*CONTENTS*

*ANNEX A* ***C2C Cable System - Assessment of Potential Impacts to Water Quality***

*ANNEX B* ***C2C Cable System - Assessment of Potential Impacts to Marine Ecological Resources***

*ANNEX C* ***C2C Cable System - Assessment of Potential Impacts for Fishing Operations and Fisheries Resources***

# 1 BASIC INFORMATION

## 1.1 PROJECT TITLE

C2C Cable Network - Hong Kong Section (Chung Hom Kok)

## 1.2 PURPOSE AND NATURE OF THE PROJECT

GB21 (Hong Kong) Limited (GB21) proposes to install an international submarine fibre-optic telecommunications cable system (C2C) that will enter the southern and eastern waters of the Hong Kong Special Administrative Region (HKSAR), land at Sha Shek Tan Beach in Stanley Bay and ultimately connect to a Landing Station at the Chung Hom Kok Cable Station (CHKCS). The C2C Cable Network comprises a 17,000 kilometre long submarine cable linking Japan, South Korea, Taiwan, Hong Kong, Philippines, Singapore, potentially Mainland China, Indonesia and Malaysia. It will provide broadband facilities to Internet Service Providers and other carriers ultimately enhancing the HKSAR's capability as a communications and service centre in Asia. C2C has started the implementation of its cable network in other areas and is expected to begin carrying commercial traffic by the third quarter of 2001.

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 cable owner, GB21 and the System Provider, TyCom (USA) Submarine Systems on the expected construction activities. Once installed, the cable will not result in any impact to the environment during its operation.

A Licence (Licence No. 025) has been issued by the Office of the Telecommunications Authority (OFTA) to GB21 for External Fixed Telecommunications Network System (EFTNS) on 20 October 2000. The CHKCS site has been specifically allocated by OFTA for the purpose of housing EFTNS who have invested directly in bringing new physical cables to Hong Kong. The submarine cable system is of great strategic importance to both GB21 and to the telecommunications network infrastructure of Hong Kong.

## 1.3 NAME OF PROJECT PROPONENT

Company: GB21 (Hong Kong) Limited
Phone: 2877 1500
Address: Suite 6708 Central Plaza
18 Harbour Road
HONG KONG

## 1.4 LOCATION AND SCALE OF PROJECT

### 1.4.1 Location

The location of the C2C Cable System and landing site are depicted in *Figure 1.4a*. Two of the three proposed cables would enter the HKSAR via the eastern waters and traverse westward between Cape d'Aguilar and the Po Toi Island group, pass the Stanley Bluff Peninsula and then travel north into Stanley Bay to a landing site on Sha Shek Tan Beach. The third cable is proposed to enter Hong Kong waters to the south of Po Toi Island on a north-westerly course and also land at Sha Shek Tan Beach.

### 1.4.2 Conditions of the Area

There are several existing submarine cables situated along the proposed C2C cable routes, from its entrance into the HKSAR through the eastern and southern waters. The seabed in the general vicinity of the proposed C2C cables to the south of the Tathong Channel has been generally disturbed from previous uses as designated Marine Borrow and Fill Areas. Similarly, the seabed in the vicinity of Tai Tam Bay, Stanley Bay and surrounding the Po Toi Islands group is also relatively disturbed, as these waters are actively fished by vessels employing trawl gear. To the west and south of the Po Toi Islands group there is currently an area gazetted for sand dredging and mud disposal, as well as an allocated Marine Borrow Area.

The proposed landing site is situated on the Sha Shek Tan Beach, to the northeast of the CHKCS. Sha Shek Tan Beach lies on the northwest of Stanley Bay and is surrounded by waters frequently used for recreational water sports. The waters directly offshore are used by the local fishing community to moor sampans and other artisan fishing vessels when not in use. There are several other submarine cables that cross the waters directly outside of the entrance of Stanley Bay.

### 1.4.3 Scale of Project

The Project involves the laying of three international submarine fibre-optic telecommunications cables in HKSAR waters to a single landing site and manhole location on Sha Shek Tan Beach in Stanley Bay. The Project will ultimately connect with a landing station to be constructed at the CHKCS (at RBL 11540 which is owned by the Project Proponent.

The cable laying process will only result in minor, localised, works within the marine environment which will not affect water quality or the marine ecology of the area. Only small scale construction works are required at the Sha Shek Tan Beach cable landing site to enable the cable to enter the manhole system.

## 1.5 *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*;
*(vi) bathing beach;* and
*(vii) Site of Special Scientific Interest.*

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

Environmental Resources Management (ERM) has been appointed by the Project Proponent to undertake the environmental permitting for this Project.

All queries regarding the Project can be addressed to:

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.

- *Shore Based Work* - A beach manhole will be constructed on Sha Shek Tan Beach with an internal size of 4 m (L) x 2 m (W) x 2.5 m (H). The manhole will be a reinforced concrete box structure with lead-in ducts from the seabed and will have out-going ducts that will lead up the hill slope to the cable landing station. The construction of the manhole and associated shore based work will be undertaken primarily using manual labour, rather than mechanical equipment. The manhole will be constructed out of reinforced concrete and, along with any other required shore based work, will take between 1 to 2 months.

- *Preparation of the Landing Site* - These activities will include site preparation, beach access and perimeter establishment. Excavation of trenches between the beach manhole and the low low water (LLW) mark with a minimum trench depth of 1 m will be undertaken. Upon completion of the civil

works, the working area will be backfilled and reinstated to its original condition. No materials will be dredged as part of the construction works and all excavated materials will be balanced on site.

- *Landing the C2C Cables* - Each cable segment (cable size will be approximately 49 mm in diameter) will be laid ashore by a floated shore-end operation from a construction barge. The construction barge will hold position as close as safely possible to the beach manhole (BMH) but within 1 km of the shore. The cable end will be hauled ashore and anchored off. The construction barge will then commence lay operations.

- *Cable Laying to HKSAR Boundary* - After completion of the landing and anchoring of the cable, the main lay vessel will commence cable laying while simultaneously burying the cable. The deep burial operation (between 3 and 5 m below the seabed) will be conducted using injection jetting technology. Deep burial operations will be performed to the HKSAR boundary. The "injector" will bury the cable in a narrow trench (0.25 m in width) to the required depth of at least 3 m below the seabed. It should be noted that no materials will be physically dredged as part of the cable installation processes, rather, displaced sediments will backfill naturally in the trench. Further, injection jetting share design is such that it will leave the seabed virtually undisturbed following installation of the cable (see *Figure 2.1a*).

- *Post Lay Protection at Landing Site* - Articulated piping (diameter 100 mm) is expected to be required for the onshore cable segments from the BMH to the LLW mark. Additional articulated piping may or may not be required in the inshore areas to protect the cable from debris/anchor damage. The post lay operations will be guided by divers and will not result in environmental impacts to the marine environment.

At this stage of the Project, all nearshore and onshore construction works are expected to be undertaken during normal working hours. If evening or night time works are required, the appropriate construction noise permits will be applied for at that time.

## 2.2 *PROJECT PROGRAMME*

The C2C Submarine Cable System is scheduled to be landed and installed at the site by mid 2001. The expected construction schedule within Hong Kong waters is as follows:

- Landing Site 5 days
- Cable Landing 6 days
- Cable Installation 30 days
- Post Lay Protection 5 days
- Civil Construction (including manhole construction - shore based work) 30-60 days

# 3 MAJOR ELEMENTS OF THE SURROUNDING ENVIRONMENT

The locations of the various major elements of the area surrounding the site are shown in *Figure 3.0a*.

## 3.1 LAND & SEA ACTIVITIES

In regard to sea based activities in the area, there are several marine based sites within the vicinity of the C2C cable system that have been designated as Marine Borrow and Fill Areas.

The waters in the vicinity of Tai Tam Bay, Stanley Bay and surrounding the Po Toi Island group are actively fished and the area supports a number of water-based recreational activities.

The site faces the East Lamma Channel, one of the busiest approaches to the Victoria Harbour and commonly used by cargo and container vessels.

## 3.2 SITES OF SPECIAL SCIENTIFIC INTEREST

The closest Site of Special Scientific Interest (SSSI) is the Cape d'Aguilar SSSI, situated more than 450 m from the closest C2C cable segment, and the Tai Tam Reservoir Catchment Area SSSI, situated more than 940 m from the closest C2C cable segment.

## 3.3 SITES OF CULTURAL HERITAGE

The closest heritage site to the cable system is the Chung Hom Wan Archaeological Site, located more than 550 m to the north west of the cable segments, land points and station.

## 3.4 GAZETTED BATHING BEACHES

The closest Gazetted Bathing Beaches are at St Stephen's in Stanley Bay, situated about 370 m from the closest segments of the proposed cables, and Chung Hom Kok Beach, which is situated about 550 m from the closest segments of the proposed cables.

### 3.5 *MARINE PARK OR MARINE RESERVES*

The Cape d'Aguilar Marine Reserve is 450 m from the closest proposed cable segment.

### 3.6 *FISH CULTURE ZONE*

The Po Toi Fish Culture Zone (FCZ), the closest FCZ to the Project, is situated more than 2.9 km from the closest cable segment.

### 3.7 *PROTECTION AND CONSERVATION AREAS*

The proposed cable landing point and manhole location on Sha Shek Tan Beach lies in an area currently gazetted (*Hong Kong Planning Area No. 19 - Stanley Outline Zoning Plan No. S/H19/5*) as a Coastal Protection Area (CPA).

### 3.8 *SEAWATER INTAKE POINTS*

There are no known Water Services Department (WSD) intakes within the vicinity of the proposed cable routes.

## 4 *POSSIBLE IMPACTS ON THE ENVIRONMENT*

### 4.1 *SUMMARY OF POTENTIAL ENVIRONMENTAL IMPACTS*

The construction impacts associated with the 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 | ✓ |

| Potential Impact | |
|---|---|
| • 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

## *4.2 DUST*

The only dust generating activities that will occur at the Project Site are the shore based works undertaken at the landing point. These construction works will be small in scale and no significant dust impacts will result from these works.

## *4.3 NOISE*

During the cable laying process, only minimal noise will be generated from the barge and cable laying equipment. The noise level would be similar to that of existing marine traffic in the area and will not impact Noise Sensitive Receivers. No direct or indirect adverse noise impacts will result from this Project.

Some noise will be generated during the shore based works at the cable landing point. However, the construction will be largely undertaken by manual labour and only a small portion of the work will require light duty construction equipment which is expected to be operated during normal daytime working hours. Therefore, no adverse noise impacts would result from the 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 relates to surface water run-off. However the following measures will be incorporated during 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 undertaken during the cable landing and construction of the shore based work 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 handle 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 seabed. The cables will be buried between 3 to 5 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 seabed sediments, which enables the injection tool to penetrate the seabed 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 $hour^{-1}$.

The cable laying will result in the formation of high suspended sediment concentrations around the injection tool, which will remain close to the seabed and settle out quickly. However, as the sediment disturbed during cable laying will remain in suspension for a very short period of time, 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 (see *Annex A*).

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 seabed in less than 3 minutes. The maximum distance of transport for the suspended sediments would be 83 m. No long term disruption of bottom sediment will occur and no disruptions to hydrodynamics will result from this Project. Therefore, 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 site, 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 on site. Therefore, no adverse waste impacts (either direct or indirect) will be generated from the cable installation works and the associated construction of the shore based facilities.

### *4.6 LANDSCAPE AND VISUAL*

Since the submarine cables are buried in the seabed, no visual obstruction or inconvenience to the public is expected to occur. All shore based works will be minor and will not result in visual impacts to sensitive receivers.

### *4.7 CULTURAL AND HERITAGE*

The closest cultural heritage site is the Chung Hom Wan Archaeology Site located at Chung Hom Kok Beach; situated 550 m from the closest cable segment. As a result, no impacts to terrestrial archaeological resources will result from this Project.

### *4.8 TERRESTRIAL ECOLOGY*

The cable landing site is situated on a beach which holds 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 is considered to be of low to medium ecological value, relative 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.

Coral communities identified during the dive survey in the proximity of the landing site are not considered to be of ecological importance. Furthermore, as impacts to water quality are predicted to be minimal (as described in *Section 4.4*) and the closest coral communities considered to be of high ecological value are 390 m from the cables (see *Annex B*), they are considered to be located at a sufficient distance from the alignment of the cables that impacts will not occur.

Similarly, no unacceptable impacts to intertidal rocky shore or sandy shore habitats are predicted to occur.

### *4.10 FISHERIES*

The proposed cable routes pass through 12 of the 189 AFCD Fishing Zones. Of the Fishing Zones, 11 are actively fished by the Hong Kong fishing fleet (*Annex C*). The majority of catches reported by fishermen operating in these waters are low value bottom dwelling crustaceans or small fast growing pelagic species of low commercial value.

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 very short duration. No specific mitigation measures have been recommended as no impacts to fisheries resources or fishing operations have been identified.

## *4.11 OTHERS*

**Gaseous Emissions**: As mostly hand operated equipment and manual labour will be used during the shore based work, only a small amount of gaseous emissions ($SO_2$ and $NO_x$) from diesel-powered equipment would be generated during construction at Sha Shek Tan Beach. 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 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 shore based work will be performed within the inshore area during normal working hours. If night-time operations are proposed at a later date, permission will be sought from the EPD for an evening or nigh-time construction noise permit.

**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 are envisioned to occur as a result of this Project.

**Disposal of Spoil or Contaminated Material:** There will be no dredging or 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 laying of the submarine cable system in Hong Kong waters is expected to take about 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 no known projects that have been approved for construction that would be undertaken concurrently with the construction of the C2C cable system. Therefore, no cumulative impacts are predicted to occur.

## 5.3 FURTHER IMPLICATIONS

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

The methods used for burying the C2C submarine cable network, as described in *Section 2.1*, have been used around the world for more than one century, including within the HKSAR waters, 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 are being/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 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 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*. 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 for this Project.


FIGURE 1.4a
圖1.4a

File:c2129_topo apr/layout4
Date: 28/11/2000

C2C Cable Alignment
C2C通訊電纜路線

Environmental Resources Management
ERM

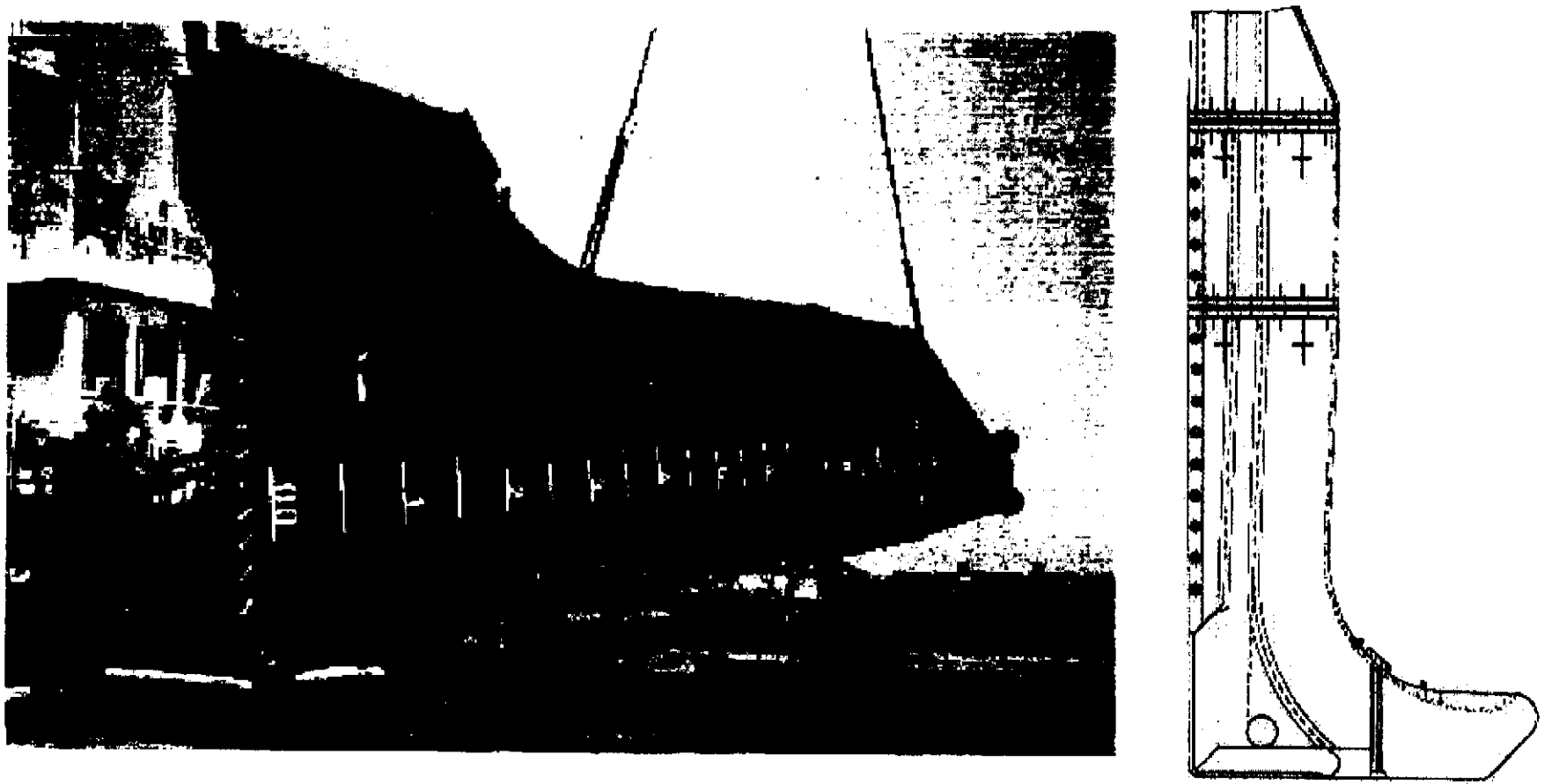


FIGURE 2.1A
圖 2.1a

DIAGRAM OF CABLE DEEP BURIAL INJECTOR
電纜深層埋藏注射器概念圖

FILE: C2129I
DATE: 04/12/00

Environmental
Resources
Management

ERM

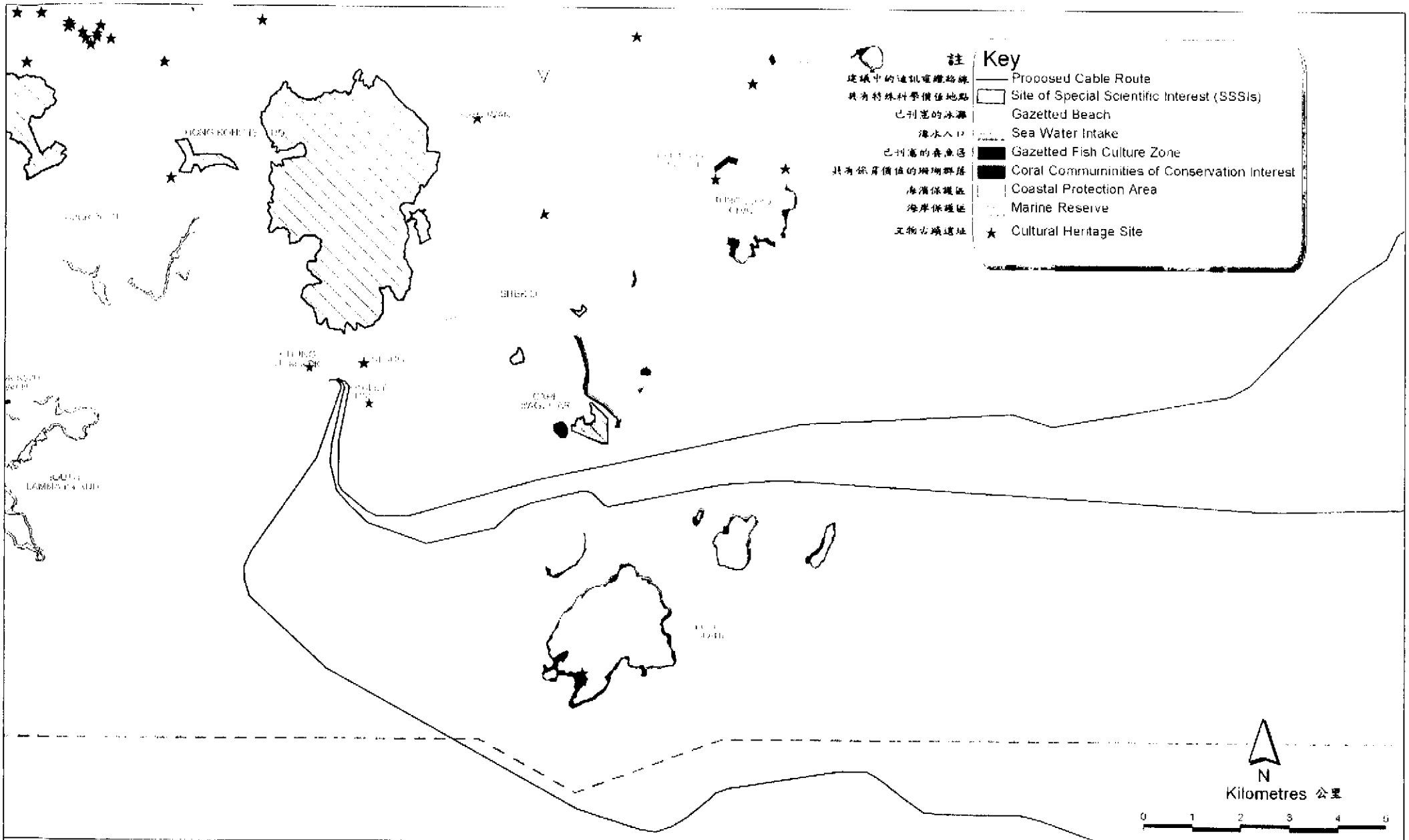



FIGURE 3.0a

ENVIRONMENTAL SENSITIVE RECEIVERS FOR THE PROPOSED NEW C2C CABLE SYSTEM

建議中的C2C通訊電纜系統的環境敏感地點

FILE: C2115m
DATE: 05/12/00

Environmental Resources Management

ERM

## *A1 INTRODUCTION*

This *Annex* presents an assessment of potential water quality impacts associated with the construction of the Hong Kong section of the proposed C2C fibre-optic submarine telecommunications cable system. Once installed, the cable would not result in any environmental impacts during operation.

## *A2 RELEVANT LEGISLATION AND ASSESSMENT CRITERIA*

The following pieces of legislation are applicable to the evaluation of water quality impacts associated with the construction and operation 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 Mirs Bay WCZs. The WQOs for the WCZs are applicable as evaluation criteria for assessing the compliance of any discharges during the construction and operation phases of the proposed fibre-optic submarine cable system.

All discharges during the construction phase of the proposed fibre-optic submarine cable 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*

The proposed cable routes pass through three distinct areas in terms of the hydrodynamic conditions. The landward portion of the cable is contained within Stanley Bay, which is sheltered from significant tidal currents, but may experience moderate wave activity due to the propagation of waves from the open sea to the south. The cable routes then split, with two segments passing along the Sheung Sze Mun to the east and one segment passing to the south, to the west of Po Toi. Currents in the Sheung Sze Mun are influenced by both offshore oceanic currents and tidal effects. The segment to the south is exposed to the offshore oceanic current.

The two segments to the east pass into open waters to the north of Waglan Island, where the oceanic current dominates. The oceanic current is characterised by currents which do not vary in direction with the tidal cycle and remain stable during each of 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 offshore areas of the cable routes will be subject to wave activity, which may become severe at times during typhoons in the wet season and when the north east monsoon winds are active in the dry season.

## *A3.2 WATER QUALITY*

There are five 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 were collected in 1998[1], are summarised in *Table A3a.* 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 and Mirs Bay WCZ for Stations Along the Cable Routes*

| WQ Parameter | SM16 | SM19 | MM8 | MM13 | MM14 |
|---|---|---|---|---|---|
| Temp (°C) | 23.0 | 23.0 | 22.1 | 22.6 | 22.4 |
| | (16.0 - 27.5) | (16.0 - 27.3) | (17.8 - 25.3) | (17.8 - 25.7) | (17.8 - 26.1) |
| Salinity | 32.3 | 32.5 | 32.5 | 32.8 | 32.8 |
| | (30.8 - 33.3) | (30.7 - 33.6) | (30.9 - 32.3) | (31.1 - 34.1) | (31.1 - 33.7) |
| DO | 5.9 | 6.1 | 6.3 | 6.4 | 6.4 |
| | (4.4 - 7.7) | (4.5 - 8.4) | (4.8 - 7.6) | (4.6 - 8.3) | (4.7 - 8.2) |
| DO Bottom | 5.5 | 5.7 | 6.0 | 5.9 | 6.1 |
| | (3.6 - 7.8) | (4.4 - 8.1) | (4.7 - 7.5) | (3.7 - 8.3) | (4.4 - 8.2) |
| $BOD_5$ | 0.7 | 0.6 | 0.6 | 0.4 | 0.5 |
| | (0.4 - 1.1) | (0.3 - 0.9) | (0.2 - 1.4) | (0.1 - 0.9) | (0.2 - 0.9) |
| SS | 2.0 | 2.7 | 1.7 | 1.2 | 1.4 |
| | (0.9 - 3.0) | (0.8 - 5.2) | (0.5 - 4.1) | (0.5 - 2.1) | (0.5 - 2.3) |
| TIN | 0.11 | 0.10 | 0.08 | 0.08 | 0.08 |
| | (0.05 - 0.17) | (0.05 - 0.18) | (0.05 - 0.13) | (0.03 - 0.13) | (0.03 - 0.13) |
| Unionised Ammonia | 0.002 | 0.002 | 0.002 | 0.002 | 0.001 |
| | (<0.001 - 0.004) | (0.001 - 0.003) | (<0.001 - 0.003) | (0.001 - 0.003) | (<0.001 - 0.003) |
| Chlorophyll-*a* (μg $L^{-1}$) | 2.7 | 2.9 | 3.7 | 2.8 | 2.5 |
| | (1.0 - 4.7) | (0.9 - 7.8) | (1.0 - 8.3) | (1.5 - 6.3) | (1.0 - 6.4) |
| *E. coli* (cfu $100mL^{-1}$) | 5 | 1 | 1 | 1 | 1 |
| | (1 - 36) | ( 1 - 1) | (1 - 2) | ( 1 - 1) | (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 Mirs Bay WCZ stations (MM8, MM13 and MM14) and the WQOs for DO and unionised ammonia at the Southern WCZ stations. 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 has been recorded for the last ten years.

### *A3.3 SEDIMENT QUALITY*

The EPD routine sediment quality monitoring stations in the vicinity of the C2C cable routes are shown on *Figure A1*. Sediment quality data for these stations are available for 1997(2) and are summarised in *Tables A3c* and *A3d*.

***Table A3b EPD Routine Sediment Quality Monitoring Data in the Vicinity of the Cable Routes***

| Parameter | SS2 | MS8 | MS9 |
|---|---|---|---|
| COD | 13,000 (9,200 - 15,000) | 11,000 (11,000 - 12,000) | 8,600 (6,600 - 10,000) |
| TKN | 430 (250 - 700) | 470 (240 - 610) | 440 (350 - 530) |
| Cadmium | 0.2 (0.1 - 0.5) | 0.1 (0.1 - 0.1) | 0.1 (0.1 - 0.1) |
| Chromium | 34 (18 - 54) | 33 (29 - 37) | 31 (29 - 33) |
| Copper | 25 (14 - 43) | 16 (14 - 22) | 13 (11 - 14) |
| Mercury | 0.1 (0.1 - 0.2) | 0.1 (<0.1 - 0.1) | 0.1 (<0.1 - 0.1) |
| Nickel | 21 (14 - 26) | 24 (22 - 27) | 24 (23 - 26) |
| Lead | 42 (35 - 72) | 34 (30 - 35) | 34 (30 - 37) |
| Zinc | 95 (72 - 110) | 93 (83 - 120) | 83 (81 - 87) |
| Arsenic | 9.5 (7.9 - 12.0) | 8.3 (7.1 - 9.8) | 8.8 (8.1 - 10.0) |
| PAHs (痢 $kg^{-1}$) | 63 (42 - 102) | 43 (39 - 54) | 39 (39 - 40) |
| PCBs (痢 $kg^{-1}$) | 7 (5 -21) | 5 (5 - 6) | 8 (5 - 11) |

**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.

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

| Parameter | MS10 | MS11 | MS14 |
|---|---|---|---|
| COD | 9,400 (6,700 - 11,000) | 8,400 (5,700 - 10,000) | 9,800 (8,000 - 11,000) |
| TKN | 440 (360 - 530) | 420 (300 - 520) | 450 (160 - 610) |
| Cadmium | 0.1 (0.1 - 0.1) | 0.1 (0.1 - 0.1) | 0.1 (0.1 - 0.1) |
| Chromium | 30 (28 - 35) | 29 (28 - 30) | 29 (27 - 31) |

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

| Parameter | MS10 | MS11 | MS14 |
|---|---|---|---|
| Copper | 11 (9 - 14) | 10 (10 - 11) | 10 (7 - 12) |
| Mercury | 0.1 (<0.1 - 0.1) | 0.1 (<0.1 - 0.1) | 0.1 (<0.1 - 0.1) |
| Nickel | 24 (22 - 25) | 24 (23 - 27) | 22 (21 - 25) |
| Lead | 32 (29 - 37) | 29 (27 - 32) | 32 (28 - 36) |
| Zinc | 80 (75 - 87) | 77 (75 - 79) | 76 (71 - 81) |
| Arsenic | 8.4 (7.8 - 9.6) | 8.4 (7.8 - 9.1) | 8.5 (7.8 - 9.6) |
| PAHs (痢 $kg^{-1}$) | 48 (39 - 72) | 45 (39 - 56) | 40 (39 - 42) |
| PCBs (痢 $kg^{-1}$) | 5 (<5 - 5) | 8 (5 - 17) | 6 (5 - 9) |

**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.

The data show that there are no exceedences of the Lower Chemical Exceedance Level (LCEL), the value below which any contamination in the sediments is not expected to have adverse biological effects. As such, the marine sediments along the cable routes are likely to be uncontaminated.

### *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 Fish Culture Zones. The identified sensitive receivers in these two categories, shown on *Figure 4.1a* of the main text, are summarised as follows.

- **Gazetted Bathing Beaches:** The closest Gazetted Bathing Beaches are St Stephen's and Chung Hom Kok, which are 370 m and 550 m respectively, from the closest segment of the proposed cable.

- **Sites of Ecological Interest:** The Cape d'Aguilar Marine Reserve is 450 m from the closest proposed cable segment. Coral communities near the cable segments have also been identified along Fury Rocks (390 m), Beaufort Island (725 m), Sung Kong (665 m) and Waglan Island (790 m).

- **Fish Culture Zone:** The Po Toi Fish Culture Zone is situated approximately 2.9 km from the closest cable segment.

### *A4.1 LAYING OF THE CABLE*

- *Shore Based Work* - A beach manhole will be constructed on Sha Shek Tan Beach with an internal size of 4 m (L) x 2 m (W) x 2.5 m (H). The manhole will be a reinforced concrete box structure with lead-in ducts from the sea bed and will have out-going ducts that will lead up the hill slope to the cable landing station. The construction of the manhole and associated shore based work will be undertaken primarily using manual labour, rather than mechanical equipment. The manhole will be constructed from reinforced concentrate and, along with any other required shore based work, will take between 1 and 2 months to complete.

- *Preparation of Landing Site* - These activities will include site preparation, beach access and perimeter establishment. Excavation will be undertaken of trenches between the beach manhole and the LLW mark and upon completion of the civil works, the working area will be backfilled and reinstated to its original condition. No materials will be dredged as part of the construction works and all excavated materials will be balanced on site.

- *Landing the C2C Cables* - Each cable segment will be approximately 49 mm in diameter and will be laid ashore by a floated shore-end operation from a construction barge. The construction barge will hold position as close as safely possible to the beach manhole (BMH) but within 1 km of the shore. The cable end will be hauled ashore and anchored off. The construction barge will then commence lay operations.

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

Apart from the short distance at the approach to the beach, the cable will be laid on the sea bed using an injection jetter designed specifically for this purpose. The injection tool fluidises a narrow trench in the seabed using 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 very 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 would be buried between 3 m and 5 m below the seabed.

The cable laying process will result in the formation of a dense cloud of high suspended sediment concentrations, which will remain very close to the seabed and will settle out rapidly. An analysis of the potential transport of fine sediments suspended into the water column during the cable laying has been carried out and is described in *Attachment A2*. The analysis has been undertaken using the current flow of the Tathong Channel, where the tidal

currents are highest and hence the sediment would be transported the greatest distances. The analysis has determined that the maximum distance of transport of the suspended sediments would be 83 m The closest sensitive receivers to the cable route that are susceptible to suspended solids are 390 m away (see *Section A3.4*), and will not be impacted by the cable installation work.

Along the cable route, the sea bed sediments are classified as uncontaminated and have low oxygen demand and nutrient content (see *Tables A3c* and *A3d*). It has been estimated that the sediment disturbed during cable laying will remain in suspension for a very short period of time (calculated as less than 3 minute in *Attachment A2*). The low levels of contamination in the sediment, coupled with the limited period of time the sediments are predicted to remain in suspension, mean that the effects of suspended sediments on water quality (ie dissolved oxygen levels, nutrient concentrations and the release of micro-pollutants) will be small and would not cause an adverse impact to water quality and no unacceptable impacts to water quality would not occur during installation of the cables.

### *A4.3 POST LAY PROTECTION OF THE CABLE SEGMENTS AT CHUNG HOM KOK*

Articulated piping (diameter 100 mm) is expected to be required for the onshore cable segments from the BMH to the LLW mark. Additional articulated piping may or may not be required in the inshore areas to protect the cable from debris/anchor damage. The post lay operations will be guided by divers and will not result in environmental 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 sea bed 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 in the immediate vicinity of the cable. No adverse impacts were found to occur to sensitive receivers from this activity.

No impacts to water quality from shore based work would result during construction.

## *ATTACHMENT A1 - CALCULATION OF THE TRANSPORT OF SEDIMENT IN SUSPENSION*

### 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 utilizes water injector technology to fluidise the sea bed 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 sensitive receivers are summarised in *Table 1*.

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

| Sensitive Receiver | Distance to Cable Route (m) |
|---|---|
| St Stephen's Gazetted Beach | 370 |
| Cape d'Aguilar Marine Reserve | 450 |
| Coral Communities | 390 |

During the cable laying process the sea bed 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 (5 m) and can be used to provide a worst case estimate of suspended solids transport.

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

Where:

| | | |
|---|---|---|
| max depth of disturbance | = | 5 m (burial depth of cable) |
| width of disturbance | = | 0.25 m (width of cable laying machine) |
| maximum cross sectional area | = | 1.25 $m^2$ |
| 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 | = | 20.85 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 sea bed, which is independent of the water depth. Although the current speeds at the sea bed are lower than those near the water surface, due to such effects as bottom friction. However, it has been assumed that the current speed is 0.6 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 | = | 20.85 kg $s^{-1}$ |
| current speed | = | 0.6 m $s^{-1}$ |
| height of sediment | = | 2 m |
| width of sediment | = | 6 m |

Initial Concentration = 2.90 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)

= 0.029 m $s^{-1}$ = 29 mm $s^{-1}$

However, as the sediment settles onto the sea bed concentrations will gradually reduce. In order to account for this reduced concentration the above settling velocity is halved, which gives a value of 14.5 mm $s^{-1}$.

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

Settling Time = 2/0.0145 = 138 s

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

Distance Travelled = 138 x 0.6 = 83 m

The above calculation indicates that the sediments disturbed during laying of the cable will settle onto the sea bed within 83 m of the cable route. The closest approach of the cable route to the sensitive receivers is 370 m from St Stephen's Beach and 390 m from coral communities. Therefore, suspended sediments from the cable laying are not expected to adversely impact the identified water quality and marine ecology sensitive receivers.

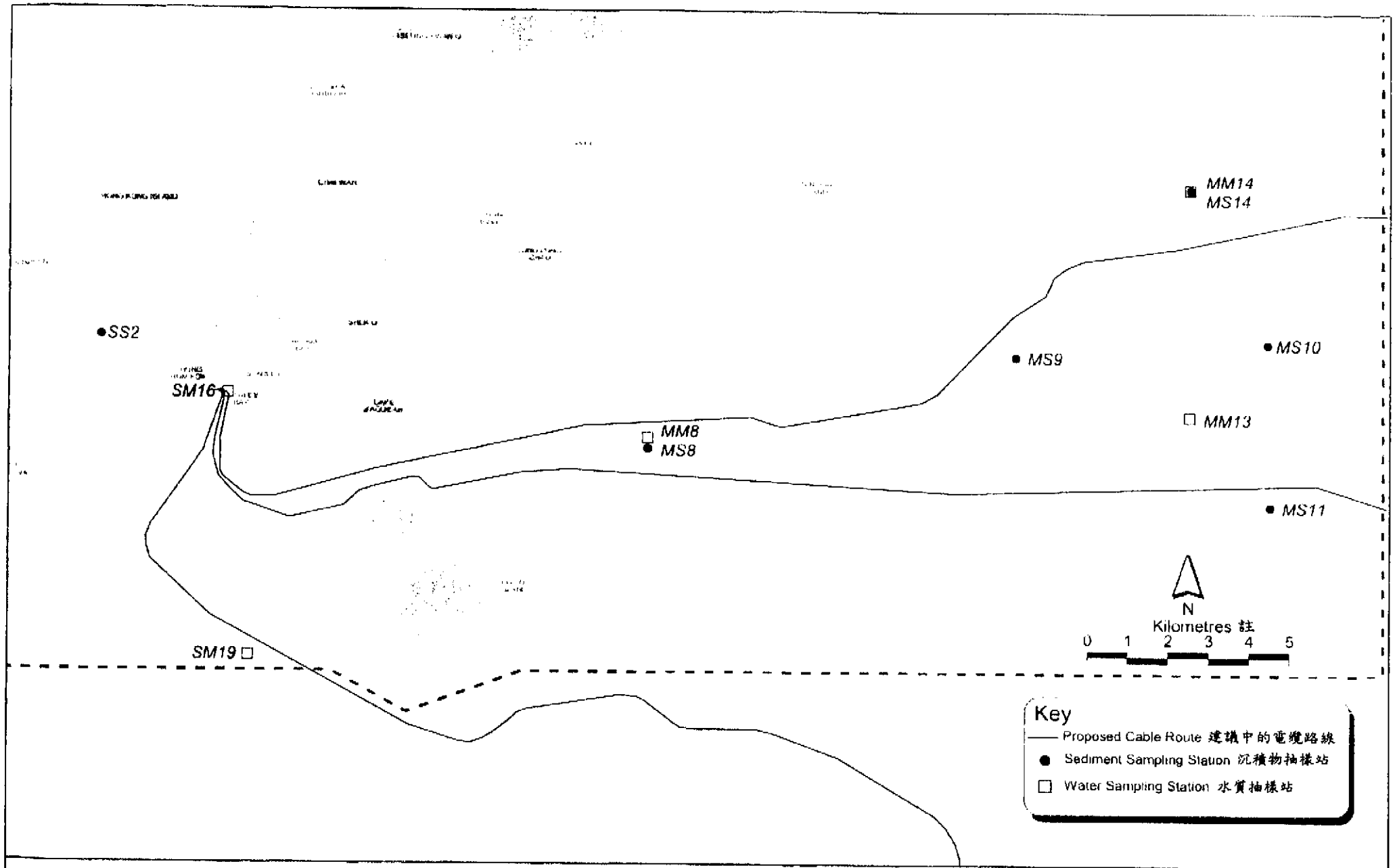



FIGURE A1
圖A1

File: c2129_monstat.apr
Date: 28 Nov 2000

Water and Sediment Sampling Stations
水質和沉積物抽樣站

Environmental Resources Management
ERM

## *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 associated with the Project.

## *B2 RELEVANT LEGISLATION AND ASSESSMENT CRITERIA*

The *EIAO TM, Annex 16,* 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 not providing information on the entire length of each route, the literature provides details on benthic assemblages around the cable route. 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 the Tathong Channel and in Eastern Waters [(1)]. These surveys found that the mean biomass of infaunal organisms was similar to a previously reported mean for Hong Kong waters [(2)]. The Tathong Channel sites reported a mean biomass of 35.7 g $m^{-2}$, and the Eastern Waters reported a mean biomass of 32.9 g $m^{-2}$, (the mean for Hong Kong was reported as 35.2 g $m^{-2}$). No species that are considered to be rare were identified in the review.

More recent studies have been conducted in Tai Tam Bay within the vicinity of the proposed cable landing site [(3)]. As part of this study, grab sampling

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

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

(3) 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.

technology was employed to investigate the soft bottom assemblages in and around the Tai Tam Bay and the Cape d'Aguilar Peninsula. 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, reported as 35.2 g $m^{-2}$ (1). No species that are considered to be rare were identified in the review.

Based on the above the subtidal soft bottom communities in the vicinity of the proposed cable routes can be considered as of low to medium ecological value in comparison to other areas of Hong Kong.

### *B3.2 SUBTIDAL HARD BOTTOM ASSEMBLAGES*

A number of areas in the vicinity of the proposed cable routes have been identified in previous studies as supporting coral communities (*Figure 3.0a*). As part of the Hong Kong wide *Coastal Ecology Studies*, dive surveys were conducted at a number of locations in the vicinity of the proposed cable routes. These surveys carried out on the subtidal rocky coasts of Sung Kong, Waglan Island, Po Toi and Beaufort Island reported a range of coral communities which vary in nature depending on the substrate (2) (3). The soft coral communities were found to be abundant below -20mPD (the soft coral *Dendronephthya* spp was the most abundant species). Gorgonians were also abundant and diverse, with *Melithaea* spp found to be common. Hard corals were not as abundant or diverse as compared to reefs in the north-eastern waters of Hong Kong (4).

Recent dive surveys were conducted at the Ninepin Islands, Waglan Island, Sung Kong and Beaufort Island as part of a baseline survey around the East Tung Lung Chau Marine Borrow Area (5). The surveys indicated that there were differences between each site in terms of abundance, diversity and percentage cover of the coral assemblages. Hard corals were most abundant and diverse at the South Ninepin, Waglan and north-west Sung Kong Island. All of the survey sites were unusual in supporting rare coral species such as *Acropora solitaryensis*, *Acanthastrea* sp and *Coscinarea columna*. In general hard corals were recorded in highest abundances in shallow and sheltered locations. Although soft corals were not recorded at the surveyed sites, they were noted as in greater numbers in deeper waters. North Ninepin possessed the greatest diversity of soft and gorgonian corals. In general, however, coral cover was low at all sites in comparison to coral communities in the north-eastern waters of Hong Kong.

(1) Shin PKS and Thompson GB (1982) *Op cit.*
(2) Binnie Consultants Limited (1996) Coastal Ecology Studies: Sung Kong / Waglan Quantitative Survey. Final Report. For the Geotechnical Engineering Office, Civil Engineering Department.
(3) Binnie Consultants Limited (1995) Marine Ecology of Hong Kong - Report on the Underwater Dive Surveys (October 1991 - November 1994) - Volume II. For the Geotechnical Engineering Office, Civil Engineering Department.
(4) Binnie Consultants Limited (1995) *Op cit.*
(5) ERM - Hong Kong, Ltd (1999) Baseline Survey at East Tung Lung Chau. Final Report. For the Civil Engineering Department.

Coral communities have also been identified and observed in the vicinity of the proposed cable alignment at Cape Collinson, Tai Long Pai, Bokhara Rocks and on the south and eastern shores of Tung Lung Chau (*D McCorry*, pers comm.) (*Figure 3.0a)*. The Marine Reserve at Cape d'Aguilar, although exposed to heavy wave action prevailing from north-easterly and south-easterly winds, has also been identified as supporting subtidal coral communities including large rock pool lined with hermatypic hard corals, comparable to the situation at Ping Chau in Mirs Bay [(1)]. Although these coral communities have been observed, there is little published information on their abundance, diversity or ecological value.

As no information was available on potential coral communities in the vicinity of the proposed cable landing site at Chung Hom Kok, dive surveys of this area were conducted. The methodology for the dive survey, along with the results is 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 location was surveyed using the Rapid Ecological Assessment as adapted from Le Vantier *et al.* 1998 [(2)] .

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 (i.e. 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

(1) Morton B (1997) The history of and future plans for the conservation of the marine environment of Hong Kong, China. Proceedings of the APEC Workshop on the Impacts of Destructive Fishing Practices on the Marine Environment, 16 - 18 December 1997.

(2) 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.

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.

The general site area, lying south of Chung Hom Kok along the shoreline was easily located. 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.

***Table B3.2d GPS Coordinates for the Dive Surveys at the Potential Chung Hom Kok C2C Cable Landing Station***

| Transect | Northing | Easting | Direction |
|---|---|---|---|
| 1 | 22′ 12″ 827 | 114′ 12″ 170 | Mag. 60 deg. |
| 2 | 22′ 12″ 836 | 114′ 12″ 211 | Mag. 50 deg. |
| 3 | 22′ 12″ 887 | 114′ 12″ 253 | Mag. 40 deg. |
| 4 | 22′ 12″ 925 | 114′ 12″ 295 | Mag. 0 deg. |
| 5 | 22′ 12″ 994 | 114′ 12″ 288 | Mag. 300 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*).

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

| Transect | Average Depth | Description |
|---|---|---|
| 1 | 3.8 m | A shallow transect with two species of encrusting hard corals, gorgonians and Dendronephthya soft corals growing on the occasional boulder on a predominantly sandy seabed. |
| 2 | 11.0 m | Uniformly sand with a thick layer of fine silt. Some gorgonians were present. |
| 3 | 5.9 m | The transect was primarily sand with some boulders and patches of rubble in the last 20 m. |
| 4 | 10.2 m | The seabed was largely sand and silt with the occasional boulder, some of which had gorgonians attached. One species of encrusting hard coral was also recorded. |

| Transect | Average Depth | Description |
|---|---|---|
| 5 | 3.4 m | This transect runs under a small mooring for sampan type fishing vessels, out from a small beach. The seabed was littered with ropes and other debris but there were some, primarily encrusting hard corals growing on small boulders which protruded from the sand. This transect recorded the highest diversity of hard corals with 8 species recorded, most of which appeared in good health, despite the silty conditions. |

*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 in three of the five transects, whereas, soft corals were observed on all transects; both, however, had a percentage cover that varied between only 1 and 10% (*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 | 3 | 2 | 1 | 1 | |
| Sea fans | | | | | |
| Leather corals | | | | | |
| Sea whips | | | | | |
| *Dendronephthya* spp | 1 | | | | |
| Tubastrea Cup Corals | | | | | |
| Sponges | 1 | | 1 | | 1 |
| Zoanthids | | | | | |
| Ascidians | | | | | |
| Bryozoans | 1 | | 1 | | 1 |
| | | | | | |
| *Ecological attributes* [b] | | | | | |
| Hard coral | 1 | | | 1 | 1 |
| Dead standing coral | | | | | |
| Soft coral | 1 | 1 | 1 | 1 | 1 |
| Sea anemone beds | | | | | |
| Macro-algae | 1 | | 1 | | 1 |

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 11 species of hard corals were recorded during the survey. Of these 11 species, the highest diversity was found on Transect 5 with 8 species recorded, namely *Favia speciosa, Favites abdita*, *Goniastrea aspera*, *Platygyra sinensis* (all Family Faviidae), *Stylocoeniella guentheri* (Family Astrocoeniidae), *Goniopora columna, Porites lobata* (both Family Poritidae) and *Psammocora superficialis* (Family Thamnasteriidae). Corals of the Family Faviidae that could not be identified to species level were also recorded on this transect. For the remaining hard coral species identified, 2 were recorded on Transect 1, namely *Oualastrea crispata* (Family Faviidae) and *Coscinaraea columna*

(Family Siderastreidae), and 1 on Transect 4, namely *Cyphastrea* sp (Family Faviidae). Each of these coral communities were categorised by the subjective assessment of abundance as rare or uncommon on the transects.

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 3 which was almost 100% sand. Transect 1, 2 and 5 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 | 1 | | 1 | 1 |
| Continuous Pavement | | | | | |
| Bedrock/boulders/sand | 1 | 1 | | | 1 |
| Rubble | | | | | |
| Cobbles | | | | | |
| Sand or sand and gravel | 5 | 5 | 5 | 5 | 5 |
| Depth Average (m) | 3.8 | 11.0 | 5.9 | 10.0 | 3.4 |

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 highest number of species recorded was on Transect 5. 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 three of the five transects, and were considered to be rare or uncommon on the transects that they were recorded on, 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.

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

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, therefore, an intertidal shore surveys were undertaken at and near the proposed cable landing site to collect baseline ecological information on the habitat, identify and quantitatively assess the floral and faunal components of the intertidal community and identify species/habitats which are of conservation importance. The ecological value of the habitats were verified based on the results obtained from field surveys. The methodology and results of this survey are presented in the following sections.

### *B3.3.1 Methodology*

*B3.3.1.1 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 1.0 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.

*B3.3.1.2 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 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. The coastline north to the landing site is lined with natural semi-exposed boulder/rocky shore and sandy shores. The shores located south of the proposed landing site are composed of natural exposed rocky shores and a sandy/pebble shore.

*B3.3.2.1 Rocky Shores*

*Semi-exposed Rocky Shore (Site R1)*

The habitat is a semi-exposed rocky/boulder shore (*Figure B2*). It is located next to the sandy beach where the proposed landing site is. The intertidal assemblages recorded on the rocky shores were dominated by snails ($102.7 m^{-2}$) with moderate abundance of limpets ($16.8 m^{-2}$) (*Table B3.3a*). Bivalves were also observed on the shore with a percentage abundance of 1.6%. Barnacles were also recorded but occurred in comparatively low abundance (0.1% cover). A percentage cover value of 1.2% was obtained for macroalgae. No species of conservation importance were recorded. The assemblages recorded were typical to other semi-exposed hard bottom shores in Hong Kong. The rocky shore appeared to have been subject to little or no human disturbance.

*Table B3.3a Intertidal Assemblages Recorded for the Semi-exposed Rocky Shore (Site R1)*

| Species Group | Abundance |
|---|---|
| Limpets | 16.8 $m^{-2}$ |
| Snails | 102.7 $m^{-2}$ |
| Chitons | 4.0 $m^{-2}$ |
| Bivalves | 1.6% |
| Barnacles | 0.01% |
| Macroalgae | 1.2% |

*Exposed Rocky Shore (Site R2)*

The habitat is a natural exposed rocky shore located south to the proposed landing site (*Figure B2*). There is an existing manhole located north to 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 to 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% |

*Exposed Rocky Shore (Site R3)*

The habitat is a natural, exposed rocky shore located south to the proposed 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 B3.3c*). Moderate abundances of snails (26.7 $m^{-2}$) were recorded on the shore (*Table B3.3c*). 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 to other exposed rocky shores in Hong Kong.

*Table B3.3c Intertidal Assemblages Recorded for the Natural Exposed Rocky Shore (Site R3)*

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

*Natural Sandy Shore (Site S1)*

The habitat is a natural, semi-exposed sandy shore located at the proposed landing site (*Figure B2*). The habitat surveyed appeared to have been subject to human disturbance as some remains of village houses were seen at the back of the beach. The substratum of the shore was mainly composed of fine sand and small-sized gravels. The intertidal assemblages recorded on this natural sandy shore were mainly composed of clams with an abundance value of 668.4 $m^{-3}$ (*Table B3.3d*). The species recorded were typical of other semi-exposed sandy shores in Hong Kong and no species of conservation importance were recorded. Whilst the abundance of assemblages recorded was considered as high, the diversity was low.

***Table B3.3d Intertidal Assemblages Recorded for the Natural Sandy Shore (Site S1)***

| Species Group | Abundance |
|---|---|
| *Cancella chinensis* | 32.0 $m^{-2}$ |
| *Donax cuneatus* | 69.3 $m^{-2}$ |
| *Donax semigranosus* | 524.4 $m^{-2}$ |
| *Tapes philippinarum* | 42.7 $m^{-2}$ |
| Total: | 668.4 $m^{-2}$ |

*B3.3.2.2 Summary*

In summary, the intertidal hard surface assemblages located in close proximity to the proposed landing point for the cable 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 shore but had been subject to human disturbance as some remains of village houses were seen at the back of the beach. The substratum of the shore was mainly composed of fine sand and small-sized gravels. The intertidal assemblages recorded on this natural sandy shore were mainly composed of bivalves (clams). No species of conservation interest were recorded. The abundance of assemblages recorded was moderate in comparison to other sites in Hong Kong, and can generally be considered as typical of a semi-exposed sandy shore. Based on these findings, the ecological importance of this sandy shore was considered to be medium.

### *B3.4 MARINE MAMMALS*

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.

## *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 an injection jetting method which will result in minimal disturbance to the seabed sediments (0.25 m). 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 potential 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 result in a reduction in sunlight penetration, decreased rate of photosynthesis of phytoplankton (primary productivity) and thus lower rate of oxygen production in the water column.

As discussed in *Annex A*, the proposed injection jetting technique for cable deployment will result in the formation of a localised cloud of high suspended sediment concentrations around the jetting. 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 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 3 to 5 m within 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 present on Sha Shek Tan Beach.

- *Species*: No species that are either of ecological importance or that are considered to be rare are predicted to be impacted by the cable laying operations.

- *Size:* The total length of each cable within Hong Kong waters is approximately 30 km.

- *Duration*: It is predicted that the deployment and installation of the cables will take only 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 sensitive habitats are predicted. The magnitude of impact 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 are proposed.

## *B6 SUMMARY AND CONCLUSIONS*

A review of existing information on the marine ecological resources surrounding the cable routing has identified in the area as supporting benthic fauna which are similar in nature to other areas of Hong Kong. Coral communities identified during the dive survey as part of this assessment are not considered to be of ecological importance. However, subtidal hard surface habitats supporting coral communities of ecological importance have been reported in the vicinity of the cables (see *Figure 3.0a*). The coral communities are located at sufficient distance from the alignment of the

cables to indicate that impacts will not occur. Similarly, no adverse impacts to the Cape d'Aguilar Marine Reserves are expected to occur as only small scale, localised impacts to water quality are predicted.

Subtidal soft bottom assemblages that will be disturbed during the construction of the cable routing are commonly recorded elsewhere in Hong Kong waters, therefore, the short term loss of benthic organisms directly along the cable route is not considered to represent an unacceptable ecological impact. The rapid reinstatement of the seabed will result in the area being available for prompt recolonisation, and hence, no permanent impacts are likely to occur.

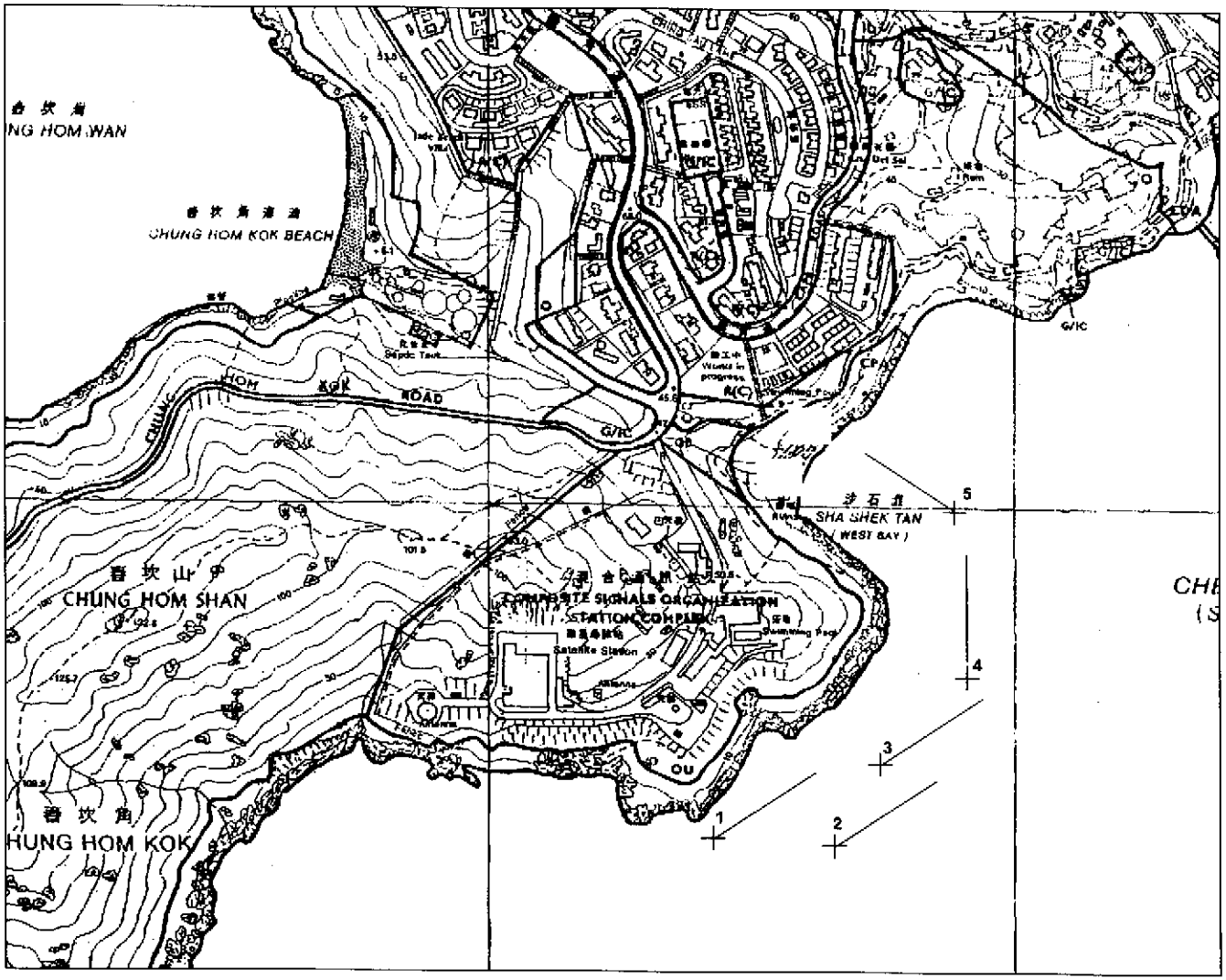
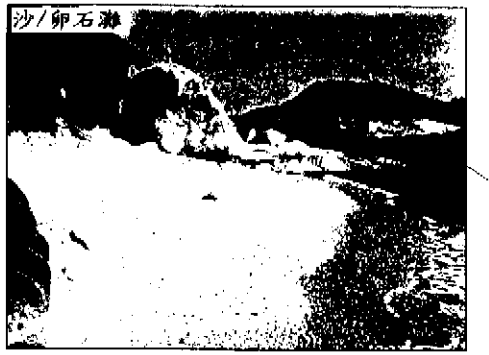



FIGURE B1
圖B1

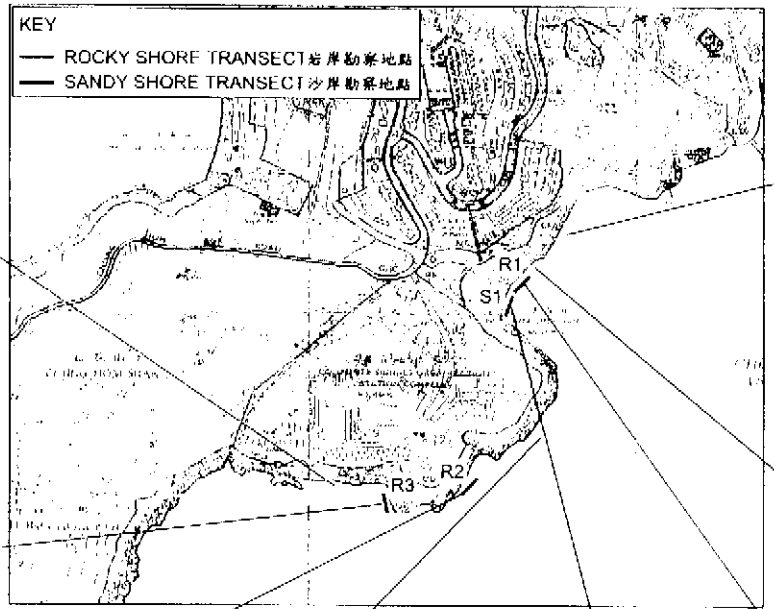
FILE: C2129d
DATE: 31/10/00

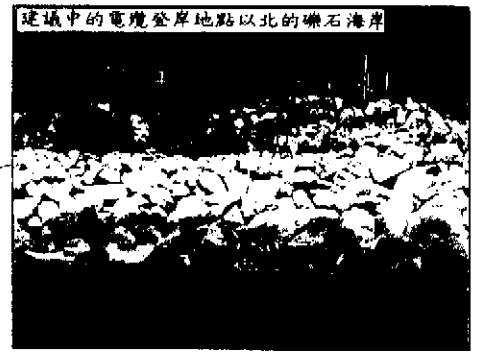
SUBTIDAL DIVE SURVEY TRANSECTS AT CHUNG HOM KOK
在春坎角進行潮下潛水勘察的橫切線地點

Environmental Resources Management
ERM



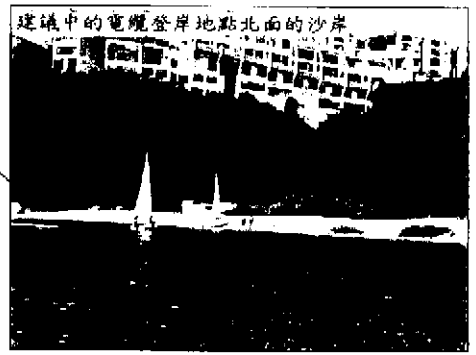

SANDY / PEBBLE BEACH



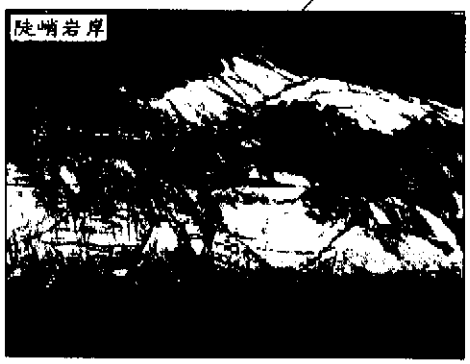

BOULDER SHORE LOCATED NORTH TO THE PROPOSED CABLE LANDING SITE


EXPOSED ROCK SHORE SELECTED FOR INTERTIDAL FIELD SURVEY




SANDY SHORE LOCATED NORTH TO THE PROPOSED CABLE LANDING SITE


EXPOSED ROCK SHORE SELECTED FOR INTERTIDAL FIELD SURVEY




STEEP EXPOSED ROCKY SHORE


SANDY SHORE - THE PROPOSED CABLE LANDING SITE


SEMI - EXPOSED ROCK SHORE SELECTED FOR INTERTIDAL FIELD SURVEY

FIGURE B2
圖 B2

INTERTIDAL HABITATS IN THE VICINITY OF THE PROPOSED CABLE LANDING SITE AT CHUNG HOM KOK
建議中的春坎角電纜登岸地點的潮間生境

FILE: C2129c
DATE: 30/10/00

Environmental Resources Management
ERM

## *C1 INTRODUCTION*

This *Annex* presents the findings of the assessment of impacts to fisheries resources and fishing operations associated with the proposed Project. Baseline information on the potentially affected fisheries resources and fishing operations, which is taken from recent studies and relevant literature, is presented and evaluated for the assessment.

## *C2 RELEVANT LEGISLATION AND ASSESSMENT CRITERIA*

The criteria for evaluating marine ecological and fisheries impacts are laid out in *Annex 17* of the *EIAO TM* and *Annex 9* of the *EIAO TM* recommends some general criteria that can be used for evaluating fisheries impacts.

Other legislation which apply to fisheries resources include: the *Fisheries Protection Ordinance (Cap 171) 1987* which provides for the conservation of fish and other aquatic life and regulates fishing practices; and the *Marine Fish Culture Ordinance (Cap 353) 1983* which regulates and protects marine fish culture and other related activities.

## *C3 DESCRIPTION OF THE ENVIRONMENT*

In Hong Kong, the commercial marine fishing industry is divided into capture and culture fisheries. As a result, the following baseline information has been presented under the headings *Capture Fisheries* and *Culture Fisheries*. The baseline information has been derived from the most up-to-date information on the Hong Kong fishery(1). Information from other relevant studies was also reviewed in order to determine if the waters of the proposed cable routes are important spawning grounds or nursery areas for commercial fisheries(2). Mariculture information was obtained from the Agriculture, Fisheries and Conservation Department (AFCD) Annual Reports(3)(4).

(1) Agriculture, Fisheries and Conservation Department (1998) Port Survey 1996 - 1997.
(2) ERM - Hong Kong, Ltd (1998) Fisheries Resources and Fishing Operations in Hong Kong Waters. Final Report. For the Agriculture, Fisheries and Conservation Department, Hong Kong Government.
(3) Agriculture, Fisheries and Conservation Department (1998) Annual Report 1996 - 1997.
(4) Agriculture, Fisheries and Conservation Department (2000) Annual Report 1998 - 1999.

## *C3.1 CAPTURE FISHERIES*

### *C3.1.1 Fishing Operations*

In 1989 - 1991 AFCD devised a system whereby the waters of Hong Kong were divided up into individual Fishing Zones[5]. Data were gathered at that time on the catches of the Hong Kong fleet derived from these Fishing Zones. Since this first Hong Kong wide survey, AFCD have updated the information which now indicates that the number of Fishing Zones equates to 189, down from the original 210 listed in 1991[6]. However, of those 189 Fishing Zones, only 179 are actively fished by vessels from the Hong Kong fleet.

The proposed cable route passes through twelve of the AFCD Fishing Zones. These Fishing Zones cover the waters of the Sheung Sze Mun Channel between the Cape d'Aguilar Peninsula and the Po Toi Islands, the Lema Channel to the south of the Po Toi Islands and the south eastern waters of Hong Kong (*Figure C1*). One of these twelve Fishing Zones, the Stanley Bay Fishing Zone (AFCD Code 69), does not currently report fishing operations within its waters.

Recent studies indicate that the majority of vessels that operate in the Fishing Zones that the proposed cable routes pass through are less that 15 m in length[7]. These vessels are commonly P4/7 vessels operating fishing gear such as hand lines, cage traps and gill nets. However, Purse Seiners, operating gear in surface to mid-level water depths, have been recorded as common around the Po Toi Islands. Only four of the eleven actively fished Fishing Zones recorded high numbers of vessels over 15 m in length, namely Po Toi South, Po Toi North, Sung Kong and Waglan Fishing Zones (AFCD Codes 92, 93, 94 and 95, respectively) (*Figure C1*). The majority of these vessels have been recorded as Stern Trawlers, operating heavy fishing gear on the seabed surface and sub-surface[8].

### *C3.1.2 Fishing Resources*

The catches reported from the Fishing Zones along the proposed cable routes consist of a variety of species which in general are of low commercial value[9]. The majority of the top ranked species caught (by weight) are mostly the AFCD termed "mixed species" group. This species group, which consists of juveniles of various commercial species, are generally sold at a low cost to mariculturists to be used as fish feed along with the other common low value species recorded in these waters.

(5) Agriculture, Fisheries and Conservation Department (1991) Port Survey 1989 - 1991.
(6) Agriculture, Fisheries and Conservation Department (1998) *Op cit.*
(7) ERM - Hong Kong, Ltd (1998) *Op cit.*
(8) ERM - Hong Kong, Ltd (1998) *Op cit.*
(9) Agriculture, Fisheries and Conservation Department (1998) *Op cit.*

Two of the eleven actively fished Fishing Zones along the proposed cable routes, recorded species of medium commercial value as the top ranked species (by weight), namely the scad/crevalle (*Caranx* spp) (AFCD Code 61, Hok Tsui Village) and the anchovy (*Stolephorus heteroloba*) (AFCD Code 66, Tung Hau Wan). These Fishing Zones encompass the waters at the entrance to Tai Tam Bay. A number of species of medium commercial value ($10 - 15 $kg^{-1}$) were also listed within, although not at the top of the list, the five most abundant species recorded (by weight) in the majority of the Fishing Zones. These species were the scad/crevalle (*Caranx* spp), squid (*Loligo* spp), the anchovies (*Stolephorus* spp, *Stolephorus heteroloba* and *Stolephorus zollingeri*) and the scad (*Trachurus japonicus*).

Although there were no species of high commercial value (> $15 $kg^{-1}$) were recorded as the top species (by weight), four such species were recorded as within the top five species abundance (by weight) at eight of the eleven actively fished Fishing Zones. These were the yellow croaker (*Pseudosciaena crocea*), shrimp (*Metapenaeus barbata*), silver shrimp (*Acetes* spp) and the AFCD group termed as "mixed prawn".

In terms of fisheries production on a per hectare basis, the majority of the Fishing Zones that the proposed cable passes through are ranked either medium (60 - 120/179) or high(1 - 59/179) in comparison to the other Fishing Zones in Hong Kong. These Fishing Zones achieve such high rankings on the basis of the commercial value of the species reported from these waters, as well as the waters supporting a fry fishery (*Section 3.1.3*).

In summary, the majority of the fisheries resources reported by fishermen operating in the waters of the proposed cable routes are low value bottom dwelling crustaceans or small fast growing pelagic species of low commercial value. Although the majority of species caught within these waters are of low commercial value, the Fishing Zones are generally ranked either medium or high in comparison to other Fishing Zones in Hong Kong waters in terms of fisheries production on a per hectare basis.

### *C3.1.3 Spawning Grounds and Nursery Areas*

The findings of a recent study on fisheries resources in Hong Kong waters has identified that the proposed cable routes pass through a spawning ground for commercial species such as the sole (*Cynoglossus macrolepidotus*) and the yellow croaker (*Pseudosciaena crocea*)[10]. In Hong Kong waters, fry and juveniles of the majority of commercial species are abundant during the period of March to September, particularly during the summer months of June, July and August[11].

(10) ERM - Hong Kong, Ltd (1998) *Op cit.*
(11) ERM - Hong Kong, Ltd (1998) *Op cit.*

### *C3.2 CULTURE FISHERIES*

One Fish Culture Zone (FCZ) lies within close proximity to the proposed cable routes, namely the Po Toi FCZ. The FCZ at Po Toi has been issued 7 operating licences with a total of 10 licensed rafts(12) . The total licensed area is 566 $m^2$ making it the second smallest of the 26 FCZs in Hong Kong. Although there are no figures available for the production of individual FCZs, the production in the whole of Hong Kong in 1998 was approximately 1,200 tonnes, making up about 5% of local demand for live marine fish(13). The main species cultured throughout Hong Kong FCZs are the spotted grouper (*Epinephelus chlorostigma*), gold lined seabream (*Rhabdosargus sarba*), mangrove snapper (*Lutjanus argentimaculatus*) and the pompano (*Trachinotus blochi*). These species are generally caught as fry or fingerlings either within, or outside of Hong Kong waters and are grown out in cages suspended by floating rafts at the FCZs until they reach marketable sizes.

## *C4 IMPACT ASSESSMENT*

### *C4.1 DIRECT IMPACTS*

The proposed cables will be submerged through the injection jetting burial method (0.25 m width) to a depth of between 3 and 5 m below the seabed. Through the employment of this burial technique, the seabed will be left virtually undisturbed and available for immediate recolonisation by benthic infauna and associated bottom dwelling organisms. Minor interruptions to fishing operations are expected to occur only during the deployment phase of the cables. These disruptions are, however, minimal as the deployment of the cable from the landing point to the SAR boundary has been predicted to require only 30 days. No impacts are expected to occur to either fisheries resources or fishing operations during the operation of the cables, therefore, operational impacts will not be discussed further. Constructional phase impacts are discussed below.

### *C4.2 INDIRECT IMPACTS*

Indirect impacts may occur through elevation in suspended solids (SS) resulting from the disturbance of the seabed through the burial of the cables. However, the proposed injection jetting method of burial will disturb only a 0.25 m area narrow trench, resulting in only short term elevations in SS in the immediate vicinity of the cable. Sediments that may be lost in suspension are likely to remain in the lower part of the water column and settle back onto the seabed within a short period of time. The majority of any disturbed sediment will be immediately replaced in its original location through the cable laying

(12) Agriculture, Fisheries and Conservation Department (1998) Annual Report 1996 - 1997.
(13) Agriculture, Fisheries and Conservation Department (2000) Annual Report 1998 - 1999.

technique. As a result, impacts to fisheries resources are predicted to be minimal, if any.

### *C4.3 IMPACT EVALUATION*

An evaluation of the impacts described above in accordance with the *EIAO TM (Annex 9)* is presented below:

- *Nature of impact:* As a result of the small scale and localised disturbances to the seabed, no adverse impacts to fisheries resources and subsequently fishing operations, are predicted to occur during either the cable laying or operation.

- *Size of affected area:* The approximate length of each cable within Hong Kong waters is around 30 km, however, the affected area of fisheries resources is predicted to be very small and localised to the immediate area of the cable deployment.

- *Size of fisheries resources and production:* The majority of the AFCD Fishing Zones that make up the waters of the proposed cable routes are ranked either medium or high compared to other areas in Hong Kong in terms of fisheries production on a per hectare basis.

- *Destruction and disturbance of nursery and spawning grounds:* Although the proposed cable routes pass through waters that have been previously identified as spawning grounds for two commercially important species, the majority of impacts associated with the deployment of the cables will be short term and restricted to within a close distance to the cable, therefore, impacts to these important areas are expected to be minimal, if any.

- *Impact on fishing activity:* The duration of time required for the cable deployment is at most 30 days for all 3 cables. As a result, increases in marine traffic, and hence disturbance to fishing activities in the area, are small scale and, thus, are not expected to be of concern.

- *Impact on aquaculture activity:* Due to the short duration and localised dispersion of potential increases in suspended solids in the water column, impacts to the Fish Culture Zone at Po Toi are not predicted to occur.

## *C5 MITIGATION MEASURES*

The water quality assessment found that water quality would not be impacted during cable laying or shore based work. Hence, no mitigation measures have been proposed.

Due to the proposed method of cable deployment and installation and short duration of works, no unacceptable impacts have been predicted to occur to fisheries resources or fishing operations.

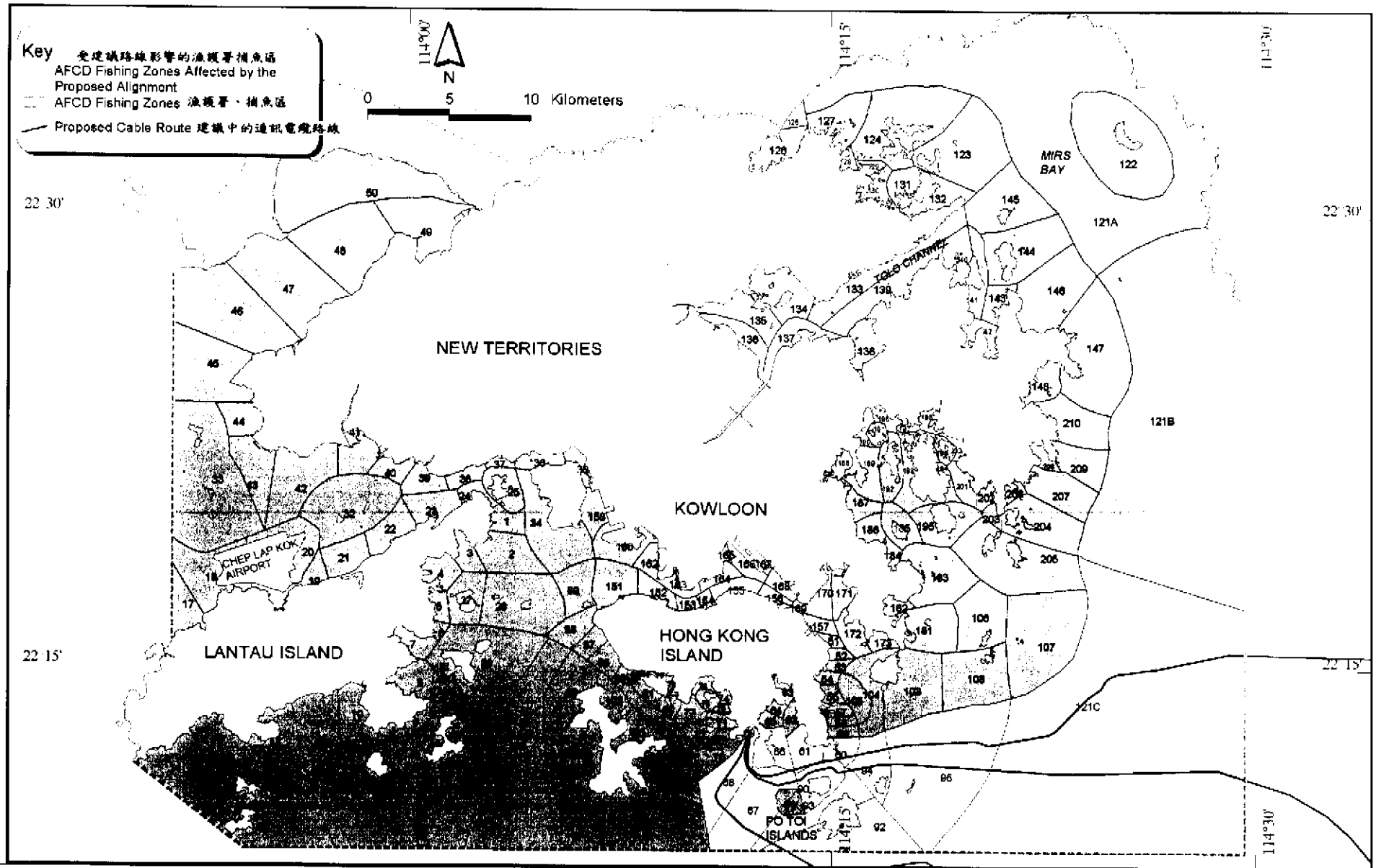



FIGURE C1
圖C1

DISTRIBUTION OF AFCD FISHING ZONES IN HONG KONG WATERS AND LOCATION OF THE PROPOSED C2C CABLE SYSTEM
香港海域內漁農自然護理署捕魚區的分佈和建議中的C2C通訊電纜系統

FILE: C2115o
DATE: 05/12/00

Environmental Resources Management
ERM