Kok and the Industrial Park is located at Tai Ho East.

The location of the Cargo Village and Business Park (which will have mixed light industrial and business uses) at Chek Lap Kok is dependent on the availability of land in Chek Lap Kok and an adequate institutional framework to implement these development projects in the locality. These issues are considered in the Study of Airport Related Activities (SARA) being undertaken by the Provisional Airport Authority.

To permit phased build-up of industrial and commercial land, the first stage of the Cargo Village (8ha), Business Park (8ha) and Industrial Park (13ha) is proposed at Chek Lap Kok. First stage Industrial Park activities are located at Chek Lap Kok on short term tenancies in high standard temporary industrial buildings. This allows the incremental phasing out of Industrial Park uses at Chek Lap Kok as demand grows for land for the Cargo Village and Business Park. These Industrial Park uses would relocate to Tai Ho East and be part of the 2011 demand for the Tai Ho East Industrial Park.

The demand for location and timing of Industrial Land has been reviewed under SARA. When its findings have been endorsed a review of the assumptions made in this Study will be necessary.

7.6 Open Space

The main elements of the open space system comprise the Town Park and other district open spaces in Tung Chung and Tai Ho, the central spine in Tung Chung West, the waterfront promenade and Pak Mong lake. Other supplementary open spaces include environmental buffers to the NLE/AEL corridor and a landscaped strip along



Promenade

the edge of the major drainage channels through Tung Chung and Tai Ho, which provide a waterfront amenity area running through the New Town. The open space and landscape function of the rural hinterland and road corridors are described in Sections 12 and 13 of this report. Local open spaces are included in the gross residential areas and industrial open space is provided to HKPSG standards.

Open spaces in the New Town should:

- o provide for an appropriate hierarchy of active and passive recreation areas and facilities;
- o accommodate pedestrian links and cycleways within corridors segregated from vehicular traffic within the New Town and connecting surrounding areas and linking to the rural hinterland and Country Park areas;
- o provide extensive landscaped buffer zones between highways, railways, industrial areas and urban developments;
- o maximise recreation and amenity potential of extensive waterfront areas; and
- o present the opportunity to structure the open space system and emphasise the main views within and beyond the New Town by encouraging a high standard and sensitive landscape treatment of these areas.

District open space comprises the Town Park, the central spine in Tung Chung west and smaller parks throughout the town. The town park is the central open space in the town. It is located south of the NLE and comprises the northern part of the Tung Chung knolls, waterfront areas below the Tung Chung Battery and a major recreation complex on G/IC land. Cycleways and footpaths link the town park to the Town Centre and adjacent residential districts.

The open space spine through Tung Chung west comprises active recreational facilities including a sports stadium, indoor recreation centre, playing fields and pedestrian and cycle facilities. This area is also an important view corridor and breezeway through the town and helps to minimise the environmental impacts of urban development on the Tung Chung valley.

The waterfront promenade passes along the seafront of the town, linking residential districts, the ferry pier and town park in Tung Chung with residential developments and district open space in Tai Ho. This promenade incorporates footpaths and cycleways, landscape open spaces with sitting out areas and cafes. At key locations along its length, district and local open spaces, footpaths and cycleways direct pedestrians into the town.

Footpaths and cycleways along the landscaped area at the edge of the major drainage channels and subsidiary channels draining Tung Chung valley link the waterfront promenade and the rural hinterland.

In Tai Ho, the major open space is a lake between Pak Mong village and the NLE/AEL corridor. It is formed by retaining the embayment created by the reclamation works for the NLE and diverting the channel draining the Tai Ho valley.

Other district open spaces provide links in the overall open space network of the New Town. The provision of district open space and the function each performs is shown in Section 7.8, Land Use Budget.

7.7 Government/Institutional and Community Uses

The New Town is planned to provide for a wide range of community needs, including education, health, social welfare, cultural facilities, transport and recreation. Most facilities are provided in discrete G/IC zones, although some, including kindergartens, primary schools, community centres and clinics are located in public housing estates.

Health clinics are located in Tung Chung and Tai Ho in public housing developments and a site for a district hospital is located in Tai Ho to serve later development phases.

The North Lantau district headquarters and divisional police station, and facilities for fire and ambulance services are proposed in the first phase development of the town in Tung Chung. An additional fire and ambulance services site is proposed in Tai Ho to serve a later stage of development. Sites for these facilities are located so as to provide easy access to the road network.

Sites for government maintenance and vehicle depots and utility requirements, a funeral depot, waste transfer station and sewage pumping station are located on the extreme edges of the urban development area. The Sewage Treatment Works, Water Treatment Works and possible gas reception and pressure reduction plant are located at Tai Ho East. Service reservoirs are proposed on platforms above the Tung Chung Fort and east of Tai Ho.

Major recreational facilities, comprising a sports stadium and swimming pool

complex are located adjacent to the Town Park. Indoor recreational centres are located on discrete sites in G/IC zones throughout the town.

The main civic cultural facilities including a cultural complex, library, post office, magistracy and public transport interchange are proposed in a comprehensive development complex linking the Town Centre with the ferry pier and waterfront promenade.

The detailed location of G/IC facilities by residential district are shown in Figure 11.1 in Section 11 of this report.

7.8 Land Use Budget

The land use budget given in Table 7.5 summarises the major land use requirements for the New Town and adjacent land uses outside the New Town. The budget is based on the land required to accommodate the uses identified in Section 5 and the detailed schedule of land uses by planning area which forms part of the RODP. In specifying land requirements, gross areas are given. A full development schedule based on the RODP, showing facilities by planning area and phase is given in Appendix I of this report.

Of the total land area of 815ha in the town, 26 percent is for residential use including village developments, 13 percent for industrial, 11 percent for open space, 4 percent for G/IC uses, 26 percent for roads and the NLE/ARL reserve, 6 percent for drainage channels and the sea channel and 14 percent for other specified uses, including sites for utility works and the possible hospital site and undetermined uses.

The residential land requirements are based on the distribution of population by housing type and gross residential densities given in Section 5. The C/R areas comprise the district centres in Tung Chung and Tai Ho. In these

Table 7.5 Land Use Budget

Land Use in the New Town	Gross Land Area/ha
Commerical	
Office/Hotel complex	4.78
Total Commercial	4.78
Residential	
Commercial/Residential (C/R)	14.10
Public Housing (RS)	24.56
Home Ownership Scheme (HOS)	34.18
R1	31.30
R2	16.85
R3	16.20
R4	11.27
Villages, Village Expansion and Village Resite Areas	66.92
Total Residential	215.38
G/IC	
G/IC Facilities	29.81
Total G/IC	29.81
Industrial	
Industrial Area at Tai Ho East	52.00
Total Industrial	52.00
Open Space	
Town Park and District Open Space	37.77
Tung Chung Knolls	14.46
Waterfront Promenade	7.64
NLE setbacks	8.02
Pak Mong Lake	15.00
Amenity Areas	5.10
Total Open Space	87.99
Transport	
Roads (including pedestrian, cycle and landscape components)	132.05
NLE/AEL corridor	76.00
Total Transport	208.05
Miscellaneous	
Other Uses	98.68
Sea Channel/Drainage Channels	47.95
Undetermined	15.34
Total Miscellaneous	161.97
Total Land in New Town	759.98

Source : Consultants' Estimates

areas, allowances for retail facilities, public transport terminus, the LAL reserve and local open space is made. Village expansion and re-site areas are included as they are directly affected by the development of the New Town.

Industrial areas are based on the industrial land strategy proposed for North Lantau and land requirements stated in Section 5.

The land requirements for G/IC facilities refer only to discrete G/IC facilities located on the RODP in areas zoned for G/IC uses. In most cases, the land allocation for individual facilities exceeds the minimum site requirements to allow flexibility in detailed site planning. Allowance is made in some of the G/IC zones to accommodate additional G/IC facilities should the need arise as the town develops.

HKPSG require a minimum provision of 20ha of district open space. The RODP provides a total of 37.77ha excluding the Tung Chung knolls, environmental setbacks for the NLE/AEL, areas of the waterfront promenade in Tung Chung and Tai Ho and the lake in Tai Ho which forms part of the stormwater drainage system for this part of the New Town.

The land area required for roads includes the primary, district and local distributor roads and reserves which allow flexibility for expansion of road traffic from 1997 levels up to 2011 levels. The road reserves accommodate footpaths, cycleways, landscaped amenity areas and adequate space for future noise mitigation measures. The area for transport requirements also includes the NLE and AEL/LAL reserve and the AEL/LAL rail depot. The land identified for the AEL excludes that part of the LAL running through Tung Chung within residential, commercial and open space zones.

7.9 Town Centre

The Town Centre is the focus for retail, commercial and cultural activities of the town. It includes shops, offices and hotel uses and the LAL station and station concourse, in a multi-level comprehensive development complex spanning the NLE/AEL transport corridor. Figure 7.3 shows the Town Centre components.

The Town Centre is accommodated in podium developments or either side of the transport corridor comprising nine levels of hotel/offices in two towers, three levels of shops, the LAL concourse at ground level south of the NLE and car parking and service areas below ground level. The podia are connected by a two level shopping bridge spanning the transport corridor.

A central enclosed mall runs through the Town Centre, each level connected by stairs, ramps and escalators. A secondary mall within Tung Chung Area 6 runs perpendicularly to the central mall providing links to the Town Park to the north and housing areas to the south. Entry points to the central and secondary malls are defined by pedestrian plazas at ground level. The main pedestrian movement through the Town Centre is at first floor level. Movement at this level allows continuous pedestrian flow in a traffic free environment between town centre components, the seafront promenade, ferry pier, permanent transport interchange, major community and cultural facilities north of the NLE/AEL and peripheral housing areas.

First phase of development comprises a three level retail complex of 10,000m², with the LAL concourse at ground level over the LAL station and the NLE

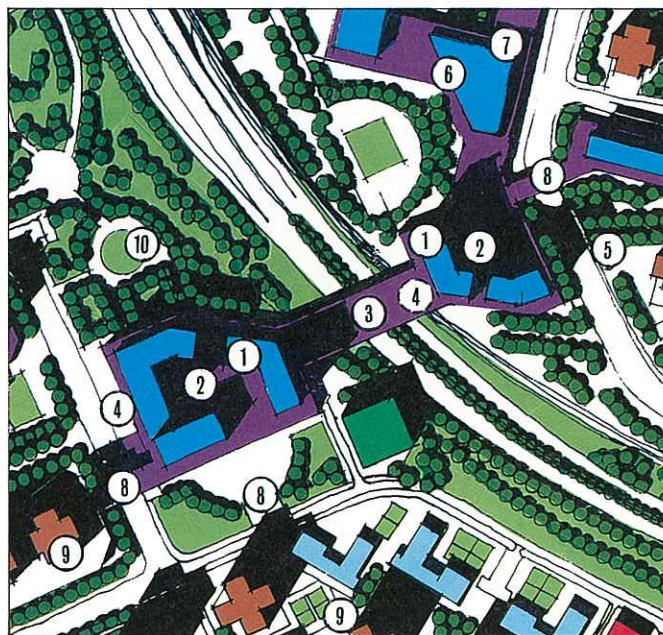


Figure 7.3 Town Centre Components

1. "Gateway" Hotel or Office Buildings
2. 3 Level of Shops/ Landscaped Plaza over LAL Platform and Concourse
3. Retail Bridge over NLE/AEL
4. LAL Entrance/ Concourse
5. Underground LAL
6. Transport Interchange/Civic Buildings
7. Bridge Link to Ferry Pier
8. Pedestrian Link to Ferry Pier
9. Residential Development
10. Temporary Transport Interchange/Gardens

bridge, which includes some retail GFA. The podium bridge over the NLE as part of first phase development ensures continuity of development and pedestrian links between phased components of the Town Centre. It forms the nucleus of a development complex that will provide a "gateway" concept in Tung Chung. Commercial floorspace comprising either an hotel or office building is allowed for in first phase development subject to demand.

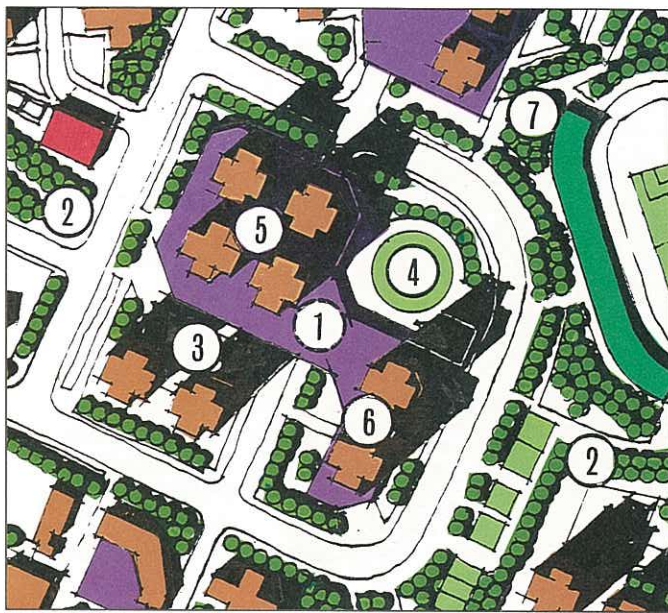
As the population of the town increases, additional phases of retail and commercial floorspace related to demand are provided in multi-level retail and commercial buildings within the core area as part of the comprehensive development. With the staging of the build-up of floorspace this way, hotel rooms and offices are added to the Town Centre when justified by demand. At the 200,000 population level, the Town Centre is planned to comprise 96,400m² GFA of shops and hotel/office gross floorspace of 49,300m², including 600 hotel rooms.

7.10 District Centres

7.10.1 Tung Chung West District Centre

Tung Chung West District Centre supports the town centre in Tung Chung by providing a lower order of comparison and convenience goods and retail services to residents living in the western part of the New Town. The centre could support up to 30,000m² of gross retail floorspace and entertainment facilities, including cinemas, restaurants and a bowling alley.

The District Centre is located in a C/R site central to its population catchment. It comprises a two level podium development incorporating the Tung Chung West LAL station, two levels of shops and car parking and residential flats for about 11 000 population located adjacent to and on the podium development. A public transport terminal is located within the site providing for bus, green mini-bus and taxi connections to other parts of the New Town.



1. LAL Station At-Grade 1st Floor Concourse Ground/ 1st Floor Shops
2. Improved At-Grade LAL
3. Transport Terminal
4. Landscaped Plaza
5. High Rise Housing on Landscaped Podium
6. Carpark under Podium
7. District Open Space

Figure 7.4 Tung Chung West District Centre Components

Figure 7.4 shows the proposed distribution of land uses within the District Centre. A central retail mall runs through the centre in a north-south direction at first floor level, linking the LAL station concourse with housing developments to the north and south. An east-west mall at ground level, paralleling the LAL, provides for pedestrian movement through the site connecting to district open spaces and recreation facilities to the east and west

of the centre. These malls are connected internally by stairs, ramps and escalators. Entry points to the shopping centre are defined at ground level by landscaped plazas.

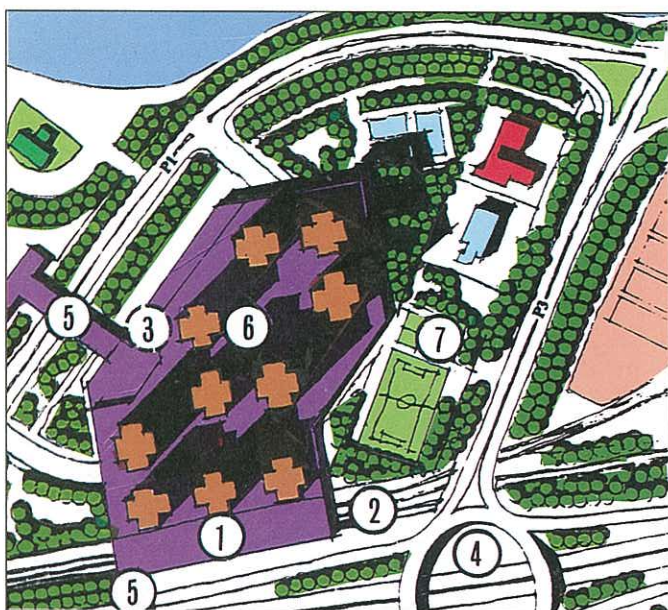
7.10.2 Tai Ho District Centre

Tai Ho District Centre would perform a similar function in the retail hierarchy of the New Town as the Tung Chung West District Centre. The District

Centre would provide convenience goods, retail services and a limited range of consumer durables for the population of Tai Ho. The District Centre could support up to 30,000m² of gross retail floorspace and a range of entertainment facilities.

The District Centre is located in a C/R site adjacent to the Tai Ho NLE Interchange. The centre is accommodated in podium development and comprises two levels of shops, the Tai Ho LAL station, a public transport terminal and residential flats for about 9 800 population located above the landscaped podium deck.

Figure 7.5 shows the distribution of land uses within the District Centre site. Ground level development comprises the LAL station and reserve for the AEL, retail floorspace, public transport terminal and car parking facilities, vehicular access routes and ground level pedestrian connections to open space and recreation facilities to the east and west of the site. At the first floor level, are located the LAL station concourse and connections to the shopping areas, pedestrian plazas and pedestrian bridges linking the centre with the housing areas south of the NLE corridor and in the western part of Tai Ho. Located on a landscaped podium deck above this development is high rise housing.



1. LAL Station At-Grade Concourse Over
2. AEL/LAL
3. Transport Terminal under Podium
4. NLE/Tai Ho Interchange
5. Pedestrian Bridges to Housing Areas
6. High Rise Housing on Landscaped Podium
7. Open Space and G/IC

Figure 7.5 Tai Ho District Centre Components

7.11 Town Park

The Town Park comprises the three retained Tung Chung knolls, the sea channel island and the waterfront promenade below the Tung Chung Battery as well as a major recreational complex on G/IC land and adjoining district open space adjacent to the town centre. This is illustrated in Figure 7.6.

Grade separated footpaths and cycleways link the Town Park to the adjacent central spine of open space through Tung Chung West, and adjacent housing developments and the Town Centre. The layout of all facilities in the Town Park and Tung Chung West central open space spine should be the subject of a comprehensive and integrated design.

In the Town Park, the Tung Chung knolls are retained in their natural form and accommodate mainly passive recreational activities. These include lookout points and pavilions, walking and jogging trails, sitting out areas and children's playgrounds in a quality landscaped setting. The Tung Chung Battery overlooking the Sea Channel is retained and should be restored to become an historical focal point in the Town Park.

A man made island in the Sea Channel will form part of the Town Park and is connected to it by pedestrian footbridges. Facilities on the island will include an extension of the seafront promenade, and a possible cafe and a support area for water based recreation activities in the Sea Channel.

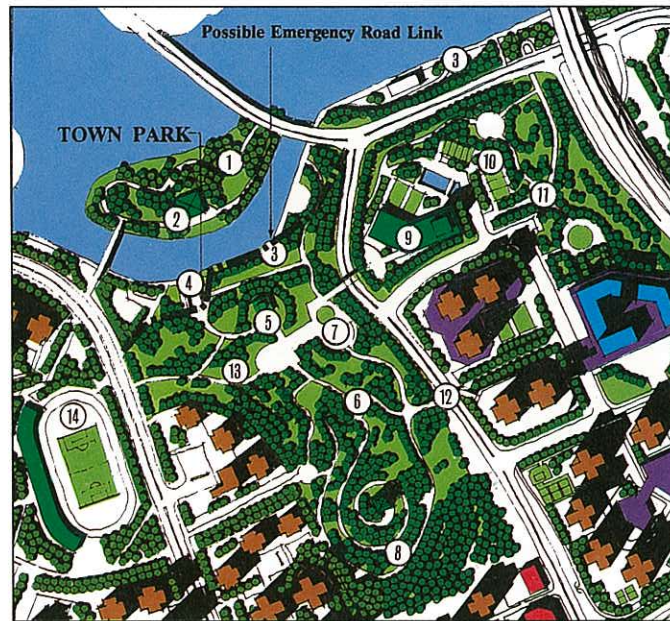


Figure 7.6 Town Park

1. Island Garden
2. Cafe/Pavilion
3. Waterfront Promenade
4. Tung Chung Battery
5. Lookout Pavilion
6. Childrens Playground
7. Amphitheatre
8. Footpaths/Fitness Trail
9. Swimming Pool Complex
10. Active Sports Facilities
11. Formal Gardens
12. Footbridge/Subway
13. Possible Cable Car Terminal
14. Stadium in District Open Space

A possible cable car service, with a terminus located adjacent to the Town Park, is proposed to link the town with hinterland recreation and tourist destinations, including the Ngong Ping Buddhist Monastery. The feasibility of this proposal, including the detailed location of the terminus facility in the Town Park, will be the subject of further study.

North Lantau Development



8. Environmental Considerations

8. ENVIRONMENTAL CONSIDERATIONS

8.1 Introduction

The following Section outlines the overall environmental assessment approach and outlines the key environmental issues and negative impacts, mitigation measures and residual impacts. It also broadly describes environmental monitoring and audit proposals required during and post construction to minimise any residual environmental impacts.

Appendix E (of this report) sets out key details of the baseline technical quantitative and qualitative environmental conditions. In addition, it contains details of the extent and severity of environmental impacts resulting from the construction and operation of all development phases. It also details mitigation recommendations (including type and location) to reduce the scale of negative construction and operational impacts and details any residual impacts.

8.2 Existing Conditions

8.2.1 Topography

The Study Area is bounded to the south by the main Lantau ridge line including the two dramatic high points of Lantau Peak and Sunset Peak. Three major valleys dominate the area, two to the west at Tung Chung and a smaller section at Ngau Kwu Lung to the east. The Ngau Kwu Lung Valley in turn comprises several smaller valley floors which are created by the smaller ridges and spurs of the lower sections of the main Lantau ridge. The two major valleys in the Tung Chung area are separated from each other by a steep central spur which emanates directly from Sunset Peak. The main valley in Tung Chung is one of great visual grandeur with Lantau Peak forming its head and the three main river courses flowing into Tung Chung Bay to the north. To the west of Tung Chung the Study Area is very remote and little developed.

On the whole the complexity of land form and marine environment are reflected in the environmental issues which were taken into account throughout the Study process. As discussed in Section 4 existing conditions place some significant constraints on development.

8.2.2 Water and Sediment Quality

Marine conditions in the Study Area reflect the complex water movement and seasonal stratification patterns which exist in parts of the North Western Waters of Hong Kong. It was essential to identify existing conditions early in the Study Process as this was a key input to the sewage treatment and disposal studies.

Surface salinities during the wet season are affected by the influx of freshwater from the Pearl River. To the north of the Study Area, in the Urmston Road, surface salinities may be depressed to 25 parts per thousand (ppt) while at the Chek Lap Kok Bank they are maintained at about 33ppt. This is considered to be due to the relatively shallow water in the area of the Chek Lap Kok Bank which acts as a barrier to the ingress of oceanic waters. Just offshore in the Study Area water depths are generally shallow and peak velocities may be as low as 0.1 to 0.2m/s. Water quality in the Study Area is influenced by pollutant loads arising in the catchments of the Pearl River and Victoria and Western Harbours, as well as the immediate catchment area. Pollution control measures in the catchment areas of the Pearl River constitute one of the major uncertainties in the predictive assessments of future water quality. A summary of existing water and sediment quality is presented in Appendix E of this report. Sediment quality is also discussed in Section 8.7.2 covering construction spoil.

The Study Area lies within the proposed North Western Water

Control Zone, scheduled to be gazetted in March/April 1992 with enforcement two years later. All beneficial uses have been assigned to this water body including primary and secondary contact recreation as well as fisheries and navigation. Sensitive receivers such as the mariculture zone at Tung Chung will be removed early in the development stage. Other new sensitive receivers, for example sea water intakes, will be created as the developments proceed.

8.2.3 Air Quality

Existing air quality conditions were difficult to assess as no air quality data specific to North Lantau were available. A short term, one week, continuous monitoring assessment was carried out at a site in Tung Chung to provide a baseline. Measurements included NO₂, NO, SO₂, CO, TSP and wind speed and direction. Estimates of air quality were also made by extrapolating monitoring data collected by the Environmental Protection Department (EPD) elsewhere in Hong Kong in tandem with a review of dispersion modelling undertaken for the Port and Airport Development Strategy Study (PADS). Results of the short-term background monitoring and of the predictive assessment of background air quality are presented in Appendix E of this report. Air sensitive receivers which could be affected by construction works were identified according to the definitions given in HKPSG and are shown on Figure 8.1. Valleys within the Study Area were given special attention in respect of the types of development which might be located therein and the possibility of recirculation zones where local air movements can cause a build up air pollution. The existence of recirculation zones depends on local topography and wind directions but they are often found at the heads of valleys such as those at Tung Chung and Tai Ho.

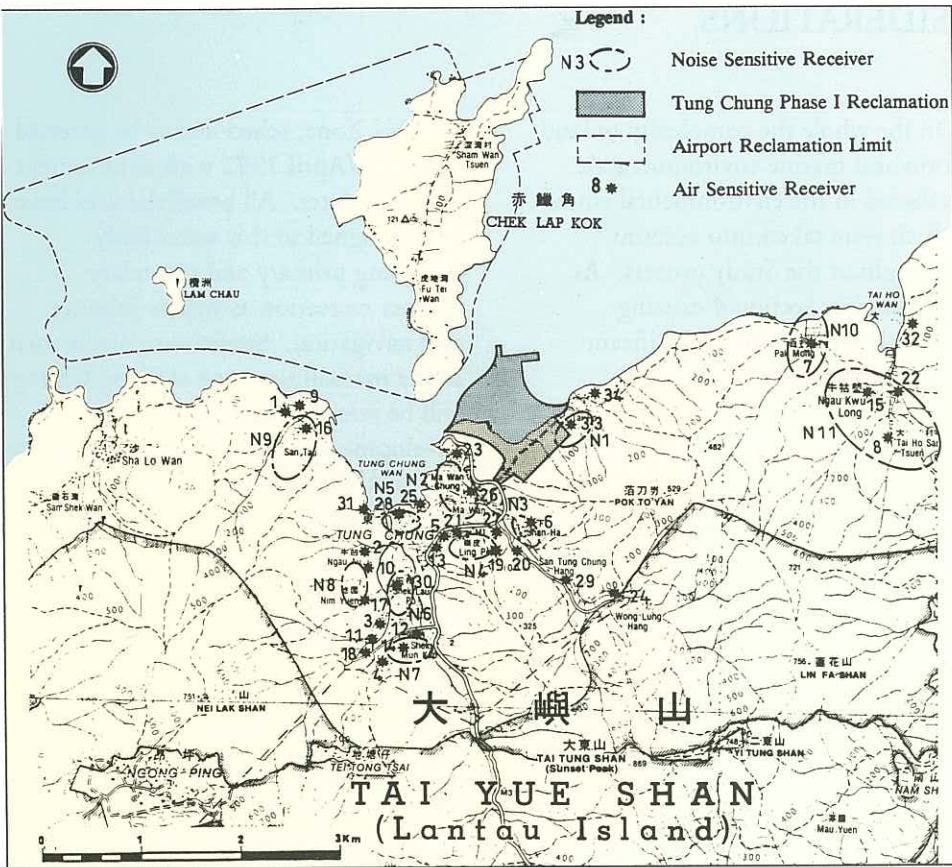


Figure 8.1 Air and Noise Sensitive Receivers for Phase I

8.2.4 Noise Levels

A noise survey was carried out to assess background noise levels and the results are summarized in Appendix E of this report. At present there are no major noise sources in the area apart from community noise, infrequent traffic noise (consisting mainly of buses and taxi movements along Tung Chung Road) and occasional overflights of aircraft. Daytime noise near the Tung Chung Road is mainly from road traffic, while marine traffic noise is significant along the waterfront. Noise sensitive receivers which could be affected by construction and development in the early stages are shown on Figure 8.1.

8.2.5 Ecological Concerns

Existing ecological data for the Study Area were scarce and thus habitat surveys were carried out to establish baseline conditions. Appendix E of this report contains details of the baseline terrestrial and marine ecological surveys. Particular attention was given to those habitats which were most likely to be

affected by the proposed developments such as the freshwater wetlands, coastal habitats and upland valley woodlands.

8.3 General Approach to Assessments

Environmental considerations have been an integral component of the Study process. As noted the initial task was to establish baseline conditions from whence constraints on and opportunities for development could be identified and incorporated into the development of the Initial Concept Plans. Environmental assessments of the four Initial Concept Plans were included in the overall evaluation process. The Preferred Concept Plan (PCP) evolved from this evaluation process. A detailed environmental assessment of the PCP was undertaken and was reported on in Topic Report TR10 (Revised), "Environmental Assessment". Further mitigatory measures which might be required to minimise any residual environmental impacts were then incorporated in the Recommended Outline Development Plan (RODP).

Further assessments of the RODP were undertaken and recommendations made for the first phase of construction in Topic Report TR18 (Revised) "Environmental Impacts from Construction of the First Phase", while residual impacts and those arising from future phases of development are assessed in Topic Report TR20 (Revised) 'Environmental Development Manual - Revised'. Environmental impacts have been considered and amelioratory measures proposed throughout the process of refinement of the development plans.

The primary environmental issues are addressed in the following sub-sections. A summary of mitigation measures which were included in the RODP is given in sub-section 8.11 with monitoring and environmental audit proposals highlighted in sub-section 8.12.

8.4 Water Quality

8.4.1 Method of Assessment

Baseline water quality surveys are presently being undertaken at the sampling locations shown on Figure 8.2. These data will be used to determine baseline conditions for construction phase monitoring. The monitoring has not been finished at the time of preparation of this report and will thus be the subject of a Supplementary Report to be issued in late 1992. Background data used for the environmental assessment are detailed in Topic Report TR10 (Revised) "Environmental Assessment".

Future water quality will be influenced by the quality of water conveyed by local and catchment drains, effluent loads from the NLD and other developments such as the New Airport (which will be determined by the level of sewage treatment and disposal) and any reduction in water movement and tidal exchanges between inshore waters

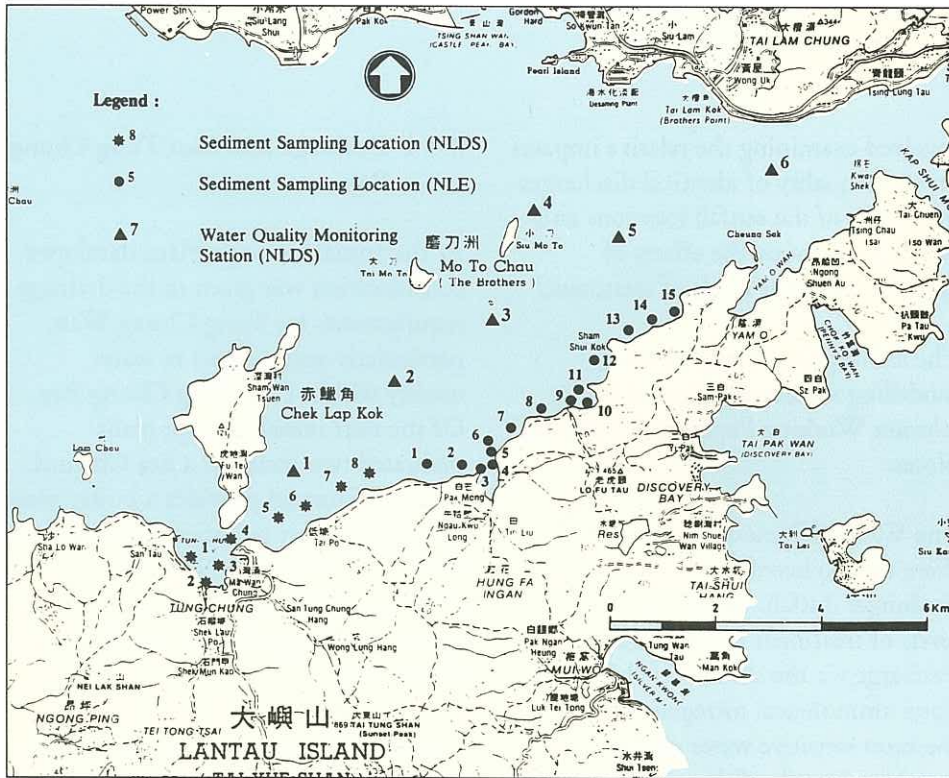


Figure 8.2 Baseline Water Quality and Sediment Sampling Locations

and the main stream. Key issues arising from the development of the Initial Concept Plans were:

- o land drainage at Tai Ho East (which has subsequently been resolved) and Tai Ho;
- o sewage treatment and disposal;
- o drainage into, and water quality within, east Tung Chung Bay and the Sea Channel; and
- o water catchments.

The WAHMO hydrodynamic, water quality and bacterial dispersion models were used to investigate potential benefits, or otherwise, of the developments on North Lantau. The Airport Master Plan Study (AMPS) and the North Lantau Development Study areas encompass the same water body and it was agreed to undertake a joint modelling programme. The impact the large reclamation required for the Airport platform would have on the local tidal regime was the primary concern of the AMPS consultants. Water quality modelling for the NLDS was required to confirm the suitability

of the location selected for discharge of effluent and to assess the impact this additional pollutant load could have on receiving water quality. The efficiency of a Sea Channel to flush East Tung Chung Bay was assessed using WAHMO intertidal flow and water quality models and an inhouse hydraulic model with boundary conditions from the WAHMO hydraulic models.

8.4.2 Drainage at Tai Ho East and Tai Ho

Drainage aspects of the NLD are discussed in sub-section 9.5 of this report. The fundamental issue of drainage design in relation to general water quality are the quality and quantity of water conveyed in the channels. The quality of upland catchment waters is good at present due to the lack of development and therefore pollution sources.

Tai Ho drains eight catchments over an area of approximately 6km², populated at present by the villagers of Tai Ho, Tin Liu, Ngau Kwu Lung and Tai Ho Sun Tsuen. In the initial stages of development an embayment will be

formed between the existing coastline and the NLE at Tai Ho. The land within Tai Ho will be formed in phases to accommodate a hospital and residential developments. Part of the embayment will be retained to form an artificial lake.

In the original scheme Tai Ho was to be drained by a 22m wide bridged channel under the Expressway at Tai Ho with secondary culverts east and west of Pak Mong. The scheme has been revised and now includes an artificial lake at Pak Mong with the main flow out to sea via a tidal channel west of Pak Mong. Two overflow culverts have also been incorporated in the design and are located at Tai Ho.

Discharge of catchment water to the adjacent marine waters is an important aspect in the water quality management of the Pak Mong Lake.

Proposals have been made to include a structure such as a rubber dam, to control flow rates, at Pak Mong. This will prevent the ingress of sea water but will restrict the flow of surface waters out of the bay. The latter is likely to be important especially during the dry season when runoff rates are low. The viability of the wetlands at Pak Mong may be threatened unless the control structure is placed well upstream. In addition this area is being considered for restoration of mangrove colonies and these will only be viable if the area remains a sea water, rather than a fresh water lake.

Flushing of runoff water from the bay during the early stages of development will need to be encouraged by channelling flow. A dredged channel through the bay inshore of and parallel to the NLE will be required at an early stage if water quality both within the bay and immediately seaward in East Tung Chung Bay is to be maintained.

Benefits of the artificial lake include the provision of a water feature to enhance the visual interest along the NLE, and also to preserve the wetlands at Pak Mong if brackish conditions are maintained. The latter is discussed further in sub-section 8.10 of this report covering ecological issues.

8.4.3 Sewage Treatment and Disposal

Selection of a suitable site for the Sewage Treatment Works took account of environmental compatibility with neighbouring land uses as well as water depth, movement, stratification and water quality. Many other factors were involved which are not directly related to environmental issues.

The location of Tai Ho East was chosen in preference to other possibilities investigated on the grounds that, inter alia, the site is favourably located in terms of outfall locations in the vicinity of the East Brother. Two alternative discharge points were selected, as shown earlier on Figure 4.4, and these were evaluated using the WAHMO water quality and bacterial dispersion models.

Initial WAHMO testing of the outfalls aimed at proving preliminary acceptability of the chosen locations. Estimates of loads and flows for the New Town plus New Airport effluent loads and flows were made for input to the models. Also included in the model were background concentrations and flows and loads from the existing North West New Territories and Pillar Point Outfalls.

The first outfall location tested was inshore discharging south of the Brothers Islands in water about 10m deep, the second was to the north of the East Brother discharging into water some 20m deep. Analysis of the initial results confirmed that either location would be acceptable for discharge of effluent. More detailed analysis

involved examining the relative impacts on water quality of identical discharges from each of the outfall locations and secondly to review the effects of applying different levels of treatment.

The assumptions made in the modelling studies are detailed in the relevant Working Papers and Technical Notes.

The WAHMO model showed that there was no benefit to be gained from the longer outfall. Assessment of the levels of treatment required before discharge via the short outfall focused upon ammoniacal nitrogen which was the most sensitive water quality variable. Details of the rationale behind the proposed levels of treatment are given in Technical Note TN2 "Sewage Treatment Levels and Outfall Location".

Preliminary treatment comprising grit removal and coarse and fine screening will be required until 2001. Primary settlement would be desirable but the additional costs cannot be justified on the grounds of water quality protection. It was concluded that full treatment including a nitrogen reducing capacity will be required in the longer term. Provision of disinfection facilities would also be prudent in the longer term.

The current assessments are based on present estimates of flows and loads and include a number of assumptions. It is therefore strongly recommended that a monitoring programme should be set up to collect additional data. This should include:-

- o composition and flow rate of influent;
- o composition of effluent entering the outfall; and
- o receiving water quality.

Levels of treatment may be reviewed once a large enough data set is available.

8.4.4 Drainage into East Tung Chung Bay

As the Initial Concept Plans developed, consideration was given to the drainage requirements for Tung Chung Wan, particularly with respect to water quality within East Tung Chung Bay. Of the four initial concept plans evaluated two included a Sea Channel. The Sea Channel provides a buffer zone for noise and air pollution between the New Airport and the New Town but its main purpose would be to maintain or improve water quality in East Tung Chung Bay.

Channels of various depths and widths were then examined using an in-house model, HYDRO, with boundary conditions from WAHMO. Many assumptions had to be made in this comparative assessment. One of the assessments was based upon the length of time a particle would take to traverse the entire length of the Sea Channel. This gave some indication as to whether pollutants released in the Sea Channel could be flushed out in one tidal cycle and thus whether water quality in the Sea Channel and East Tung Chung Bay would deteriorate. It was concluded that the Sea Channel would be beneficial.

A Sea Channel was therefore incorporated in the RODP. The Sea Channel has a surface width of 200m at the eastern end and would be dredged to a depth of -7mPD. This was assessed to be sufficient to maintain water quality in East Tung Chung Bay assuming the waters within the sea channel were not polluted by contaminated runoff from either the New Airport or New Town drainage systems. The Sea Channel has been designed in detail and a drawing and further background detail is given in Appendix F of this report.

8.4.5 Construction Impacts and Progressive Developments

Impacts on the marine environment arising from construction of the first phase are detailed in Technical Report TR18 (Revised) "Environmental Impacts from Construction of the First Phase" and in Appendix E of this report. Assessments of subsequent phases are reported in Technical Report TR20 "Environmental Construction Manual" and also in Appendix E.

In TR18 (Revised) it was determined that water quality may be adversely affected during the construction phase by:

- o dredging;
- o reclamation and land formation; and
- o off-site disposal of construction wastes.

The first phase impacts from dredging and reclamation works at Tai Ho East and Tung Chung are not likely to be severe unless there are significant levels of suspended solids in tailwaters from marine fill or at dredging faces. Pollution control will be required at work sites including provision of solid and liquid waste collection and disposal facilities and possibly floating refuse booms.

Phasing of land formation, particularly in Tung Chung Wan could have an impact on water movement and water quality but this will be resolved by subsequent land formation.

Measures to minimise the potential impacts on water quality during construction were proposed in TR18 (Revised) and TR20 (Revised) together with monitoring requirements. The former description of mitigation measures are presented in Appendix E of this report and the latter are highlighted in sub-section 8.12 on monitoring requirements.

8.4.6 Water Catchment Areas

Upper parts of the Tung Chung Valley catchment are part of the Water Supplies Department water catchment area. This was identified as a constraint in Topic Report TR3 "Constraints and Opportunities" and development of the upper valley areas was not recommended in order to preserve their water quality and prevent their degradation. This also conformed with the landscape and ecological aims of the Study.

Developments in the villages in Tung Chung have been included in the RODP with associated river training and diversion schemes. These developments are scheduled for later phases of New Town development, and in Topic Report TR20 "Environmental Development Manual -Revised" recommendations are made to minimise the potential impacts on water quality during the later development period. These recommendations are included in Appendix E of this report.

8.5 Air Quality

8.5.1 Approach to Assessment

The mountainous terrain of the Study Area gives rise to the complex flow and dispersion characteristics of the local airshed. Rigorous air quality assessments were undertaken and provided key inputs to the development process. The general approach to the air quality assessment was as follows:

- o background air pollution and meteorological data were collected;
- o possible emission sources were identified and emission levels calculated;
- o box models were used to calculate a preliminary estimate of air pollution and the results used as an input to the Initial Concept Plans; and

- o the Initial Concept Plans were analysed using a wind tunnel and mathematical dispersion modelling.

Details of these studies and results are given in Topic Reports TR8, TR10 (Revised), TR18 (Revised), Technical Note TN3 (Revised) and are summarised in Appendix E of this report.

The range of pollutants considered included SO₂, NO, NO_x, NO₂, C_xH_y, CO, RSP and TSP. Photochemical air pollution (O₃) was not included as PADS identified that this was not a major problem in Hong Kong. Dispersion characteristics of the airshed over the Study Area needed to be known in sufficient detail to predict the impact on air quality for alternative development concepts. Valleys and potential air recirculation areas are illustrated on Figure 8.3.

Constraints on developments in terms of air quality have been taken into account throughout the planning study. Key components of the overall plan which might have a potential impact on air quality included industrial developments, high rise buildings, the Sewage Treatment Works, the Refuse Transfer Station, and road and rail traffic. These had to be considered together with emissions from the New Airport as well as background sources of air pollution such as the power station at Castle Peak.

At the Initial Concept Stage the development options did not differ substantially in terms of maximum concentrations of pollutants predicted by air quality modelling and wind tunnel studies. As anticipated, the main differences were local interfaces and cross boundary edge effects. Hong Kong's Air Quality Objectives taken together with the HKPSG provided the basis for assessment.

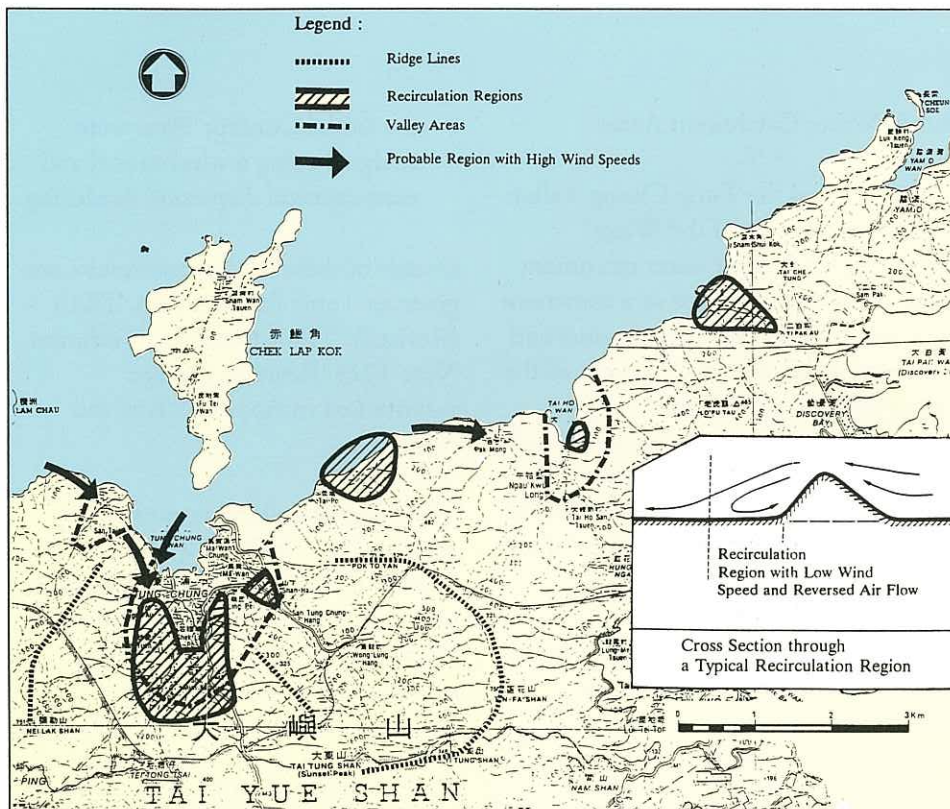


Figure 8.3 Valleys and Potential Recirculation Zones

8.5.2 Industrial Development

The degree of air pollution arising from operations within the industrial areas (at Chek Lap Kok and Tai Ho East) will depend upon the types of industry permitted. The PADS premise was that only clean industry would be located in North Lantau. Definitions of clean industry raise complex issues. One definition is simply, "industries which do not have off-site impacts". If the aims of the NLD Study are to be realised, structured management of the industrial area sites will be required to ensure pollution control measures are adopted. The management of the industrial areas should be under one authority similar to the authority responsible for the existing industrial estates in Hong Kong. The management authority should then be charged with vetting applications for industrial sites to ensure that the air, water and noise pollution from the estate does not exceed the guidelines developed in this Study. These have been detailed in Topic Report TR20 (Revised) and are summarised in Appendix E. A hospital is planned for Tai Ho and restrictions on fuel usage

and emissions will be needed to meet these guidelines.

The refinement of the initial development concepts ensured no large air pollution sources or residential areas were located in the recirculation zone of Tung Chung Valley. A breeze path was created to the west of the Tung Chung Valley together with two secondary breeze ways through the urban area to encourage dispersion and dilution of pollutants. These concepts were carried through to the RODP.

Industry to be located at the New Airport will be situated to the west of the New Town residential areas and will therefore be downwind in the prevailing wind conditions. There are, however, fairly frequent northerly winds that could blow pollution from the industrial areas which have been proposed for the airport island. Pollution control of industry in the airport island may be necessary depending on the results of SARA. It should be noted that significant changes in the location of industry on the RODP could change the conclusion of this Study.

8.5.3 High Rise Buildings

The air quality assessment of the Preferred Concept Plan identified a potential problem arising from the location of high density, high rise residential land uses in Tai Ho and Tai Po, where recirculation could occur under unfavourable conditions, leading to unacceptable air quality. Development in these areas was modified accordingly.

Distances between buildings and the orientation blocks of buildings was given particular attention in terms of the criteria for the plan in order to minimise potential air quality problems arising from poor dispersion characteristics. Guidelines for development of detailed layout plans and estate plans are included in TR20 and summarised in Appendix E of this report.

8.5.4 Sewage Treatment Works and Refuse Transfer Station

One of the many factors taken into account when identifying a suitable location for the Sewage Treatment Works and the Refuse Transfer Station was the relative distance of these sites from residential areas. The choice of sites at Tai Ho East ensures the impact of odour emissions on potential sensitive receivers will be minimal. Visual impacts on residential areas will also be minimal and landscaping will reduce the impact on users of the NLE and AEL.

8.5.5 Road and Rail Traffic

The broad alignment of the major transport corridor within the area (the NLE/AEL) was common to all development concepts. Pollution generated by vehicles using the NLE will primarily consist of oxides of nitrogen and particulates although the former was predicted to have a bigger

impact. Localised problems may arise at the NLE/AEL corridor interchanges and junctions.

An Environmental Impact Assessment of the NLE/AEL corridor has been carried out (by the NLE Consultants) and a set back distance of approximately 40-45 metres from the centre of the NLE was found to be necessary for the development of any sensitive land use. The distance from the centre of the NLE to the highway boundary is approximately 30 metres so the development constraints imposed by NO₂ emissions are unlikely to be major. However, these have been taken into account in the RODP and no sensitive uses have been placed in this zone.

8.5.6 The New Airport

It is clear that the New Airport will be one of the primary sources of air pollution in the area, and preliminary calculations carried out for this Study indicated that AQO's for NO₂ and SO₂ could possibly be exceeded when north and north-westerly winds are blowing. Such wind conditions occur on average about 30 days per year with the worst affected areas being alongside the airport boundary and the recirculation zones in the head of the Tung Chung valley.

This was taken into consideration when locating residential developments in the New Town. In general the air quality improves with distance from the New Airport. Wind tunnel and air quality modelling results detailed in Topic Report TR10 (Revised) and summarised in Appendix E confirmed the suitability and compatibility of locating residential developments near the New Airport. The modelling for this Study was, however, carried out before complete details of emissions from the New Airport and the proposed power station at Black Point were available. An air pollution study has

subsequently been carried out by the AMP Consultants but this excluded most of the NLE sources and did not allow possible exceedances of air quality objectives to be assessed. The impacts of the proposed power station and increased industrial use of the airport island resulting from the SARA study are, as yet, unknown. It has therefore not been possible to conclude that air quality objectives will not be exceeded.

8.5.7 Construction Impacts

Impacts on air quality may arise during construction from land reclamation and formation, the construction of drainage channels and basic infrastructure on formed or existing land. Air quality impacts arising from construction and summarised in Appendix E. Air quality sensitive receivers were identified for the first phase of the construction works, during which time both the New Airport platform and the NLE/AEL corridor will be formed.

Dust will be the major source of pollution during construction. This will be generated by vehicles using haul roads, drilling, blasting and rock crushing, concrete batching and asphalt mixing. The latter will also generate emissions of SO₂, NO₂ and CO. Handling of materials could also give rise to dust.

The major impact during construction will be from TSP from construction traffic using the haul roads.

The hourly air objectives for TSP and RSP could be exceeded on occasions during the Phase 1. However dust levels can be reduced by up to 40 percent by mitigation measures such as watering haul roads. Mitigation measures have been considered in Topic Report TR18 (Revised) and Topic Report TR20 (Revised) and are included in Appendix E of this report.

8.5.8 Conclusions

Neither CO nor RSP emissions will have any significant impact on the New Town area by 2011. General background concentrations including those from the New Airport and the Power Station at Black Point would add significantly to local air pollution levels.

The highest NO_x emissions originate, as expected, from the New Airport and the NLE/AEL corridor. The latter, however, still comply with the AQO's except immediately adjacent to the corridor. Setback distances were incorporated into the RODP to ensure that the HKPSG were met. Air pollution mitigation measures and residual impacts are summarised in Appendix E.

Confirmation that air quality objectives will not be exceeded cannot be made until an assessment of the combined impact from the New Airport (including industrial emission) and the power station has been completed.

8.6 Noise

8.6.1 Method of Assessment

With the dramatic change in the environment of North Lantau, noise levels will undoubtedly rise significantly above existing background levels (presented in Appendix E). In order to characterise the existing noise environment a baseline monitoring survey was carried out. This provided information on the main sources of noise, background levels and the temporal variations within the Study Area. For detailed results reference should be made to "Background Noise Survey for the North Lantau Development Project" although the results have been summarised in Appendix E.

Major noise generators are common to all the development plans (ICP, PCP and RODP) and include the NLE, the AEL and LAL as well as airport related noise. The noise impacts arising from the operational phases noise sources are included in Appendix E. Other issues specific to individual plans were buffer distances between residential areas and noise sources and noise levels in the vicinity of the industrial park at Tai Ho East. Throughout the planning process cognisance was given to criteria set out in HKPSG.

Measures introduced in the planning and development process, to reduce noise impacts have been included in Appendix E and include:

- o all sensitive noise uses to be located outside the airport NEF 25 contour;
- o high density residential developments to be located an appropriate distance from the NLE;
- o road traffic to be limited through residential areas;
- o buffer zones to be provided between industrial areas and residential area (for example the town park at Tung Chung)
- o the rail depot to be located away from residential developments and possibly to be partly covered reducing noise and offering space for development of commercial activities;
- o LAL to be depressed and partly in tunnel through Tung Chung; and
- o sewage treatment works and the refuse transfer station to be remote from residential areas.

8.6.2 Industrial Park and Railway Depot

According to the HKPSG noise from the industrial park and railway depot should not exceed the relevant ANL-5dB(A) as defined in the Noise Control Ordinance (NCO) at the facade of the nearest sensitive receiver.

No details of the industrial users likely to be attracted to the industrial park are available at present. However, it is recommended that the lease conditions include the requirement to comply with the HKPSG. This is unlikely to be a serious problem as the sensitive receivers in Tai Ho are located some distance from the source.

8.6.3 New Airport

One of the fundamental design constraints was the need to locate all noise sensitive development outside the NEF 25 contour. The Consultants for the Airport Master Plan Study have advised that noise levels from ground and general airport noise will comply with the guidelines set in the HKPSG and NCO and will therefore not restrict New Town development. The existing village at Sha Lo Wan does however fall within the NEF 25 contour for 2030.

8.6.4 Road Traffic

Road traffic will be the primary contributor to noise levels in the New Town. Noise tolerant uses, such as godowns, open spaces, hotels and car

parking have been sited to screen noise sensitive uses wherever possible. Where the demand for noise compatible land uses is insufficient alternative mitigation measures need to be considered, as described in Appendix E. Initial assessments were carried out by considering noise impact cross sections of the NLE, primary distributors and local roads. Setback distances required for noise sensitive uses were then derived. Setback distances for residential properties both with and without noise barriers alongside the road are given in Table 8.1. The setback distance for the NLE and primary distributor is from the nearside edge of the carriageway closest to the receiver. This is generally the primary distributor. These figures assume that a friction course will be applied to the NLE. This will reduce the traffic noise by at least 3.5dB(A). The NLE noise barriers assumed are 6m high earthbunds with 3m solid barriers on top.

The benefit of noise barriers is reduced when receivers are high rise buildings and little benefit is gained by building noise barriers alongside primary distributor roads. For primary distributor roads adjacent to residential uses the inclusion of the friction course will eliminate residential noise constraints. However, for primary distributor roads adjacent to schools the inclusion of a friction course will have to be supplemented by a 3m high earthbund with 3m solid barrier on top to achieve the HKPSG criteria.

Table 8.1 Setback Distance (m) from the Nearside Edge of the Carriageway (With and Without Mitigation)

Road Type	Without Mitigation	With Proposed Mitigation
	HKPSG Compliance	HKPSG Compliance
NLE Tung Chung Section	172	136
NLE Tai Ho Section1	209	176
NLE+ Primary distributor	200	143

Source : Consultants' Assessment (see Topic Reports TR10 and TR20 (Revised))

Noise contours were developed into planning constraints (as shown on Figures 8.4 and 8.5) for the RODP and appropriate buffer distances have been incorporated in the RODP. Figure 8.4 illustrates the constraints placed on the development of noise sensitive land uses on either side of the NLE between the two Tung Chung interchanges. Most of the noise conflicts in the Preferred Concept Plan have been resolved in the RODP by a combination of:-

- o setbacks;
- o noise barriers; and
- o development controls.

For example noise barriers in the form of 6m high earth bunds with 3m high solid barriers have been allowed for on either side of the NLE as it passes through the New Town centre in Tung Chung, and to the north of the NLE at Tai Ho. The schematic location of road mitigation requirements for all phases are summarised in Appendix E. These also indicate friction course requirements to eliminate noise constraints. The latter item in the list of mitigation measures allows developers flexibility in meeting noise standards. For example the assessment has assumed that buildings could be orientated such that they have a 120° angle of view of the road. This reduces the noise significantly when compared with a 180° angle of view. However developers may prefer to build residential blocks closer to the road orientated so that windows have a narrower field of view, or further away with a broader field of view. The development controls allow this flexibility while still meeting the standards in the HKPSG.

For low rise buildings, say up to 30m, the setback distances required by HKPSG are smaller than for high rise development and these may be built close to the roads.

Table 8.2 Setback Distances (m) Required to Satisfy the HKPSG Controlling Criteria for Rail Noise (No Mitigation)

Train Service	Setback
AEL + LAL	185m
AEL	105m
LAL	80m

Source : Topic Report TR20 (Revised)

8.6.5 Railways

Wayside noise was calculated by taking the sound emission level of the latest British Rail Engineering Ltd (BREL) type rolling stock, as measured by the rolling stock manufacturers. This was 83dB(A) (measured as free field noise) at 25m from the centre line of the track when 4-car trains were running at 135km/hr. The noise generation was adjusted in the assessment calculations to allow for the proposed 8 car LAL trains and 10 car AEL trains. Setback distances for noise sensitive receivers required to satisfy HKPSG L_{eq} (24hr) 65dB(A) requirements are given in Table 8.2. These distances assume no mitigation measures have been applied, that 8-10 car trains will be used and that the train frequency proposed in the Airport Rail Feasibility Study will be adopted.

Constraints placed on the planning and development process are more severe if the NCO night-time L_{eq} (30 min)

60dB(A) criteria are to be met, as shown in Table 8.3.

In view of the setback distances demonstrated to be required for locating noise sensitive uses near the railway lines, consideration was given to developing appropriate railway mitigatory measures. Consideration was initially given to fully enclosing the railway line, but in view of cost effectiveness together with operational difficulties this concept was abandoned in favour of a 1.5m high inward curved trackside barrier. This double barrier would need to be installed alongside each track on the side of the noise sensitive receiver. Where there are noise sensitive receivers on both sides then barriers will be required on either side of the tracks to protect them (i.e. double barriers on both tracks). Setback distances with the double trackside barrier in place were calculated and are given in Table 8.4. The setback distance for trains is much less than that required for road traffic noise

Table 8.3 Rail Setback Distances (m) Required to Satisfy the NCO Night-time Criteria (No Mitigation)

Train Service	Setback
AEL + LAL	510m
AEL	285m
LAL	225m

Source : Topic Report TR20 (Revised)

Table 8.4 Setback Distances (m) Required to Satisfy the NCO Night-time Criteria With 1.5m Inward Curved Double Trackside Barriers

Train Service	Setback
AEL + LAL	60m
AEL	54m
LAL	51m

Source : Topic Report TR20 (Revised)

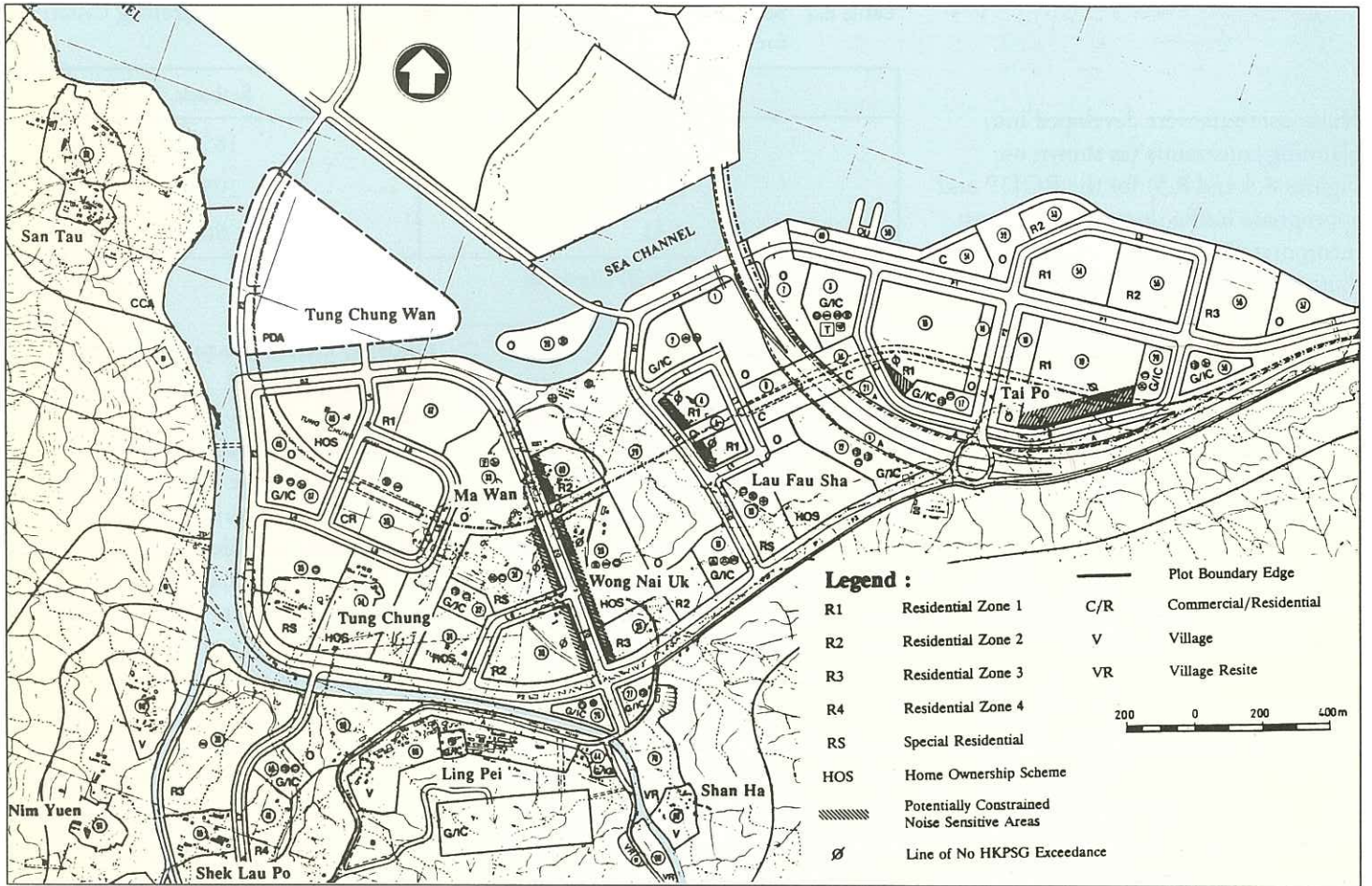


Figure 8.4 Noise Constraints on the RODP - Tung Chung Area (with Noise Mitigation)

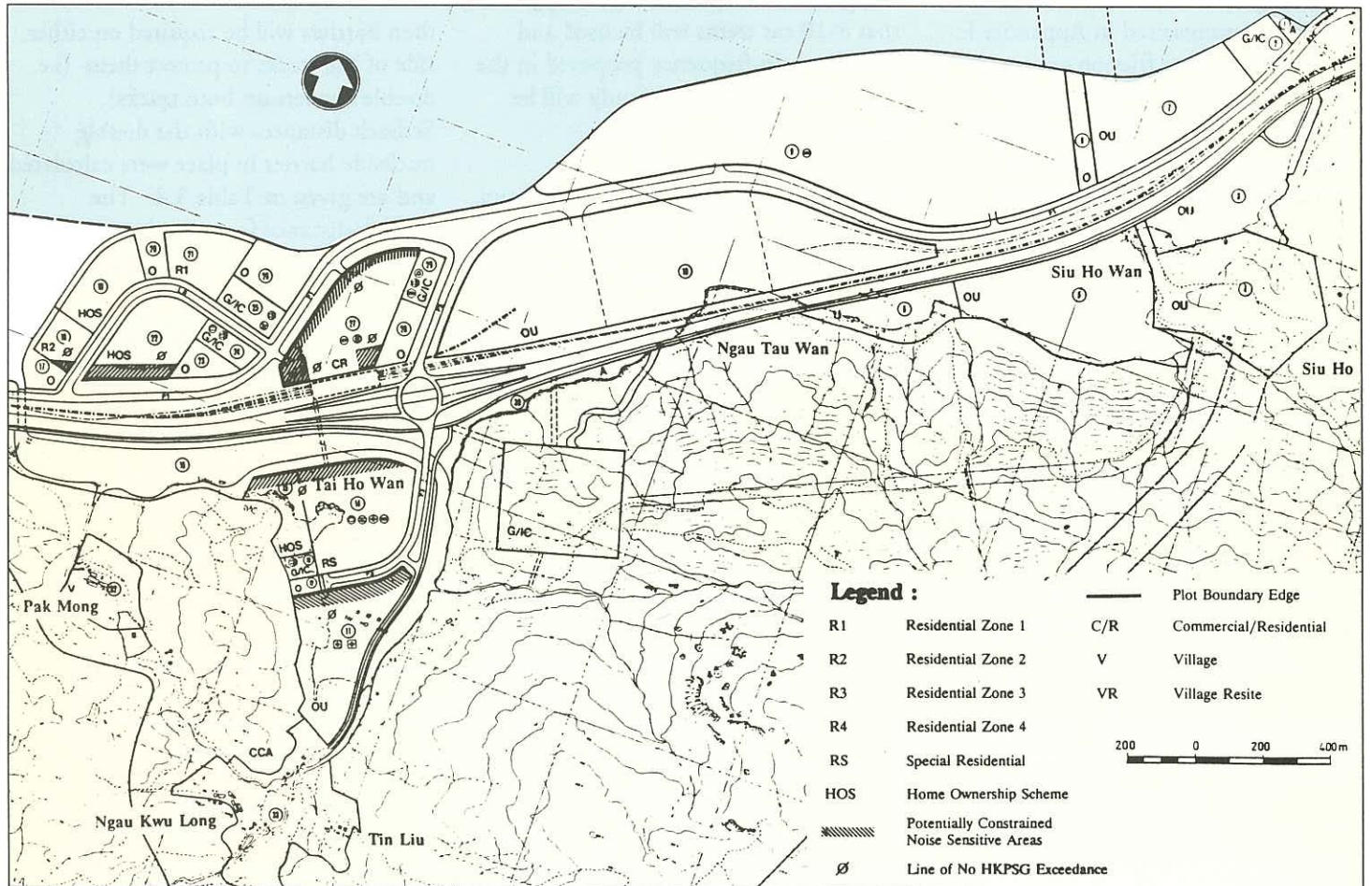


Figure 8.5 Noise Constraints on the RODP - Tai Ho Wan Area (with Noise Mitigation)

Table 8.5 Rail Setback Distances (m) Required to Satisfy the NCO Night-time Criteria for a '89 dB(A) Train' (No Mitigation)

Train Service	Setback
AEL + LAL	>100
AEL	880
LAL	710

Source : Topic Report TR20 (Revised)

and since the railway line runs alongside the NLE through most of the New Town, buildings have been set back from the road to meet road traffic noise standards. Clearly rail noise standards will also be achieved.

As noted the noise from trains has been estimated based on an assumed type of rolling stock. It is possible that noise levels could be higher if very noisy trains are used or if track is not regularly maintained. Changes in frequency of operation from those assumed will also affect the noise predictions. The railway operator will need to take these factors into account when designing the system and when setting out maintenance procedures.

The implications of noisier trains have been identified by calculating impacts from a train generating 89 dB(A) (free field noise) at 25m from the track when trains (assumed to be 8-10 cars) are running at 135 km/hr. Setback distances for this type of train, with no mitigation are shown in Table 8.5.

The noisier train requires about 50 percent more setback distance than that required by the quieter train to achieve the 60dB(A) NCO night-time standard.

A review of the rail noise mitigation will be needed when details of rolling stock and train frequency are available.

8.6.6 Construction Impacts

Construction noise impact arising from the development phases were assessed to determine whether or not construction activities would comply with the

requirements of Water and Air Pollution Control Ordinances and the Noise Control Ordinance. The noise impacts arising from construction, mitigation measures and residual impacts are included in Appendix E of this report.

The assessments of the construction of Phase 1 of the New Town concluded that air and noise pollution levels can not be reduced to acceptable levels by mitigation at source and thus alternative forms of mitigation will be required. Suitable forms of mitigation have been developed and have been included in the construction contracts for Phase 1 such that standards will be achieved. However, it is considered that as the subsequent phases are less time constrained environmental standards could be achieved via careful works programming. As a result of these two different mitigation approaches it is considered that the environmental impact of construction of the whole development can be maintained within the current standards.

Water and air quality and noise levels should be monitored throughout the construction of the NLD to ensure that the specified levels are not exceeded.

8.7 Visual Impact

8.7.1 General Approach

Lantau and Sunset Peaks dominate the Study Area together with the valleys, at Tung Chung, Tai Ho and Ngau Kwu Long. Coastline which is considered to be of high scenic value forms the shoreline between San Tau and Sham

Wat, and includes dramatic granitic and sandstone formations between sheltered sandy beaches. To the east the less rugged coastline of Tai Ho is also attractive. Landscape issues are further discussed in Sections 12 and 13.

A visual review of the Study Area divided features into coastal edges, coastal plains, valleys, ridges and peaks. When preparing development plans, each key component was assessed in terms of its overall relationship to the Study Area and its importance in terms of the visual character of the area. The feng shui significance and opportunities for further development were also considered as were constraints such as height restrictions or orientation of buildings.

Account was taken of the visual characteristics of the area west of Tung Chung. The introduction of the Sea Channel option in two of the initial concept plans allowed a large area of scenic beauty to be preserved. Inclusion of the sea channel in the RODP provides benefit not only in ecological terms but also aids water quality.

8.7.2 Potential Impacts

The major components of the Preferred Concept Plan which had visual impact included areas of reclamation and major engineering works requiring landfilling or cutting of slopes. Visual characteristics of the Study Area are illustrated on Figure 8.6. Urban development and provision of transport corridors also has a high visual impact as does the provision of the utilities required to service the developments. Sensitivity to visual impact depends largely on the existing environment, the degree of disturbance and the number of people affected. The degree of potential visual impacts created by the Preferred Concept Plan are summarised in Table 8.6 below:

sampling and analyses are recommended before any spoil from this location is disposed of, to ascertain the extent of the contamination.

One of the design aims of the Study has been to limit the extent of dredging works wherever possible prior to land formation, thereby minimising the potential impact on local water quality and the amount of spoil requiring disposal. Some mud will however be generated through Phases 2, 3 and 4 of the development. Section 9.4 describes this in more detail.

Disposal methods for spoil have been considered and include hydraulic layering and progressive trenching. The advantages and disadvantages of these methods are set out in Technical Note TN14 "Dredged Mud Disposal". The disadvantages include the length of time involved and the fact that disposal rates are less than proposed generation rates. Final methods adopted for the disposal of spoil will ultimately depend upon the favoured method at the time the Contract is let. It has been ascertained, from the data collected, that except possibly at site SS4, mud is unlikely to require pretreatment if dumping at gazetted spoil grounds is the disposal method adopted.

8.8.3 Solid Waste

Development of a New Town with an estimated final population of 260,000 together with a New Airport with related commercial and industrial activities gives rise to the need for safe and effective disposal of solid wastes. Waste disposal options were developed in accordance with the Waste Disposal Plan for Hong Kong (1988) and the Hong Kong Planning Standards and Guidelines (1990).

Incineration, waste processing and recycling along with landfill were the disposal methods considered. Reasons

behind the selection of the landfill option are given in Working Paper WP5 "Waste Disposal Options (Revised)" and include the fact that landfilling is in accordance with Hong Kong's Waste Disposal Strategy.

Due to the lack of landfill facilities on North Lantau the wastes will be collected at a central facility and packed into containers. Transportation of the containers will be by barge except during those periods when sea traffic is disrupted due to inclement weather. Adoption of standard types of containers will allow road transport during such times as a contingency measure. Site selection thus required to take account the need for road and marine access as well as availability of main services.

As Refuse Transfer Stations' (RTS) are considered to be environmentally incompatible with many other land uses, separation from residential and other sensitive land uses was a pre-requisite. The RTS area chosen includes the provision of an adjacent area for the Regional Services Department cleansing facilities and for parking and maintenance of their vehicle fleet. Location of the RTS in relation to the New Airport was important when considering minimising the potential risk of attraction of birds to the site.

A site at Tai Ho East was initially investigated and this was included in the initial concept plans in an area zoned for general industrial development. With the location of water and sewage treatment works together with major road and rail facilities in this area, an opportunity existed to locate the RTS adjacent to these compatible uses. In the RODP the small area immediately to the east of the RTS designated for amenities will be planted to provide landscaping and improve the visual aspect.

The proposed location of the RTS has remained unchanged throughout the development process.

Recommendations have been made to minimise impacts from dust, odour, noise, vehicle exhaust emissions and microbiological aerosols which should be incorporated in the detailed design. These are detailed in Topic Report TR10 (Revised) "Environmental Assessment" and the potential environmental impacts from the refuse transfer station and recommended mitigation measures have been included in Appendix E.

8.8.4 Chemical, Radioactive, Animal and Clinical Wastes

Small quantities of animal, clinical, chemical and radioactive wastes will be generated within the waste catchment area either from the New Town or the New Airport. Individual storage areas will be required, and specific procedures for the handling and storage of wastes must be adopted by staff at the RTS.

Clinical wastes and animal carcasses will be directed to the proposed centralised incineration facility (CIF) for clinical wastes. Chemical wastes will be treated at the proposed Chemical Waste Treatment Facility (CWTC) on Tsing Yi.

The small amounts of radioactive wastes likely to be produced should be dealt with according to the collection, transportation and disposal guidelines contained in the Radiation Ordinance.

8.9 Hazardous Materials

Three utility sites which will handle potentially hazardous materials will be located in North Lantau. These are:

- o the water treatment works at Tai Ho East, which will store some 73 tonnes of chlorine, assumed to be in in one-tonne drums to be delivered either by road or barge;

- o the sewage treatment works at Sham Shui Kok, which will have a very small store of chlorine; and
- o possibly a gas pressure reduction and metering station.

Another site potentially handling hazardous material was the one designated for Aviation Fuel Storage. Although a site for this facility is still indicated on the RODP it is not certain it will be required. The PAA is continuing its review of Aviation Fuel Supplies.

A preliminary review of hazards associated with the above land uses confirmed that the PHI's proposed in the Preferred Concept Plan and carried through to the RODP could be accommodated without unacceptable risk to each other or to their neighbours.

Significant potential for off-site damage exists at the Water Treatment Works, and the gas reception and pumping station. This aspect will be further examined in the detailed design of these facilities which is currently in hand.

As far as can be determined on the basis of the preliminary risk assessment, the situation of the PHI's has been optimised in terms of avoiding the densely populated areas within the Study Area and on the New Airport.

One important point to note is that the levels of risk will depend to some extent on plant capacities which may be expected to expand over the years. This needs to be taken into account in any future expansion plan and appropriate risk analyses carried out.

8.10 Ecology

The Study Area is quite unique in the Territory as the only remaining place where the full range of Hong Kong's

habitat types from coastal mangrove and freshwater wetlands through upland grasslands and woodland at over 800m altitude is present without significant intrusion from urban or industrial development. The proposals for North Lantau will change the area from one of rural tranquility to one of urban growth with the potential loss of natural habitat.

As part of the baseline studies an habitat inventory was undertaken which included analysis of aerial photographs, topographic and geologic maps in addition to extensive ground surveys undertaken on foot. In this way ecological features peculiar to the study area have been identified and

conservation measures proposed. These are described in Table 8.7. Appendix E also includes details of ecological impacts and mitigation measures. Conservation aspects are also discussed further in Section 13.

The Initial Concept Plans aimed to minimise disturbances to ecological systems and natural landscape features. As previously noted two of the Initial Concept Plans envisaged the preservation of a Sea Channel between the New Airport and the New Town. This feature was carried through as an integral component of the RODP and provides many benefits in ecological terms.

Table 8.7 Ecological Features and Conservation Measures Proposed

Ecological Features	Conservation Measures
<p><u>Natural woodland:</u> The Study Area encompasses the largest area of natural woodland in the Territory. In addition to its ecological value this feature adds to the landscape character and visual aspect of the area.</p>	<ul style="list-style-type: none"> o recommend that identified woodland area be protected and retained o early provision of fire breaks o long-term on going programme of reforestation of the upland area o public access be restricted and any proposed footpaths be designed to avoid areas of natural woodland.
<p><u>Woodland area below 300m:</u> These are all apparently secondary woodland or planted. While these areas, in common with shrubland, provide important wildlife habitats they are not unique in ecological terms. These woodlands do contain many mature trees of fung shui and landscape value.</p>	<ul style="list-style-type: none"> o retention and if possible incorporation into urban parks and open spaces where proposed urban development encroaches on these areas.
<p><u>Streams and freshwater wetlands:</u> Many of the streams run unregulated and unpolluted into the sea. Ecologically these are important avenues during the breeding season especially for catadromes. Consequent to the many developments on North Lantau much of the wetland habitat will be destroyed.</p>	<ul style="list-style-type: none"> o lowland streams at Sha Lo Wan and possibly Tai Ho may have conservation value o indirect catchment areas for Shek Pik Reservoir should be protected from development o ensure the persistence of the diverse fauna of upland streams, preventing degradation of the terrestrial landscape and silting of catchment channels and tunnels.
<p><u>Mangrove:</u> None of the patches of mangrove in the Study Area is sufficiently large or well developed to be of unique importance by itself. However the mangroves do support Hong Kong's entire mangrove flora (except for <i>Heritiera littoralis</i>) and a rich fauna. With the planned developments on North Lantau virtually all of the mangrove is under threat.</p>	<ul style="list-style-type: none"> o retention of as much mangrove and freshwater wetland as possible.

Source : Consultants' Assessment (see Topic Report TR10 (Revised))

In overall terms, a number of mangrove areas will be lost as a result of the construction of the New Airport, the NLE/AEL corridor and the New Town. In Tai Ho a water feature was included in the plan to preserve some of the coastal wetland area along the Pak Mong coastline. Whether the mangrove colonies in Pak Mong will thrive in the lake following the introduction of a control structure, remains uncertain, although as noted earlier this could be placed in such away as to ensure brackish water in the area of the mangrove colonies.

Throughout the development process account was taken of the ecologically important habitats within the area. Upland encroachment has been avoided to preserve the upland woodlands area, the visual aspects have been maintained wherever possible and the water catchment area has been preserved.

8.11 Environmental Mitigation Measures

Components of the RODP included to minimise environmental impacts and mitigation measures and recommendations are summarised below in Table 8.8.

8.12 Environmental Monitoring and Audit

Monitoring of the impact of construction activities is an important component of the overall development process. As the New Town grows and more people live and visit the area the potential impacts will affect an ever increasing number of people. Topic Report TR20 (Revised) has therefore been produced as an Environmental Development Manual to give guidance and standards to be followed throughout.

Monitoring and audit proposals were evolved for the Phase 1 of construction

and are detailed in Topic Report TR18 (Revised). Monitoring and audit proposals for subsequent stages follow similar guidelines. These are discussed in Topic Report TR20 (Revised) and are summarised below.

Air Quality

Impact monitoring of one hour and 24 hour TSP levels should be carried out at all sensitive receivers and at the site boundary whenever works generating dust are being carried out. The monitoring schedule should be determined by the Engineer depending on the contractor's method of working but as a guide should be about three days per week at all sensitive receivers that are likely to be affected and at selected points around the site boundary. A one hour and a 24 hour sample should be collected on each day with the one hour sample being representative of high impacts (for example during blasting). More frequent impact monitoring will be necessary if dust levels increase. Baseline monitoring should be carried out prior to the start of the construction works with measurements being taken at each monitoring station daily for two weeks.

All monitoring should be reported on daily record sheets which will record the sampling point, the sampling time, the monitored level, the equipment used, the weather conditions and the activities being carried out on site. Monthly reports of all monitoring data should be prepared and copied to the Contractor and EPD.

Where the impact monitoring shows that the recorded dust (TSP) level is significantly greater than the levels established in the baseline survey or that TSP levels are increasing as a result of the contractor's activities, the Contractor should be directed to take effective remedial measures including,

but not limited to, reviewing dust sources and modifying working procedures. The contract documents should include methods of dust suppression to be adopted by the contractor.

The Contractor should be instructed to inform the Engineer of all steps taken. Written reports and proposals for action should be passed to the Engineer by the Contractor whenever air quality monitoring shows that the recorded dust level is significantly greater than the levels established in the baseline survey or that dust levels are increasing.

Table 8.9 shows trigger, action and target levels proposed for construction dust which would be reasonable based on the assessment carried for Topic Reports TR18 (Revised) and Topic Report TR20 (Revised).

Water Quality

Water quality monitoring should be carried out by the Engineer using equipment supplied by the contractor. The monitoring should be used to determine baseline conditions and then for impact monitoring. It should also provide a data base for use in subsequent project audit.

Baseline water quality monitoring for the North Lantau Development Study has already commenced although results are not yet available. However the monitoring stations (except for Station 1, Figure 8.2) are remote from the location of the First Phase works and these data are not intended to be used for contract specific monitoring. Locations should be equally spaced at 500m spacing and 500m from the dredging and reclamation works. In the vicinity of the Sea Channel this spacing should be reduced to 100m.

Baseline conditions should first be established at these stations by taking

Table 8.8 Environmental Mitigation Measures

Component	Mitigation Measures and Recommendations
<p><u>Water Quality</u></p> <ul style="list-style-type: none"> o Sewage Effluent 	<ul style="list-style-type: none"> o tidal sea channel included to maintain flows which presently exist between Chek Lap Kok and North Lantau o Sea Channel will have a surface width of about 200m, dredged to -7mPD with side slopes of about 1 in 1.5. o consider establishing discharge guidelines specifically for protection of water quality within the sea channel o infrequent dredging required to control sedimentation o full sewage treatment plus nitrogen reduction and disinfection facilities to be provided by 2011.
<p><u>Air Quality</u></p> <ul style="list-style-type: none"> o NLE and primary distributor roads located as far away as possible from residential areas in Tung Chung. o industrial areas located at Chek Lap Kok South and Tai Ho East away from residential areas o buffer zones included between and residential uses o the NLE and busy primary distributor roads, industrial and residential areas are located away from those areas which could suffer poor air quality due to topographical effects. o high rise buildings located to maximise air movements and dispersion of pollutants. o a sea channel to provide a buffer zone for dispersion of pollutants from the airport or any industrial areas located at Chek Lap Kok South. 	<ul style="list-style-type: none"> o an efficient and cost effective railway and road based public transport scheme should be developed as early as possible. o industries likely to cause significant air pollution to be discouraged from locating at Chek Lap Kok South or Tai Ho East. o process emission standards for industry to be limited and use of low sulphur fuel stipulated. o emission controls including desulphurisation and denitrification of existing and proposed power stations to minimise background emissions and to help maintain acceptable air quality
<p><u>Noise</u></p> <ul style="list-style-type: none"> o residential areas all located within areas with NEF 25 or less o new noise sensitive uses located, where possible, where they will not be exposed to excessive traffic noise levels o potential new noise sources such as the railway depot, industrial area and refuse transfer station located away from sensitive uses o NLE and busy sections of primary distributor network located away from core of residential areas within Tung Chung 	<ul style="list-style-type: none"> o friction course on NLE and busy primary roads to reduce noise levels. o landscaped bunds and barriers alongside sections of NLE and primary distributor roads where noise sensitive developments planned near to these roads. o installation of a noise barrier close to the wheel-rail interface to reduce noise levels from ARL/LAL operations. o appropriate setback distances incorporated for noise sensitive uses. o design of noise emitting operations such as at the rail depot, refuse transfer station and industrial uses to comply with HKPSG o inclusion of the Sea Channel as a buffer zone to reduce New Airport ground noise levels.
<p><u>Visual and Landscape</u></p>	<ul style="list-style-type: none"> o preservation of existing knolls at Pak Mong, Ma Wan Chung and Chek Lap Kok o a coordinated recreational strategy for the urban hinterland o all planting for landscaping or slope stabilisation within the New Town and along side transport corridors should use native tree species.
<p><u>Ecology</u></p> <ul style="list-style-type: none"> o avoided development in upland valley and woodland areas above 300m o the coastline west of Tung Chung and Sau Tau was highlighted as a valuable area and the inclusion of the Sea Channel prevents the loss of this stretch of coast along with its flora and fauna o wetlands at Pak Mong, west of Tai Ho, San Tau and Sha Lo Wan worthy of preservation. 	<ul style="list-style-type: none"> o suitable sites for relocating mangrove colonies should be identified. o no development should be permitted west of Tung Chung o tidal lake at Tai Ho may preserve mangrove colonies.
<p><u>Potentially Incompatible Land Uses</u></p> <ul style="list-style-type: none"> o all located with appropriate HKPSG buffer distances from residential areas, in Tai Ho East 	

Source : Consultants Recommendations (see Topic Report TR10 (Revised))

measurements on four sampling days per week, at mid-flood and mid-ebb, for four consecutive weeks within six weeks of the start of the marine works. Measurements should be at two depths, 1m below the water surface and 1m above the sea bed unless the water is less than 3m deep in which case the measurement should be at the mid-depth only. In-situ measurements of turbidity, temperature, salinity and dissolved oxygen should be taken and samples recovered for laboratory determination of suspended solids.

Impact monitoring should be carried out throughout the contract whenever marine works are in progress and should continue until the adjacent water body has returned to normal conditions. The monitoring programme will depend on the contractor's activities but as a guide a data set (comprising all the parameters collected for baseline monitoring) should normally be collected up to three days per week. It may be possible to delete the suspended sediment test if an adequate calibration between turbidity and suspended sediments can be determined. Monitoring should be more frequent if there are indications that water quality is deteriorating.

Should the impact monitoring record levels of turbidity, suspended solids, or dissolved oxygen which are indicative of a deteriorating situation such that closer monitoring is reasonably indicated, then the Engineer should undertake daily impact monitoring until the recorded depth averaged values of these parameters indicate an improving and acceptable level of water quality.

Where impact monitoring shows a deteriorating water quality, the Contractor should be directed to take all necessary steps to ensure that the works being carried out by the

Contractor are not contributing to the deterioration. These steps should include, the checking of all marine plant and equipment, the maintenance or replacement of any marine plant or equipment contributing to the deterioration and the review of all working methods. The Contractor should inform the Engineer of all steps taken. Written reports and proposals for action should be passed to the Engineer by the Contractor whenever water quality monitoring shows deteriorating water quality.

Table 8.9 shows trigger, action and target levels for water quality which would be reasonable based on the assessment carried out for Topic Reports TR18 (Revised) and Topic Report TR20 (Revised).

Noise

Noise monitoring should be carried out at all sensitive receivers. Measurement should be at least twice per day, once in each of the restricted periods, unless complaints are received in which case more frequent measurements will be needed. Measurements will also be needed during the daytime at up to three days per week or more frequently if noise levels become high. The Contractor should be instructed to take action to reduce noise levels whenever any level is measured in excess of those defined in the Construction Noise Permit.

Trigger, action and target levels for noise are shown in Table 8.9. These include daytime noise levels which are recommended but will not be mandatory under the legislation. The recommendations for noise show two levels. The level in brackets is for a rural area or low density residential area; this would apply to the existing environment on North Lantau and to

any village areas in the future. However most of the North Lantau Development should be considered as urban after first occupation of Phase 1 and the higher figures in the table will apply. In this case the lower figures will only apply when village or other low density development are close to the works.

In the case that the background air pollution level plus 30% is higher than the action level the Engineer should decide on an appropriate percentage (lower than 30%) for the target level.

The location of monitoring is clearly important. Monitoring for dust and noise should be at the nearest sensitive receiver with the location of the monitoring station selected in accordance with standard practice. Monitoring downstream for water quality would normally be about 500m from the activity except for works within Tung Chung Wan or works within 500m of the eastern end of the sea channel where monitoring should be 100m from the activity due to the greater sensitivity of this area. Monitoring upstream should be sufficiently far away from the activity such that undisturbed background levels are obtained.

The action level has been based on a running mean of the samples of the previous month to avoid the situation where action levels could be very much more or less than the current ambient conditions due to natural seasonal fluctuations. However trends in water quality must be monitored to ensure that a gradually deteriorating situation does not result.

The proposed action plans for monitoring air, noise and water pollution during construction phases are given in Tables 8.10, 8.11 and 8.12.

Table 8.9 Trigger, Action and Target Levels Proposed for Dust, Noise and Water

Impact	Trigger		Action		Target	
<u>Dust</u>						
24hr TSP level in $\mu\text{g}/\text{m}^3$	Background level plus 30%		Average of trigger and target level		260	
1 Hour TSP level in $\mu\text{g}/\text{m}^3$	Background level plus 30%		Average of trigger and target level		560	
<u>Noise dB(A)</u>						
	Period 1	Period 2	Period 1	Period 2	Period 1	Period 2
Restricted Periods	55(50)	40(35)	50(55)	45(40)	65(60)	50(45)
Daytime	65		70		75	
<u>Water</u>						
Suspended Solids	30% increase above baseline level		30% increase above the running mean of sampling data for the previous month		30% increase above the maximum level recorded upstream of the works on that sampling day	
Dissolved Oxygen	As for suspended solids by 30% decrease		As for suspended solids by 30% decrease		As for suspended solid by 30% decrease	

Source : HKPGS and Consultants Recommendations

Note: (1) * Period 1: All days during the evening (1900 to 2300 hours), and general holidays (including Sundays) during the day-time and evening (0700 to 2300 hours)

Period 2: All days during the night-time (2300 to 0700 hours)

(2) Higher levels have been agreed for Phase 1 for dust and noise due to tight construction periods, the small number of receivers affected and the difficulty in achieving the levels specified here.

Sensitive receivers and specific monitoring locations for assessing noise, dust and water quality impacts will depend upon the works being undertaken. During Phase 1 sensitive receivers in terms of air quality include Ma Wan Chung. Residents of Tai Po and visitors to the Youth Camps will be affected by increased noise levels during construction of the Phase 1.

Water quality monitoring for Phase 1 has been recommended for those water bodies where marine activities are being undertaken, particularly in the Sea Channel, Tung Chung Wan, Tai Ho Wan, and East Tung Chung Bay.

Other water quality monitoring proposals include visual inspections of drainage channels to determine maintenance requirements together with monitoring of influent flows and loads at the Sewage Treatment Works together with receiving water quality to allow assessments of the efficacy of treatment levels to be made.

8.13 Conclusions

In summary it can be seen that many of direct environmental impacts of the NLD have been overcome as a result of careful environmental planning and this has resulted in a high quality

environment where the HKPSG and NCO standards can be achieved. Mitigation measures have also been proposed for construction phases and for the incorporation into later stages of the New Town design to minimise impacts on environmental quality.

The assessments of the construction of Phase 1 of the New Town concluded that air and noise pollution levels can not be reduced to acceptable levels by mitigation at source and thus alternative forms of mitigation will be required. Suitable forms of mitigation have been developed and have been included in the construction contracts

Table 8.10 Construction Dust Action Plan

Event	Action	
	Engineer	Contractor
Exceedance of trigger level for one sample	Repeat measurement as soon as possible	-
Exceedance of trigger level for more than one consecutive sample	Repeat measurements Notify contractor	-
Exceedance of action level for one sample	Repeat measurement as soon as possible Notify contractor	-
Exceedance of action level for more than one consecutive sample	Increase frequency of monitoring to daily Notify contractor Require contractor to make proposals to reduce dust	Review plant and methods Submit proposals for reducing dust to Engineer Implement remedial actions
Exceedance of target level for one sample	Repeat measurement as soon as possible Notify contractor	-
Exceedance of target level for more than one sample	Increase frequency of monitoring to at least daily Notify contractor Notify EPD Require contractor to implement immediate steps to reduce dust	Review plant and methods Implement measures to reduce dust immediately Notify Engineer of action taken

Source : Consultants' Assessment

Table 8.11 Construction Noise Action Plan

Event	Action	
	Engineer	Contractor
Exceedance of Period 1 or 2 trigger levels Exceedance of daytime trigger or action level	Notify Contractor	-
Exceedance of Period 1 or 2 action levels Exceedance of daytime target level	Notify Contractor Require Contractor to propose measures to reduce noise Increase monitoring frequency to at least two measurements per daytime/Period 1/Period 2 as appropriate	Submits noise mitigation proposals to the Engineer Implements noise mitigation proposals
Exceedance of Period 1 or 2 target level	Notify Contractor Notify EPD Require contractor to implement mitigation measures Increase monitoring frequency to hourly	Implement mitigation measures Advise Engineer of measures applied

Source : Consultants' Assessment

Table 8.12 Construction Water Quality Action Plan

Event	Action	
	Engineer	Contractor
Exceedance of trigger level for one sample	Repeat measurement as soon as possible	-
Exceedance of trigger level for more than one consecutive sample	Repeat measurements Notify contractor	-
Exceedance of action level for one sample	Repeat measurement as soon as possible Notify contractor	-
Exceedance of action level for more than one consecutive sample	Increase frequency of monitoring to at least daily Notify contractor Require contractor to make proposals to reduce water pollution	Review plant and methods Submit proposals for improving water quality to Engineer Implement remedial actions
Exceedance of target level for one sample	Repeat measurement as soon as possible Notify contractor	-
Exceedance of target level for more than one sample	Increase frequency of monitoring to at least daily Notify contractor Notify EPD Require contractor to implement immediate steps to improve water quality	Review plant and methods Submit proposals to improve water quality to the Engineer Implement measures to improve water quality immediately Notify Engineer of action taken

Source : Consultants' Assessment

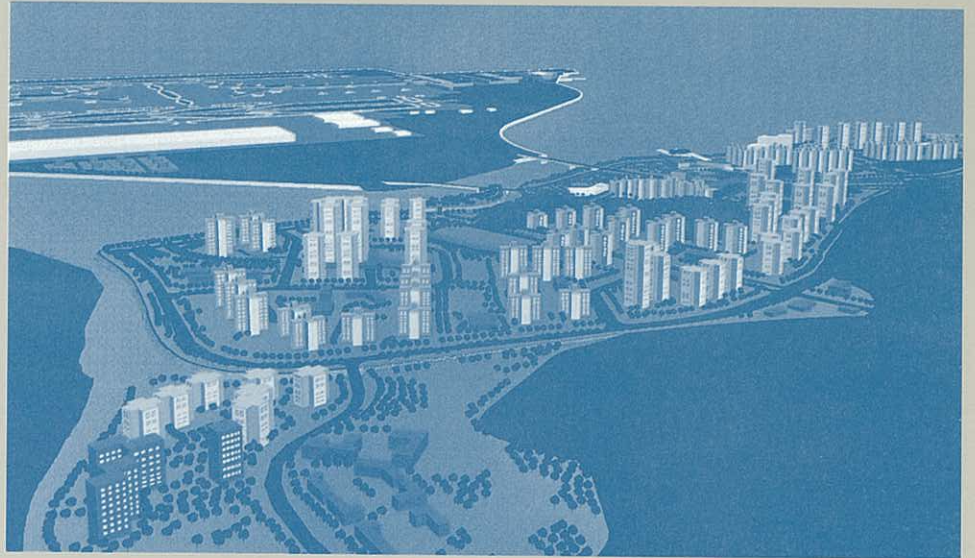
for Phase 1 such that standards will be achieved. However, it is considered that as the subsequent phases are less time constrained environmental standards could be achieved via careful works programming. As a result of these two different mitigation approaches it is considered that the environmental impact of construction of the whole development can be maintained within the current standards.

In addition an environmental monitoring and audit framework has also been developed to prevent deterioration in environmental quality during and after the construction phase which prescribes sequential action plans to react to any adverse environmental changes.

In summary the initial and underlying environmental objective for the NLDS was to produce a high quality living urban environment whilst minimising the impact on the natural environment and it is concluded that this objective has been largely achieved.

A New Town will be developed on a green field site and the design has included provisions for environmental considerations contained in the HKPSG. As a result Tung Chung will be the first new town where the latest Hong Kong environmental planning and pollution control standards will be achieved. Thus the New Town will offer a high quality living environment and will be built in such a way so as to minimise the environmental impact on nearby environmentally sensitive receivers.

North Lantau Development



9. Engineering Considerations

9. ENGINEERING CONSIDERATIONS

9.1 General

The topography, geology and seabed conditions of North Lantau imposed significant challenges to the engineering solutions required of the concept plans and eventually the RODP. These had to be considered in conjunction with cost and programming requirements, soundness of construction techniques, availability of resources and funding, interaction with other major engineering in the area and prediction of design and construction techniques for a decade or more to come.

Although a "green field" site, the natural conditions required rather more than the standard approach to new town construction as experienced elsewhere in Hong Kong.

The programme time for early phases of construction will inevitably be short but moreover the initial first phase will be hampered by the remoteness of the location and lack of any established construction support facilities.

Notwithstanding this, phasing of the development has been determined with ease of construction and initially lower formation costs in mind. It is expected that Government revenues arising from early phases of development will provide financial support for the subsequent phases of construction.

A number of important engineering issues were debated, which had a profound effect on the plans. These included the nature and size of the Sea Channel and the form of its crossings, the method of reclamation to be used, the form of the Tai Ho interchange, the Pak Mong water feature, the LAL alignment and the alignment of the primary access into the airport.

9.2 Engineering Geology of the Study Area

9.2.1 Onshore Area

Geological conditions in North Lantau have been studied in depth by the Geotechnical Control Office (GCO), which completed a Geotechnical Area Studies Programme (GASP) Report VI and a Geotechnical Area Study (GAS) Report 7. Furthermore, an Engineering Geological Map at 1:20,000 scale has also been produced by the GCO.

The Hong Kong Geological Survey of GCO (HKGS) have, in addition, undertaken a geological re-survey of the North Lantau Area. Information relevant to the Study Area in the form of draft maps covering the eastern extremity of the Study Area were made available by HKGS.

The geological features shown in the draft maps and the 1:20,000 scale maps produced by GCO are generally in agreement with the logs of drillholes and trial pits of the various site investigations given in Table 9.1. Working Paper WP10 'Geotechnical Design Report' was produced during the Study. It reviews the available geotechnical data and describes the engineering geology and properties of the soils and rocks found in the North Lantau Study area. Geotechnical parameters for design of construction works are given. Figures giving rockhead contours for Tung Chung and Tai Ho are provided in Appendix I.

In general terms, the principal rock types of the Study Area are volcanic rocks of tuff and lava over most of the southern and western parts of the Area, intrusive igneous rocks of feldsparphyric rhyolite dyke swarms over the eastern part and granite over the Sha Lo Wan/San Tau headland. These bedrock materials are often heavily decomposed *in situ* to form deep saprolite mantles.

However during the course of the GEO engineering geology study the thicknesses of overlying residual soils have been found to be relatively thin and much of the colluvium in fact overlies saprolite.

Examination of the logs of drillholes and trial pits indicates that the depth of decomposition below ground level is greater in the intrusive igneous rocks than in the volcanic rocks. The residual soils are sometimes overlain by thin deposits of younger superficial deposits which are generally colluvial, alluvial or littoral in character. Colluvial deposits cover much of the footslopes. The valleys are also frequently infilled with colluvial deposits.

Major geotechnical instability problems have been attributed to the presence of shear surfaces existing just below colluvium/residual soil interface. This has been experienced in Tuen Mun Area 19. Although there is little field evidence to suggest that similar conditions exist in North Lantau, Area 19 displays a similarity in footslope terrain to some valleys in the Study Area. GCO have concluded that the geotechnical instability in Tuen Mun Area 19 may be attributed to the parent rock origin of the residual soils/saprolite. For the North Lantau area, the parent rock origin of the residual soils/saprolite is very different from that of Tuen Mun Area 19.

In view of the fact that bedrock containing cavernous marble has been masked by alluvial deposits in the Northwest New Territories, five deep drillholes (maximum depth 67m) have been made in the alluvial floodplains in the Tung Chung valley and Tai Ho Wan valley. Logs of these drillholes suggest that marble does not exist in the bedrock underneath the alluvial floodplains of these valleys. The cavernous marble has however been found in bedrock in the offshore area east of the East Brother Island.

Table 9.1 Summary of Existing Site Investigations

Title of Site Investigation	Total No. of Marine Holes	Total No. of Land Holes	Geophysical Traverse
1. North Lantau Development Site Investigation - Study Stage TDD Contract No. IS11/90 (1990)	23 plus 15 vane shear holes	42 plus 36 trial pits	-
2. North Lantau Development - Investigations Site Investigation Report - P.W.P. Item No. NDE 19(1) S.I. Contract No. 682/77 (1977 and 1978)	82	185	marine and land
3. Preliminary Site Investigation Trunk Road to Replacement Airport PWD Term Contract No. 424 of 1979	11	-	-
4. Phase 1 Site Investigation Trunk Road to Replacement Airport EDD Contract No. 462 of 1981	144 plus 25 vane shear holes	239 plus 98 trial pits	marine and land
5. Preliminary Site Investigation commissioned by PWD in 1973 for the "Long Term Planning Investigation for the Hong Kong Air Transport System"	5	3	marine
6. Site Investigation for the Civil Engineering Design Studies for the Replacement Airport at Chek Lap Kok PWD Contract No. 440/81 (1981)	82 plus 93 piezoprobes & 35 vane shear holes	35	marine and land
7. Geotechnical Investigation (1990) New Airport at Chek Lap Kok Geotechnical Control Office (GCO)	15 plus 16 piezoprobes & 8 vane shear holes-	-	marine
8. North Lantau Expressway Site Investigation - Phase 1 Contract No. HY/90/23 (1990)	67 plus 32 piezoprobes & 50 vane shear holes	94 plus 5 trial pitsmarine	marine

Source : Government Data (see Working Paper WP10)

9.2.2 Offshore Area

The coastal waters of the Study Area are generally very shallow (averaging about 2m in depth) except for the strait south of Chek Lap Kok where the maximum depth is about 9 metres. The borehole logs and geophysical survey results indicate that the stratigraphy of the offshore sub-soil generally comprises marine deposits, alluvium, colluvium, decomposed rock and bedrock.

Marine deposits in possible reclamation sites of the Study Area, comprising mainly soft silty clay, are generally about 12 metres thick or less, although in places (for example to the east of Chek Lap Kok) the thickness increases to about 18 metres. This is demonstrated in Figure 9.1. In the Tung Chung bay area, the marine deposits are quite thin and appreciable depths of alluvial sands exist at the mouth of major stream courses. Similar

conditions are found at Pak Mong and Siu Ho Wan. Figures giving bathymetry, mud thickness contours and base levels of marine deposits are provided in Appendix I of this report.

The greater thickness of the soft silty clay at some locations of the Study Area is believed to be due to deposition of the clay in gullies or channels incised into the surface of the underlying soil stratum. This interpretation is

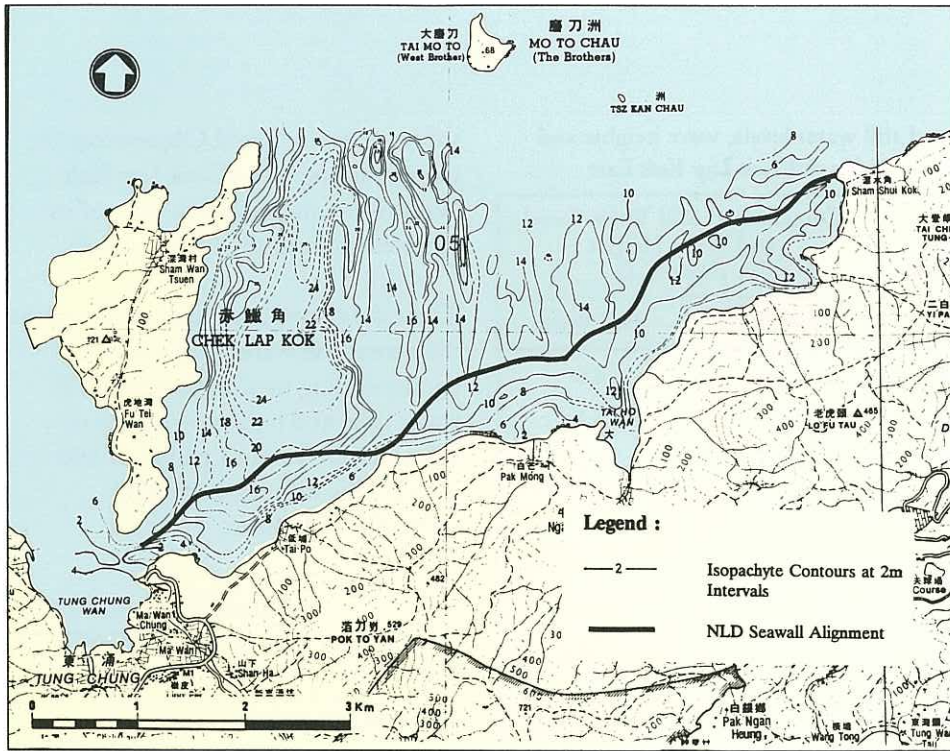


Figure 9.1 Mud Thickness Contours

consistent with the findings obtained from other marine areas of Hong Kong where there are numerous gullies and channels incised in the lower stratum (Dr. Langford et al, 1989).

In between the soft silty clay layer and the decomposed rock is a zone of alluvial and colluvial deposits consisting largely of layers of stiff silty clay, medium dense to dense sand, and gravels and cobbles. The thickness of the whole zone is generally about 10m to 20m. The base of the zone (that is the top of decomposed rock) appears to be gently undulating. Examination of the borehole logs indicates that in Tung Chung Wan and Lau Fau Sha, the correlation of layer boundaries between boreholes is rather poor and there are generally no clear divisions between layers in these two areas.

Two marine boreholes which were carried out to the east of the East Brother Island indicate the presence of marble in the bedrock, and a cavity was found in the marble from one of these boreholes. This marble is believed to be associated with the sedimentary rocks of sandstones and siltstones of the Tai O

Formation which outcrop at The Brothers Islands, because rocks of the Tai O Formation were formed at approximately the same geological period as the Lok Ma Chau Formation. The later formation is a sedimentary rock of metasandstones and metasiltsstones containing cavernous marble underneath the alluvial deposits at Yuen Long in the Northwest New Territories.

The rocks of the Tai O Formation however, do not occur in the Study Area, except at the Brothers Islands and a relatively small outcrop occurring on the coast between Tai O and Sha Lo Wan headland. This headland is proposed to be used as a country park expansion area and it will not be affected by the presence of cavernous marble in the bedrock.

9.3 Seawalls

9.3.1 General

The extent of seawalls when compared with the area of land formation for North Lantau Development is relatively large. Each and every phase of

development will involve the construction of seawalls, the location of which have a significant influence on land formation costs.

9.3.2 Background Data

Various seabed conditions including depth to and the change in gradient of firm material (which determines the width at the base of the seawall mound), bathymetry and mud thickness contours were taken into consideration in the positioning of the seawall alignment. Since the complete removal of the soft marine mud is required for seawall construction, the cost and location of the seawall line is sensitive to the base level as well as the thickness of marine mud. This was a contributory factor in deciding the extent of reclamation offshore. Figure 9.1 showing mud thickness contours, indicates how this has affected the final location of the seawall as at year 2011.

The seawall crest level has been determined by the requirement to limit the average overtopping discharge due to the most likely unfavourable combination of both wave heights and water levels which correspond to a given storm event. During the Study it was considered prudent to request the Royal Observatory to repeat their 1982 numerical model study on extreme water levels along the North Lantau coastline using the additional meteorological data available for the years 1983 to 1989. Although the resulting predicted extreme still water levels are similar to those of the 1982 studies, the revised figures were taken into account in determining the design of the seawalls.

Return Periods of the still water levels, wave heights and coincidental still water levels and wave heights at Chek Lap Kok East and Sham Shui Kok as calculated by the model are given below in Tables 9.2 and 9.3 respectively. The

Table 9.2 Return Periods of the model estimated still water levels, wave heights and coincidental still water levels and wave heights at Chek Lap Kok East

Return Period (years)	Still Water Level (m above C.D.)	Full Wave Height (m)	Coincidental Still Water Level and Wave Height (m above C.D.)	
			Half Wave	Full Wave
5	3.2	0.8	3.6	3.9
10	3.5	0.9	3.9	4.3
15	3.6	1.0	4.0	4.5
20	3.7	1.1	4.2	4.6
25	3.8	1.1	4.3	4.8
50	4.1	1.3	4.6	5.1
100	4.3	1.5	4.8	5.5
150	4.5	1.5	5.0	5.7
200	4.6	1.6	5.1	5.8
250	4.6	1.7	5.2	5.9
500	4.9	1.8	5.5	6.3

Source : Royal Observatory Water Level Model

Table 9.3 Return Periods of the model estimated still water levels, wave heights and coincidental still water levels and wave heights at Sham Shui Kok

Return Period (years)	Still Water Level (m above C.D.)	Full Wave Height (m)	Coincidental Still Water Level and Wave Height (m above C.D.)	
			Half Wave	Full Wave
5	3.2	0.8	3.5	3.9
10	3.5	1.0	3.8	4.3
15	3.6	1.2	4.0	4.5
20	3.7	1.3	4.1	4.7
25	3.8	1.3	4.2	4.8
50	4.0	1.5	4.5	5.2
100	4.3	1.7	4.8	5.5
150	4.4	1.8	5.0	5.8
200	4.5	1.9	5.1	5.9
250	4.6	2.0	5.2	6.0
500	4.9	2.2	5.5	6.4

Source : Royal Observatory Water Level Model

values given by Royal Observatory for the remaining area (Chek Lap Kok West) were discounted in view of its remoteness from the NLD seawalls.

These data have been used to determine the actual still water level value corresponding to a coincidental still water level and half wave height of 4.8mCD for a return period of 100 years. This value is 3.95mCD calculated as follows:

$$4.8 - \frac{17}{2} = 3.95\text{mCD} = 3.8\text{mPD} \text{ approximately}$$

9.3.3 Seawall Crest Level

The value of 3.8mPD determined above is expressed as the design coincidental maximum water level corresponding to that estimated to exist at the peak of the storm.

In order to determine the seawall crest elevation it is necessary to define the limiting overtopping discharge which can be accepted during a given event. During the design extreme storm event it is certain that the activities within area in the vicinity of the seawall will not be operational. Temporary localised flooding behind the seawall during such an event will therefore be acceptable provided overtopping waves do not cause permanent damage to the reclamation or to the roads and developments.

The limiting overtopping discharges for various seawall types adopted by this Study are set out below:

- (i) Limiting discharge in a 1 in 100 year storm to be 0.05 and 0.2m³/s/m for unpaved rubble mound and block type seawalls respectively. This is sufficient to prevent excessive damage during an extreme event.

- (ii) Limiting discharge in a 1 in 20 year storm to be $0.05\text{m}^3/\text{s}/\text{m}$ for both temporary rubble mound seawall and breakwater with respective apron and back slope unpaved. This is sufficient to prevent excessive damage during an extreme event of reduced return period.
- (iii) Limiting discharge in a 1 in 5 year storm to be $15 \times 10^{-5}\text{m}^3/\text{s}/\text{m}$ for both rubble mound and block type seawalls and breakwaters to maintain normal functioning of the development.

Using a combination of design coincidental maximum water level and acceptable limiting overtopping discharge, a minimum seawall crest level of 5.5mPD was adopted. This corresponds to the minimum level of reclamation of 5.5mPD calculated using different criteria as discussed in Section 9.4 Land Formation.

Seawall crest elevations have been determined using present values of mean sea level with no allowance for the “Greenhouse Effect”.

9.3.4 Seawall Design

The methods used to determine seawall armour design, determination of crest level, blockwork design, return period derivation etc. are described in Topic Report TR9 Design Memorandum.

Armour Design

Rock armour for seawall and breakwater is sized to withstand design storms with return periods of 100 years with “minimal” damage and 20 years with “acceptable” damage respectively. It was found that use of the Van der Meer design method described in Topic Report TR9 contributes to a general decrease in design armour weight compared to that derived using the traditional Hudson armour design.

This is thought to result from the fact that the over-simplistic Hudson method does not reflect seawall permeability. Nevertheless provided armour slopes are not unduly steep, they may sustain considerable damage (in terms of displacement of armour stones) before failure. Such damage could be readily repairable either from the seawall side of the wall or from the access road behind the wall as appropriate.

Where further reclamation seaward of a current phase is proposed in the future, it is appropriate to design such lengths of seawall for a reduced life. This can be achieved by adopting design return periods of greater frequency than for the full-life seawall. The resulting form of the temporary seawall would therefore be a scaled-down version of a full-life wall. It is proposed that the temporary seawalls are designed for 10 year design life, with rock armour sized to withstand a design storm with a return period of 20 years. If future proposals are delayed for a protracted period, additional rock armour protection could be added to supplement the temporary seawall.

Blockwork Design

Standard concrete blocks (as per CEO standard details) will be adopted, for construction of the vertical seawalls.

Blockwork instability against sliding, overturning, bearing capacity failure and overall slip failure will be checked to confirm that factors of safety are within acceptable limits. Details are provided in Table 9.4 below:

9.3.5 Forms of Seawall

Conventional Forms

The conventional forms of seawall in Hong Kong are block type (with a vertical quay face) and rubble mound (sloping face) construction. Typical cross sections of these forms of seawall are shown in Figure 9.2. Design of these seawalls and breakwaters involves consideration of environmental conditions (wave climate and water levels), as well as comparison of different design concepts on the basis of costs, construction programming constraints and availability of suitably graded materials.

Table 9.4 Factors of Safety Blockwork Seawalls

Condition	Permanent		Temporary ⁽⁴⁾
	Normal	Extreme	
Sliding ⁽¹⁾	1.75	1.5	1.5
Overturning	2.0 ⁽²⁾	1.5 ⁽³⁾	1.5
Deep Slip Failure	1.3	1.2	1.2
Dredged Trench in Marine Clay	-	-	1.4

Source : Topic Report TR9 Design Memorandum

Notes:

1. Coefficient of friction for blockwork = 0.6
2. Case I : static load only (resultant to be within middle third)
Case II : static + environ load (resultant may be outside middle third)
3. Cases I & II as above (resultant may be outside middle third)
4. Suggested values not in CE Manual

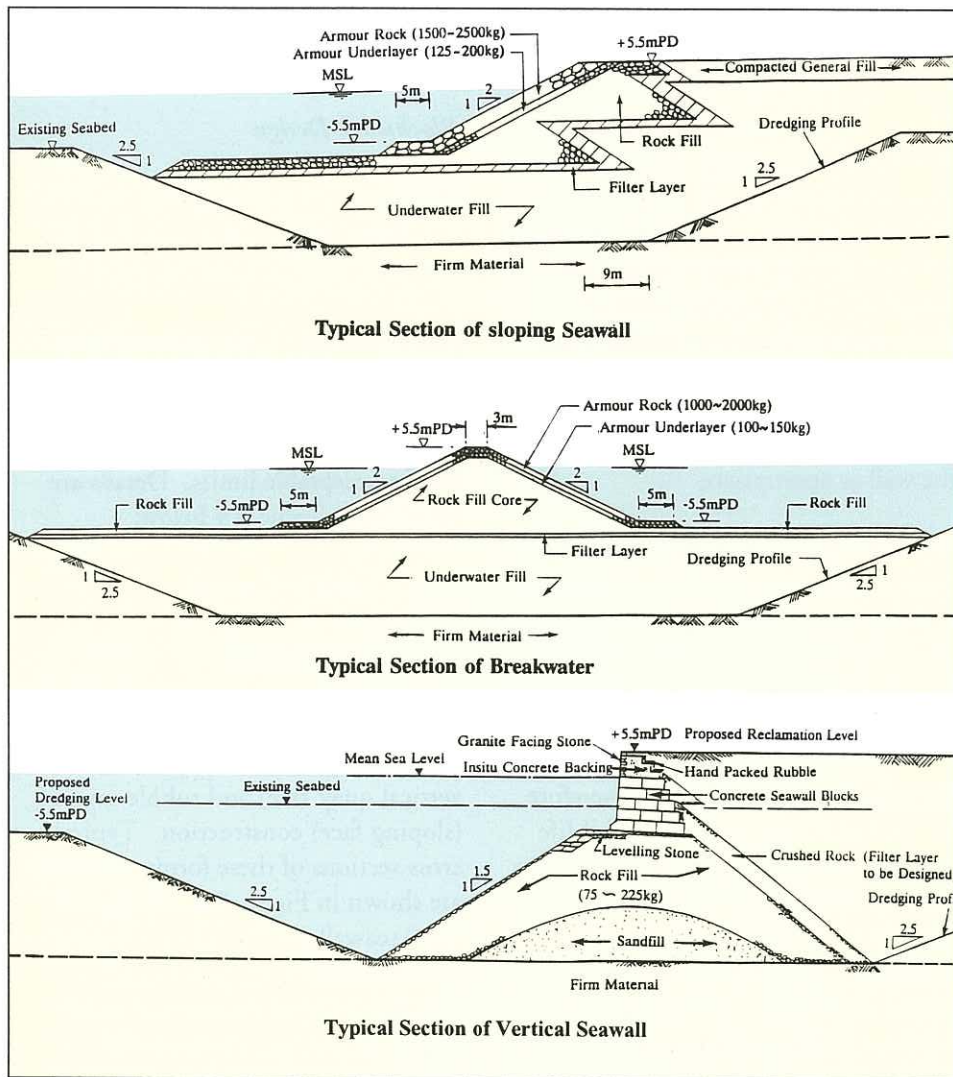


Figure 9.2 Conventional Forms of Seawall

Alternative forms of rubble mound seawall such as sand or rock beaches are possible, but their design would require confirmation by physical model studies. The time constraint on early phases of the North Lantau Development does not allow for design development using model studies. It was therefore decided to adopt the proven forms of construction as shown in Figure 9.2, for these phases.

Sand Fill Beach

The simplest means of protecting the reclamation would be to provide a beach slope using extra dredged sandfill from a marine borrow area. Such a beach could potentially be very effective in withstanding severe wave attack. A

beach slope is illustrated in (a) of Figure 9.3. Such an arrangement could only be adopted where the sea bed is relatively flat. It would not be feasible over certain lengths of the North Lantau Development where the seabed is relatively steeply sloping. A disadvantage of this form of seawall is that the use of marine sourced sandfill to form a beach capable of protecting the reclamation would necessitate the use of large volumes of material.

Rock Fill Beach

An alternative to a sandfill beach would be to form a rockfill beach using surplus excavated cutting material or imported material from a borrow area. A rockfill beach would be steeper than a sand

beach (say 1:4 to 1:8 for rock compared with 1:20 to 1:30 for sand) and the rate of erosion of material would be much reduced.

A rockfill beach could not be placed directly onto the marine deposits forming the seabed. It is likely that the beach would have to be formed over a trench dredged through the mud and filled with marine sand in order to prevent disturbance or shear failure of the mud. For a sand beach the extent of dredging and sand replacement might be much reduced. A composite beach with sandfill at a shallow slope below low water and a steeper rockfill beach on top to resist wave action might produce a workable compromise beach type solution. A rockfill beach is illustrated in (b) of Figure 9.3.

Widely Graded Armour Slope

It is also possible to devise intermediate forms of wall between the conventional rubble mound seawall (where large rock fragments of a relatively narrow size range withstand wave attack with low displacement) and a beach (where substantial movement and redistribution of material occurs). A potential solution would include a widely graded armour layer of a thickness substantially greater than primary armour for a conventional wall. An advantage of such an approach is that it is likely to make better use of rockfill excavated from the borrow areas (by contrast, conventional narrowly graded armour would be probably be imported from external commercial quarries). A further advantage would be that a thick, widely graded armour layer would be placed by tipping or dumping resulting in greater speed and lower cost than conventional armour, which must be carefully placed. A sea wall formed using widely graded armour is illustrated in (c) of Figure 9.3.

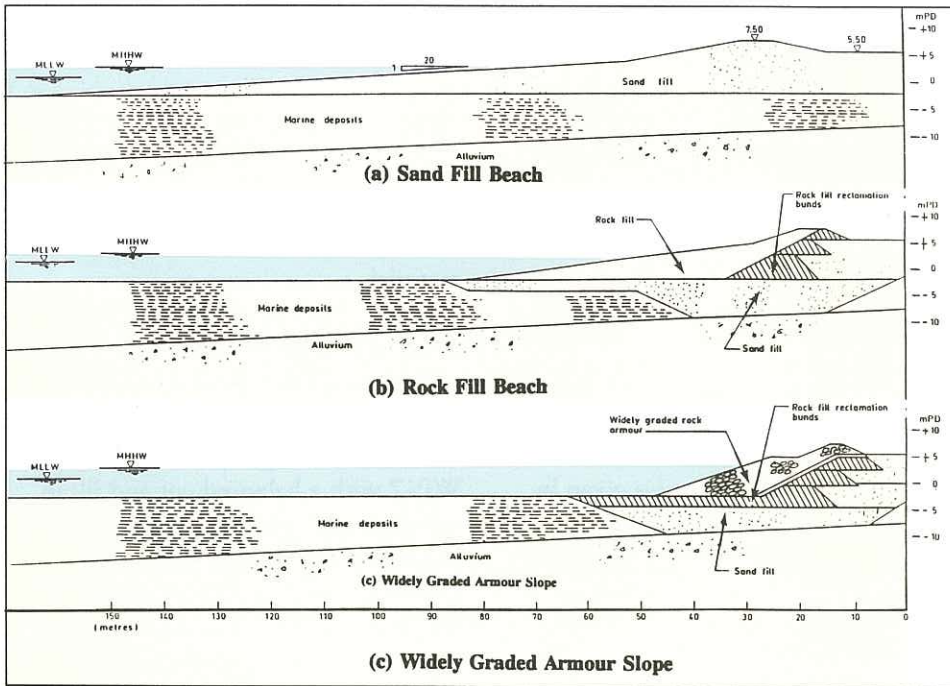


Figure 9.3 Alternative Forms of Seawall

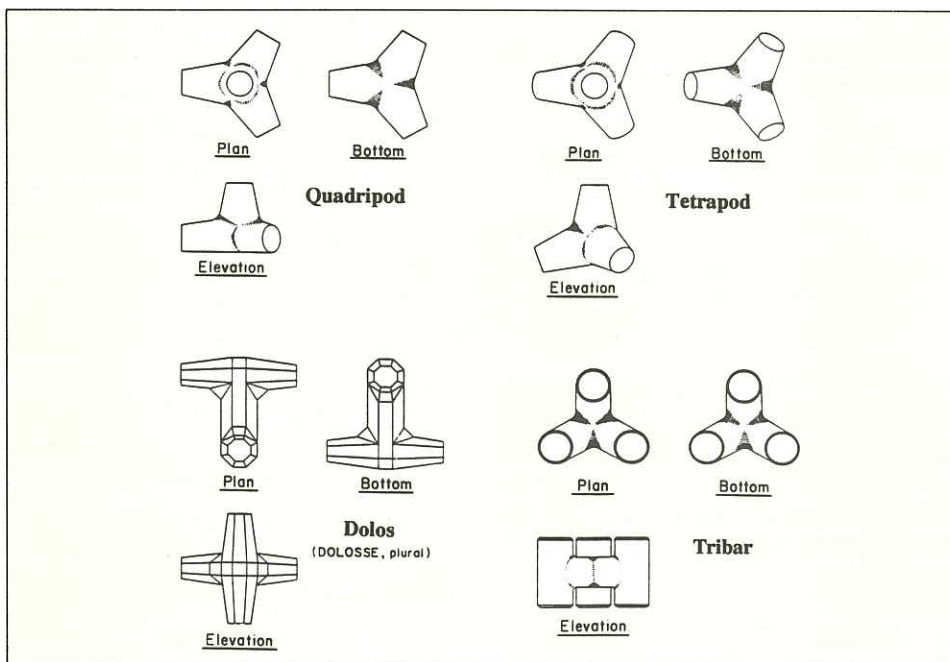


Figure 9.4 View of Armour Units

Precast Armouring

In the event rock armour material becomes scarce, the use of pre-cast units may be the only alternative. Unlike rock, concrete armouring is prone to breakage with the result that self weight is reduced and eventually if enough units break, the stability of the armour layer is affected. Its real advantage, lies

in the interlocking ability of the units. Tetrapods have been used to good effect in High Island Reservoir where the considerable wave action warrants their use.

For North Lantau where wave action is not so severe, the design of armouring has shown a nominal size of 4 tonnes for armour stone is necessary. The total

thickness of two layers of Type 3 rock armour is 1.85m. It is considered pre-cast units such as tetrapods would be scaled down versions in order to be appropriate. Tetrapods are normally placed in two layers and the resulting depth of tetrapod layer would be 1.94m.

A cost comparison of rock armour using current rates for placing in North Lantau Development Phase 1 and Tetrapods using current pre-cast concrete rates was carried out. Rock armour per metre length of seawall costs \$8,125. Tetrapods designed to the same requirements cost \$16,165 per m.

Various forms of patented interlocking units are shown in Figure 9.4 although other variations resembling anchors and modified cubes also exist.

Alternative Forms

There are also alternatives to conventional block type seawall construction such as steel sheet pile quay walls and continuous soil/rock filled cellular steel structures. Both the steel sheet pile wall and cellular structure construction would basically require the presence of a firm stratum into which sheet piles can be embedded to provide the required toe stability. The thick weak marine deposits along North Lantau coast would present difficulties in achieving this.

The effect of long term corrosion of steel structures immersed in sea water in HongKong has to be ascertained. Unfortunately there has been very limited experience in this respect to provide a reliable guidance.

9.3.6 Cost of Conventional Seawalls

The cost of vertical seawalls is higher than sloping seawalls. For essential cargo loading areas such as the First

Phase construction support facilities and the Refuse Transfer Station vertical seawalls have been obligatory. The remainder of seawall construction is intended to be sloping, rubble mound seawall.

A comparison of typical costs of vertical and sloping seawalls is given in Table 9.5 below:

9.4 Land Formation

9.4.1 General

Formation of platforms is normally achieved by a combination of excavation and filling, utilising existing areas of land and adjacent shoreline where possible to provide deposition areas. Although on North Lantau limited areas of existing land can be utilised, these will not be sufficient to meet the required demand. The steep topography discourages large excavations into the hillsides so

additional land will be formed by a combination of reclamation and minimal cutting where possible to form platforms. Working Paper WP3 discussed Initial Land Formation options during the early part of the Study. This has been refined and updated by Working Paper WP17 which describes the Land Formation Strategy for each phase. Further description of this strategy is given in Section 14 of this Final Report.

9.4.2 Excavation

Cutting into Existing Formation

For the initial Phases of Development it is demonstrably cheaper to use marine sourced fill for use in reclamation. Furthermore it was apparent from the topography and the geology of the study area, that large scale cutting into the hillside to form platforms for development would not be cost effective. In a number of locations, the

geological conditions tend to preclude extensive cutting back into the slopes altogether, due to uncertainty over the stability of the in-situ colluvium material.

Areas of existing land to be redeveloped are generally low lying with a gentle gradient. Whilst platform reference levels have been given in Working Paper WP17 with a balanced cut and fill in mind, the amount of excavation and movement of material from each platform is relatively small when compared to the reclamation quantities.

There will be trimming works required at the head of Tung Chung Valley to remove existing topsoil and vegetation. Although the small quantity in Phase 1 is to be disposed of off-site, the larger volume of material arising from subsequent phases should usefully be put to various landscaping areas, town park, earth bunds and nurseries which will become available for filling after Phase 1 Formation. Approximate quantities of topsoil arising in Tung Chung are given in Table 9.6. Volumes yielded from Tai Ho and from Phase 4 are negligible.

Table 9.5 Costs of Seawalls (HK\$/lin.m)

Seawall Type	Top of Alluvium (mPD)	Thickness of mud (m)				
		0	5	10	15	20
Vertical Seawalls	-15.0	86,000	91,000	96,000		
	-20.0	94,000	99,000	108,000	119,000	
	-25.0	105,000	110,000	121,000	133,000	149,000
Sloping Seawalls Exposed Location	-15.0	40,000	46,000	53,000		
	-20.0	51,000	58,000	66,000	79,000	
	-25.0	66,000	75,000	86,000	98,000	112,000
Sloping Seawalls Protected Location	-5.0	8,000				
	-10.0	18,000	21,000			
	-15.0	28,000	33,000	41,000		
	-20.0	40,000	47,000	57,000	68,000	
	-25.0	53,000	63,000	74,000	86,000	99,000

Source : Consultants' Estimates

Assumptions:

1. Average formation level : +5.5mPD;
2. Rock armour with soft fill from marine source; and
3. Total mud removal under seawall with disposal south of Cheung Chau.

Table 9.6 Volume of Topsoil Yielded in Tung Chung

Phase	Quantity m ³
2	20,000
3	45,000

Source : Consultants' Estimates

Borrow Areas

Whilst it is possible to reduce certain peaks to yield filling material and provide usable areas of land this option was discounted because most areas suitable for large scale excavation and formation are quite remote from the coastline and the major township infrastructure. Such isolated sites may only be suitable for specialised uses such

as the Water Treatment Works at Siu Ho Wan or, say, a hospital site.

For the First Phase, the cost of reclaiming land using marine fill is cheaper than forming land by excavation and processing the excavated material to render it suitable for filling. However locally sourced marine fill will be largely exploited by 1996 and remaining sources may be too fragmented for economic use. In the meantime it should be assumed that later phases of development may need to rely on an imported supply from the mainland or, if it is unavoidable, exploit the limited amount of local borrow areas.

The cost of fill from the mainland may be in the order of HK\$40 - 50/m³ if sourced from the western half of the Pearl Estuary. This can be compared to the use of borrow areas in North Lantau for reclamation fill, for which rates are in the order of HK\$50 - 100/m³. The cost of borrow area material may be offset by the resulting usable area created.

If a need for land borrow areas should arise for later phases of development, a limited number of borrow areas could be utilised. The location of these are shown in Figure 9.5. These borrow areas may provide a certain amount of usable area as follows:

- o The hill between Tai Ho Wan and Pak Mong (Tai Ho Wan Hill) and those at Ngau Kwu Long (Tai Ho Wan platforms) offer useful land for future use. Approximately 35ha of land would be available with good access to Tai Ho infrastructure. However, the Tai Ho Wan Hill is considered a fung shui hill and therefore its use for borrow should be avoided as far as possible.
- o Wong Kung Saddle, mid-way between Tai Ho and Mui Wo would



Figure 9.5 Possible Land Borrow Areas

be suitable for recreational uses. Formation level would be from 150mPD to 200mPD and thus road access would be steep and limited. The site is in a prominent location visible from both sides of Lantau hence minimal excavation is recommended. The site is further restricted by the presence of a proposed water works reserve beneath. The site is suitable for borrow only, and should subsequently be reinstated by careful landscaping.

- o Levelling of Wo Liu Tun hill overlooking Tung Chung could

provide a source of fill although road access to this site would be rather circuitous. Its position with a platform level of about 200mPD would create a dominant feature overlooking Tung Chung and it is possibly the least desirable of the potential land formation sites.

Estimated quantities of fill material available from these borrow areas, together with that which would be available from the Tung Chung Central Knoll (although this is presently reserved for town park use) are given in Table 9.7. The following assumptions have been made in the estimation:-

Table 9.7 Fill Available From Possible Land Borrow Areas

Land Borrow Area Location	Net Excavation Volume (Mm ³)	% Rock	Available Fill Volume (Mm ³)
Primary Sources			
Tung Chung Central Knoll	0.6	70	0.7
Tai Ho Wan Hill	5.3	70	6.2
Tai Ho Wan Platforms	2.5	0	2.5
Secondary Sources			
Wong Kung Saddle	5.2	58	6.0
Wo Liu Tun Hil	9.0	59	10.3

Source : Consultants' Estimates

- o There is no volumetric change as the result of “soft” material being excavated from borrow areas and placed in a reclamation zone.
- o The volume of “rock” after excavation, processing and placing in a reclamation zone is increased by 25 percent (that is the bulking factor is 1.25).

As well as their remoteness and difficulty of access a further disadvantage of possible Borrow Areas within the Study Area is that they occupy prominent positions overlooking the development area. As noted, the elevation of the reduced platform at Wo Liu Tun overlooking Tung Chung would be approximately 200mPD. A borrow area here would be an unattractive feature dominating Tung Chung and interrupting the transition between low density periphery residential areas/villages and the country park. The Tung Chung central knoll is of prime importance as the Town Park and the yield of material from this borrow area would not be significant.

The borrow area identified at Wong Kung Saddle could ultimately yield approximately 20Mm³ of fill if reduced to below 150mPD over a large area. However this would entail much excavation in rock protection measures over the water reserve and most importantly a large scar visible from both sides of Lantau. A reasonable amount of material is yielded with a useful recreational/golf course area if the area is carefully stepped from 200mPD to 150mPD.

All possible borrow areas identified would entail serious alterations to the landscape. It is this natural landscape which is acknowledged as one of the major attractions of the new town. Every effort should be made to avoid

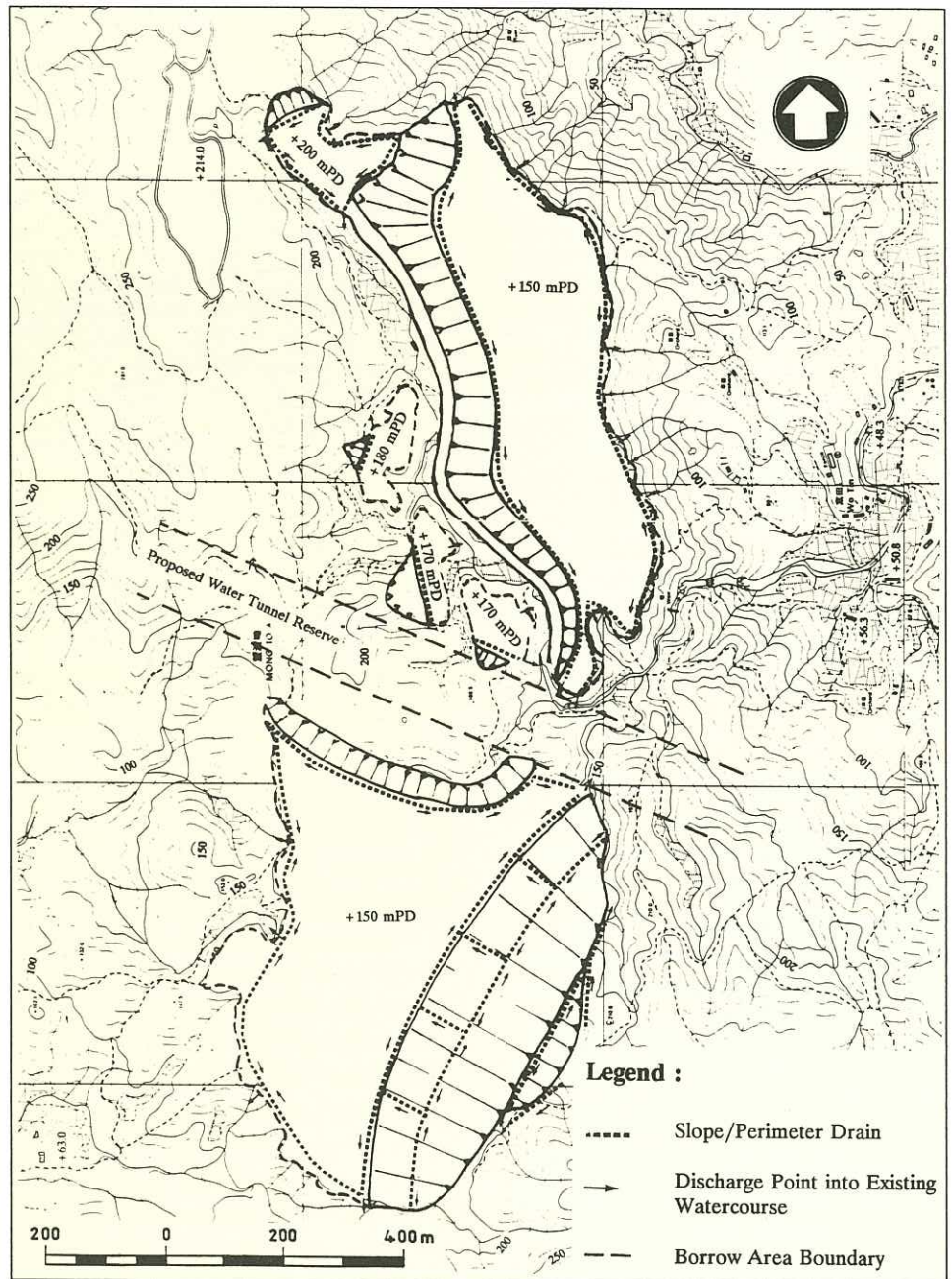


Figure 9.6(a) Wong Kung Saddle Borrow Area

the use of these Borrow Areas and they should be considered only as a last resort. If such borrow areas are eventually opened up then measures should be taken to mitigate the visual intrusion caused by careful screening and replanting. Conceptual designs of the borrow areas at Wong Kung Saddle and Wo Liu Tun Hill, the two most prominent borrow areas, are shown in Figure 9.6(a) and 9.6(b).

In the last five years some Hong Kong quarry operators have set up quarrying

activities in the islands to the south of Hong Kong waters including the Lima group of islands. These quarries excavate rock for special rockfill uses including seawall filling materials and armour stone. Indications are that supply of rock from these sources is plentiful but limited by the amount of capital investment the quarrying companies are willing to commit. The proximity of Lantau to these sources will be of assistance in future phases when demand for these materials will continue.

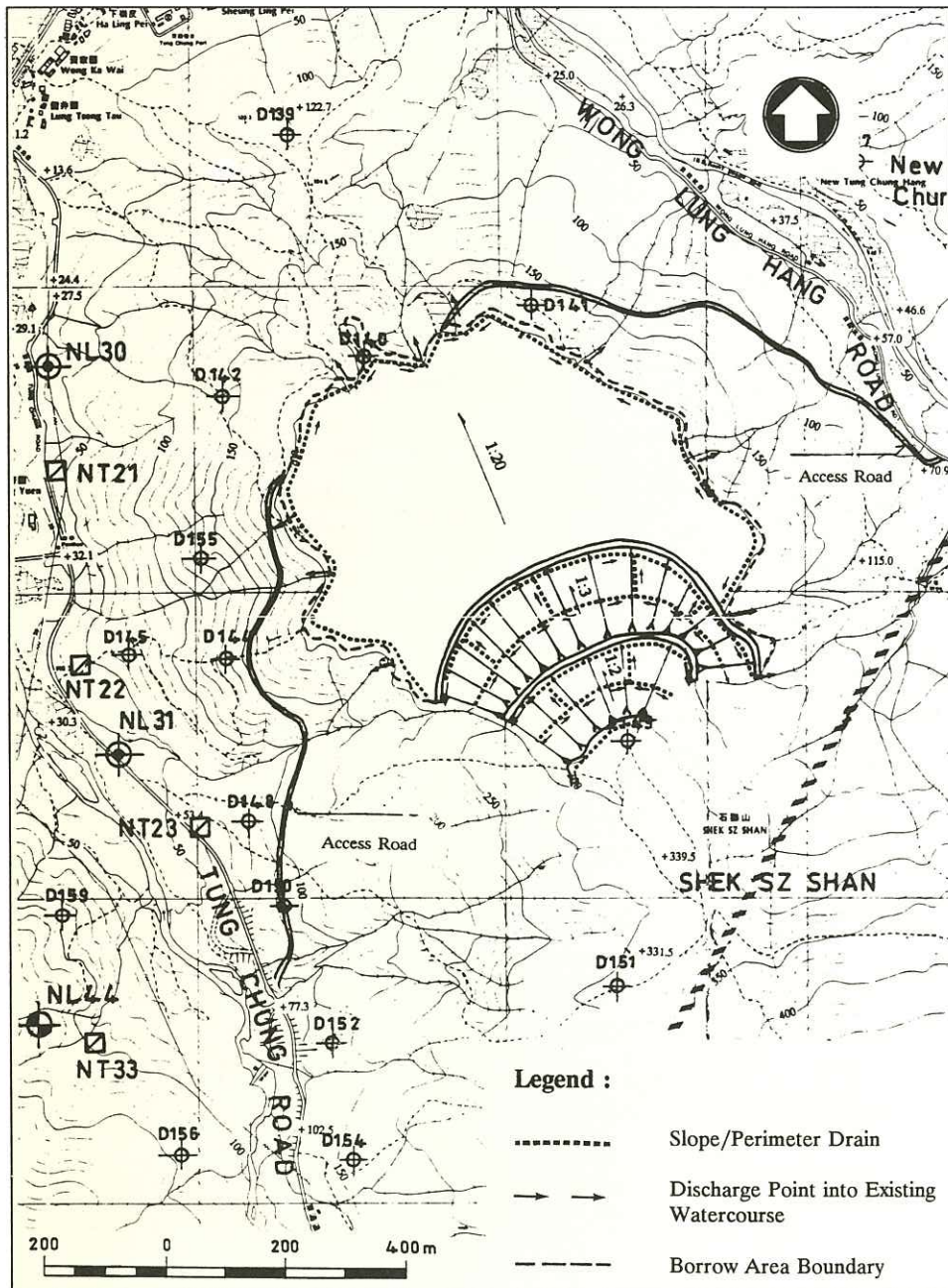


Figure 9.6(b) Wo Liu Tun Hill Borrow Area

Caverns

As an alternative to forming land by open excavation or reclamation, the formation of caverns was considered at an early stage in the study as a possible method for aviation fuel storage and to provide accommodation for a Sewage Treatment Works. Earlier studies, specifically the "Study of the Potential use of Underground Space" dated December 1989 demonstrated that it was feasible to create caverns in North Lantau for specific uses.

However, it is demonstrably more costly in terms of construction and equipment to provide space for fuel storage or sewage works underground than on the surface, even if reasonably favourable rock conditions are assumed and if surface works are assumed to include land formation and piled foundations.

The factors which can prevail over these extra costs and the physical disadvantages of underground installations are related to land availability and value. The extent of

development on North Lantau is constrained by factors other than land availability. There is ample opportunity to form additional land to meet all foreseeable requirements including those for the Sewage Treatment Works and for aviation fuel storage. Operational considerations (including operation and maintenance costs) are influenced by the layout being determined by cavern construction constraints.

In conclusion the use of caverns for the specific uses which had already been provisionally located at Siu Ho Wan was discounted and this view was endorsed by DPC at its 106th Meeting on April 8th 1991. This conclusion applies specifically to the coastal region near Siu Ho Wan and is not intended as a general argument against underground facilities, which have been shown to be cost effective and practical in other circumstances. If the need for cavern storage should arise in the future, there are a number of areas within the Study Area which have been found by GCO to be suitable for possible cavern formation. A map of these areas is provided in Appendix I.

9.4.3 Reclamation

Methods of Reclamation

The majority of land required for the New Town on North Lantau is to be created by reclamation. As noted in Section 9.2, previous geophysical surveys and marine boreholes indicated that the coastal waters of the proposed reclamation areas are generally very shallow (average about 2 metres), except for an area south of Chek Lap Kok where the maximum depth is about 9 metres. Previous site investigation results indicated that the marine muds of the North Lantau coastal area comprise very soft, highly compressible silty clay which, if surcharged by

reclamation fill, would require a very long period of reclamation settlement time.

Two methods of reclamation commonly used in Hong Kong, were considered for shortening of reclamation settlement time. These were:

- o complete removal of the soft marine mud and filling of the area to formation levels (dredged reclamation); and
- o controlled placement of the fill on top of the marine mud, installation of vertical drains to accelerate its consolidation and continued filling to required formation levels (drained reclamation).

Whilst coastal seabed levels are relatively shallow, marine deposits vary in thickness upto 18m, averaging approximately 10m. To overcome problems of mud disposal and to conserve resources of fill, the marine deposits will generally be left in place, to be consolidated over time by means of vertical weep drains and surcharging. The dredged method of reclamation will be used only where the future construction methods and programme will not tolerate the presence of marine deposits, for example along the underground LAL alignment in Tung Chung.

Weepdrains

Weepdrains will be installed in reclamation where mud is left in place. The weepdrain shortens the flow path for excess porewater to leave the marine deposits, aiding consolidation of the mud and reducing the time of primary settlement.

The spacing of weepdrains is dependant on the time required to achieve primary settlement and the nature of the marine

deposits to be drained. Spacings for North Lantau Development will be typically 1.6m to 2m. In Siu Ho Wan spacings of up to 3m can be used for the Sewage Treatment Works site formation as this is to be built in phases. The high cost of weepdrains is significantly reduced as the spacing increases at the expense of longer settlement times.

The flow of water to the weepdrains is both vertical and horizontal. For North Lantau this horizontal flow is assumed to be radial consequently a staggered spacing of weepdrains is used. This arrangement provides an equal distance between each and every weepdrain.

A period of primary settlement follows initial reclamation. With installation of weepdrains and surcharge above formation level, this period is shortened to allow earlier availability of land for subsequent construction. A typical settlement curve for Siu Ho Wan and for Tung Chung is given in Figure 9.7 to illustrate this point.

Reclamation Level

The minimum reclamation level of 5.5mPD was based on a 100 year return period and on Government's current guidelines for global sea level rise. The Royal Observatory repeated their 1982 numerical model study on extreme water levels along the North Lantau coastline. These latest predicted extreme still water levels were taken into account in determining the reclamation level.

Topic Report TR9 'Design Memorandum' (and Section 9.3 above) explains how the design coincidental maximum water level of 3.8mPD is taken as a minimum level to avoid flooding. To this is added an allowance of 10mm per year over a design life of 100 years, that is 1.0m, to account for

the effect of sea level rise. Post construction settlements of 0.2m after 50 years plus a tolerance for accommodating culverts and utilities brings the minimum reclamation level up to 5.5mPD.

Mud Disposal

At the same time as local sources of marine fill become scarce, it is anticipated that it will become increasingly difficult to dispose of dredged marine deposits within the vicinity of Hong Kong waters. During the Study a review of beneficial mud disposal options was undertaken to ascertain its advantages in future reclamation for the New Town. This has been reported in Topic Report TN14.

Primary Settlement Prediction
Two methods of beneficially disposing of dredged mud from North Lantau have been considered. These are:

- o Progressive Trenching; and
- o Evaporative Drying and Hydraulic Filling.

Both methods of beneficial disposal are viable, each requiring its own special arrangements for the reception and treatment of the dredged slurry. Progressive trenching has been carried out on a large scale for production dredge spoil disposal operations elsewhere in the world. Hydraulic layering has been carried out only in the form of small and large scale trials and further development work would be required before the technique could be brought to the same level of production development as progressive trenching.

Hydraulic filling will deal with dredged spoil at about 5.5 times the rate of progressive trenching. The disposal capacities of the two methods are as

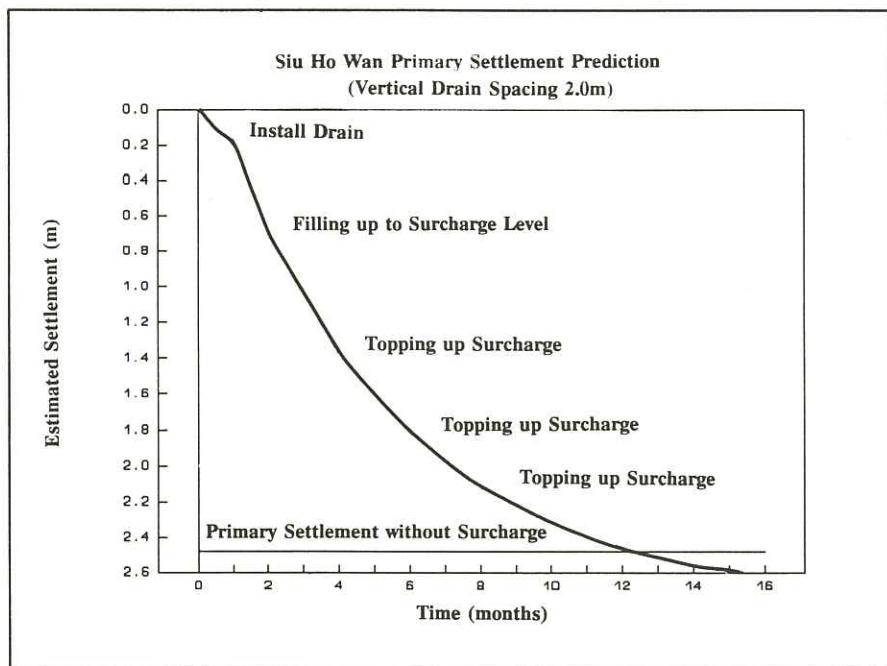
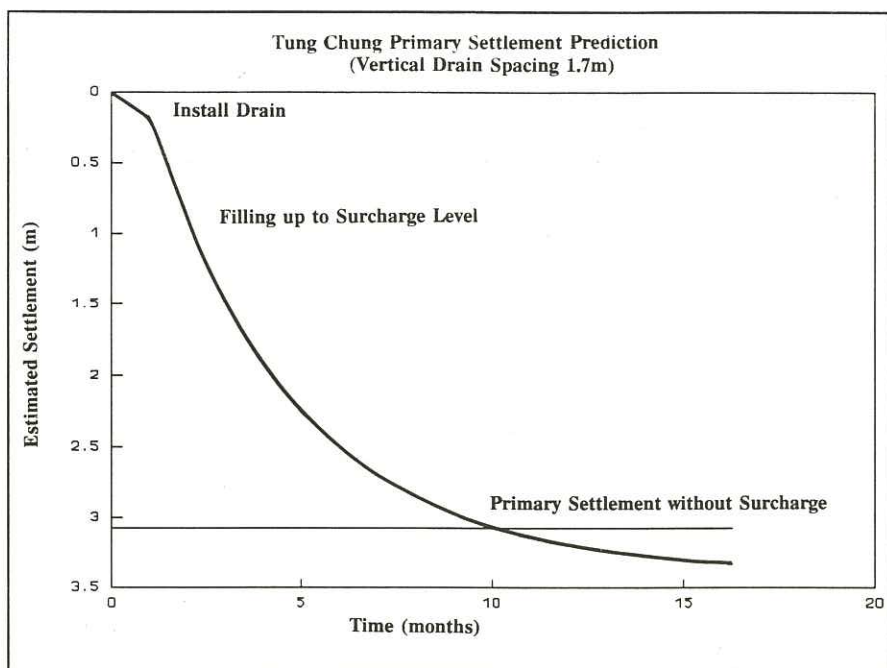


Figure 9.7 Primary Settlement Prediction

shown in Table 9.8 below. The mud disposal zones are shown in Figure 9.8.

Clearly the use of beneficial mud disposal will have significant advantages in reducing the amount of reclamation material required in the later phases. Working Paper WP17 'Land Formation Strategy' indicates the filling quantities required for each phase of development.

The quantity required for Phase 4 is relatively large hence it is recommended that beneficial mud disposal areas are set up for Phase 4 reclamation areas where site formation is due to commence in 2004. It is recommended to assign Tai Ho Phase 4 as a beneficial mud receiving area as this is remote from both areas which will have an established community, and from ferry

activities to and from Tung Chung. Clean marine mud from Phase 2 site formation may usefully be disposed of here. The area could also receive clean mud from other contracts in Hong Kong with the depositor being responsible for setting up the polder area.

For purposes of comparison, the maximum volume of dredged mud that could be disposed of in a non-beneficial manner would be approximately 10.4M cu m over a period of say two or three years. This is not recommended for engineering, environmental and birdstrike reasons.

9.4.4 Public Dumping Material

Further assistance will be given to reducing fill demand by the use of public dump material at sites of future reclamation. It is recommended that some areas of reclamation are reserved for the public dumping of construction waste. This material, typically consisting of excavation arisings, builders rubble and hardcore etc. is quite acceptable in marine filling. Such materials need to be filtered to eliminate timber and plastic items. Hard material (eg rock, concrete) must first be broken down to 200mm maximum size thus making the waste more suitable for land reclamation purposes where piling is intended. The area for dumping will require protection against wave erosion, this could be in the form of a breakwater or temporary seawall.

Supplies of public dump material will be sporadic, so an area assigned for reception of public dump material should be one that is required for development in the long term rather than short term. In this way preparations, (for example the provision of a temporary seawall) to receive the material will have a more useful life. Tai Ho Area 7 as shown on Figure 9.8

Table 9.8 Beneficial Mud Disposal Capacities (m³)

Method	Option A	Option B
<u>Progressive Trenching</u>		
Disposal Volume (M cu m)	17.3	10.3
Disposal Rate (cu m/yr)	553,000	553,000
Disposal Time (yr)	2	2
Available for Development (year)	2024	2013
Disposal Volume at 2011 (M cu m)	9.2	9.2
<u>Hydraulic Layering</u>		
Disposal Volume (M cu m)	15.1	8.9
Disposal Rate (cu m/yr)	3,000,000	3,000,000
Disposal Time (yr)	5	3
Site Preparation and Research & Development (yrs say)	3	3
Total Disposal Time (yrs)	7	3
Available for Development (year)	2000	1998

Source : Consultants Data

Note: Option A : disposal from seabed level in a polder initially
 Option B : disposal from a platform at +2mPD with gravity drainage

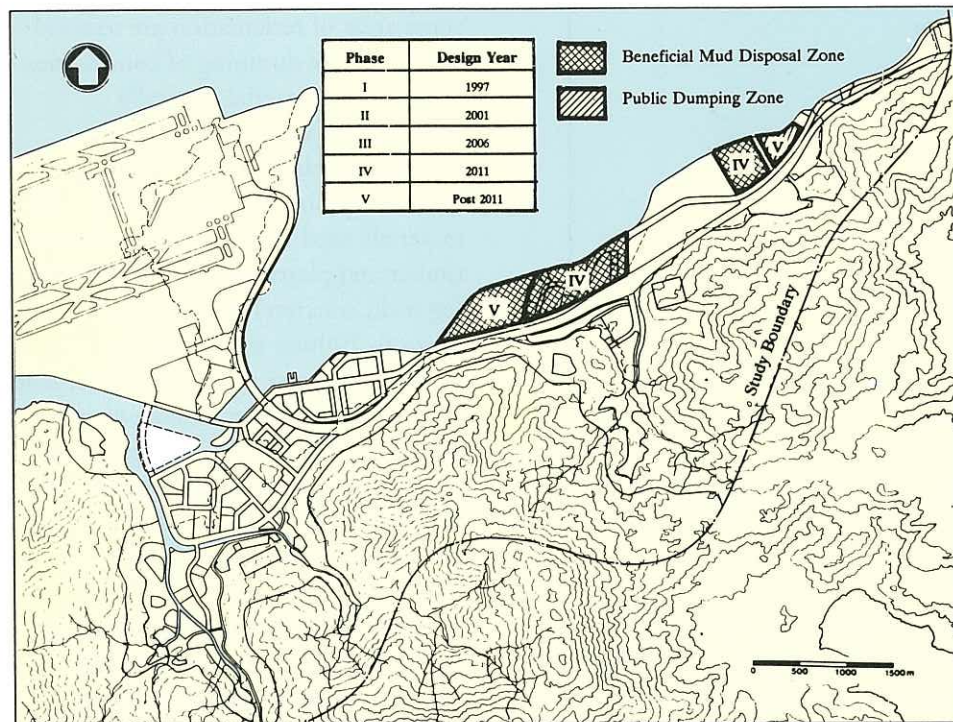


Figure 9.8 Beneficial Mud Disposal Zones

is suggested as a suitable site. It has the benefit of sea access requiring little or no dredging, is remote from residential development and should offer a long dumping life. This site is free of short term development requirements provided its reservation as a fuel storage area is only required in the long term, if at all.

9.4.5 Possible Use of Pulverised Fuel Ash

Site formation in post Phase I development (mostly reclamation) may benefit from the use of Pulverised Fuel Ash (PFA) as load bearing fill above high tide level. PFA has been used elsewhere in Hong Kong notably in Tuen Mun as filling material. In comparison with other filling materials such as marine sand and decomposed granite, PFA is readily compactable when treated with water (approximately 25 percent moisture content is needed) and it does not require excavation from a marine or land based borrow area. For this reason it may form an economical alternative to conventional filling methods in North Lantau. This has been examined and described in Working Paper WP17 following some discussions with China Light and Power.

In the short term, approximately 1Mm³ of PFA is likely to be produced each year by China Light and Power. It is possible this may increase by the time Phase III is requiring material that is at about the year 2001, due to growth in electricity demand and with the operation of the gas/coal powered Black Point Power Station now being proposed. However the production of PFA will not increase by a large amount. Hong Kong Electric Company may be able to offer an alternative source of PFA but haulage distance would be greater.

PFA is approximately 30 percent lighter than marine sand and Completely Decomposed Granite (C.D.G.) resulting in smaller settlements when placed over existing areas of fill. The main concern with the material is control over fugitive dust, requiring measures to retain a minimum moisture content until protected in situ by a final 300mm layer of soil. Its lightness renders PFA unattractive in marine filling when compared to sand since it can be easily washed away causing environmental problems and loss of material.

PFA will be ideally suited to the formation of platforms in the upper reaches of the Tung Chung and Tai Ho Valleys. These areas are remote from the shoreline and therefore filling by use of marine sand will require double handling and marine sand will not therefore have the same advantage as when it is used in reclamation. A possible question over the continued supply of PFA through a given development Phase exists and alternative back-up sources of filling material will require identification. In the meantime some preliminary investigation should be made into its suitability and cost effectiveness with a view to making a reservation for future PFA production for North Lantau land filling.

9.5 Stormwater Drainage and the Sea Channel

9.5.1 Introduction

The drainage system of the New Town includes open drainage channels, water features, closed culverts and a sea channel. Drainage channels are preferred for the main streams as it would be too expensive to locate them beneath ground. The open drainage channels can serve as landscape buffers between different uses. They can also

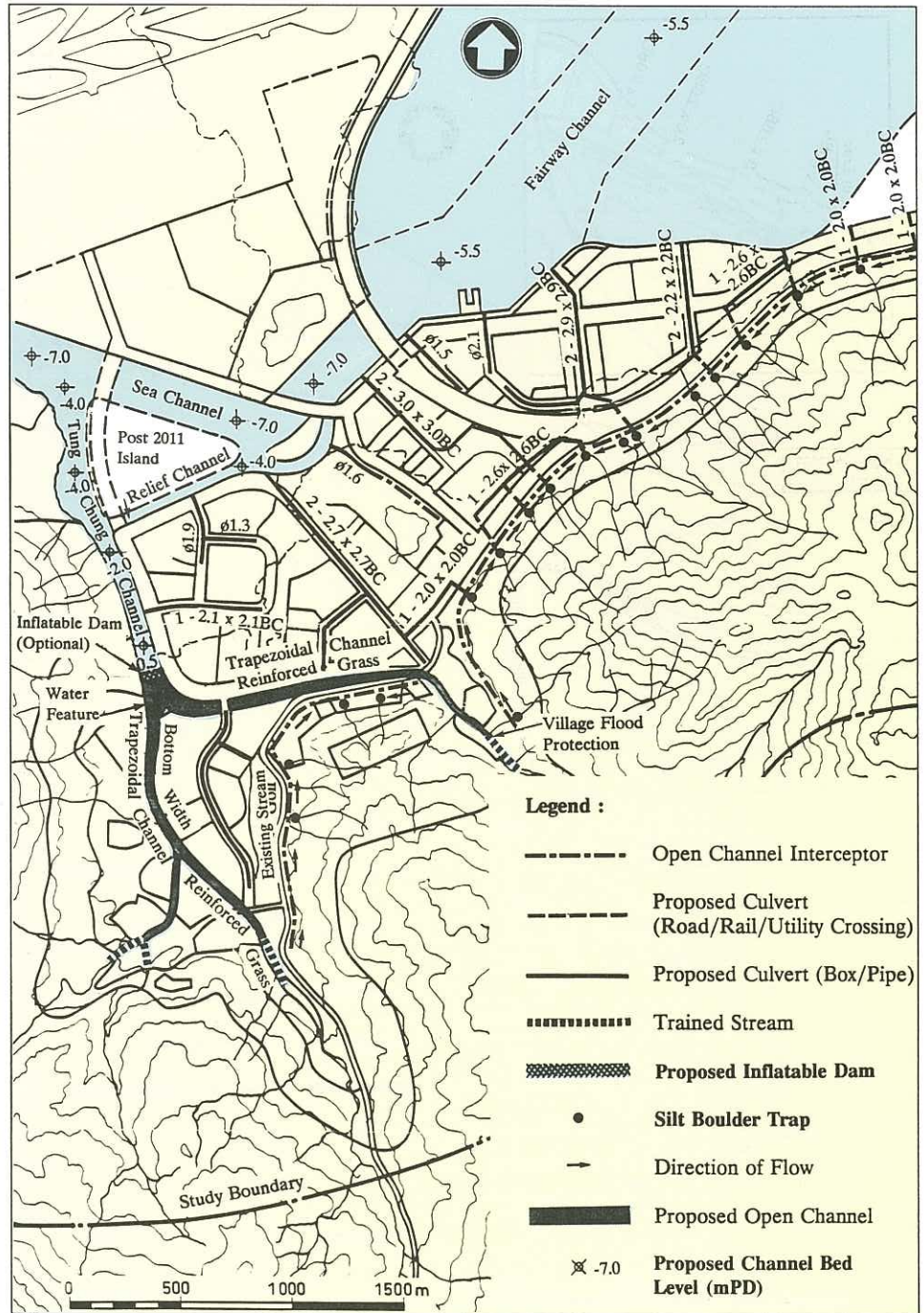


Figure 9.9 Drainage Layout - Tung Chung Area

form water features which can be incorporated into open spaces and merged into existing coastal features so as to enhance the visual and environmental treatment of such works. Box culverts are adopted in the reclamation areas in order to reduce losses of valuable land and reduce constraints to development. Where possible main drains are grouped together into major drains to reduce the required number of crossings of railway,

roads and utilities to a minimum while allowing some saving on construction and maintenance costs.

The main elements of the stormwater drainage and water features are shown in Figures 9.9 and 9.10, more detailed plans are provided in Appendix I.

The Sea Channel, although not entirely a drainage feature, links the Tung Chung drainage channels to the sea,

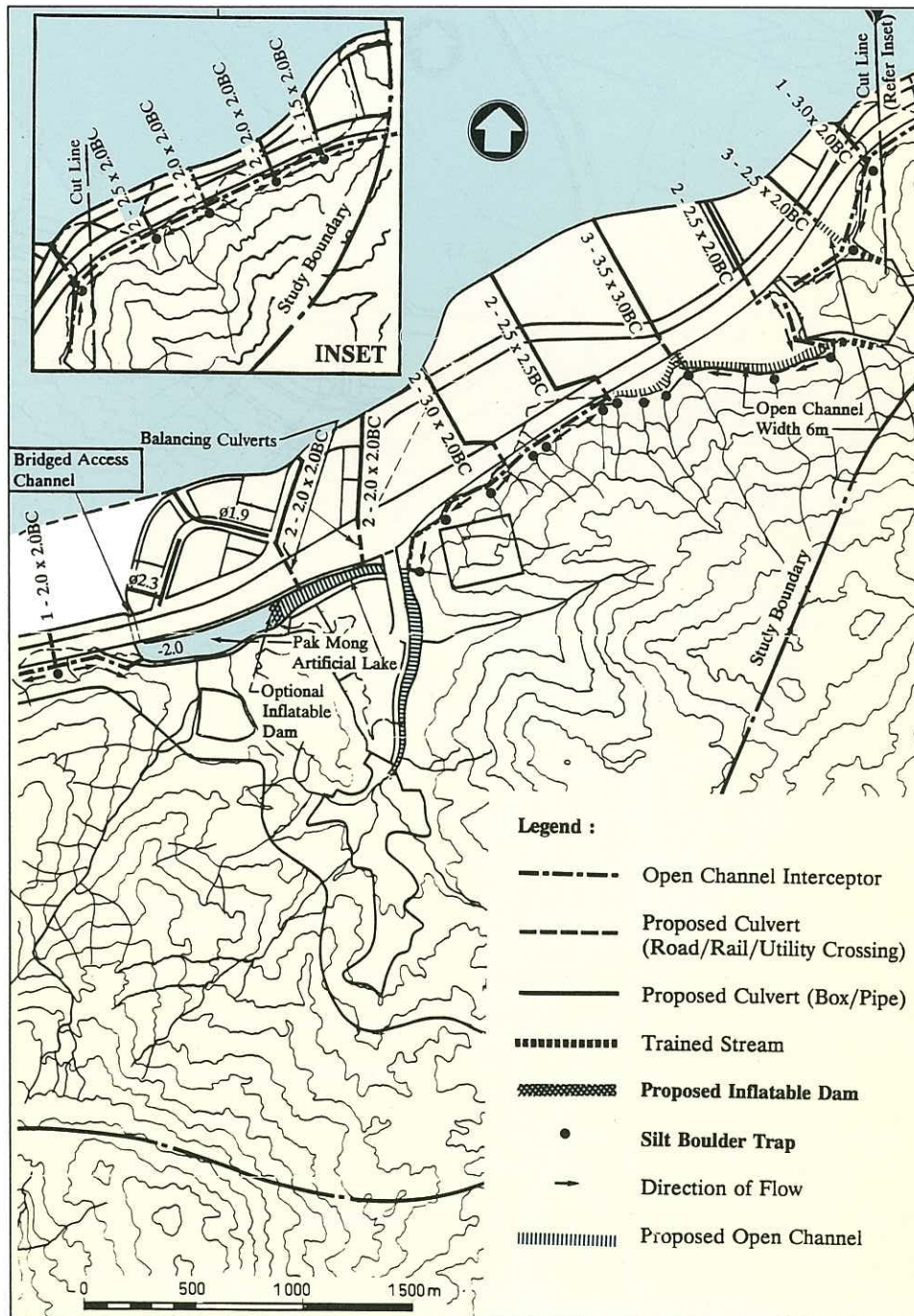


Figure 9.10 Drainage Layout - Tai Ho Area

improves tidal exchange and helps to preserve water quality in the channels and in Tung Chung Bay. It links the embayment of water to the east of the Airport to that to the west.

9.5.2 Stormwater Drainage

The stormwater drainage will be designed in accordance with the 'Civil Engineering Manual' and the additional criteria as laid out in Topic Report TR9 'Design Memorandum'. The main

channels and culverts of the system will be designed for a two hundred year return period flood event. The case of the combination of extreme tide in conjunction with moderate rainfall is included in the design of outfall sections. Consideration has also been given to the effects of flood events exceeding the design return period. Reclamation levels have been set out to provide escape routes for flood water to the sea while limiting damage to infrastructure.

The outline design for the stormwater drainage for the entire New Town development is contained in two reports. These are Working Papers WP6 and WP11. The first (WP6) investigated the drainage options in respect of the Initial Concept Plans and the Preferred Concept Plan. It was here that three distinct alternatives for the main drainage channel through Tung Chung were investigated. These were essentially conducting most drainage through either a large channel to the east, or to the west or both east and west of the western half of Tung Chung. WP6 also provided input to the North Lantau Expressway Design. Working Paper WP11 reviews the Tung Chung and Tai Ho drainage proposals to accommodate changes that occurred following the issue of WP6 and the Recommended Outline Development Plan (RODP).

9.5.3 Open Drainage Channels

To conserve as much land as possible for development, the use of open drainage channels is limited to those necessary for conveying the very large streamcourses circumventing the town. Preliminary configurations of open channels have been chosen to complement the adjacent open spaces and amenity areas. These can be divided into three parts: an upper fluvial section unaffected by tidal waters, a tidal section subject to tidal fluctuations and a transition reach between these two. This subdivision reflects both hydraulic conditions and maintenance requirements.

Tidal sections have invert levels below -2.0 mPD and an unlined bottom to allow maintenance by marine dredging. Side walls will be lined to provide protection against erosion and wave action depending on exposure to prevailing wave action.

Fluvial sections have an invert level above +0.5 mPD and will be fully lined. Lining provides protection against erosion and reduces maintenance costs. Up to maximum tide level (approximately 2.6 mPD) lining will be of stone masonry to give a good aesthetic appearance and reduce maintenance.

In the fluvial sections, a reinforced grass lining and a stone masonry lined, dry weather flow channel has been proposed to limit visual impact and costs. Figure 9.11 is provided to show a typical fluvial section. A vertical transition between tidal and fluvial sections has been provided to avoid inconvenience in carrying out maintenance operations and limit exposure of the channel bottom at low tide.

9.5.4 Water Features

These have been introduced in order to provide an efficient means of draining rainwater run-off, enhancement of recreational opportunities and merging the stormwater drainage system to the surrounding landscape. Two water features have been suggested for the development. The first is in Tung Chung at the junction of the two main

drainage channels from Tung Chung valley. This feature provides a buffer between low and high density residential land and isolates the second access road to the airport from the surrounding development. It is surrounded by an open space and will improve the amenity of these surroundings. The water feature may be further improved and controlled by an inflatable dam which can be deflated in the event of a flood. It can control water levels and quality in the artificial lake and, if required, prevent ingress of sea water.

The second feature proposed is at Tai Ho. This artificial lake forms part of the second largest drainage basin in Lantau (approximately 8 km²) and occupies the area required for a noise setback created by the NLE/AEL corridor. It includes the existing coastline at Pak Mong. By collecting the run-off from a number of streamcourses into one water feature the number of culverts which would otherwise be necessary to deal with this large catchment area is reduced to one outlet. A 22-metres-wide bridged channel outlet links the lake to the sea and provides access to marine plant for reclamation, construction and

maintenance dredging. The feasibility of this artificial feature has been presented in Technical Note TN9 - 'Artificial Lake at Pak Mong (Revised)'.

A possible bonus in the use of the water features is a backup supply of irrigation water since both features will contain good quality water, accessible to the main irrigation demands. In the short term this source could be extracted by water bowser on the adjacent utilities reserve. In the long term a rubber dam would be desirable to give better management of the water quality and improvement of ecological conditions.

9.5.5 Box Culverts

Surface run-off from reclaimed land is collected and conveyed to the sea by box culverts. These follow road alignments and boundaries between different land uses to make best use of concealing the box culverts beneath ground level. Where possible invert levels have been kept above the minimum tide level to facilitate maintenance. Access points will be provided for inspection and maintenance equipment and machinery.

9.5.6 Sand/Boulder-Traps

These have provided at the interface of the engineered drainage system with the natural upstream areas. The objective is to prevent sediment and other detritus from entering the drains and provide a more convenient method for removal of silt from the drainage system.

9.5.7 The Sea Channel

This performs various functions between the New Town and New Airport developments. The principal objectives are the provision of a safety and landscape buffer between the New Airport and the New Town, to provide

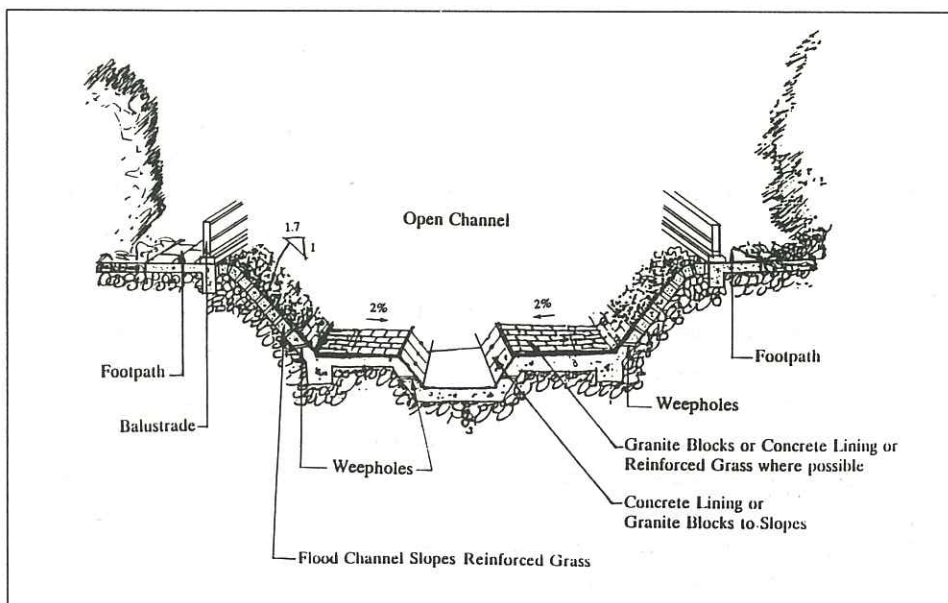


Figure 9.11 Drainage Channel - Fluvial Sections

flushing of the embayment to the east of Tung Chung and tidal portions of the drainage channels and to preserve the existing Lantau coastline between San Tau and Sha Lo Wan.

The relief channel, which separates the main Tung Chung reclamation from the Post 2011 island, facilitates tidal recirculation in these lower reaches of the Tung Chung drainage channels. Special concern was given to preserving the Elephant's Trunk, a fung shui feature in the delta area of the stream draining the San Tau valley. Details of this feature are given in Section 13.1 of this report dealing with the Rural Hinterland.

A further explanation of the Sea Channel giving the philosophy behind its introduction, design criteria, sedimentation and a general layout is provided in Appendix F. A section on the relief channel is also given.

9.6 Transport Infrastructure

9.6.1 Roads

The Tung Chung and Tai Ho development areas of the New Town are composed of platforms gently reducing in level towards the coast. This affords a generally at-grade road layout avoiding high embankments or deep cuttings. Exceptions to this are necessitated by approaches to elevated interchanges and sea channel bridges as well as underpass arrangements.

Consideration should be given to the use of a friction course to reduce vehicle wheel noise instead of concrete paving. It is recommended that primary distributor roads and district distributor roads are paved with such a friction course as these roads carry more traffic and generate higher speeds. The maintenance and introduction of services is likely to be less than with

local distributor roads which could be concrete paved for ease of reinstatement. At the same time, local distributor roads carry less traffic at slower speeds, and for this reason also they are suitable for concrete paving.

In order to make the best use of the limited available land, minimum radii and junction separations will be obligatory. Transport Planning and Design Manual requirements should be achievable however and there are no constraints to phased construction of roads and junctions. The use of landscaped central reserves will be encouraged throughout the development. A 5m central reserve has been allowed in the NLE Tung Chung section, however the need for a wide central reserve was not justified in Tai Ho. A system of major walkways and cycletracks will be integrated with the road layout. Maximum reserve widths will be allowed for in the infrastructure design and care taken to avoid interruption of the routes by the use of subways. The design criteria and landscape treatment of roads and footpaths is described in Topic Report TR9 'Design Memorandum'.

Certain access roads to remote utility installations and outlying villages will be circuitous by virtue of the surrounding steep topography. These may form important links between the town and proposed leisure/lookout areas thus being deserving of more than just access road design criteria.

9.6.2 Interchanges

There will be two elevated interchanges providing access to the development. These were finalised following exhaustive deliberation on the position and level of the interchanges to best serve the interests of the community. Whilst the Tung Chung interchange was readily adopted as elevated, by

virtue of its position on the foothill above Tai Po, the Tai Ho interchange had benefits in both elevated and at-grade form.

An at-grade Tai Ho roundabout provided an easier engineering solution for the interchange although rail bridges across its northern approach would be costly. The drawback to this arrangement was its effect on the surrounding town plan. The visual intrusion and setbacks required, were unmanageable after the interchange area was incorporated into the town. Furthermore the rail station could not be accommodated close to the interchange and therefore be adjacent to a part of the commercial and district centre of the Tai Ho area. The merits of the forms of interchange at Tai Ho were presented in Technical Note TN8.

Primarily for planning reasons, the elevated roundabout was finally adopted at Tai Ho. The approach arms on embankment, irrespective of the method of reclamation, provide a softer treatment of the interchange and improved alignments of rail and expressway. Lengthy drainage culverts under the interchange were minimised by the introduction of the Pak Mong artificial lake. This will divert most of the catchment water arriving at Tai Ho, to the west of the interchange.

The need for providing the Tai Ho interchange in the early phases of Tai Ho development has been questioned. To satisfy the early access requirements of the Refuse Transfer Station and Rail Depot, an underpass has been provided at Sham Shui Kok. This location represents the best balance between end user access and ease of construction. The future of this underpass lies in giving restricted access to nearby utility installations, including the Sewage Treatment Works, the Refuse Transfer Station, the Gas Reception Station, the

Water Supply Department Reservoir and the sub-stations of China Light and Power.

9.6.3 Links to the Rest of Lantau

The viability of links from other parts of Lantau to the New Town and hence to the New Airport and the mainland depends largely on whether the cost of engineering of the link is justified. Notwithstanding the rugged terrain immediately adjacent to the North Lantau Coastline area, the existing development is presently linked to other parts of the island by the Tung Chung Road and by footpaths over the mountains.

Topic Report TR19 'Transportation and Highway Systems' included sensitivity tests which were conducted to determine the effects on the RODP of different development strategies for the rest of Lantau, focusing on increased development on South Lantau. The impacts of increased traffic flows were discussed in the context of the RODP, NLE and the three external connections to Lantau. The Study Brief required the feasibility of two road links to Tung Chung to be assessed. These were:

- o upgrading of the existing Tung Chung Road to provide a single traffic lane in each direction; and
- o construction of a new road connecting Sham Wat to Sha Lo Wan and Tung Chng.

Technical Note TN16 'External Links to Tung Chung' was issued to explain the engineering and costs anticipated with providing the above links to Tung Chung.

Upgrading Tung Chung Road

Tung Chung Road presents the most

likely and most cost effective link to the south of the island. Being currently only a single track restricted road (3.5m wide) with passing bays every 150m or so, its existing width is not suitable for unrestricted use. The road will require widening along its entire length from Tung Chung almost to the junction with the South Lantau Road at Cheung Sha, a distance of some 5km.

In Tung Chung the Tung Chung Road is planned to be widened to two lanes up to its junction with the Shek Mun Kap Road, as part of the RODP. Beyond this point it follows a generally smooth horizontal alignment to Pak Kung Au, 300m higher. Although proceeding at gradients typically flatter than 1 in 10 for one kilometre the last two kilometres to Pak Kung Au become much steeper at up to 1 in 7. No improvement to this gradient can be made because the road lies at the junction of two very steep slopes leading to Lantau and Sunset Peak.

From Pak Kung Au descending for 2km to the junction with the South Lantau Road, the existing road becomes very steep. Gradients up to 1 in 6 are necessary, reducing to typically 1 in 10 after traversing the catchwater located 900m before the junction. Although the horizontal alignment is circuitous to take best advantage of the contours, there are only two locations where a radius less than 30m is demanded. At 30m radius the safe speed is just 30km/hr. Similar situations occur elsewhere in Hong Kong, for example, in Peak Road on Hong Kong Island.

The full widening of this road in the future will be possible albeit with considerable difficulty and cost in some sections. It will not be possible to widen uniformly on one side only. Rather, the widening will need to take best advantage of the terrain depending on which side of the existing road this

lies. There will be no alternative but to adopt the same general horizontal and vertical alignment of Tung Chung Road as there is little scope for varying the route. As well as widening, emergency over-runs should be incorporated, particularly at sharp bends.

Discussion of costs of upgrading Tung Chung Road involves a number of uncertainties namely, the extent of geotechnical works, buttressing and retaining walls, the level of improvements required and possible drainage upgrading. Without a detailed survey of the route and adjacent area it is only possible to estimate in broad terms, the minimum cost of upgrading the Tung Chung Road which stands at approximately \$40M.

Road Link to Sham Wat

At present there is no direct road linking the villages of Sham Wat via Sha Lo Wan and San Tau to Tung Chung. Sham Wat is accessed by the Sham Wat Road via the Ngong Ping Road to Keung Shan Road and Highway Department have plans to provide a road link between Sham Wat and Sha Lo Wan. It is presently a very circuitous route to reach Tung Chung with part being along narrow tracks and part on coastal footpaths. Access is also gained by sea between piers at Sha Lo Wan and Tung Chung.

Notwithstanding this, a question over the economic justification for providing a direct link between Sham Wat and Tung Chung exists since there are believed to be less than 90 residents in Sham Wat and Sha Lo Wan who would benefit from it.

In addition it should be remembered that an important objective of the Study was to preserve as far as possible the coastal region west of Tung Chung. This was identified as an area of

standing beauty and consequently
y plans to open up the area to
hicular access (and therefore, possibly,
velopment) should be viewed
itically

link between Tung Chung and Sham
Wat is feasible in engineering terms
though not considered appropriate
r other reasons) and a fairly smooth
ignment is achievable which would
rovide access to San Tau, Sha Lo Wan
nd thence through to Sham Wat. The
ngth of this alignment is over 6km,
nd is shown in Figure 10.8(b). The
ost of a 3.5 m wide rural road with
assing bays along this alignment
ould be in the order of HK\$135m.
art of the route requires a strip of
clamation to circumnavigate a steeply
ded foothill of dubious geological
ability west of San Tau. The
ignment will rise above Hau Hok
Van to pass through an area of cutting
efore descending to Sha Lo Wan.

9.6.4 Access across the Sea Channel

In developing the Concept Plans the
osition of the New Airport primary
nd secondary accesses played an
important role in the layout of the New
Town. Although a submerged primary
ccess crossing of the sea channel was
onsidered to have the least impact on
the town, this was found to be
rohibitively expensive. A bridged
rossing was adopted for the Preferred
oncept Plan. However, the impact of
s alignment and that of the NLE
rough the Tung Chung area was
ritical to the layout of the Town
entre and the interface with the
irport Master Plan.

A detailed examination of this
ignment was undertaken for
roduction of the RODP, so as to
rive at the optimum alignment of the
irport primary access over the Sea
hannel. Vertical alignments of the

NLE were considered for the case where
the primary distributor P1 was elevated
over the NLE and for where it was
depressed under the NLE. This
examination of the vertical alignments
was described in Technical Note TN12
'Form of Primary Access over Sea
Channel'.

Provided the NLE/AEL corridor can
return to grade through the Town
Centre, the form and level of the bridge
over the Sea Channel will mainly affect
the treatment of the primary distributor
P1. The treatment of this primary
distributor was found to have
significant adverse effects on the Town
Centre when elevated over the NLE.
This was due to the impact of the
extensive elevated structure to carry the
P1 over the NLE and back to grade.

For this reason it is recommended that
the primary distributor runs through at
grade alongside the Sea Channel with a
local depression under the NLE/AEL if
necessary. This represents the least
expensive treatment of the primary
distributor.

The primary Sea Channel crossing to
Chek Lap Kok will require a minimum
of 200m of elevated structure with piers
founded on bedrock lying a
considerable depth below sea level.
This is overlaid by alluvium and thick
marine deposits, such that long spans
will be justified. Without the need for
large vessel access into the inner
channel, a minimum clearance can be
tolerated between the bridge structure
and the sea level resulting in a more
cost effective solution. The optimum
level of the bridge over the Sea Channel
may then be determined such that the
level of the NLE over the primary
distributor is not lower than +11.8mPD
nor higher than 12.5mPD, provided
also that the expressway returns to grade
through the Town Centre. A part
section of the Tung Chung side of the

primary access over the Sea Channel is
shown on Figure 9.12.

9.6.5 Railways

The alignment of the Airport access
corridor through Tung Chung was
determined by the minimum radius
which could be tolerated for the AEL.
This was confirmed by the potential rail
operator as 900m. For geotechnical
stability reasons it is expected that
major excavation into the hillside above
Tai Po will not be possible. Allowing
for minimal excavation into the hillside
above Tai Po and crossing the Sea
Channel to the east of Chek Lap Kok
knoll, the minimum radius presented
the least length of Airport Railway
passing through the Tung Chung area
of the New Town.

The LAL will pass through the full
length of the development with due
allowance for its extension through to
the west of Tung Chung. It will be
constructed at grade from Tai Ho Wan
through Tung Chung Area 19 where
the vertical alignment will dip to
slightly below grade, continuing as such
before going fully under-ground to pass
beneath the NLE/AEL primary access
corridor and the Tung Chung knolls.
This arrangement will require
tunnelling and cut and cover
construction for upto 1km of the LAL
thereby minimising its visual and
environmental impact on the town
centre and park. As it emerges into the
western portion of Tung Chung the
LAL will again be retained at slightly
below grade.

An elevated form of the LAL where it
crosses the NLE and AEL had been
considered during refinement of the
RODP. Although its engineering cost
would have been less than an
underground crossing, a serious loss in
revenue from adjacent development
would have been incurred. This was

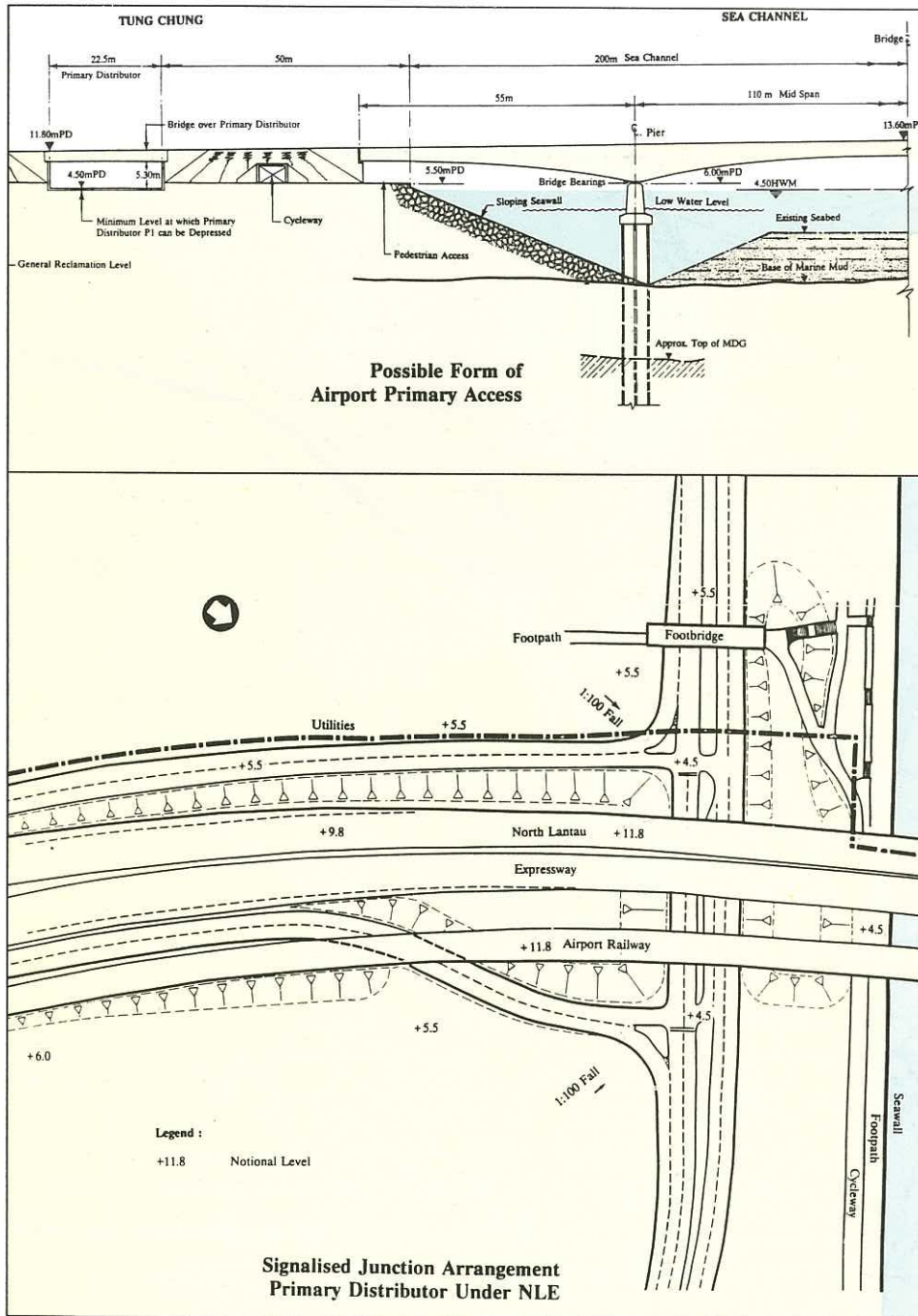


Figure 9.12 Sea Channel Crossing

exacerbated by the need for the line to remain elevated through much of the east Tung Chung area in order to cross distributor roads. West Tung Chung would also have been similarly affected. The higher initial engineering costs of an underground LAL crossing of the NLE and AEL were considered tolerable in view of the improved Town Centre layout it afforded and the possibility of providing a higher quality development scheme for the Town Centre as a whole.

Design criteria have been derived for the LAL in determining its alignment through the New Town and a minimum 500m radius has been allowed for approaches into LAL stations. This assumes a reduced line speed on approach to the station.

In certain situations (as in Tung Chung town centre) a fully dredged corridor will be provided in the reclamation as a LAL foundation.

Early in the Study, the Railway Depot site was proposed at Tai Ho East. The required size of the depot was considered too large for accommodation within the Tung Chung area of the New Town and would also have imposed the requirement for end de-training, a depot procedure unpopular with the railway operator. Its position alongside a straight portion of Airport Express Line meant Tai Ho East was an obvious choice. Coupled with the improved proximity to Tai Ho station provided by an elevated roundabout at the interchange, this site was adopted as the depot location in the Preferred Concept Plan.

9.6.6 Ferries

An interim ferry pier will be provided off Tung Chung Area 49 to be replaced by an adjacent permanent facility in later phases. The interim pier will be essentially a flat suspended slab finger pier designed to accommodate two vessels and will have a design life of 15 years.

The permanent ferry pier is expected to form part of a larger complex and will thus be designed with additional floor space in mind. A fareway dredged to -5.5mPD will be formed during the initial construction phase and retained for future permanent use.

The existing ferry pier at Sha Lo Wan will be retained whilst those at Ma Wan Chung and Pak Mong will be phased out. The latter will be re-provisioned on the seaward side of the NLE/AEL corridor. Landing steps and berthing facilities will be incorporated in vertical seawall designs at Tung Chung Area 49 and the Refuse Transfer Station at Tai Ho Area 2.

9.7 Provision of Utilities

9.7.1 General

Existing utility provisions are inadequate to meet the requirements of the New Town. Consequently new utility supplies to the development will be implemented in conjunction with those provided for the New Airport. Water Supplies Department and Hong Kong China Gas Co. Ltd. will establish major installations on North Lantau. The former as part of their strategic upgrading of water supply to the Territory as a whole.

The mains supplies will be routed through a dedicated utilities reserve running parallel with the NLE/AEL corridor. This continues from Ta Pang Po through to the Sea Channel crossing. At appropriate points along the route, distribution supplies will be taken off to the various development sites. A layout of the utilities services is provided in Figures 9.13(a) and 9.13(b).

9.7.2 Water Supply

Raw water supply to Siu Ho Wan water treatment works will be obtained from Tai Lam Chung Reservoir via a raw water aqueduct system, which landfalls at Ta Pang Po. Potable water supply will be distributed from the Siu Ho Wan Water Treatment Works to the development via two service reservoirs located south of Tung Chung and south of Tai Ho.

A salt water supply will be installed to provide flushing water to the development. It will operate as a system requiring an intake and pumping station on the coast linking up with a storage reservoir within the potable water reservoir site. The location of WSD's saltwater intake is particularly sensitive to drainage outfalls

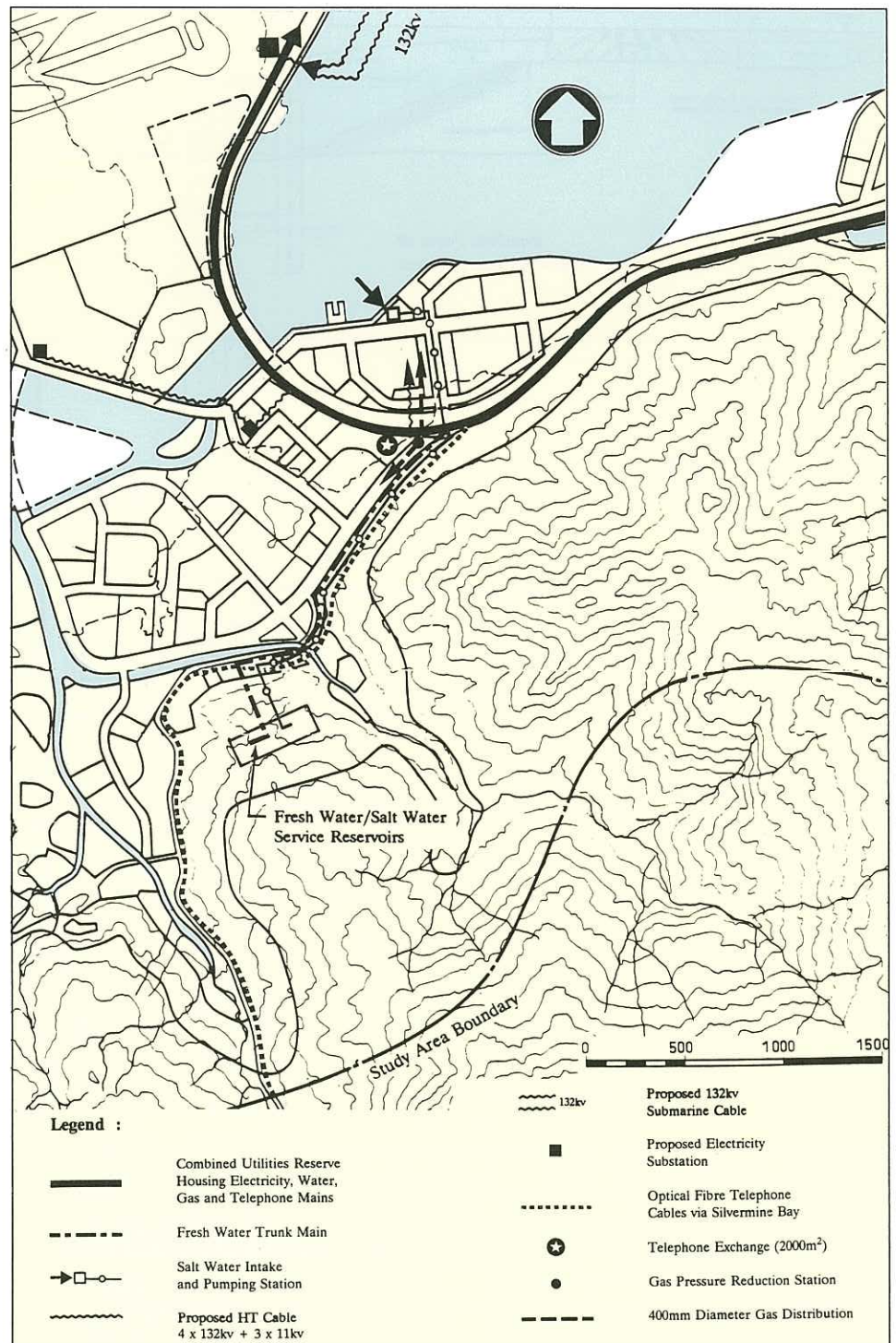


Figure 9.13(a) Utilities Layout - Tung Chung

and ferry terminal pollution. A separation of at least 100m is desirable and water quality needs to be good. For this reason a location within Tung Chung Area 51 has been reserved pending detailed layout plans for the

area being finalised. Construction is expected before the year 2000.

Irrigation water demand is likely to be significant, especially during plant establishment. In view of the value of

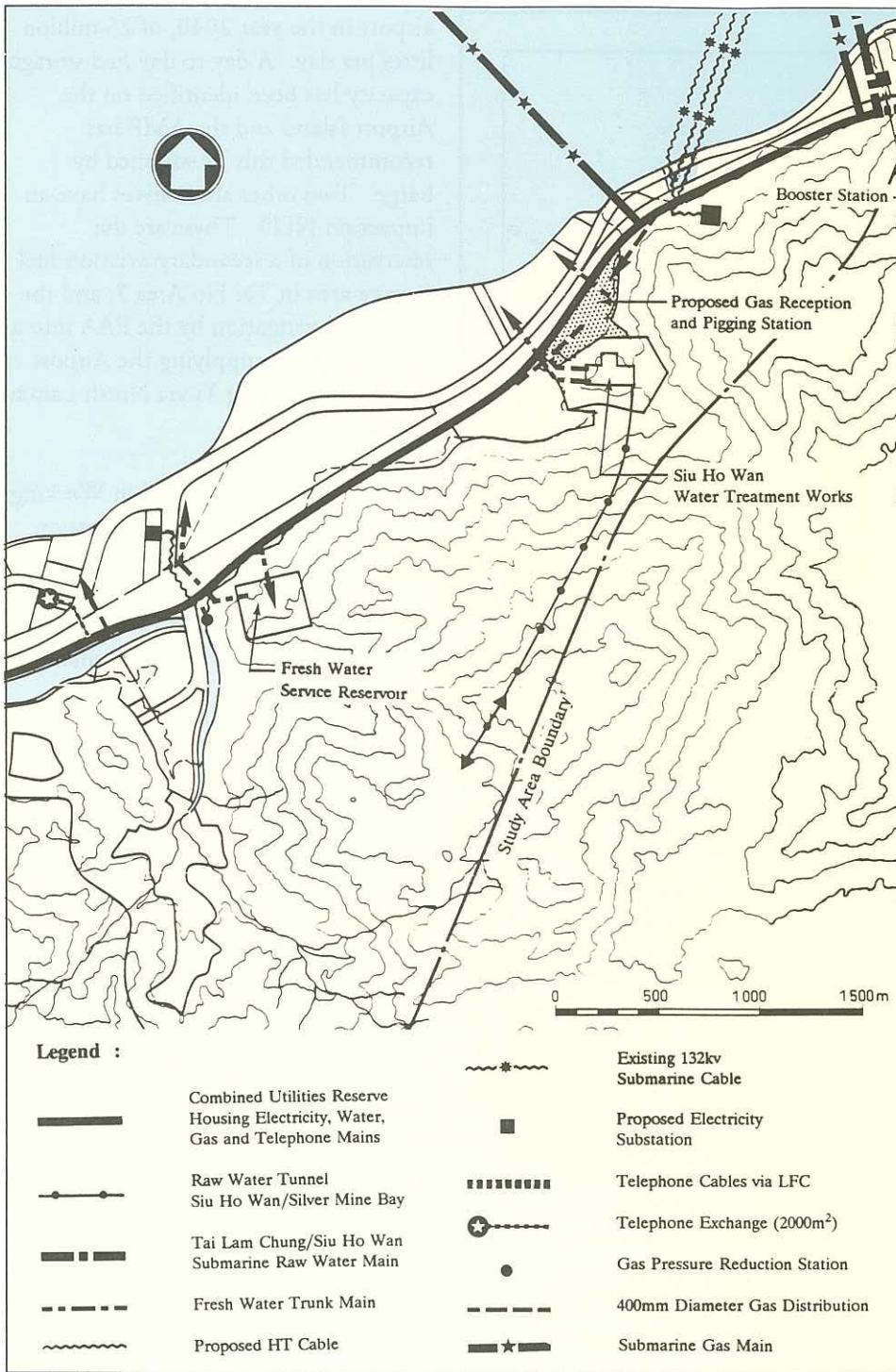


Figure 9.13(b) Utilities Layout - Tai Ho

water supply for other purposes, raw/potable water will not be entirely available for irrigation purposes. Alternative sources such as the proposed artificial lakes at Tung Chung and Pak Mong or treated effluent supply (in the

long term) from the Sewage Treatment Works may alleviate the shortfall.

The latter option will undoubtedly entail additional treatment in the form of further polishing and possibly

disinfection of the effluent. This process could increase capital cost by at least 10 percent. A further complication is that salt water flushing may be extensively used and would render the effluent too saline for irrigation water.

Well water may satisfy demand for irrigation water in the short term. However this source would likely become brackish over long term use. A reasonably reliable depth to dry weather ground water level has been estimated in Tung Chung based on piezometer measurements. A plot of assumed dry weather water table east and west of Tung Chung knoll is shown in Figure 9.14. It is recommended that a well is sunk somewhere in the Town Park (Tung Chung Area 29) which is designed to provide an initial source of irrigation water for early phases of development. This may then become a backup source for later phases when the Town Park is due for full development and planting.

Another possibility is the use of the reservoir which is to be constructed by WSD under their Contract 32/WSD/90 for use in providing a temporary water supply to the Airport Core Projects. This reservoir may, possibly, be adapted to receive a certain quantity of locally intercepted catchment which may be stored in the reservoir and transferred through the mains. WSD should be consulted on this option.

9.7.3 Electricity

North Lantau Development will be served by a 132kV network from Castle Peak Power Station. This is initially afforded by three submarine cables with their landfall at Sham Shui Kok. The 132kV cables will be routed in the utilities reserve to some seven primary substations in Tai Ho Wan, Tung Chung and at the New Airport.

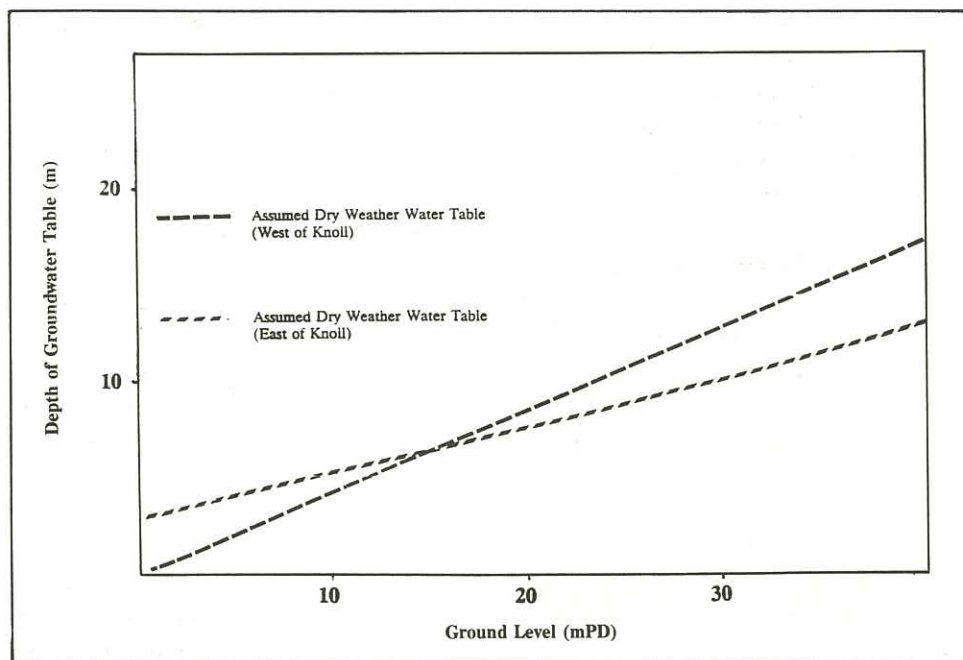


Figure 9.14 Ground Water Levels at Tung Chung Knoll

A further 132kV Supply will be laid beyond the year 2000 to a primary substation to be located in Tung Chung. This will supplement the initial supply arrangements.

An 11kV network will run in parallel with the 132kV cables in the utilities reserve to provide power for road lighting, emergency services and also to serve as interconnectors between primary substations. A separate overland 33kV supply to the Tung Chung area forming part of the present Lantau service already exists and may be retained for use in addition to the proposed Sham Shui Kok 132kV network.

9.7.4 Gas

In the absence of any mains gas supply on North Lantau, Hong Kong China Gas Co. Ltd is to provide a supply to the New Airport and the New Town from the high pressure gas transmission network in the new territories.

This will require a submarine main which landfalls at Ta Pang Po, feeding a Reception and Pressure Reduction Station at Siu Ho Wan. This facility will feed both to the New Airport and the New Town. Further pressure reduction stations will be required for gas distribution to both Tung Chung and Tai Ho townships.

9.7.5 Telephone

New telephone services using a fibre optic cable will be provided via the utilities reserve to new telephone exchanges to be located at Tung Chung and Tai Ho. The Tung Chung telephone exchange will also serve the New Airport and will be sized accordingly. As a result, the cabling associated with this exchange will be extensive.

9.7.6 Aviation Fuel

The Airport Master Plan estimated a projected fuel consumption for the new

airport in the year 2040, of 25 million litres per day. A day to day fuel storage capacity has been identified on the Airport Island and the AMP has recommended this be supplied by barge. Two other alternatives have an impact on NLD. These are the reservation of a secondary aviation fuel storage area in Tai Ho Area 7, and the current investigation by the PAA into a pipeline option supplying the Airport directly from Tsing Yi via North Lantau Development.

Tai Ho Area 7 was decided in Working Paper WP8, as the optimum location for a Jet A fuel reception and secondary storage area on NLD because it has good deep sea access and is rather remote from residential development. It offered a direct link between the storage area and the Airport, if a submarine pipe was required to supply the fuel onwards to the Airport. The site at Tai Ho Area 7 is now on hold pending final resolution of the method of aviation fuel supply to the Airport.

The latest proposal from the Oil Tank Farm Consortium in Tsing Yi suggests running twin 300 dia. pipelines from Tsing Yi to east Lantau. This route then broadly follows the NLE through to the southern Airport area. Investigations by PAA are underway to verify the engineering feasibility of this option.

9.8 Public Service Facilities

9.8.1 Sewerage and Sewage Treatment

The development of North Lantau gives rise to a need for comprehensive sewerage, sewage treatment and disposal facilities. Various options were considered and it was concluded that a single treatment works with capacity to treat flow from the Airport, North

Lantau Development, retained communities and possibly the port, offered the most economic solution. This option also affords sufficient flexibility to allow incorporation of the scheme into the proposed strategic sewage disposal system or, alternatively, upgrading to full treatment at some future date. Options involving the construction of separate treatment works for Airport and Development have been investigated by the Airport Master Plan Consultants (AMPC). Their report to the Provisional Airport Authority (PAA) of March 1991 "Cost of Sewage Treatment Works", concurred that a single treatment works was the most cost effective option.

The key issues involved in the selection of a suitable point of final discharge and the selection of a site for the Sewage Treatment Works were broadly defined in Working Paper WP8. In consideration of the point for the final discharge of sewage effluent Working Paper WP8 identified the following issues as being decisive factors,

- o identification of receiving water of adequate depth and demonstrating sufficient tidal current to afford acceptable initial dilution and dispersion of the polluting load,
- o assessment of the assimilative capacity of the receiving water and the impact on water quality of the discharge,
- o avoidance of submarine utilities,
- o avoidance of gazetted marine borrow areas,
- o consideration of the potential hazard to aviation posed by sea birds attracted to outfall discharges.

Working Paper WP8 identified two possible discharge points, the first in water of approximately 10m depth to the south of East Brother Island and the second in deep water to the north of East Brother Island.

A water quality impact assessment was carried out on both of these identified options. This assessment employed the WHAMO suite of mathematical hydrodynamic water quality and bacterial dispersion models. The water quality modelling was reported on in Technical Note TN2. This included a comparison of the water quality impact of both options and an assessment of the level of sewage treatment required to comply with the water quality objectives. Technical Note TN2 recorded that there was no discernable benefit from considering a longer outfall to the north of East Brother Island and recommended a shorter outfall to the south of East Brother Island be selected. Technical Note TN2 also reported that preliminary treatment of sewage would be adequate to meet current water quality objectives but recommended that sufficient space be reserved at the Sewage Treatment Works site for primary on full treatment in case this should be required at a later date.

In selecting a site for the Sewage Treatment Works, Working Paper WP8 addressed considerations of land availability, access and identification of compatible land uses. A reclaimed embayment site resulting from the construction of the NLE at Siu Ho Wan in Tai Ho Area 5 was identified as offering the optimum location and this location was recommended. Working Paper WP8 was endorsed and the selection of the recommended treatment works site was approved at the 4th Steering Group Meeting of 7th

December 1990. Subsequently at their meeting on 8th April 1991 DPC endorsed the principle of an above ground treatment works at Siu Ho Wan.

The sewage treatment process options were detailed in Design Memorandum DM1 in which an outline design was developed. This outline design defined the ultimate land requirement for the works and established design principles. The draft layout for the works has been further refined and is shown in Figure 9.15.

Stage 1 of the works will comprise preliminary treatment combining coarse screening, fine screening and degritting. Stage 2 could include full treatment but should connection to the strategic sewage disposal system be required primary treatment only may be adequate. In either event the Stage 1 outfall works will be retained for final effluent discharge in the full treatment option or as an emergency overflow system in the strategic sewage disposal option.

The treatment works has been sized to allow for phased implementation to meet requirements up to the year 2040. Over this extended timespan technology may improve, water quality objectives may be revised or economic factors may change. The provisions allowed for in the currently perceived ultimate requirements should enable all but the most radical variations to be accommodated.

The estimated flow and loads for the various component sources over the full design horizon are indicated in Table 9.9. These figures have been updated and revised in line with the latest estimates of Airport flow from the

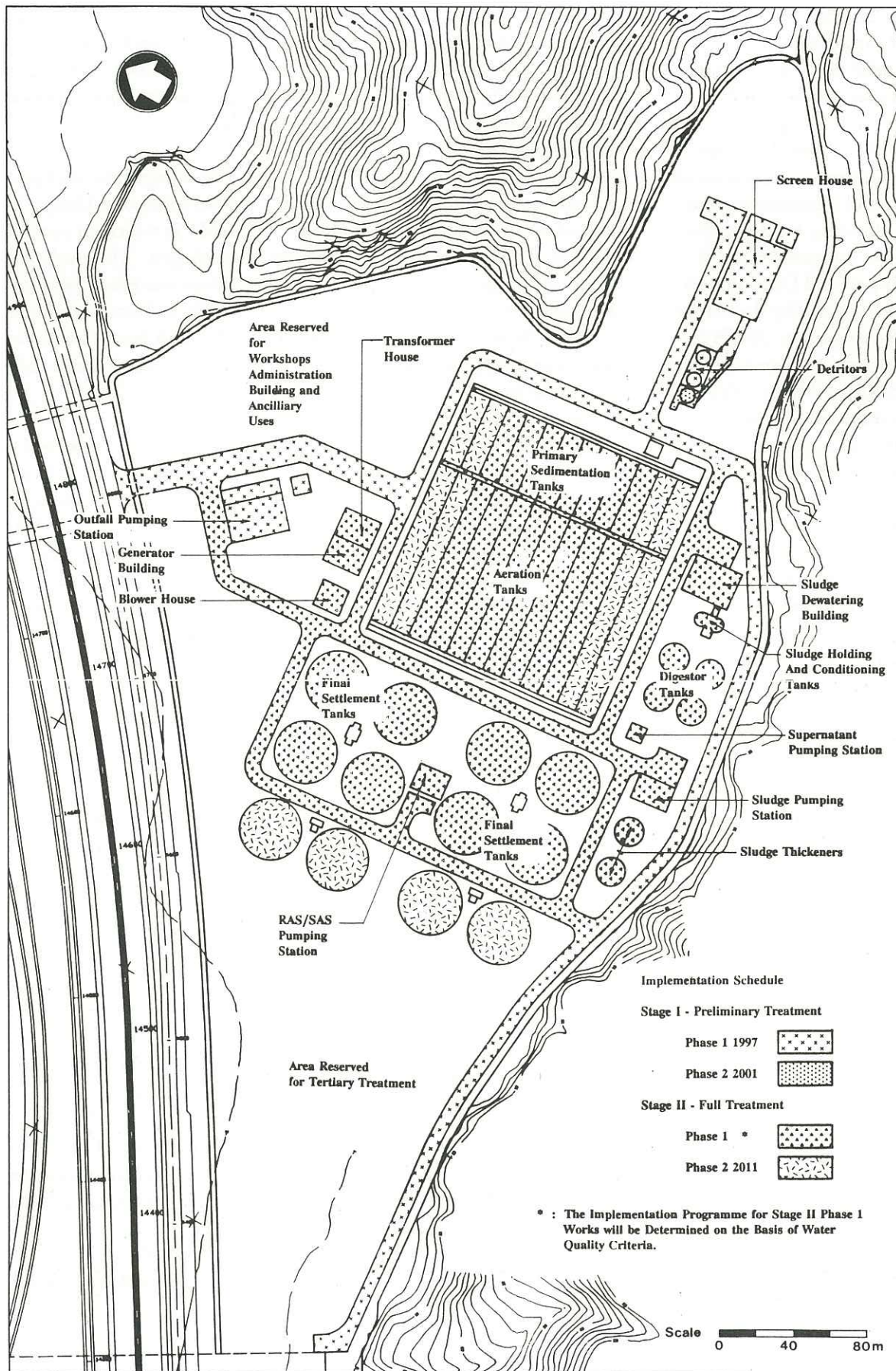


Figure 9.15 Sewage Treatment Works Layout

Table 9.9 Total Flows and Loads

Year	Source	Flow m ³ /d	SS Kg/d	BOD Kg/d	COD Kg/d	TKN Kg/d	NH ₃ N Kg/d	TTM Kg/d	E.coli (x10 ¹⁰ /d)
1997	Airport ⁽¹⁾	14040	5317	6692	13933	955	459	28	360000
	Development ⁽²⁾	6929	1503	1711	4123	278	154	109	118497
	Port ⁽²⁾	1262	236	383	739	22	9	42	2197
	Total	22231	7056	8786	18795	1255	622	179	480694
2001	Airport	14040	5317	6692	13933	955	459	28	360000
	Development	25666	5569	6338	15272	1030	569	404	438931
	Port	3937	729	1189	2295	68	28	129	6821
	Total	43643	11615	14219	31500	2053	1056	561	805752
2006	Airport	14040	5317	6692	13933	955	459	28	36000
	Development	47632	10048	12577	27274	1865	1046	666	807382
	Port	7943	1456	2371	4760	151	67	262	21720
	Total	69615	16821	21640	45967	2971	1572	956	1189102
2011	Airport	14040	5317	6692	13933	955	459	28	360000
	Development	74002	15553	19194	41494	2951	1648	882	1300300
	Port	14084	2559	4166	8286	272	118	437	42705
	Total	102126	23429	30052	63713	4178	2225	1347	1703005
2040	Airport	23200	7525	9037	19109	1296	660	38	520000
	Development	99144	20421	25190	54387	3860	2172	1169	1702890
	Port	17605	3200	5200	10358	340	148	546	53381
		139949	31146	39427	83854	5496	2980	1753	2276271

Source : NLD and AMP Consultants

Note: (1) Airport flows and loads AMPC estimate

(2) Development and Port flows and loads NLDC estimate

AMPC and reflect the residential and occupational distributions proposed in the Recommended Outline Development Plan. Port flows and loads have been estimated from the data in LDPC Paper 20/90. It is not currently expected that more detailed information on port flows will be available before the commencement of detailed design of the Phase 1 works but no major revisions are anticipated.

The sewerage scheme and sewage transfer system to Siu Ho Wan will be implemented in distinct phases. The phasing will allow the maximum flexibility in design to accommodate any changes in scheme requirements that may emerge as the development proceeds.

In the first phase a pumping station and rising main will convey sewage arising

from the Airport and Tung Chung Phase 1 to Siu Ho Wan. As the pumping station site and the sewage treatment works are both located adjacent to the North Lantau Expressway an opportunity is afforded to route the connecting pipeline along the expressway to achieve a direct route with a low pumping head. The rising main will be routed along the utilities reserve and has been sized to carry flows

emanating from the Tung Chung area of the New Town and the New Airport up to year 2011. Beyond this time it is planned to accommodate the increasing flows from the New Airport and Post 2011 development in the Tung Chung area, within a second sewerage route. This will also be designed to receive flows from Tai Ho Wan area and will be commissioned with the later development phases of the New Town. Sewerage layouts for the Tung Chung and Tai Ho areas of the New Town are shown on Figures 9.16 and 9.17 respectively. More detailed plans are provided in Appendix I.

The second route will be part gravity and part rising main and will follow an alignment generally along the primary distributor road P1. Its presence will ensure there is flexibility in the sewerage layout for accepting future sewage flows. The phased implementation will limit initial costs to just those associated with the earlier development of Tung Chung.

9.8.2 Refuse Transfer Station

The development of a New Town to house a population ultimately rising to 260,000, together with a major New Airport, related commercial and industrial activities gives rise to requirements for the effective management of wastes and their safe disposal.

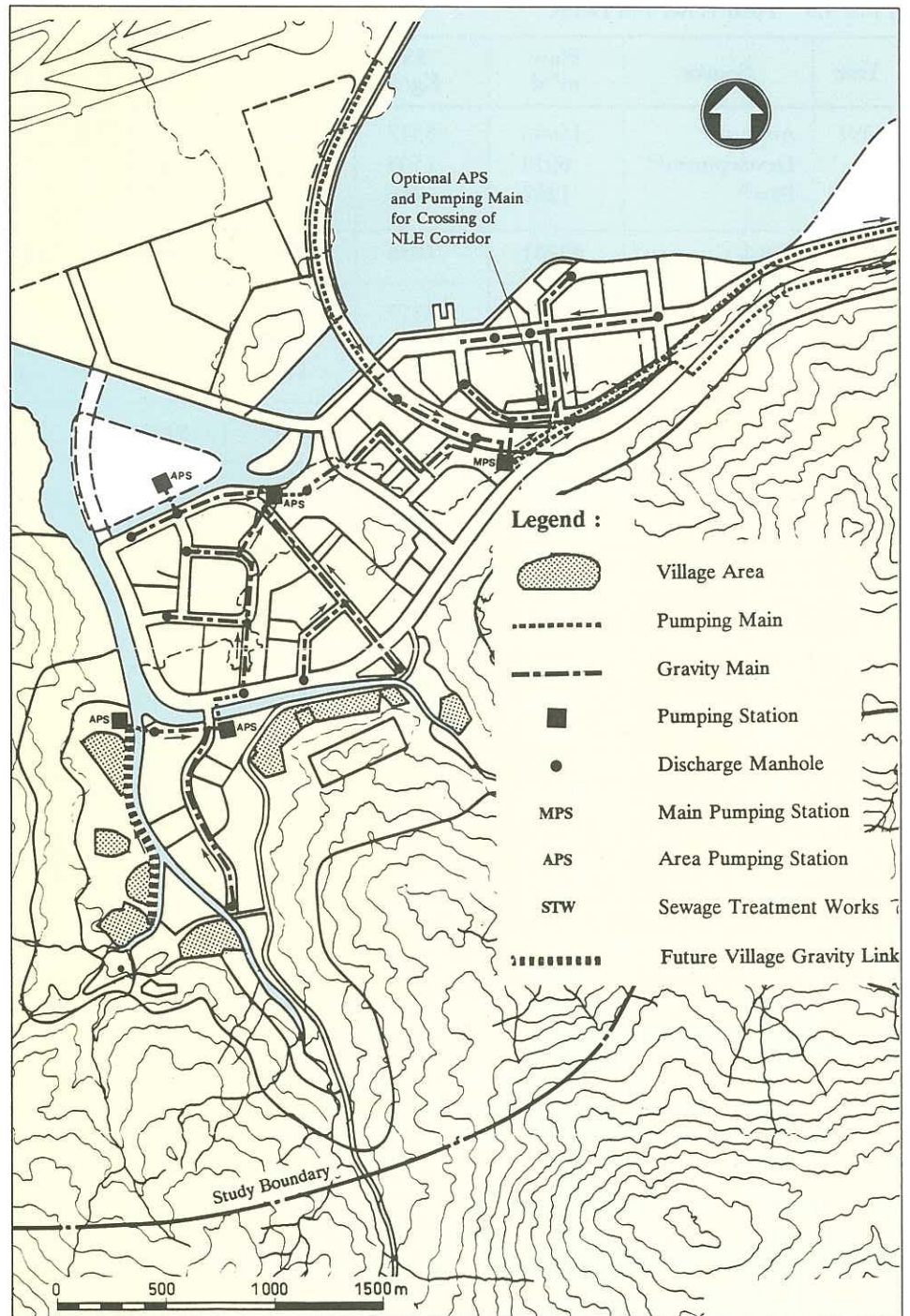


Figure 9.16 Sewerage Layout - Tung Chung Area

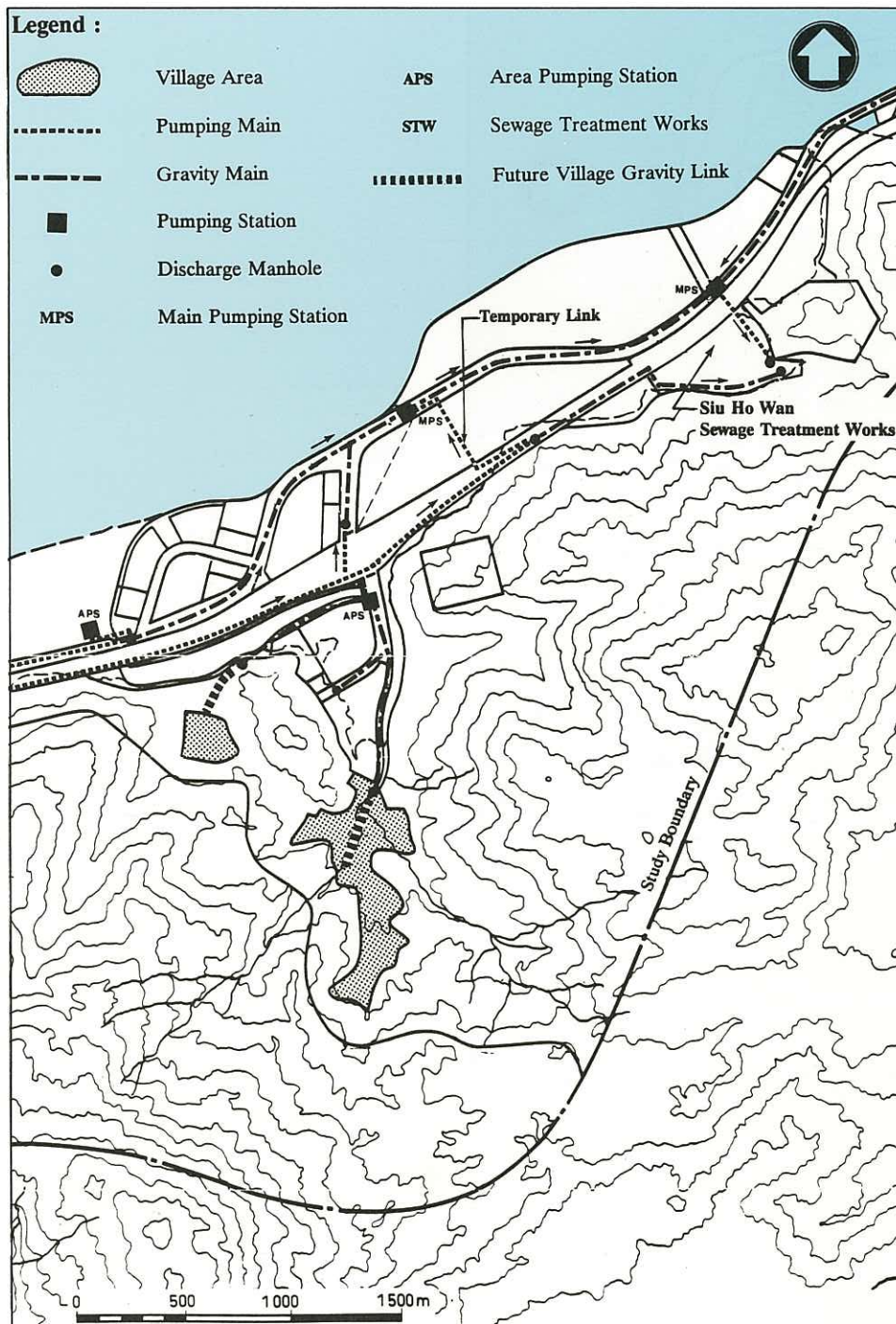


Figure 9.17 Sewerage Layout - Tai Ho Area

A facility for dealing with collected solid wastes will be sited at Sham Shui Kok. This facility will be designed to receive such wastes from the New Airport, the New Town and the Port Peninsula, as well as additional solid waste arising from the nearby Sewage and Water Treatment Works. A common refuse transfer facility was found to be the most cost effective means of dealing with waste arisings from these adjacent developments. All waste received will then be handled and compacted so as to be suitable for transfer off North Lantau by barge to a designated landfill in the West New Territories (WENT).

The site of the Refuse Transfer Station has been chosen because of its remoteness from residential developments, because it provides adequate marine access and reduced risk of birdstrike to aircraft using the New Airport. Vehicular access will be provided both along the Primary distributor P1 (in the longer term) as well as through an underpass to the utilities reserve which refuse vehicles will use in the short term.

The area reserved for this facility was based on data of waste arisings from similar sources gathered during the study. The total waste arisings are forecast to be as shown in Table 9.10 below. These are preliminary estimates only and will need to be reviewed prior to commitment at system design stage.

A suggested layout of the Refuse Transfer Station has been developed to check the site area allocation on the RODP. This suggested arrangement is shown in Figure 9.18.

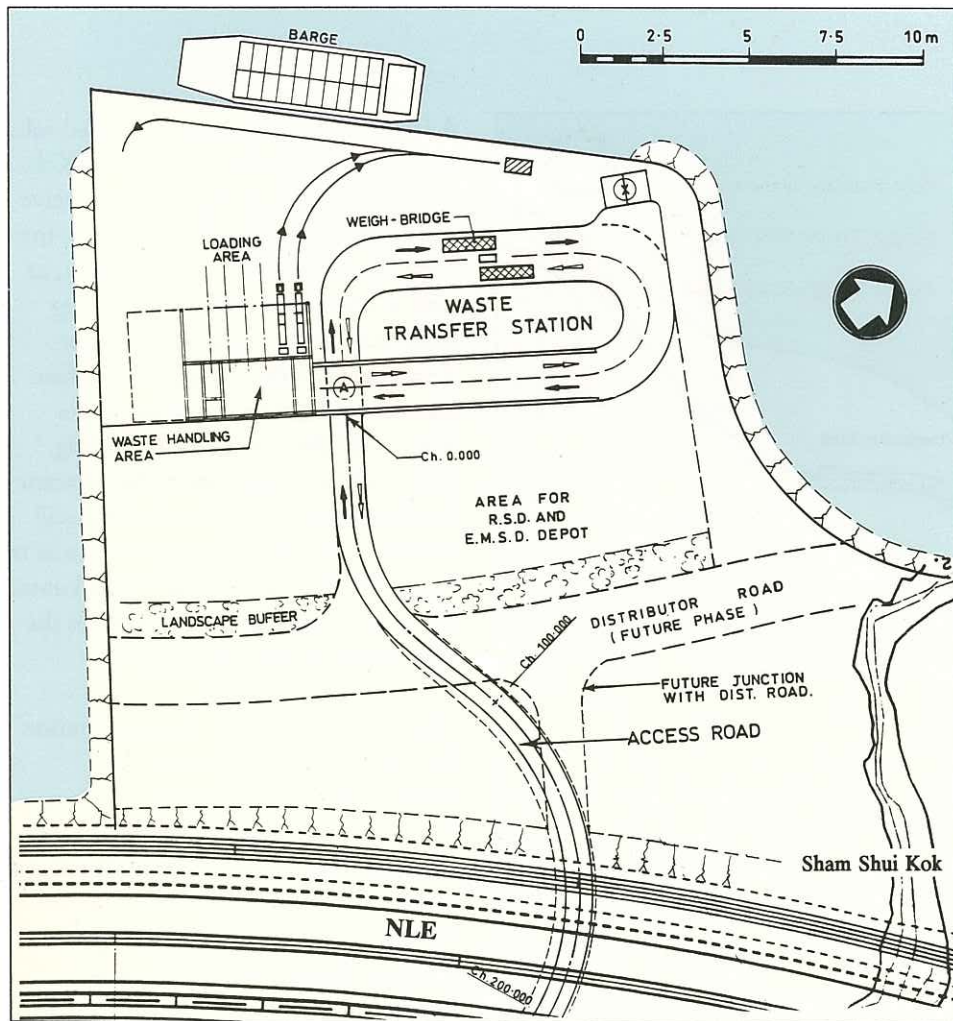


Figure 9.18 Refuse Transfer Station Layout

Table 9.10 Total Forecast Waste Arisings (tonnes/day)

Source of Waste	Year/Persons per hectare				
	1997	2001	2006	2011	Post 2011
Publicly Collected	18	60	120	200	260
Privately Collected					
Airport	130	140	165	195	423
Other	28	89	170	237	284
Sub Total (1)	176	289	455	632	967
Sewage Sludge (max)	28	56	83	93	120
Water Works Sludge	14	28	42	46	60
Construction	4	13	31	47	156
Port Peninsula(2)	40	80	120	150	180
Total	262	466	731	968	1483

Source : EPD 1989 - Data and Consultants Estimates

- Note: (1) Amount for direct delivery to transfer station.
 (2) Notional amounts subject to review by Port Peninsula Development Consultants.

North Lantau Development



10. Transport Issues

10. TRANSPORT ISSUES

10.1 General Approach

10.1.1 Background

The Transport Plan of the RODP was developed using the North Lantau Transport Model to determine future transport conditions. The North Lantau model is itself based on the PADS version of the CTS-2 transport model.

10.1.2 Boundary Conditions

The PADS model was run for the three forecast years (2001, 2006 and 2011) required by the Study Brief to determine traffic movements to and from Lantau. These external flows then served as “boundary conditions” for the North Lantau Transport Model, which determined local on-Lantau movements. Details of these boundary conditions are set out in Appendix G.

The committed road transport system which will link Lantau to the rest of the Territory will consist of:

- o Lantau Fixed Crossing (LFC): dual-three lane bridge to be completed by 1997;
- o Green Island Link (GIL): dual-two lane tunnel to be completed by 2006; and
- o Ma Wan - Sham Tseng Link (MW-STL): dual-two lane crossing to be completed by 2011.

In addition to these, the Airport Express Line will connect Lantau to the Urban Area via:

- o Airport Express Line (AEL): providing air passengers and their companions with a 21-minute service between Chek Lap Kok Airport and Hong Kong Island; and

- o Lantau Line (LAL): a domestic service serving Tung Chung, Tai Ho Wan and the Port Peninsula on Lantau Island and various developments along the route to Hong Kong Island.

These external transport infrastructure links are illustrated in Figure 10.1.

The road links shown in Figure 10.1 will provide a total of seven traffic lanes on and off Lantau offering a total hourly capacity of 12,600 passenger car units (pcu) per direction. These facilities are key links in the airport/port access system and must maintain acceptable operating conditions to effectively serve these two important centres.

With the AEL operating from airport opening, the external road links will provide acceptable conditions. These are indicated in Table 10.1 in terms of

a volume-capacity (V/C) ratio of 0.9 or less for the combined external crossings. A delay in the opening of the AEL, or a change in the capacity or timing of the planned road links, could have significant negative implications on the development potential of Lantau Island in general, and for North Lantau in particular.

The external flows presented in Table 10.1 have an implied self-containment factor. Self-containment can be defined in many ways. In this case, it is the number of home-based North Lantau person trips staying on Lantau as a percentage of total North Lantau home-based trips excluding passenger-related airport trips. By 2011, the self-containment factor is expected to be 59 percent.

The New Town on North Lantau is being planned to be as self-sufficient as possible, with nearby employment

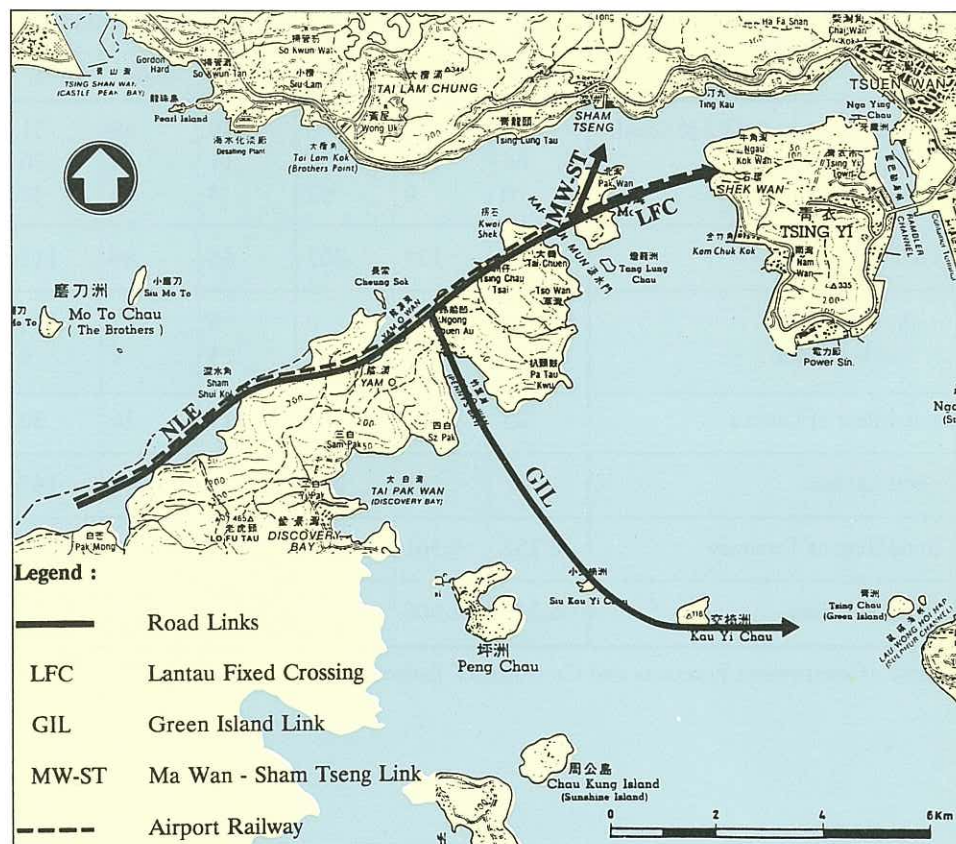


Figure 10.1 External Transport Infrastructure

Table 10.1 External Boundary Conditions

Peak Hour	Road Link	PCUs ('000s)/Volume - Capacity Ratio					
		To Lantau			From Lantau		
		2001	2006	2011	2001	2006	2011
AM	LFC	4.7/0.9	4.5/0.8	4.4/0.8	4.1/0.8	4.3/0.8	4.1/0.8
	GIL	-	2.1/0.6	2.7/0.8	-	2.1/0.6	3.3/0.9
	MW-STL	-	-	3.6/1.0	-	-	3.4/0.9
	Total	4.7/0.9	6.7/0.7	10.7/0.8	4.1/0.8	6.4/0.7	10.8/0.9
PM	LFC	4.1/0.8	4.2/0.8	3.6/0.7	4.8/0.9	4.7/0.9	4.1/0.8
	GIL	-	2.1/0.6	3.0/0.8	-	2.2/0.6	3.0/0.8
	MW-STL	-	-	3.1/0.9	-	-	3.3/0.9
	Total	4.1/0.8	6.3/0.7	9.7/0.8	4.8/0.9	6.9/0.8	10.4/0.8
Mid-day	LFC	4.7/0.9	4.7/0.9	4.0/0.7	5.1/0.9	5.1/0.9	4.4/0.8
	GIL	-	2.3/0.7	3.3/0.9	-	2.5/0.7	3.5/1.0
	MW-STL	-	-	3.6/1.0	-	-	3.5/1.0
	Total	4.7/0.9	7.0/0.8	10.9/0.9	5.1/0.9	7.6/0.8	11.4/0.9

Source : Consultants' Estimates

Table 10.2 Land Use Assumptions

Area	Population ('000s)			Employment ('000s)		
	2001	2006	2011	2001	2006	2011
o New Airport and CLK South	0	0	0	46	49	51
o Tung Chung	64	123	150	11	23	30
o Tai Ho	0	0	52	8	16	30
Total NLD Area	64	123	202	65	88	111
o Port Peninsula	1	0	0	6	12	26
o South Lantau	22	22	21	5	4	4
Total Rest of Lantau	23	22	21	11	16	30
Total Lantau	87	145	223	76	104	141
Total Rest of Territory	6,252	6,361	6,406	3,056	3,106	3,097
Total Territory	6,339	6,506	6,629	3,132	3,210	3,238

Source : Government Forecasts and Consultants' Estimates

opportunities, recreational/shopping facilities and schoolplaces. However, for transport planning purposes it is necessary to assume a more balanced situation so that the critical external link demands are not underestimated. Therefore, the 59 percent self-containment factor noted above should not be taken as representative of what is actually being planned for North Lantau.

10.1.3 Land Use Assumptions

Both the PADS and North Lantau transport models use estimates of population, employment, schoolplaces and hotel rooms to forecast traffic. Details of the assumptions used for Lantau and the rest of the Territory are provided in Appendix G. Table 10.2 presents a summary of the critical population and employment assumptions for areas defined in Figure 10.2.

The New Airport and Port Peninsula are two significant contributors of traffic. The estimates of airport groundside traffic were provided by the Airport Master Plan Study (AMPS) Consultants. These estimates reflect the annual activity levels set out in Table 10.3.

The level of Lantau port development assumed in the forecasts is the same as for the original PADS Study. This is shown in Table 10.4.

Since the beginning of the NLD Study in August 1990, there have been downward revisions to the port forecasts suggesting less multi-purpose terminal development on Lantau. Since the strategic road network was able to accommodate the higher traffic demands associated with the original PADS forecasts, this reduction does not

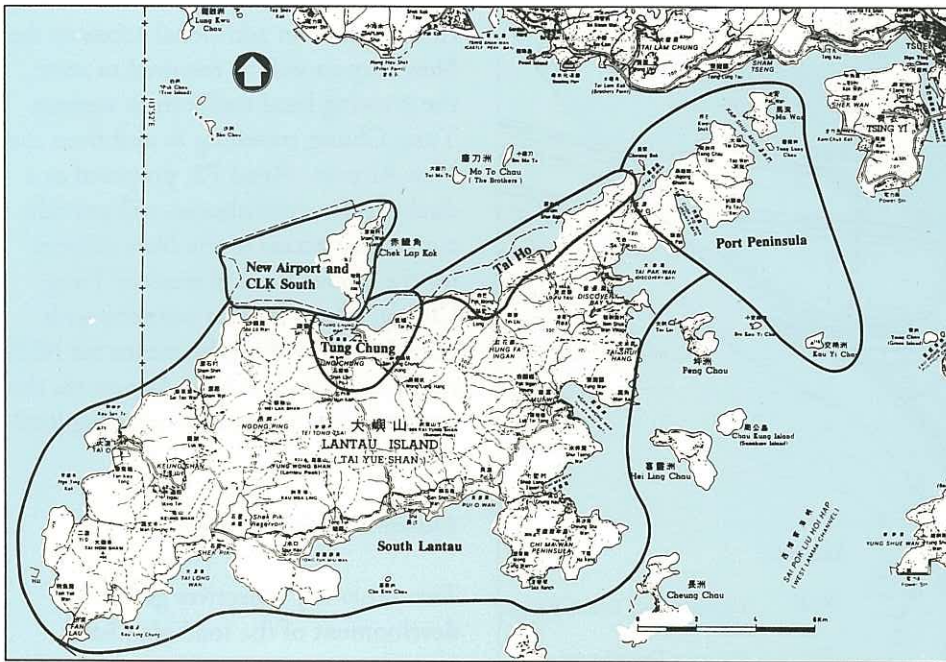


Figure 10.2 Land Use Areas and Population Zones

Table 10.3 Predicted New Airport Throughput

Year	Arrivals / Departures (millions)	Freight Traffic (million tonnes)
2001	26	1440
2006	33	1990
2011	39	2450

Source : Airport Master Plan Study

Table 10.4 Predicted Lantau Port Facilities

Year	Metres of Berth	
	Container Terminal	Multi-Purpose Terminal
2001	1,160	1,600
2006	4,160	3,620
2011	8,840	9,150

Source : PADS

have a significant impact on the planning of NLD. The boundary conditions also reflect the PADS Study recommendation that if it is necessary, relocation of the Macau/China Ferry Terminal should be in the Port Peninsula area.

10.1.4 Other Studies

As previously noted, the airport traffic forecasts were provided by the Airport Master Plan Study (AMPS) Consultants. These forecasts are

consistent with the findings of the Airport Railway Feasibility Study (ARFS) in terms of the percentage of air passengers predicted to use the AEL. This is, 45 percent of passengers in 2001, falling to 36 percent by 2006, and rising again to 43 percent by 2011.

Another study providing significant input to the transport modelling was the Study of Industrial and Commercial Enterprises that Need Relocation with the Airport (SICENRA). This study provided employment estimates for airport-related activities and the methodology for estimating air cargo village traffic. The outputs of the SARA Study (when available) may also effect the transport modelling so far carried out.

10.2 Road Network

10.2.1 Principal Features

Figures 10.3(a) and 10.3(b) indicate the proposed road network road system for the New Town on North Lantau. Key objectives which have guided the plan are highlighted below.

Airport Access

The starting point of the highway planning was the North Lantau Expressway (NLE) which principally serves the New Airport. An objective of the plan was to maintain high traffic standards on this critical access as it passes through the urban areas. Discussion of this issue with the Airport Master Plan Study (AMPS) led to the concept of the segregation of local New Town traffic from New Airport and through traffic on the NLE in order to eliminate any weaving movements which would reduce the capacity of this important road section.

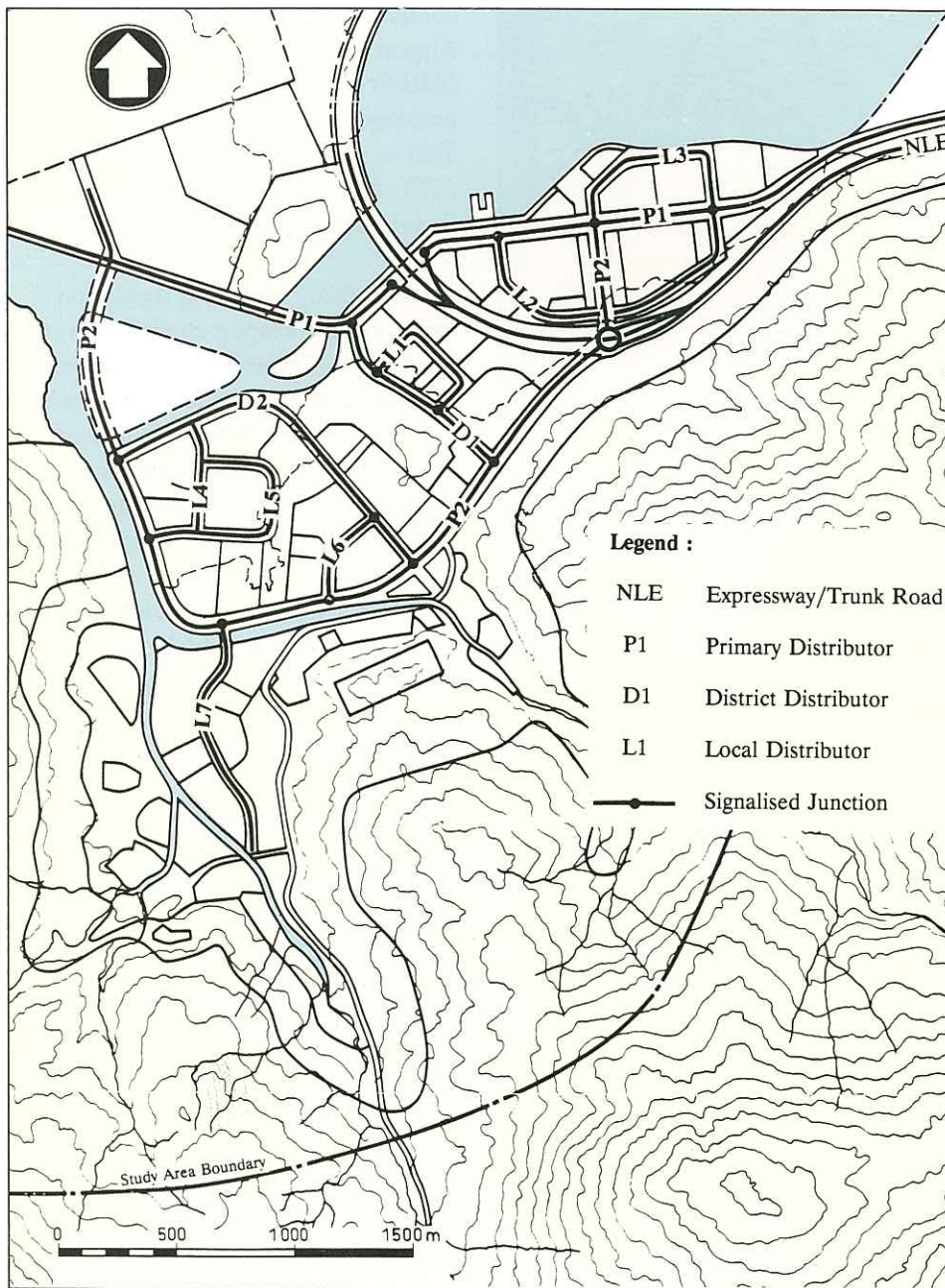


Figure 10.3(a) Proposed Road Network for the New Town at Tung Chung Area

Consequently, from New Airport opening, there will be two roads crossing the sea channel to Chek Lap Kok Island. These are:

- o the dual three-lane NLE serving longer distance travel; and

- o the dual two-lane distributor road (P1) catering for local traffic between Tung Chung and the New Airport.

The local road network on Chek Lap Kok Island has not been fully defined so that the routing of the Road P1, north of the sea channel, is only indicative at this time.

In the future an additional access to the New Airport will be required to serve the growing local traffic from western Tung Chung travelling to and from the New Airport. Road P2, proposed as a dual two-lane distributor, will provide convenient access to the New Airport for the labour force in western Tung Chung. Road P2 also connects with the NLE, providing the means for NLE traffic to access the New Airport via the western route without penetrating local residential areas.

Distributor Road System

Two other key objectives guiding development of the road plan have been:

- o to keep airport traffic out of the local Tung Chung neighbourhoods; and
- o to keep all through traffic out of local residential areas.

This has been accomplished by providing a primary and district distributor road system which encircles the development areas, routing traffic around, but not through them. Road P1 is not recommended to continue westward to connect to Road D2 in order to form a complete circular distributor system for three reasons. Firstly with the provision of Tung Chung West rail station, the capacity of such a link is not required. Secondly in the worst scenario of an accident on the southern section of Road P2, traffic between junctions P2/D1 and P2/D2 has two alternative route choices; these are either the depressed or at grade P2 (whichever is not blocked) or via the Airport Island using Roads P1 and P2 crossing the Sea Channel. Thirdly, by not having the road link the Town Park continues all the way to the waterfront promenade, enhancing the pedestrian

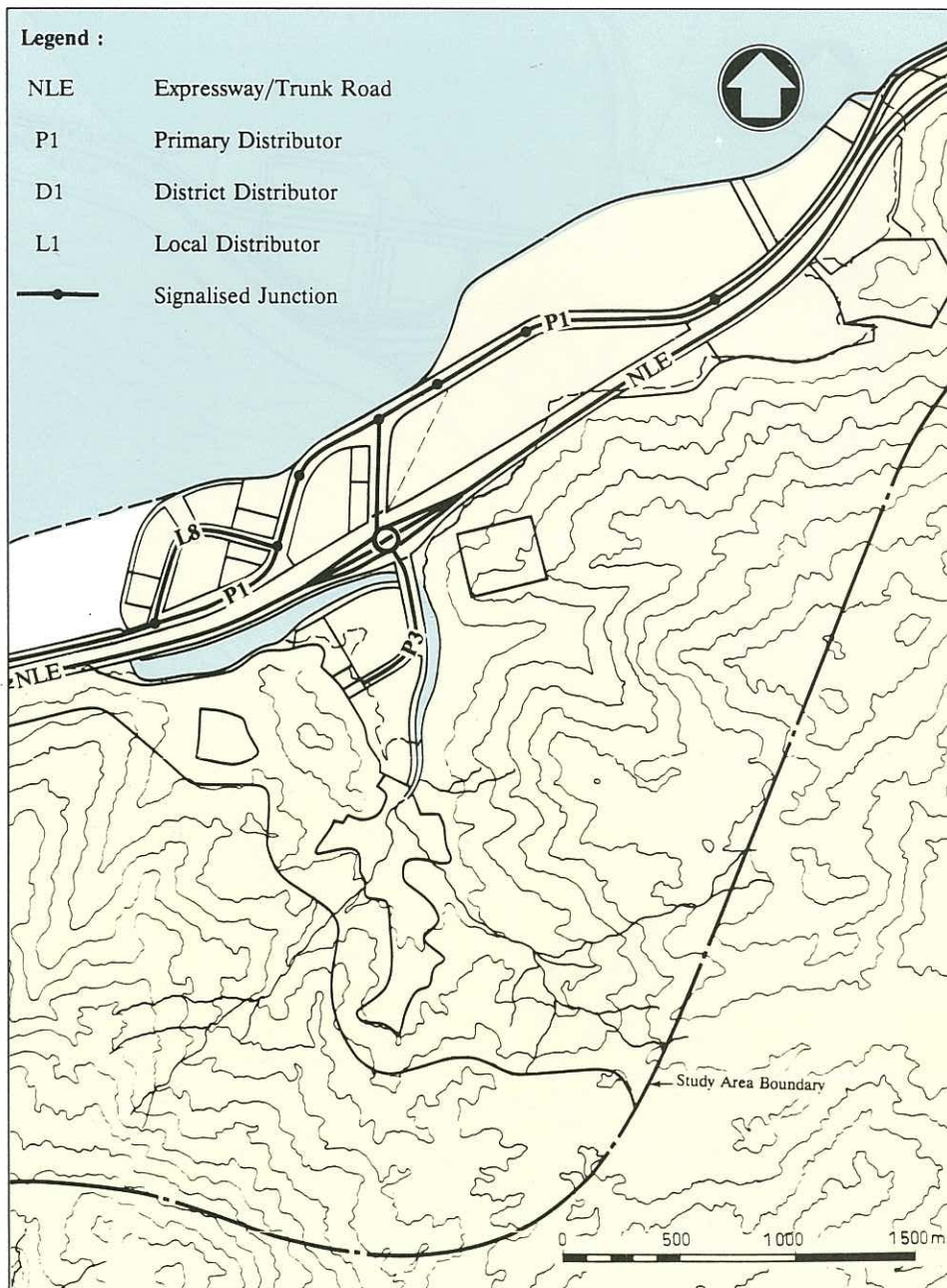


Figure 10.3(b) Proposed Road Network for the New Town at Tai Ho Area

accessibility of both facilities. However, should a second rail station not be provided, resulting in changed traffic conditions, a link road across the seaward end of the Town Park (essentially to be used as a busway) could be provided at an amenity cost.

A possible route is indicated in Figure 7.6, the Town Park. This route may also be considered as an emergency link for other traffic.

10.2.2 North Lantau Expressway

The NLE is a dual three-lane highway connecting the Lantau Fixed Crossing

to the New Airport. In the NLD area there will ultimately be three interchanges, two in Tung Chung and one in Tai Ho Wan.

Tung Chung Interchanges

Both interchanges are proposed to be in place in 1997, although the eastern one will not be fully complete until a later phase when development in areas to the north of the NLE is more advanced.

The eastern interchange is an elevated roundabout initially serving development to the south of the NLE and later to the north as well. The interchange adjacent to the Sea Channel will be at grade, with the slip ramps to and from the NLE incorporated into a signalised junction. Both interchanges serve movements across the NLE and movements between Tung Chung and eastern Lantau. No local Tung Chung traffic, travelling to or from the New Airport, can use the NLE. Providing this movement at either interchange would result in weaving movements through the section, compromising the NLE capacity.

Tai Ho Wan Interchange

The Tai Ho Wan interchange is an elevated roundabout providing full movements to, from and across the NLE, and would (with minor approach modifications) be able to cater for any connection with South Lantau accessing the NLE at this location.

10.2.3 Primary Distributors

There are three primary distributors in the NLD road system. All are dual two-lane dual 7.3m carriageways, with widening at signalised junctions where necessary.

Road P1

In its final form Road P1 will extend from the New Airport to the Port Peninsula, providing a parallel route to the NLE which could be used to reroute traffic in the event of an incident on the NLE. Initially the Tung Chung section will serve as the access road for local traffic to the New Airport and the Tai Ho Wan section will provide access for developments in the Siu Ho Wan area. Road P1 through Tung Chung and Tai Ho Wan Town Centres serves both primary and district distributor functions. It has been given the higher primary distributor classification to ensure it is designed to the stricter requirements of a primary distributor.

Road P2

Road P2 distributes local traffic around Tung Chung while also providing, in the long term, an alternative means for NLE traffic to access the New Airport. By Phase 3 (2006) when most of western Tung Chung is developed there will be the need for additional capacity at the junctions of Road P2 and Road D1 and with Road D2. This additional capacity can not be satisfactorily provided by junction widening, so that some form of grade-separation will be required. It is proposed that a depressed road section be formed at this location providing for the through traffic movements on Road P2. Removing these movements from the two signalised junctions results in acceptable junction conditions.

Road P3

Road P3 is the primary distributor connecting Tai Ho Wan North to Tai

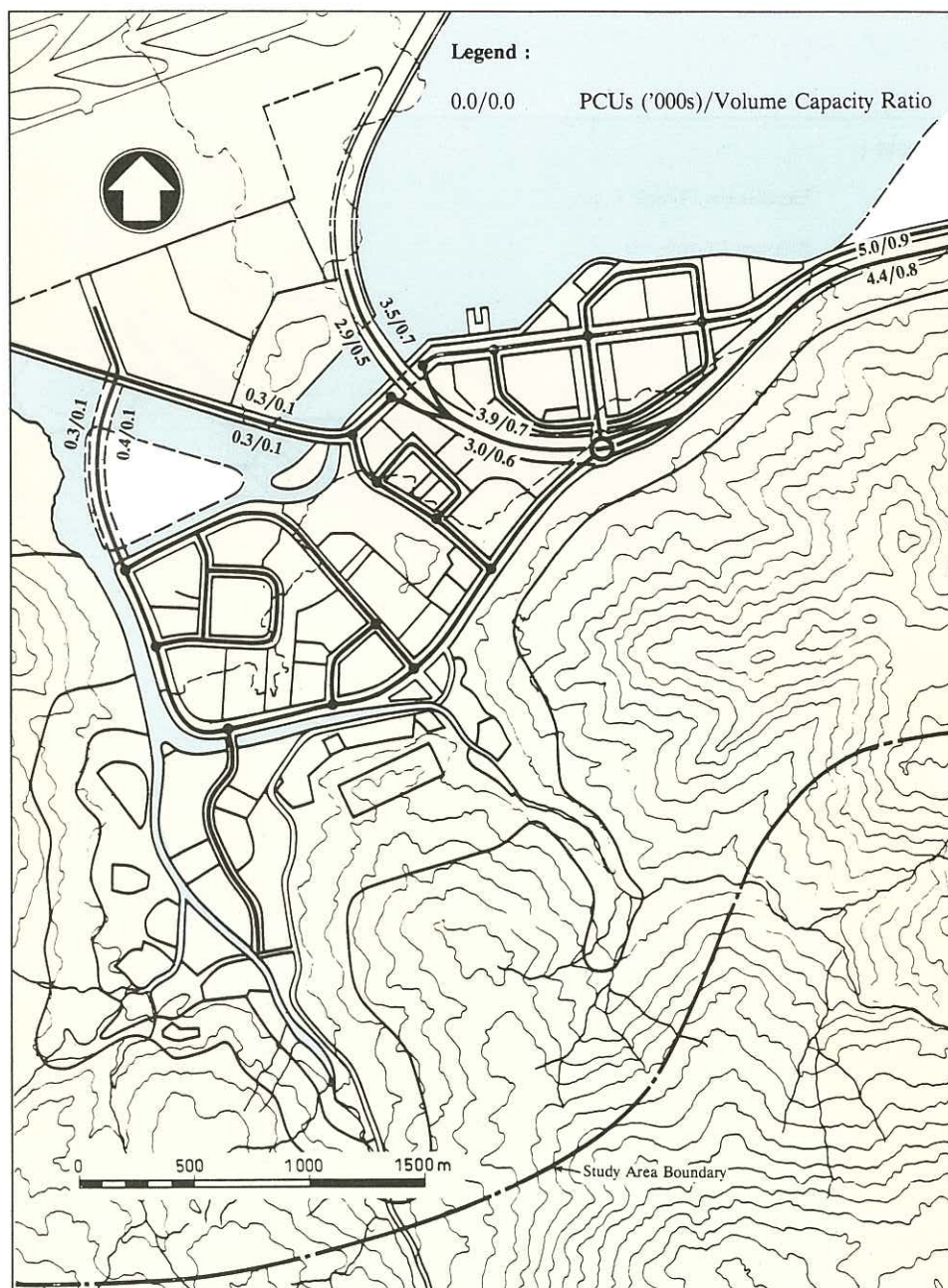


Figure 10.4(a) Midday Peak Hour : Traffic Conditions on NLE and P1 at Tung Chung Area

Ho Wan South. In the same way as the in-town sections of Road P1, the southern section of Road P3 serves both primary and district distributor functions. However, it is necessary for it to have primary distributor standards to ensure proper operation of the Tai Ho Wan interchange.

10.2.4 District Distributors

There are two district distributors, both located in Tung Chung. They are proposed to be dual two-lane 7.3m carriageways. These roads form part of a distributor system encircling development areas routing traffic

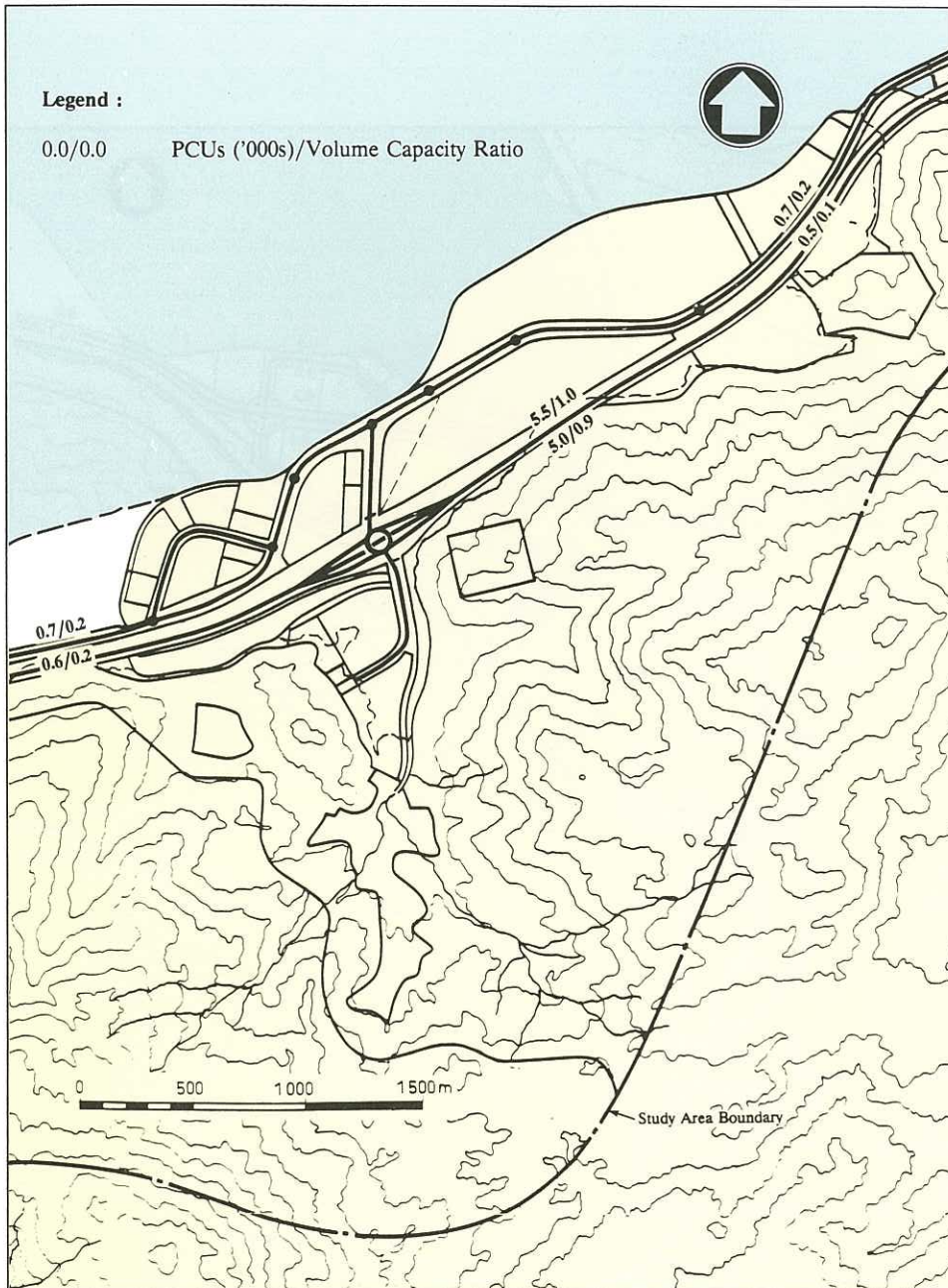


Figure 10.4(b) Midday Peak Hour : Traffic Conditions on NLE and P1 at Tai Ho Area

Table 10.5 NLE Traffic Conditions (2011)

NLE Road Segment	Direction	Peak Hour Volume (pcu)		Volume/Capacity Ratio	
		AM	Midday	AM	Midday
Channel Crossing	NB	2400	2900	0.4	0.5
	SB	2100	3500	0.4	0.7
Tung Chung	NB	2900	3200	0.5	0.6
	SB	2700	3900	0.5	0.7
Between Tung Chung and Tai Ho Wan	NB	4300	5000	0.8	0.9
	SB4	4000	4400	0.7	0.8
East of Tai Ho Wan	NB	4800	5500	0.8	1.0
	SB	4600	5000	0.8	0.9

Source : Consultants' Estimates

around, and not through, residential neighbourhoods. No individual development should have direct access onto a district distributor. Instead, this function should be provided by the local distributors and local roads.

10.3 Traffic Conditions

10.3.1 Introduction

Anticipated traffic conditions for the 2011 design year are presented in this section. General information on intermediate years is provided in Appendix G with details available in Topic Report TR19 (Revised).

10.3.2 The Expressway

The critical peak period for the local roads serving Tung Chung will occur typically in the morning. On the NLE, there will be more traffic around midday, which is the peak period for airport traffic. Figures 10.4(a) and 10.4(b) present midday peak-hour traffic conditions on the NLE in the Tung Chung and Tai Ho areas respectively. In Table 10.5 morning and midday peak-hour conditions on the NLE are compared.

In 2011, although the NLE through Tung Chung will have substantial spare capacity, it will be limited by the minimal spare capacity on the external links and on the section of the NLE east of Tai Ho Wan. Any additional traffic that can be accommodated by the external crossings can reach Tung Chung and the airport using Road P1 paralleling the NLE. This requires Road P1 being connected to the NLE at the Yam O interchange so traffic can travel from the external links to Road P1 and on to Tung Chung, and vice versa.

10.3.3 Tung Chung

Local traffic conditions are controlled by junction/roundabout operations. Morning peak-hour traffic and reserve capacity conditions in the Tung Chung area are presented in Figure 10.5 (a).

Reserve capacity is the percentage growth in traffic volumes that occur before congestion becomes a significant problem. Only 1 of the 14 signalised junctions in Tung Chung will have less than 25 percent reserve capacity. This indicates a large degree of flexibility in the transport plan to accommodate greater than anticipated traffic volumes. The Tung Chung roundabout will have acceptable conditions throughout the day with the morning peak hour being the critical peak period.

10.3.4 Tai Ho Wan

Figure 10.5(b) includes morning peak-hour traffic conditions in Tai Ho Wan. All junctions and the roundabout are expected to have reserve capacity, although there is only minimal spare capacity in the morning peak to take any additional traffic.

10.4 Public Transport

10.4.1 General Structure

Figures 10.6(a) and 10.6(b) show the public transport plan for the Tung Chung and Tai Ho areas of the New Town. Provisions for a ferry pier, rail stations, bus and Public Light Bus (PLB) termini, taxi stands and bus stops are indicated. The plan is a general guideline indicating the type and distribution of public transport service requirements. Additional in-depth studies will be necessary to fine tune details of bus and PLB provisions.

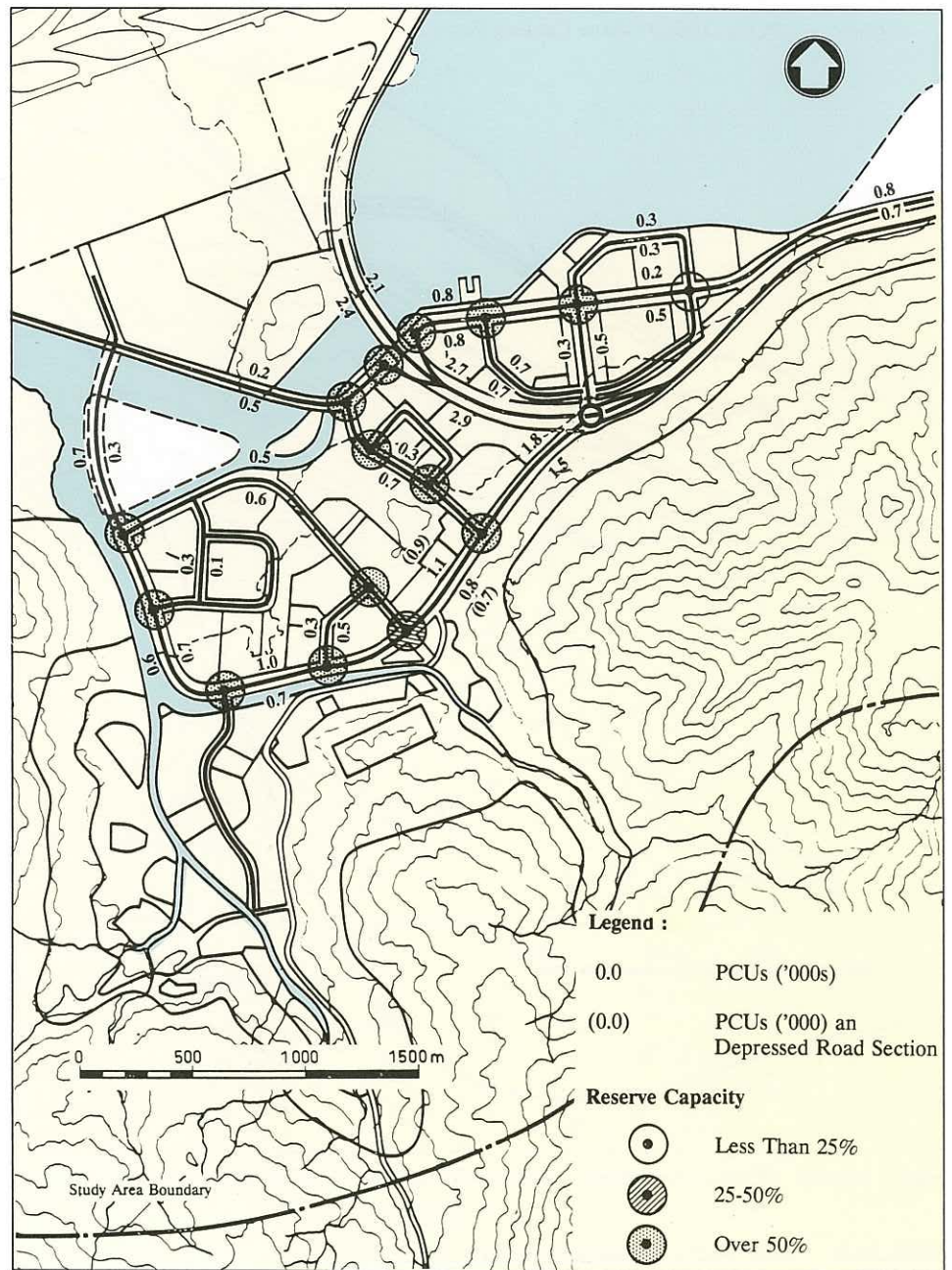


Figure 10.5(a) Tung Chung Area : AM Peak Hour PCU's and Reserve Capacity (2011)

As proposed, the transport plan does not include any dedicated busways since the LAL service would be used for fast connections between east and west Tung Chung. The RODP does not detail local road requirements and it is possible that some local busways could

be incorporated into the plan during Layout Plan development. If the plan is modified in execution and the Tung Chung West station is not built, busways would be required to provide adequate accessibility to residents in this area of the New Town.

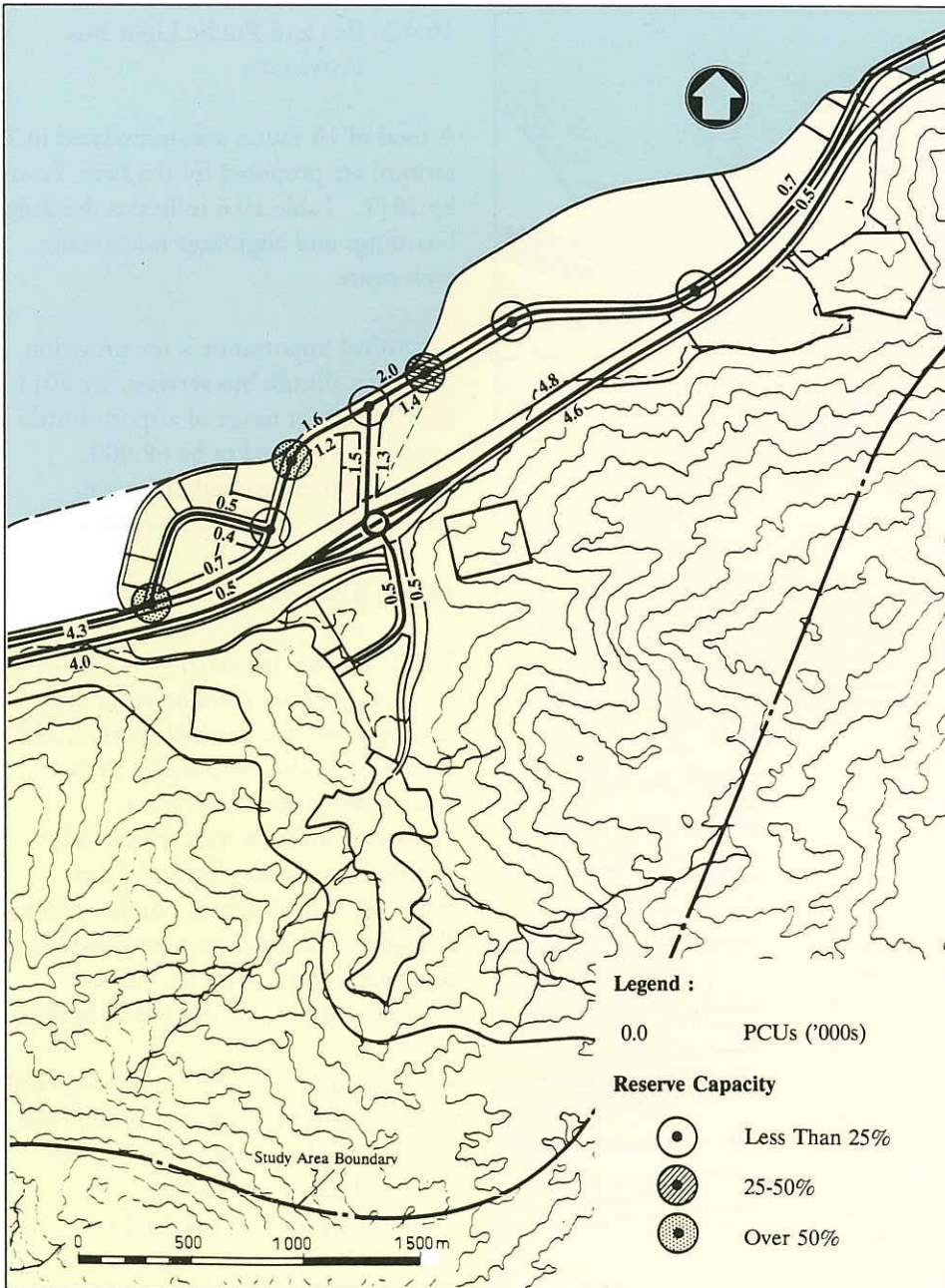


Figure 10.5(b) Tai Ho Area : AM Peak Hour PCU's and Reserve Capacity (2011)

10.4.2 Rail Stations

The plan provides ultimately for three Lantau Line (LAL) stations to serve the New Town; two in Tung Chung and one in Tai Ho Wan.

Tung Chung Stations

Two stations are recommended in Tung Chung in order to:

- o meet the objective of maximised rail usage,
- o minimise vehicular travel; and
- o give ease of accessibility and mobility, a critical feature in attracting residents to Lantau Island.

The first station to be developed will be Tung Chung Town Centre, which is assumed to be operational by 1997. This station will serve not only Tung Chung residents, but also workers on the Airport Island who will travel by airport shuttle buses from this station to their places of employment. By 2011, this station is expected to handle 101,000 passengers daily.

The timing of Tung Chung West station is tied to the development of the western part of Tung Chung. By 2006 when the population in Tung Chung is expected to be some 120,000, the second station should be in place. Usage of this station is estimated to rise to 95,000 passengers daily by 2011. In the event the Tung Chung West Station is not provided consideration to alternative busways (possibly crossing the Town Park) would have to be made.

Tai Ho Station

The Tai Ho station would not be provided until the period 2006 - 2011. By 2011, with the Industrial Park at Siu Ho Wan and a resident population of 50,000 in Tai Ho Wan, daily patronage of 61,000 passengers is expected.

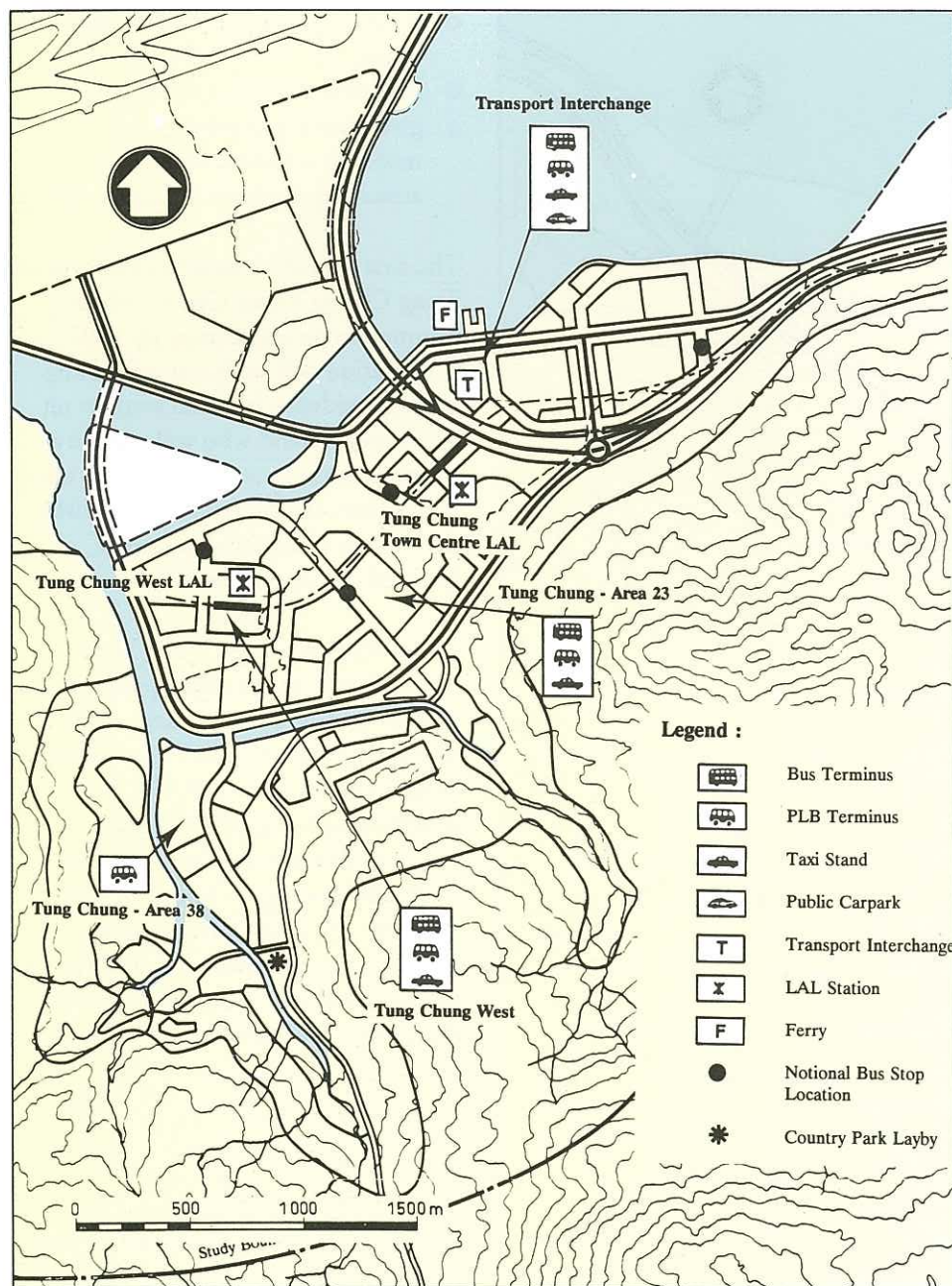


Figure 10.6(a) Public Transport Plan for the New Town at Tung Chung Area

Extension of LAL

Both the on and off-Lantau transport systems have sufficient capacity to accommodate anticipated airport traffic volumes up to at least 2011 without an extension of the domestic rail line to the Airport Island. But with additional

New Airport and New Airport-related development planned to occur subsequently on the Airport Island, it may be prudent to align the Tung Chung West Station in such a way that a route for a future extension (in the event that it is ever warranted) could be provided.

10.4.3 Bus and Public Light Bus Provisions

A total of 16 routes accommodated in 7 termini are proposed for the New Town by 2011. Table 10.6 indicates the daily boardings and alightings forecast for each route.

Of critical importance is the provision of airport shuttle bus services. By 2011, daily passenger usage of airport shuttle services is expected to be 68,000. Details of these and other interim services are included in Appendix G.

10.4.4 Transport Interchange

The Transport Interchange is located between the ferry pier and the Tung Chung Town Centre LAL station, and should be as close as possible to the more heavily used rail station. Pedestrian linkages must be carefully planned to provide clearly defined routes with a minimum number of level changes. The Transport Interchange comprises a bus terminus, PLB terminus, taxi stand and public carpark.

A temporary Transport Interchange will be required during Phase 1 of the New Town. It will be located west of the NLE and south of Road P1, immediately adjacent to the LAL station. The final location of the Transport Interchange is being considered as part of the ongoing town centre masterplan.

10.4.5 Other Termini Provisions

Combination bus and PLB termini will be provided in Tung Chung Area 23, at Tung Chung West, and at Tai Ho Wan North. PLB terminus provisions are also recommended to be located at the Industrial Park, at Tai Ho Wan South and at Tung Chung Area 38.

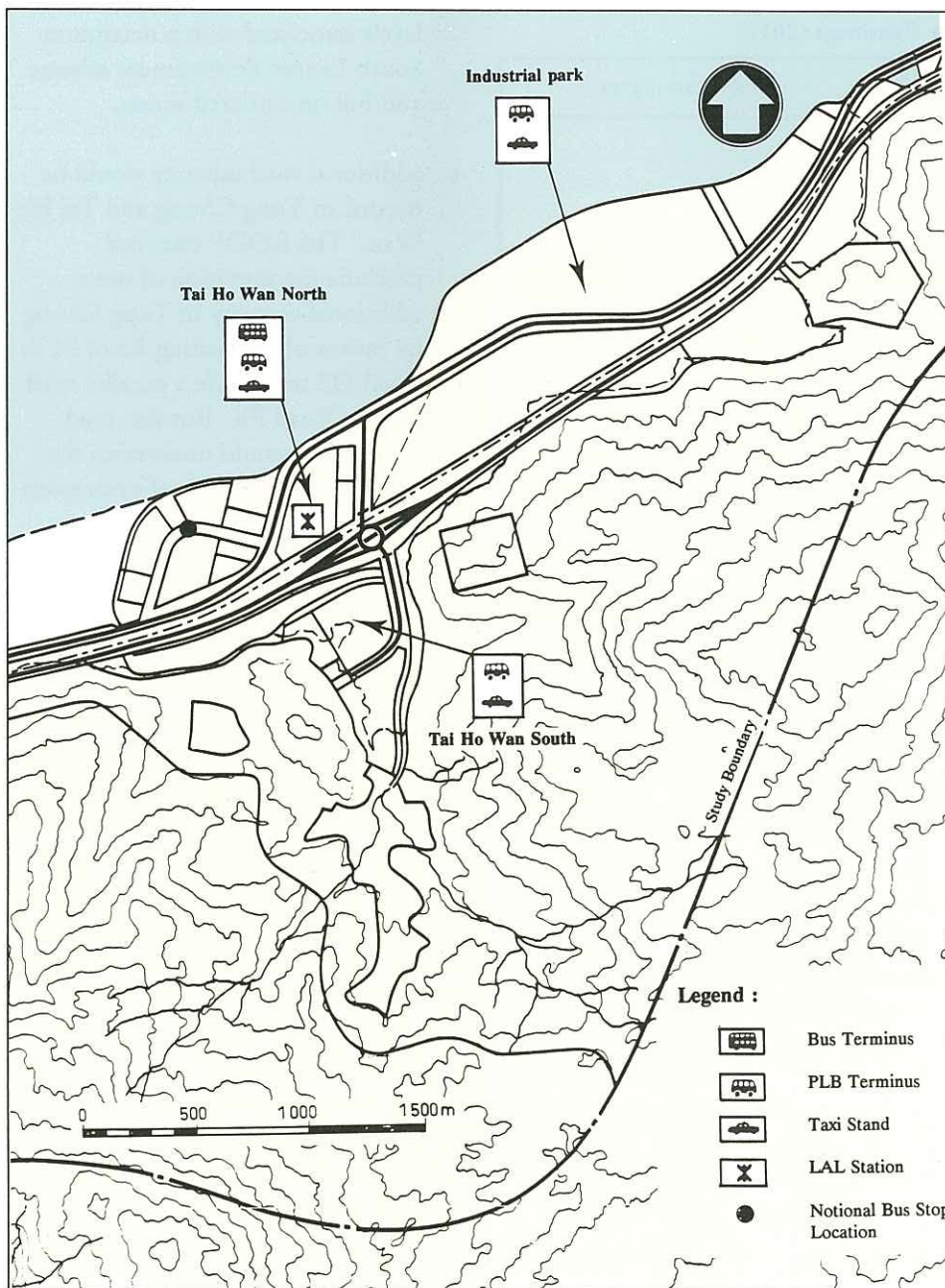


Figure 10.6(b) Public Transport Plan for the New Town at Tai Ho Area

10.4.6 Ferry Pier

Ferry services will not serve as a daily principal mode of transport but are expected to be an important weekend travel mode. Provision has therefore been made for a ferry pier which has convenient pedestrian links to the Transport Interchange.

10.4.7 Other Considerations

It is likely that there will be the need to provide some form of shuttle bus service between the Transport Interchange and the head of Tung Chung Valley to satisfy weekend and holiday recreational demands of Country Park users. A location for a suitable layby or terminus

facility has been indicated on the RODP to meet this requirement.

10.5 Impacts on the Rest of Lantau

The RODP assumes an upgraded Tung Chung Road, providing a single traffic lane in each direction (currently this road is largely a single lane with passing places) and continuation of restricted usage. This will permit better public transport accessibility between North Lantau and the existing southern Lantau road system.

Sensitivity tests were conducted to determine the effects on the RODP of different development strategies for the rest of Lantau, particularly South Lantau. The detailed results of these tests have been given in Topic Report TR19.

It has been suggested in Governments review of alternative development scenarios that the maximum (or worst case) residential development potential of South Lantau, including Tai O and Discovery Bay as well as Mui Wo, Tong Fuk, Cheung Sha and Pui O, could be a population of 84,000. In addition to the expanded residential community, there could be a medium-density international tourist resort development comprising up to 4,000 hotel rooms. This level of development suggests high traffic volumes of up to about 5,000 one-way hourly pcus, if unrestricted road access is permitted.

The implications of this additional traffic are:

- o a substantial increase in 2011 traffic on Lantau's external crossings in the morning peak hour, equivalent to approximately one traffic lane. Although this increase does not result in unacceptable conditions on the external crossings, it would push some sections of the NLE to capacity conditions.

Table 10.6 Public Transport Routes and Daily Patronage (2011)

Type of Service	Daily Passengers
<u>External Routes (No. of Routes)</u>	
Transport Interchange (4)	51,000
Tung Chung West (1)	17,000
Tai Ho Wan North (2)	19,000
Total	87,000
<u>Internal Routes</u>	
Tung Chung Area 23 - Transport Interchange	2,000
Tung Chung Area 38 - Transport Interchange	12,000
Tung Chung West - Transport Interchange	12,000
Industrial Park - Tai Ho Wan North	23,000
Tai Ho Wan South - Tai Ho Wan North	3,000
Total	52,000
<u>Airport Shuttle</u>	
Transport Interchange	27,000
Tung Chung Area 23	3,000
Tung Chung West	33,000
Tai Ho Wan North	5,000
Total	68,000

Source : Consultants' Estimates

Note: The four external routes would be to Central, Tsim Sha Tsui, Yuen Long and the Port Peninsula

o the 5,000 peak hour pcu demand cannot be accommodated by just one road connection between South and North Lantau. The likely connections, between South and North Lantau are shown in Figure 10.7(a). These would be a link to west Tung Chung via Sham Wat (shown in more detail in Figure 10.7(b)), a link (or links) to Tai Ho and the existing Tung Chung Road. Most of the additional development

is expected to occur in the eastern part of South Lantau, in the Discovery Bay, Mui Wo and Pui O areas. This results in the traffic demands being the greatest on the possible link to Tai Ho which would be the most convenient connection for Discovery Bay and Mui Wo residents. If such a link were provided design changes to the Tai Ho Wan Interchange may be required to accommodate the traffic

levels associated with a maximum South Lantau development scheme and full unrestricted access.

- o additional road capacity would be needed in Tung Chung and Tai Ho Wan. The RODP does not preclude the provision of some additional capacity in Tung Chung by means of connecting Road P1 to Road D2 to provide a parallel relief road to Road P1. But this road connection would undermine the concept of continuity of open space from the waterfront to the Town Park.
- o in Tai Ho Wan, widening or grade separation at the Road P1 junctions in order to provide extra capacity to relieve the congested NLE corridor would be required.

Many different issues must be examined before a strategy on the integration of North and South Lantau is developed. The high cost of additional unrestricted road links between North and South Lantau and the serious environmental penalty their provision implies must be carefully considered. However, the RODP has the flexibility to be able to accommodate the traffic associated with whatever strategy is developed, so it is not a constraint to the integration of North and South Lantau.

10.6 Construction Traffic Impacts

The phased development of the New Town in virtually a greenfield site does not have the inherent negative traffic impacts of construction in the urban area. Each phase of development is in a discrete area with primary distributor access so that construction vehicles do not have to travel through established neighbourhoods.

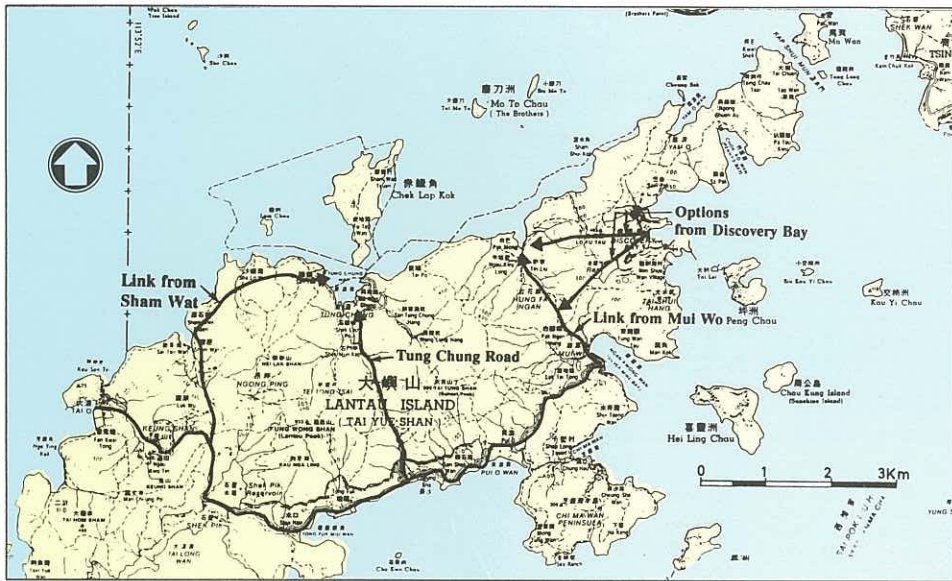


Figure 10.7(a) Possible Road Links to the Rest of Lantau

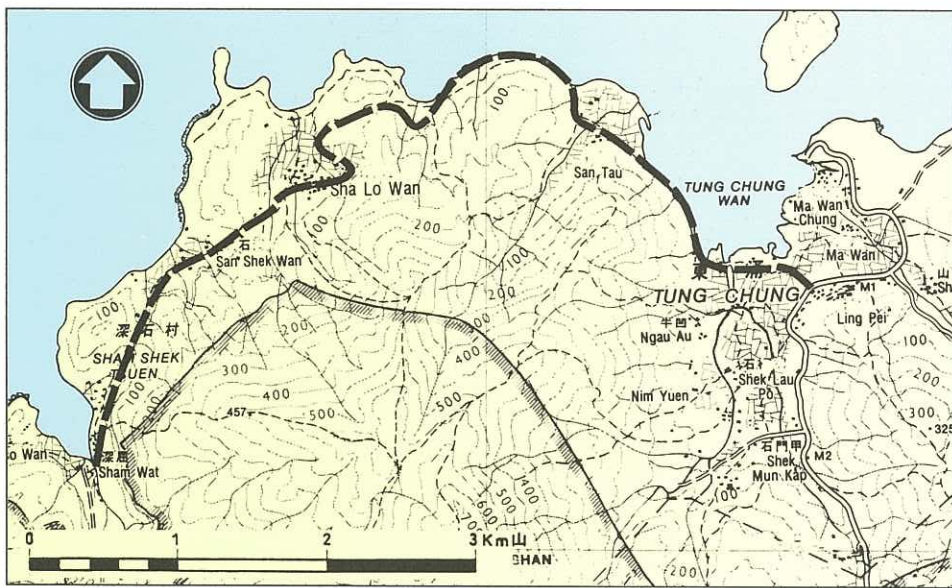
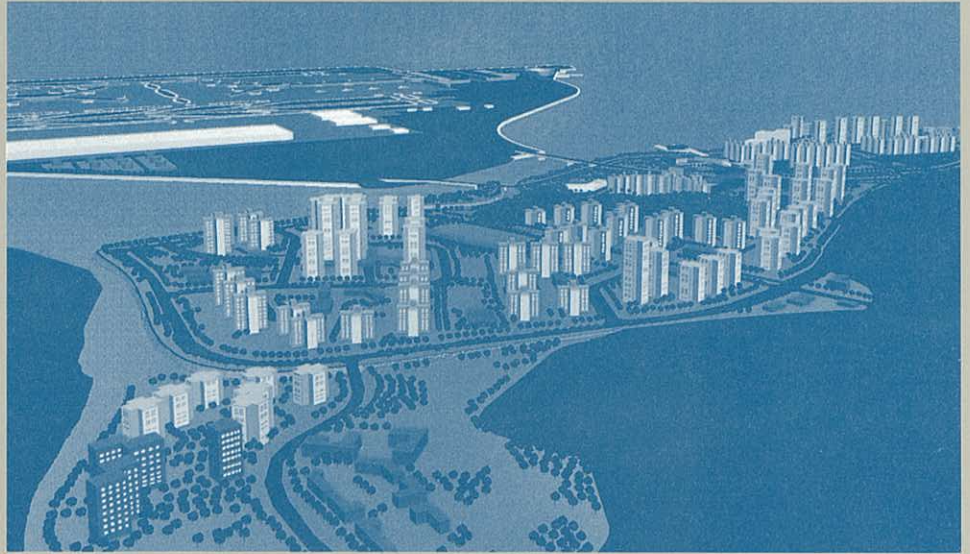


Figure 10.7(b) Detail of Possible Links to Sham Wat

North Lantau Development



11. Land Use

11. LAND USE

11.1 Introduction

The location, distribution and programming of shops, offices, schools, community and recreation uses, many of which require discrete sites, is important in order to respond to the needs of the population as it builds-up and to support the self containment objectives of the town. The planning criteria which have gone into covering these requirements of the New Town are described below.

11.2 Commercial Facilities

Shops and retail services are accommodated in a hierarchy of centres based on population catchments and the types of commodities/services being sold. Three types of centres are proposed. These are a Town Centre at Tung Chung serving the entire North Lantau Development of some 200,000 persons; two District Centres at Tung Chung and Tai Ho Wan each serving a minimum population of 50,000 persons; and local centres distributed throughout residential areas. The Town Centre provides predominantly comparison goods shopping together with a wide range of ancillary services and the office/hotel complex providing airport-related commercial floorspace. It also functions as a local centre providing for the day-to-day needs of people living nearby. The District Centres provide primarily convenience goods with a limited range of durable goods and services. Local centres will provide only convenience goods and very limited services.

It has been estimated that an area of 320,000m² gross floorspace should be provided for all retail facilities required in the New Town. This space is distributed throughout the Town Centre, the two District Centres and local centres in such a manner as to

support the Town Centre as the primary retail centre for the town. District Centres support the Town Centre by providing a lower order of comparison and convenience goods and retail services to each District Centre's catchment area.

Retail floorspace requirements for the New Town and each centre in the hierarchy are derived by an expenditure-based method in which household expenditure patterns are related to retail floorspace through sales, as described in Section 5 of this report.

The Town Centre and District Centres could provide about 50 percent of the New Town's retail facilities. The Town Centre could be expected to support up to 96,000m² gross of retail floorspace as well as commercial offices and hotels in a commercial complex associated with the Tung Chung LAL station. The district centres in Tung Chung West and Tai Ho Wan are also centred on LAL stations and each could support up to 30,000m² gross of retail floorspace. Entertainment facilities, such as cinemas, skating rinks and bowling alleys could also be accommodated in these centres.

Retail and commercial facilities located outside the Town Centre and District Centres should not compete with these centres and should provide only for the needs of local residents. Local shopping and small markets could be provided in public and private housing developments beneath residential blocks or podia, based on a pro-rata distribution of retail floorspace. A total of up to 165,000m² of gross floorspace should be distributed throughout the town in these local centres. Some 50,000m² gross floorspace is required by 2011 for offices and hotels in the New Airport and New Town, and a portion of this should be used to

anchor the Town Centre development at Tung Chung. The target market for office space would include regional headquarters, import/export firms, as well as professional service firms interested in relocating from the urban areas of Kowloon and Hong Kong Island.

This requirement would be accommodated in two 300 room hotels and an office building in the Town Centre, developed as and when demand justifies.

11.3 Community Facilities

11.3.1 Overall Needs

North Lantau will require a comprehensive range of community facilities. The distribution of these facilities is shown on Figure 11.1(a) and 11.1(b), and includes schools, police and fire services facilities, markets, community centres, social welfare facilities, recreational requirements and transport facilities.

11.3.2 Schools

The requirements for primary and secondary schools have been assessed in relation to the proportion of the projected population which will be of school age considered likely to settle in the New Town. The assessment indicates that based on the new "flexi-school" design, 12 primary schools and 12 secondary schools will be required to serve the population of 200,000 by 2011. One primary school is located in each of the four public housing estates. The remaining 8 primary schools and 12 secondary schools have been located close to population centres to minimise travelling distances, and also close to open spaces.

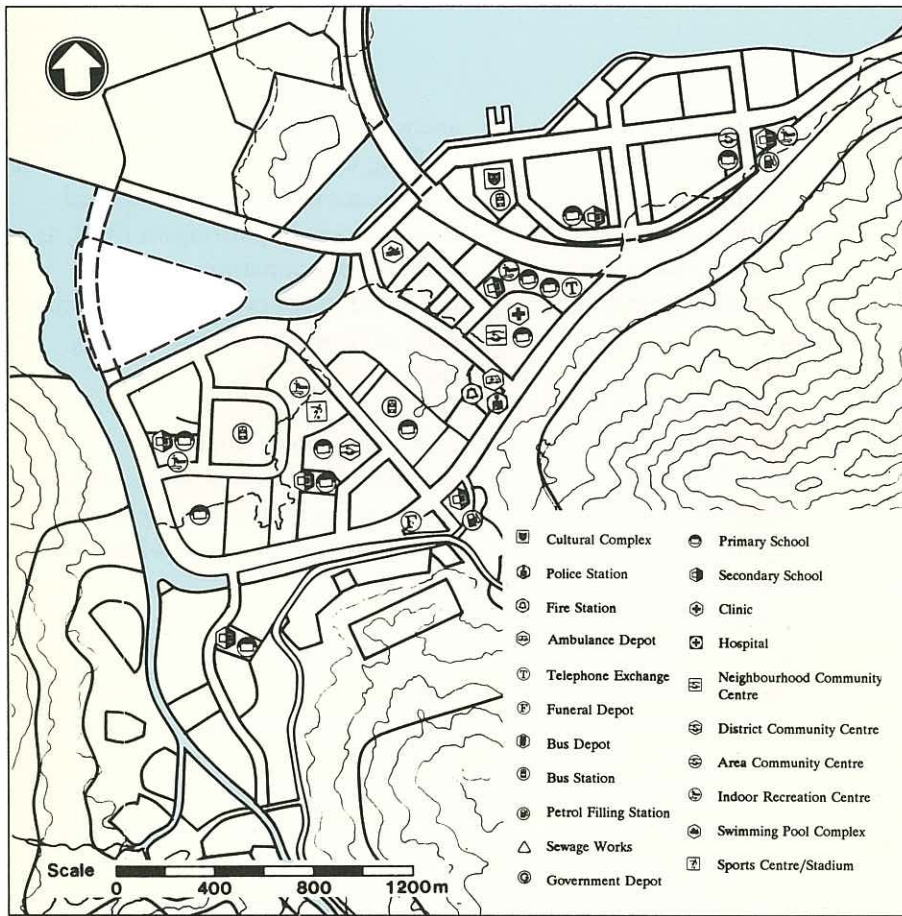


Figure 11.1(a) Community Facilities at Tung Chung

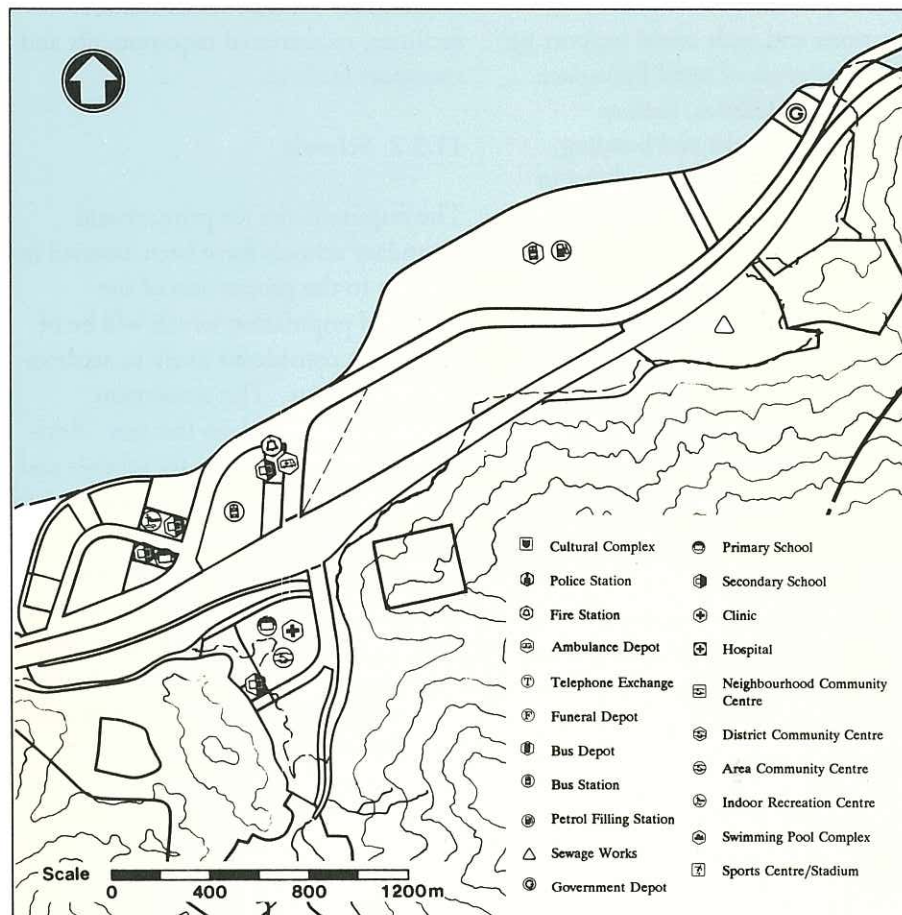


Figure 11.1(b) Community Facilities at Tai Ho

Kindergartens and nurseries have not been shown on the plan as they do not require discrete sites but can be accommodated in public and private housing developments. Provision would be based on population projections according to the HKPSG standards.

11.3.3 Police Facilities

A District Police Headquarters, incorporating a Divisional Station and other police functions will be required in the first phase of development. This facility has been located in the Tung Chung area, such that it has good access onto distributor road D2. Married staff quarters are located on an adjacent site and would be provided in two phases. Police facilities to serve the Tai Ho Wan district would be provided as population in the district builds up. The appropriate type of facility to be provided will be determined by RHKP. A temporary police station would be provided to meet the needs arising during the early construction period of the New Town, that is, before 1997.

11.3.4 Fire Stations

Two fire stations each incorporating an ambulance facility will be required. One will be located in Tung Chung and the other in Tai Ho Wan. Both sites have good access to all parts of the New Town. The divisional fire station in Tung Chung will also serve as a major back up to possible emergency incidents on the New Airport.

11.3.5 Market Areas

Markets would be provided within public and private residential areas throughout the New Town as part of the real shopping provision.

11.3.6 Community Centres

Community centres will provide a focal point for the local community and the range of social activities undertaken by all age groups. Such centres have been provided in the New Town based on Social Welfare Department and HKPSG standards. Four centres are proposed, including:

- o a neighbourhood centre in the first phase public housing area in Tung Chung;
- o two area community centres, one each in Tung Chung and Tai Ho Wan. The Tung Chung East centre has been located on a discrete site in a G/IC zone serving the coastal area of Tung Chung. The Tai Ho Wan centre has been located in the public housing development proposed for this part of the town, and
- o a district community centre, located in a public housing area in Tung Chung West.

All the centres are sited in easily accessible locations within their catchment areas and close to other community facilities.

11.3.7 Social Welfare Facilities

Social welfare facilities which do not require discrete sites have been allowed for in the gross residential densities. These include facilities for the children, the youth, the disabled and the elderly of the community. The need for these facilities, including children and youth centres, day nursery, social centres, multi-service centres, day care centres for the elderly, sheltered workshops, work activity centres and pre-school centres for the disabled, will be assessed

when detailed planning of housing areas is undertaken.

11.3.8 Recreation

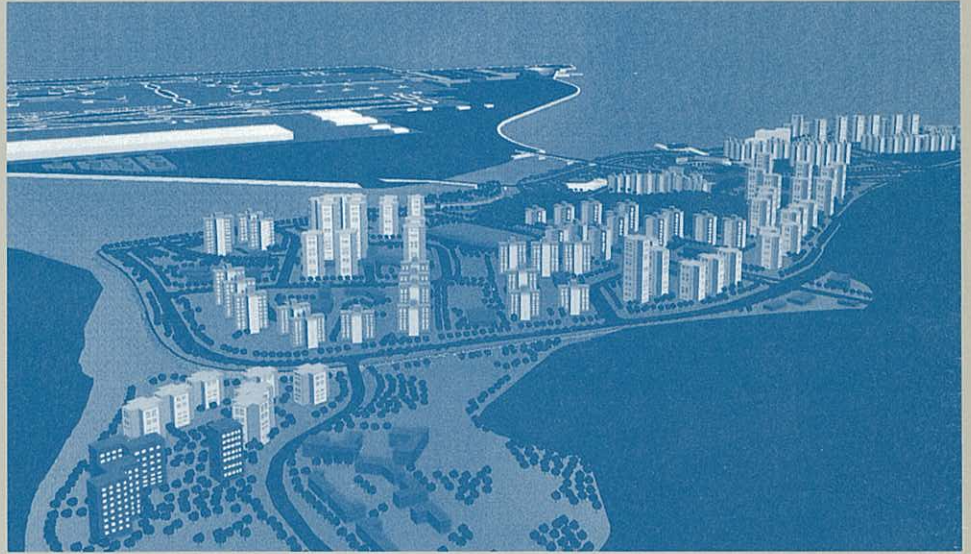
Recreation facilities include a sports stadium in Tung Chung West, a swimming pool complex located in the town park adjacent to the Town Centre and five indoor games halls.

The indoor games halls have been located centrally to population catchments. Of the four games halls in Tung Chung, one has been located in the G/IC zone in the first phase development area adjacent to RS/HOS housing and the Town Centre; two have been located in G/IC zones in the western and eastern districts of Tung Chung respectively; and one has been located in the central spine of open space through Tung Chung West. The games hall in Tai Ho Wan has been located centrally to HOS and private developments and the District Centre in a G/IC zone.

11.3.9 Other Uses

Other facilities required in the New Town include petrol filling stations. For this purpose, three sites have been provided on the periphery of the New Town, two in Tung Chung and one in Tai Ho Wan.

North Lantau Development



12. Landscape

12. LANDSCAPE

12.1 Landform

12.1.1 Terrain Patterns

The North Lantau Development area is bounded to the south by the main Lantau Ridgeline including the two dramatic high points of Lantau Peak and Sunset Peak. This generally steep main ridgeline creates a very imposing backdrop to the New Town and provides a magnificent visual setting. The central ridgeline generally slopes steeply towards the coastline. Steep spurs subdivide the study area to create three major valleys, two in Tung Chung and one in Tai Ho Wan. The steep central spur in Tung Chung (Wo Liu Tung) emanates directly from Sunset Peak and provides a strong landscape element.

A number of smaller spurs and ridgelines further subdivide the main valleys at lower elevations. The lower spurs contain, in general, more weathered material which in addition to a more favourable microclimate allows the development of more diverse vegetation communities. The smaller of the Tung Chung valleys is the Wong Lung Hang area which has been identified as probably one of the largest natural woodlands in the Territory and is one of the most scenic valleys in the Study Area. The ridgeline bounding the Tung Chung valley to the north-east extends to the coastline as a series of three knolls. The spurs and knolls that occur on the edge of or within the valleys provide good opportunity for natural landscape elements and open space areas to penetrate the New Town development, sub-dividing and relieving the visual impact of the urban form to be located largely on the valley floors.

The main areas of coastal alluvial plain occur in Tung Chung and Tai Ho Wan with smaller stretches at Tai Po, San Tau and further west at Sha Lo Wan. The main Tung Chung valley is one of

great visual grandeur with Lantau Peak forming its head and three main river courses flowing into Tung Chung Bay to the north. The river plain extends approximately 1.5km into the valley and is generally 0.75km wide containing for the most part, village settlements and abandoned agricultural lots.

12.1.2 Vegetation

The vegetation observed in the Study Area can be divided into four general categories, namely; broadleaf woodlands, scrub, grassland and wetlands. The factors affecting the existing form of the vegetation include both man-made and climatic influences. Perhaps the most obvious man-made factor is the effect of hillfires on upland areas indicated by the retreat of some stands of existing woodland and the continued spread of scrub and grassland. However, the correlation between landform and vegetation can be clearly discerned throughout the study area.

On the hillsides above 300m PD there are significant areas of natural broadleaf woodland, the best example being the extensive rich woodland in the Wong Lung Hang valley.

Woodland below 300m PD is apparently all either young secondary woodland or planted including small Fung Shui woods around villages and other mainly economic and/or exotic species. Wherever possible such trees or copses should be preserved for incorporation into the overall landscape structure of the New Town. The bulk of North Lantau is covered by fire maintained grassland and shrubland. Towards the crests of the hills the vegetation becomes progressively poorer with trees thinning out and shrubs becoming dominant. This is typical considering the contrast between the richer colluvial deposits on

lower slopes and the thinner, poorer soils on steeper, upland slopes. The more exposed or steeper upland terrain frequently supports only grass with occasional stunted scrub species.

Wetland habitats occur where the largest streams in the area enter the sea at Tung Chung Wan. The streams, like others in the area, provide irrigation for agriculture around villages on the alluvial plains. At the river mouths areas of mangrove have established. Although the majority of the mangroves will be lost during development there should be preservation or replacement of mangrove where possible.

12.1.3 Village Settlements, Ancient Monuments and Fung Shui Features

The Study Area contains a total of 35 villages located in the fertile alluvial plains of the valleys or on the coast. The villages are generally small and are in scale with the rural, natural surroundings of the Study Area. Many contain buildings of historic and archaeological importance and are closely associated with areas of woodland or topographical features of fung shui significance. The general aim has been to retain the buildings of historic or archaeological importance and fung shui features intact and incorporate them as far as possible into the proposed urban development.

12.2 Landscape Framework

12.2.1 General

An overall Master Landscape Plan has been prepared as Topic Report TR14 (Revised). This has been summarized for the purposes of this section of the Final Report, and should be referred for more detailed information. The Master Landscape Plan design concept and planting framework is based on a

Table 12.1 Plant Selection Matrix

landscape system comprising three main land types within the study area, namely; wooded landscape, structural landscape and centres of activity/special areas/major open spaces. These will be the key elements determining the landscape quality of the New Town and will provide the major public open space and recreational opportunities for the New Town population. Figures 12.1 and 12.2 illustrate the planting structure for the Master Landscape Plan and Tables 12.1 and 12.2 list typical species mixes for different areas.

12.2.2 Woodland Areas - General Comment

These will form the external framework of the New Town landscape system and include the Country Parks. The woodland areas comprise a number of different landscape types namely;

- o natural hillside vegetation
- o wooded landforms retained within developed areas, for example the Tung Chung and Pak Mong knolls
- o re-afforestation to formed slopes or borrow areas
- o additional woodland provided in urban areas

The woodland areas penetrate the urban areas and connect with the internal landscape structure of the New Town. By so doing the built form and character of the New Town can be softened and integrated more sensitively into the natural valley setting of Tung Chung and Tai Ho Wan.

Woodland areas linked to the New Town will also provide opportunity for passive recreation and pedestrian access from the urban fringe into hinterland and upland recreation areas.

In addition, the existing woodland areas should be supplemented to connect pockets of isolated or fire damaged woodland and create continuous

Plant Selection Matrix (Refer also to shrub species lists and native tree species list for North Lantau)	1.1 Seafront Promenade	1.2 Sheltered Promenade	1.3 Town Centre Seafront	2.1 NLE/ARL corridor	2.2 Native & Slope Planting	3.1 Primary Distributors	3.2 District & Local Distributors	4 Footpaths & Cyclepaths	5 Industrial Estate	6 Town Centre	7 Town Park
Tree species											
Albizia lebbek	●	●	●			●		●			●
Aleurites moluccana		●		●		●	●		●	●	
Bauhinia blakeana				●		●	●	●	●	●	●
Bischofia trifoliata					●						●
Bombax malabaricum						●	●			●	
Callistemon rigidus							●			●	
Cassia alata						●	●			●	
Cassia fistula						●	●			●	
Cassia surattensis				●		●	●		●	●	
Casuarina equisetifolia	●	●	●						●		
Celtis sinensis					●			●			●
Cerbera manghas	●	●	●								
Crataeva religiosa				●		●					
Delonix regia		●									●
Eucalyptus citriodora				●							
Eucalyptus torelliana				●							
Ficus benjamina						●	●			●	
Ficus microcarpa	●	●	●					●			●
Ficus religiosa						●	●	●		●	●
Firmiana simplex				●							
Grevillea robusta				●		●					
Hibiscus tiliaceus	●	●	●					●			●
Lagerstroemia speciosa								●			●
Liquidambar formosana					●						●
Litsea glutinosa					●						●
Macaranga tanarius	●	●	●					●			●
Melaleuca leucadendron	●	●	●			●	●		●	●	
Michelia alba						●	●		●	●	
Nerium indicum				●							
Peltophorum pterocarpum				●		●		●			●
Pyrenaria championi					●						●
Rhodoleia championi					●						●
Salix babylonica		●									
Schima superba					●						●
Spathodea campanulata								●			●
Sterculia lanceolata					●						●
Terminalia catappa								●			●
Thevetia peruviana				●							
Tristania conferta	●		●			●			●		
Palm Species											
Archontophoenix alexandrae			●				●			●	
Livistona chinensis							●			●	
Roystonea regia			●				●			●	
Washingtonia robusta							●			●	



Plant Selection Matrix
(Refer also to shrub species lists and native tree species list for North Lantau)

	1.1 Seafront Promenade	1.2 Sheltered Promenade	1.3 Town Centre Seafront	2.1 NLE/ARL corridor	2.2 Narrow & Slope Planting	3.1 Primary Distributor	3.2 Distributor & Local Distributor	4 Footpath & Cyclepath	5 Industrial Estate	6 Town Centre	7 Town Park
Tree species											
<i>Albizia lebbek</i>	•	•	•	•	•	•	•	•	•	•	•
<i>Aleurites moluccana</i>	•	•	•	•	•	•	•	•	•	•	•
<i>Bauhinia blakeana</i>	•	•	•	•	•	•	•	•	•	•	•
<i>Burchardia trifoliata</i>	•	•	•	•	•	•	•	•	•	•	•
<i>Bombax malabaricum</i>	•	•	•	•	•	•	•	•	•	•	•
<i>Callistemon rigidus</i>	•	•	•	•	•	•	•	•	•	•	•
<i>Cassia alata</i>	•	•	•	•	•	•	•	•	•	•	•
<i>Cassia fistula</i>	•	•	•	•	•	•	•	•	•	•	•
<i>Cassia suratanensis</i>	•	•	•	•	•	•	•	•	•	•	•
<i>Casuarina equisetifolia</i>	•	•	•	•	•	•	•	•	•	•	•
<i>Celtis sinensis</i>	•	•	•	•	•	•	•	•	•	•	•
<i>Cerbera manghas</i>	•	•	•	•	•	•	•	•	•	•	•
<i>Crasura religiosa</i>	•	•	•	•	•	•	•	•	•	•	•
<i>Dodonaea regia</i>	•	•	•	•	•	•	•	•	•	•	•
<i>Eucalyptus citriodora</i>	•	•	•	•	•	•	•	•	•	•	•
<i>Eucalyptus toetiana</i>	•	•	•	•	•	•	•	•	•	•	•
<i>Ficus benjamina</i>	•	•	•	•	•	•	•	•	•	•	•
<i>Ficus microcarpa</i>	•	•	•	•	•	•	•	•	•	•	•
<i>Ficus religiosa</i>	•	•	•	•	•	•	•	•	•	•	•
<i>Firmiana simplex</i>	•	•	•	•	•	•	•	•	•	•	•
<i>Grevillea robusta</i>	•	•	•	•	•	•	•	•	•	•	•
<i>Hibiscus siliaceus</i>	•	•	•	•	•	•	•	•	•	•	•
<i>Lagerstroemia speciosa</i>	•	•	•	•	•	•	•	•	•	•	•
<i>Liquidambar formosana</i>	•	•	•	•	•	•	•	•	•	•	•
<i>Litsea glutinosa</i>	•	•	•	•	•	•	•	•	•	•	•
<i>Macaranga tanarius</i>	•	•	•	•	•	•	•	•	•	•	•
<i>Melaleuca leucadendron</i>	•	•	•	•	•	•	•	•	•	•	•
<i>Michelia alba</i>	•	•	•	•	•	•	•	•	•	•	•
<i>Nerium indicum</i>	•	•	•	•	•	•	•	•	•	•	•
<i>Peltophorum pterocarpum</i>	•	•	•	•	•	•	•	•	•	•	•
<i>Pyrenaria championi</i>	•	•	•	•	•	•	•	•	•	•	•
<i>Rhodoleia championi</i>	•	•	•	•	•	•	•	•	•	•	•
<i>Salix babingtonia</i>	•	•	•	•	•	•	•	•	•	•	•
<i>Schinus molle</i>	•	•	•	•	•	•	•	•	•	•	•
<i>Spathodea campanulata</i>	•	•	•	•	•	•	•	•	•	•	•
<i>Sterculia lanceolata</i>	•	•	•	•	•	•	•	•	•	•	•
<i>Terminalia catappa</i>	•	•	•	•	•	•	•	•	•	•	•
<i>Thevetia peruviana</i>	•	•	•	•	•	•	•	•	•	•	•
<i>Tristania conferta</i>	•	•	•	•	•	•	•	•	•	•	•
Palm Species											
<i>Archontophoenix alexandrae</i>	•	•	•	•	•	•	•	•	•	•	•
<i>Livistona chinensis</i>	•	•	•	•	•	•	•	•	•	•	•
<i>Roystonia regia</i>	•	•	•	•	•	•	•	•	•	•	•
<i>Washingtonia robusta</i>	•	•	•	•	•	•	•	•	•	•	•

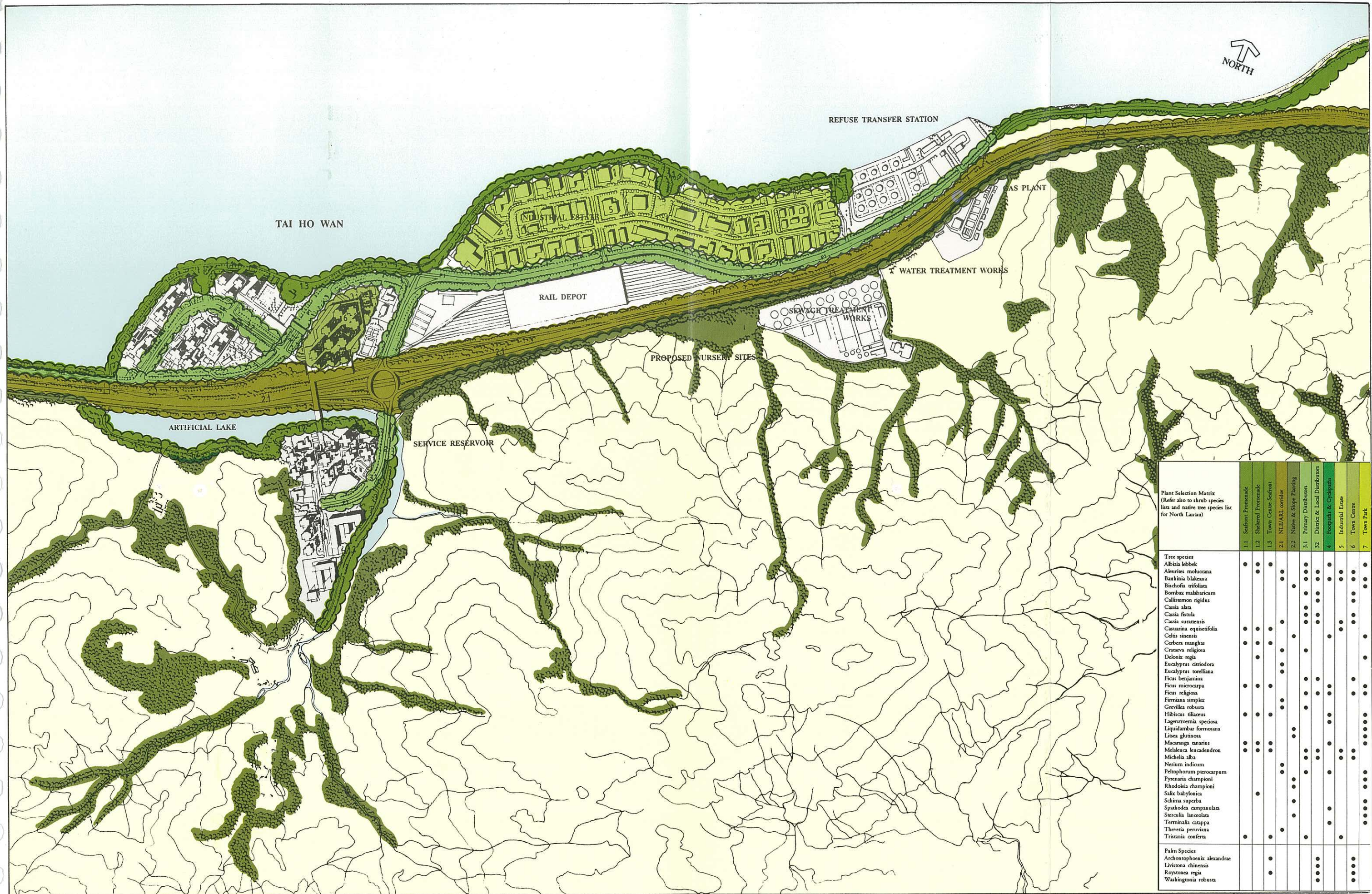
Tung Chung Master Landscape Plan

Hong Kong Government
Territory Development Department
South West New Development Office

SCALE 1:5000

NORTH LANTAU DEVELOPMENT
Consultants
Mott MacDonald Hong Kong Ltd.
in association with
Shankland Cox
Wilbur Smith Associates
EBC Hassell Ltd.
Drawing No. TR14-27

Figure 12.1 Tung Chung Master Landscape Plan



Plant Selection Matrix
(Refer also to shrub species lists and native tree species list for North Lantau)

	1.1 Seafront Promenade	1.2 Sheltered Promenade	1.3 Town Centre Seafront	2.1 NUGAR corridor	2.2 Nature & Slope Planting	3.1 Primary Distribution	3.2 District & Local Distribution	4 Footpaths & Cyclepaths	5 Industrial Estate	6 Town Centre	7 Town Park
Tree species											
<i>Abutilon</i> spp.	•	•	•	•	•	•	•	•	•	•	•
<i>Azadirachta indica</i>	•	•	•	•	•	•	•	•	•	•	•
<i>Bauhinia</i> spp.	•	•	•	•	•	•	•	•	•	•	•
<i>Bombax</i> spp.	•	•	•	•	•	•	•	•	•	•	•
<i>Callistemon</i> spp.	•	•	•	•	•	•	•	•	•	•	•
<i>Cassia</i> spp.	•	•	•	•	•	•	•	•	•	•	•
<i>Casuarina</i> spp.	•	•	•	•	•	•	•	•	•	•	•
<i>Celtis</i> spp.	•	•	•	•	•	•	•	•	•	•	•
<i>Cerbera</i> spp.	•	•	•	•	•	•	•	•	•	•	•
<i>Crataegus</i> spp.	•	•	•	•	•	•	•	•	•	•	•
<i>Delonix</i> spp.	•	•	•	•	•	•	•	•	•	•	•
<i>Eucalyptus</i> spp.	•	•	•	•	•	•	•	•	•	•	•
<i>Ficus</i> spp.	•	•	•	•	•	•	•	•	•	•	•
<i>Grevillea</i> spp.	•	•	•	•	•	•	•	•	•	•	•
<i>Hibiscus</i> spp.	•	•	•	•	•	•	•	•	•	•	•
<i>Lagerstroemia</i> spp.	•	•	•	•	•	•	•	•	•	•	•
<i>Liquidambar</i> spp.	•	•	•	•	•	•	•	•	•	•	•
<i>Litsea</i> spp.	•	•	•	•	•	•	•	•	•	•	•
<i>Macaranga</i> spp.	•	•	•	•	•	•	•	•	•	•	•
<i>Melaleuca</i> spp.	•	•	•	•	•	•	•	•	•	•	•
<i>Nerium</i> spp.	•	•	•	•	•	•	•	•	•	•	•
<i>Pithecolobium</i> spp.	•	•	•	•	•	•	•	•	•	•	•
<i>Pyrenaria</i> spp.	•	•	•	•	•	•	•	•	•	•	•
<i>Rhododendron</i> spp.	•	•	•	•	•	•	•	•	•	•	•
<i>Salix</i> spp.	•	•	•	•	•	•	•	•	•	•	•
<i>Schinus</i> spp.	•	•	•	•	•	•	•	•	•	•	•
<i>Spathodea</i> spp.	•	•	•	•	•	•	•	•	•	•	•
<i>Sterculia</i> spp.	•	•	•	•	•	•	•	•	•	•	•
<i>Terminalia</i> spp.	•	•	•	•	•	•	•	•	•	•	•
<i>Thevetia</i> spp.	•	•	•	•	•	•	•	•	•	•	•
<i>Tournefortia</i> spp.	•	•	•	•	•	•	•	•	•	•	•
Palm Species											
<i>Archontophoenix</i> spp.	•	•	•	•	•	•	•	•	•	•	•
<i>Livistona</i> spp.	•	•	•	•	•	•	•	•	•	•	•
<i>Roystonea</i> spp.	•	•	•	•	•	•	•	•	•	•	•
<i>Washingtonia</i> spp.	•	•	•	•	•	•	•	•	•	•	•

Tai Ho Master Landscape Plan

Figure 12.2 Tai Ho Master Landscape Plan

Table 12.2 Shrub species for Amenity, Ornamental and Slope Planting Mix

Shrub species for Amenity and Ornamental Planting Mix		Shrub species for Slope Planting Mix
Abutilon striatum	Hibiscus schizopetalus	Alocassia odora
Acalypha wilkesiana	Hibiscus syriacus	Camellia spp.
Aglaia odorata	Holmskioldia sanguinea	Clerodendron fragrans
Allamanda cathartica	Hydrangea macrophylla	Ervatamia divaricata
Allamanda neriifolia	Ixora chinensis	Ficus pumila
Asclepias curassavica	Ixora coccinea 'Lutea'	Gordonia axillaris
Acalypha hispida	Ixora coccinea	Ilex rotunda
Asclepias physocarpa	Impatiens sultanii	Ixora chinensis
Ardisia crenata	Jasminum mesnyi	Lantana camara
Barleria elatior	Jasminum pubescens	Ligustrum sinense
Barleria lupulina	Jasminum sambac	Melastoma candidum
Brunfelsia calycina	Jasminum spp (white flower)	Melastoma intermedium
Buddleia asiatica	Jasminum petanemum	Melastoma sangmneum
Bambusa sp.	Justica procumbens	Mussaenda pubescens
Buxus microphylla	Lagerstroemia indica	Rhaphiolepis indica
Caesalpinia pulcherrima	Lawsonia inermis	Rhododendron simsii
Calliandra haematocephala	Ligustrum sinensis	Rhodomyrtus tomentosa
Camellia japonica	Malvaviscus arboreus	Rhus chinensis
Clerodendrum nutans	Manihot esculenta 'Variegata'	
Clerodendrum ugandense	Murraya paniculata	
Clerodendrum kaempferi	Michelia figo	
Codiaeum variegatum	Mussaenda erythrophylla	
Cordyline terminalis	Machilus spp	
Cuphea hyssopifolia	Nandina domestica	
Cuphea ignea	Nerium oleander	
Calliandra surinamensis	Nerium oleander 'Album'	
Cestrum nocturnum	Pittosporum tobira	
Camellia spp	Polyscias fruticosa	
Cassia spp	Polyscias guilfoylei	
Clerodendrum fragrans	Polyscias guilfoylei 'Variegata'	
Coprosma williamsii	Punica granatum	
Dieffenbachia picta	Pentas lanceolata	
Dracaena sanderiana	Pyracantha cranulata	
Beloperone guttata	Paris chinensis	
Duranta repens	Rhaphiolepis indica	
Dracaena spp	Reinwardtia indica	
Dracaena deremensis	Rhododendron simsii	
Duranta plumieri	Rhododendron spp	
Dombeya wallichii	Rhodomyrtus tomentosa	
Carmona microphylla	Risinus communis var.	
Eranthemum nervosum	Rosa spp	
Ervatamia divaricata	Russelia samentosa	
Euphorbia milii	Serissa serissoides	
Euphorbia pulcherrima	Sophora tomentosa	
Excoecaria cochinchinensis	Schefflera arboricola	
Euphorbia cotinifolia	Sanchezia nobilis	
Gardenia augusta	Tecoma stans	
Gmelina hystrix	Tecomaria capensis	
Hamelia patens	Thryallis glauca	
Hibiscus mutabilis	Thunbergia erecta	
Hibiscus rosa-sinensis		

corridors or belts of woodland. Such additional woodland will help provide a visually and ecologically diverse woodland setting to the New Town.

12.2.3 Woodland Areas - Landscape Guidelines

The following design guidelines are proposed for woodland areas:-

Upland Slopes

The existing pockets of woodland on the hillsides have been reduced in scale over the years by hillfires and there is a good opportunity to include reforestation in a combined Country Park/Hinterland management strategy. The species selected should be appropriate indigenous species to supplement the existing woodland areas. Suitable species are shown in Table 12.3.

Should additional nursery production facilities be required to provide the quantities of indigenous plants for the New Town, two adjacent sites have been identified for nursery development in the Tai Ho Wan area. These are Tai Ho Wan planning areas 5 and 6 on the RODP. Area 5 will be successively developed for the Sewage Treatment Plant in Phases 1, 2 and 3. But the entire site will be formed during Phase 1 providing approximately 8 hectares of land which would be available for a plant nursery up to 1997 and reducing to 4 hectares by the end of Phase 2 in 2001. The adjacent site, planning area 6, is classified "Undetermined" and it is proposed that this too can be utilised for a plant nursery. The site is 4 ha. in size, will also be formed during Phase 1, and will be available until the completion of Phase 3 in 2006 (and beyond) unless required for other development. A possible additional temporary nursery site is a portion of planning area 3 earmarked for the proposed gas plant.

Table 12.3 List of Native Trees for Upland Slope Planting on North Lantau

Abarema clypearis	Lithocarpus spp.
Acronychia pedunculata	Litsea monopetala
Artocarpus hypargyreus	Machilus breviflora
Artocarpus tonkiensis	Machilus chinensis
Bischofia trifoliata	Machilus ichangensis
Carallia brachiata	Machilus oreophila
Castanopsis spp.	Machilus thunbergii
Celtis sinensis	Machilus velutina
Cheorospondias axillaris	Meliosma rigida
Cinnamomum parthenoxylon	Myrica rubra
Cratoxylum ligustrinum	Quercus spp.
Cryptocarya chinensis	Prunus phaeosticta
Diospyros eriantha	Pygeum topengii
Diospyros morrisiana	Reevesia thyrsoides
Elaeocarpus sylvestris	Sapium discolor
Endospermum chinense	Sarcosperma laurinum
Eustigma oblongifolium	Schefflera octophylla
Evodia meliaefolia	Schima superba
Ficus variegata B1 var chlorocarpa	Scolopis chinensis
Garcinia multiflora	Sterculia lanceolata
Garcinia oblongifolia	Styrax suberifolius
Gironniera nitida	Syzygium hancei
Gordonia axillaris	Syzygium levinei
Helicia cochinchinensis	Ternstroemia gymnanthera
Ixonanthes chinensis	Trema orientalis
Liquidambar formosana	Viburnum odoratissimum

Source : Consultants' Recommendation

Villages and Urban Fringe

Generally, the village areas contain copses of woodland which typically comprise a mix of old woodland stands and more recently planted Fung Shui, ornamental and fruit tree species. In order to retain the character of the villages and help contain and complement future village resite or expansion areas the existing woodland copses should be extended wherever possible using a compatible mix of indigenous species.

Knolls and Open Space

The existing knolls are at Ma Wan Chung, Pak Mong and the southern tip of Chek Lap Kok. These will be retained and will be strong landscape

elements within the New Town. However the vegetation cover is mainly scrub and grassland and it is therefore proposed that they should be reafforested to achieve a more appropriate scale in the urban area.

Roads

The NLE corridor alignment follows the existing coastline for much of its length particularly between Tai Ho Wan and Tung Chung. However, due to the irregularity of the coastline, filled embayments will be created between the service road and highway and the adjacent hillside. Mass planting of the portions of the transport corridor abutting the hillside is proposed. The interface between the level areas of coastal fill against the existing hillside

are visually sensitive and substantial planting is required to ensure the visual impact of the transition between the man-made and natural elements is minimised.

Cut Slopes

Although it is intended that slope cutting should be kept to a minimum, some slope cutting will be required to accommodate road construction and some areas of residential or G/IC development. The following planting guidelines are proposed for treating areas where significant earthworks and slope cutting are involved:-

- o Where slope cutting is required the design of cut slopes should ensure that slope gradients allow reinstatement to complement the adjacent slope profile and permit total revegetation;
- o Where hard rock slopes are exposed after cutting slopes should be benched and planting provided;
- o Planting should comprise low maintenance species although necessary maintenance must be carried out;
- o Planting must be in scale with the type of road involved and use predominantly indigenous species to blend with the adjoining vegetation;
- o Topsoil should be retained during earthworks and used to treat cut and fill slopes.
- o Use of chunam, shotcrete or concrete slope treatments should be avoided; and
- o Slope drainage should be as understated as possible and avoid conspicuous straight lines.

12.2.4 Structural Landscape Areas - General Comment

These areas form the internal framework of the landscape system. The structural landscape design is derived from the main planning and engineering elements which form the basis of the New Town configuration. Accordingly, the main structural landscape areas will be partly formal and geometric in design. In responding to the shape and form of engineering works, highway alignments and buildings, the patterns of urban landscape will contrast with the woodland external framework. The main structural elements include the Seafront Promenade, Drainage Channels, a Central Open Space Corridor, the NLE/AEL transport corridor and other Landscape Links.

12.2.5 Structural Landscape Areas - Landscape Guidelines

The following design guidelines are proposed of structural landscape areas:-

Circulation System : Roads and Railway

The system provided for the movement of vehicles, cyclists and pedestrians within the New Town has very important landscape implications. The following design criteria are recommended to provide a coherent and attractive landscape treatment of the New Town's circulation system.

- o as a general principle, road routes should always be tree lined;
- o wider roads such as the trunk and primary distributors should have central reserve planters;
- o to protect the roadside planting from excessive vehicle spray in wet weather and maximise the screening effect for pedestrians, raised planters

and highway barrier walls are essential;

- o in general, the planting should be in scale with the size of the transport corridor and adequate planting reserves between the NLE, AEL, primary distributors, service roads and associated cycletracks and footpaths should be provided;
- o where noise and visual screening to the transport corridor is required, particularly in built-up areas, a combination of landscaped bunds and noise barriers is proposed. The location and configuration of these would be subject to detailed design.
- o due to the linear form of the transport corridor and the high speeds of vehicles the form of the road and railside planting should be bold and comprise relatively long sections of each species mix. Denser planting would occur in sections related to woodland areas;
- o in urban areas planting would also be bold in character but could be more formal to create an avenue or boulevard effect;

- o shade planting should be provided to cyclepaths and footpaths incorporated into NLE and AEL amenity strips. Ornamental planting for interest could be incorporated where appropriate, for example at major intersections/focal points in the urban area;
- o generally, low maintenance, hardy, wind and salt tolerant species should be used; and

Sea Channels and Drainage Channels

The sea channel promenade and strips of open space running along both sides of the main drainage channels form a boundary between urban development

areas and the key water elements of the NLD. Special landscape treatment is required to take full advantage of the recreational opportunities afforded by these linear open spaces and the following design guidelines are proposed.

- o In response to the form of these spaces, the planting proposal comprises single or double rows of one species.
- o Where there are intersections of access paths from adjacent development on to the promenade or at promenade focal points then different species would be used with more spreading form to accentuate the nodes of activity. By so doing the linear nature of the sea wall or drainage channels can be broken up visually. The species used in these linear sections should be continued for some distance along the adjoining roads, footpaths etc. when there is an intersection.
- o In order to ensure proper establishment of plants along the seafront and more exposed sections of the drainage channels, species which are hardy, wind and salt tolerant should be used. Wherever possible promenade planting should provide shade as well as structure to create a more pleasant environment for pedestrians and cyclists.
- o The current proposal to construct landscape bunds adjacent to the sea channel along the southern perimeter of the airport landfill is strongly supported. The bunds will be vital to screen the airport from the town and villages of western Tung Chung, particularly San Tau. Accordingly, it is recommended that the landscape bunds should be designed as permanent elements to screen the views to and noise from the airport. More detailed study

would be necessary to calculate the optimum height of the bunds, however, they should be continuous and extend westwards from the southern knoll of Chek Lap Kok to give full protection to the New Town and San Tau.

The natural coastline west of Tung Chung should be preserved and not channelised.

Landscape Links

The landscape links within the urban area between the seafront promenade, NLE/AEL corridor, open space system and hinterland will vary widely in character, from formal treatment of the town centre to more informal treatment of the urban fringe. Guidelines are:

Generally, the planting should be in scale with the surrounding buildings or open spaces and be generous in nature to provide the required visual impact, accent and structure to the linkages.

For links connecting open spaces within the urban area and where sites are more sheltered, the planting character can be more varied and include informal areas with a wider selection of ornamental plant species.

Planting in linkages that extend through the urban fringe and into the rural hinterland or village areas should respond to the existing species mix and informal character of these areas. Predominantly indigenous species should be used with particular care given to the occurrence and fabric of Fung Shui stands associated with villages.

- o The central open space corridor forms a major landscape linkage and it should be complemented by bold structure planting to enhance and frame the strong visual axis from the mountain backdrop through the urban area to the seafront promenade.

12.2.6 Centres of Activity, Special and Major Open Space Areas - General Comment

These areas include specific sites or areas which have special qualities requiring specific design solutions within the main landscape system. The main centres of activity, special areas and open space areas include :

- o Town Park and Waterfront
- o Tai Ho Wan Lake
- o Tung Chung Fort
- o Industrial Estate
- o Town Centre
- o Residential Developments
- o Utility Developments

The landscape design of the above areas will vary according to the landscape types associated with each in order to blend the development into the overall landscape system of the New Town.

12.2.7 Special Areas - Landscape Guidelines

The following design guidelines are proposed for special areas:-

Town Park and Waterfront

The Town park comprises the three knolls behind Ma Wan Chung in the centre of the urban area. The Battery is proposed to be retained in its present location on the northernmost knoll and be restored to become an important focal point within the park and along the promenade. It is intended that in order to conserve the waterfront context

of the Battery, the existing coastline below the historic site will be retained as part of the landfill limit and Sea Channel edge.

The knolls are relatively steep sided and would accommodate mainly passive recreation activities allied with substantial reafforestation using native species. In contrast, the more active recreation activities should be concentrated on the more level waterfront area. To this end it is proposed that an island be incorporated into the sea channel design which will reinforce the focal point of the park, enhance the landscape character of the waterfront and provide excellent opportunities for establishment and support of water-based recreation such as boating and fishing.

In addition to the reafforestation of the knoll, accent planting using ornamental species of varied form, colour and seasonal interest should be included depending on the character of the space.

Tai Ho Wan Lake

The creation of an artificial lake between the NLE and the Pak Mong shoreline in Tai Ho Wan is proposed. An informal lakeside footpath and sitting areas will provide access from residential development to the lake edge. Planting and hard landscape detailing to the lake edge and the surrounding open space should be sensitive to the adjacent existing natural vegetation and low-key scale and landscape character of Pak Mong and its environs. Predominantly indigenous species should be used. The possibility of re-establishing mangrove in the lake merits further studies.

Tung Chung Fort

The Tung Chung Fort is an impressive monument and is a popular stop for weekend walkers passing through Tung

Chung. The walls, watchtowers and cannons have been well preserved and reinstated. Dense woodland on the slopes immediately behind the Fort provide an attractive backdrop to the site and will be retained.

At present the Fort contains a small village school and associated playgrounds. With the development of the New Town and provision of primary and secondary schools it is proposed that the Fort can be further reinstated to its original condition and a folk museum and visitor centre be incorporated within the Fort compound.

Industrial Estate

Generous planting reserves between sectors of the estate and roadside planting should be provided to enhance the visual character of the estate and help soften the form and reduce the scale of the development. The typically rectilinear or grid form of the estate can be complemented by the provision of bold avenues or boulevards of large spreading species of street trees to provide structure to the development and shade for pedestrians and cyclists. Adequate screening of the estate from the NLE/AEL is required. This can be achieved by earth mounding and generous amenity planting at the edge of the NLE/AEL Corridor.

Town Centre

The town centre as a focal point of the “gateway” to Hong Kong should be designed to the highest standards using high quality materials. Planting should be generous and will include bold and formal patterns reinforcing the structure and civic identity of the town centre.

Town plazas should include shade bearing street tree planting and adequate planters for dense, colourful and ornamental plant display in scale

with the surrounding built form. The plant species mix should be distinct from other parts of the town landscape system.

Residential Development

The residential development of the New Town will comprise a cross-section of private, HOS, public and village housing. Each estate will be subject to detail design prior to development. However, in order to maintain a high standard of landscape treatment throughout the town the following guidelines are proposed.

Where housing areas are located adjacent to major roads, generous amenity reserves comprising landscape bunds are provided to help screen the roads from the housing. Should developers be required to include such landscape treatment to “Green Areas” on lot boundaries then the density and general mix of species should be consistent throughout the town. This will ensure the objectives of the landscape structure planting outlined above is achieved.

The quantities of open space provision within each lot will be dictated by the Hong Kong Planning Standards and Guidelines. The planting associated with each development should be in scale with the built form and open space provision.

Selection of plant species should consider the character of the estate and the variety of functions the planting will perform including; shade, floral display, seasonal interest, formal structure, colour and textural contrast.

Utilities

The major utility developments include the Gas Plant, Water Treatment Works and Waterworks pumping stations, Refuse Transfer Station and Sewage

Treatment Works at Siu Ho Wan and two service reservoirs located on the slopes above Tung Chung and Tai Ho Wan.

These services installations at Siu Ho Wan will cover relatively large portions of land by the side of the NLE/AEL corridor. Although the facilities are expected to be generally low-rise, generous earth mounding and dense, continuous landscape planting will be required along the road and railside to screen travellers’ views of the utility developments.

Bold and generous structure planting should be provided between the different utility sites and wherever possible within individual lots to reduce the visual impact and scale of the built form.

Hardy, wind and salt tolerant species should be used to ensure good establishment and rapid, effective screening is achieved.

The service reservoirs could be very visually intrusive located on the hillsides above the urban area. Great care should be taken in the detail design of these sites to address fully the problem of visual impact and avoid the creation of unsightly scars in the landscape. Reinstatement of the sites will include the slope cutting guidelines outlined above. In addition, best use of the existing terrain should be made to conceal the reservoir. The site formation and detail construction of the service reservoirs should include comprehensive and detailed landscape design and reinstatement proposals.

12.2.8 Hard Landscape Materials

The experience in existing New Towns of hard landscape treatment has shown the importance of consistent selection of natural materials for external finishes to create a successful and attractive townscape

The NLD is intended to be a showpiece design as a gateway to Hong Kong. Accordingly, the highest quality finishes selected to date in the New Towns should be selected for the NLD and the following guidelines are proposed.

Raised planters to road, pedestrian and cyclepath routes should be clad in natural materials such as granite stone facing or applied pebble/aggregate finishes. The finishes selected should be consistent throughout the town to create a common theme to the design.

Finishes selected for planters should also be co-ordinated with other site furniture such as bollards, balustrades, kerbs and paving trim.

Paving finishes will vary depending upon the location. Cyclepaths and footpaths should have contrasting materials to distinguish clearly each route from the other to help prevent conflict. Asphalt finish for cyclepaths would be appropriate and coloured interlocking concrete blocks for footpaths. In urban fringe or rural areas, brush finish concrete would be appropriate for footpaths.

In important areas such as the town centre, high quality tile and block paving or applied pebble finishes would be appropriate for footpaths and plazas.

Other site furniture including seats, shelters, lighting, signage, litter bins and fencing should be co-ordinated in terms of style, scale and character to avoid creating a visual clutter.

In the interests of conservation it is proposed that the use of hardwood in landscape structures should be minimised and suitable, durable substitute materials such as Radiata pine are used instead.

- o all planted areas within the urban area and amenity areas along roadsides will require fresh water irrigation to ensure proper plant establishment. The irrigation system should comprise predominantly manually operated standpipes at appropriate intervals. Use of automatic irrigation systems would likely be required for planting that is less accessible such as central medians to roads. However, use of automatic irrigation systems should be kept to a minimum.
- o noise barriers to the NLE corridor are currently proposed as part of the noise mitigation measures within the urban area. It is intended that in the majority of locations the barriers will be located within landscaped amenity strips and can therefore be screened by dense planting. Where barriers are located in close proximity to cycle or footpath routes within amenity strips then the opportunity to utilise the barriers for shade and shelter should be taken. A wide range of materials are available for noise barriers including transparent polycarbonate sheeting and a variety of finishes for patterned treatment. The selection of the appropriate materials will be subject to detail design according to the character of the surrounding area through which the NLE passes.

12.3 Open Space

The main elements of the open space system comprise the Town Park, waterfront promenade, central spine, district and local open space and industrial open space. The open space system for the New Town is shown on Figure 12.3. An extensive footpath and cycleway network is provided within landscaped corridors and amenity reserves to connect the central cores of

open space with residential neighbourhoods. Further local open space is included within gross residential areas.

The basic design objectives for the open space are as follows :

- o Provision of an appropriate hierarchy of open space with both active and passive recreation areas.
- o Provision of pedestrian links and cycleways, segregated from vehicular traffic, both within the town and connecting surrounding areas.
- o Provision of extensive landscaped buffer zones between highways, railways, industrial areas and residential development.
- o Maximise recreation and amenity potential of the extensive waterfront area.
- o Provision of shaded walkways and shelters.
- o Provision of a "gateway" element to Tung Chung from the NLE and AEL.
- o Provision of a series of pedestrian links to the rural hinterland and Country Park areas.
- o Provision of tree belt/boulevard planting to structure the open space system and to emphasise the main views within and beyond the New Town.

The Town Park is the central open space of the New Town. It is located adjacent to the waterfront and incorporates the northern portion of the existing knolls at Ma Wan Chung. The Town Park will contain a variety of active and passive facilities and retain historical features such as the Tung Chung Battery. Strong visual and pedestrian axes radiate from the Town Park up the Tung Chung valley to the mountain peaks behind and to the north-east and north-west along the sea channel alignment.

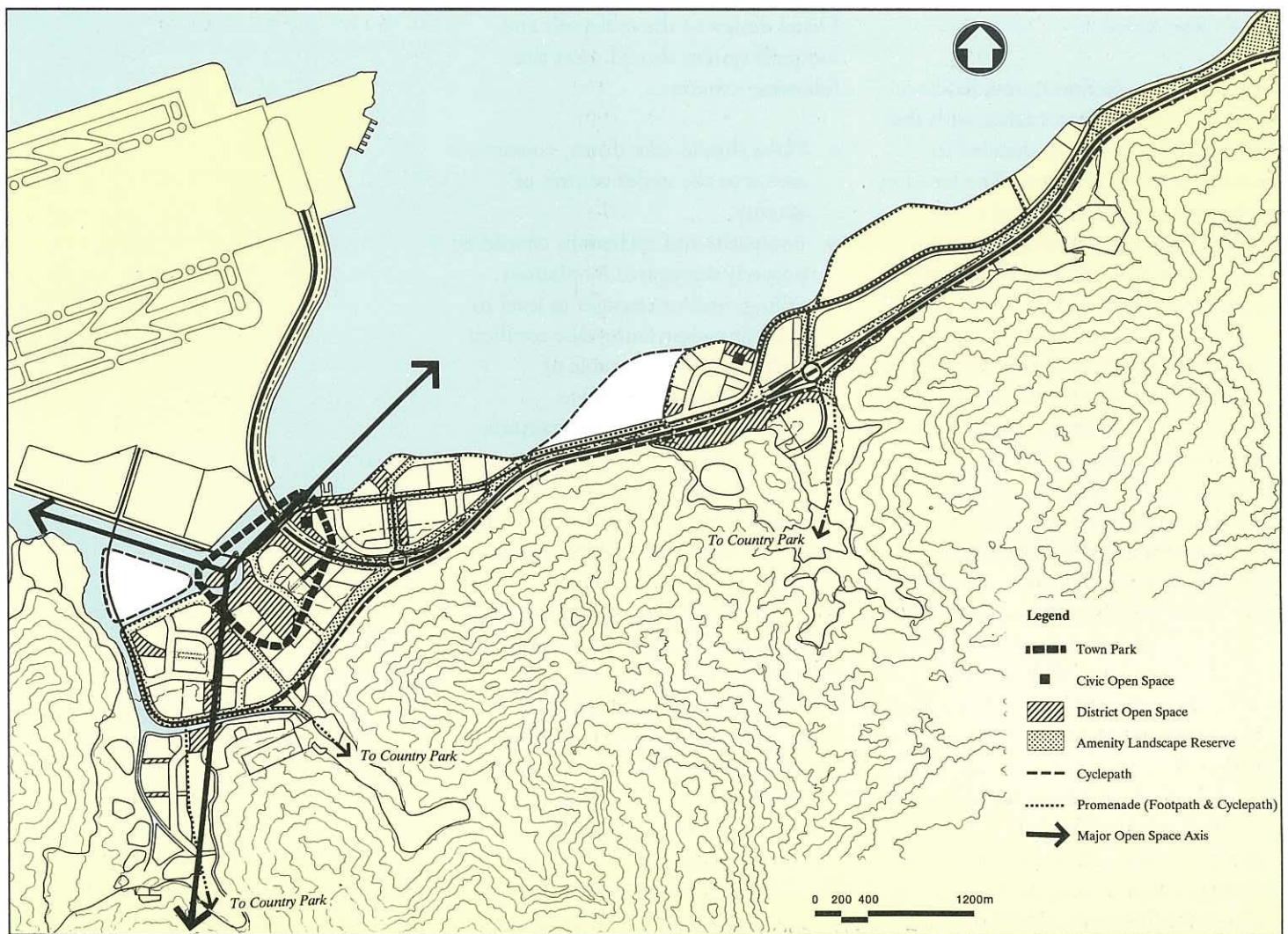


Figure 12.3 The Open Space System of the New Town

A central corridor of mainly active open spaces serves the western residential neighbourhoods of Tung Chung. This provides an important pedestrian/cycleway route through the heart of the town and acts as a breezeway. From the head of the Tung Chung valley, open space facilities within this corridor progressively become more passive towards the sea channel. A promenade provides segregated pedestrian and cyclist access along the seafront in Tung Chung and extends from Tung Chung to Siu Ho Wan. This promenade could incorporate passive open space with cafes and sitting areas in appropriate

locations. In Tung Chung, the sea channel could be used for fishing and boating.

Neighbourhood open space areas are provided throughout the town. Within these areas self-contained indoor recreation centres and a variety of outdoor active and passive open spaces are provided. These open space areas are connected to the central and promenade open space corridors and Town Park by landscaped footpaths and cycleways incorporated in the distributor road amenity reserves.

The Tung Chung and Tai Ho Wan open space systems, although connected by the seafront promenade, are considered as independent centres for recreation. In Tai Ho Wan, the main open space comprises a lake between Pak Mong village and the NLE/AEL corridor suitable for windsurfing and boating. The lake is to be formed by retaining the embayment created by the reclamation works for the NLE corridor. As in Tung Chung, continuous pedestrian links are provided, segregated from vehicular traffic to connect the other open space areas in the residential neighbourhoods, including the industrial open space, and the centrally located district park on the waterfront.

12.4 Recreation

The recreation facilities provided have been calculated in accordance with the HKPSG and have been detailed in Section 5.5 of this report. The location of these facilities is intended to complement population distribution to ensure an acceptable level of recreation provision is achieved.

In addition to the core activities advocated by the HKPSG, other recreational facilities are proposed in response to the particular site conditions and character. The future demand for access to the Country Parks from the new town is recognised and will be catered for by connecting the open space system and footpath/cycleway corridors through the Tung Chung and Tai Ho Wan valleys into the hinterland and Country Park at strategic locations.

The open space structure at the periphery of the urban areas, is intended to provide the transition from urban development to the Country Parks. The land use and recreation proposals for the hinterland area are discussed in the following section.

12.5 Footpath and Cycleway Network

The system of pedestrian footpaths and cyclepaths proposed for the New Town will provide an integrated, comprehensive and convenient network for pedestrians and cyclists which provides access to and links between prominent recreational features such as the Town Park and major open spaces, the waterfront promenade, the rural hinterland and the adjacent Country Parks. There should be a high degree of pedestrian/vehicle segregation to ensure pedestrian safety and at the same time facilitate vehicular traffic movements.

Detail design of the cyclepath and footpath system should meet the following criteria :

- o Paths should take direct, convenient routes to the major centres of activity.
- o Footpaths and cyclepaths should be properly segregated by planters, railings and/or changes in level to prevent pedestrian/cyclist conflicts.
- o Paths should be capable of supervision by the police.
- o They should be easy to maintain and clean.
- o They should be well lit and have adequate stopping points, seating, rain/sun shelters, public telephone and access to public toilets.
- o They should be well landscaped and, in particular, shaded and sheltered by trees.
- o Major paths should connect to facilities such as shops, public transport services, schools, open spaces, recreation centres etc.
- o Adequate signage should be provided and
- o Grade separation between roads and cyclepaths/footpaths should be adopted as much as possible.

12.6 Town Art

It is proposed that funds should be set aside for commissioning or purchasing sculptural works of art for inclusion in the civic areas and plazas of the Town Centre. The intention is to complement the high quality of architectural landscape and urban design proposed for the town centre and reinforce the civic identity and gateway concept of the New Town. The works of art will provide focal and reference points within the pedestrian network and may include sculpture, fountains, murals and statues. It is not essential that works of art be installed immediately but places should be reserved for later installation.

North Lantau Development



13. Urban Fringe

13. URBAN FRINGE

13.1 Rural Hinterland Strategy

13.1.1 Role of the Hinterland

The immediate hinterland of a New Town plays an important role in the creation of a quality environment in which to live and work; it provides a landscape backdrop to the city as well as offering recreational and educational opportunities. A full 'Rural Hinterland Strategy' has been developed and this is described in Topic Report TR15 (Revised). This should be referred to for specific details.

In the case of this New Town and its proximity to the New Airport, the hinterland will also act as part of the "visual gateway" to Hong Kong, comprising visitors' first sighting of the Lantau hills.

With the proposed high class road and rail links to the New Town and New Airport, the hinterland will become one of the most accessible areas of attractive unspoilt countryside within the territory. Recreational pressures are likely to be high from visitors living in the New Territories, the metropolitan area and from overseas, in addition to the needs of the New Town population itself.

North Lantau is at present an ecologically rich and valuable resource; with the currently planned development the North Lantau Hinterland will act as a buffer to control urban sprawl and to protect ecologically important sites from the pressures of recreation and development.

The role of the hinterland is therefore seen as a multiple, providing a green backdrop to the city, to be conserved and protected wherever possible, but also providing much needed recreational and educational resources for both the local population and visitors alike.

13.1.2 Specific Objectives of the Strategy

The specific objectives of the Rural Hinterland Strategy have been to:-

- o to conserve major landscape features such as peaks, ridgelines, spurs, coastlines and hillsides currently excluded from the Country Parks;
- o to conserve and protect areas of ecological importance such as natural and fung shui woodland, streams, marshland and mangrove currently excluded from the Country Parks by habitat extension and enrichment where possible;
- o to compensate loss of coastal and lowland habitats by allocating areas for new habitat creation;
- o to control future development by defining the extent and limits of urban growth and regulating land uses; and
- o to optimise opportunities for recreational use.

13.1.3 The Strategy

The Hinterland Strategy for the Study Area is conservation - orientated, protecting and conserving wherever possible the landscape features which form the setting of the New Town, the ecological habitats and the existing villages while at the same time providing recreational outlets for the New Town residents and visitors to the area.

The Hinterland Strategy comprises a Combination of Conservation, Recreation and Development Control proposals, and is illustrated in Figures 13.1 and 13.2. The key components of each of these aspects are described in the following sub-sections.

13.1.4 Conservation

The existing and proposed conservation elements of the Hinterland Strategy are

illustrated in Figure 13.1 and include the following proposals:

Country Park Extension

It has been recommended in both the SWNT Development Strategy and the earlier Topic Reports (TR7 and TR10) of the NLD Study that the Country Park boundaries should be extended to coincide with the hinterland fringe of the New Town development.

This would provide comprehensive protection and management of these areas in addition to strict land use control by means of the Country Parks Ordinance.

The boundary definition of the proposed Country Park (CP) extension is open to interpretation. The CP boundary can be extended up to the limit of planned development, or alternatively a 'buffer zone' can be allocated to allow for possible future urban expansion and to maintain a transition zone between the city and the CP.

The concept of a landscape 'buffer' between the urban area and the Country Parks is strongly advocated by the CPA, preferably with a statutory zoning such as CCA or Green Belt (GB), in order to protect the quality of the Country Parks. There is currently however no designated authority responsible for the active management of such 'buffer zones' which can become 'grey areas' in landscape management terms.

If the CP boundary is extended to the edge of the planned development, all the land becomes managed land, allocated to a particular authority. There is however an unknown element in the future land use of RPA zonings; no allowance is made for fire risk or for future development needs such as new roads and infrastructure requirements.

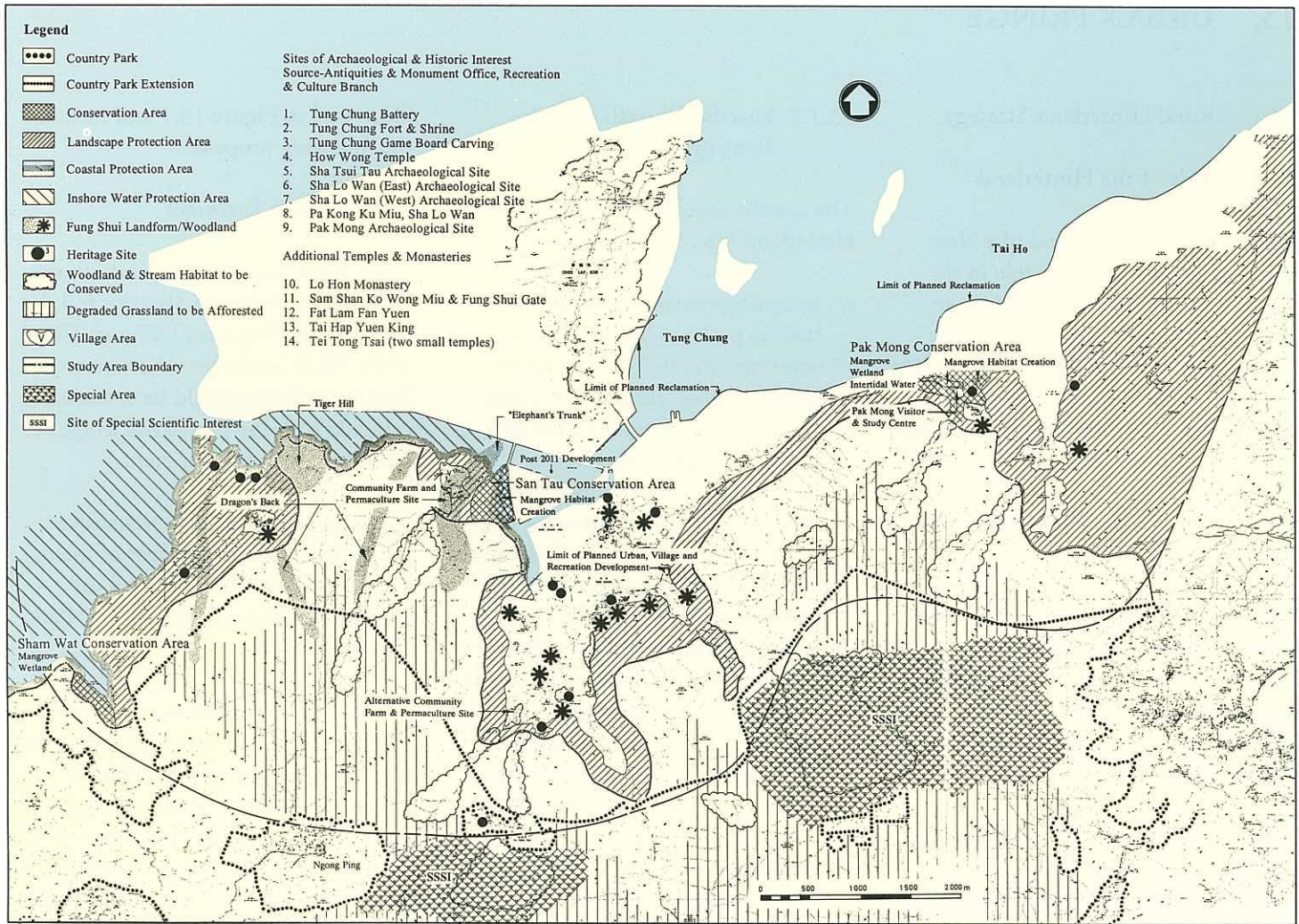


Figure 13.1 Conservation Proposals

The following criteria have been taken into account while determining the boundary of the proposal CP extension:

- o The concept of the CPA plan showing 'possible extension of North Lantau Country Park' has been closely adhered to.
- o All natural woodland of ecological importance together with a 200 metre "protection zone" has been included within the CP extension.
- o Psychological segregation has been provided between the Country Park and existing and existing/planned development, either through a change in level or a water body.
- o Physical separation between the Country Park and existing/planned development has been provided through a notional 200 metre buffer zone.
- o 'Development' has been taken to include residential development and other urban land uses. Recreational developments such as urban fringe parks and long distance trails are generally seen as compatible with the CP and no buffer zone is proposed. Wherever possible, the CP has been set back 200 metres from village boundaries and private sector recreation development such as the Cableway Stations and Golf Course.

Landscape Protection Areas

These are areas of high quality natural landscape comprising features such as knolls, spurs and hillslopes lying outside the Country Park Extension.

Proposed control measures for these areas are:

- o a general presumption against development but certain compatible uses such as crop-growing and recreation proposals may be considered.

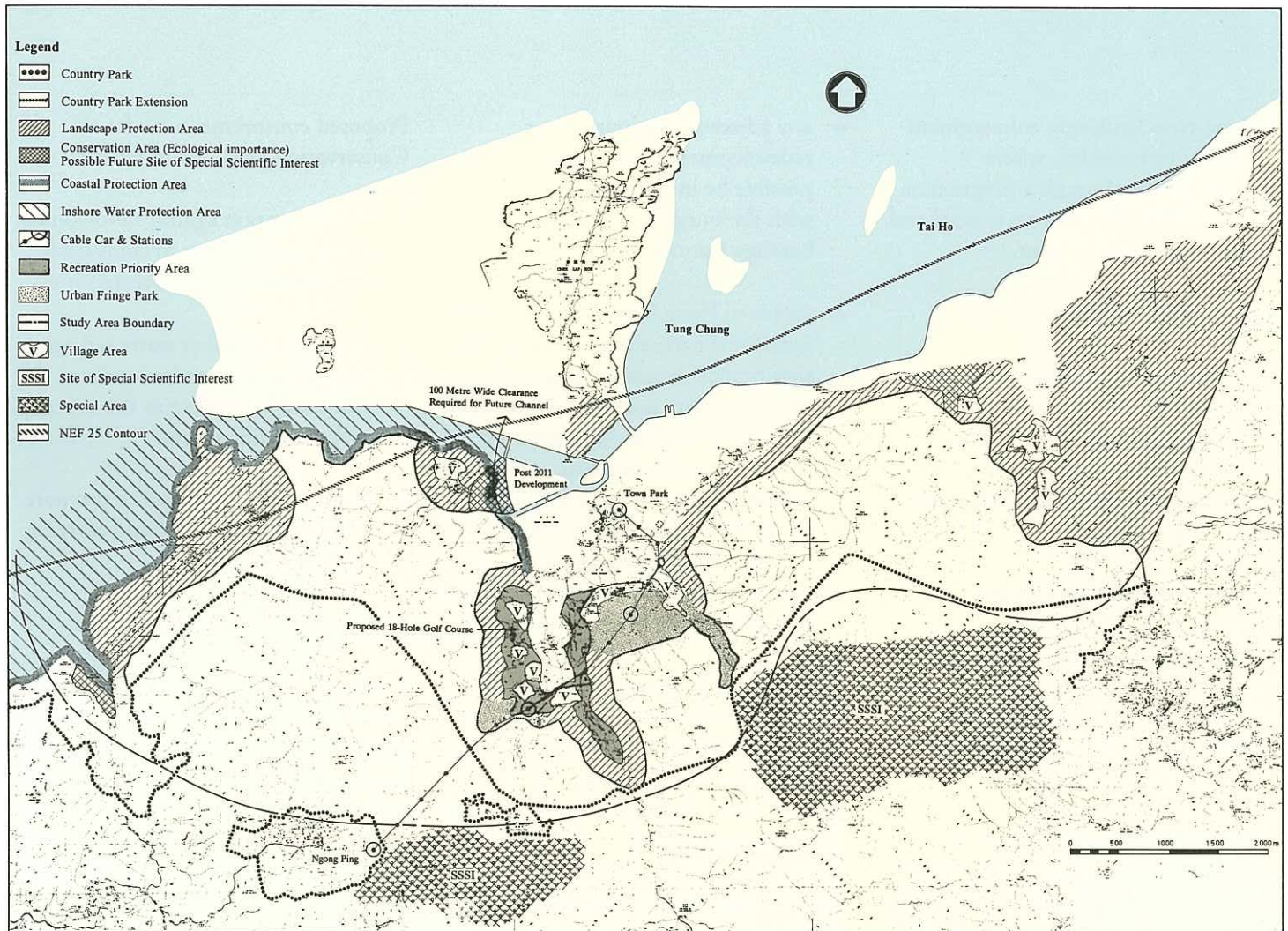


Figure 13.2 Rural Hinterland Strategy - Tung Chung and Tai Ho Areas

- o essential infrastructure such as sewage treatment plants, electric cables, pipelines and service reservoirs should be located underground wherever possible with full landscape reinstatement including regrading and planting. Roads should be carefully designed with minimum cut and fill and full landscape reinstatement. Pedestrian access to the countryside should be retained and extended.
- o stands of woodland and shrubs should be protected and retained where possible. Consideration should be given to the introduction of penalties for any unauthorised excavation or clearance. A landscape design including full reinstatement proposals should be submitted for all redevelopment.

- o long-term landscape enhancement should be provided through a programme of tree planting, erosion control and landscape management.

Coastal Protection Areas

These are areas of high quality natural coastline. They should be protected and conserved principally for their amenity value.

Proposed control measures are :

- o a general presumption against development or reclamation but certain compatible uses such as low key recreation proposals may be considered.

- o essential infrastructure such as sewage treatment plants, electric cables, pipelines and roads should be routed inland or underground where possible. Where this is not feasible, cable and pipelines should generally be incorporated as part of coastal footpaths, carefully detailed to cause minimum visual intrusion to the landscape. Roads should be designed with minimum cut and fill and their design should allow for continuous public access to the waterfront.
- o coastal vegetation should be protected and maintained as fully as possible. Consideration should be given to the introduction of penalties for any unauthorised excavation or clearance.

- o long-term landscape enhancement should be provided, where appropriate, through a programme of tree planting, erosion control and landscape management.

Inshore Water Protection Areas

These are areas of inshore waters located in the vicinity of beaches used for swimming and water sports. They should as a general presumption be protected and retained for recreational use.

Proposed control measures are :

- o all forms of commercial and marine uses such as dredging, barge loading and anchorage should be restricted. Pleasure vessels should be subject to continued speed restrictions.
- o water quality should be strictly controlled and monitored by EPD due to the large number of beaches in the area, which are likely to come under increasing demand for both bathing and water sports. Future gazettal of beaches at San Shek Wan and Sha Lo Wan is proposed.
- o particular care should be taken during construction of the planned reclamation works to minimise the impact on these areas.

Fung Shui Elements and Heritage Sites

Fung Shui landforms, Fung Shui woodland and sites of archaeological or historical interest, temples and monasteries are identified on the Hinterland Conservation Proposals.

Proposed control measures are:

- o both the Fung Shui element/ heritage feature and its immediate surroundings should be protected and conserved.

- o any adjacent development or redevelopment should as far as possible be in character and scale with the Fung Shui elements and heritage features.
- o stands of Fung Shui woodland and individual nature trees of Fung Shui significance should be protected and retained where possible. Consideration should be given to the introduction of penalties for any unauthorised clearance or excavation. A landscape design including full reinstatement proposals should be submitted for all redevelopment.
- o long term landscape enhancement should be provided through a programme of tree planting and landscape management.

Conservation Areas

Three Conservation Areas are proposed within the North Lantau Hinterland at San Tau, Sham Wat and Pak Mong, based on existing mangrove and/or stream and wetland habitats. At San Tau and Pak Mong additional new areas of mangrove are proposed.

There are only two areas of existing mangrove within the NLD Area which can be feasibly retained together with the planned development; they occur at San Tau and Sham Wat. The boundary of the proposed Conservation Areas is based on the existing habitat area together with a notional 150 metre "protection zone", to protect both the habitat and its landscape setting.

Two stream/wetland conservation areas are proposed at Sham Wat and Pak Mong both of which would be in conjunction with existing and artificially created mangrove habitats respectively.

Proposed control measures for all Conservation Areas are as follows:

- o A presumption against development of any kind subject to compatible educational and research facilities.
- o No public access or restricted access only, following marked trails or board-walks, subject to the capacity of the individual area.
- o Habitat to be managed to promote its ecological diversity and carrying capacity for wildlife.

Habitat Creation Areas

Extensive new areas of mangrove are proposed at Pak Mong and San Tau, to replace where possible those mangrove habitats lost through reclamation and construction works.

Further study will be required to ensure that there is no conflict between the existing and proposed mangrove sites and

- o drainage and water movement, and
- o shorebirds attracted within the vicinity of the new airport.

The method used to plant mangroves at Tolo Harbour included the dumping of dredged marine mud followed by a waiting period of up to two years to allow the mud to dry out before a start could be made on the planting of mature "droppers" of *Kandelia candel* and *Bruguiera conjugata* at 300 millimetre centres. Further research will be required to ensure that the two proposed sites are appropriate for mangrove establishment; environmental input will be needed at all design stages of the Pak Mong Lake and the post 2011 reclamation at Tung Chung.

Woodland and Stream Habitats to be Conserved

These are areas of ecological importance comprising rich natural woodland and clear running streams lying within the Country Parks boundary, which should be managed as for Conservation Areas. Wherever possible, the proposed Country Park extension covers the woodland areas identified together with a 200 metre "protection zone" to allow for perimeter woodland planting.

Degraded Grassland to be Afforested

A comprehensive revegetation plan is proposed for the grassland and shrubland areas of North Lantau in order to :

- o reduce the fire risk;
- o increase ecological value; and
- o improve visual quality

Adequate fire prevention is required to permit natural regeneration together with infill planting of native species, based originally around the existing pockets of relic woodland which occur in gullies and ravines.

Fire Risk and Prevention

The risk of fire at certain times of the year is high in all rural and urban fringe areas in Hong Kong.

On North Lantau there are large tracts of fire maintained grassland/shrubland and field studies suggest that certain of the woodlands are in retreat due to regular burning of the adjacent grassland affecting the woodland edge. The orientation of the area, the evidence of frequent past fires and the fact that large numbers of construction workers followed by large numbers of residents will be moving into the area over the next few years imply that the

fire risk for the North Lantau Hinterland is likely to be extreme.

Objectives of a comprehensive fire management plan should include the following:

- i) Safeguard and protect all existing and retreating woodland areas; and
- ii) Permit natural regeneration of grassland.

The CPA currently uses three main techniques to assist with fire prevention and control :

- o fire breaks;
- o green belts; and
- o controlled burns.

Fire break design varies according to the terrain, aspect, drainage pattern, vegetation type and gradient of the site. An effective fire break can consist of a road or footpath or an area stripped of vegetation, and may range in width from one metre in an area of mature woodland to over 100 metres in an area of exposed grassland.

A 'green belt' consists of a buffer strip of fire resistant tree species planted to protect vulnerable areas of woodland. Establishment of the greenbelt can be difficult due to fire risk, exposure and drought and in can take up to 5 to 10 years to become effective. In the past introduced Australian species have been used in Hong Kong such as Acacia mangium, A. confusa and A. auriculiformis, selected for their fast growth, hardiness and fire resistance. Local species such as Schima superba have been successfully used in Southern China, but only in more favourable sheltered sites.

Controlled burning is a technique used widely in Australia and other parts of the world to clear ground level

vegetation and hence reduce the risk of fire. In Hong Kong the technique can only be used on an average of 10 to 20 days a year, during mid to late October; skilled and fit workers are needed but it offers a cheaper and more successful method of vegetation clearance than alternative physical or chemical means. The technique can also be used to create fire breaks and help establish green belts.

Visitor and Study Centre

A visitor and study centre is proposed in the Conservation Area at Pak Mong providing educational and research facilities for school children, students, local residents and visitors. A full spectrum of ecological habitats including woodland, wetland, stream and mangrove is available for study. Trails and boardwalks can be provided with information panels for casual visitors. Lectures and field studies can be arranged for organised groups together with hostel accommodation.

Community Farm and Permaculture Site

A community farm and permaculture site is proposed to the south of San Tau village which can provide 'hands on' farming experience for local residents of all ages together with a small information centre and outlet for fresh farm produce. Permaculture promotes an ecologically sound and sustainable use of all natural resources including food, water and energy and will be highly compatible with an agro-forestry approach within the North Lantau Hinterland. A possible alternative site for a community farm and for permaculture is proposed at the edge of the Mok Ka urban fringe park.

13.1.5 Recreation

The North Lantau Rural Hinterland offers the potential for a wide range of recreation facilities to be planned and developed as part of the NLD, maximising the amenity value of the North Lantau foothills and coastline. The recreation proposals are illustrated in Figure 13.2 and include the following facilities.

Links to New Town and Country Park

The provision of good access from the New Town into the surrounding hinterland is seen as a prime objective of the hinterland recreation proposals and the Landscape Masterplan. The distribution of open space within the New Town creates a strong focus at the Town Park, with a southerly open space axis reaching up the Tung Chung valley. Three types of linkage are proposed from the town centre into the Hinterland :

- o a possible cable car system linking the Town Park with the hinterland and the Lantau Hills;
- o a footpath and cycle network connecting the New Town pedestrian and cyclepath routes with long distance trails and cycletracks in the hinterland and the Country Parks; and
- o a visual link - the North Lantau Hinterland provides a green backdrop enclosing the New Town and will be seen from most parts of the new urban area.

Country Park

The existing North Lantau Country Park (CP) covers the most spectacular and remote countryside within the NLD Area and offers facilities for hill

walking and hiking, barbeques and nature trails together with camp sites and visitor centres. The proposed Country Park Extension would offer improved recreational facilities for both new town residents and visitors to Lantau and is likely to become one of the more accessible and popular of the Territory's Country Parks.

Cable Car

A cable car system linking the Town Centre with two intermediate stations in the hinterland and Ngong Ping, a popular destination for current visitors to Lantau, should be further investigated.

With the new rail link North Lantau will become one of the more accessible rural areas of Hong Kong, instead of one of the more remote. Current Government policy is for restricted transport links between Tung Chung/ Tai Ho Wan and the rest of Lantau; a cableway would provide an attractive recreational link between the New Town Centre, the North Lantau Hinterland, the Country Parks and the rest of Lantau. Through careful siting of the stations, visitors could be directed to areas with an appropriate carrying capacity and away from sensitive ecologically important areas.

In a preliminary concept of such a system four stations have been proposed each with a different character and range of recreational activities. These are:

o Town Centre Station

This would be located on the fringe of the Town Park easily accessible from the adjacent railway station, public transport interchange, public car park and the town centre.

o Wo Liu Tun Station

This would be located on a prominent spur below Wo Liu Tun Hill with panoramic views across the New Town towards Chek Lap Kok. A restaurant, cafe and outside eating area could be provided here.

This would be a popular day time and evening venue for both residents and visitors to Tung Chung. Well-lit footpaths would lead down through the gardens and urban fringe park to Tung Chung Fort and the New Town.

o Mok Ka Station

This would be located at the southern edge of the Tung Chung valley, close to the Country Park boundary and set within an urban fringe park. The recreation facilities would be low key and informal in character and could be used mainly at weekends and during school and public holidays.

o Ngong Ping Station

Located high in the Lantau hills, Ngong Ping is well known for the Po Lin Monastery, Giant Buddha, Tea Gardens and Riding Centre. As an existing tourist attraction, accessible only by bus from South Lantau, Ngong Ping is an obvious choice for a possible fourth Cableway Station. In addition to the immediate attractions, the station would provide hiking access to the Lantau Trail and Sunset and Lantau Peaks, as well as public transport to South Lantau. Some upgrading would be required of existing facilities at Ngong Ping to cope with additional users; a comprehensive design approach would be recommended to integrate the existing and new facilities.

The design and alignment of such a cableway system will clearly require detailed consideration to avoid any major environmental or visual impact on the hinterland area. A gondola cableway would offer an economical and unobtrusive system; two person enclosed gondolas require towers at 350 metre centres and could move 400 people an hour. Closed gondolas would be recommended to minimise risk of fire or litter pollution. The proposed cableway alignment follows valley sides where possible, and avoids ridge-lines. A 25 metre wide reserve could be provided through the urban area which could be allocated for non-building areas within development sites, open space and transport reserves. This has not been shown on the RODP as the concept has not been fully evaluated.

Urban Fringe Parks

Urban Fringe Parks (UFPs) provide a recreational link between the urban area and the countryside, offering facilities and an environment not currently available within a traditional urban park or a Country Park. They will help to relieve the pressure on CPs for more intensive recreational facilities such as taichi areas, morning walks and barbecues, especially close to residential areas on the urban fringe.

Two UFPs are proposed which will be formed in association with the intermediate cableway stations at Wo Liu Tun and Mok Ka. A third park is proposed in the Wong Lung Hang valley which would be developed as an arboretum.

Long Distance Trails

A comprehensive network of long distance trails (LDTs) is proposed linking the UFPs to each other and providing strong connections between

the urban area and the CPs. The trails will be based on upgraded existing tracks wherever possible with short sections of new track formed as necessary. Two grades of trail are proposed - primary trails are wide, surfaced trails connecting the main recreational nodes, generally contour paths or well graded with steps and ramps; secondary trails are generally unsurfaced hill tracks offering hiking and hill-walking possibilities. Some 34km of primary trails are proposed within the study area.

Cycletracks

A segregated cyclepath system is proposed in the NLD area. There are opportunities for some additional cycletracks to be provided for recreational use in the Rural Hinterland, for example into the Wong Lung Hang Arboretum and into the upper Tung Chung valley, connecting with the Main New Town Cycle-path network. Dedicated mountain bike trails could also be considered for future introduction into the Hinterland and Country Parks, should the demand be sufficient. A total of 18km of cycle tracks are proposed within the North Lantau Hinterland area.

Golf Course

An 18-hole Golf Course and Clubhouse could be provided behind and around the villages of Shek Lau Po, Shek Mun Kap, Chap Mun Tau, Mok Ka, Nim Yuen, Tung Hing and Ngau Au. Much of this land is privately owned agricultural land and a comprehensive development approach would be required to consolidate land ownership and prepare design proposals. A golf course is seen as an attractive private sector development option, fulfilling an anticipated demand from local residents and visitors, as well as providing a

pleasant green outlook for non-golfers. As with the Cable car concept a full evaluation of this concept will be required before the idea can be implemented. The area in question is only shown as RPA on the RODP.

Outward Bound Centre and Water Sports Centres

An Outward Bound and Water Sports Centre is proposed on the coast to the north of San Tau village, subject to Airport security requirements.

The Outward Bound Centre can offer varied courses for groups such as students, managers, executives, athletes, handicapped and deprived children/adults based on outdoor physical activities. Courses would be geared around the goals of each group which could range from improved physical mobility and self confidence to team work, survival and fitness training. Access to the Country Park would allow for hiking, running and orienteering while the adjacent Water Sports Centre could offer water based activities. The proposed Water Sports Centres at San Tau and Pak Mong can offer recreational facilities and training for canoeing, rowing, dingy sailing and windsurfing. They would operate as public centres but could also include club facilities and in the case of San Tau provision for training and outward bound courses.

Inshore Water Recreation Areas

These are within the proposed Inshore Water Protection Areas and are suitable for a range of slow-speed intensive water sports such as canoeing, rowing, novice sailing and windsurfing, all of which require adjacent shore facilities and clean water. This use would be subject to Airport security requirements.

Beaches

Two gazetted beaches are proposed (subject to Airport security requirements) San Shek Wan and Sha Lo Wan, both located within the proposed Inshore Water Recreation Area and the North Lantau Water Control Zone.

Launching for Windsurfers/Dinghies

Safe beaches suitable for the storage and launching of small craft such as dinghies and canoes are identified at Sun Sam, Hau Hok Wan, Sha Lo Wan and San Shek Wan. This activity would be subject to Airport security requirements.

Marina

A possible site for a marina has been identified at Kei Tau Kok, in eastern Tung Chung. Further work is required to examine the feasibility of this site for marina/water front residential development.

Campsites, Hostels and Holiday Accommodation

Campsites are proposed in both seaside and countryside locations, to serve beach users during the swimming season and walkers during the hiking season. These should help to relieve pressure on the beaches during the popular summer season and encourage year-round use.

Seaside camps are proposed at San Shek Wan and Sha Lo Wan, both of which are within convenient reach of nearby beaches.

Countryside camps are proposed at Sham Wat Wan, San Shek Wan (South), Sha Lo Wan (South), Ngau Kwu Long, Tai Ho and Tai Ho San Tsuen. Holiday accommodation in the form of bungalows or hostels is

proposed at Sha Lo Wan. This could be developed into resort-type facilities including gardens, swimming pools and sports facilities or alternatively retained at a low key level of self-catering accommodation with barbeque sites, combined with campsites.

Possible Conflicts with Conservation

Care has been taken to locate new recreation facilities well away from the more sensitive ecological areas and to avoid wherever possible any conflict between recreation and conservation objectives.

13.1.6 Development Control

Overview

The hinterland will be subject to a range of development pressures which could lead to a progressive degradation of the environmental and visual quality of the urban fringe and coastal areas. Stringent development control will be essential to overcome these pressures, which may be described as follows:-

Urban Pressures on the Hinterland

Urban pressures on the hinterland include the following :

- o ad hoc development in village areas which can extend urban and suburban sprawl;
- o the demand for additional development sites for uses such as infrastructure (transport requirements, transmission lines, water storage and utilities), low density housing, Government/ Institution and Community Uses (G/IC) and private recreation facilities;
- o the demand for unsightly or temporary uses such as container storage, holding areas, illegal

dumping, squatter settlements and grave sites;

- o recreational demand from high numbers of residents and visitors, which can lead to environmental stress, slope erosion, damage to vegetation, litter pollution and fire risk; and
- o urban pressures which are likely to increase over time as the resident population of the New Town reaches its planned target level.

Urban Fringe Land Uses

Proposed land uses for the North Lantau Hinterland are predominately conservation and recreational uses, with allowance made for controlled village expansion and village resite areas, as required.

Private Land

A significant sector of the land within the Hinterland Study Area is privately owned, consisting of village areas and associated agricultural land. Outside the allocated village areas, this land is generally zoned CCA. It is recognised, however that there is likely to be considerable pressure for private sector residential and/or recreational development. Allowance has been made for a major recreational development on private land in Tung chung through the golf course proposed on land zoned as Recreation Priority Area (RPA).

In other parts of the hinterland, opportunities for private development include holiday accommodation at Sha Lo Wan and camp sites in several locations.

Development Constraints

A principle constraint to adhoc private development in the hinterland area is

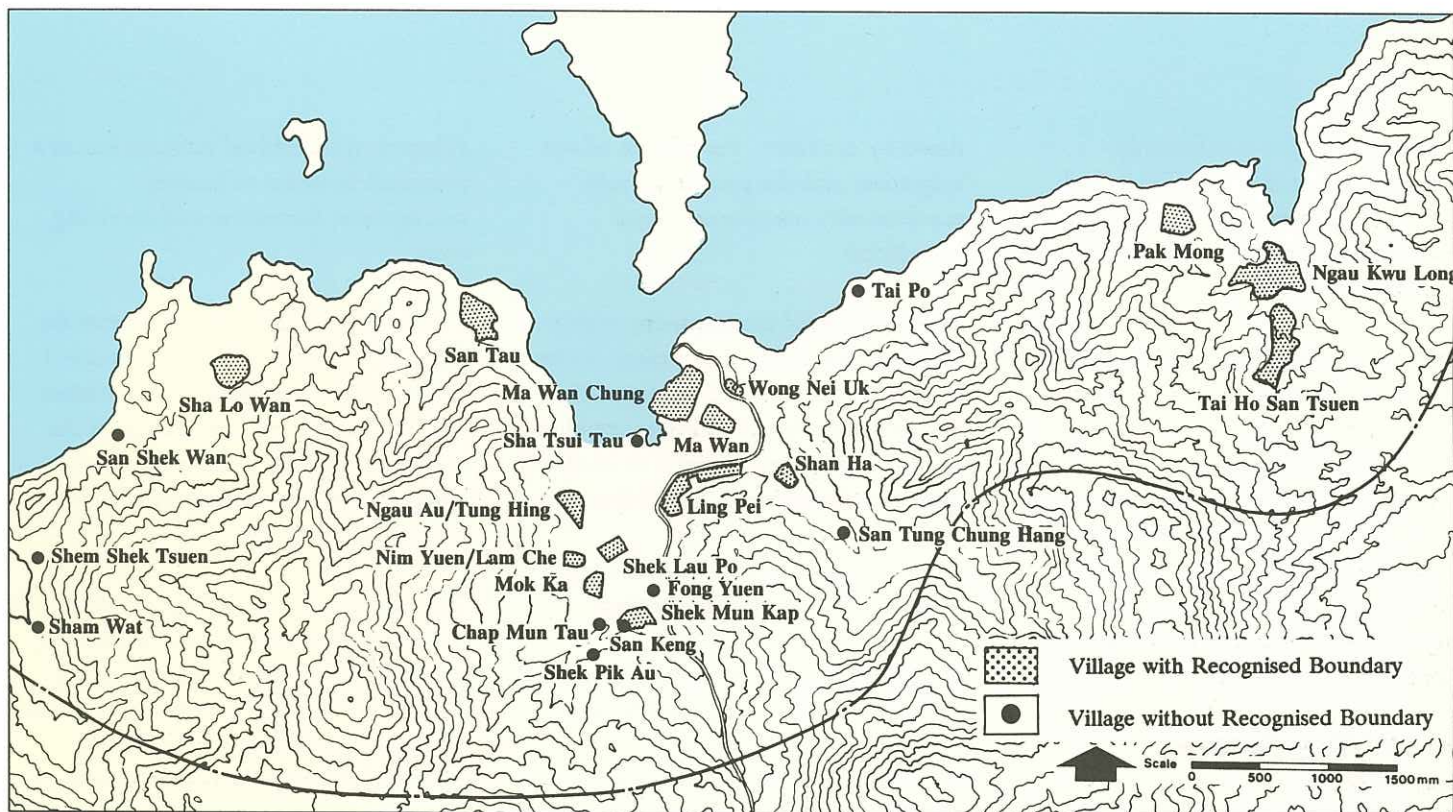


Figure 13.3 Villages in The Study Area

likely to be one of access. Current plans for NLD show vehicular access restricted to the urban area, with local vehicular access provided only to the villages in the Tung Chung and Tai Ho Wan valleys. No vehicular access is proposed to the west of Tung Chung; access by water would also be subject to the restrictions of the proposed Inland Water Protection Zone, prohibiting barge lading and anchorage of commercial vessels.

Restricted access for vehicles and barges is seen as the key to controlling private sector development in the North Lantau Hinterland.

Additional constraints to private development in the urban fringe will occur through existing planning controls provided by Outline Zoning Plans and Special Control Areas, supplemented by administrative guidelines, as set out in Section 8.2 of this report.

Land Use Zoning

The majority of the Hinterland Area is currently zoned Countryside Conservation Area (CCA), Village Type Development (V) or Country Park (CP). Suggested future land use zoning, includes an extended Country Park area and Recreation Priority Area (RPA), designated for a possible golf course development. The hinterland lying adjacent to the new town or proposed RPA development has been designated Green Belt (GB), in order to conserve and enhance the existing landscape features and discourage development other than for recreation, forestry or agriculture. The remaining hinterland is designated as CCA, covering the more remote and rural areas, and Coastal Protection Area (CPA) covering the natural coastline which will be retained to the west of Tung Chung.

13.2 Village Development

13.2.1 Existing Position

There are 35 settlements within the study area. These are concentrated mainly in the lowlands of the Tung Chung and Tai Ho Wan valleys. Of these, 21 are pre-1898 recognised villages and the majority fall into 15 groups of villages with recognised boundaries. Figure 13.3 shows the existing villages located within the Study Area. Further data relating to existing villages and proposals for village re-sites can be found in Topic Report TR16 'Village Concept Plans' and Working Paper WP12 'Village Studies' which are further summarized in Appendix H of this Report.

In developing the RODP, the principle of retaining as many as possible of the existing settlements in-situ has been adopted. Separate plans have been prepared for each settlement to demonstrate how the retained

settlement can be satisfactorily integrated into the New Town and urban fringe areas and accommodate the future small house demands of indigenous villagers.

Villages and other settlements that would be directly affected by New Town development are to be relocated to designated village re-site areas located on the periphery of the planned urban area. These settlements include Tai Po, Wong Nai Uk, Ma Wan, Ma Wan Chung and Sha Tsui Tau. The requirements for these settlements are given in Appendix H.

13.2.2 Village Expansion

North Lantau has experienced low demand by indigenous male villagers to exercise their traditional right to build an exempted Small House. This is due to the relatively poor levels of accessibility and infrastructure, the relatively high proportion of indigenous villagers who occupy dwellings passed

down by ancestors, the pattern of out migration and the predominantly economically inactive and aged population.

Most residential development within existing villages has taken place under the provisions of the Government's Small House Policy. This policy allows eligible indigenous villagers to establish their entitlement for a Small House by:

- o purchasing a grant lot on crown land on concessionary terms;
- o exchanging private agricultural land for a Free Building Licence; or by
- o building on private building lots

A further method of accommodating demand for Small House entitlements has involved the resumption, by Government, of private land within the recognised village environs, provision of site formation and service infrastructure and the granting back to eligible

villagers of individual serviced lots at a premium in order to recover resumption, formation and servicing costs.

Table 13.1 presents an estimate of the demand for Small Houses up to 2011 in the retained villages. This estimate has been based on a projection of the number of eligible male indigenous villagers and the existing number of private building lots.

The estimation method for assessing future small house demand is given in Topic Report TR16 'Village Concept Plans'. In those villages where estimates of demand appear low (for example Ling Pei and Shan Ha) sufficient land is available to accommodate additional housing demand should the need arise.

Concept plans to accommodate this demand have been prepared and are presented in Figures H1 to H12 of Appendix H.

Table 13.1 Estimated Demand for Small Houses in Retained Villages to 2011

Village	Estimated Indigenous Population	Estimated Indigenous Male Adults		No. unclaimed entitlements	Existing Pre/Post-War Building Lots	Estimated Small House Demand
	1990	1990	2011			2011
1. Sha Lo Wan	500	192	320	182	127	192
2. San Tau	320	123	206	114	981	08
3. Ngau Au/Tung Hing	136	52	89	50	42	47
4. Nim Yuen/Lam Che	35	14	24	14	10	14
5. Mok Ka	130	50	84	47	52	32
6. Shek Mun Kap	120	46	78	43	64	14
7. Shek Lau Po	140	54	91	N/A	40	51
8. Ling Pei	302	116	194	92	290	0
9. Shan Ha	69	27	46	24	43	3
10. Pak Mong	100	39	65	39	44	21
11. Ngau Kwu Long	150	58	97	58	40	57
12. Tai Ho San Tsuen	150	58	97	58	36	61
Total	2152	829	1391	721	886	600

Source : Consultants' Estimates

These provide a planning framework to aid the preparation of statutory layout plans. They show existing land uses and the proposed location of village expansion areas. Wherever possible, village expansion areas have been identified within recognised village boundaries. Factors considered in determining the suitability of land within the recognised village boundaries to accommodate Small House demand were:

- o Land tenure : Expansion areas were identified on Crown Land where ever possible. Private land was recommend only where there was insufficient suitable Crown Land to meet demand.
- o Geotechnical Constraints : In villages sited on geotechnically unsuitable soils, predominantly colluvium soils, areas where the slope gradient exceeded 1 in 10 were excluded from consideration.
- o Fung Shui and Indigenous Woodland : The integrity of existing fung shui and indigenous woodland should be preserved in planning village expansion areas.
- o Sites of Archaeological and Historical Interest : Within existing recognised village boundaries, all temples, shrines, significant buildings and sites of archaeological and historical interest are to remain in-situ. Consideration is to be given to re-siting the Hau Wong Temple near Sha Tsui Tau and the Tin Hau Temple on the western shores of Tai Ho Wan as both sites are affected by planned future development.
- o Accessibility : All villages will be accessible by footpath. Upgraded pedestrian access to San Tau and Tai Ho San Tsuen is proposed, with all remaining villages to be accessed by existing or proposed roads.

- o Utility services : most villages are provided with electricity and telephone services and piped water supply, although in some cases water supplies are obtained from local streams. Future upgrading of village utility services infrastructure would be expected to be undertaken as the New Town is developed.

In preparing Concept Plans for village expansion areas a figure of 250m² per Small House has been used to estimate gross land requirements and housing capacity of the expansion area. This figure makes allowance for the Small House Building Lot, local access and circulation, local open space and local G/IC facilities within the re-site area.

13.2.3 Village Resite

Indigenous villagers whose village or property is affected by development of the New Town and requires clearance may receive compensation under the Government's Village Removal Policy.

Development of the New Town will directly affect three recognised villages and two other settlements. These would require to be relocated to the village re-site areas proposed at the periphery of the urban area at different stages of development of the New Town. The settlements to be relocated include:

- o Tai Po, to be relocated during Phase I development;
- o Ma Wan and Wong Nai Uk, to be re-sited during the Phase II development; and
- o Ma Wan Chung and Sha Tsui Tau, to be re-sited during the Phase III development

In estimating gross land requirements for village re-site areas to accommodate the relocated villagers, allowance was made for:

- o the number of houses estimated to be affected by development and requiring relocation;
- o the provision of local open space, car parking and G/IC facilities; and
- o small house entitlements of the future indigenous villagers up to 2011.

Table 13.2 summarises the existing village re-site requirements. The number of existing houses to be relocated and the future small house grant lot demand is estimated to be 88 and 131 respectively. Estimates of the number of houses to be relocated, however, may vary following detailed survey by Government.

Three areas have been identified on the fringe of the New Town to resite eligible villagers and to accommodate future Small House entitlements up to 2011 from eligible male indigenous villagers who have been resited. These village resite areas are shown on Figure 13.4 and are located at Shan Ha North, Shan Ha South and south of Mok Ka Village.

Concept plans to guide future layout planning and development of these areas were prepared and are presented in Appendix H, Figures H13, H14 and H15. As noted, in preparing these plans, a figure of 250m² per Small House was used estimate gross land requirements and housing capacity. This figure makes allowance for the Small House building lot, local open space, access requirements and G/IC facilities within the re-site area.

Table 13.2 Village Resite Requirements

Village	Estimated Indigenous Population	Estimated No. Male Adults		Houses to be removed	Estimated Demand for Small Houses by 2011
	1990	1990	2011	No.	No.
1. Tai Po	88	34	58	4	0
2. Ma Wan/Wong Nai Uk	130	50	84	46	38
3. Ma Wan Chung	193	74	125	35	90
4. Sha Tsui Tau	0	0	0	3	3
Total	411	158	267	88	131

Source : Consultants' Estimates

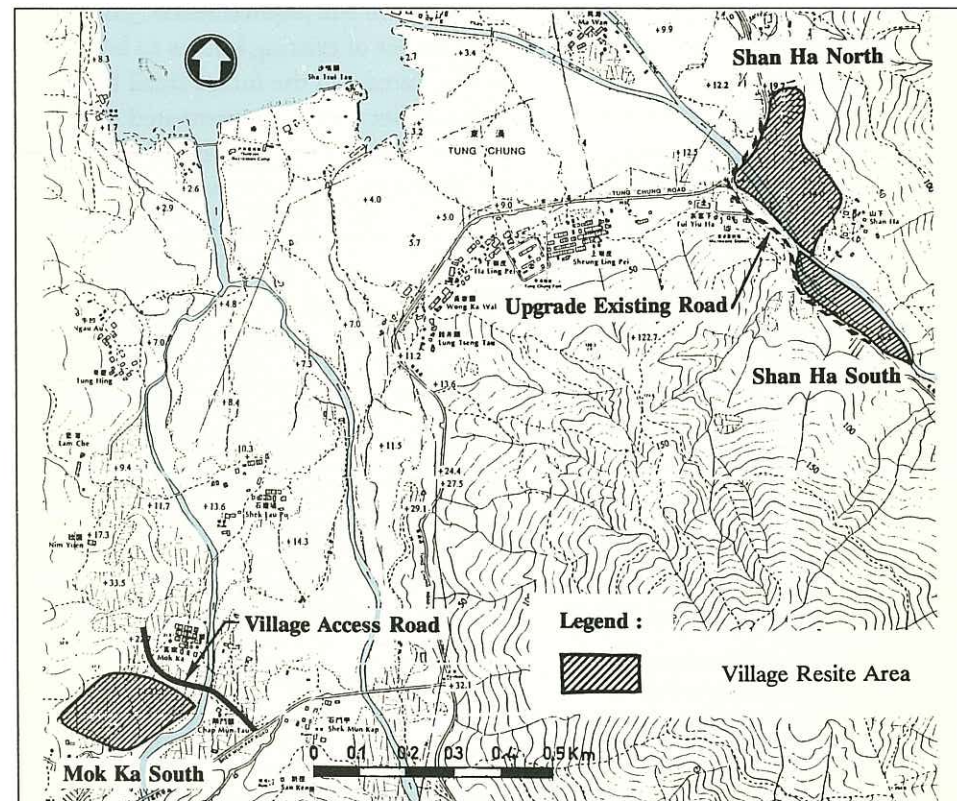


Figure 13.4 Village Resite Areas

13.2.4 Sites of Scientific, Archaeological and Historical Interest

North Lantau was one of the earliest places to be settled in Hong Kong and thus contains a number of historic and archaeological features. These have been indicated on Figure 4.1.

There are two declared monuments in North Lantau under the Antiquities and Monuments Ordinance. These are the Tung Chung Fort and the Tung Chung Battery, which were gazetted in 1979 and 1983 respectively. Tung Chung Fort has recently been restored and now houses the Tung Chung Public School and the office of the Tung Chung Rural Committee. Tung Chung Battery will be retained in situ and be integrated with proposals for the Town Park. The Tung Chung Game Board Carving is located on the Tung Chung knolls and will also be integrated into the Town Park.

North Lantau also contains sites of special archaeological significance at Pak Mong, Sha Lo Wan and Sha Tsui Tau. These are sites which have yet to be fully investigated but are likely to contain sites or buildings of

archaeological or historic interest. Archaeological surveys should be carried out at Pak Mong and Sha Tsui Tau before development occurs to determine the value of these sites.

There are seven temples and one monastery in the Study Area. Of these temples, the Pa Kong Ku Miu at Sha Lo Wan and the Hau Wong Temple at Sha Tsui Tau are identified as being of historic interest. Only the Hau Wong Temple is affected by development of the New Town. The remaining development will be retained in situ.

The Hau Wong Temple is located within a planned RS/HOS housing site. Future planning of the housing site may prove incompatible with the retention of the temple in-situ. It is thus recommended that the temple be relocated. A site for this purpose has been identified at the convergence of the drainage channels adjacent to Tung Chung Area 38. Development of the RS/HOS housing site is proposed in phase 3 development of the New Town. This allows ample time to pursue with villagers the issue of the relocation of the temple and agreement of the new site. Should these negotiations not achieve relocation of the temple, the existing site is a constraint to the planning of the future RS/HOS developments.

13.2.5 Burial Grounds

There are nine existing designated burial grounds in Tung Chung and two in Tai Ho Wan. The location of the Tung chung burial grounds is shown on Figure 13.5. The Tai Ho Wan burial grounds will not be affected by development of the New Town.

Of the Tung Chung burial grounds, only two will be affected by the development of the New Town. These are those located on the knolls east of Ma Wan Chung and adjacent to Lau Fau Sha. Both designated burial grounds and a substantial number of graves and burial pots located outside the designated area over the Ma Wan Chung knolls will need relocation during the early phases of development of the New Town.

A search for new burial grounds and examination of the potential to expand existing burial grounds in Tung Chung was carried out in conjunction with the appropriate Government Department. The results of this are also shown on Figure 13.5.

Expansion of two existing burial grounds has been recommended to

accommodate graves and urns/bone pots relocated from existing burial grounds affected by the Phase 1 development of the New Town. These are the Lung Tseng Tau and Shek Mun Kap burial grounds.

Other burial ground extension areas have been recommended to accommodate either the longer term burial requirements of indigenous villagers or burial ground removals required in later stages of the New Town's development. These extensions are to the Nim Yuen Burial ground (No. 15), the Mok Ka Burial ground (No. 16) and the Tung Chung Road Burial Ground (No. 18) respectively. Further investigation should be carried out to assess the suitability of a site located within an abandoned quarry at the end of Shek Mun Kap Road for this purpose.

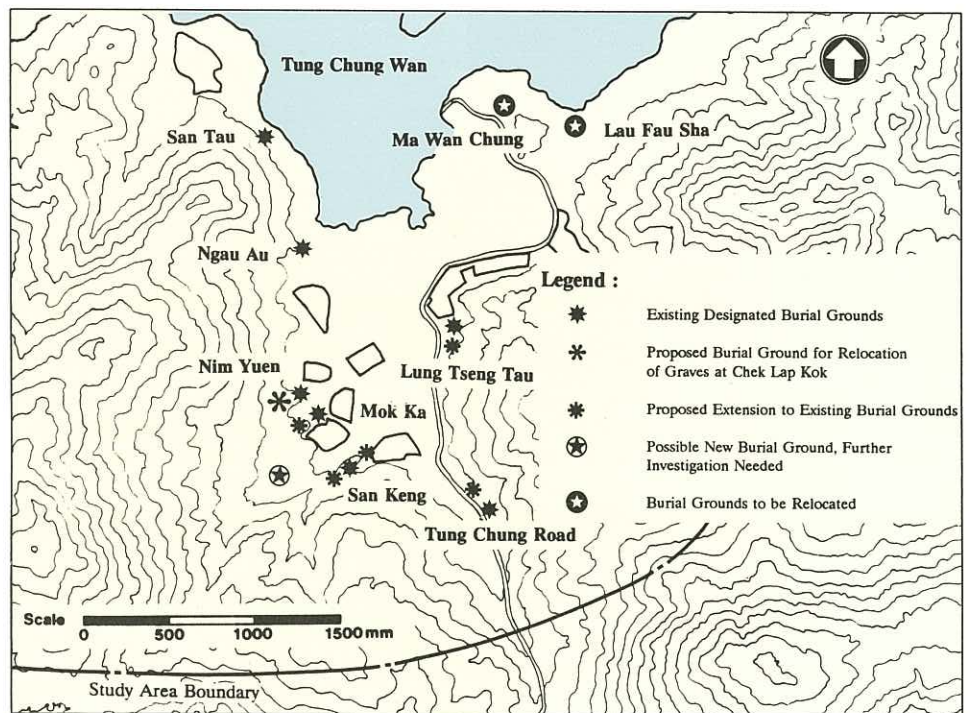
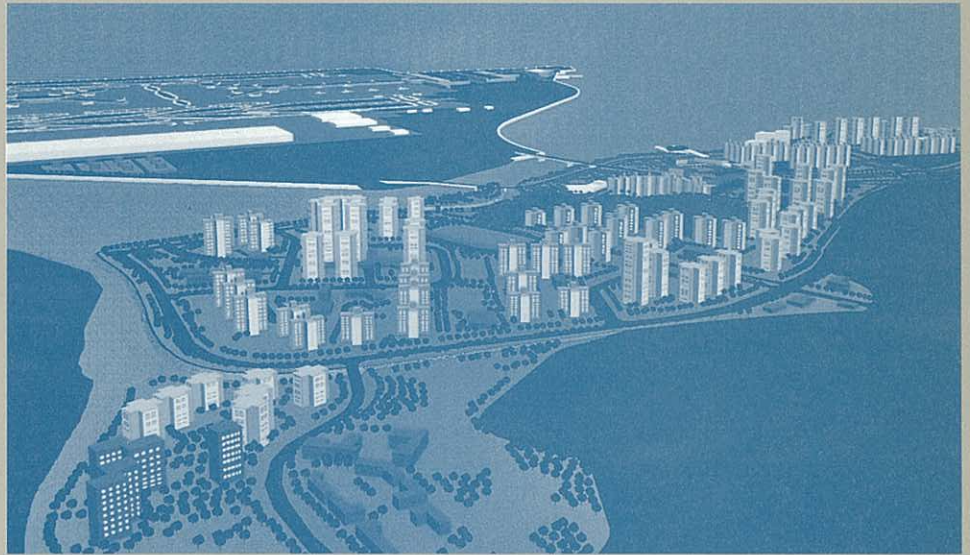


Figure 13.5 Burial Grounds

North Lantau Development



14. Development Programme and Implementation

14. DEVELOPMENT PROGRAMME AND IMPLEMENTATION

14.1 Initial Population Targets

The Study Brief set out the initial population targets and housing mix for public and private section housing, including HOS, with a first intake in 1997. The targets were based on a population build up in the two main districts of Tung Chung and Tai Ho. These targets (as set out in Table 5.1) are re-presented in Table 14.1.

a balanced development of housing and community facilities in one geographic area. The sequence of the development (pending any agreement on advancement of Phase II) is shown in Figure 14.1 for Tung Chung and in Figure 14.2 for Tai Ho.

The master development programmes for Tung Chung and Tai Ho are shown in Figures 14.3 and 14.4 respectively.

Table 14.1 Initial Population Targets

District	Design Year				
	1997	2001	2006	2011	Post 2011
Tung Chung	20,000	60,000	120,000	150,000	(1)
Tai Ho	-	-	-	50,000	(1)
Total	20,000	60,000	120,000	200,000	260,000

Source : Study Brief and LDPC Paper 20/90

Note :(1) Population distribution will depend on the detailed planning of the Potential Development Areas in Tung Chung and Tai Ho.

These population targets and the housing mix have been reviewed during the Study and a revised population build up and housing mix are presented in Section 14.3.

14.2 Development Packages and Programme

The New Town will be developed in five phases in the two districts of Tung Chung and Tai Ho, in accordance with the broad population targets described in Section 14.1.

Development packages have been chosen to suit the New Town developments at Tung Chung and Tai Ho. Each package generally relates approximately to the time duration of a single phase. It aims to include all those component projects required to produce, on completion of the package,

The programmes illustrate in outline the timing of when various site formation, infrastructure and building developments are planned to take place. Land acquisition activities have also been also shown where appropriate.

In Table 14.2 the proportion of each planning area expected to be completed within each package is shown.

The population intake for Phase II in Tung Chung may be advanced by two years showing completion by 1999. This need for this has come about following the decision to have the Lantau Line (LAL) operational by airport opening in 1997. This acts as a catalyst for earlier private residential and commercial developments adjacent to the LAL. Public housing completion is also to be advanced by two years in order to maintain the desired balance of housing mix.

14.3 Implementation

14.3.1 Revised Population Build-up

Population targets and the housing mix have been reviewed during the Study and a revised population build up is presented in Table 14.3.

In the first three phases of the New Town development, that is for design years 1997, 2001 and 2006, housing development will be in Tung Chung only. Housing Development in Tai Ho will only take place in Phases IV and V that is for the design year 2011 and beyond.

14.3.2 Phase I - 1997

Tung Chung (Package 1)

Development Package 1 is aimed at providing an initial community support to the New Airport which is scheduled for opening in 1997. It covers Planning Areas 4, 5, 6 and 8 to 14 inclusive in Tung Chung with a target population of over 20,000 and the extent is as shown in Figure 14.1.

Land will be formed mainly in reclamation but partly on existing land, which will involve the acquisition of some private land. Site formation is scheduled to commence in April 1992 and will take two years to complete terminating in March 1994, as indicated in Figure 14.3.

Public housing development requires a construction period of some 3¼ years. It is scheduled to commence in 1994 and will be completed by April 1997. A two to three month period has been allowed for the intake of population.

The construction of the Tung Chung Railway Station together with the associated private residential development will take place between

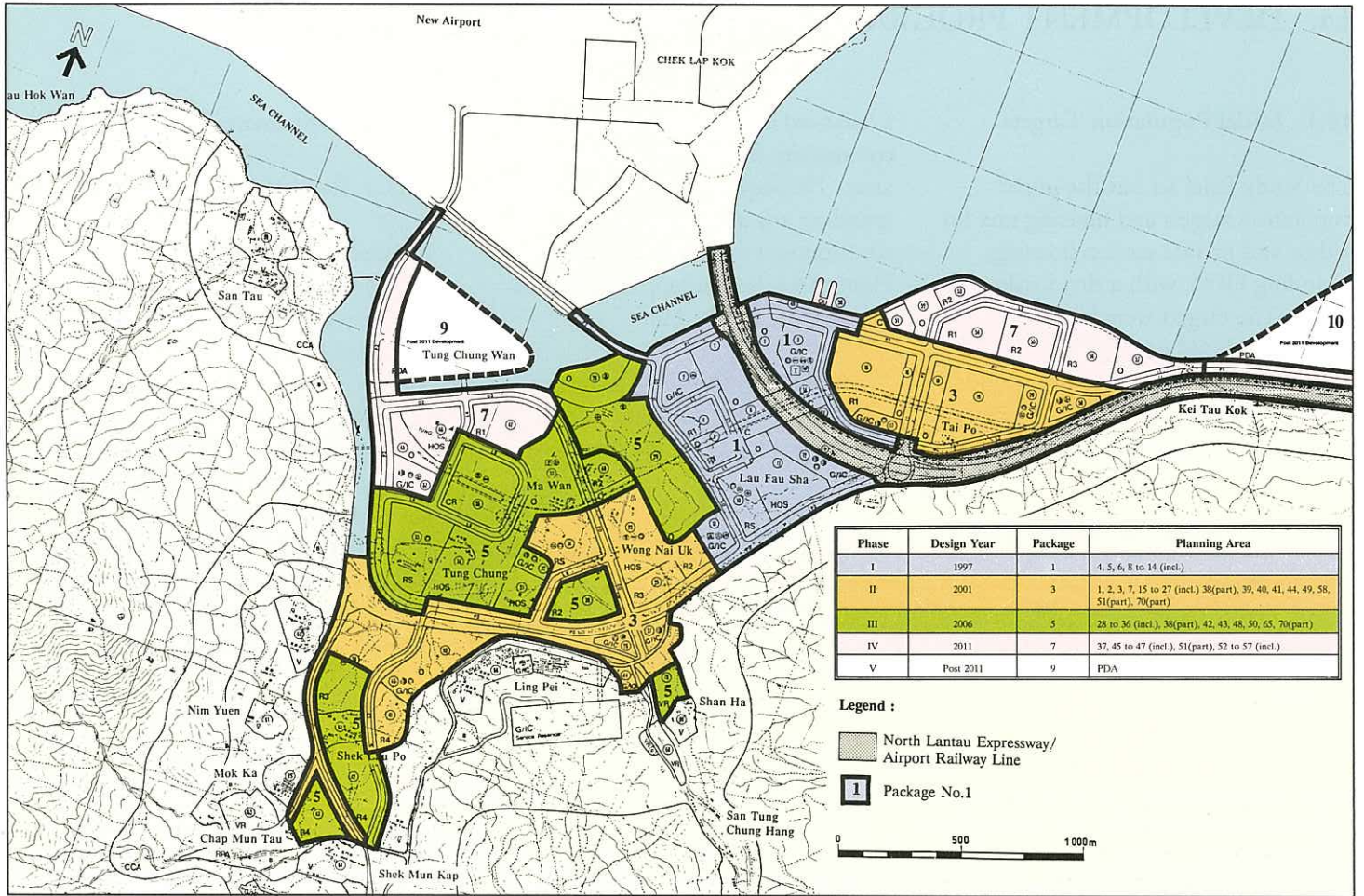


Figure 14.1 Sequence of Development - Tung Chung

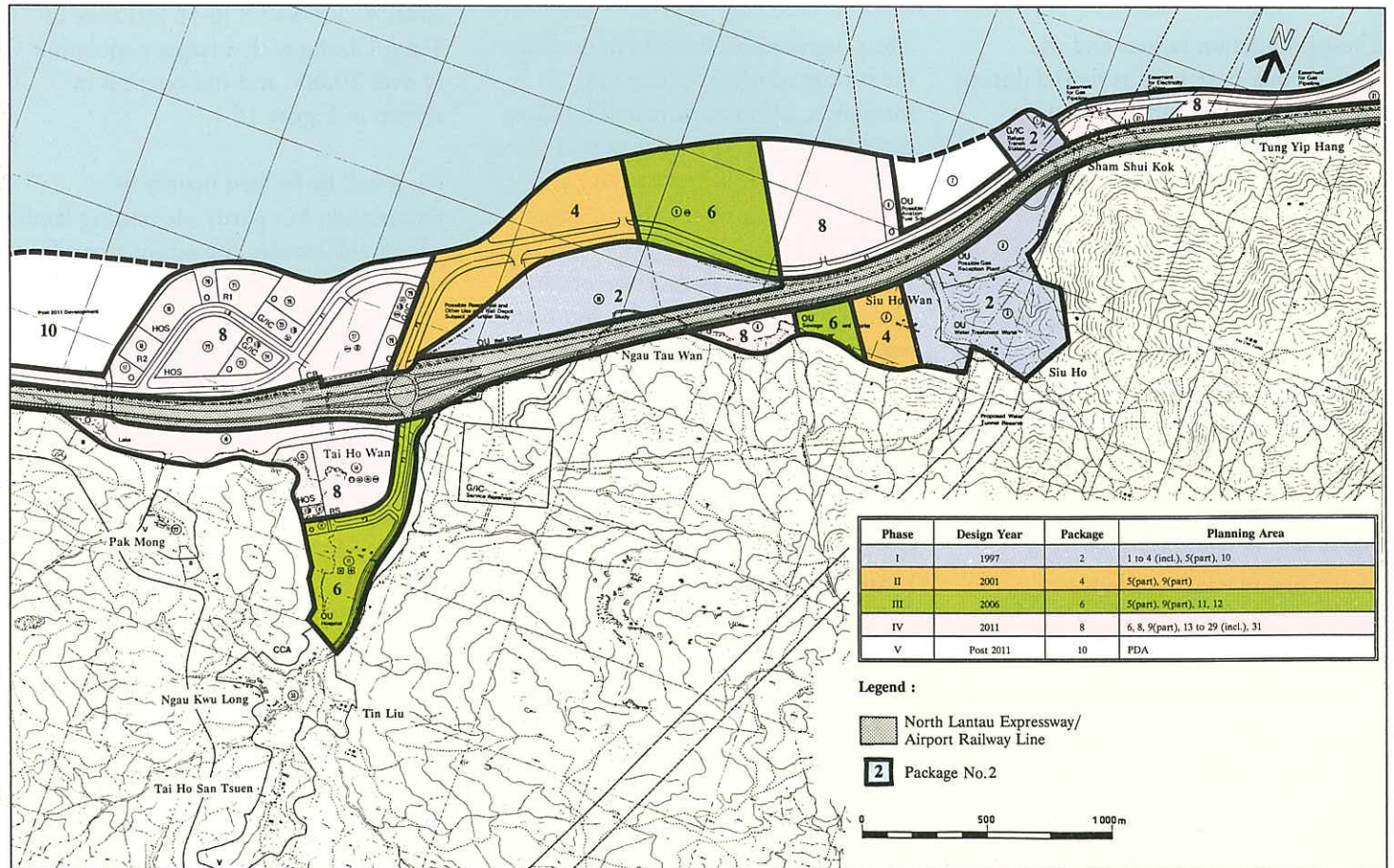


Figure 14.2 Sequence of Development - Tai Ho

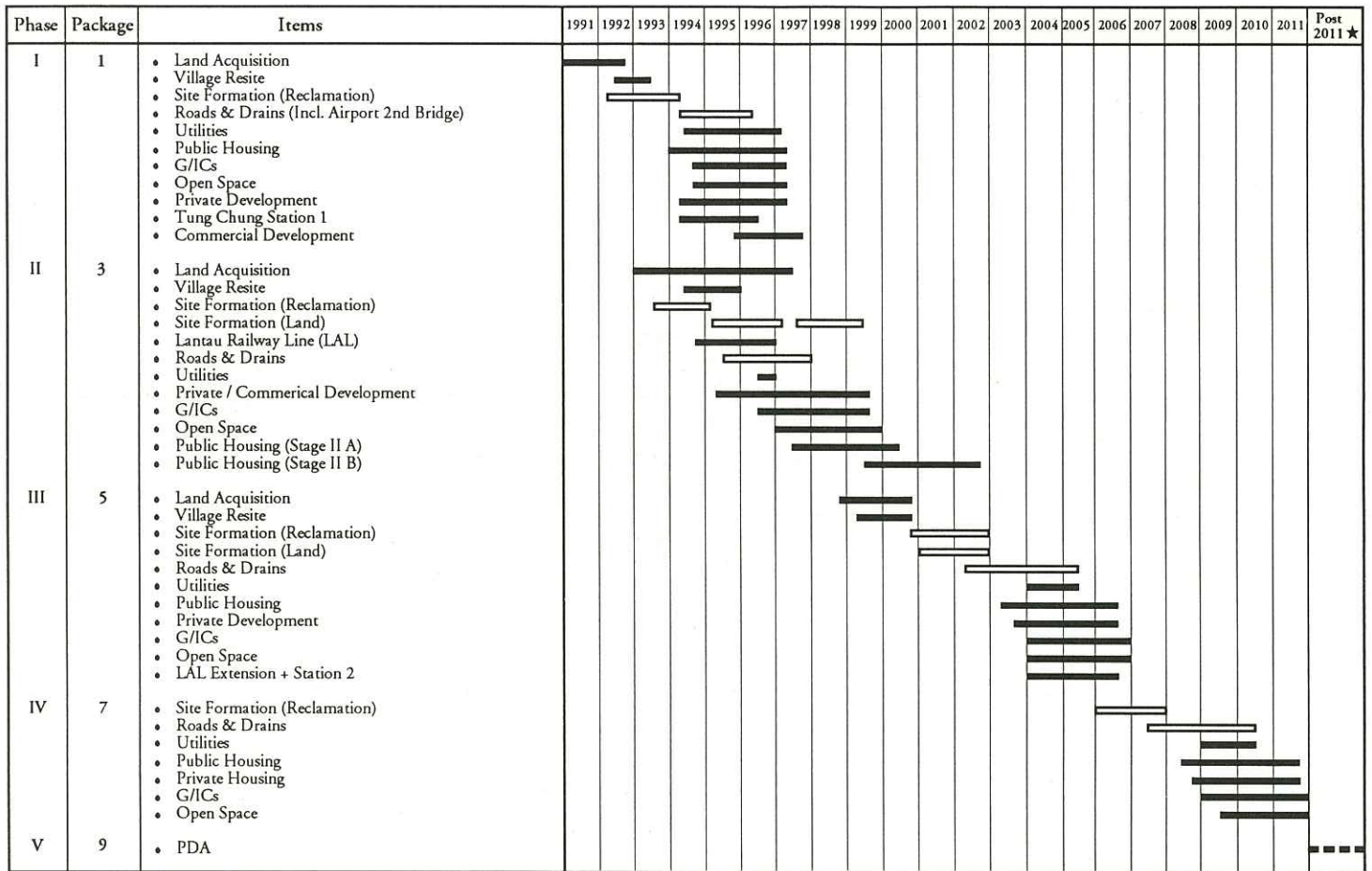


Figure 14.3 Master Development Programme - Tung Chung

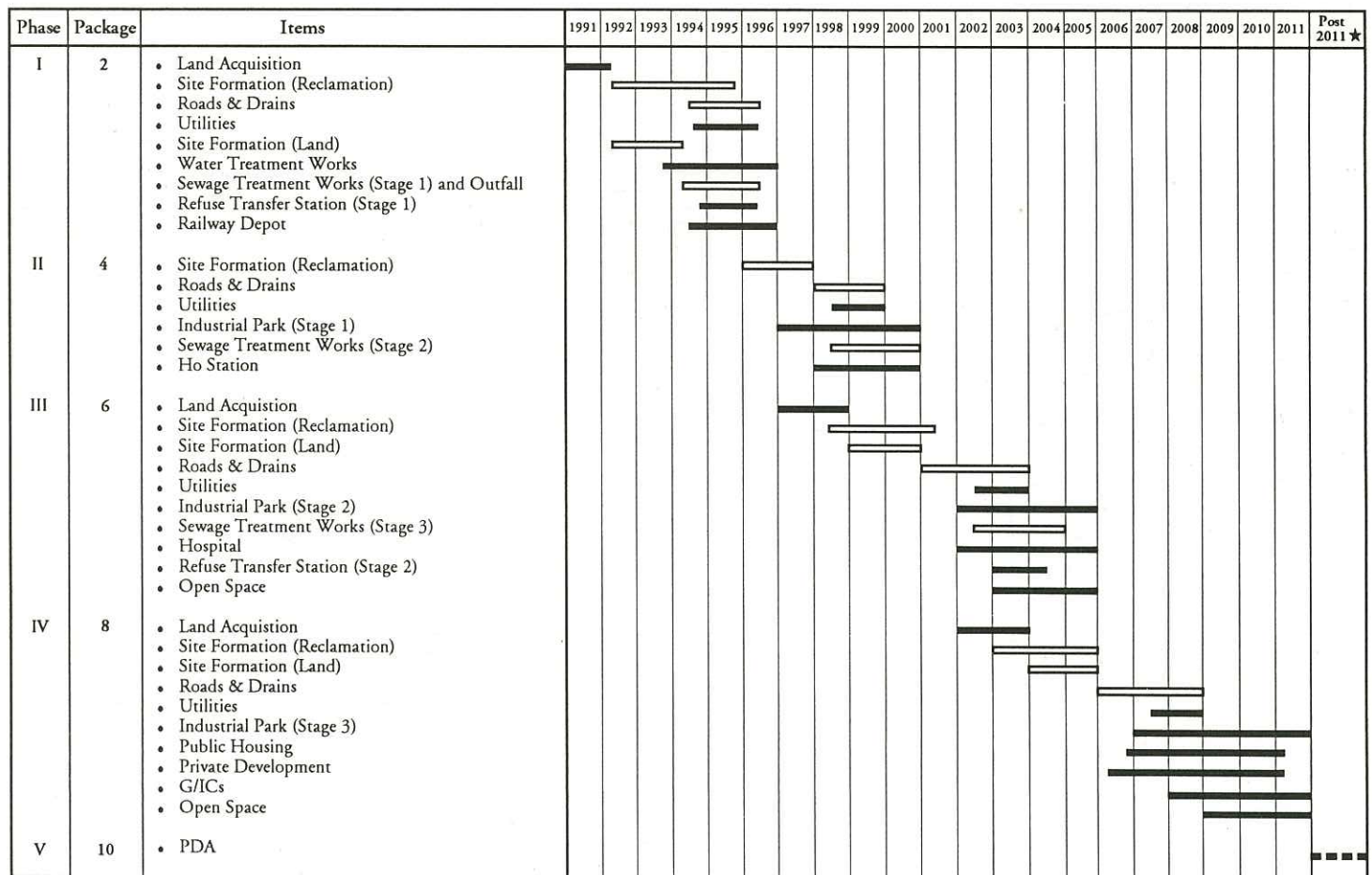


Figure 14.4 Master Development Programme - Tai Ho

Works by TDD
 Works by others
 ★ Calendar Year

Table 14.2 Development of Planning Areas by Package

Planning Area	Designated Use	Planning Area (Ha)	Package No	Allocation Ha
(A) Tung Chung	R3	9.60	3	4.30
			7	5.30
			1	0.70
	O	1.20	3	0.20
			7	0.30
			3	0.45
	C	1.85	5	1.40
			3	2.60
	VR	3.90	7	1.30
			7	3.40
PDA	Post 2011	18.60	9	15.20
(B) Tai Ho	OU	15.80	4	7.00
			6	4.80
			8	4.00
	I	52.00	4	21.5
			6	16.7
			8	13.8
	OU	24.50	2	4.6
			4	19.9

Source : Consultants' Analysis

Table 14.3 Population Build-up by Housing Type by Design Year

Type	Design Year				
	1997	2001(1)	2006	2011	Post 2011(2)
<u>Public Housing</u>					
Increment	6,200	10,360	13,200	16,800	11,400
Cumulative	6,200	16,560	29,760	46,560	57,960
<u>HOS</u>					
Increment	8,520	14,400	14,710	26,960	18,600
Cumulative	8,520	22,920	37,630	64,590	83,190
<u>Private</u>					
Increment	6,460(3)	15,840(3)	18,790	36,470	32,000
Cumulative	6,460(3)	21,940(3)	54,550	91,020	123,020
<u>Total</u>					
Increment	21,180	40,240	60,520	80,230	60,000
Cumulative	21,180	61,420	121,940	202,170	262,170

Source : Consultants' Estimates

- Note: (1) This design year will be advanced to 1999.
 (2) Population build-up based on demand estimates using Tables 5.4 and 5.5.
 (3) Includes government non-departmental quarters.

1994 and 1997. Completion of the comprehensive commercial development in Areas 6 and 14 is likely to extend beyond 1997 with the first phase being completed by 1997.

Planning Areas 1, 2, 3, 7 and 49 will be formed in Phase I to provide land for construction support facilities. These include a cargo handling area and works areas for a number of major construction projects including the Tung Chung Section of the North Lantau Expressway.

In addition to the provision of G/IC and open space facilities, a main sewage pumping station will be constructed in Area 12. The pumping station will serve as a central collection point for foul water discharge from the Airport Island and the Tung Chung New Town. The collected sewage will be pumped to the Sewage Treatment Works at Siu Ho Wan via a rising main laid along the utility service road. All these facilities are scheduled for completion by 1997.

All building developments will be adequately served by roads and utility services including water supplies, electricity, gas and telephone. A storm and foul water drainage system will be constructed together with the road network. The distributor road link into the New Airport will also be constructed as part of the Phase I road system.

Tai Ho (Package 2)

Development Package 2 covers Phase I developments in the Tai Ho area. It comprises the construction of a Water Treatment Works (Stage I) in Area 4, a Sewage Treatment Works (Stage 1) in Area 5, a Refuse Transfer Station Stage I in Areas 1 and 2 and the Railway Depot in Area 10.

With the exception of the water treatment works site which is on land, all the sites will be formed on reclamation. Site formation will commence in May 1992 with land becoming available in 1994. All of the above facilities are scheduled for completion by 1997 as indicated in Figure 14.4.

In conjunction with the Sewage Treatment Works, an offshore submarine outfall will also be constructed, discharging the treated sewage (preliminary treatment only for Phase I) into receiving waters south of the Brothers Islands.

14.3.3 Phase II - 2001

Tung Chung (Package 3)

Development Package 3 comprises Phase II of the Tung Chung development bringing its population level to over 60,000. Planning areas included and their distribution have been shown in Figure 14.1. The size of this package has changed from that shown in the Interim Recommend Outline Development Plan in Topic Report TR11. The whole of Planning Areas 15 and 19 have now been included. This has resulted from the decision to advance the construction of the LAL, which has in turn led to the advancement of this phase of the Tung Chung Development by two years. Completion may now be scheduled for the year 1999 instead of the year 2001.

Land formation will be partly on land and partly in reclamation. Major land resumption and village resites will be involved for the land based sites. At least a two-year period has to be allowed for land acquisition procedures when major villages have to be cleared. This will need to commence by mid 1992 as indicated in Figure 14.3. Land reclamation of Areas 15 and 19 is

scheduled to start in 1993 in order to allow for the commencement of the underground LAL construction in 1994. The LAL is scheduled for completion by airport opening in 1997.

Infrastructure and building developments are scheduled to take place between 1995 and 1999.

Tai Ho (Package 4)

Development Package 4 covers Phase II developments in Tai Ho. It includes the first stage of the Industrial Park in Area 9 and Stage 2 of the Sewage Treatment Works in Area 5 as shown in Figure 14.2.

Site formation for the Industrial Park is scheduled to commence in 1996 and to be completed by 1998. Site formation is in reclamation and no land acquisition will be required.

Development of the Industrial Park (Stage 1) and the Sewage Treatment Works (Stage 2) will take place between 1998 and 2001.

14.3.4 Phase III - 2006

Tung Chung (Package 5)

Development Package 5 comprises Phase III of the Tung Chung Development which, upon completion, will take its population level above 120,000. The location of Package 5 and the Planning Areas included are shown in Figure 14.1.

Again, this phase of development will involve major land resumption and the need for village resites. Land acquisition procedures are scheduled to start in late 1998 with land formation commencing in late 2000. Infrastructure and building developments will take place between 2003 and 2006 as shown in Figure 14.3.

This phase of the Tung Chung Development will also include the construction of the Town Park, the second Tung Chung Railway Station (and associated LAL extension) and the Ferry Terminal in Area 50.

Tai Ho (Package 6)

Development Package 6 comprises Phase III of the Tai Ho Development. It includes principally Stage 2 of the Industrial Park in Area 9, a hospital in Area 11 and Stage 3 of the Sewage Treatment Works in Area 5 as shown in Figure 14.2.

Site formation is scheduled to commence in 1999 and to be completed by 2002. Development of the Industrial Park (Stage 2), Sewage Treatment Works (Stage 3), Water Treatment Works (Stage 2) and the hospital are scheduled to take place between 2003 and 2006 as shown in Figure 14.4.

14.3.5 Phase IV - 2011

Tung Chung (Package 7)

Development Package 7 comprises Phase IV of the Tung Chung Development. Its full development will increase the Tung Chung population level to over 150,000. Planning areas included and their locations are shown in Figure 14.1.

Site formation will be mainly in reclamation and is scheduled to commence in the year 2006. Infrastructure and building development are scheduled to take place between 2008 and 2011 as shown in Figure 14.3.

Tai Ho (Package 8)

Development Package 8 represents Phase IV of the Tai Ho development which includes residential developments for a population of some 50,000.

Figure 14.2 shows the geographic location of this phase of the development. It comprises principally public and private residential developments, a district centre, G/IC facilities, Stage 3 of the industrial park and the implementation of the Tai Ho Railway Station.

Site formation is programmed to commence in 2004 and to be completed in 2006. Infrastructure and building developments are programmed to take place between 2007 and 2011 as shown in Figure 14.4.

14.3.6 Phase V - Post 2011

Phase V of the New Town development comprises Package 9 in Tung Chung and Package 10 in Tai Ho. The development areas have a potential to support an additional population of 60,000. Detailed planning and implementation are to be determined at a time closer to 2011 when development requirements are better defined.

14.4 Other Aspects of Implementation

14.4.1 Housing Provision

Public housing sites responding to this population build-up would be serviced and developed in accordance with the development programme for the New Town, as set out in Topic Report TR21 'Development Programme - Revised' and in the Government's Public Housing Programme.

In other new towns in Hong Kong, private sector housing has generally lagged slightly behind the development of public housing. On North Lantau the private sector may play a dominant role in providing housing in the early phases of the development due to the early provision of employment opportunities offered by the New

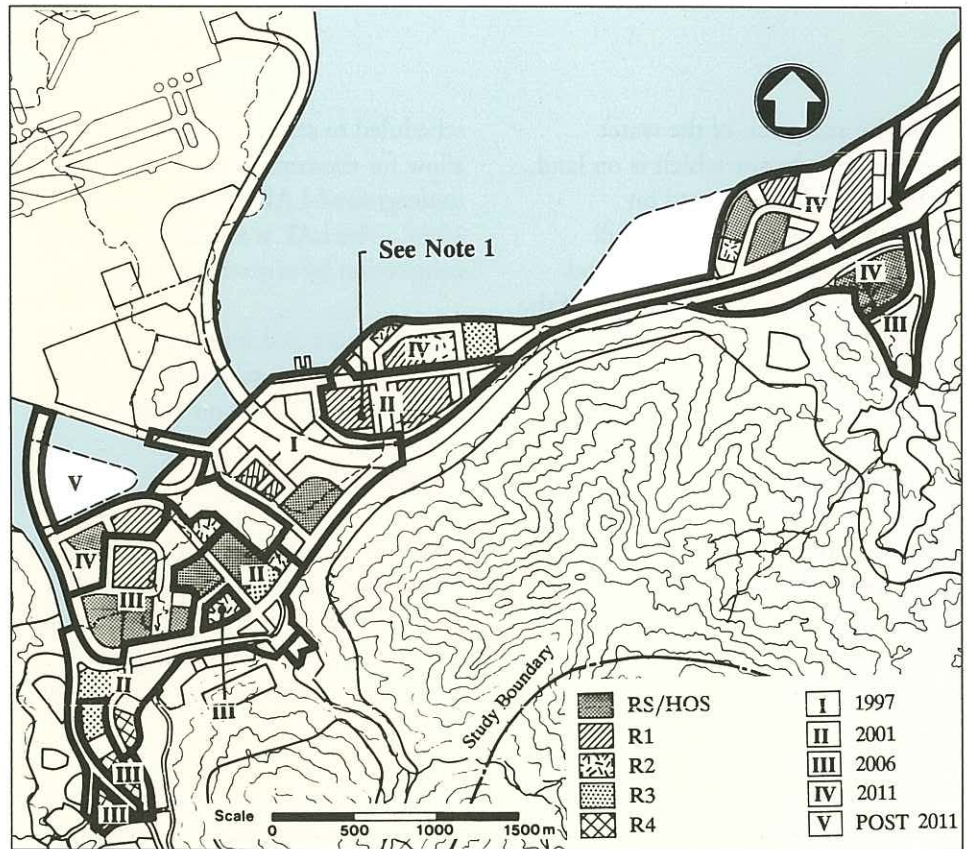


Figure 14.5 Residential Completions by Target Year/Type

Note 1 : Part of Phase II subject to comprehensive development proposals from MTRC

Airport, the limited opportunities throughout the build-up of the town for large scale public housing developments and the potential development rights in conjunction with the early provision of LAL services to the New Town.

The private sector housing programme will need regular monitoring and review to ensure land supply is adequate to respond to demand and is able to maintain the balance between public and private sector housing. Figure 14.5 provides residential completions for each phase by both target year and residential type.

For first phase private housing, the programme for including sites in the five year sales programme for disposal in the middle of 1994 (assuming a 36 month building period for completion in mid 1997) may be achievable provided site servicing and infrastructure could be completed by

the end of 1993. In view of this tight programme, disposal of first phase private housing sites through a private sector participation scheme should be considered. During the latter months of the Study, Government has been investigating the benefits of private sector involvement in the North Lantau development. In particular, discussions have been held with the MTRC and the Hong Kong Housing Authority over the scope and extent of this involvement in the initial stage of the New Town's development. This is discussed further in the following subsection.

14.4.2 Privatisation of Development

The first phase development of North Lantau is an airport-core project. As such, Government funds have been allocated to complete the first phase of development. As with all airport-core projects, the New Town has come under considerable pressure to minimise

demands on expenditure and cash flow. To achieve this objective it is appropriate to look at ways of transferring responsibility for development to the private sector.

For this purpose, it will be necessary to identify developments within the programme of the New Town which could be implemented directly by the private sector. Private sector implementation would require a comprehensive approach to engineering, land formation and servicing, and building construction.

The criteria for selecting sites for private sector implementation are:

- o a site should be free from constraints on land assembly, such as multiple land ownership, need for land resumption, and the need for removal of existing settlements or other developments.
- o a site should be free of potential conflict with other construction works or concurrent engineering contracts;
- o a site should not contain elements of major infrastructure required to serve other areas of the New Town which may be developed at the same time;
- o a site should not contain head works of major infrastructure required to serve the remainder of the New Town;
- o a site should be of sufficient size to give a significant reduction in expenditure or work by government; and
- o a site should offer adequate returns to the developer;

In the early phases of development, opportunities for private sector participation include:

- o the provision of G/IC facilities, including schools and recreation uses, to be incorporated into the first phase public rental and HOS housing areas and constructed by the Housing Authority. Provision of infrastructure within the site would also be included in this package.
- o the opportunity for comprehensive development packages comprising first phase R1 housing, the commercial components of the Town Centre and advancement of second phase R1 housing to ensure the early provision of the LAL and the underground Tung Chung Town Centre LAL station.

14.4.3 Implementation Procedures

The proposals outlined in this report comprise a Recommended Outline Development Plan (RODP) and a development programme which includes the cost of implementing development proposals and an estimate of the revenue which might accrue to government as the programme is implemented. Details of the development programme are given in TR21, "Development Programme - Revised".

These proposals provide the framework for future detailed planning and provision of infrastructure for the New Town. Part of the detailed planning and implementation has been undertaken in this Study. Layout Plans for first phase development have been prepared (Topic Report TR17) and tenders have been called for the first phase development site formation contract. The first phase layout plans provide the basis for the preparation of engineering designs for the provision of infrastructure, including roads, sewers and drains, to the first phase development area.

Following established Government procedures, it would be expected that implementation of the New Town would be continued through the South West New Territory Development Office of the Territories Development Department. This would include provision of infrastructure based on planning layouts prepared by the Planning Department.

With this approach to land development and servicing, land disposal would be by the conventional mechanism used by Government in other new towns. Opportunities for private sector involvement in land development and disposal have been identified by Government in the first phase development area and part of the second phase development area of the New Town.

Given the possibility of large scale private sector participation in land and building development, it is imperative that Government retains control over the final form of development if the urban design objectives for the New Town are to be achieved. This should be done by the preparation of detailed master plans, layout plans and development conditions to be included in land grant documents. These would guide and control the final form of development and give Government a benchmark against which applications for development of sites could be evaluated.

14.5 Provision of Supporting Infrastructure

14.5.1 Land Formation

Land will be formed as necessary for development areas. This will be timed to allow a period of approximately 3¼ years for construction of roads and buildings such that occupation can take place as scheduled. The preceding

Table 14.4 Formation Quantities in Mm³

Area	Phase I			Phase II			Phase III			Phase IV			Phase V		
	Fill Arising from Excavation	Imported Fill	Mud Disposal	Fill Arising from Excavation	Imported Fill	Mud Disposal	Fill Arising from Excavation	Imported Fill	Mud Disposal	Fill Arising from Excavation	Imported Fill	Mud Disposal	Fill Arising from Excavation	Imported Fill	Mud Disposal
Tung Chung	0.30	7.80	9.50	0.95	4.80	2.80	0.02	3.30	1.00	-	6.00	1.00	-	2.50	1.20
Tai Ho	1.30	8.30	3.00	-	5.90	2.00	-	4.80	1.80	-	13.60	3.50	-	5.00	1.50
Total	1.60	16.10	12.50	0.95	10.70	4.80	0.02	8.10	2.80	-	19.60	4.50	-	7.50	2.70

Source : Consultants' Estimates

Note : Figures for filling include rock at bulked volume

Figures for imported fill include required surcharging quantities

Fill arising from excavation is surplus to that required for landfilling

period of excavation, dredging seawall construction, reclamation and surcharging will be dependant on the quantities of materials involved. This may usefully be advanced for Phases III and IV to allow longer periods of settlement, thereby avoiding the need for costly weep drains and surcharging.

Broad quantities of materials in excavation and reclamation have been derived for each phase assuming a drained method of reclamation. However these are only indicative as the extent of each phase is subject to change. The following table can be used as a guide.

Filling quantities will be conserved if the mud left in place method of reclamation is used wherever possible. Further economies of filling to that shown in Table 14.4, may be realised by the use of beneficial mud disposal as discussed in Section 9 of this report and by the use of PFA and public dump material as reclamation material.

14.5.2 Land Formation Strategy

The following is provided as a guide to the strategy for land formation for each phase taking due account of anticipated trends in supply of filling materials. Further information is provided in Working Paper WP17.

Phase I

Phase I filling materials are predominantly marine sand, some excavation arisings and rock materials for seawall construction. The use of marine based fill in this phase and subsequent phases was favoured in Topic Report TR20 as it minimises haul road lengths required which is beneficial in terms of air quality (dust). Phase I surcharge material will have served its purpose by the commencement of Phase II reclamation. This will be deposited as it becomes available into Tung Chung Area 15.

Phase II

It is proposed that Phase II drained reclamation should rely on marine sand as the main source of filling material in view of its timing and location. The filling areas near the head of Tung Chung valley could be filled using Pulverised Fuel Ash (PFA). This would be useful as a trial deposition to estimate settlements and rates of filling for subsequent contracts. A capping layer of Completely Decomposed Granite (CDG) will be necessary but this small quantity may be found from locally excavated material. Topsoil arising should be used in Phase I landscaping wherever possible.

Phase III

A shortfall of locally sourced sand is likely for Phase III land formation. This shortfall will preferably be satisfied from imported supplies such as marine fill from the mainland and PFA from Castle Peak Power Station.

The use of Lantau land based borrow areas is not favoured as the material excavated and processed is likely to be more expensive than marine sourced filling and is likely to have serious negative environmental impacts including significant dust and noise pollution. Furthermore deposition areas are mostly seaward of existing development.

Phase IV

Phase IV Tai Ho Wan, will benefit from 'beneficial mud disposal'. As the shortfall of marine sourced material is likely to be more acute by Phase IV it is prudent to mitigate the problem by promoting this area for mud disposal. However, it should be noted that the environmental (water quality, sediment loadings and ecology) impacts of such mud disposal should be thoroughly assessed during the detailed design stage of the appropriate development phase.

Should the need for land borrow areas arise, it will be sensible to defer this requirement until Phase IV. The higher cost of sourcing this material will be more easily borne by the revenue derived from earlier phases. The exact requirements will be more refined and so the extent of excavations into the designated borrow areas will be more precise. This will also minimise unnecessary excavation of the surrounding topography.

Phase IV is mostly concentrated around Tai Ho. This suggests Tai Ho Wan platforms at the head of the valley or if necessary Wong Kung saddle, would be suitable land based borrow areas. These are considered the least objectionable of the designated borrow sites in terms of visual impact, haul roads and cost effectiveness. In terms of environmental impact, noise and dust pollution will be significant. However, it is considered that a land based borrow area in the vicinity of Tai Ho Wan will have less impact than in the vicinity of Tung Chung as the Tai Ho Wan population of 50,000 (2011) will be one third of that at Tung Chung and thus there will be significantly fewer noise/air sensitive receivers. It should be noted that the relative environmental impact of different land based borrow areas needs to be assessed at the detailed design stage of this development phase.

Phase V

As with Phase IV, the post 2011 development would benefit from 'beneficial mud-disposal'. However as the requirement for this land is not certain, Phase V should be reserved for any surplus 'beneficial mud disposal' to that used for Phase IV. This will avoid the possibility of an undesirable area of mud lying offshore of a residential area for an undetermined period which could have significant deleterious

impact on water quality sedimentation and ecology in Tung Chung Wan, East Tung Chung Bay and the Sea Channel.

The material supply for Phase V is uncertain but if marine sourced filling materials are out of the question (the areas are all reclamation) then Wong Kung Saddle is likely to have sufficient capacity.

14.5.3 Provision of Utilities

The utilities companies and WSD have been consulted during the study to co-ordinate their requirements with the layout and phasing of development. Although all utilities will be available from the first phase of development by virtue of the utilities reserve, certain services will require upgrading during the growth of the township as follows:-

Water Supplies

WSD will provide a fresh water supply to Tung Chung from the proposed Tung Chung service reservoir. The associated distribution mains is to be implemented in phased steps with the roadwork construction. Initially Tai Ho will not be supplied from a distribution main network but instead, directly from the freshwater pumping main. Later development at Tai Ho will be served from the Tai Ho service reservoir.

A salt water flushing supply will not be available for first phase development. WSD will rely on fresh water for flushing in Phase I and implement a salt water intake and pumping station as part of Phase II.

Power Supplies

China Light and Power will satisfy early development demand from the 132kV supply which landfalls at Sham Shui Kok and which will feed the existing

but upgraded substation in Tung Chung. Later phases of development will be served by a new and larger substation to be built east of the NLE corridor in Tung Chung and supplied by an additional set of 132kV cables landfalling at Chek Lap Kok east. The existing substation in Tung Chung will be decommissioned during Phase II.

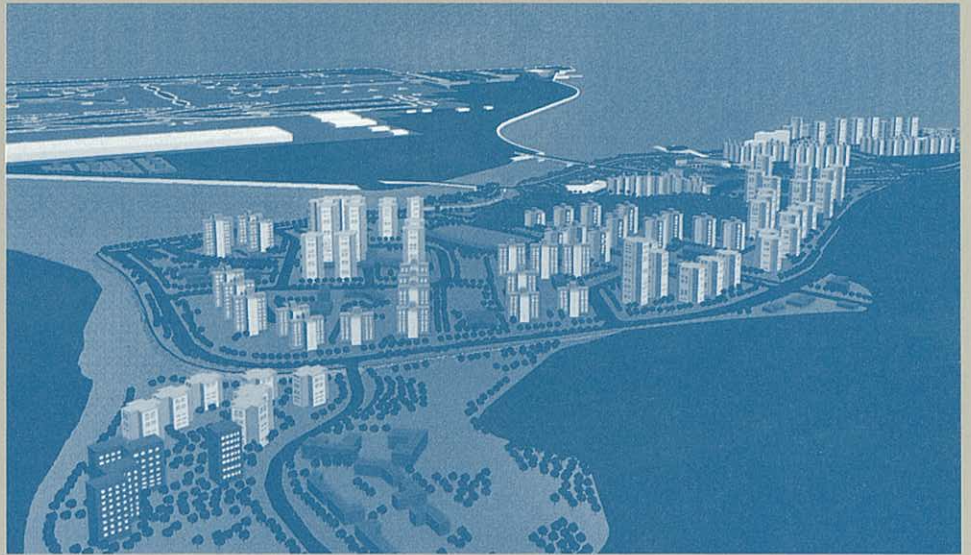
Gas Supplies

The Hong Kong Gas Co Ltd intend to meet demand from residential, commercial and industrial sites in accordance with the development programme. The methodology will be to initiate a distribution to Tung Chung and Tai Ho with a pressure reduction station for each town area and to transfer gas from the high pressure mains carried in the utilities reserve. Sleeves will be provided under the Airport access corridor at Tung Chung, Tai Ho and at Siu Ho Wan for later introduction of a 450mm diameter gas main and distribution system as development north of the NLE demands.

Telecommunications

A new telephone exchange will be built as part of Phase I development in Tung Chung. It will be designed to serve the Tung Chung Area of the New Town up to and beyond 2011 and will replace the existing micro-wave station. A similar facility is planned for Tai Ho and will be introduced as required in later phasing.

North Lantau Development



15. Financial Implications

15. FINANCIAL IMPLICATIONS

15.1 Assumptions

This Section sets out the main financial implications to Government of the development proposals for the New Town. The degree of accuracy is consistent with the level of detail of the planning and engineering proposals. The following assumptions form the basis of the financial assessments presented in the following sections :-

- o only Government capital costs have been included. Recurrent costs associated with operating the New Town and its infrastructure are excluded;
- o costs of the ARL and LAL including stations have not been included;
- o estimated expenditures for Phase I and Phase II of the North Lantau Expressway are shown. In assessing cash flows, neither the estimated costs of the NLE nor the major Water Works projects have been included;
- o no attempt has been made to assess Phase V (Post 2011) costs as the plan for this phase has not been defined;
- o financial implications are assessed strictly on the basis of Government costs and revenues (derived from lands sales). Privatisation and its effect on expenditure forecast have not been considered;
- o with the exception of land acquisition cost and the Phase I North Lantau Development and Expressway site formation costs at Tung Chung, all costs have included a 10 percent allowance for contract contingencies and 12 percent for consultancy fees and site supervision; and
- o all costs and revenues are estimated at December 1991 prices.

15.2 Contract Packages and Costs and Government Expenditure Forecasts

Each development package comprises a number of components which will be implemented under various contract packages. The estimated costs have been prepared based on the following contract packages:-

(i) Site formation

This includes the formation of sites both on land and in the reclamation areas. Principal drainage works within the sites are provided under the site formation contracts.

(ii) G/IC

These are Government, Institutional and Community facilities provided by Government within the New Town. These are normally implemented under separate building contracts. However, no attempt has been made to identify separate contracts for this work. Only one contract package number has been allocated for each development package.

(iii) Open Space

This includes the provision of local and district open space to be implemented by the Regional Council. Again, this could involve a number of smaller contracts within a development package, but only one contract package number has been allocated.

(iv) Roads and Drains

This involves the construction of roads, bridges, subways, secondary storm and foul water drainage within the development areas. Roadside planting is included in this item. The North Lantau Expressway has been identified separately.

The major Water Works projects represent significant expenditures which have not been included under the development packages. These projects involve works undertaken by the Water Supplies Department as part of their strategic upgrading of the Territories' water supply. For North Lantau, it includes the construction of a Water Treatment Works and associated water works installations. Therefore Tables 15.1 and 15.2 do not include the cost of these works. For reference, the estimated total cost of Water Works advised by the Water Supplies Department for the North Lantau 1992 Development Programme is HK\$2.533 billion.

Government costs for the Tung Chung Development and Tai Ho Development are presented separately in Tables 15.1 and 15.2. The estimate of the cost of land acquisition has also been included in the costs. Unit rates used for earthworks and site formation costs are given in Appendix I.

The annual expenditure forecast for Government for the years 1992/93 to 2010/11 is indicated in Figure 15.1.

15.3 Revenue

15.3.1 Introduction

Estimated revenues from land sales have been assessed by reference to typical values prevailing in comparable locations and developments in the New Territories in December 1991. The figures should be regarded as approximate only.

No allowance has been made for the effects of inflation on property values during the periods in question. Similarly, the estimates do not reflect potential gains attributable to real growth in value as the development of the New Town progresses towards maturity.

Table 15.1 Tung Chung Development Costs (HK\$ Millions - 1991 prices)

Phase	Development Package	Contract Package	Description	Cost	Total Cost
I	1	-	o Land Acquisition (incl. Tai Po) (1)	280	280
		1.1	o Site Formation	1164	1164
		1.2	o G/IC		
			- Indoor Recreation Centre	56	
			- Neighbourhood Community Centre	49	
			- Primary School (2 no.) (2)	85	
			- Secondary School (2 no.)	117	
			- Clinic	42	
			- Sub Divisional Fire Station	37	
			- Divisional Police Station	73	459
	1.3	o Open Space	37	37	
	1.4	o Roads and Drains (Inc. Airport Second Bridge)			
	1.5	o Public Housing	1365	1365	
	-	o North Lantau Expressway (3)	5582	5582	
II	3	-	o Land Acquisition (1)	1060	1060
		3.1	o Site Formation (River Training inc.)	669	669
		3.2	G/IC		
			- Swimming Pool Complex	98	
			- Cultural Complex	183	
			- Primary School (5 no.)	207	
			- Secondary School (2 no.)	115	
			- Community Centres (2 no.)	98	
	- Indoor Recreation Centre	56	757		
	3.3	o Open Space	175	175	
	3.4	o Roads and Drains	266	266	
	3.5	o Public Housing	2394	2394	
III	5	-	o Land Acquisition (1)	434	434
		5.1	o Site Formation	406	406
		5.2	o G/IC		
			- Primary School (3 no.)	124	
			- Secondary School (3 no.)	172	
			- Sports Stadium	73	
			- Indoor Recreation Centres (2 no.)	112	
			- Ferry Pier	122	604
	5.3	o Open Space	451	451	
	5.4	o Roads and Drains	123	123	
	5.5	o Public Housing	2789	2789	
IV	7	7.1	o Site Formation	616	616
		7.2	o G/IC		
			- Primary School	41	
			- Secondary School	57	
			- Indoor Recreation Centre	56	155
		7.3	o Open Space	67	67
		7.4	o Roads and Drains	195	195
7.5	o Public Housing	783	783		

Source : Consultants' Estimates

Note: (1) Includes notional cost of village resite.

(2) The total number of schools included in cost estimates in Tables 15.1 and 15.2 differs from the total for the estimated number of schools given in the RODP but it is consistent with the number of schools in the 1992 Development Programme for North Lantau and Islands.

(3) The cost of the NLE is derived from the 1992 Development Programme for North Lantau & Islands.

Table 15.2 Tai Ho Development Costs (HK\$ Millions - 1991 prices)

Phase	Development Package	Contract Package	Description	Cost	Total Cost	
I	2	-	o Land Acquisition (1)	10	10	
		2.1	o Site Formation (Railway Depot inc.)804804			
		2.2	o G/IC - Main Pumping Station and Sewage Treatment Works (Stage 1) - Sewage Outfall, Culvert and Main - Refuse Transfer Station (Stage 1)	356	903	
		2.3	o Principal Drainage	92	92	
II	4	4.1	o Site Formation	594	594	
		4.2	o Roads and Drains	151	151	
		4.3	o G/IC - Sewage Treatment Works (Stage 2)	183	183	
III	6	6.1	o Site Formation	266	266	
		6.2	o Roads and Drains	102	102	
		6.3	o G/IC - Refuse Transfer Station (Stage 2) - Sewage Treatment Works (Stage 3) - Hospital (660 beds)	159 183 1369	1710	
			6.4	o Open Space	10	10
IV	8	8.1	o Site Formation	1175	1175	
		8.2	o Roads and Drains	267	267	
		8.3	o G/IC - Primary School (3 no.) - Secondary School (3 no.) - Community Centre - Clinic - Indoor Recreation Centre - Sub-divisional Fire Station	124 172 49 41 56 37	479	
			8.4	o Open Space531531		
			8.5	o Public Housing	3885	3885

Source : Consultants' Estimates

At the time of preparing these estimates, it is understood that the grant of certain sites within Phase I of Tung Chung is under negotiation with MTRC. The revenue projections in respect of these sites may need to be reviewed in due course in the light of a final agreement on terms.

C/R and R1 - 60 percent
R2, R3 and R4 - 70 percent
Industrial - 60 percent

(ii) The following plot ratio assumptions and estimates of accommodation values (December 1991 plus) have been adopted:-

15.3.2 Assumptions

The following assumptions have been made in respect of the revenue potential:-

(i) Gross/Net site areas

Saleable land areas have been calculated on the basis of the following percentages of gross land areas:-

	Plot Ratio	Value (HK\$)/m ²
C/R and R1 (Town Centre)	- PR.8.0	7500-8500
Other R1	- PR.5.0	7000-7500
R2	- PR.3.3	6500-7000
R3	- PR.2.1	8000-9000
R4	- PR.0.4	14000
Industrial	- PR.2.5	2500

Wholly commercial development are estimated to have a value of HK\$10500-16000/m²

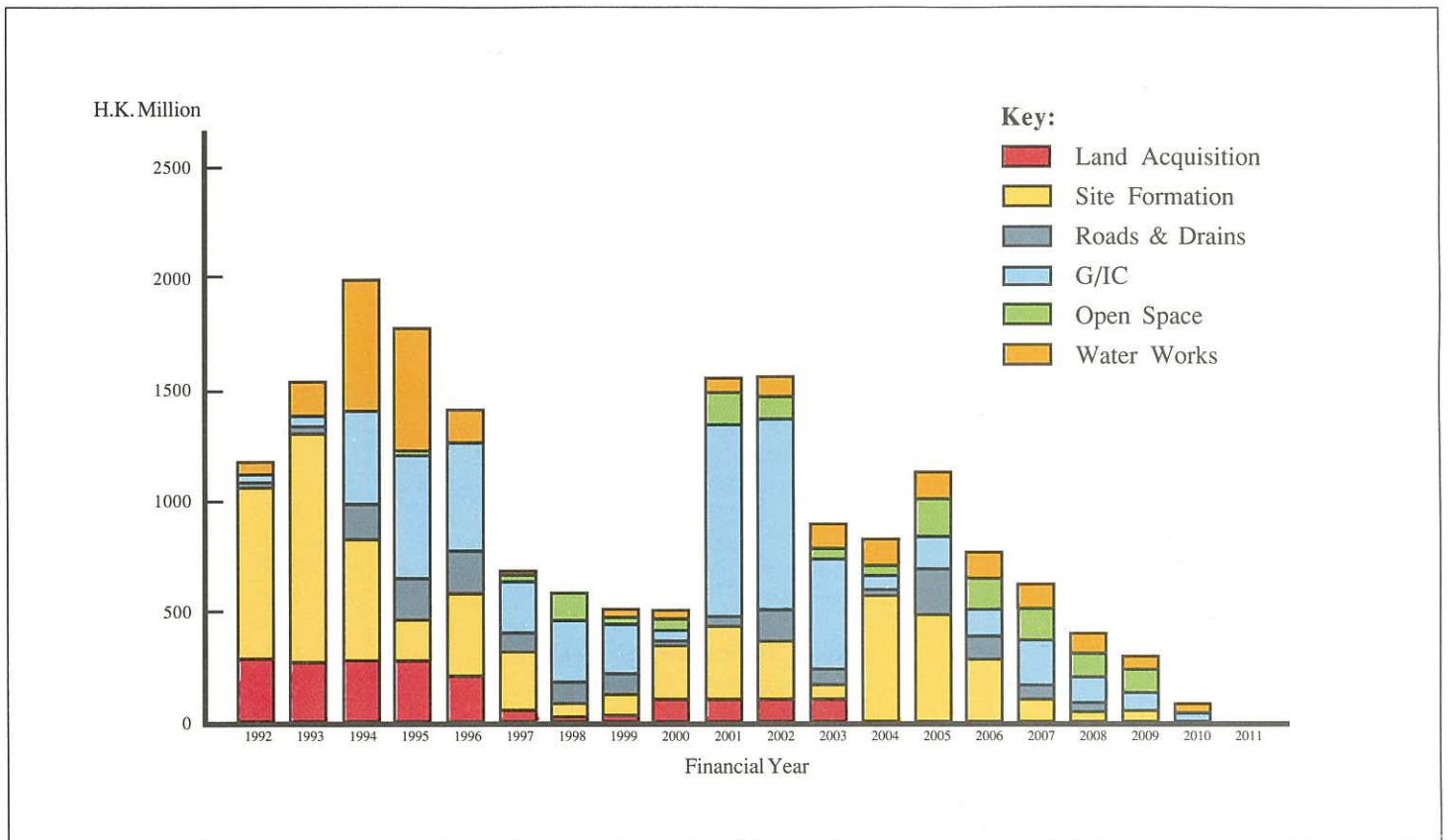


Figure 15.1 Government Expenditure Forecast

15.3.3 Land Sales Revenue

Based on the above valuations estimated revenues from lands sales are given in Table 15.3. Total revenue is expected to be of the order of HK\$22,300 million accruing over the period 1994 to 2009. It should be noted that this does not include any revenue from the sale of public housing although the costs of providing public housing have been included in Tables 15.1 and 15.2 for reference. Such revenue from the sale of public housing is excluded from the estimated cash flow figures in Table 15.4.

15.4 Cash Flow Analysis

By comparing the estimated cost and revenue streams presented in Tables 15.1, 15.2 and 15.3, a notional cash flow can be calculated. This has been done in Table 15.4. The estimated costs and revenues for each phase of the development are shown separately. None of the project costs relating to the NLE and the major Water Works have been included in the estimated cash flow calculations set out in Table 15.4. On the basis of these preliminary estimates, the development should show a net return to Government (in 1991 HK\$) of the order of HK\$6,800 millions over the whole development period from 1992 to 2011.

Table 15.3 North Lantau Development - Estimated Land Sales Revenue (HK\$ Millions - 1991 prices)

Type	Planning Area ⁽¹⁾	Year of Land Sale								
		1994	1998	2002	2003	2004	2006	2007	2008	2009
R1	Area 4 Area 15 Phase I Phase II/III Area 19 Phase I Phase II Area 54 Area 47 Area 21(TH)	1368	1023 1079		1636 910			1356	935	680
COMM	Area 6/14 Phase I Phase II		330							
C/R	Area 36 Area 27(TH)				2815				2592	
R2	Area 22 Area 30 Area 53 Area 55 Area 48 Area 18(TH)	366			797			275 647	364 240	
R3	Area 38(Pt) Area 25 Area 38(Pt) Area 56		463 236	807					505	
R4	Area 43 Area 41 Area 42		157		97 188					
HOS	Area 11 Area 23 Area 31 Area 34 Area 46 Area 15(TH) Area 19(TH) Area 22(TH)	(108) ⁽²⁾	(182)		(64) (122)		(88) (55)	(78) (119)		
RS	Area 10 Area 24 Area 35 Area 14(TH)	(65)	(109)		(139)				(177)	
IND			487	225	262	262		225	262	225
	Total	2264	3775	1032	6705	262	-	2503	5578	225

Source : Consultants' Estimates

Note : (1) Planning areas refer to Tung Chung except where otherwise stated (TH-Tai Ho).

(2) Figures for HOS and RS in brackets are included for reference only but are not included in the cash flow calculations in Table 15.4.

Table 15.4 Estimated Cash Flow⁽¹⁾ 1992 - 2011 (HK\$ Millions - 1991 prices)

Type	Estimated Expenditure (-)	Estimated Revenue (+)	Cumulation Balance (+ or -) overall
<u>Phase I</u>			
1992/93	1105	-	- 1105
1993/94	936	2,264	- 2041
1994/95	896	-	- 673
1995/96	758	-	- 1431
1996/97	394	-	- 1825
1997/98	17	-	- 1842
Phase Total	4,106	2,264	- 1,842
<u>Phase II</u>			
1993/94	417	-	- 417
1994/95	491	-	- 908
1995/96	453	-	- 1361
1996/97	849	-	- 2210
1997/98	637	-	+ 2847
1998/99	564	3,775	+ 364
1999/2000	376	-	- 12
2000/2001	67	-	- 79
Phase Total	3,854	3,775	- 79
<u>Phase III</u>			
1998/99	111	-	- 111
1999/2000	187	-	- 298
2000/01	330	-	- 628
2001/02	1312	-	- 1940
2002/03	1172	1032	- 2080
2003/04	680	6705	+ 3945
2004/05	190	262	+ 4017
2005/06	126	-	+ 3892
Phase Total	4,107	7,999	+ 3,892
<u>Phase IV</u>			
2004/2005	443	-	- 443
2005/2006	1119	-	- 1562
2006/2007	783	2,503	+ 158
2007/2008	559	5,578	+ 5177
2008/2009	307	225	+ 5095
2009/2010	234	-	+ 4861
2010/2011	40	-	+ 4821
Phase Total	3,485	8,306	+ 4,821
Total all Phases	15,552	22,344	+ 6,792

Source : Consultants' Estimates

Note : (1) Cash flow does not include NLE or major Water Works costs.

ACKNOWLEDGEMENTS

The Consultants wish to thank the many people, both from the public and private sectors, who have provided either original data or assistance during the Study.

Government Sector

Agriculture and Fisheries Department
Airport Railway Division HyD
Buildings and Lands Department
Census and Statistics Department
Civil Engineering Services Department
Civil Aviation Department
Correctional Services Department
District Lands Office, Lantau & Islands
District Planning Office Lantau & Islands
Drainage Services Department
Economic Services Branch
Education Department
Electrical and Mechanical Services Department
Environmental Protection Department
Environmental Pollution Advisory Committee
Finance Branch
Fire Services Department
Geotechnical Control Office, Civil Engineering Services Department
Highways Department
Hospital Authority
Housing Department
Industry Department
Islands District Office, City and New Territories Administration
Lands and Works Branch
Marine Department
New Airport Projects Co-ordination Office
Planning Department PADS Section
Planning, Environment and Lands Branch
Port Works Division, Civil Engineering Services Department
Post Office
Provisional Airport Authority
Recreation & Culture Branch
Regional Services Department
Royal Hong Kong Auxiliary Air Force
Royal Observatory
Royal Hong Kong Police Force
Social Welfare Department
South West NT Development Office
Territory Development Department
Transport Department
Transport Branch
Water Supplies Department
Works Branch New Airport Works Division

Private Sector

Airport Master Plan Consultants
Cathay Pacific Airways Ltd.
China Light and Power Co. Ltd.
Dragonair Hong Kong
Hong Kong and China Gas Company Ltd.
Hong Kong Construction Association Ltd.
Hong Kong Telephone Co. Ltd.
Hong Kong Yaumatei Ferry Company Ltd.
International Bechtel, Inc.
Mass Transit Railway Corporation
Mobil Oil Hong Kong Ltd.
North Lantau Expressway Consultants

THE STUDY TEAM

The Study Team comprised Mott MacDonald Hong Kong Ltd, in association with Shankland Cox, Wilbur Smith and Associates, and EBC Hassell Ltd.

Project Management

R J Whalley - Director in Charge
J Figueiras - Planning Director

Project Management

J H Ebden - Project Manager
P K Tse - Engineering Co-ordinator
S V Jones - Environmental Co-ordinator

Planning Group

I Andrews - Group Manager
J Jessamine
H I Absalom
M Harrison
G Rex
K Nicholson
B Wong
S Chan

Engineering Infrastructure Group

D Mepham - Group Manager
P Larentis
R Henes
D England
K J White
A Grant
Y C Koo
W H Kwan
D Ross
R Szeto

Transport Planning Group

L K Carpenter - Group Manager
M Clark
J Wheway
S Chow

Environmental Planning Group

T J Peirson-Smith - Group Manager
A F Watker
N J Duijm
D Smith
D Dudgeon
R A Cox
D Melville
R T Cortlett

Specialist Advisors

M Alexander - Marine Operaitons
G W Lovegrove - Geotechnical Engineering
J Land - Dredging and Spoil Disposal

Specialist Sub-Consultants

Chesterton Petty - Land Valuation (G Moffoot)
Netherlands Organisation for Applied Scientific Research (TNO) - Air Quality Modelling
Enpac - Noise Assessments and Air Quality Baseline Survey
ERL Asia - Hazard Assessment

Draughting

Jim Tse
Thomas Wai

Graphics

Leung Wing-tak
Wong Ka-man

Secretarial

Alice Ho
Louisa Hui
Mariam Wong