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# 1 BASIC INFORMATION

## 1.1 PROJECT TITLE

New T&T (Hong Kong) Limited - Domestic Cable Route.

## 1.2 PURPOSE AND NATURE OF THE PROJECT

New T&T (Hong Kong) Limited (New T&T) proposes to install two domestic submarine fibre-optic telecommunication cables within Hong Kong waters. One cable is planned to connect Chung Hom Kok, Hong Kong Island, with Cheung Sha, Lantau Island, and a second cable is planned to connect Chung Hom Kok with Sandy Bay, both of which are on Hong Kong Island. The domestic fibre-optic cables will facilitate network connections and will ultimately enhance the Hong Kong Special Administrative Region's (HKSAR) capability as a communications and service centre in Asia.

This Project Profile includes an assessment of the potential environmental impacts associated with the installation of the submarine telecommunications cable system. The assessment has been based on information compiled by the Project Proponent describing the expected construction activities. Once installed, the cable will not result in any impact to the environment during its operation.

## 1.3 NAME OF PROJECT PROPONENT

New T&T (Hong Kong) Limited
5$^{th}$ Floor, New T&T Centre
No. 7 Harbour City
Tsimshatsui
Kowloon
HONG KONG

Attention: Director, Network

Phone: , Fax:

## 1.4 LOCATION AND SCALE OF PROJECT

### 1.4.1 Location

The proposed New T&T domestic cable route is depicted in *Figure 1.4a*. The proposed cables would land at newly constructed manhole locations at Chung Hom Kok, Cheung Sha and Sandy Bay. The locations of the landing sites are presented in *Figures 1.4b, 1.4c* and *1.4d.*

The two cables would travel from the Chung Hom Kok Composite Signals Organization Station Complex (CSOSC) presently being developed by SmarTone and then traverse a small beach to the south east of the CSOSC site. The cables would then travel west to the south of Lamma Island along the boundary of HKSAR waters. The two cables will travel in parallel before diverting once they pass south of the Ha Mei Tsui Peninsula on the south of Lamma.

One cable will continue westward, bearing west north west, continuing south of Cheung Chau and Shek Kwu Chau before ultimately landing at Cheung Sha on Lantau Island. The second cable will travel north north-west following the western coastline of Lamma Island. The cable will then bear north north-east following the boundary of the North West Lamma Anchorage and then continue in parallel to the boundary of the North Lamma Anchorage before landing at Sandy Bay on the west coast of Hong Kong Island.

### *1.4.2 Scale of Project*

The Project involves the laying of two domestic submarine fibre-optic telecommunications cables in HKSAR waters between three landing sites and manhole locations in Chung Hom Kok, Cheung Sha and Sandy Bay. The total length of the Chung Hom Kok to Cheung Sha cable is approximately 37 km and the Chung Hom Kok to Sandy Bay cable is approximately 32 km in length.

The cable laying process will only result in minor works within the marine environment which will not adversely affect water quality or the marine ecology of the area. Only small scale construction works are required at the cable landing sites to enable the cable to enter the manhole systems.

## *1.5 CABLE ROUTING SELECTION PROCESS*

### *1.5.1 Selecting a Marine Based Option*

The decision to construct a submarine cable system, rather than a land based system, was based on the following considerations.

- The route connecting Hong Kong to Lantau Island was selected as there is only one land route that can be constructed to provide a service between these two areas. Thus, the submarine cable route provides additional route diversity and increases service availability to international telecommunication traffic.

- The second route, from Chung Hong Kok to Sandy Bay, has been selected due to restrictions imposed on road opening along the Tai Tam Road. Furthermore, within the road system, there is very little room for cable laying activities to occur without significant disruption to vehicle traffic. As these road systems need to accommodate all underground

facilities for all Government and public utilities, a marine based route was considered to be a practical alternative solution.

### 1.5.2 *Marine Route Planning Considerations*

There are several existing physical constraints to the New T&T cable routes, which have confined the alignment of the cables into a narrow corridor (*Figure 1.5a*). The following areas have been avoided as far as practicable.

- Avoiding multiple crossing other submarine cables situated along the proposed New T&T cable route and ensuring that cable laying operations do not compromise the integrity of other cable systems.
- Avoiding the planned Strategic Sewage Disposal Scheme (SSDS) outfall located to the south west of Lamma Island and providing a sufficient buffer distance from this outfall.
- Routing the cables to avoid the planned gas pipeline for the Lamma Power Station Extension.
- Avoiding the three gazetted Dangerous Goods anchorage areas to the south of Lamma Island.
- Avoiding the two gazetted anchorage areas to the north of Lamma Island.
- Avoiding the gazetted open seafloor disposal facility for uncontaminated dredged material located to the south of Cheung Chau.
- Avoiding the proposed extensions of the approaches to the Lamma Power Station.

## 1.6 *DESIGNATED PROJECTS TO BE COVERED BY THE PROJECT PROFILE*

The Project is classified as a Designated Project under the *Technical Memorandum on Environmental Impact Assessment Process (TM EIAO)*:

Schedule 2 (Part I), C.12 - A dredging operation which ---

*(a)* *is less than 500 m from the nearest boundary of an existing or planned---*
*(v) coastal protection area*; and
*(vi) bathing beach*

## 1.7 *NAME AND TELEPHONE NUMBER OF CONTACT PERSON*

EGS (Asia) Limited has been retained by New T&T to undertake the survey work and the overall management of the Project. Environmental Resources Management (ERM) has been appointed by EGS to undertake the environmental permitting for this Project.

All queries regarding the Project should be addressed to:

EGS (Asia) Limited
9th Floor South, Somerset House
979 King's Road
Taikoo Place
Hong Kong

Phone: 2894 8622
Fax: 2576 3590
Attn: Dr Ian Wright

and,

Environmental Resources Management
21/F Lincoln House
979 King's Road
Taikoo Place
Hong Kong

Phone: 2271 3000
Fax: 2723 5660

# 2 OUTLINE OF PLANNING AND IMPLEMENTATION PROGRAMME

## 2.1 PROJECT PLANNING AND IMPLEMENTATION

The Project will be constructed through the following activities:

- ***Preparation of the Manhole Locations -*** The cables will be laid in a trench (1 to 2 m deep) along the shoreline to the manhole locations.

- ***Cable Laying Methodology -*** Cable burial in the nearshore area will be undertaken by divers using jet probes to sink the cable into the sediment. All marine cable burial works will be conducted using the injection jetting technique. The injection jetting technique will employ the use of an "injector" which is designed to simultaneously lay and bury cables. With a diver in the water to assist, the injector is lowered to the seabed to ensure proper functioning and positioning. Once the diver confirms that the injector and the cable are in the right position, the cable laying and burial commences simultaneously.

  The cables are to be buried under the seafloor for the majority of the route at approximately -7 m below the seabed; however, depending on the substrate the burial depth may be approximately -9 m below the seabed in places. All burial depths at the approaches to the landing points will be at approximately -3 m below the seabed. Where the cables cross existing cables, the burial depth will be approximately 1 m below the seabed. The broad areas of shallow and deep burial are shown on *Figure 2.1a*.

- ***Post Lay Protection:*** It is expected that articulated piping (diameter 100 mm) will be applied over a distance of 100 m from the manholes. This will ensure that the cable is sufficiently protected from storm and wave scour. The post lay operations will be guided by divers and will not result in environmental impacts to the marine environment.

All nearshore and onshore construction works are expected to be undertaken during normal working hours. If evening or nighttime works are later found to be necessary, a construction noise permit (CNP) will be applied for.

## 2.2 PROJECT PROGRAMME

The New T&T Domestic Cable System is scheduled to be landed and installed at the Chung Hom Kok, Cheung Sha and Sandy Bay landing sites by mid 2001. The expected construction schedule within Hong Kong waters is:

| | |
|---|---|
| Landing Site Preparation | 30 days |
| Cable Landing (at each site) | 3-5 days |
| Cable Laying (for each segment) | 30 days |
| Post Lay Protection (at each site) | 2-3 days |

# 3 *MAJOR ELEMENTS OF THE SURROUNDING ENVIRONMENT*

## 3.1 *LAND & SEA ACTIVITIES*

### 3.1.1 *Landing Sites*

*Chung Hom Kok*

The landing site at Chung Hom Kok is situated on the eastern part of the Chung Hom Kok headland on the south of Hong Kong Island. The cable is proposed to land at the small beach located to the south of the final landing site at the designated CSOS Complex. The coastline in this area is designated as a Coastal Protection Area (CPA) on the *Town Planning Ordinance, Hong Kong Town Planning Board Hong Kong Planning Area No. 19 - Stanley Outline Zoning Plan (S/H19/5).*

*Cheung Sha*

The landing site at Cheung Sha is situated on the south coast of Lantau Island. The landfall access is immediately north and outside of the gazetted bathing beach. The landing site is generally composed of fine grained sand, lying on a shallow gradient. Once on the beach, the cable will then be trenched across the beach and will run adjacent to the concrete walkway to follow the pedestrian footpath to the bus stop where the manhole will be positioned. The coastline in this area is designated as CPA on the *Town Planning Ordinance, Hong Kong Town Planning Board South Lantau Coast - Outline Zoning Plan (S/SLC/8).*

*Sandy Bay*

The landing site at Sandy Bay is situated on the west side of Hong Kong Island. The landing site is on unused land lying close to Telegraph Bay. The cable landfall site comprises a shallow gradient sandy beach that has numerous pebbles and rocks of various sizes.

### 3.1.2 *Shipping Lanes and Fairways*

There are two major shipping lanes which the proposed cable routes pass through; the East Lamma Channel, and the Adamasta Channel.

### 3.1.3 *Gazetted Marine Facilities*

To the south of Lamma Island is the South Lamma Dangerous Goods Anchorage and to the north of Lamma Island is the North West Lamma Anchorage and the North Lamma Anchorage. To the north are the Kau Yi Chau Dangerous Goods Anchorage, the Western Anchorage No. 3 and the Reserved Dangerous Goods Anchorage. The seabeds within these gazetted anchorages are presumed to be disturbed by anchor scour.

To the south of Cheung Chau Island there is a gazetted open seafloor disposal facility for uncontaminated dredged material, which has been in use since 1981. The majority of operations within this disposal facility are, at present, being conducted in the eastern portion, closest to the proposed Chung Hom Kok to Cheung Sha cable route.

### 3.1.4 *Cables, Pipelines and Outfalls*

There are numerous submarine cables located to the south of the Chung Hom Kok landing site and a number located to the south west of the proposed Cheung Sha landing site. The planned Strategic Sewage Disposal Scheme (SSDS) outfall is located to the south west of Lamma Island and north of the route of the proposed cables. The final portion of the Chung Hom Kok to Sandy Bay cable route passes to the south of the planned SSDS outfalls.

### 3.1.5 *Other Proposed Facilities or Amenities*

The waters to the south of Lamma Island are under review for the designation of a proposed Marine Park; however, the boundary of this proposed reserve have not yet been established.

A gas pipeline is planned to land at the Lamma Power Station Extension. The pipeline will travel from Shenzhen into the eastern waters of Hong Kong and follow the southern boundary before travelling north to the Ha Mei Tsui Peninsula on Lamma Island.

## 3.2 SITES OF SPECIAL SCIENTIFIC INTEREST

The closest Site of Special Scientific Interest (SSSI) is the Tai Tam Reservoir Catchment Area SSSI which is located over 1.3 km north of the Chung Hom Kok landing site and the South Lamma Island SSSI which is located more than 2.3 km from the proposed Chung Hom Kok to Sandy Bay cable route.

## 3.3 SITES OF CULTURAL HERITAGE

No declared/deemed monuments, graded or recorded heritage resources are located in the vicinity of the proposed cable alignments or in the surrounding areas of any of the landing sites. The closest heritage site to the Chung Hom Kok landing site is the Chung Hom Wan Archaeological Site, located approximately 600 m to the north west of the cables at Sha Shek Wan Tan. The closest heritage site to the Cheung Sha landing site is the Cheung Sha Beach Archaeological Site, located 900 m to the east.

## 3.4 GAZETTED BATHING BEACHES

The closest Gazetted Bathing Beach to the entire system is the Cheung Sha Upper Gazetted Bathing Beach which is approximately 15 m from the Cheung

Sha cable landing point. In Chung Hom Kok, St Stephen's Beach in Stanley Bay is situated approximately 420 m from the closest cable segment.

## 3.5 *MARINE PARK OR MARINE RESERVES*

The Cape d'Aguilar Marine Reserve is located 5 km from the closest part of the proposed cable routes.

## 3.6 *FISH CULTURE ZONES*

The Po Toi Fish Culture Zone (FCZ) is situated over 4.5 km from the closest cable segment, whereas, the So Kwu Wan and Lo Tik Wan FCZs are located over 3.5 km and 4.5 km away from the closest parts of the proposed cable routes, respectively.

## 3.7 *PROTECTION AND CONSERVATION AREAS*

The beach landing sites at Chung Hom Kok and Cheung Sha lie in areas currently designated on the Outline Zoning Plans as CPA.

## 3.8 *SEAWATER INTAKE POINTS*

There are four seawater intakes in the vicinity of the proposed cable routes. These are, the Queen Mary Hospital/Sha Wan Drive intake, Wah Fu Estate intake, Kennedy Town Water Supplies Department intake and Cheung Chau intake. The closest seawater intake to the cable route is the Queen Mary Hospital/Sha Wan Drive intake, which is 525 m from the closest cable segment.

# 4 POSSIBLE IMPACTS ON THE ENVIRONMENT

## 4.1 SUMMARY OF POTENTIAL ENVIRONMENTAL IMPACTS

The construction impacts associated with the domestic submarine cable system are summarised in *Table 4.1a* and are described in further detail in the following *Sections*. There are no environmental impacts that are expected to occur during the operation of the submarine cable system.

*Table 4.1a* ***Potential Sources of Environmental Impacts (Construction)***

| **Potential Impact** | |
|---|---|
| • Dust | × |
| • Noise | × |
| • Liquid Effluents, Discharges, or Contaminated Runoff | ✓ |
| • Generation of Waste or By-products | × |
| • Disruption of Water Movement or Bottom Sediment | ✓ |
| • Unsightly Visual Appearance | × |
| • Cultural & Heritage | × |
| • Ecological Impacts: | |
| - Terrestrial | × |
| - Marine | ✓ |
| - Fisheries | ✓ |
| • Gaseous Emissions | × |
| • Odour | × |
| • Night-time Operations | × |
| • Traffic Generation | × |
| • Manufacturing, Storage, Use, Handling, Transport, or Disposal of Dangerous Goods | × |
| • Hazardous Materials or Wastes | × |
| • Risk of Accidents Which Result in Pollution or Hazard | × |
| • Disposal of Spoil Material, Including Potentially Contaminated Materials | × |

**Notes:** ✓ = Potential to result in adverse impacts, × = Not expected to result in adverse impacts

The environmental sensitive receivers in the vicinity of the cables are shown in *Figure 4.1a*.

## 4.2 DUST

The only potentially dust generating activities that would occur at the Project sites are from manhole construction works. The construction works will be small in scale and no significant dust impacts will result from these works.

## 4.3 NOISE

There are no Noise Sensitive Receivers close to the Project works sites and the land based works are expected to be small in scale, in the order of minor public utility works. Thus noise generated during construction of the cable landing sites and associated manholes are not expected to result in impacts to sensitive receivers.

During the cable laying process, only minimal noise will be generated from the barge and cable laying equipment. This is considered to be similar to that of existing marine traffic in the area and will not impact Noise Sensitive Receivers. On this basis, no direct or indirect adverse noise impacts will result from this Project.

## 4.4 WATER QUALITY

The potential for impacts to water quality during the land based activities, involving cable installation and construction of the manholes, primarily relate to surface water run-off. However the following measures will be incorporated into the land based construction activities to prevent any adverse impacts to water quality.

- stockpiles of materials will be covered with tarpaulin or similar fabric to minimise runoff during the rainy season;
- care will be taken during the cable landing and construction to avoid any spillage of materials to the adjacent marine waters and to ensure that spoil materials are not discharged into adjacent waters; and
- all construction waste will be handled and disposed of in accordance with the *Waste Disposal Ordinance*.

The above measures will be sufficient to prevent adverse impacts to water quality during the shore based construction activities. Therefore, there are no predicted adverse impacts (either direct or indirect) to water quality from the shore based construction activities.

The marine based construction activities involve burying the cables below the existing sea bed. The cables will be buried between 3 and 9 m below the existing seabed using a barge mounted injection tool. This burial depth is necessary to provide protection to the cables. The injection jetting tool utilises water injector technology to fluidise the sediments, which enables the injection tool to penetrate the sea bed to the desired depth and lay the cable. The cables are expected to be installed over a 30 day period. The maximum speed during cable laying will be approximately 1 km $hour^{-1}$.

Cable laying will result in the formation of an area of high suspended sediment concentrations around the injection tool, which will remain close to the seabed and settle out quickly. The sediment disturbed during cable laying will remain in suspension for a very short period of time, and hence the potential for the release of any contaminants from seabed sediments and

exertion of an oxygen demand on the receiving waters will be limited and is not expected to cause adverse impacts to water quality.

Analysis of the potential transport of fine sediments suspended in the water column was undertaken and it was determined that the sediments would settle onto the sea bed in less than 3 minutes. The maximum distance of transport for the suspended sediments would be 104 m.

No long term disruption of bottom sediment will occur and no disruptions to water movement will result from this Project. No adverse impacts to water quality will occur during or after the marine works.

### *4.5 WASTE MANAGEMENT*

During the cable landing work, no waste material will be generated at the sites, other than general construction waste materials, which will be handled and disposed of in accordance with the *Waste Disposal Ordinance*. There will be no dredged materials and any excavated material will be balanced at the sites. Therefore, no adverse waste impacts (either direct or indirect) will be generated from cable installation works and construction of the cable manholes.

### *4.6 LANDSCAPE AND VISUAL*

Since the cable conduits will be underground and the submarine cables are buried in the seabed, no visual obstructions or inconveniences to the public are expected to occur.

### *4.7 CULTURAL AND HERITAGE*

No known heritage sites are identified to be impacted by either of the proposed cable routes. At the Cheung Sha landing the cable will be laid beneath the recently formed beach. The alignment follows an existing concrete footpath up to the concrete path at South Lantau Road to the proposed manhole location. No impacts to archaeological deposits are expected to result due to the minimal amount of work required and the existing disturbance in this area.

Similarly, at Sandy Bay and Cheung Hom Kok, the proposed cable alignment is small in scale and only creates minor disturbance to the terrain. Only small scale manhole construction would be undertaken at the beaches and will only involve excavation of shallow trenches. Therefore no impacts are expected to result to archaeological deposits.

## 4.8 TERRESTRIAL ECOLOGY

The cable landing sites are situated on beaches which hold no important terrestrial ecological resources. No impacts to terrestrial ecology will arise from this Project.

## 4.9 MARINE ECOLOGY

A review of existing information on the marine ecological resources surrounding the cable routing has identified the area as supporting benthic fauna which can be considered to be of low to medium ecological value in comparison to other areas of Hong Kong. Although these soft bottom assemblages will be disturbed during the cable laying works, the area of disturbance is small and rapid reinstatement of the seabed will result in the area being available for prompt recolonisation, and hence, no permanent impacts are likely to occur.

No coral communities of ecological importance have been identified along the cable routes or in the vicinity of the cable landing site (see *Annex B*). Coral assemblages of ecological importance have been identified within 510 m from the proposed cable routes (see *Figure 4.1a*). The coral communities are considered to be at a sufficient distance from the alignment of the cables to indicate that impacts will not occur (see *Annexes A* and *B*). Similarly, based on intertidal surveys undertaken at the landing sites no unacceptable impacts to intertidal rocky shore or sandy shore habitats are predicted to occur.

Both the Finless Porpoise and the Indo-Pacific Hump-backed Dolphin have been sighted in the waters of the proposed cable routes. Although sightings have occurred, the waters that the proposed cable routes pass through are not considered to be critical habitats. Based on this, and the predicted localised and very short term impacts to water quality (described in *Annex A*), no impacts are predicted to occur to marine mammals.

As there are no unacceptable impacts predicted to occur to marine ecological resources, no mitigation measures are recommended other than those proposed to minimise potential impacts to water quality.

## 4.10 FISHERIES

The proposed cable routes pass through 14 of the 189 AFCD Fishing Zones, of which 13 are actively fished by the Hong Kong fishing fleet. The majority of the catches reported by fishermen operating in the waters are low value bottom dwelling crustaceans or small fast growing pelagic species of low commercial value. The Fishing Zones have, in general, been ranked as medium in comparison to other Fishing Zones in Hong Kong waters, in terms of fisheries production on a per hectare basis. There are no AFCD gazetted Fish Culture Zones within the vicinity of the proposed routes.

Due to the proposed method of cable deployment and installation, no unacceptable impacts have been predicted to occur to fisheries resources or fishing operations. Any potential disturbances to the seabed will be minimal, localised and of a short duration. No specific mitigation measures have been recommended as no impacts have been identified.

## 4.11 *OTHERS*

**Gaseous Emissions**: Only a small quantity of gaseous emissions ($SO_2$ and $NO_x$) from diesel-powered equipment would be generated during construction of the cable landing sites. These emissions will not impact Air Sensitive Receivers.

**Odour:** No odour impacts are expected to occur as a result of this Project.

**Traffic Generation:** Only short term, minimal traffic is expected to be generated as a result of the Project and this will not generate significant noise or gaseous emissions.

**Dangerous Goods:** No dangerous goods will be involved in this Project.

**Night-time Operations:** It is expected that all cable laying and burial work will be performed within the inshore area during normal working hours. If works are proposed during the evening or night-time hours, a Construction Noise Permit will be applied for at the time.

**Hazardous Materials or Wastes:** No hazardous materials or wastes will be generated by this Project.

**Risk of Accidents Resulting in Pollution or Hazard:** No pollution or hazard generating accidents will result from this Project.

**Disposal of Spoil or Contaminated Material:** There will be no disposal of spoil or contaminated materials, hence no impacts are expected to result from this Project.

# 5 PROTECTION MEASURES AND ANY FURTHER IMPLICATIONS

## 5.1 POSSIBLE SEVERITY, DISTRIBUTION AND DURATION OF ENVIRONMENTAL EFFECTS

The marine installation works for the submarine cable system are expected to take approximately 30 days. The residual environmental impacts of the works activities are predicted to be localised to the immediate vicinity of the cable alignment and of low severity and, hence are considered to be acceptable.

No environmental impacts are predicted during the operation of the submarine cable system.

## 5.2 CUMULATIVE IMPACTS

There are a number of concurrent projects within the Western Harbour area that will be undertaken during the laying of the submarine cables. These projects include: reclamation works at Penny's Bay, Container Terminal 9 and the extension to the Lamma Power Station; disposal of uncontaminated mud at the South Tsing Yi Marine Borrow Area (MBA) and South Cheung Chau Disposal Area; and sand dredging at the East Lamma Channel and South Tsing Yi MBAs. The sediment disturbed during cable laying will remain close to the sea bed, and is predicted to remain in suspension for less than 3 minutes. Any sediment was predicted to settle onto the sea bed within 104 m of the cable route. No cumulative impacts are predicted to occur with other concurrent projects (see *Annex A*).

## 5.3 FURTHER IMPLICATIONS

The geotechnical environment of the proposed landing points have been confirmed to be suitable for submarine cable landing by electronic surveys.

The methods used for burying the New T&T domestic submarine cable system, as described in *Section 2.1*, have been used around the world for more than one century and are widely accepted to have no impact on the surrounding environment. The working period is very short and no waste or contaminant disposal issues or excessive noise will be generated by such an operation.

## 5.4 USE OF PREVIOUSLY APPROVED EIA REPORTS

Similar recent projects that have been conducted in the HKSAR include the following:

- *East Asian Crossing (EAC) Cable System (TKO), Asia Global Crossing.* The Project Profile for this study was submitted to EPD on 11 August 2000 (AEP-081/2000). The study concluded that there would be no adverse long term or cumulative effects/impacts on the environment and the Environmental Permit was granted on 4 October 2000 (EP-081/2000).

- *East Asian Crossing (EAC) Cable System, Asia Global Crossing.* The Project Profile for this Study was submitted to EPD on 21 June 2000 (AEP-079/2000). The Study concluded that there would be no adverse long term or cumulative effects/impacts on the environment and the Environmental Permit was granted on 6 September 2000 (EP-079/2000).

- *Submarine Cable Landing Installation in Tong Fuk Lantau for Asia Pacific Cable Network 2 (APCN 2) Fibre Optic Submarine Cable System, EGS*. The Project Profile for this study was submitted to the EPD in May 2000. The study concluded that there would be no adverse long term or cumulative effects/impacts to the environment and the Environmental Permit was issued on 26 July 2000 (EP-069/2000).

- *Telecommunication Installation at Lot 591SA in DD 328, Tong Fuk, South Lantau Coast and the Associated Cable Landing Work in Tong Fuk, South Lantau for the North Asia Cable (NAC) Fibre Optic Submarine Cable System*. The Project Profile for this study was submitted to the EPD in March 2000 (AEP-064/2000). The study concluded that there would be no adverse long term or cumulative effects/impacts to the environment and the Environmental Permit was granted in June 2000 (EP-064/2000).

- *Cable Landing Work in Deep Water Bay for SEA-ME-WE 3 Fibre Optic Submarine Cable System, Hong Kong Telecom*. The Project Profile for this study was submitted to the EPD in May 1998 (AEP-001/1998). The study concluded that there would be no adverse long term or cumulative effects/impacts to the environment. The Environmental Permit was granted July 1998 (EP-001/1998).

### *5.5 ENVIRONMENTAL MONITORING & AUDIT*

As no environmental impacts have been identified, no environmental monitoring and audit measures have been recommended as being necessary for this Project.

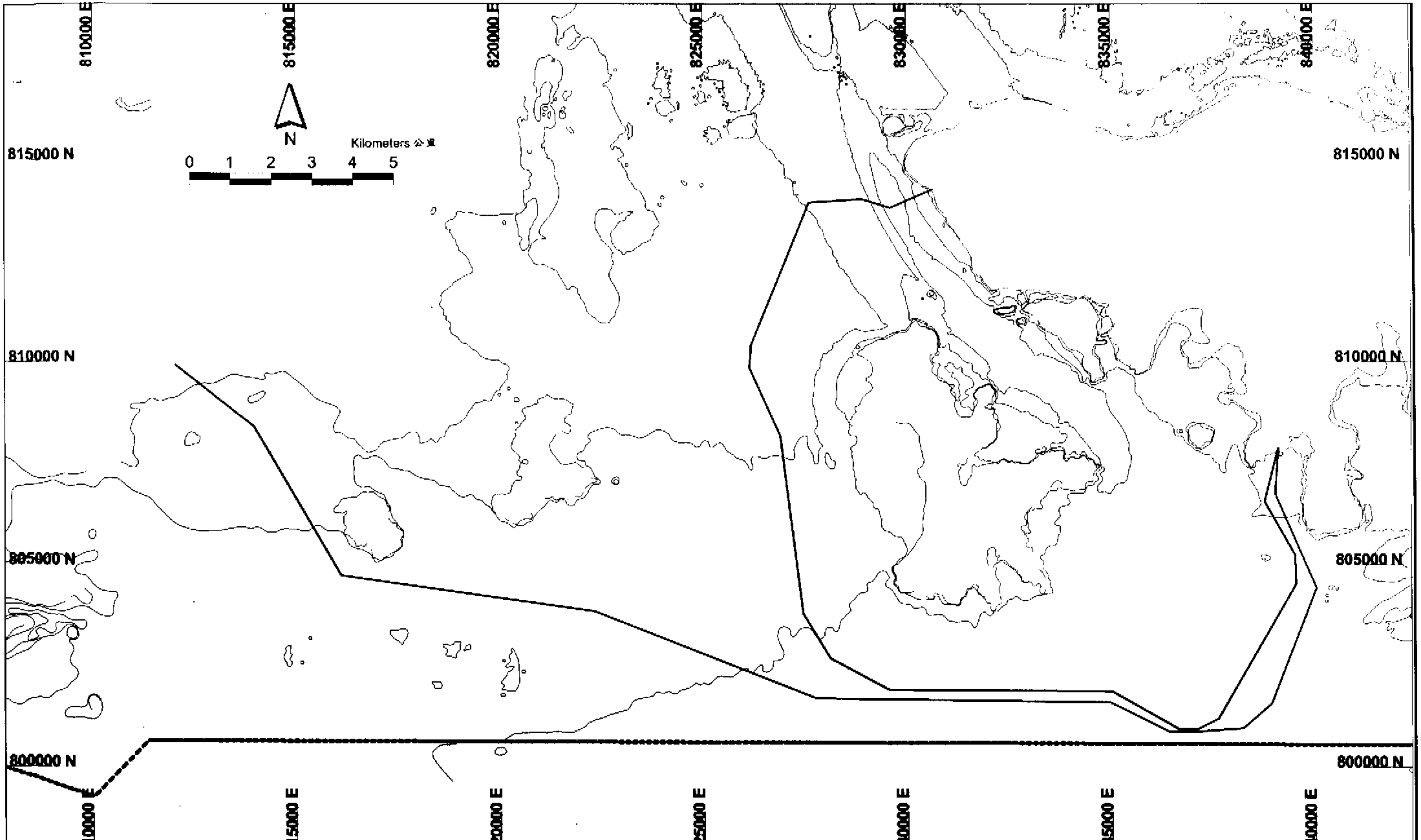


FIGURE 1.4a
圖 1.4a

LOCATION OF THE PROPOSED NEW T&T CABLE SYSTEM
建議中的新電訊本地通訊電纜路線

FILE: C2116a
DATE: 29/11/00

Environmental
Resources
Management
ERM

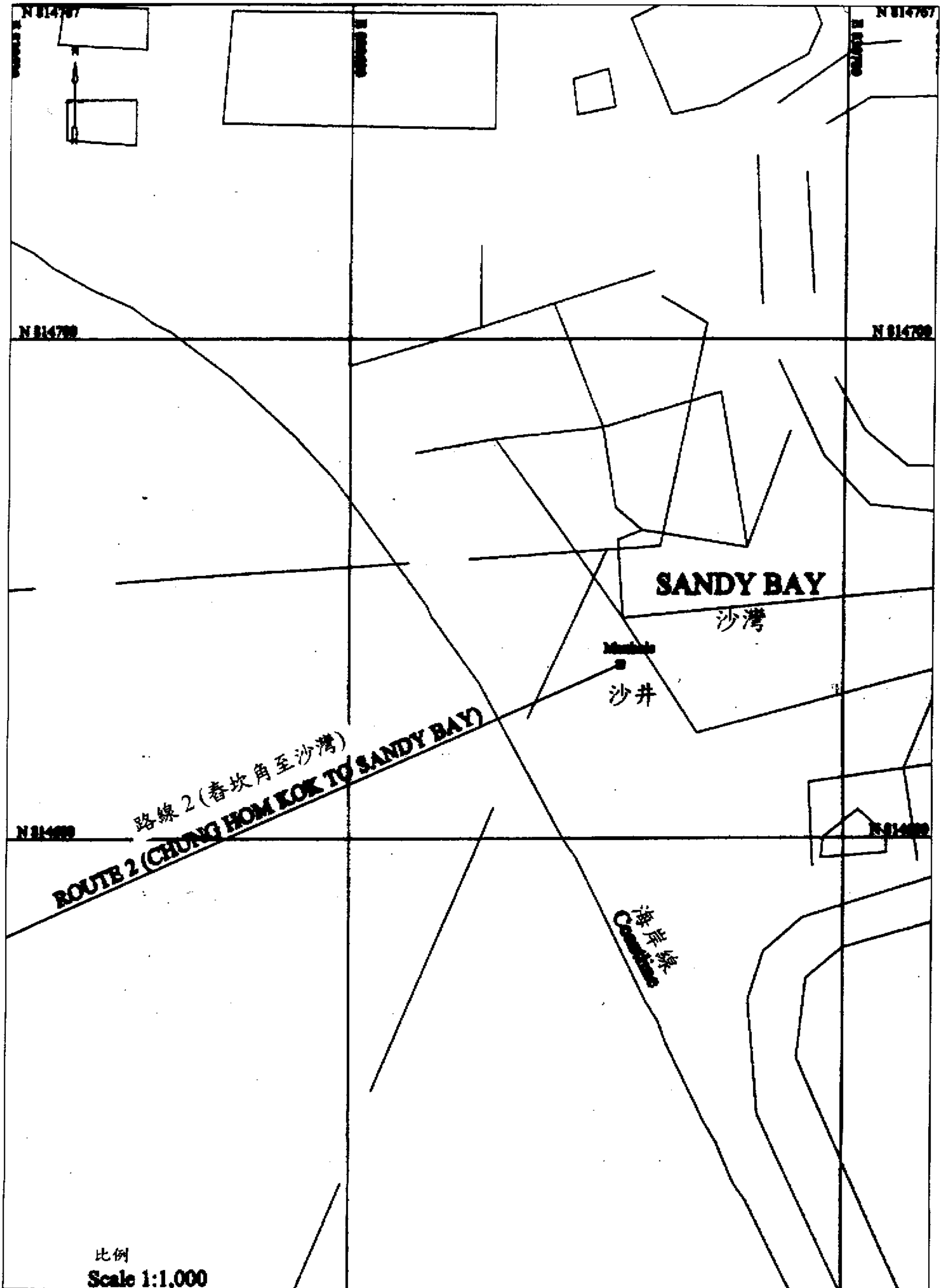


FIGURE 1.4b
圖 1.4b

SANDY BAY LANDING SITE
沙灣登岸位置

Environmental Resources Management
ERM

FILE: C2115d
DATE: 28/11/00

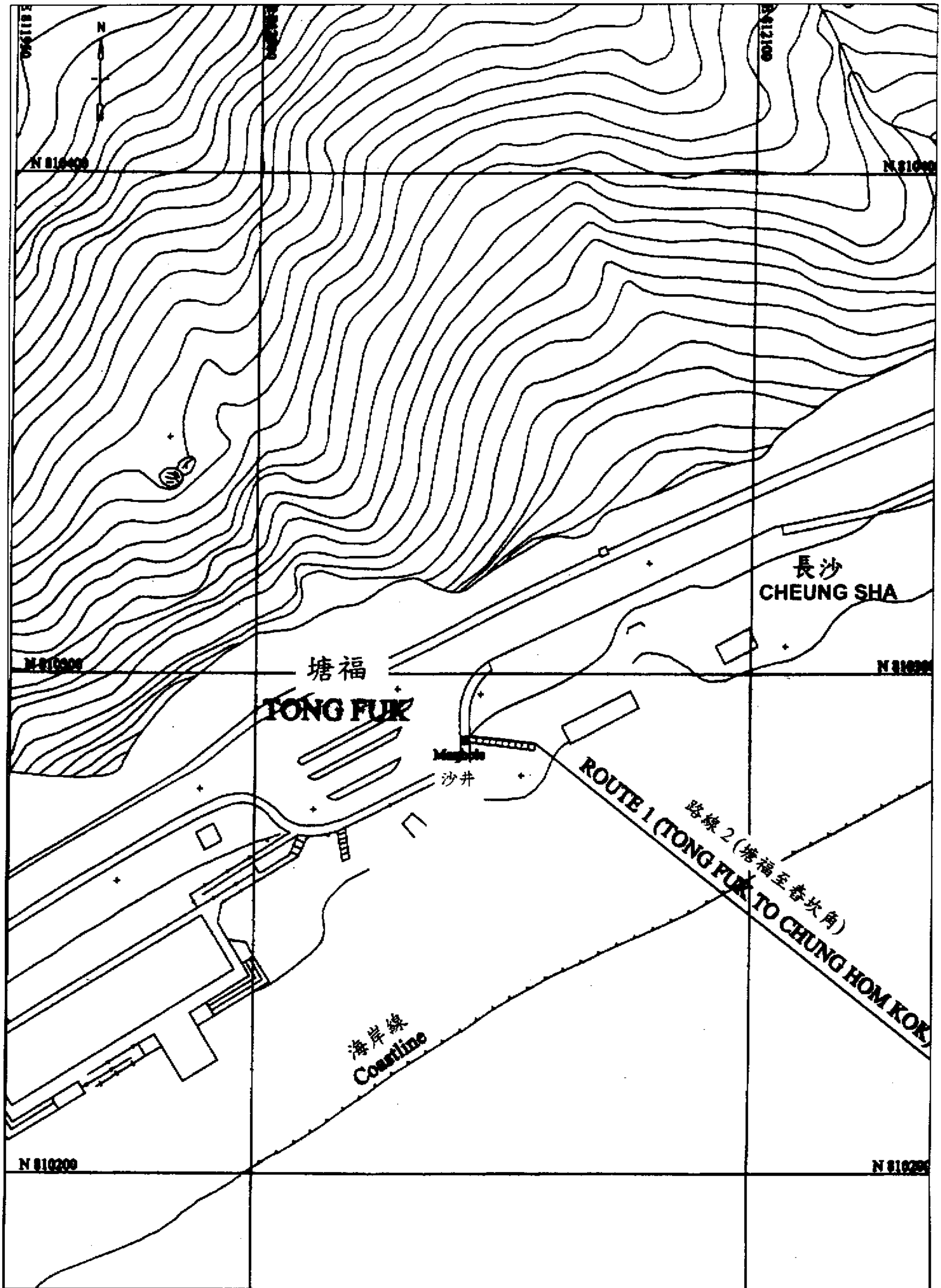


FIGURE 1.4c
圖 1.4c

CHEUNG SHA LANDING SITE
長沙登岸位置

Environmental
Resources
Management
ERM

FILE: C2115b
DATE: 28/11/00

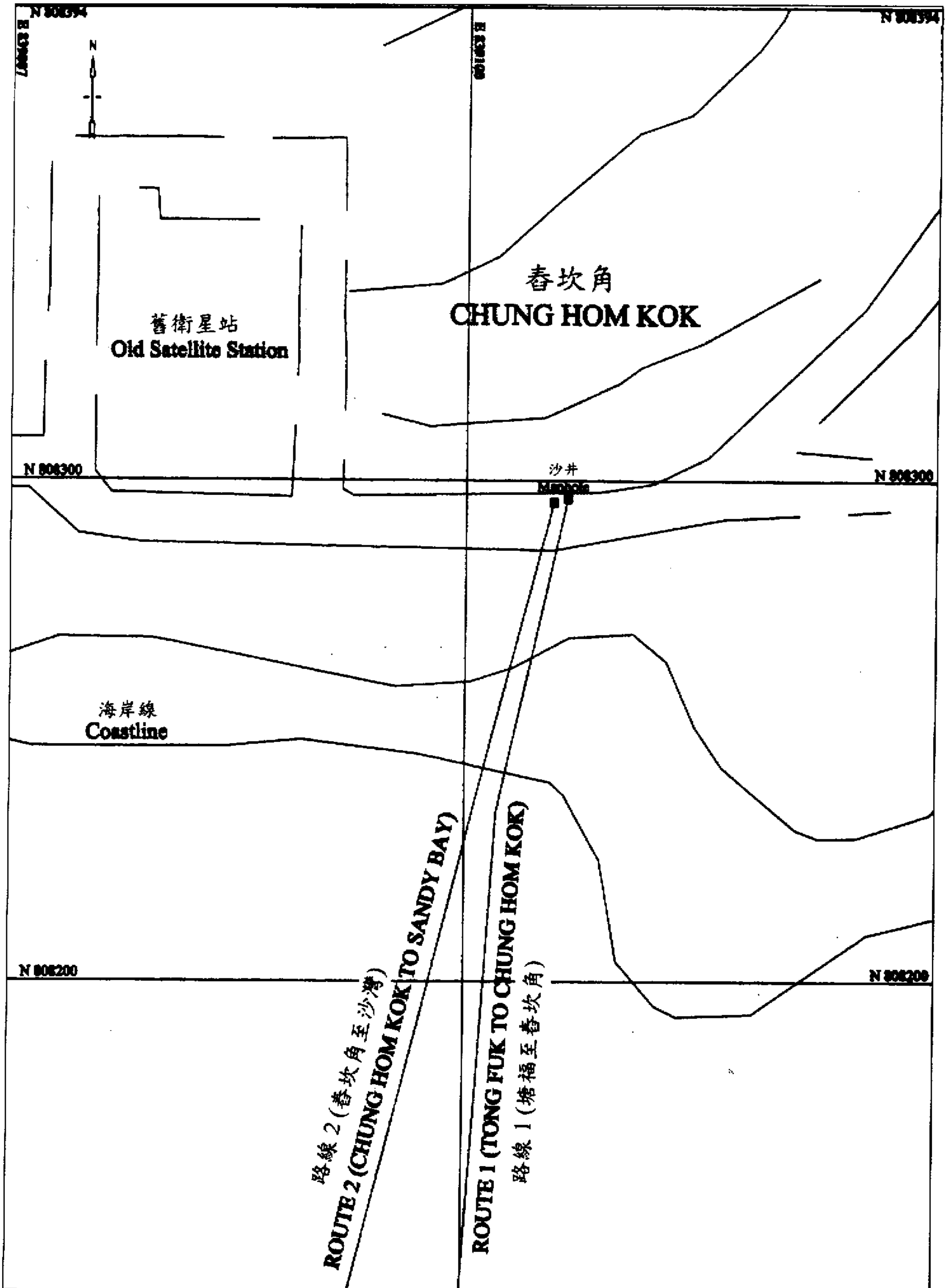


FIGURE 1.4d
圖 1.4d

CHUNG HOM KOK LANDING SITE
春坎角登岸位置

FILE: C2115c
DATE: 28/11/00

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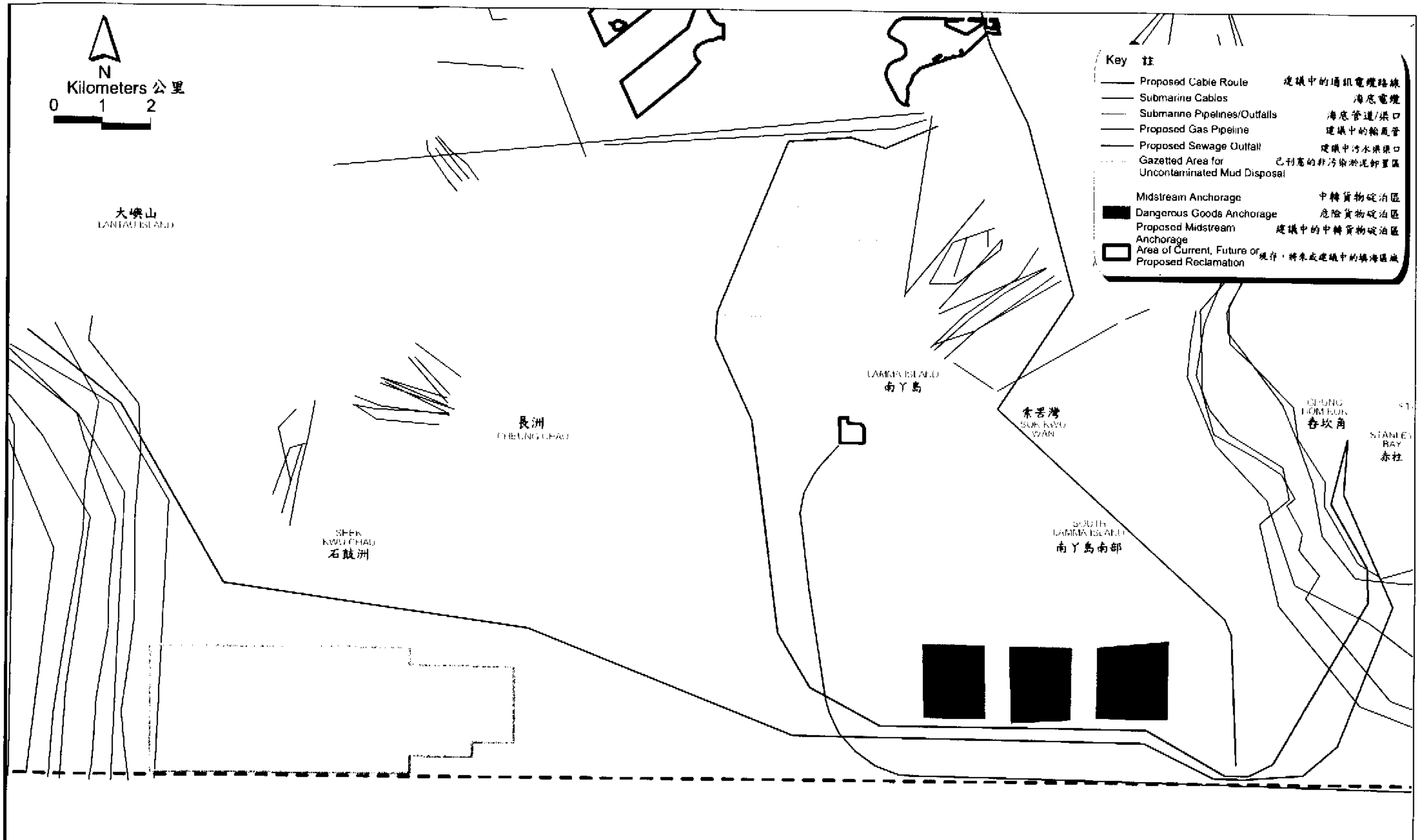


FIGURE 1.5a
圖 1.5a

PHYSICAL CONSTRAINTS FOR THE PROPOSED NEW T&T CABLE SYSTEM
建議中的新電訊本地通訊電纜的物理性限制

FILE: C2115f
DATE: 30/11/00

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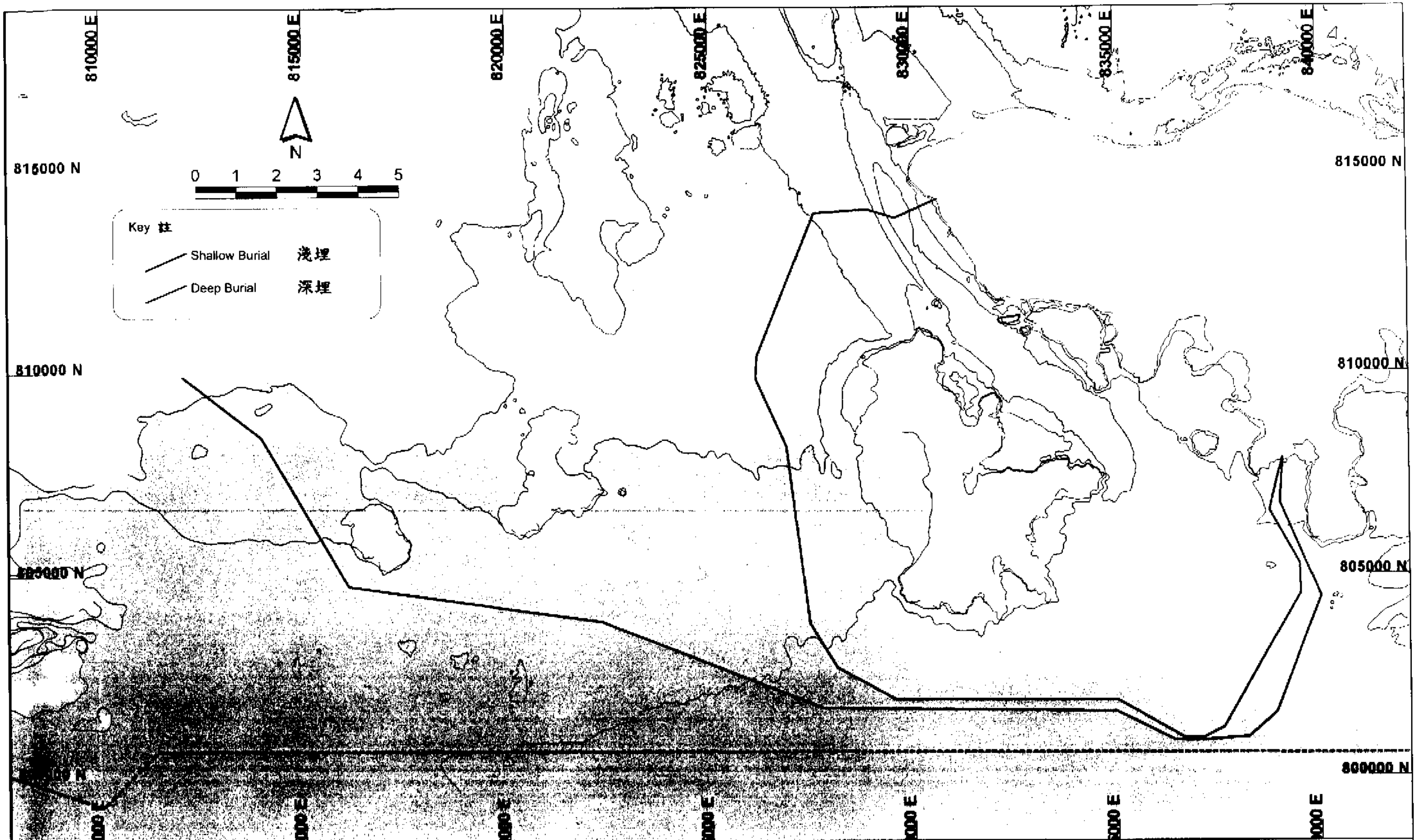


FIGURE 2.1a
圖2.1a

BURIAL DEPTH OF THE PROPOSED NEW T&T CABLE SYSTEM
建議中的新電訊本地通訊電纜掩埋深度

FILE: C2115p
DATE: 05/12/00

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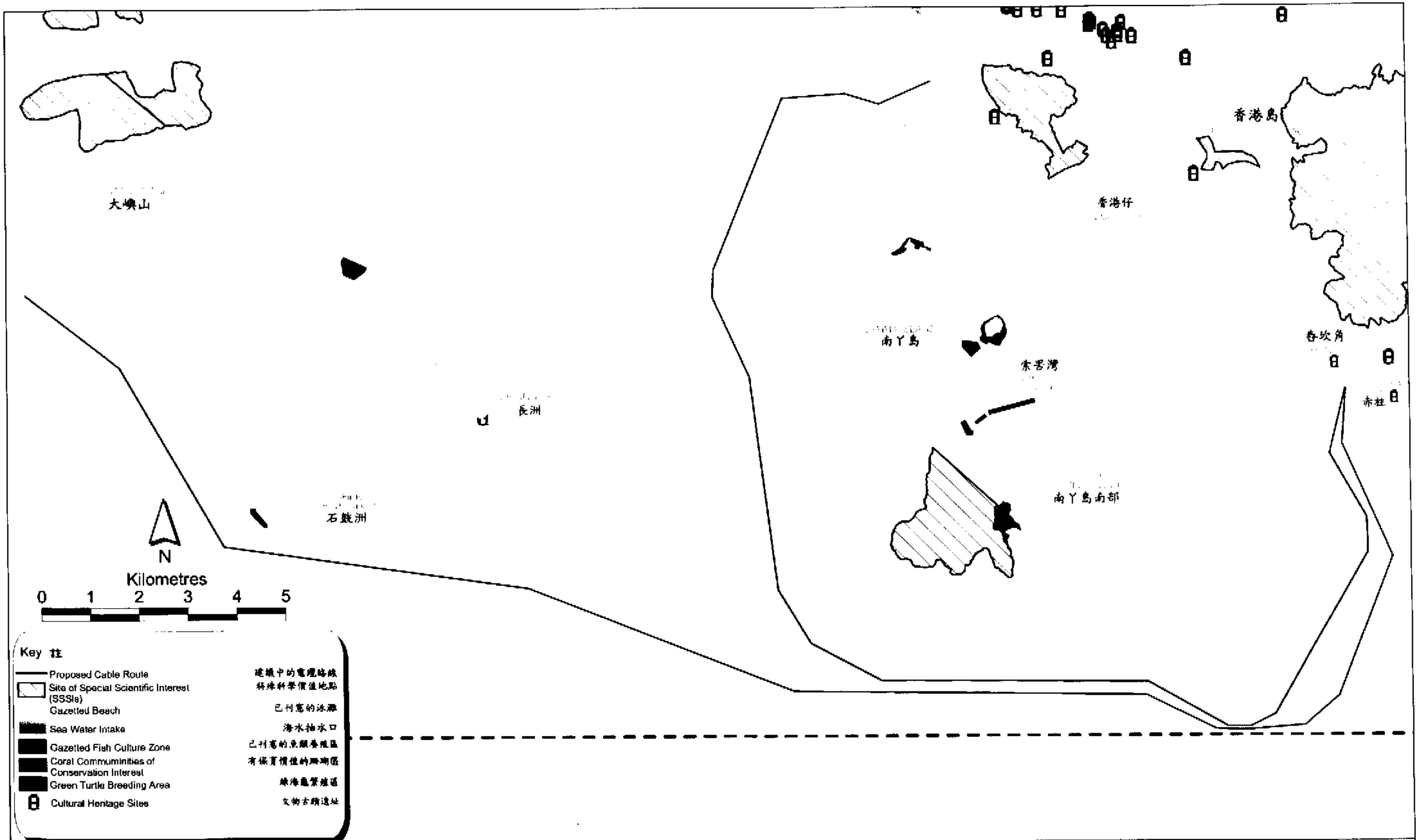


FIGURE 4.1a
圖 4.1a

ENVIRONMENTAL SENSITIVE RECEIVERS FOR THE PROPOSED NEW T&T CABLE SYSTEM
建議中的新電訊本地通訊電纜系統的環境敏感地點

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DATE: 30/11/00

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## *A1 INTRODUCTION*

This *Annex* presents an assessment of potential water quality impacts associated with the construction of the New T&T domestic fibre-optic submarine telecommunications cable system. Once installed, the cable would not result in any environmental impacts during operation and hence the focus of the assessment is on the construction phase.

## *A2 RELEVANT LEGISLATION AND ASSESSMENT CRITERIA*

The following items of legislation are applicable to the evaluation of water quality impacts associated with the construction of the proposed fibre optic submarine cable system.

- *Environmental Impact Assessment Ordinance (Cap. 499. S.16)* and the *Technical Memorandum on EIA Process (EIAO TM), Annexes 6* and *14*;
- *Water Pollution Control Ordinance (WPCO)*; and
- *Technical Memorandum for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters (TM ICW)*.

The *WPCO* is the primary legislation for the control of water pollution and water quality in Hong Kong. Under the *WPCO*, Hong Kong waters are divided into 10 Water Control Zones (WCZs). Each WCZ has a designated set of statutory Water Quality Objectives (WQO). The route for the proposed fibre optic submarine cable system passes through the Southern and Western Buffer WCZs. The WQOs for the WCZs are applicable as evaluation criteria for assessing the compliance of any discharges during the construction of the proposed system.

All discharges during the construction of the system are required to comply with the *TM ICW* issued under Section 21 of the *WPCO*, which defines acceptable discharge limits to different receiving waters. Under the *TM ICW*, effluents discharged into the drainage and sewerage systems, inshore and coastal waters of the WCZs are subject to pollutant concentration standards for particular volumes of discharge. These are defined by EPD and specified in licence conditions for any new discharge within a WCZ.

# A3 DESCRIPTION OF THE ENVIRONMENT

## A3.1 HYDRODYNAMICS

### A3.1.1 Chung Hom Kok to Cheung Sha

The western part of the cable routing, from the landing at Cheung Sha to the area to the south of Cheung Chau, is in an area where tidal currents dominate. The tidal currents are generally low due to the sheltering effects of the various islands along the south Lantau coastline. The cable routing then passes into open waters to the south of Lamma Island, where the waters are strongly influenced by the oceanic current and subject to strong wave activity due to waves propagating from the open sea to the south. The oceanic current is characterised by currents which do not change direction with the tidal cycle and remain stable during both the wet and dry seasons. In the wet season, the currents flow in a north easterly direction, while in the dry season, the currents reverse, to flow in a south westerly direction. The routing crosses the East Lamma Channel to make landfall at Chung Hom Kok. Currents in the East Lamma Channel are strong, as the East Lamma Channel forms one of the main flow paths for waters into and out of the Western Harbour and reverse with the tide.

### A3.1.2 Chung Hom Kok to Sandy Bay

This section of the cable routing crosses the East Lamma Channel to the south and north of Lamma Island, and will be subject to the strong tidal currents in the channel, as discussed above. The cable segment passes to the south of Lamma Island, close to the routing from Tong Fuk to Sandy Bay, where the oceanic current dominates and where wave activity is likely to be strong. The segment to the west of Lamma Island will also be exposed to strong wave activity and is contained within the West Lamma Channel, where strong tidal currents occur.

## A3.2 WATER QUALITY

There are nine EPD routine water quality monitoring stations in the vicinity of the cable routes. The most up to date published water quality data for these stations, which was collected in 1998(1), are summarised in *Tables A3a* and *A3b.* The locations of the stations are shown in *Figure A1*.

(1) EPD (1999). Marine Water Quality in Hong Kong in 1998.

*Table A3a* ***EPD Routine Water Quality Monitoring Data for the Southern WCZ for Stations Along the Cable Routes***

| WQ Parameter | SM13 | SM18 | SM6 | SM7 | SM9 |
|---|---|---|---|---|---|
| Temperature | 23.3 | 23.4 | 23.4 | 23.7 | 23.8 |
| (°C) | (16.7 - 26.8) | (16.3 - 26.8) | (16.4 - 26.8) | (17.2 - 27.0) | (17.5 - 26.9) |
| Salinity | 31.0 | 32.2 | 31.9 | 31.1 | 30.7 |
| | (28.5 - 33.7) | (30.8 - 33.4) | (29.6 - 33.5) | (29.6 - 33.3) | (28.1 - 33.2) |
| DO | 6.1 | 5.8 | 5.9 | 5.9 | 5.6 |
| | (4.3 - 7.6) | (4.5 - 8.0) | (4.5 - 8.2) | (4.2 - 8.0) | (4.0 - 7.2) |
| DO Bottom | 5.8 | 5.6 | 5.3 | 5.5 | 5.3 |
| | (4.3 - 7.5) | (3.9 - 8.4) | (2.0 - 8.5) | (4.2 - 8.3) | (4.0 - 7.5) |
| $BOD_5$ | 0.8 | 0.5 | 0.6 | 0.5 | 0.6 |
| | (0.1 - 1.7) | (0.3 - 1.0) | (0.3 - 1.1) | (0.3 - 0.8) | (0.2 - 1.7) |
| SS | 6.9 | 4.1 | 3.8 | 5.0 | 6.1 |
| | (4.5 - 11.7) | (1.2 - 13.7) | (0.7 - 11.5) | (1.1 - 8.7) | (2.2 - 12.8) |
| TIN | 0.19 | 0.11 | 0.12 | 0.20 | 0.25 |
| | (0.11 - 0.32) | (0.02 - 0.19) | (0.03 - 0.24) | (0.15 - 0.29) | (0.18 - 0.33) |
| Unionised | 0.002 | 0.002 | 0.002 | 0.003 | 0.004 |
| Ammonia | (<0.001 - 0.006) | (<0.001 - 0.003) | (0.001 - 0.005) | (0.001 - 0.006) | (0.001 - 0.006) |
| Chlorophyll-*a* | 4.1 | 2.6 | 2.7 | 2.4 | 3.7 |
| (µg $L^{-1}$) | (0.9 - 13.7) | (1.5 - 5.3) | (1.0 - 5.9) | (1.3 - 5.6) | (1.1 - 12.7) |
| *E. coli* | 2 | 1 | 1 | 4 | 69 |
| (cfu $100mL^{-1}$) | (1- 10) | (1 - 2) | (1 - 3) | (1 - 48) | (2 - 4,400) |

**Notes:**

a) Except as specified, data presented are depth-averaged.
b) All units are mg $L^{-1}$, unless stated.
c) Data presented are annual arithmetic means except for *E. coli* which are geometric means.
d) Data enclosed in brackets indicate the range.
e) Shaded cells indicate non-compliance with the WQOs for either DO , TIN or Unionised Ammonia.

*Table A3b* ***EPD Routine Water Quality Monitoring Data for the Western Buffer and Southern WCZs for Stations Along the Cable Routes***

| WQ Parameter | WM2 | WM1 | SM16 | SM19 |
|---|---|---|---|---|
| Temperature (°C) | 23.1 | 23.0 | 23.0 | 23.0 |
| | (16.7 - 27.7) | (16.6 - 27.5) | (16.0 - 27.5) | (16.0 - 27.3) |
| Salinity | 31.1 | 31.7 | 32.3 | 32.5 |
| | 27.1 - 33.8) | (29.3 - 33.7) | (30.8 - 33.3) | (30.7 - 33.6) |
| DO | 5.8 | 5.9 | 5.9 | 6.1 |
| | (3.6 - 7.9) | (3.5 - 8.5) | (4.4 - 7.7) | (4.5 - 8.4) |
| DO Bottom | 5.4 | 5.5 | 5.5 | 5.7 |
| | (2.5 - 8.0) | (2.5 - 8.7) | (3.6 - 7.8) | (4.4 - 8.1) |
| $BOD_5$ | 0.9 | 0.7 | 0.7 | 0.6 |
| | (0.2 - 1.8) | (0.3 - 1.1) | (0.4 - 1.1) | (0.3 - 0.9) |
| SS | 5.7 | 4.0 | 2.0 | 2.7 |
| | (1.1 - 13.0) | (1.3 - 6.5) | (0.9 - 3.0) | (0.8 - 5.2) |
| TIN | 0.25 | 0.18 | 0.11 | 0.10 |
| | (0.13 - 0.39) | (0.08 - 0.30) | (0.05 - 0.17) | (0.05 - 0.18) |
| Unionised Ammonia | 0.004 | 0.002 | 0.002 | 0.002 |
| | (0.001 - 0.007) | (0.001 - 0.005) | (<0.001 - 0.004) | (0.001 - 0.003) |
| Chlorophyll-*a* (μg $L^{-1}$) | 3.4 | 3.0 | 2.7 | 2.9 |
| | (0.8 - 11.2) | (0.9 - 6.9) | (1.0 - 4.7) | (0.9 - 7.8) |
| *E. coli* (cfu $100mL^{-1}$) | 230 | 71 | 5 | 1 |
| | (32 - 1,900) | (14 - 240) | (1 - 36) | (1 - 1) |

**Notes:**
a) Except as specified, data presented are depth-averaged.
b) All units are mg $L^{-1}$, unless stated.
c) Data presented are annual arithmetic means except for *E. coli* which are geometric means.
d) Data enclosed in brackets indicate the range.
e) Shaded cells indicate non-compliance with the WQOs for either DO , TIN or Unionised Ammonia.

The data show compliance with the WQOs for dissolved oxygen, unionised ammonia and total inorganic nitrogen at the Southern WCZ stations (SM13, SM18, SM6, SM7, SM9, SM16 and SM19). The WQO for TIN was breached at Station SM16, but achieved at Station SM19, which was the only station to show compliance within the Southern WCZ. This low rate of compliance with the TIN WQO has been recorded for the last ten years. At Stations WM1 and WM2, in the Western Buffer WCZ, only the WQO for depth averaged DO was breached. In 1998 all of the Western Buffer WCZ stations breached this WQO, which was a deterioration from the previous year.

### *A3.3 SEDIMENT QUALITY*

The EPD routine sediment quality monitoring stations in the vicinity of the cable routes are also shown on *Figure A1*. Sediment quality data for these stations are available for 1997[(2)] and are summarised in *Tables A3c* and *A3d*.

(2) EPD (1998). Marine Water Quality for Hong Kong in 1997.

*Table A3c* ***EPD Routine Sediment Quality Monitoring Data in the Vicinity of the Cable Routes***

| Parameter | SS6 | SS3 | SS4 |
|---|---|---|---|
| COD | 9,000 (8,000 - 10,000) | 15,000 (11,000 - 18,000) | 15,000 (11,000 - 17,000) |
| TKN | 320 (190 - 480) | 360 (220 - 490) | 360 (210 - 530) |
| Cadmium | 0.2 (0.1 - 0.5) | 0.2 (0.1 - 0.5) | 0.3 (0.1 - 1.0) |
| Chromium | 21 (17 - 24) | 30 (20 - 36) | 36 (26 - 43) |
| Copper | 12 (10 - 16) | 27 (13 - 37) | 41 (28 - 55) |
| Mercury | 0.1 (<0.1 - 0.1) | 0.1 (0.1 - 0.2) | 0.2 (0.1 - 0.2) |
| Nickel | 13 (11 - 15) | 20 (15 - 22) | 21 (16 - 26) |
| Lead | 25 (22 - 28) | 38 (22 - 45) | 47 (38 - 69) |
| Zinc | 61 (49 - 67) | 89 (62 - 100) | 108 (81 - 130) |
| Arsenic | 6.9 (6.1 - 9.3) | 8.3 (6.7 - 9.8) | 10.1 (6.7 - 12.0) |
| PAHs (痢 $kg^{-1}$) | 61 (39 - 218) | 154 (40 - 421) | 104 (43 - 260) |
| PCBs (痢 $kg^{-1}$) | 5 (<5 - 5) | 8 (5 - 20) | 10 (5 - 40) |

**Notes:**
a) Data presented are arithmetic mean; ranges are enclosed in brackets.
b) Results are based on laboratory analysis of bulk samples, which are collected twice per year from each sampling location.
c) All determinands are reported on a mg $kg^{-1}$ dry weight basis, unless otherwise stated.
d) Shaded cells indicate exceedence of the LCEL.

*Table A3d* ***EPD Routine Sediment Quality Monitoring Data in the Vicinity of the Cable Routes***

| Parameter | WS2 | SS2 |
|---|---|---|
| COD | 14,000 (10,000 - 20,000) | 13,000 (9,200 - 15,000) |
| TKN | 460 (300 - 980) | 430 (250 - 700) |
| Cadmium | 0.2 (0.1 - 0.5) | 0.2 (0.1 - 0.5) |
| Chromium | 38 (32 - 46) | 34 (18 - 54) |
| Copper | 53 (27 - 110) | 25 (14 - 43) |
| Mercury | 0.2 (0.1 - 0.3) | 0.1 (0.1 - 0.2) |
| Nickel | 23 (21 - 25) | 21 (14 - 26) |
| Lead | 42 (32 - 52) | 42 (35 - 72) |
| Zinc | 108 (92 - 130) | 95 (72 - 110) |
| Arsenic | 9.8 (7.7 - 15.0) | 9.5 (7.9 - 12.0) |
| PAHs (痢 $kg^{-1}$) | 123 (39 - 622) | 63 (42 - 102) |
| PCBs (痢 $kg^{-1}$) | 8 (5 - 19) | 7 (5 - 21) |

**Notes:**
a) Data presented are arithmetic mean; ranges are enclosed in brackets.
b) Results are based on laboratory analysis of bulk samples, which are collected twice per year from each sampling location.
c) All determinants are reported on a mg $kg^{-1}$ dry weight basis, unless otherwise stated.
d) Shaded cells indicate exceedence of the LCEL.

The data show that there are exceedences of the Lower Chemical exceedence Level (LCEL) for copper and arsenic at Station WS2 and for PCB at Station SS4. There are no exceedences of the Upper Chemical Exceedence Level (UCEL), the level above which sediments are classed as being seriously contaminated.

### *A3.4 MARINE SENSITIVE RECEIVERS*

Sensitive receivers in the vicinity of the cable route and landing station have been identified under the broad designations of gazetted bathing beaches, areas of ecological interest and sea water intakes. The identified sensitive receivers in these three categories, shown on *Figure 4.1a* of the main text, are summarised as follows.

- **Gazetted Bathing Beaches:** The Gazetted Bathing Beaches in the vicinity of the cable routes are Tong Fuk, Cheung Sha Upper, Cheung Sha Lower, St Stephens and Chung Hom Kok. The closest Gazetted Bathing Beach to the cables is Cheung Sha Lower which is within 15 m of the cable landing site at Cheung Sha.

- **Sites of Ecological Importance:** Coral communities near the cable segments have been identified around the Sokos Islands (5.5 km), Lamma (over 3 km) and coral communities at Shek Kwu Chu (510 m). The south western coast of Lamma Island, which is designated as a SSSI, is 2.3 km from the cable routes.

- **Sea Water Intakes:** Sea water intakes near the cable segments are those for Queen Mary Hospital/Sha Wan Drive and Kennedy Town. The Queen Mary Hospital/Sha Wan Drive intake is the closest to the cables (525 m).

## *A4 IMPACT ASSESSMENT*

There will be no impacts to water quality from the operation of the proposed fibre optic submarine cable system. The potential for any adverse direct and indirect impacts to water quality from the construction of the submarine cable system have been assessed below.

### *A4.1 LAYING OF THE CABLE AT THE LANDING SITES*

*Chung Hom Kok*

The cables will be connected to the manhole sites by construction of an underground duct approximately 1 m deep. Both manholes will be on the main road. The two cables will be protected with articulated piping and sunk at least 1 m below the surface across the beach and out to sea for a distance of about 100 m.

*Chung Sha and Sandy Bay*

Both of these cable landing sites will be constructed in the same manner. The cables are to be protected with articulated piping and buried to at least 2 m for a distance of 100 m to the manholes. The cable section on the beaches will be

trenched manually or using a back hoe. The marine sections of the cable burial will be conducted utilizing divers with jet probes to bury the articulated piping into the sediment.

The potential for impacts to water quality during the trenching activities on land primarily relate to surface water run-off and the discharge of pumped water, both of which may be readily controlled through the measures discussed in *Section 4.4*.

## *A4.2 INSTALLATION OF THE MARINE SECTIONS OF THE CABLE*

Apart from a short distance at the approaches, the cable will be laid on the seabed using an injection jetter designed to bury submarine cables. In this method, the cable and injection tool are lowered to the seabed. The injection tool fluidises a trench using high pressure water jets and the cable is immediately laid within the trench. The sides of the trench slip around the cable, burying it and leaving a small depression in the seabed, which is infilled by natural sedimentation. The maximum width of the seabed fluidised by the injection jetter is 0.25 m and the cable is buried to a maximum depth of 9 m.

The cable laying process will result in the formation of a dense cloud of high suspended sediment concentrations around the injector, which will remain very close to the seabed. The sediments will settle rapidly, owing to their proximity to the seabed. An analysis of the potential transport of fine sediments suspended into the water column during the cable laying process has been carried out and is described in *Attachment A2.* The analysis has been undertaken for the part of the cable route which passes along the East Lamma Channel, where the tidal currents are highest (up to 0.9 m $s^{-1}$) and hence the sediment would be transported the greatest distances. The analysis has determined that the maximum distance of transport for the suspended sediments would be 104 m. The closest marine sensitive receivers that are considered sensitive to suspended solids concentrations are 510 m away (see *Section A3.4*), and will not be impacted by the cable installation work. Cheung Sha Bathing Beach (within 15 m of the cable landing site) may be impacted by suspended solids, reducing the clarity of the water in this area. However, visual impacts would only occur for 4 to 5 days during the nearshore cable landing works and are considered to be short term, which would thus not adversely affect the beneficial use of this sensitive receiver.

There are a number of projects within the Western Harbour area which will have works undertaken concurrently. These projects include reclamation construction at Penny偲 Bay, Container Terminal 9 and the extension to the Lamma Power Station, disposal of uncontaminated mud at the South Tsing Yi Marine Borrow Area (MBA) and the South Cheung Chau Disposal Area and sand dredging at the East Lamma Channel and South Tsing Yi MBAs. The sediment disturbed during cable laying will remain close to the seabed, as discussed above, and is predicted to remain in suspension for less than 3 minutes and settle onto the seabed within 104 m of the cable route and will

not impact marine receivers that are sensitive to suspended solids. Suspended sediment plumes from cable laying and the other concurrent projects are predicted to only occur in non-sensitive areas and would be for a very short duration, close to the seabed. It is thus concluded that there will not be adverse cumulative impacts from the cable laying works.

Along the majority of the cable route, the seabed sediments are classified as uncontaminated and have a low oxygen demand and nutrient content (see *Tables A3c* and *A3d*). The low levels of contamination in the sediment indicate that the effects of suspended sediments on water quality (ie dissolved oxygen levels, nutrient concentrations and the release of micro-pollutants) will be negligible. Along the portion of the cable route passing along the northern part of Lamma Island to the landing at Sandy Bay, routine EPD sediment quality monitoring data indicate that the seabed sediments have elevated levels of copper, arsenic and PCBs (see *Table A3c* for Station SS4 and *Table A3d* for Station WS2). The sediment disturbed during cable laying will remain in suspension for a very short period of time (calculated as less than 3 minutes in *Attachment A1*). Therefore, the potential release of contaminants to the receiving waters will be limited and would not cause adverse impacts on the water column and no unacceptable impacts to water quality would occur during installation of the cables.

### *A4.3 POST LAY PROTECTION OF THE CABLE SEGMENTS*

Articulated piping (diameter 100 mm) will be applied over a distance of 100 m from the manholes. This will ensure that the cable is sufficiently protected from storm and wave scour. The lay operations will be guided by divers and will not result in impacts to the marine environment.

## *A5 MITIGATION MEASURES*

No adverse impacts to water quality were predicted and, as such, mitigation measures will not be required.

## *A6 SUMMARY AND CONCLUSIONS*

The marine based construction activities relate to burying the cable below the existing seabed levels. The cable will be laid using injection jetting construction methods, which would only give rise to minimal, short term, elevations in suspended sediment concentrations, if any, in the immediate vicinity of the cable. No adverse impacts were found to occur to sensitive receivers from this activity.

No impacts were predicted to occur from land based activities.

## INJECTION JETTING

The cable laying in Hong Kong waters will be carried out using an underwater injection tool deployed from a lay barge. The injection tool uses utilizes water injector technology to fluidise the seabed sediments, which enables the cable to be safely and accurately inserted to the specified burial depth. Since there is no separation between the vessel and the burial tool (ie the cable is fed directly down to the injector from the cable vessel), residual tension is minimized, thereby providing safe and effective full-depth burial.

## INJECTION PROCEDURES

The injection tool is mounted on a barge and the cable is loaded directly into the injector and is lowered to the seafloor. Once the tool is on the seafloor, the water injectors are turned on and the barge moves ahead while the tool penetrates the sea floor, and buries the cable. Burial depth can be adjusted by raising or lowering the tool from the barge. The expected burial speed will be a maximum of 1 km $hour^{-1}$.

## WATER QUALITY SENSITIVE RECEIVERS

The distances between the cable route and the identified representative sensitive receivers are summarised in *Table 1*.

***Table 1 Closest Approach of the Proposed Cable Route to Sensitive Receivers***

| Marine Sensitive Receiver | Distance to Cable Route |
|---|---|
| Cheung Sha Upper Gazetted Beach | 15 m |
| Shek Kwu Chau Island Corals | 510 m |
| South Lamma SSSI | 2.3 km |
| Queen Mary Hospital / Sha Wan Drive Intake | 525 m |

During the cable laying process the seabed sediments will be initially disturbed and a small percentage will enter to suspension in the marine waters in the immediate vicinity of the injection tool. This small amount of suspended sediment will be advected away from the cable route by tidal currents. In order to demonstrate that suspended sediment will not impact the identified sensitive receivers, the following calculation has been carried out to determine the maximum potential transport for the sediments disturbed during the cable laying process and can be used to provide an estimate of the likely quantities of sediment entering suspension and the potential distance this sediment may be transported. The maximum depth of cable burial has been used.

The rate of sediment entering suspension may be calculated as follows :

| | | |
|---|---|---|
| Release Rate | = | cross section area of disturbed sediment x speed of cable laying machine x material density x percentage loss |

| | | |
|---|---|---|
| depth of disturbance | = | 9 m (maximum burial depth of cable) |
| width of disturbance | = | 0.25 m (width of seabed disturbance as cable buried) |
| maximum cross sectional area | = | 2.25 $m^2$ |
| loss rate | = | 10% (majority of sediment not disturbed) |
| speed of machine | = | 0.278 m $s^{-1}$ (1 km $hour^{-1}$) |
| in situ dry density | = | 600 kg $m^{-3}$ (typical of Hong Kong seabed sediment) |
| Release Rate | = | 37.53 kg $s^{-1}$ |

During cable laying, the seabed sediment will be released at the bottom of the water column which will result in high localised suspended sediment concentrations and high settling velocities. This is because at high concentrations suspended sediment will tend to form large aggregations of sediment particles, the process of flocculation, which have a higher settling velocity than the individual sediment particles.

It is expected that the suspended sediments will remain within 1 m of the seabed, which is independent of the water depth. Although the current speeds at the seabed are lower than those near the water surface, due to such effects as bottom friction, it is assumed that the current speed is 0.9 m $s^{-1}$, which is an upper bound estimate of surface current speeds in the vicinity of the cable route. It is assumed that the sediment will initially spread to a maximum of 6 m along the centre-line of the cable route, which represents the longitudinal dimension of the injection tool, and that the worst case is a cross-current carrying the sediment towards the sensitive receivers.

Based on the above, and given the worst case scenario that the sediment mixes evenly over the lower 2 m of the water column and over the initial length of spread of the sediment, the initial concentration of the suspended sediment is as follows:

| | | |
|---|---|---|
| Initial Concentration | = | release rate / (current speed x height of sediment x width of sediment) |

Where:

| | | |
|---|---|---|
| loss rate | = | 37.53 kg $s^{-1}$ |
| current speed | = | 0.9 m $s^{-1}$ |
| height of sediment | = | 2 m |
| width of sediment | = | 6 m |
| | | |
| Initial Concentration | = | 3.48 kg $m^{-3}$ |

The settling velocity has been calculated by the following relationship which was derived during the WAHMO studies and successfully applied to a number of assessments in order to determine the behaviour of sediment disturbed during dredging works in Hong Kong, which are similar to the sediment disturbance during the cable laying process.

Settling Velocity = $0.01\ C^1$ (where C is the suspended sediment concentration)

= $0.0348\ m\ s^{-1} = 34.8\ mm\ s^{-1}$

However, as the sediment settles onto the seabed, concentrations will gradually reduce. In order to account for this reduced concentration the above settling velocity is halved, which gives a value of 17.4 mm $s^{-1}$.

The time taken for the sediment to settle onto the seabed will thus be the maximum height of the sediment divided by the average settling velocity.

Settling Time = 2/0.0174 = 115s

The distance travelled by the sediment will thus be the time multiplied by the current speed.

Distance Travelled = 115 x 0.9 = 104 m

The above calculation indicates that the sediments disturbed during laying of the cable will settle onto the seabed within 104 m of the cable route. The closest approach of the cable route to the sensitive receivers is more than 500 m from the closest cable segment. Therefore, suspended sediments from the cable laying are not expected to adversely impact the identified water quality and marine ecology sensitive receivers.

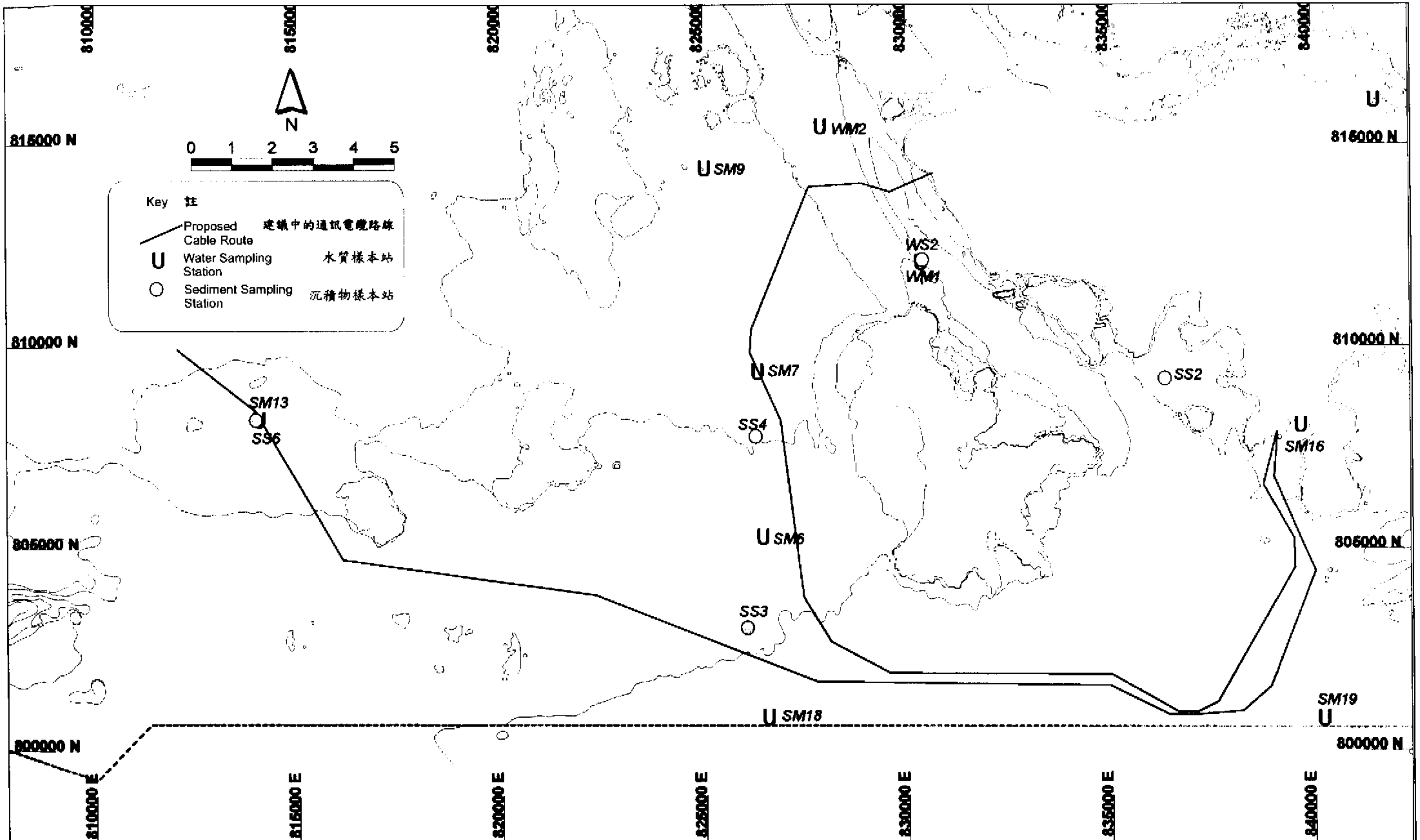


FIGURE A1
附件圖 A1

WATER AND SEDIMENT SAMPLING STATIONS
水質及沉積物樣本站

Environmental Resources Management

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FILE: C2115i
DATE: 30/11/00

# B1 INTRODUCTION

This *Annex* presents the marine ecological resources within and adjacent to the waters around the proposed cable routes and evaluates the potential for direct and indirect adverse impacts to these resources.

# B2 RELEVANT LEGISLATION AND ASSESSMENT CRITERIA

The criteria for evaluating marine ecological impacts are laid out in the *EIAO TM*. *Annex 16* of the *EIAO TM* sets out the general approach and methodology for the assessment of marine ecological impacts arising from a project or proposal, to allow a complete and objective identification, prediction and evaluation. *Annex 8* of the *EIAO TM* recommend the criteria that can be used for evaluating such impacts.

Other legislation which applies to marine ecology includes: *The Wild Animals Protection Ordinance (Cap. 170) 1980*, which protects all cetaceans.

# B3 DESCRIPTION OF THE ENVIRONMENT

## B3.1 SUBTIDAL SOFT BOTTOM ASSEMBLAGES

Information on the soft bottom marine benthic assemblages is available from published literature of studies undertaken in the vicinity of the cable routes. Although published literature does not provide information on the entire length of each route, the literature provide details on benthic assemblages around Stanley, South Lamma, South Cheung Chau, and Western Harbour. A discussion of the findings of these studies is presented below.

Recent studies have been conducted in Tai Tam Bay within the vicinity of the proposed cable landing site at Chung Hom Kok [(1)]. These surveys found that the mean biomass of infaunal organisms near Sheung Sze Mun was 16.6 g $m^{-2}$, which is low in comparison to the mean for Hong Kong, which is reported as 35.2 g $m^{-2}$ [(2)]. No species that are considered to be rare were identified in the review.

(1) ERM - Hong Kong, Ltd (2000) Performance Verification of Stanley and Shek O Outfalls: *Results of Benthic Ecology Monitoring*. For the Environmental Protection Department, Hong Kong Government.

(2) Shin PKS and Thompson GB (1982) Spatial Distribution of the Infaunal Benthos of Hong Kong. Marine Ecology Progress Series. 10: 37-47.

As part of the Hong Kong wide *Seabed Ecology Studies*, grab sampling and Sediment Profile Imagery (SPI) technology were employed to investigate the soft bottom assemblages in and around South Lamma and South Cheung Chau [(3)]. These surveys found that the mean biomass of infaunal organisms was similar to a previously reported mean for Hong Kong waters, with South Lamma waters reporting a mean biomass of 30.6 g $m^{-2}$ and South Cheung Chau reporting a mean biomass of or 47.2 g $m^{-2}$ (Hong Kong mean 35.2 g $m^{-2}$) [(4)]. It was reported that the high mean biomass at South Cheung Chau could be as a result of a recruitment pulse in the area, as high numbers of individuals were recorded. No species that are considered to be rare were identified in the review.

In terms of the benthos along the proposed cable route to Sandy Bay, studies during 1991 - 1992 using a 0.05 $m^2$ Van Veen grab at four stations were undertaken within the proposed area for the Lantau Port & Western Harbour Development study [(5)]. Polychaetes were the most abundant group of organisms found at the study site, comprising 83% of the total species recorded. Similarly, two sites were surveyed using grab samples in the Sulphur Channel, between Green Island and Kennedy Town, during December 1993 [(6)]. Ninety-two macrobenthic organisms belonging to 32 taxa were recorded and the most abundant group were the polychaetes (69% by number), while the remainder of taxa were composed of molluscs and crustaceans. In both studies, no species of conservation importance were identified.

Based on the above, the subtidal soft bottom communities in the vicinity of the proposed cable routes can be considered as being of low to medium ecological value in comparison to other areas of Hong Kong. Although recent studies have found that the benthos south of Cheung Chau contained a higher number of individuals than the Hong Kong mean, it was concluded that this was potentially as a result of a recruitment pulse prior to sampling.

## *B3.2 SUBTIDAL HARD BOTTOM ASSEMBLAGES*

As no information was available on potential coral communities in the vicinity of the proposed cable landing site at Chung Hom Kok, dive surveys were conducted. The methodology for the dive survey, along with the results are presented in the following Sections.

### *B3.2.1 Dive Survey Methodology*

In the vicinity of the proposed cable landing site five locations were surveyed covering mainly rocky habitat but also some gravel and boulder areas. Each

(3) ERM - Hong Kong, Ltd (1998) Seabed Ecology Studies: Composite Report. For the Civil Engineering Department, Hong Kong Government.

(4) Shin PKS and Thompson GB (1982) *Op cit.*

(5) APH Consultants (1992) Lantau Port & Western Harbour Development Studies, Environmental Survey Data Report, for Civil Engineering Department, Port Development Office.

(6) Binnie Consultants Limited (1994) South Cheung Chau & Sulphur Channel Seabed Ecology Pilot Survey by Grab Sample. Report to Civil Engineering Department.

location was surveyed using the Rapid Ecological Assessment as adapted from Le Vantier *et al.* (1998) (7) .

At each of the locations along the cable alignment five 100 m transects were surveyed. Information was recorded by observers, experienced in the field identification of sessile benthic taxa, swimming down-current at each location using scuba gear. Start points of transects were determined with a portable Global Positioning System (GPS) unit and were selected at random prior to survey work. A 100 m transect was laid out and video footage taken of the benthos along the transect followed by an assessment of the benthic cover and taxon abundance in a swathe ~ 4 m wide, 2 m either side of each transect. At the completion of each transect, five ecological and seven substratum attributes were assigned to one of six standard ranked (ordinal) categories. An inventory of benthic taxa was compiled during each dive (ie each transect). Taxa were identified *in situ* to the following levels:

- Scleractinian (hard) corals to species wherever possible.
- Soft corals, anemones and conspicuous macroalgae were recorded according to morphological features and to genus level if possible.
- Other benthos (including sponges, zooanthids, ascidians and bryozoans) were recorded to genus level wherever possible but more typically to phylum plus growth form.

At the end of each dive, each taxon in the inventory was ranked in terms of abundance in the community. Broad categories rank taxa in terms of relative abundance of individuals, rather than the contribution to benthic cover along each transect. The ranks are subjective assessments of abundance, rather than quantitative counts of each taxon. Photographs of representative coral species located in the surveyed areas were taken. At each of the five transects, video footage was recorded. Each set of video footage from each transect was copied from Hi-8 to VHS after editing.

### *B3.2.2 Results*

#### *B3.2.2.1 Site Description*

The survey was performed on the 23 October 2000. The weather was clear with good sunshine and the sea was calm. The visibility was, however, poor, generally at 0.5 – 2.5 m as the survey followed several days of strong wind and rain.

Transect locations were marked using GPS and the coordinates are provided in *Table B3.2a* for future reference. All coordinates presented use the Hong Kong 1963 reference.

(7) Le Vantier LM, De'ath G, Done TJ and Turak E (1998) Ecological assessment of a complex natural system: a case study from the Great Barrier Reef. Ecological Applications 8: 480-96.

*Table B3.2a GPS Coordinates for the Dive Surveys at the Chung Hom Kok New T&T Landing Site*

| Transect | Latitude | Longitude | Direction |
|---|---|---|---|
| 1 | 22′ 12″ 846 | 114′ 11″ 981 | Mag. 100 deg. |
| 2 | 22′ 12″ 820 | 114′ 11″ 967 | Mag. 110 deg. |
| 3 | 22′ 12″ 818 | 114′ 12″ 002 | Mag. 100 deg. |
| 4 | 22′ 12″ 839 | 114′ 12″ 077 | Mag. 110 deg. |
| 5 | 22′ 12″ 800 | 114′ 12″ 141 | Mag. 75 deg. |

*B3.2.2.2 Descriptions of Transects Including Notes on Marine Life of Interest*

Transects were labelled 1 to 5 from west to east along the Chung Hom Kok shore line (*Figure B1*). A brief description of each transect is presented in *Table B3.2b*).

*Table BB3.2b Descriptions of Transects Including Notes on Marine Life of Interest*

| Transect | Average Depth | Description |
|---|---|---|
| 1 | 4.6 m | The seabed consists of patches of small and medium sized boulders, interspersed with areas of sand and rubble. There were a few gorgonians, including sea-fans. |
| 2 | 5.2 m | The seabed was uniformly sand with a thick layer of fine silt. Some gorgonians were present. |
| 3 | 8.4 m | The benthos was primarily sand with some boulders, bedrock and rubble scattered throughout. Gorgonians were abundant on this transect in comparison to the others surveyed. |
| 4 | 4.2 m | The seabed was mostly sand with some rubble, hard substrate and associated gorgonians and soft corals (*Dendronephthya* spp). |
| 5 | 8.5 m | This transect was different to the others surveyed as the transect started on top of a series of large boulders at a depth of 6 m, many of which exceeded 3 m across and 2 m in height. The soft corals, scleractian hard corals and *Tubastrea* cup corals were almost all found on the flat, upper surfaces of these boulders which gave way to sand and rubble after about 30 m along the transect (from the west). The transect finished at 11 m depth. |

*B3.2.2.3 Survey Records*

The abundance of benthic organisms (non-hard coral) varied along the transects (*Table B3.2c*). The majority of benthic organisms observed were simple gorgonians, although whilst these were observed on all transects these organisms were considered to be generally uncommon.

Hard corals were present on only one of the five transects, whereas, soft corals were observed on all transects, however, with a percentage cover that varied between only 1 and 10%. No macroalgae were recorded (*Table B3.2c*).

*Table B3.2c* ***Ordinal Ranking of Benthic Organisms and Ecological Attributes of the Survey Transects***

| **Ecological Attribute** | **1** | **2** | **3** | **4** | **5** |
|---|---|---|---|---|---|
| *Benthic Organisms* [a] | | | | | |
| Simple Gorgonians | 2 | 2 | 3 | 2 | 2 |
| Sea fans | 1 | | | | 1 |
| Leather corals | | | | | |
| Sea whips | | | | | |
| *Dendronephthya* spp | | | | 2 | 2 |
| Tubastrea Cup Corals | | | | | 1 |
| Sponges | 1 | | 1 | 1 | 1 |
| Zoanthids | | | | | |
| Ascidians | | | | | |
| Bryozoans | 2 | | | 1 | |
| | | | | | |
| *Ecological attributes* [b] | | | | | |
| Hard coral | | | | | 1 |
| Dead standing coral | | | | | |
| Soft coral | 1 | 1 | 1 | 1 | 1 |
| Sea anemone beds | | | | | |
| Macro-algae | | | | | |

a Note: 1 = Rare, 2 = Uncommon, 3 = Common, 4 = Abundant, 5 = Dominant.
b Note: 1 = 1-10% Cover, 2 = 11-30% Cover, 3 = 31-50% Cover, 4 = 51-75% Cover, 5 = 76-100% Cover.

A total of 4 species of hard corals were recorded along the transects, however, all of these corals were recorded on Transect 5. These were *Montipora venosa* (Family Acroporidea), *Cyphastrea* sp (Family Faviidae), *Stylocoeniella guentheri* (Family Astrocoeniidae) and *Coscinarea columna* (Family Siderastreidae). Each of these coral communities were categorised by the subjective assessment of abundance to be rare on the transect.

The seabed substrate types varied between the five transects surveyed as part of the assessment. The majority of the transects had primarily a sand, or sand and gravel seabed composition, particularly Transect 2 which was almost 100% sand. Transect 3 recorded the most diverse substratum (*Table B3.2d*).

*Table B3.2d* ***Seabed Attributes Along the Survey Transects***

| **Substratum attributes** [a] | **1** | **2** | **3** | **4** | **5** |
|---|---|---|---|---|---|
| Hard substrate | 1 | | 2 | 1 | 2 |
| Continuous Pavement | | | | | |
| Bedrock/boulders/sand | 2 | | 1 | | 2 |
| Rubble | 1 | | 2 | 1 | 1 |
| Cobbles | | | | | |
| Sand, sand and gravel | 4 | 5 | 3 | 5 | 3 |
| Depth Average (m) | 4.6 | 5.2 | 8.4 | 4.2 | 8.5 |

a Note: 1 = 1-10% Cover, 2 = 11-30% Cover, 3 = 31-50% Cover, 4 = 51-75% Cover, 5 = 76-100% Cover.

In summary, the subtidal hard surface habitat was considered to be generally barren with regard to hard corals. The results were typical for southern Hong Kong Island, where conditions are commonly found to be less than optimal

for hard coral growth. Soft corals and gorgonians were recorded in relative abundance at a number of transects, particularly in the undisturbed and sheltered areas of sand within the depth range of 5 to 10 mPD. However, these species are not generally considered to be of high ecological value. As hard corals were only found on one transect and were considered to be rare on the transect, the hard coral communities in the vicinity of the proposed cable routes are considered to be of low ecological value. As a result, the coral communities identified during the dive survey are not considered to be of ecological importance.

*Cheung Sha*

Recent dive surveys at Tong Fuk indicated that few organisms of ecological interest are present in the area as only two individual colonies of gorgonian sea whips were observed during the survey [8] . Although the presence of these gorgonian sea whips is of ecological interest, they are common in Hong Kong waters and are not considered to be rare. No other species of conservation interest were recorded. Based on this, the subtidal hard surface communities within proximity to the proposed Cheung Sha landing site are considered to be of low ecological value.

A recent survey was also conducted on the subtidal hard surface habitats at Shek Kwu Chau, which is in the vicinity of the proposed cable route into Cheung Sha Upper beach [9]. The results of this Remotely Operated Vehicle (ROV) survey found that the subtidal hard surface habitat were of medium ecological value in comparison to other areas in Hong Kong. Corals were generally recorded in low numbers and low densities. The exception to this was the moderately high numbers of the hard coral, *Tubastrea* sp, recorded on two of the transects surveyed. As this species is common throughout the majority of Hong Kong's southern and eastern waters, the presence of this species does not appear to merit a high ecological value ranking, therefore, the subtidal hard surface assemblages of Shek Kwu Chau were considered to be of medium ecological value.

*Sandy Bay*

Extensive dive surveys were conducted between October 1991 and November 1994 in Hong Kong waters [10]. The results from the dive surveys conducted at Telegraph Bay and along the East Lamma Channel showed that the area contained rich soft coral and sea fan assemblages. Sea urchins, sea cucumbers, gastropods, barnacles, sponges and sea whips were also common. The subtidal communities of two survey sites in Telegraph Bay and one site near Fok Yeuk Chau (Magazine Island) were less diverse and were assigned a

(8) ERM - Hong Kong, Ltd (2000) Telecommunication Installation at Lot 591SA in DD 328, Tong Fuk, South Lantau Coast and the Associated Cable Landing Work in Tong Fuk, South Lantau for the North Asia Cable (NAC) Fibre Optic Submarine Cable System. For Level (3) Communications Limited.

(9) ERM - Hong Kong, Ltd (1999) Sludge Treatment and Disposal Strategy. Final Report. For the Environmental Protection Department.

(10) Binnie Consultants Limited (1995b) Marine Ecology of Hong Kong, Report on Underwater Dive Surveys Vol I. Fo the Civil Engineering Department, Hong Kong Government.

low conservation value based on the low abundance of corals and other macro-invertebrates. All three stations were found to have a mixture of boulder habitats and a soft mud bottom.

In February 1997, a qualitative survey of the hard-bottom communities was conducted on the northern side of Kau Yi Chau (11). The northern side of the island was composed of a gentle sloping shore with a seabed of boulders. At -2 mPD, at least 2-5 cm depth of fine sediment covered most of the substrate. Isolated colonies of hard corals, prominent cover of filamentous algae and low abundance of sea anemones and gastropods were recorded. At a depth of -4 mPD, no hard corals existed, however, sea whips and sea urchins were observed. On the eastern and southeastern sides of the island, similar communities to the northern side were recorded, but these showed a lower abundance of hard corals.

Recent surveys involving Remotely Operated Vehicle (ROV) were undertaken along transects located around Green Island, Little Green Island and the Sulphur Channel. Soft corals were recorded only at transects around Little Green Island and Green Island, with no sign of soft corals found at the western end of Hong Kong Island. Four species of soft coral and gorgonians including the Pink Soft Coral, Orange Sea Fan, White Sea Whip and Purple Sea Whip were recorded in the surveys.

Although studies have shown that there are subtidal hard surface communities that are of ecological interest in the waters of the proposed cable route into Sandy Bay, these communities are not in close proximity to the route itself. Assemblages that have been identified close to the route appear to be of low diversity and abundance and, therefore, are considered to be of low ecological value.

## *B3.3 INTERTIDAL HARD SURFACE AND SOFT SHORE ASSEMBLAGES*

### *B3.3.1 Chung Hom Kok*

As with the subtidal hard surface assemblages, little information was available on the potential intertidal hard surface and soft shore assemblages near the proposed cable landing point. An intertidal shore survey was, therefore, undertaken at and near the proposed cable landing site to collect baseline ecological information on the habitat. The methodology and results of this survey are presented in the following sections.

(11) Binnie Consultants Limited (1997) Coastal Ecology Studies. Kau Yi Chau Qualitative survey. Final Report. For the Civil Engineering Department, Hong Kong Government.

### *B3.3.1.1 Methodology*

**Quantitative Rocky Shore Surveys**

The rocky shores at Chung Hom Kok located near the proposed cable landing point were surveyed using a quantitative belt transect method. A total of three sites were chosen for field surveys (*Figure B2*). At each site, horizontal (belt) transects were set up along the shore line and surveyed at three heights up the shore at 50 cm intervals perpendicular to the waterline starting at 1 m above Chart Datum. On each transect, 5 quadrats (50 x 50 cm) were placed randomly to assess the abundance and distribution of flora and fauna. All animals found in each quadrat were identified and recorded to species level so that density $m^{-2}$ can be determined. Sessile animals such as barnacles and oysters in each quadrat were not counted but estimated as a percentage of coverage on the rock surface. All species of algae (encrusting, foliose and filamentous) were also identified and recorded by estimating the percentage of cover of the rock surface.

**Quantitative Sandy Shore Survey**

At the sandy shore site, three line transects were deployed from the low tide mark up to the high tide mark and the number of mobile organisms was recorded. At five locations chosen at random along each of the transects, a core was taken (50 cm x 50 cm x 15 cm) and all organisms within the core were identified and their numbers recorded.

### ***B3.3.2 Results***

The results from field surveys indicated that the coastline at and near the proposed cable landing point is composed of natural hard rocky/boulder shores and natural soft sandy/pebble beaches. *Figure B2* illustrates the type of intertidal shores found at and near the proposed landing site.

*Exposed Rocky Shore (Site R1)*

The habitat is a natural, exposed rocky shore located to the east of the proposed cable landing site (*Figure B2*). The shore appeared to have been subject to little or no human disturbance. Comparatively high densities of limpets (61.6 $m^{-2}$), chitons (33.1 $m^{-2}$) and barnacles (21.1%) were recorded on the shore (*Table B3.3a*). Moderate abundances of snails (26.7 $m^{-2}$) were recorded on the shore (*Table B3.3a*). Bivalves were also observed with a percentage cover value of 2.4%. A percentage cover value of 3.6% was obtained for macroalgae. No species of conservation importance were recorded. The assemblages recorded were typical of exposed rocky shores in Hong Kong.

*Table B3.3a* ***Intertidal Assemblages Recorded for the Natural Exposed Rocky Shore (Site R1)***

| Species Group | Abundance |
|---|---|
| Limpets | 61.6 $m^{-2}$ |
| Snails | 26.7 $m^{-2}$ |
| Bivalves | 2.4% |
| Barnacles | 21.1% |
| Macroalgae | 3.6% |

*Exposed Rocky Shore (Site R2)*

The habitat is a natural exposed rocky shore located to the east of the proposed cable landing site (*Figure B2*). There is an existing manhole located to the north of the shore. The shore appeared relatively free of human disturbance, such as pollution. The intertidal assemblages recorded on this rocky shore were mainly composed of snails (44.3 $m^{-2}$), limpets (37.9 $m^{-2}$) and barnacles (16.4%) (*Table B3.3b*). Chitons and bivalves were also recorded but occurred in much lower abundance, ie 3.7 $m^{-2}$ and 3.0% cover, respectively. A percentage cover value of 2.8% was obtained for macroalgae. No species of conservation importance were recorded. The assemblages recorded were typical of other exposed rocky shores in Hong Kong.

*Table B3.3b* ***Intertidal Assemblages Recorded for the Natural Exposed Rocky Shore (Site R2)***

| Species Group | Abundance |
|---|---|
| Limpets | 37.9 $m^{-2}$ |
| Snails | 44.5 $m^{-2}$ |
| Bivalves | 3.0% |
| Barnacles | 16.4% |
| Macroalgae | 2.8% |

*Natural Sandy/Pebble Shore (Site S1)*

The habitat is a natural, semi-exposed sandy/pebble shore located at the proposed cable landing site (*Figure B2*). The habitat surveyed appeared to have been subject to little or no human disturbance. The substratum of the shore was mainly composed of small to medium-sized pebbles in the high and low-shore regions with find sand observed on the mid and low shore. The beach is almost devoid of life and no macrofauna were identified in any of the core samples surveyed.

**Summary**

In summary, the intertidal hard surface assemblages located in close proximity to the proposed cable landing point at Chung Hom Kok were found to be typical of semi-exposed or exposed intertidal assemblages in Hong Kong. No species of conservation interest or that are regarded as rare were recorded. As a result, the intertidal hard surface assemblages were considered to be of medium ecological value.

In terms of the sandy shore survey, the habitat appeared to be a natural, semi-exposed sandy/pebble shore which had been subject to little or no human disturbance. The substratum of the shore was mainly composed of small to medium-sized pebbles in the high and low-shore regions with find sand observed on the mid and low shore. The beach is almost devoid of life and no macrofaunal species were identified in any of the core samples surveyed. Based on these findings, the ecological importance of this sandy shore was considered to be low.

### *B3.3.3 Cheung Sha*

The coastline in the vicinity of the proposed cable landing site at Cheung Sha is mainly composed of natural sandy beaches and boulder/rocky shores. The sand flat at Shui Hau (approximately 2 km west to the Cheung Sha landing site) is known to be a breeding/nursery habitat for the locally threatened horseshoe crabs [(12)].

The results obtained from recent field surveys conducted at Tong Fuk indicated that the intertidal assemblages recorded on the boulder/rocky shores were mainly composed of snails, bivalves, limpets and barnacles. These communities were found to be typical of semi-exposed intertidal assemblages in Hong Kong. No species of conservation importance have been recorded on these intertidal hard shores. Due to the abundance of organisms recorded and the generally undisturbed nature of the natural boulder/rocky shores, the assemblage was considered to be of medium ecological value.

Recent field surveys conducted on the intertidal sandy/pebble shore habitats at Tong Fuk have shown that the assemblages recorded on were mainly composed of snails, bivalves and barnacles. No species of conservation interest were recorded. The abundance of assemblages recorded was generally low in comparison to other sites in Hong Kong, and can generally be considered as typical of a semi-exposed sandy/pebble shore. These sandy/pebble shore is mainly covered with hard pebbles which are considered unsuitable for the locally endangered horseshoe crabs to breed as, in general, horseshoe crabs prefer undisturbed, sheltered sandy beaches or protected sandy-mud/mud flats to breed [(13)]. Based on these findings, the ecological importance of these sandy/pebble shores was considered to be low.

A recent survey was also conducted on the intertidal hard surface habitats at Shek Kwu Chau, which is in the vicinity of the proposed cable route into the Cheung Sha Upper beach [(14)]. The coastline was in general steep and primarily composed of rocky habitats. No soft shore habitats were found on the island. The survey found that the intertidal assemblages have a low

(12) Chiu HMC and Morton B (1999) The Biology, Distribution, and Status of Horseshoe Crabs, *Tachypleus tridentatus* and *Carcinoscorpius rotundicauda* (Arthropoda: Chelicerata) in Hong Kong: Recommendations for Conservation and Management. Final Report to China, Light and Power.

(13) Chiu HMC and Morton B (1999) Op cit

(14) ERM - Hong Kong, Ltd (1999) Sludge Treatment and Disposal Strategy. Final Report. For the Environmental Protection Department.

number of species and a low percentage cover. No species that are considered as rare were identified and no assemblages of particular ecological value were observed. However, the coastline at Shek Kwu Chau remains largely undisturbed, therefore, the assemblages that are present are representative of relatively undisturbed habitats on exposed shorelines in Hong Kong, the intertidal hard surface assemblages can, therefore, be considered as of medium to low ecological value.

### *B3.3.4 Sandy Bay*

The northwestern shores of Hong Kong Island comprise steep and narrow stretches of rocky outcrops, with intermittent areas of coarse sand, stones and boulders. Past baseline surveys of the natural northwestern hard shores of Hong Kong Island have shown that the intertidal community was typical of an exposed shore, supported assemblages of periwinkles (*Nodilittorina trochoides* and *N. radiata*), limpets (*Patelloida saccharina*), chitons (*Acanthopleura japonica*) and stalked barnacles (*Capitulum mitella*) [15] [16]. Encrusting algae were common in the low intertidal zone.

Artificial seawalls including commercial harbours and ferry piers comprise a large length of shoreline near the proposed cable landing site in Sandy Bay. Fouling organisms are documented as common on artificial sea walls, wharf piles and other marine structures [17]. Various species of algae, coelenterates, ascidians, polyzoans, sponges, crustaceans, molluscs and polychaetes are commonly observed on these artificial structures.

As little information was available on the intertidal shore assemblages in the vicinity of the proposed cable landing point in Sandy Bay, an intertidal shore survey was conducted at and near the proposed landing site to collect baseline information on the habitat. The methodology used for surveying intertidal habitats at Chung Hom Kok (see *Section B3.3.1.1 - Methodology*) was employed to survey the intertidal shores in Sandy Bay. The results of this survey are presented in the following section.

### *B3.3.5 Results*

The results from field surveys indicated that the coastline at and near the proposed cable landing point is mainly composed of artificial seawalls and a natural sandy/pebble beach. *Figure B3* illustrates the type of intertidal shores observed at and near the proposed landing site.

(15) Scott Wilson Kirkpatrick Consulting Engineering (1995) Green Island Reclamation (Part)-Public Dump. Environmental and Traffic Impact Assessment, Final Report Vol I Environmental Impact Assessment, for Civil Engineering Department.

(16) Pypun/Parsons Brinckerhoff Joint Venture (1998) Infrastructural Works for Housing Development at Telegraph Bay, Engineering Feasibility Study. Draft Environmental Impact Assessment Report for territory Development Department, October 1998.

(17) Morton B Morton J (1983) Op cit.

*Semi-exposed Sandy/Pebble Shore (Site S2)*

The habitat is a natural, but disturbed, semi-exposed sandy/pebble shore located at the proposed landing cable landing site. There was a drainage channel located in the middle of the beach with waters running through the channel into the sea. The backshore area of the beach south to the drainage channel lined with an artificial boulder/concrete seawall (*Figure B3*). A small jetty was seen located near the northern edge of the beach. A roadsign indicating presence of underwater cable was seen on the backshore north to the drainage channel.

The substratum of the beach near the drainage channel was mainly composed of coarse to fine sand in the mid and high-shore regions with small to medium-sized pebbles scattered over the area. Pebbles of small to medium sizes were seen fringing the low shore region. The northern and southern edges of the beach were covered by pebbles and rocks of various sizes.

The intertidal assemblages recorded on this natural, but disturbed, sandy/pebble shore were mainly composed of snails (11.2 $m^{-2}$) and limpets (0.8 $m^{-2}$) (*Table B3.3c*). Bivalves and barnacles were also recorded but occurred in low abundances with percentage values of 0.03% and 0.02%, respectively. No species of conservation importance were recorded. The abundance of assemblages recorded is in general low and is typical to other semi-exposed sandy/pebble shores in Hong Kong. As the sandy/pebble shore was found to support comparatively low diversity and abundance of macrofaunal organisms and has been disturbed by urban development, the ecological importance of the shore was considered to be low.

***Table B3.3c*** ***Intertidal Assemblages Recorded for the Natural Sandy/Pebble Shore (Site S2)***

| Species Group | Abundance |
|---|---|
| Limpets | 0.8 $m^{-2}$ |
| Snails | 11.2 $m^{-2}$ |
| Bivalves | 0.03 % |
| Barnacles | 0.02 % |

## *B3.4 MARINE MAMMALS*

The Indo-Pacific Hump-backed Dolphin (*Sousa chinensis*) and the Finless Porpoise (*Neophocaena phocaenoides*) are the only species of marine mammal regularly sighted in Hong Kong waters. The population of *Sousa chinensis* is reported to be centred around the Pearl River Estuary and the waters of Hong Kong are thought to represent the eastern portion of this marine mammals range [(18)]. The eastern waters of Hong Kong do not appear to be an important habitat for *Sousa chinensis* as no sightings, during the extensive surveys conducted since early 1996, have been made for this species east of Lamma Island.

(18) Jefferson TA (1998) Population Biology of the Indo-Pacific Hump-backed Dolphin (*Sousa chinensis* Osbeck, 1765) in Hong Kong Waters. Final Report. For the Agriculture, Fisheries and Conservation Department.

The Finless Porpoise, *Neophocaena phocaenoides*, is the most common and most important species of cetacean in the southern waters. The most important habitat for this species of cetacean appear to be the waters off the Lamma Island, however, the use of these waters appears to vary on both a temporal and spatial basis. Preliminary abundance estimates indicate that the porpoise population around Lamma Island is largest during the spring (47 individuals) and lowest during the summer months (2 individuals). In the waters around Po Toi Island the population is estimated to be 52 individuals in the spring and 12 in the summer, suggesting that the cetacean moves eastwards during the summer and autumn months [(19)].

The section of the proposed cable alignment near Chung Hom Kok appears to be north or west of areas where the Finless Porpoise has been observed [(20) (21)]. Although one of the proposed cable routes passes through waters within the vicinity of the Po Toi Islands, the routing does not pass through areas where the porpoise has been recorded in greatest abundance. As the waters of the proposed cable alignment are situated north of areas where sightings have been made for either of the Indo-Pacific Hump-backed Dolphin (*Sousa chinensis*) or the Finless Porpoise (*Neophocaena phocaenoides*) these waters are unlikely to be critical habitats for these species.

The south Lantau waters which the proposed cable routing passes through appear to be utilised by *Sousa chinensis* [(22)]. This species was observed in these waters most commonly during the summer and autumn months, with the western part of the south Lantau waters near the Sokos Islands and Fan Lau used more heavily than the eastern area, near Cheung Chau. However during a two and a half year survey, conducted between September 1995 and March 1998, less than twenty sightings of *Sousa chinensis* were recorded in these waters [(23)]. The findings from this study could not verify the exact use of these waters with respect to the life cycle of these marine mammals, ie breeding, calving or feeding, as it appears that dolphins engage in a full range of activities in each of areas surveyed throughout the waters of Hong Kong. It is unlikely that the south Lantau waters which the proposed cable passes through are critical habitats for either marine mammal species given the low number of sightings and the fact that the waters are busy shipping lanes that are used frequently by high speed ferries.

In terms of the cable route to Sandy Bay, marine mammal surveys conducted in southern and eastern waters of Hong Kong have shown that Finless Porpoises are encountered in these waters [(24)]. Finless Porpoises have been sighted to the north of Lamma Island, although the majority of sightings have been recorded in the nearshore waters off the southwestern coast of Lamma

(19) ERM - Hong Kong, Ltd (1999c) Environmental Impact Assessment for an 1,800 MW Gas Fired Power Station at Lamma Extension. For The Hongkong Electric, Co. Ltd.

(20) ERM - Hong Kong, Ltd (1999c) *Op cit.*

(21) Reeves RR, Wang J Y and Leatherwood S (1997) The Finless Porpoise, *Neophocaena phocaenoides* (G Cuvier 1829): A summery of current knowledge and recommendations for conservation action. Asian Marine Biology 14: 111 - 143.

(22) Jefferson TA (1998) *Op cit.*

(23) Jefferson TA (1998) *Op cit.*

(24) ERM-HK Ltd (1999c) *Op cit.*

Island (mainly observed during the spring season). The section of the proposed cable alignment near Sandy Bay appears to be west of the areas where the highest number of Finless Porpoise sightings have been observed.

## *B4 IMPACT ASSESSMENT*

### *B4.1 CONSTRUCTION PHASE*

#### *B4.1.1 Direct Impacts*

No long term direct impacts are expected to occur due to the laying of the cables. Short term impacts will arise to the soft bottom benthic assemblages present along the cable route. As discussed in *Annex A* the cable will be laid using the injection jetting method which will only result in a minor, localised disturbance to the seabed. Once the cable laying operations have ceased, the sediments will be rapidly recolonised by similar benthic fauna and consequently direct impacts to these assemblages are not regarded as severe.

#### *B4.1.2 Indirect Impacts*

Indirect impacts may occur through seabed disturbance, resulting in increases in suspended solids in the water column. Such elevated suspended sediment levels can cause smothering of filter feeders such as corals and bivalves and potentially clog gill filaments in other organisms. Another potential indirect impact involves reduction in dissolved oxygen concentrations caused by elevated levels of suspended sediment. An increase in solids in the water column will potentially result in a reduction in sunlight penetration, decreased rate of photosynthesis of phytoplankton (primary productivity) and thus a lower rate of oxygen production in the water column.

As discussed in *Annex A*, the proposed injection jetting method for cable deployment will result in the formation of a localised cloud of high suspended sediment concentrations around the plough. As these suspended sediments are predicted to remain close to the seabed, the sediments are expected to settle rapidly back onto the seabed leaving little trace of disruption. Due to the small scale, short term and localised nature of the impacts, no unacceptable adverse impacts to marine ecological resources are predicted to occur.

### *B4.2 OPERATION PHASE*

No impacts to ecological resources are predicted to occur during the operation of the cables. The cables are unlikely to be damaged as they will be buried at a depth of approximately 1 m to 9 m beneath the surface of the seabed.

### *B4.3 IMPACT EVALUATION*

An evaluation of the impact in accordance with the *EIAO TM Annex 8 Table 1* is presented below.

- *Habitat Quality*: Short term impacts are predicted to occur to subtidal soft-bottom habitats and intertidal soft shore assemblages.

- *Species*: The organisms of ecological interest recorded in the vicinity of the proposed cable alignment are hard corals, the Finless Porpoise and the Indo-Pacific Hump-backed dolphin. However, as impacts to water quality are not predicted to be severe and will be localised, impacts to these organisms are not predicted to occur.

- *Size:* The total length of the Chung Hom Kok to Cheung Sha cable is approximately 37 km, whereas, the Chung Hom Kok to Sandy Bay cable is approximately 32 km in length. Both cables will be laid using the injection jetting technique.

- *Duration*: The duration of time required for the cable laying would be 30 days.

- *Reversibility*: Impacts to the assemblages inhabiting the soft bottom assemblages along the cable alignment are expected to be short term and recolonisation of the sediments is expected to occur once the cable is laid.

- *Magnitude*: No adverse impacts to ecologically important or sensitive habitats are predicted to occur. The magnitude of impacts during cable laying is likely to be of low severity and acceptable, given that the disturbances are short term and localised.

## *B5 MITIGATION MEASURES*

No adverse impacts are expected to occur to marine ecological resources. Therefore, no mitigation measures have been recommended.

## *B6 SUMMARY AND CONCLUSIONS*

A review of existing information on the marine ecological resources surrounding the cable routing has identified the area as supporting benthic fauna which can be considered as of low to medium ecological value in comparison to other areas of Hong Kong. Although these soft bottom assemblages will be disturbed during the cable laying works, rapid reinstatement of the seabed will result in the area being available for prompt

recolonisation, and hence, no permanent impacts are likely to occur.

No coral communities of ecological importance have been identified along the cable routes or in the vicinity of the cable landing site. Coral assemblages of ecological importance have been identified within 510 m from the proposed cable routes. The coral communities are considered to be at a sufficient distance from the alignment of the cables to indicate that impacts will not occur. Similarly, based on intertidal surveys undertaken at the landing sites no unacceptable impacts to intertidal rocky shore or sandy shore habitats are predicted to occur.

Both the Finless Porpoise and the Indo-Pacific Hump-backed Dolphin have been sighted in the waters of the proposed cable routes. Although sightings have occurred, recent studies on the ecology of these marine mammals indicate that the waters that the proposed cable routes pass through are not considered to be critical habitats. Based on this, and the predicted localised and very short term impacts to water quality, no impacts are predicted to occur to marine mammals.

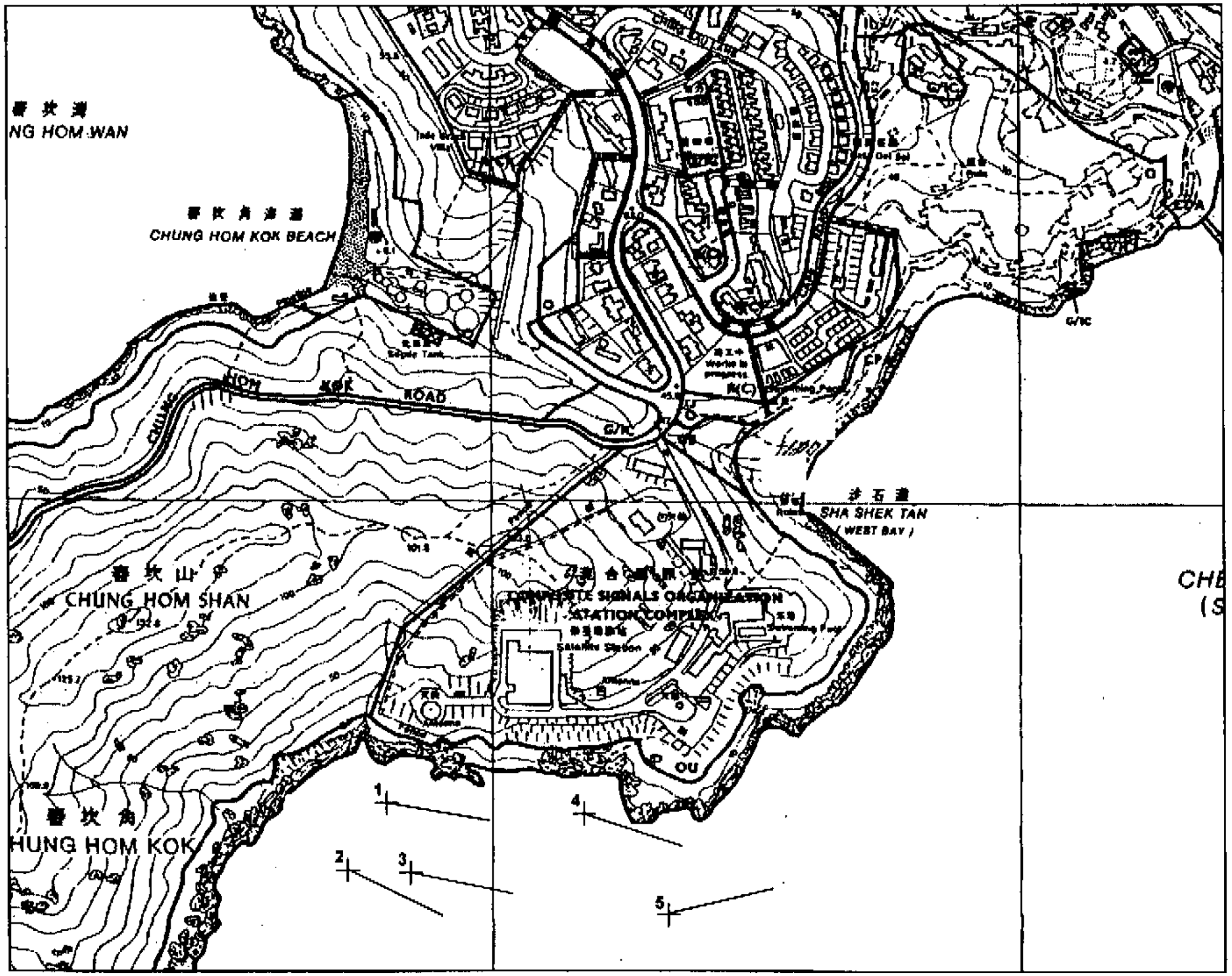


FIGURE B1
圖B1

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SUBTIDAL DIVE SURVEY TRANSECTS AT CHUNG HOM KOK
在舂坎角進行潮下滑水勘察的橫切線地點

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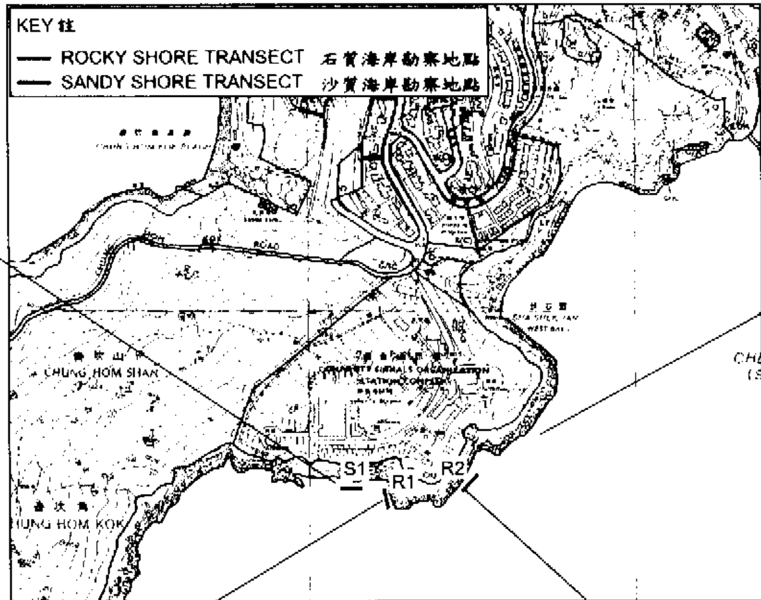
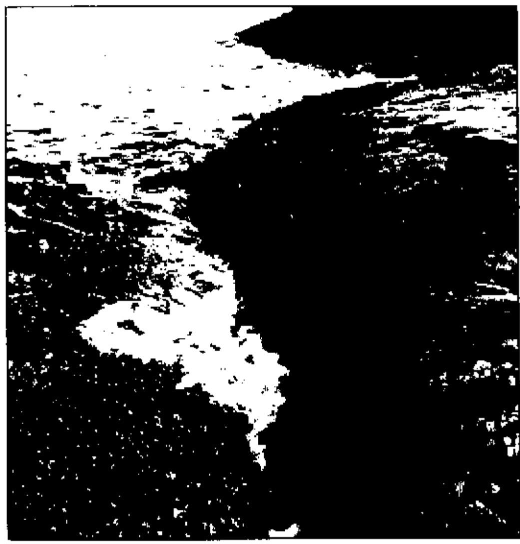
SANDY / PEBBLE BEACH - THE PROPOSED CABLE LANDING SITE
沙/卵石灘 — 建議中的通訊電纜登岸地點




STEEP EXPOSED ROCKY SHORE
陡峭暴露石質海岸



EXPOSED ROCK SHORE SELECTED FOR INTERTIDAL FIELD SURVEY 暴露石質海岸選作潮間實地勘察

EXPOSED ROCK SHORE SELECTED FOR INTERTIDAL FIELD SURVEY
暴露石質海岸選作潮間實地勘察

FIGURE B2
圖 B2

INTERTIDAL HABITATS IN THE VICINITY OF THE PROPOSED NEW T&T DOMESTIC CABLE LANDING SITE AT CHUNG HOM KOK
建議中的新電訊本地通訊電纜舂坎角登岸地點附近的潮間生境

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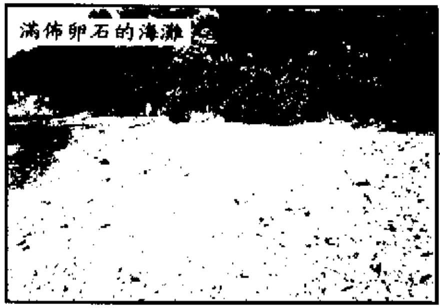
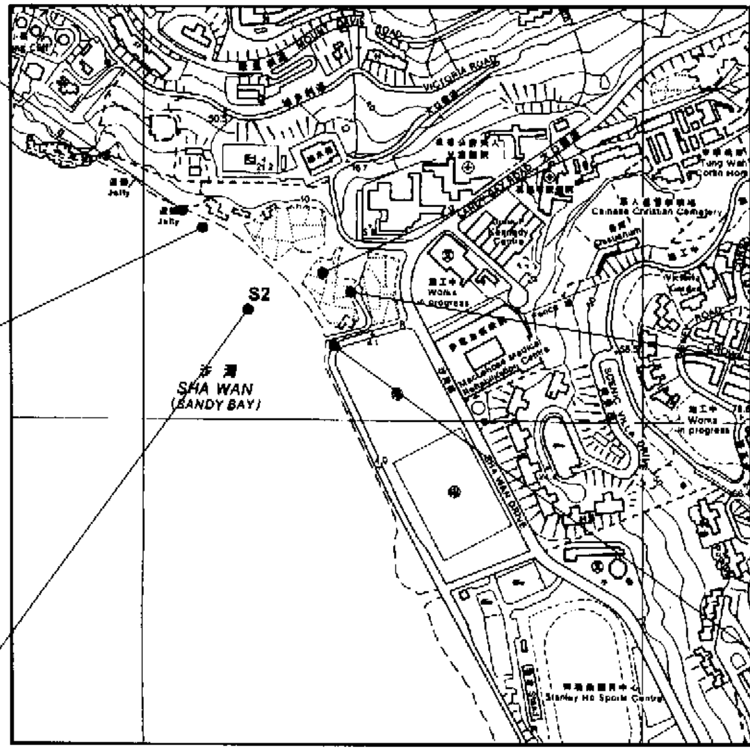
A small jetty located near the northern edge of the beach

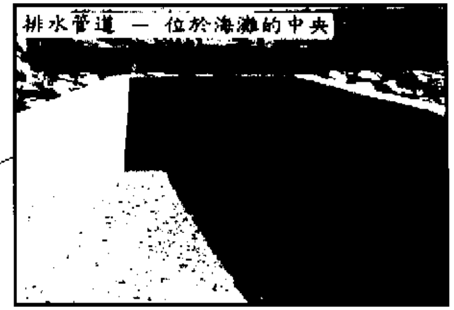


Beach surface covered with pebbles

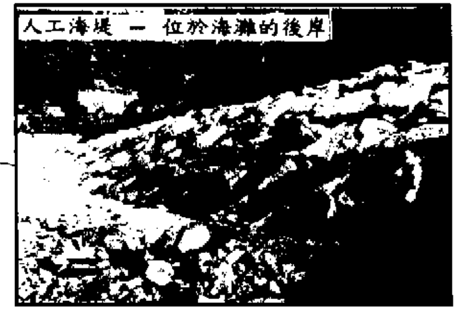
Sandy/Pebble beach at Sha Wan



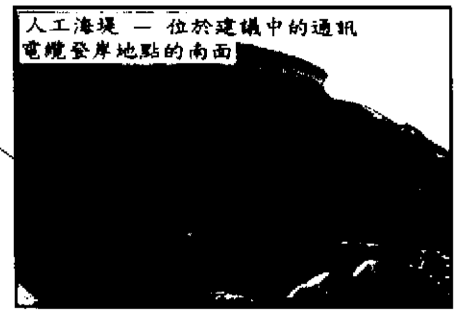
**S2** - Sandy Shore Transect 沙質海岸勘察地點



Drainage Channel - located in the middle of the beach



Artificial seawall on the backshore of the beach



Artificial Seawall - located south to the proposed cable landing site

FIGURE B3
圖 B3

INTERTIDAL HABITATS AT THE PROPOSED NEW T&T CABLE LANDING SITE AT SHA WAN
建議中的新電訊本地通訊電纜沙灣登岸地點的潮間生境

FILE: C2115j
DATE: 01/12/00

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