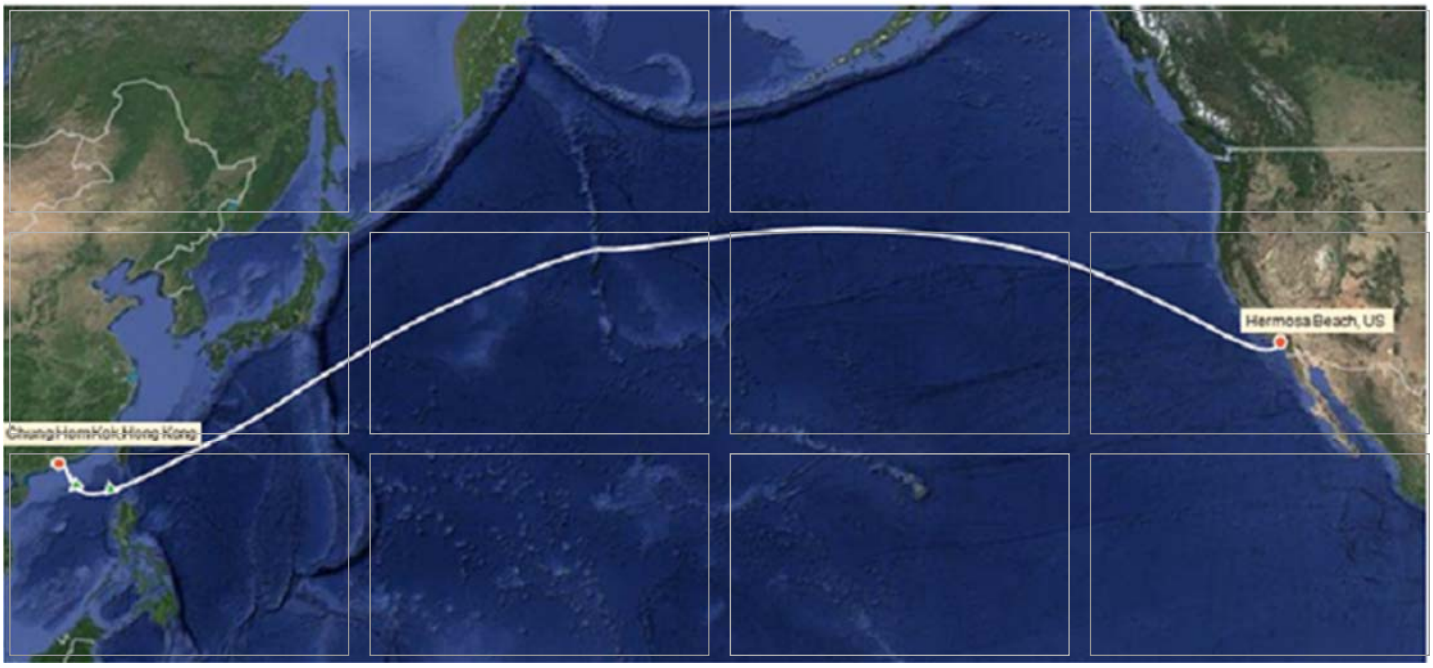

HKA Submarine Cable - Chung Hom Kok

Project Profile

November 2018

Environmental Resources Management
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HKA Submarine Cable - Chung Hom Kok

Project Profile

ERM Document Code: 0444245.doc

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Client: China Telecom Global Limited (CTG)	Project No : 0444245
Summary: Project Profile prepared by Environmental Resource Management – Hong Kong (ERM), for the permitting process under the Environmental Impact Assessment Ordinance (EIAO) for HKA Submarine Cable – Chung Hom Kok	Date: 26 November 2018 Approved by: *Terence Fong* *Partner*

Revision	Description	By	Checked	Approved	Date
v0	Project Profile for Formal Submission	FZ	FZ, TF	TF	26/11/18

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Annex B	*Assessment of Potential Impacts to Marine Ecology Resources*
Annex C	*Assessment of Potential Impacts to Fisheries Resources and Fishing Operations*
Annex D	*Assessment of Potential Noise Impacts*
Annex E	*Assessment of Potential Impact to Marine Archaeological Resources*
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1 BASIC INFORMATION

1.1 PROJECT TITLE

The title of the project is 'HKA Submarine Cable - Chung Hom Kok' (hereafter referred to as the Project).

1.2 PURPOSE AND NATURE OF THE PROJECT

The **HKA Consortium** has decided to build a new trans-Pacific optical communications system, linking Hong Kong to America, the 'Hong Kong-America (HKA)' submarine cable network. This HKA open cable system will span more than 13,000 km and deliver a massive boost to bandwidth between the two continents, while reinforcing Hong Kong as a key communication hub in the Asia-Pacific region.

The cable will connect to Chung Hom Kok (CHK) within the HKSAR. **China Telecom Global Limited (CTG)** is providing the cable landing point and the associated cable landing service in Hong Kong for the HKA Consortium.

This Project Profile includes an assessment of the potential environmental impacts associated with the installation and operation of the submarine telecommunications cable system within HKSAR, including the connection to land at Sha Shek Tan beach at CHK. The assessment has been based on information compiled by the Project Proponent describing the expected construction and operation activities, as well as potential maintenance work, i.e. repair operations.

1.3 NAME OF PROJECT PROPONENT

As the landing service provider, **China Telecom Global (CTG)** is responsible for the cable landing issue within HKSAR and is therefore the Project proponent. Contact details are:

China Telecom Global Limited
38/F Everbright Centre
108 Gloucester Road
Wan Chai, Hong Kong

1.4 LOCATION AND SCALE OF THE PROJECT

1.4.1 Location

The route of the proposed HKA submarine cable system is depicted in ***Figure 1.1***. The proposed cable would land at an existing Beach Manhole (BMH) location at Sha Shek Tan, CHK. Further detail of the landing site location is presented in ***Figure 1.3*** and ***Figure 1.4***.

It should be noted that CHK is currently the landing site for a number of submarine cables (i.e. New T&T domestic cable route, GB21's C2C Cable network; and NEC's SJC). The existing BMH is connected to the Cable Landing Station (CLS) on the hill above the landing beach and existing conduits connect the BMH and CLS.

The cable will travel from Sha Shek Tan of CHK southward, exiting Stanley Bay, turning east near the Stanley Peninsular and past Cape d'Aguilar, continuing eastward, north of Beaufort and Sung Kong Islands, to the eastern boundary of HKSAR waters, where it will enter the South China Sea.

1.4.2 Scale of Project

The HKA submarine cable has a total length of approximately 34 km within HKSAR waters.

Only small-scale construction works are required at the cable landing site to enable the cable to enter the existing Beach Manhole (BMH) and connect to the CLS. The marine cable laying process will also only require minor works within the marine environment, with the burial depth offshore being approximately 5 m below the seabed in HKSAR waters. Construction is not expected to adversely affect water quality or marine ecological and fisheries uses of the area.

During operation, the cable is not expected to result in any impact to the environment.

1.5 CABLE ROUTE SELECTION PROCESS

1.5.1 Landing Site Selection

The HKA Purchaser has considered a number of constraints and benefits when selecting the landing site, including commercial factors such as availability of existing Beach Manholes (BMHs) to minimise land works and connectivity to the nearest available Cable Landing Station (CLS), as well as physical and environmental factors.

Chung Hom Kok (CHK) is one of the key cable landing locations in Hong Kong and is currently the landing site for a number of existing telecommunication submarine cables including New T&T domestic cable route, GB21's C2C Cable network; and NEC's SJC. The majority of existing in-service cables landing on CHK peninsular land at Sha Shek Tan beach. An alternative pebble beach landing at CHK was considered, approximately 400 m to the SSW of Sha Shek Tan beach, where two New T&T domestic in-service cables land (See ***Figure 1.3***); however, it was not selected because it would involve additional crossing of multiple in-service cables and there is no known available infrastructure at this point with links to the selected CLS, while construction of new infrastructure of this kind may cause some terrestrial impacts. In comparison, for the current

landing point at Sha Shek Tan, minimal terrestrial works would be required due to existing facilities being available for this Project.

Overall, Sha Shek Tan, CHK was selected due to the following reasons:

- With existing BMH operated by Telstra (part of the HKA consortium);
- With existing CLS operated by Telstra (part of the HKA consortium);
- With well connected conduits between the BMH and CLS. Limited additional disturbance to the terrestrial environment after the submarine cable landed and connected to the existing BMH;
- The landing point at Sha Shek Tan, CHK is a sandy beach which is considered as a preferred cable landing location and therefore the cable installation is expected to be completed relatively quickly;
- The HKA cable will closely parallel existing cables landing at Sha Shek Tan, to minimize land disturbance. For more details of the land cable installation see *Section 2.1.2*.

Due to all these considerations the Sha Shek Tan site at CHK, as shown in ***Figure 1.3*** and ***Figure 1.4***, is the selected landing site for the HKA cable system in HKSAR.

1.5.2 Marine Route Planning Considerations

There are several existing environmental and physical constraints to the proposed HKA cable route (***Figure 1.5***), which have influenced the alignment of the cable. The following issues have been taken into consideration in finalising the route.

Avoiding Major Marine Vessel Fairways

Major Marine Vessel Fairways have Traffic Separation Schemes (TSSs) and should be avoided where possible, so as to minimise impacts on marine traffic and maximise the safety of the HKA cable laying operations.

To avoid proximity to environmentally sensitive receivers, particularly for coral and the coastline along north Beaufort Island and Sung Kong Islet, a route north of the islands but south of existing telecommunication cables was explored. However, given the deep waters in this area and the need to maintain a suitable distance between the existing telecommunication cables, which is calculated as a multiple of water depth (refer to *Other Submarine Cables and Pipelines* below), a route north of the existing telecommunication cables was selected, as outlined in ***Figure 1.5***. A route to the south of Po Toi was also considered but not deemed feasible due to high congestion of other submarine cables in the area (see ***Figure 1.5***), a rocky seabed limiting the route running close to Po Toi and the Traffic Separation Scheme/ Inshore Traffic Zone just outside Hong Kong's boundary, limiting the route going further south-east.

The finalised alignment crosses and then runs parallel to a vessel traffic stream north of the Beaufort Island and although this is not termed one of the major marine vessel fairways in Hong Kong, nevertheless vessel traffic is reasonably high and therefore will be taken into consideration.

Environmental Sensitive Receivers

The route should preferably avoid all known key environmentally sensitive receivers/ areas, such as Fish Culture Zones (FCZs), Coral Communities of High Ecological Value, Coastal Protection Areas (CPAs), Marine Reserve and Sites of Special Scientific Interest (SSSI) as shown in ***Figure 1.5***, and maintain a suitable distance from such receivers/ areas i.e. beyond the maximum dispersion reach of suspended sediment (calculated as 180 m in *Annex A*). As shown in ***Figure 1.2*** an adjustment was made to divert the proposed route to move away from the Cape d'Aguilar Marine Reserve (from 430 m before to 640 m after route adjustment) and Hok Tsui (Cape d'Aguilar) SSSI (from 360 m before to 610 m after route adjustment), i.e. maintain over 500 m separation from these areas. In addition, the proposed route aims to minimize disturbance to the existing sea bottom and minor adjustments were made to move away from rockier bottom areas (e.g. where nearest to St. Stephen's beach and where rounding Stanley Peninsular, as shown in ***Figure 1.2***), for easier burial.

Minimize Disturbance to Known Marine Archaeological Resources

Avoid impact and minimize disturbance to any known marine archaeological resources.

Other Submarine Cables and Pipelines

Minimize disturbance to existing submarine cables and pipelines, thereby ensuring that the HKA cable laying operations do not compromise the operation or integrity of other cables. This includes minimising crossings with other submarine cables and pipeline infrastructure situated along the proposed HKA cable route. Hong Kong waters have a number of existing cables and therefore crossings are unavoidable. Crossings have been minimised to route between existing cables and pipelines but given the congested nature of Hong Kong waters, some are unavoidable (see *Section 2.1.4*).

Other recommendations to maintain existing cable integrity will also be adhered to, with reference to the International Cable Protection Committee (ICPC)(1), European Subsea Cables Association (ESCA)(2) and North American Submarine Cable Association (NASCA)(3), in particular aiming to adopt a default minimum separation distance between cables of three times water depth from in service cables. Appropriate separation from existing cables and

(1) International Cable Protection Committee website available at https://www.iscpc.org/ [Accessed Nov 2018]

(2) European Subsea Cables Association website available at http://www.escaeu.org/ [Accessed Nov 2018]

(3) North American Submarine Cable Association website available at https://www.n-a-s-c-a.org/ [Accessed Nov 2018]

pipelines is important for successful and efficient repair operations if required in the future.

Other Physical Constraints

Avoid the anchorage areas south of Lamma Island and the deep water and old spoil ground between Po Toi and Beaufort Islands.

In addition, the cable should ideally avoid rocky outcrops on the seabed as cable installation in outcrop areas will require the cable to be surface laid or shallow burial, increasing the risk of cable damage due to vessel anchors and fishing activity during operation.

Gazetted Bathing Beaches

Direct routing to gazetted bathing beaches should be avoided insofar as practical, especially the swimming area (within the shark net). The gazetted CHK bathing beach has been avoided, being on the other side of the peninsular to the landing site. The landing site is situated directly opposite across Stanley bay from the gazetted St. Stephen's Beach and does not route within its boundary. The small landing site beach at Sha Shek Tan is not a bathing beach and is not one of the bathing beaches of Hong Kong Island as listed in the *Fourth Schedule to the Public Health and Municipal Services* (Cap. 132).

Minimize Disturbance at Landing Site

To minimize disturbance at the CHK landing site, the HKA cable will closely follow the route of the existing submarine cable shore ends.

1.6 DESIGNATED PROJECTS TO BE COVERED BY THE PROJECT PROFILE

The project is classified as a Designated Project (DP) under the *Environmental Impact Assessment Ordinance (EIAO)* as specified below and illustrated in ***Figure 1.2.***

- Schedule 2 (Part I), C.12 - A dredging operation which (a) is less than 500 metres from the nearest boundary of an existing or planned
  - (iii) bathing beach[1]; and
  - (vii) coastal protection area.

[1] Under Schedule 1 of EIAO, "bathing beach" is interpreted as any bathing beach specified in the *Fourth Schedule to the Public Health and Municipal Services* (Cap. 132). Since Sha Shek Tan is not a bathing beach under Cap.132, the proposed cable installation works at and within 500 m of Sha Shek Tan is not a DP. However, since the cable route falls within 500 m from the boundary of St. Stephen's Beach which is a bathing beach under Cap.132, the cable installation in this area would constitute a DP.

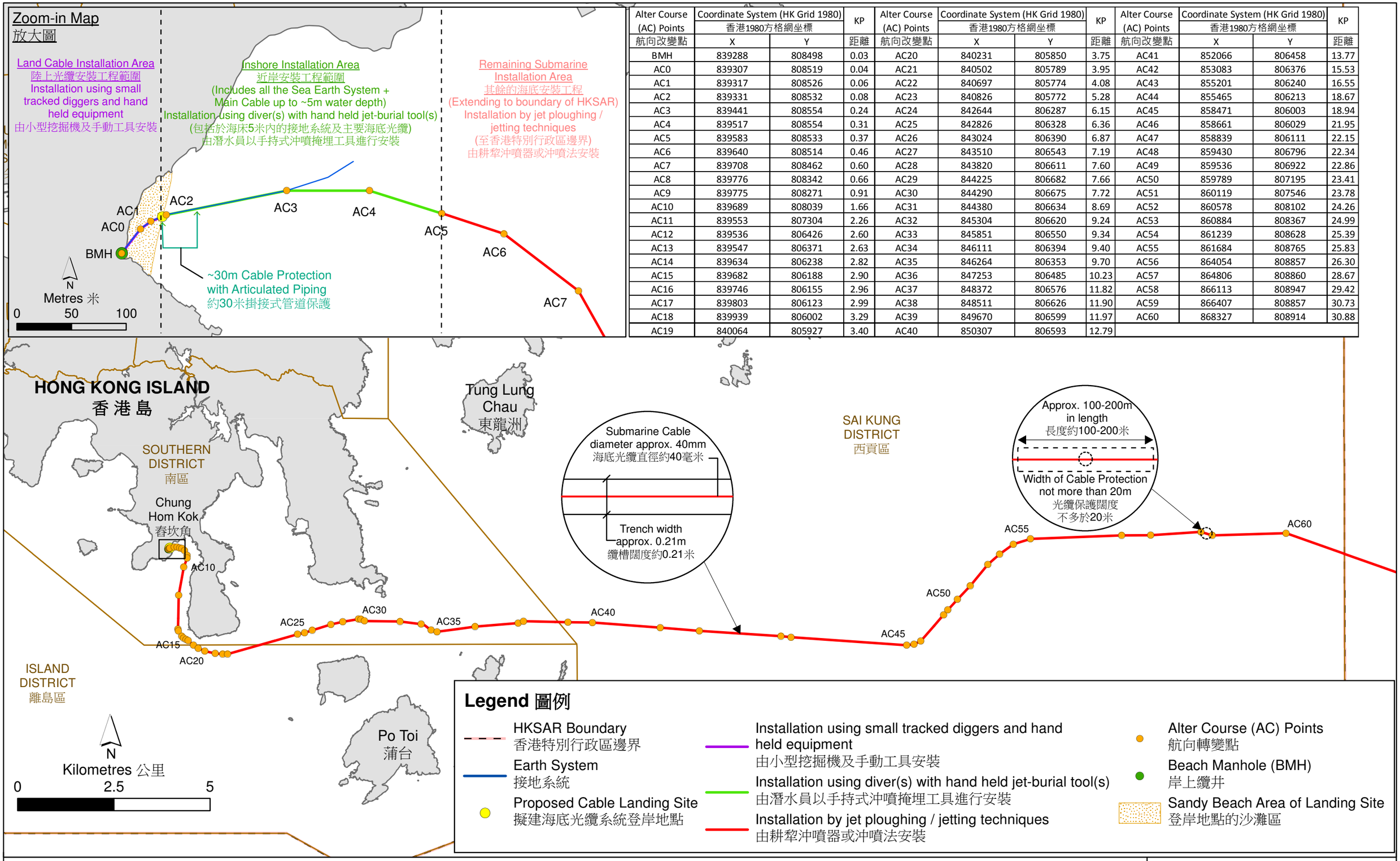
1.7 *NAME AND TELEPHONE NUMBER OF CONTACT PERSON*

Environmental Resources Management (ERM) has been appointed to undertake the environmental permitting for this Project. All queries regarding the project can be addressed to:

Environmental Resources Management
2507, 25/F One Harbourfront
18 Tak Fung Street, Hung Hom,
Kowloon, Hong Kong
Attention: Partner
Telephone: (852) 2271 3000
Fax: (852) 2723 5660

and

China Telecom Global Limited
38/F Everbright Centre
108 Gloucester Road
Wan Chai, Hong Kong, China
Attention: Zheng Qiuzeng
Telephone: (852) 3757 7737 OR (852) 6893 2185
zhengqz@chinatelecomglobal.com, and copy to
submarinecable@chinatelecomglobal.com



Alter Course (AC) Points 航向改變點	Coordinate System (HK Grid 1980) 香港1980方格網坐標 X	Y	KP 距離	Alter Course (AC) Points 航向改變點	Coordinate System (HK Grid 1980) 香港1980方格網坐標 X	Y	KP 距離	Alter Course (AC) Points 航向改變點	Coordinate System (HK Grid 1980) 香港1980方格網坐標 X	Y	KP 距離
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AC4	839517	808554	0.31	AC25	842826	806328	6.36	AC46	858661	806029	21.95
AC5	839583	808533	0.37	AC26	843024	806390	6.87	AC47	858839	806111	22.15
AC6	839640	808514	0.46	AC27	843510	806543	7.19	AC48	859430	806796	22.34
AC7	839708	808462	0.60	AC28	843820	806611	7.60	AC49	859536	806922	22.86
AC8	839776	808342	0.66	AC29	844225	806682	7.66	AC50	859789	807195	23.41
AC9	839775	808271	0.91	AC30	844290	806675	7.72	AC51	860119	807546	23.78
AC10	839689	808039	1.66	AC31	844380	806634	8.69	AC52	860578	808102	24.26
AC11	839553	807304	2.26	AC32	845304	806620	9.24	AC53	860884	808367	24.99
AC12	839536	806426	2.60	AC33	845851	806550	9.34	AC54	861239	808628	25.39
AC13	839547	806371	2.63	AC34	846111	806394	9.40	AC55	861684	808765	25.83
AC14	839634	806238	2.82	AC35	846264	806353	9.70	AC56	864054	808857	26.30
AC15	839682	806188	2.90	AC36	847253	806485	10.23	AC57	864806	808860	28.67
AC16	839746	806155	2.96	AC37	848372	806576	11.82	AC58	866113	808947	29.42
AC17	839803	806123	2.99	AC38	848511	806626	11.90	AC59	866407	808857	30.73
AC18	839939	806002	3.29	AC39	849670	806599	11.97	AC60	868327	808914	30.88
AC19	840064	805927	3.40	AC40	850307	806593	12.79				

Figure 1.1
圖 1.1

Proposed HKA Cable System
擬建港美 (HKA) 國際海底光纜系統路線

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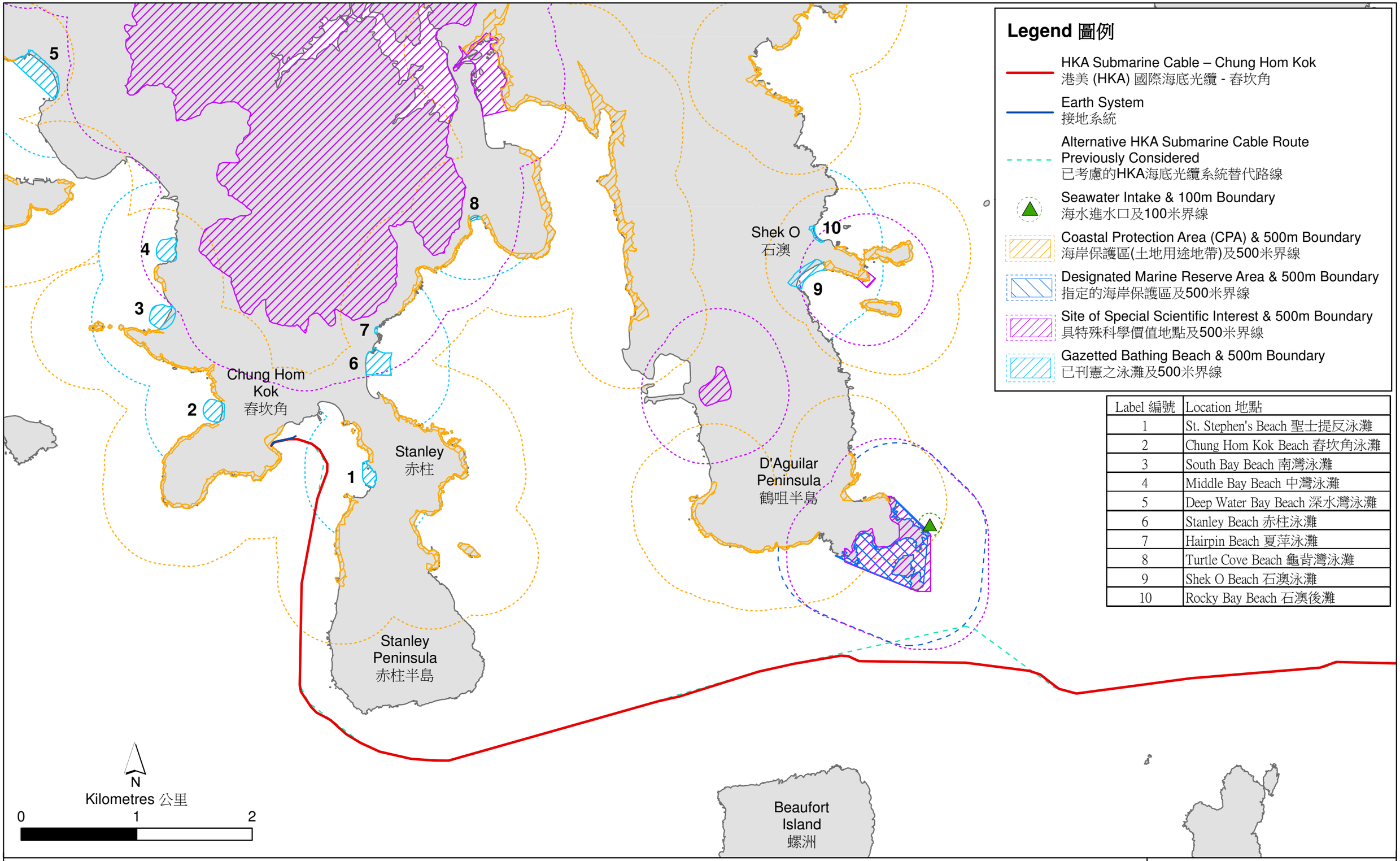
Date: 16/11/2018

Environmental Resources Management
ERM



Label 編號	Location 地點
1	St. Stephen's Beach 聖士提反泳灘
2	Chung Hom Kok Beach 春坎角泳灘
3	South Bay Beach 南灣泳灘
4	Middle Bay Beach 中灣泳灘
5	Deep Water Bay Beach 深水灣泳灘
6	Stanley Beach 赤柱泳灘
7	Hairpin Beach 夏萍泳灘
8	Turtle Cove Beach 龜背灣泳灘
9	Shek O Beach 石澳泳灘
10	Rocky Bay Beach 石澳後灘

Figure 1.2
圖 1.2

Proposed HKA Cable System Landing at Chung Hom Kok - Designated Project Elements
擬建港美 (HKA) 國際海底光纜系統路線於春坎角的登陸點 - 指定工程項目的元素

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Date: 30/10/2018

Environmental Resources Management
ERM

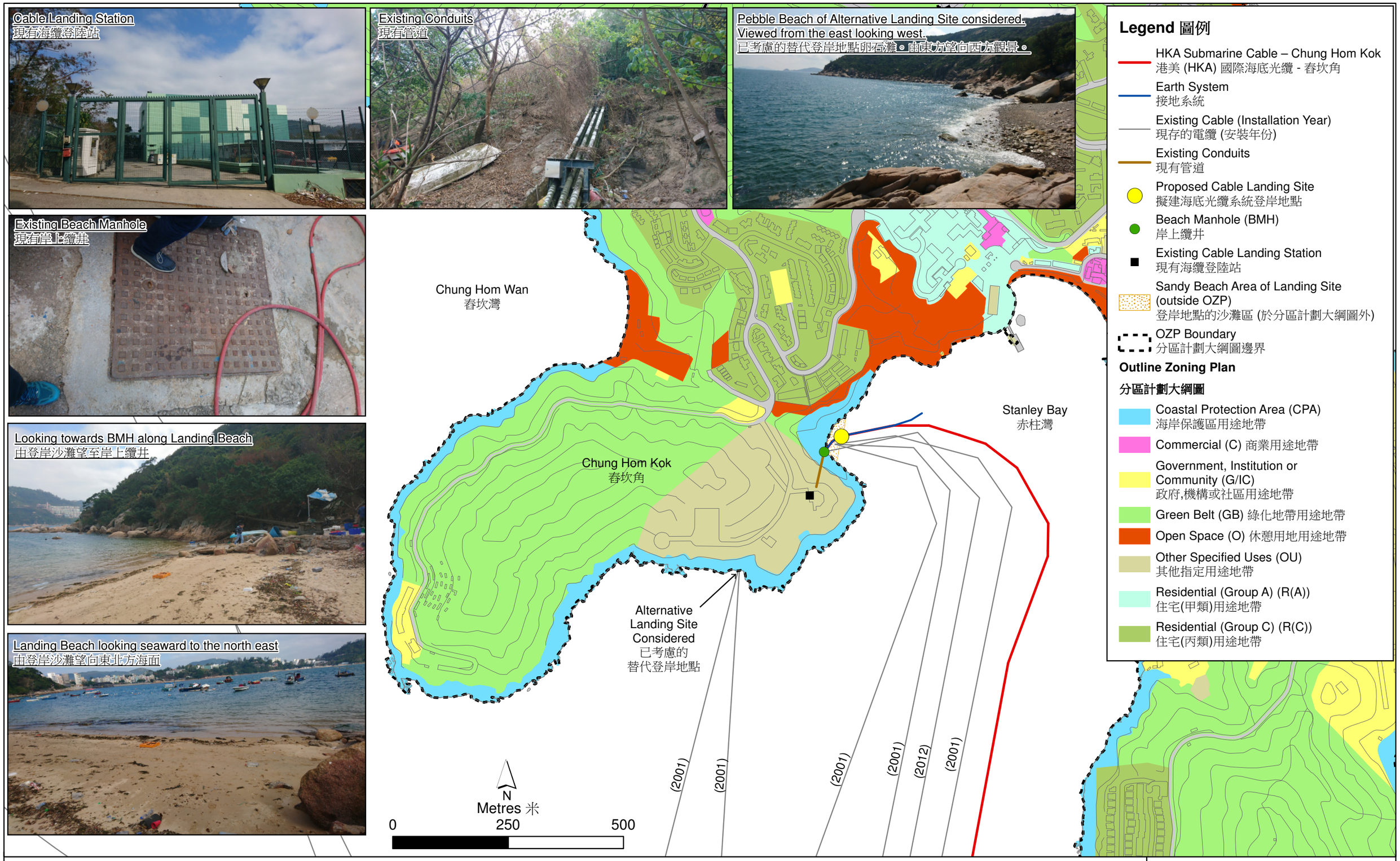

Figure 1.3
圖 1.3

Proposed Cable System Landing at Sha Shek Tan, Chung Hom Kok & area Outline Zoning Plan
位於春坎角沙石灘的擬建海底光纜系統登岸地點及其附近地區的分區計劃大綱圖

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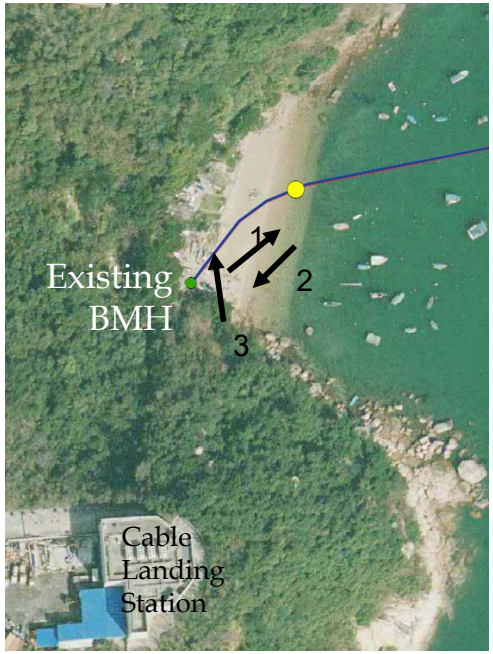
Date: 31/10/2018

Environmental
Resources
Management

ERM



Proposed HKA cable landing site
擬議港美光纜登岸地點

Beach Manhole (BMH)
岸上纜井

Proposed HKA cable alignment
擬議港美光纜定線

Proposed HKA earth system alignment
擬議港美光纜接地系統定線

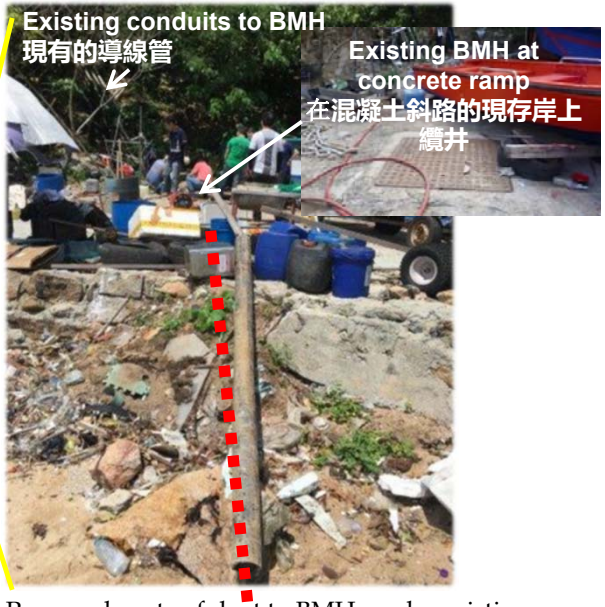
Proposed HKA duct (and cable) alignment under existing wall/ramp, to BMH
現存的牆/斜路下的擬議港美光纜管道(及電纜)定線至岸上纜井

Direction of Photograph Number
相片編號#的方向

Proposed estimated route at landing point (looking NE)
於登岸點的擬議估計路線(向東北)

Proposed estimated route from landing point along beach (looking SW)
由登岸點沿著海灘的擬議估計路線(向西南)

Landing Beach looking landward to the north
登岸灘(向北登岸)



Proposed route of duct to BMH, under existing supporting wall and concrete ramp
承重牆和混凝土斜路下連接至岸上纜井的擬議管道路線

Figure 1.4
圖1.4

DATE: 18/09/2018

Proposed Cable System Landing at Sha Shek Tan, Chung Hom Kok – Proposed Route from Landing Point to BMH
位於春坎角沙石灘的擬議海底光纜系統 –由登岸點至岸上纜井擬議路線

Environmental Resources Management

ERM

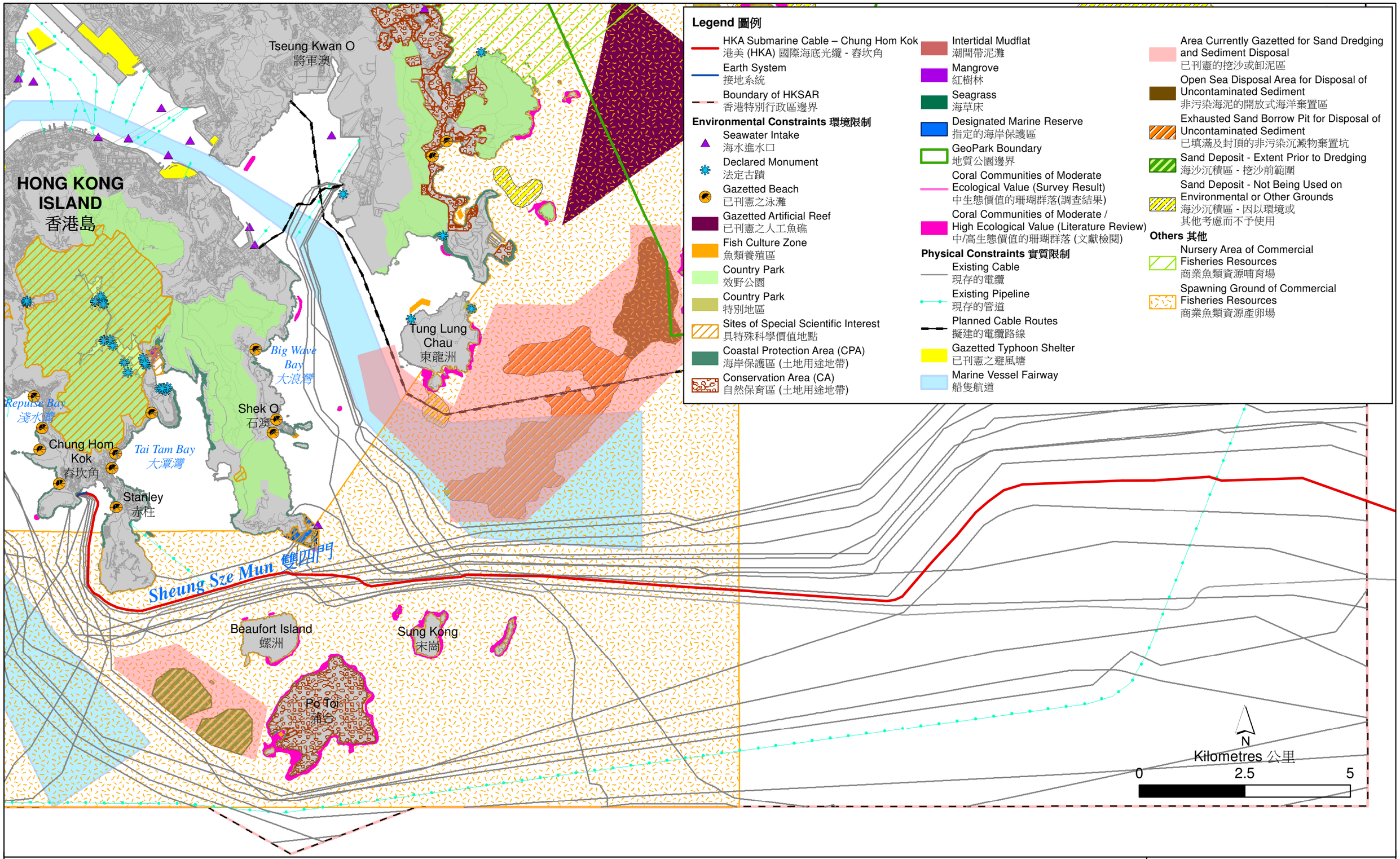


Figure 1.5
圖 1.5

Key Environmental & Physical Constraints
主要的環境及實質限制

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Date: 30/10/2018

Environmental Resources Management

ERM

2 OUTLINE OF PLANNING AND IMPLEMENTATION PROGRAMME

2.1 PROJECT PLANNING AND IMPLEMENTATION

The Project will be led and managed by CTG, part of the HKA Consortium. Planning and construction of the submarine cable system will be undertaken by ASN on behalf of HKA Consortium. The cable will be operated by CTG.

The Project is not expected to interact with any other projects and will include the following stages:

1. Preparation for Marine Cable Installation, including route clearance and pre-lay grapnel run;

2. Land Cable Installation (approximately 50 m between BMH & the Landing Point at LWM of Sha Shek Tan); and in existing facilities for approximately 100 m between BMH and CLS); and

3. Marine Cable Installation (from LWM of Sha Shek Tan (i.e. the Landing Point) to boundary of HKSAR waters (approximately 34 km), including diver burial from LWM of Sha Shek Tan (landing point) to location near the coastline where the installation barge will be set up (approximately 260 m).

This *Section 2* provides details on each of the above stages and goes on to provide other details associated with cable installation such as depth, earthing system, and cable/pipeline crossing procedures.

At cable operation (after installation), there may be a potential requirement for maintenance work (i.e. cable repair at particular fault location due to unexpected damage) to be carried out.

2.1.1 *Preparation for Cable Installation*

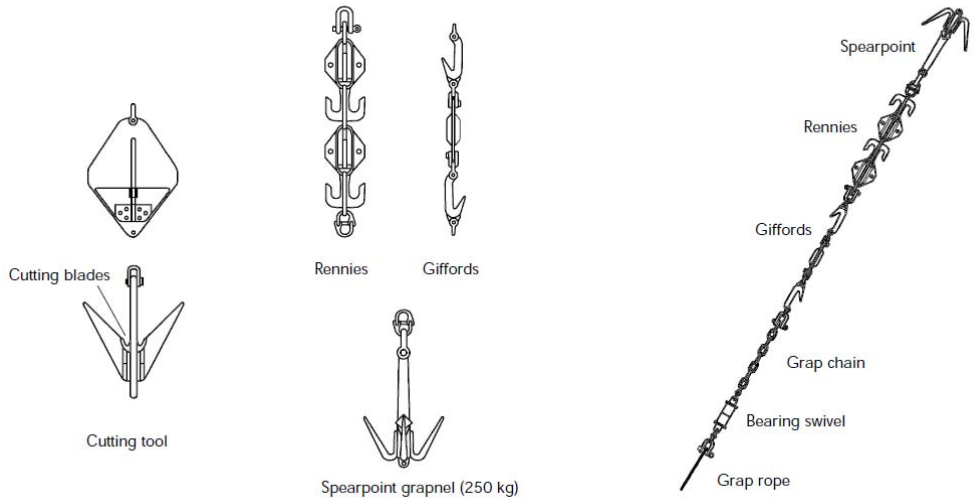
Prior to the HKA cable laying and burial, Route Clearance (RC) and/or Pre-Lay Grapnel Run (PLGR) will be conducted over the length of the proposed cable route for burial, to minimize the risk of later damage to the burial equipment and ensure an efficient installation. PLGR is designed to remove any surface debris (e.g. abandoned fishing nets, wire rope or other significant debris on the seabed surface) that would be an obstruction to the simultaneous cable lay and burial process. RC would remove any out-of-service (OOS) cables identified to be crossing or otherwise obstructing the proposed cable route.

The PLGR would be conducted by towing a grapnel along the proposed cable route before the actual cable installation, using grapnel fluke penetrating between 0.2-1 m into the seabed (subject to seabed conditions). The RC would be conducted using specialized grapnel with longer flukes penetrating up to 1.5 m (or may be supported by diver hand-jetting and manual diver cutting during installation where OOS cables buried outside the normal reach of specialized grapnel) and a section of the OOS would be cut/removed to allow

the installation and burial process to continue. Typical grapnel gear is presented in ***Figure 2.1***.

All debris recovered from the seabed will be disposed appropriately to an approved dumping ground.

Figure 2.1 ***Typical "Grapnel Gear" used to penetrate seabed, grip, cut and recover cable***



RC/ PLGR operation(s) are intended to be carried out along the entire proposed cable route over a short period of time (see *Section 2.2* for the tentative timeline). The actual areas covered will likely be reduced and restricted subject to the detailed findings of marine route survey (e.g. detailing rocky outcrops/ cable crossings which may prevent PLGR).

2.1.2 *Land Cable Installation*

CTG, is the Project Proponent for Hong Kong, and will provide the BMH, ducts linking the BMH with the Cable Landing Station (CLS) and space within the CLS for the HKA system.

Low Water Mark (LWM) - Beach Manhole (BMH)

On land down to LWM, the construction activities will entail construction of new ducts from the BMH to the supporting wall, trench excavation along the beach, cable laying, installation of articulated pipes on the cable and back filling.

For the construction of new ducts, holes (approximately 0.1 m diameter) will be drilled from inside the BMH near the top, through the BMH wall (approximately 0.2 m thick) to the edge of the concrete ramp; a groove (up to approximately 0.8 m wide x 1.0 m deep x 5 m long) will be cut across the existing concrete boat ramp; and a concrete footing (approximately 0.5 m x

0.6 m x 1.3 m) with duct fittings built at the supporting wall (see ***Figure 2.2*** and ***Figure 1.4***). Boulders at the seawall will be temporarily moved to allow construction of the concrete footing, and will be reinstated following cable installation through the duct, with the ramp groove also restored with concrete to its original state.

Typically, the new duct installation and reinstatement will be carried out using hand held drilling equipment, diamond disk cutter and jackhammers. The beach excavation will typically be carried out using small tracked diggers (see ***Figure 2.3***) and any equipment that cannot be carried in by hand, including small tracked diggers, will be brought in by sea. A backhoe machine and hand tools will be used to form a trench of approximate dimension 0.5 m (width) x 2.0 m (target depth) along the beach.

Approximately 5.0 m^3 of excavated materials are estimated to be produced when drilling through the BMH wall and cutting the groove across the existing concrete boat ramp. The majority of this volume is expected to be sand and stones under the boat ramp, which will be backfilled once the ducts are installed. Approximately 1.2 m^3 of inert concrete waste will be handled and disposed of in accordance with the *Waste Disposal Ordinance*. The use of small tracked diggers allows the excavation to be completed quickly and minimise the nuisance and the excavated materials associated with the beach trench will be reused to backfill the trench such that the beach will be reinstated to its original, pre-Project condition. The cable will pass via the duct into the BMH, typically by small winch or hand pulling.

Figure 1.3 and ***Figure 1.4*** show the proposed land routing of the HKA cable at CHK from the landing point to the BMH (and up to the CLS), while ***Figure 2.2*** (and ***Figure 1.4***) provides an overview photograph of the landing site. After the cable has been laid, the boat ramp and beach will be reinstated to the original condition.

Figure 2.2 ***Landing Site Overview***

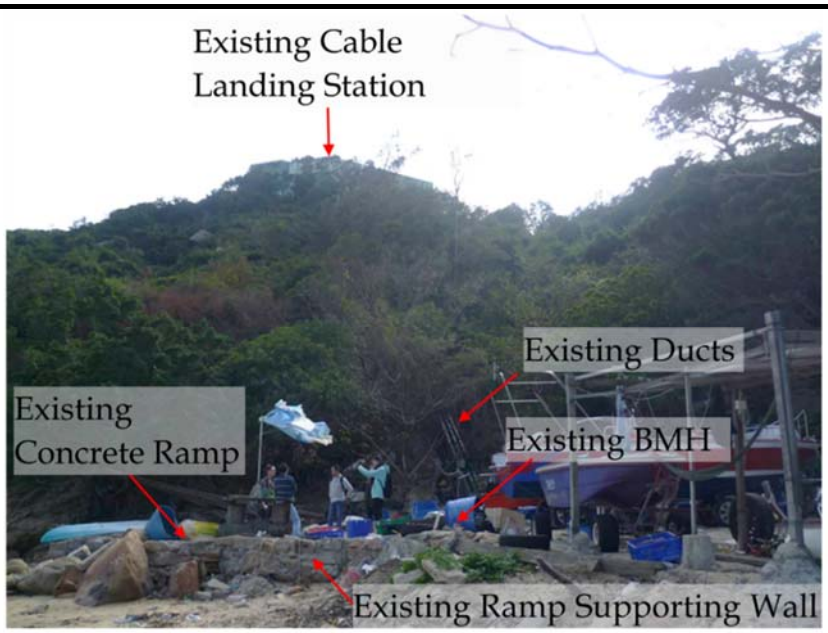


Figure 2.3 ***Example Small Tracked Digger for Beach Trenching Works***

Beach Manhole (BMH) - Cable Landing Station (CLS)

In order to complete the link between the BMH and the CLS, the land cable will be installed in an existing terrestrial conduit. The method of installation will be by hand pulling from the BMH or CLS.

2.1.3 Marine Cable Installation

Inshore installation

First, the cable installation barge will set up as close as possible to the shore for the cable landing and a work boat will bring the cable ashore, attaching floats as it goes. Once the cable has been hauled ashore and is secured on the beach, the floats are cut away and the cable route adjusted on the seabed by divers (if required). Divers will install articulate pipes (see ***Figure 2.4***) onto the cable up to, approximately 30 m from the landing point, to offer additional protection to the cable.

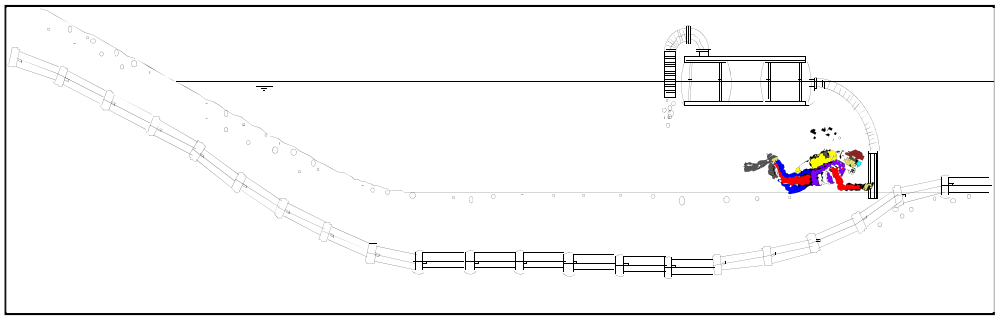
Figure 2.4 ***Typical Articulated Pipes***

Articulated pipes ready for installation

Articulated Pipes covering a cable prior to burial

Cable burial for the inshore segment near the LWM will be undertaken using a diver operated hand-jet burial tool as indicated in ***Figure 2.5*** and be used for approximately 260 m of cable from the landing site, as indicated in ***Figure 1.1***.

Figure 2.5 ***Typical Cable burial by Divers using Jet Probes***



Diver jetting burial

Remaining Submarine Installation to boundary of HKSAR

For the remaining submarine installation after the inshore installation, the cable will be loaded onto a purpose-built cable installation barge with cable burial tool. The barge will lower the cable burial tool to the target burial depth at the shore end position and install out to the boundary of HKSAR waters.

Most of the marine cable burial works will be conducted using jetting technique. This method uses "Injector Burial Tool" or "Sledge Tool" which are designed to simultaneously lay and bury the cable (***Figure 2.6*** and ***Figure 2.7*** with indicative photographs in ***Figure 2.8***). Using these methods, the injector fluidises a trench using high pressure water jets and the cable is immediately laid within the trench. The expected maximum width of the seabed fluidised by the injector is approximately 105 mm either side of the centre line of the proposed cable

route (i.e. 210 mm width) and the cable is buried to a depth of 5 m. The cable itself is expected to occupy only no more than 40 mm width for the majority of the marine route and 135 mm width along the marine route where there is articulated pipe protection i.e. approximately 30 m from the landing point.

It should be noted that the seabed can be expected to naturally reinstate to before-work level and condition shortly after completion of the works.

See *Section 2.2* for the full proposed schedule of works for all elements of the Project.

Figure 2.6 Simultaneous Cable Lay and Burial Operation using "Injector Burial Tool"

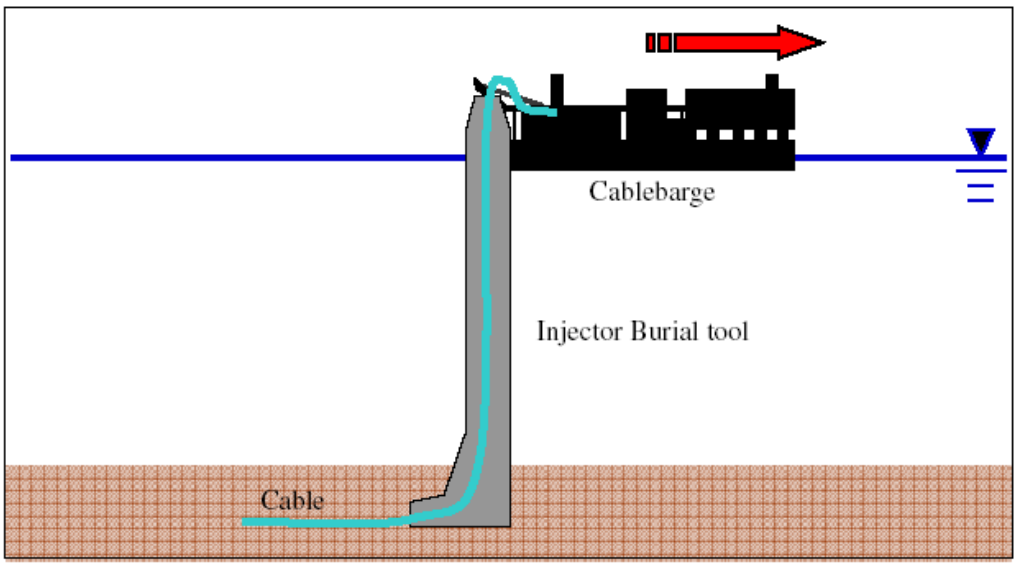


Figure 2.7 Simultaneous Cable Lay and Burial Operation using "Sledge Tool"

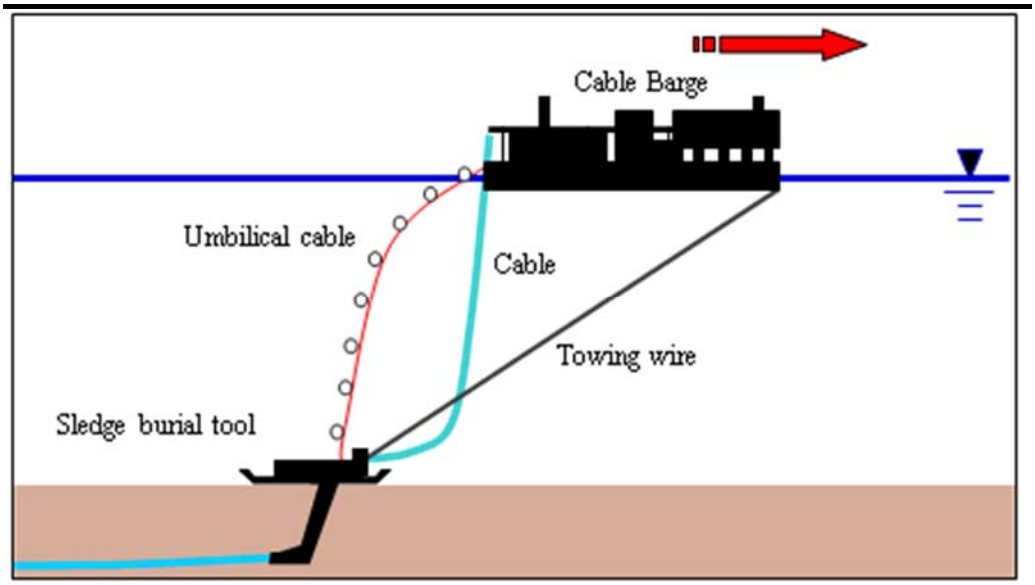


Figure 2.8 *Equipment for Simultaneous Cable Lay and Burial Operation using "Sledge Tool" or "Injector Tool" Typical installation barge*

Typical Cable Installation Vessel / Barge using Sledge Tool

Typical Cable Installation Barge/
Vessel using Injector Burial Tool

Typical Injector Burial Tool

Typical Remotely Operated Vehicle (ROV)

Typical Sledge Tool

2.1.4 *Other Cable Installation Details*

Burial Depth

The HKA cable segment between the Low Water Mark (LWM) and Beach Man Hole (BMH) on land will be buried to a target of 2 m below the soil level or when the burial tool meets bedrock (whichever comes first). Between the LWM and the location near the coastline where the installation barge will be set up, burial will transition to 5 m below seabed/mudline at i.e. burial will increase from 2 m to 5 m at the barge. The installation barge will deploy the burial tool from this location up to where the cable leaves HKSAR waters, burying the cable to 5 m depth. Shallower burial depth is foreseen at cable/pipeline crossings (see below). It should be noted that the seabed will be naturally reinstated by currents to before-work level and condition very shortly.

Cable/ Pipeline Crossing

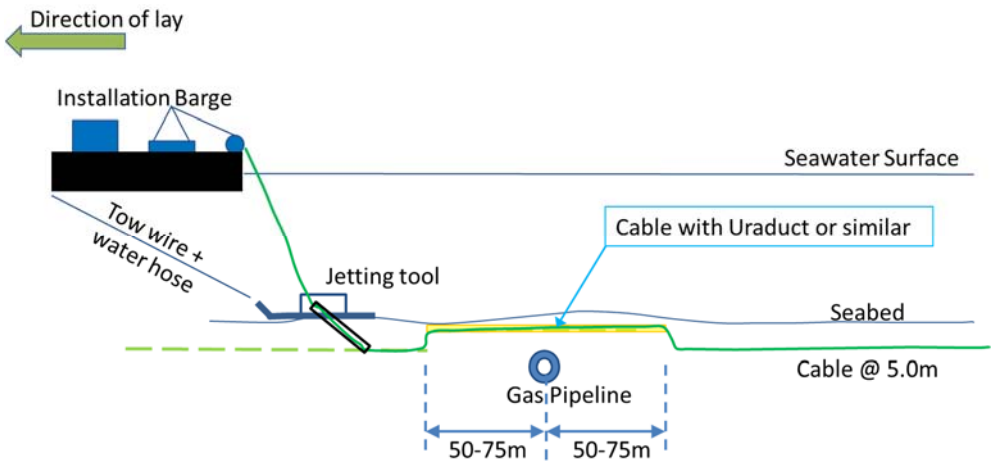
There are some areas where cables or pipelines will be crossed and the HKA cable burial depth will be shallower. Currently the HKA cable route is anticipated to cross ten (10) in-service cables fourteen (14) times, and 5 OOS cables eleven (11) times, as well as one (1) utility gas pipeline once.

For crossing existing cables, this is expected to involve shallow burial or surface lay, subject to the as-built burial depth of the existing cables and taking due care to ensure the integrity of all cables. Final details will be subject to cable crossing agreements with existing cable owners and will follow the ICPC guidelines where possible. A cable localization operation will be performed at cable crossing points. The exact location of existing cables will be identified referencing the cable Route Survey data and using a submersible tone/magnet detector operated by diver or from a remotely operated vehicle (ROV). The localization operation will be scheduled to take place before the actual cable laying operation. To ensure a smooth operation, all cable crossing points will be confirmed before the start of the operation.

Where the cable crosses the Hong Kong Electric Gas Pipeline close to the boundary of HKSAR waters owners will mutually agree the crossing procedure. Cable owners wish to simultaneous lay and bury the cable as deep and as close to the pipeline as possible, to maximize cable protection, and this will depend on pipeline burial depth as found during the Route Survey.

It is foreseen that the HKA cable should cross the pipeline approximately 1.5 m above the top of the pipeline. This operation may be accommodated by the burial tool with jetting legs raised to a reduced burial depth at the pipeline crossing. Alternatively, a short section of the cable will be diver jetted to the depth possible/agreed while the installation barge is at the crossing position. Burial tool will then be deployed and continue on the other side of the pipeline. ***Figure 2.9*** provides a schematic illustration of the potential pipeline crossing. The cable will be protected by URADUCT® or similar protection for approximately 100-150 m at the pipeline crossing.

Figure 2.9 Indicative Schematic Illustration of Gas Pipeline Crossing



Earthing System

The cable system will include a 'system earth' which is a dedicated earth for the power feed equipment (PFE), installed at the terminal station. This is sometimes called an ocean ground bed (OGB) and is preferably, but not always, located near the beach manhole (BMH), and connected to the terminal station with an earth return cable.

Selection of the type and location of the 'system earth' is carried out during the land cable route site survey and parameters for selection include the availability of suitable land, local permit restraints and soil resistivity, when deciding to take the form of earth rods buried underground or an earth plate off-shore.

For this Project, the 'system earth' will be an OGB, taking the form of a 2-metre diameter steel 'earth plate', approximately 25 mm thick and with an overall weight of approximately 900kg (See ***Figure 2.10***), buried just off-shore (approximately 300 m from the BMH) at a minimum water depth of 3 metres. Divers will excavate a shallow hole for the earth plate, typically minimum 1 m depth (subject to sediments), using diver hand held suction method or similar. The sea earth plate will be lowered into the shallow hole and sediments expected to naturally backfill over time, with the sea earth plate sinking further into the seabed due to its weight and gravity if the seabed sediments are soft. The earth cable will be approximately 300 m long and connect to the BMH and the sea earth plate. It will share the same trench as for the fibre-optic submarine cable on the beach and in the water as long as required, before following a separate proposed route (see ***Figure 1.3***). Using same method as the fibre-optic submarine cable, divers will install articulated pipes and bury using diver-jetting.

Figure 2.10 Example Circular Steel Earth Plate

2.1.5 *Cable Operation (After Installation), including Maintenance and Repair.*

During operation there may be a potential requirement for maintenance work to be carried out (i.e. cable repair at particular fault location due to unexpected damage). These works will be similar in nature to cable installation works described in *Section 2.1.1-2.1.4*. Should repair operation be required, mitigation measures proposed for the construction phase will be implemented as outlined further in *Section 5.*

For land based repairs, the equipment and methods will be the same as for cable installation works, as outlined in *Section 2.1.2*.

For inshore and submarine cable repairs, equipment and methods would again be similar to those outlined in *Section 2.1.3* but not along the full alignment, i.e. of smaller scale, with the potential to use smaller equipment such as Remotely Operated Vehicles (ROVs) equipped with injector tool and divers with hand held tools (as shown in ***Figure 2.5***).

The repair works process for shore end and marine works is outlined below:

- **Terminal Testing**: Testing from cable station terminal, to try and determine fault location as precisely as possible using optical or electrical characteristics of the submarine cable;

- **Initial Inspection**: Cable will be inspected using ROV or divers where appropriate to determine the precise fault location and nature if unknown. If the cable is buried, tracking equipment will be used;

- **Cut Faulty cable, Buoy off, Recover to vessel:** If necessary to cut the cable at the fault area, either an ROV or grapnels will be used, or if feasible, divers. Divers use hand-jetting and ROV use jetting technique to uncover buried cable. Grapnels penetrate the seabed without jetting to pick up the cable and ***Figure 2.1*** shows typical grapnel gears used to penetrate the seabed, and grip, cut and recover cables. The cable ends will be recovered

to the vessel, using diver, ROV or gripper grapnels. While one cable end is repaired on the vessel, the other cable end will be attached to a rope that is lowered to seabed and this rope will be attached to a buoy to mark its location. Typical buoys are shown in ***Figure 2.11***.

- **Cable Splice and Repair:** Damaged cable section will be cut out. First one end will be spliced to the spare repair cable section and electrical and optical testing conducted to ensure the integrity of the splice and cables. Then the second cable end will be picked up and spliced back to the repair cable section. Upon completion, the cable integrity will be confirmed through end-to-end electrical and optical testing.

- **Replacement of Repaired Cable:** Once the cable has been fully repaired and connected, it will be lowered onto the seabed, along the 'as-laid' cable route. Any protective measures, such as articulated piping (nearshore only), URADUCT® (pipeline crossings only) or other means would be added to the cable prior to re-laying. Once the repaired cable is in the 'as-laid' cable route alignment, a diver or ROV will perform an inspection of the repair area, including determining the beginning and ending of unburied cable.

- **Post Lay Inspection and Burial (PLIB):** Should burial at the repair area be necessary, it will be carried out to best endeavour or pre-determined target depth, using diver or ROV jetting up to 3 m or burial tool if deeper. If burial is not possible, other means of protection may be considered such as articulated piping, URADUCT® or other means. Once completed one final diver or ROV inspection and burial (PLIB) will be carried out before repair works are completed.

Figure 2.11 Typical buoy types used for connecting to cable end by rope

2.2 PROJECT PROGRAMME

The HKA cable system is provisionally scheduled to be landed and installed at CHK commencing in the Quarter 1 of 2020.

The expected construction schedule within the HKSAR is as presented in ***Table 2.1*** noting that some phases of work may overlap. Overall, the marine cable installation during Construction (not including RC and/or PLGR or post-lay works or any weather downtime and some contingency) is expected to be up to 30 working days.

Table 2.1 Tentative Construction Schedule

Cable Installation Stage	Tentative Timeframe
Preparation for Cable Laying & Burial	
- Route Clearance (RC) and/or Pre-Lay Grapnel Run (PLGR), if necessary.	Up to an estimated 36 working days (Subject to detailed findings of marine route survey and number of OOS crossings identified for the final route)
Land Cable Installation*	
– Works on the landing beach between landing point and BMH (~50m)	Up to 9 working days
Marine Cable Laying & Burial	
Works between BMH and boundary of HKSAR, consisting of (as described in S2.1.3 and shown in ***Figure 1.1***):	Total: within 30 working days under normal weather conditions, consisting of approximately:
i) inshore cable installation (up to ~260 m seaward from landing point)	i) Up to 8 working days
ii) remaining submarine cable installation to boundary of HKSAR (from ~260 m to boundary of HKSAR)	ii) Up to 22 working days

* Works between BMH and CLS can be carried out independently of installation to BMH with cable spliced together at BMH.

All cable installation/ repair works are expected to be undertaken during non-restricted working hours, i.e. between 0700 and 1900 hours on any day not being a general holiday or a Sunday. If works during restricted hours are later found to be necessary, a Construction Noise Permit (CNP) will be applied for.

The cable is expected to be operational for a minimum of 25 years. Duration of any cable repair work during operation is anticipated to be of shorter duration than cable installation during construction.

3 MAJOR ELEMENTS OF THE SURROUNDING ENVIRONMENT

Figure 3.1 shows the major elements of the environment surrounding the proposed cable alignment and details are provided below.

3.1 MAJOR VESSEL FAIRWAYS

The East Lamma Channel and Tathong Channel are both major vessel fairways with Traffic Separation Schemes and the proposed cable corridor has avoided crossing either of these major vessel fairways and is at least 500 m from either.

3.2 GAZETTED MARINE FACILITIES

There are no gazetted marine facilities in the proposed cable corridor.

3.3 CABLE, PIPELINES AND OUTFALLS

There are a number of existing submarine telecommunication cables located at the cable landing site at CHK. The proposed routing of the cable corridor aims to reduce the number of crossings of existing cables and avoid or minimize crossing any of the existing pipelines and outfalls.

3.4 OTHER PROPOSED FACILITIES OR AMENITIES

At present, there are no other known proposed marine facilities or amenities that the cable corridor will cross.

3.5 GAZETTED BATHING BEACHES

The landing site is situated at a non-gazetted sandy beach (Sha Shek Tan) on the east side of Chung Hom Kok Peninsula, facing Stanley Bay. The gazetted Chung Hom Kok Beach is the other side of the peninsular and other gazetted Stanley Main Beach, Hairpin Beach, South Bay Beach, Middle Bay beach and Turtle Cove Beach are all over 500 m away from the cable landing site and the cable alignment. The cable alignment passes within 500 m of St. Stephen's Beach (approximately 310 m to the gazette boundary of St. Stephen's Beach and 400 m to the beach itself) as shown in ***Figure 1.2*** and this is considered further within *Annex A*.

3.6 COASTAL PROTECTION AREA

The HKA cable route landing point at Sha Shek Tan, CHK connects to land at a Coastal Protection Area (CPA), as designated by the *Town Planning Ordinance, Hong Kong Town Planning Board Hong Kong Planning Area No. 19 – Approved Stanley Outline Zoning Plan No. S/H19/12*, and is shown in ***Figure 1.3*** and ***Figure 1.4.*** As stipulated in the Explanatory Statements attached to the

statutory notes for the CPA, the intention of such zoning is "*to conserve, protect and retain the natural coastlines and the sensitive coastal natural environment, including attractive geological features, physical landform or area of high landscape, scenic or ecological value, with a minimum of built development*".

The HKA cable will connect to an existing BMH and existing ducts leading from the BMH up to the CLS, with some minor temporary excavation works necessary to establish a duct into the BMH from the beach, as outlined in *Section 2.1.2.* Minimal, temporary beach works are required as outlined in *Section 2.1.2.* Overall, for the cable installation within CPA, only a small amount of existing concrete and soft sand will be removed and reinstated. The impacts associated with the Project are temporary and upon completion of the installation, the site will be reinstated to its original, pre-Project condition and the Project will not be noticeable except for markers posting the location of the cables. No flora or fauna will be adversely affected and no geological features disturbed and overall no ecological impacts due to these Project works in the CPA are anticipated.

The entire coast in the vicinity of the CLS has been zoned as CPA (see ***Figure 1.3***), therefore routing through CPA zone is unavoidable. It should be noted that several other cable systems have landed through the CPA at this site into the same BMH and are in operation in the proximity of the Project, connecting to the same existing CLS at Chung Hom Kok and this Project will share some existing facilities with them.

3.7 SEAWATER INTAKE

There is no seawater intake within 500 m of the Project alignment. The nearest seawater intake is located at Cape d'Aguilar (see ***Figure 3.1***), being the seawater intake for The University of Hong Kong Swire Institute of Marine Science positioned over 1 km from the cable alignment.

3.8 SITES OF SPECIAL SCIENTIFIC INTEREST

The closest Sites of Special Scientific Interest (SSSI) are the Tai Tam Reservoir Catchment Area SSSI, Nam Fung Road Woodland SSSI and Deep Water Bay Valley SSSI, located approximately 1 km, 4.7 km and 4.5 km respectively away from the cable landing site. These SSSIs are terrestrial in nature and more than 1 km away from the landing site. Hence, these areas will not be affected in any way by the Project.

Regarding SSSIs with a marine element, one at Cape d'Aguilar (named 'Hok Tsui (Cape D'Aguilar) SSSI' and important both ecologically and geologically), is located approximately 610 m away from the proposed cable alignment at its nearest point (See *Annex B,* ***Figure B1***). Other SSSIs with a marine element, such as Tai Tam Harbour (Inner Bay) and Sham Wan SSSI are over 3 km and 7 km respectively away from the cable alignment route.

As detailed in *Section 4.2.2*, it is expected that the maximum distance of transport for suspended sediments from Project works would be 180 m and would settle onto the seabed in less than 4 minutes (see *Annex A* for details), hence any sediment plume due to the Project works would not be expected to reach any of the identified SSSIs and overall no anticipated impact is foreseen in these areas.

3.9 CAPE D'AGUILAR MARINE RESERVE

Cape d'Aguilar Marine Reserve was designated in July 1996, comprising 20 ha of marine area, in order to further protect the Hok Tsui (Cape d'Aguilar) SSSI at the top of the peninsular (***Figure 3.1***). It was established exclusively for the conservation of marine resources, scientific research and public education. Fishing, collecting animals and plants, as well as certain activities such as water-skiing, boating, swimming and diving are prohibited in the marine reserve. The marine reserve is approximately 640 m to the north of the proposed route of the submarine telecommunication cable and discussed further in *Section 4.4*.

3.10 CORAL COMMUNITIES

There are coral communities of ecological importance at the south of Kau Pei Chau of Cape d'Aguilar, along the south-eastern coast and north of Beaufort Island, at Sung Kong Islet and the northern coast of Sung Kong as well as along the entire coast of Po Toi which is further from the proposed alignment (***Figure 3.1***). The shortest distances from the cable alignment to the closest coral communities near Kau Pei Chau, Beaufort, Sung Kong Islet, and Sung Kong are approximately 580 m, 860 m, 510 m and 720 m respectively and are further discussed in ***Annex B***.

3.11 CULTURAL HERITAGE

No declared monuments, proposed monuments, graded historic sites / buildings, and government historic sites identified by the Antiquities and Monuments Office are located in the vicinity of the proposed cable alignment or in the area surrounding the cable landing site. The land- based Chung Hom Wan Site of Archaeological Interest, where middle Neolithic period (c. 4000-2500 BC) archaeological deposits have been discovered, is approximately 470 m away from the cable landing site at Sha Shek Tan (see ***Figure 3.2***).

A marine archaeological assessment of the area has been conducted based on a review of previous marine archaeological investigation (MAIs) and marine archaeological assessment conducted, historical records and admiralty charts and review of geophysical survey data from the MAI Study Area (***Annex E***). One wreck (W1) as shown in ***Figure 3.2***, is recorded by the United Kingdom's Hydrographic Office (UKHO) but it has been designated 'Dead', and no longer exists. This was confirmed through not being able to locate any material on the seabed at the wreck location when reviewing the geophysical data.

There is a lot of debris in the MAI Study Area of which only one is a possible wreck (SC246), being 198 m from the cable, and one considered to be man-made debris (SC072), which is 38 m from the cable. None of the other debris in the MAI Study Area is within 5 m of the cable and none of it is considered to be man-made material with archaeological interest. Upon close review, the possible wreck (SC246) and the one man-made piece of debris (SC072) are not considered to be objects of marine archaeological significance.

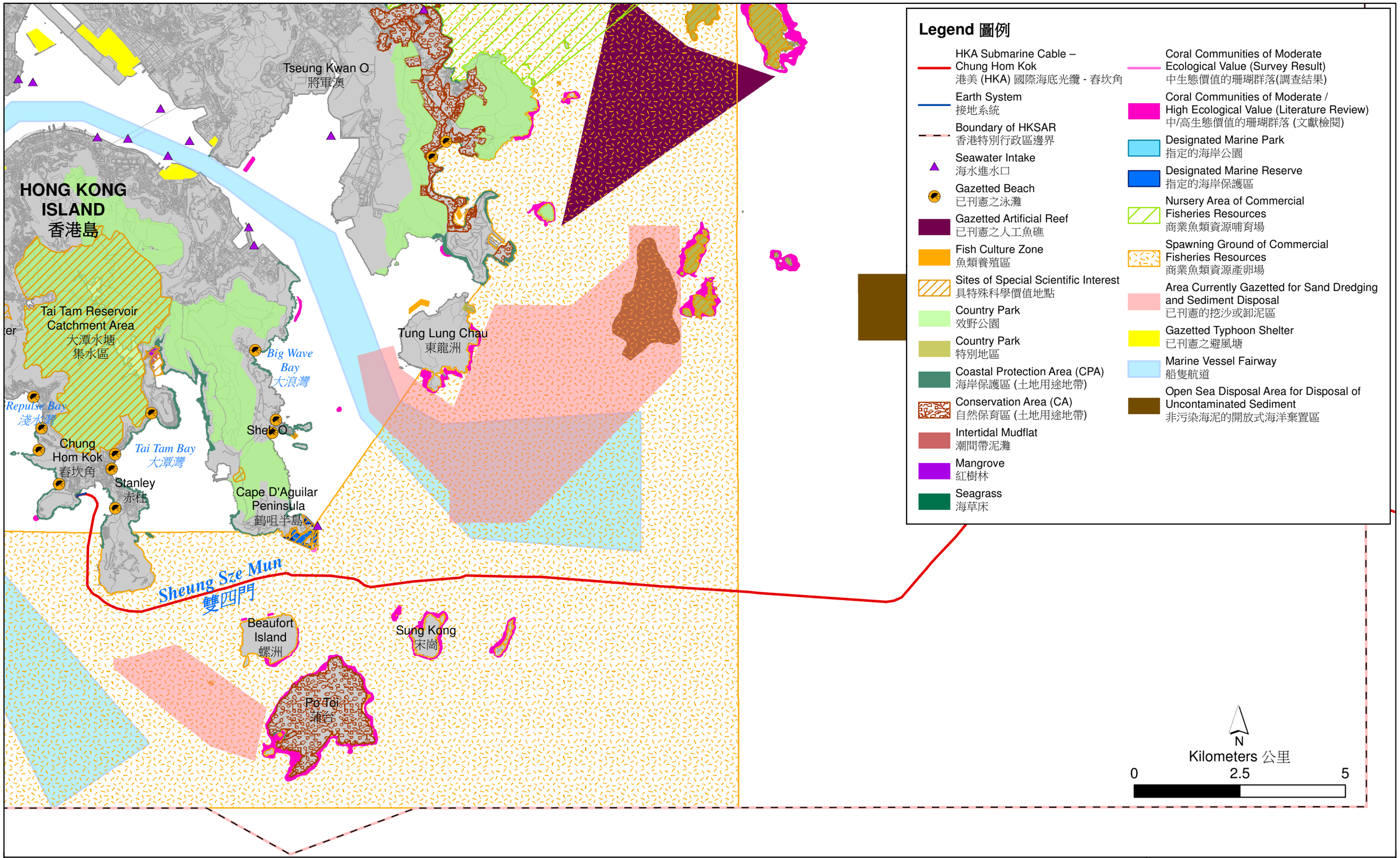


Figure 3.1
圖 3.1

Major Elements in the Surrounding of the Proposed Cable System
擬建的海底光纜系統附近的主要元素

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Environmental Resources Management

ERM

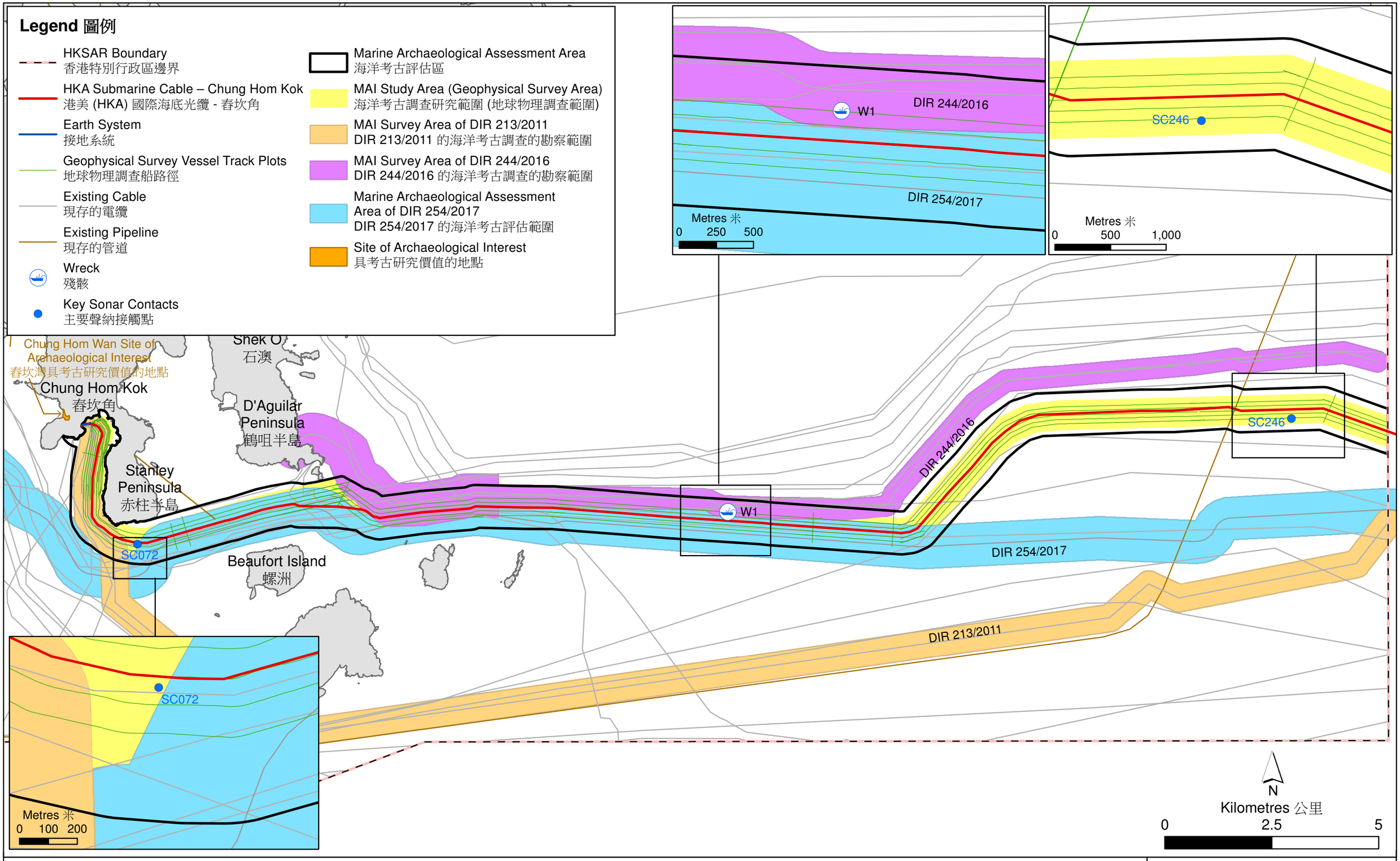

Figure 3.2
圖 3.2

Marine Archaeological Assessment Area, MAI Study Area and Closest Location of Land-based Site of Archaeological Interest
海洋考古評估區、海洋考古調查研究範圍及最近的陸上具考古研究價值的地點

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Environmental Resources Management

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4 POSSIBLE IMPACTS ON THE ENVIRONMENT

4.1 SUMMARY OF POTENTIAL ENVIRONMENTAL IMPACTS

The HKA cable system installation/repair process in HK SAR waters will require minor works within the marine environment and only small scale construction works at the cable landing site, to enable the cable to enter the existing BMH and connect to the Cable Landing Station at Chung Hom Kok. The construction, normal operation and potential repair during operation impacts associated with the proposed HKA cable system are summarised in *Table 4.1* and elaborated on in the following sections.

No environmental impacts are expected to occur during the normal operation of the submarine cable system. There is a potential requirement for maintenance work (i.e. cable repair at particular fault location due to unexpected damage) to be carried out during operation and *Section 4.10* addresses the potential impacts associated with these works.

Table 4.1 Potential Sources of Environmental Impacts

Potential Impact	Construction	Normal Operation	Potential Repair during Operation*
• Liquid Effluents, Discharges, or Contaminated Runoff	×	×	×
• Disruption of Water Movement or Bottom Sediment	✓	×	✓
• Generation of Waste or By-products	×	×	×
• Unsightly Visual Appearance	×	×	×
• Ecological Impacts:			
- Terrestrial	×	×	×
- Marine	✓	×	✓
- Fisheries	✓	×	✓
• Dust	×	×	×
• Noise	✓	×	✓
• Cultural Heritage	×	×	×
• Gaseous Emissions	×	×	×
• Odour	×	×	×
• Night-time Operations	×	×	×
• Traffic Generation	×	×	×
• Manufacturing, Storage, Use, Handling, Transport, or Disposal of Dangerous Goods	×	×	×
• Hazardous Materials or Wastes, including Potentially Contaminated Materials	×	×	×

Potential Impact	Construction	Normal Operation	Potential Repair during Operation*
• Risk of Accidents Which Result in Pollution or Hazard	×	×	×
• Generation of Waste and Disposal of Spoil Material	✓	×	×

Notes: ✓ = Potential to result in adverse impacts
× = Not expected to result in adverse impacts
* = Potential adverse impacts are expected to be less than during construction due to duration of any cable repair work during operation anticipated to be of shorter duration than cable installation during construction, repair work generally covering point location rather than full cable alignment within HK SAR waters, and potential to use smaller or less powerful equipment e.g. ROV rather than Injector Tool (see *Section 4.10*)

4.2 WATER QUALITY

4.2.1 *Land Based Activities*

The potential impacts to water quality during the land-based cable installation activities 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.

- The machinery employed will be inspected prior to work to ensure the waters and beach will not be polluted with oil/grease/fuel. No machinery maintenance will be carried out onsite. Oil absorbent materials will be readily placed on site and will be applied immediately should any oil leakage incidents occur, to ensure the nearby water quality would not be affected; and

- All construction waste and drainage will be handled and disposed in accordance with the *Waste Disposal Ordinance* and *Practice Note for Professional Persons*, *Construction Site Drainage* (*ProPECC PN1/94*) and in particular the following measures adhered to:

  - 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

  - Best Management Practices (BMPs) will be applied to avoid and minimise contaminated runoff from work sites, marine plants and vessels, including wastewater being properly treated and discharged to storm drain.

The above measures will be sufficient to prevent adverse impacts to water quality during the land-based cable installation activities. Therefore, there are

no predicted adverse impacts (either direct or indirect) to water quality from these activities.

During normal operation, no land based activities are anticipated and no water quality impacts are expected.

4.2.2 *Marine Based Activities*

The marine based construction activities include the preparation for cable installation (Route Clearance [RC] and/or Pre-Lay Grapnel Run [PLGR]) operation, inshore installation and remaining submarine cable installation and involve burying the cable below the existing seabed. The cable will be buried as described in *Section 2.1.3,* to a depth of 5 m below the seabed using a vessel mounted injection tool along most of the route, and transitioning from 2-5 m below the seabed using divers for the inshore installation (i.e. for approximately 260 m of cable from the landing site seaward, as indicated in ***Figure 1.1***). The burial depth is necessary to provide protection to the cable. An injection jetting tool utilises water injection technology to fluidise seabed sediments, which then enables the tool to penetrate the seabed to the desired depth and so to lay the cable. The cable is expected to be installed in up to 30 working days. The maximum speed during cable laying will be approximately 1 km $hour^{-1}$. *Section 2.1.1* provides full details of RC and PLGR procedures. These operations will be scheduled to take place before the actual cable laying operation and are expected to take up to 36 working days and restricted to limited areas, wherever necessary.

Cable laying, and to a lesser degree some RC/ PLGR operation(s), will result in the temporary formation of an area of high suspended sediment concentration around the injection tool or grapnel anchor, 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; 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 4 minutes (see *Annex A* for details). Hence the potential for the release of any contaminants from sediments and exertion of an oxygen demand on the receiving waters will be very limited and are not expected to cause adverse impacts to water quality. The maximum distance of transport for the suspended sediments is calculated to be 180 m and the cable alignment is over 300 m from any of the identified water sensitive receivers (see *Annex A*). It is hence expected that the sediment plume will not reach any of the identified coral colonies along the coasts of Round Island, Chung Hom Kok, Kau Pei Chau of Cape d'Aguilar, Beaufort Island, Sung Kong, Waglan, Po Toi, or any of the other identified water sensitive receivers and there will be no adverse impacts to them. (See *Annex A* for details).

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

The operation of the cable will not result in any pollutant emissions into the surrounding waters and no water quality impacts are anticipated.

4.3 *DISRUPTION OF WATER MOVEMENT OR BOTTOM SEDIMENT*

There will be small scale temporary displacement of bottom sediment during the laying of the HKA cable using the cable burial tool. Once the cable is installed, the bottom sediment will naturally resettle (see *Section A4.2* of *Annex A*).

4.4 *MARINE ECOLOGY*

The closest marine SSSIs of the Project are the Hok Tsui (Cape d'Aguilar) SSSI, and Tai Tam Harbour (Inner Bay) SSSI, which are located about 610 m and just over 3 km from the closest cable segment, respectively. As detailed in *Section 4.2.2*, it is expected that the maximum distance of transport for suspended sediments from Project works would be 180 m and these would settle onto the seabed in less than 4 minutes (see *Annex A* for details). It is therefore expected that any sediment plume due to the Project works would not reach any of the identified SSSIs and overall no direct or indirect impacts are anticipated (see *Annex B*).

A review of the existing information on the marine ecological resources surrounding the cable route has identified the area as supporting benthic fauna which can be considered as typical for Hong Kong waters and thus of low ecological value (see *Annex B*). 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 recolonization. Hence, no permanent impacts are likely to occur.

No coral communities of high ecological importance have been identified within the cable corridor (see *Annex B* and ***Figure B1***). Coral assemblages of moderate to high ecological value have been identified around the south of Kau Pei Chau of Cape d'Aguilar, Round Island, Beaufort Island, Sung Kong Islet, Sung Kong, Po Toi and Waglan Island. All of these are over 500 m from the alignment (see ***Figure B1***). As the dispersion of the sediment plume is predicted to be no more than 180 m from the cable burial tool, the coral communities are not expected to be affected by the Project (see *Annexes A* and *B*). Two coral colonies of low ecological value were recorded in the vicinity of the cable alignment at the landing site and no direct impact to these is anticipated, however, as a precautionary measure, pre-installation and post-project coral dive surveys have been recommended as detailed further in *Annex F*.

The south-eastern waters of Hong Kong are not considered to be a frequently used habitat for the Chinese White Dolphin (CWD). Sightings of the Finless Porpoises (FPs) were also found to be infrequent along the proposed cable corridor. It is expected that the cable installation works will last for a short duration (approximately 30 working days for the cable laying) and will involve

one main cable installation barge. Cable laying works using injector burial tools are not expected to cause unacceptable elevations in underwater sounds to marine mammals as the water jets will be located within marine sediments which will dampen down sounds generated during the works. Significant disturbance to the FP and CWD, in terms of underwater noise, marine traffic and food sources, is therefore not expected (*Annex B*).

Based on this, and the predicted localised and very short term impacts to water quality, no unacceptable impacts are predicted to occur to marine mammals.

Impacts to marine ecological resources have largely been avoided during cable laying, as well as RC/ PLGR operation(s), through the selection of a landing site and cable corridor that reduces impacts to coral communities and through the employment of cable laying techniques that result in little disruption to the marine environment.

Mitigation measures that have been recommended to reduce impacts to water quality are also expected to control impacts to marine ecological resources, particularly for coral communities in the vicinity of the cable alignment. These mitigation measures include limiting the maximum speed of the cable laying machine and implementing good house-keeping practices during land based activities. In addition, a marine mammal exclusion zone during cable installation works is recommended to be implemented as a precautionary measure to reduce disturbance to marine mammals, especially the FPs, as described in *Annex F*.

During normal operation, the cable will be below the seabed and no impacts on marine ecology are anticipated.

4.5 FISHERIES

A review of the existing information on the fisheries resources showed that fisheries production along the cable corridor ranges from >0 – 50 kg per hectare to >300 – 400 kg per hectare and fishing operations traversed by the proposed cable route has identified waters north of Beaufort Island, Sung Kong and Waglan Island as the cable section with the highest fisheries production in terms of weight of adult fish (>300-400 kg of adult fish per hectare). Fisheries production then decreases as the cable moves away from this area, with the majority of the cable route traversing production grids of >0 kg – 300 kg adult fish per hectare. In addition, there are no AFCD gazetted Fish Culture Zones within 500 m of the proposed cable route. The Po Toi Fish Culture Zone is the closest FCZ, located over 3.6 km away from the cable route.

Since the increase in suspended solids (SS) concentrations will be localised and temporary, occurring within 180 m of the cable alignment, and the marine works over the whole submarine cable corridor will last for a short period of time (i.e. within 30 working days for cable laying), it is expected that the sediments lost in suspension are likely to remain in the lower part of the water column (i.e. within 1 m of the seabed, independent of the water depth) and

settle back onto the seabed within a short period of time (ie within 200s as detailed in *Annex A*) and fishing vessels could continue to operate in nearby waters during the construction the Project (see *Annex C*). Therefore, no long-term direct impacts to fisheries resources or fishing operations are expected to occur aside from minor short-term disturbances to the seabed and fishing ground/spawning ground of commercial fisheries resources in the immediate vicinity of cable laying activities, as well as RC/ PLGR operation(s), and short-term displacement of fishing activities from the works area. The seabed will be reinstated to before-work level and condition very shortly. Hence the works are not expected to result in any unacceptable impacts to water quality (see *Annex A*) that would affect fisheries resources, nor to result in any unacceptable impacts to fishing operations (see *Annex C*).

No specific mitigation measures have been recommended as no significant impacts to fisheries resources have been identified. Mitigation is not considered necessary, however as a precautionary measure water quality monitoring will be carried, to help verify that the Project works will not result in any unacceptable impacts to water quality, and consequently to fisheries. These monitoring details are presented in *Annex F*.

During normal operation, the cable will be below the seabed and no impacts on fisheries are anticipated.

4.6 NOISE

A noise assessment was undertaken to describe and evaluate the potential noise impacts arising from the onshore and offshore works associated with submarine cable installation. The results of this assessment are presented in *Annex D*. No noise exceedances would occur at the identified Noise Sensitive Receivers.

Cable laying and burial is at present expected to take place during non-restricted hours i.e. to take place between 0700 and 1900 hours on any day not being a Sunday or a general holiday. If works during restricted hours are later found to be necessary, a Construction Noise Permit (CNP) will be applied for.

During operation, no adverse noise impacts are anticipated.

4.7 CULTURAL HERITAGE

The cable landing site is located over 500 m from any declared monuments, proposed monuments, graded historic sites / buildings, or government historic sites identified by the Antiquities and Monuments Office and approximately 470 m away from the closest land-based Chung Hom Wan Site of Archaeological Interest with middle Neolithic period (c. 4000-2500 BC) archaeological deposits. Due to large separation distance, it will not be affected in any way by the Project.

The marine archaeological assessment identified a possible wreck (SC246), and a man-made debris (SC072) located 198 m and 38 m respectively from the cable alignment (*Annex E*). They are not considered of archaeological significance and they will not be impacted by this project given the distance away from the cable. No adverse impacts to marine archaeological resources are expected to occur as a result of the Project during installation or at operation.

4.8 WASTE MANAGEMENT

During the cable landing work, the materials excavated at the beach during trenching will be used shortly after for *in-situ* backfilling. For the trenching across the existing concrete ramp and to the BMH, less than 1.2 m^3 of solid, inert waste material will be generated and removed from site to be disposed of appropriately to an approved dumping ground. Any general construction waste materials, will be handled and disposed of in accordance with the *Waste Disposal Ordinance*. Any debris collected during preparation for cable laying (route clearance/ pre-lay grapnel run) will be disposed of appropriately to an approved dumping ground. There will be no dredged materials and no waste generated during marine cable installation, with the seabed expected to naturally reinstate do its original state. There will be no waste generated during operation of the cable. Therefore, overall no adverse waste impacts are anticipated from the Project.

4.9 OTHERS

Terrestrial Ecology: No impacts to terrestrial ecology will arise from the construction and operation of the submarine cable, during land cable installation at the beach (requires up to 9 working days) or operation.

Landscape and Visual: Since the submarine cable is buried in the seabed it will not cause any visual obstruction. At the landing site, the installation will use existing BHM and conduits from BHM to CLS infrastructure and no tree felling is anticipated. There will be some trenching along the beach and across the existing concrete ramp, to bury the cable and construct the duct from beach into the existing BMH, but the beach and concrete boat ramp will both be reinstated to their original state immediately afterwards and the proposed works are not anticipated to not incur any long term adverse impact on existing landscape resources or existing landscape character. Therefore no adverse landscape, tree or visual impact is anticipated during either construction or operation.

Dust: There will not be significant dust impacts during construction as the construction works will be short-term and small in scale and thus no unacceptable impacts are predicted to occur. Appropriate dust control measures as stipulated under the *Air Pollution Control (Construction Dust) Regulation* should be implemented where applicable. No dust will be generated during operation.

Gaseous Emissions: Only a small amount of gaseous emissions (SO_2 and NO_x) from diesel-powered equipment would be generated during trenching for the cable landing site. Requirements stipulated in the *Air Pollution Control (Non-road Mobile Machinery) (Emission) Regulation* will be followed to control potential gaseous emissions from any non-road mobile machinery during construction phase. No unacceptable impacts are anticipated. During operation, no gaseous emissions will be generated.

Odour: No odour impacts are expected during either the construction or operation phases of the proposed project.

Night-time Operations: It is expected that cable system laying and burial will be performed during non-restricted working hours, i.e. between 0700 and 1900 on any day not being a Sunday or general holiday. If works are proposed during restricted hours, a Construction Noise Permit will be applied for.

Traffic Generation: Only short term, minimum increase in traffic movements is expected to be generated as a result of the Project during construction and this will not generate significant noise or gaseous emissions. During operation the Project is not expected to generate vehicular traffic.

Dangerous Goods: No dangerous goods will be involved in this project in either the construction or operation phases.

Hazardous Materials or Wastes, including Potentially Contaminated Materials: No hazardous materials, including potentially contaminated materials or wastes will be generated by this Project at either construction or operation phases.

Risk of Accidents Resulting in Pollution or Hazard: No pollution or hazard generating accidents will result from this Project at either construction or operation phases.

4.10 MAINTENANCE AND REPAIR

It is considered unlikely that the submarine cable will require maintenance during operation, however should an occasion of cable fault arise that necessitates this, repair operation will be required. Methods used for cable maintenance and repair at any location along the submarine cable route are anticipated to be as per those used for cable installation during construction, with the potential to use smaller equipment such as Remotely Operated Vehicles (ROVs) equipped with injector tool. More details are provided in *Section 2.1.5* as to the general repair methodology and sequence.

Repair works will be conducted along the same proposed alignment as installed cable but duration of any cable repair work is anticipated to be of shorter duration than cable installation during construction, since repair work will generally be conducted at point fault location(s) rather than along the whole cable alignment. ROVs generally have reduced jetting power compared to

installation injector tools (typical injector tools jet around eight times (x8) more litres of water per minute than typical ROVs) and diver hand jetting is even less powerful (ROVs jet around four times (x4) more litres of water per minute than typical diver jetting). Grapnels on the other hand do not use jetting but simply penetrate the sea bed and are therefore not expected to cause significant sediment plumes. The recovery of any faulty cable using diver, ROV or grapnels is expected to cause sediment plume that would be no greater than sediment plume generated during installation, i.e. the maximum distance of transport for the suspended sediments would not be more than 180 m.

Therefore overall, potential impacts are anticipated to be less during cable maintenance and repair works than those for cable installation during construction. Since cable installation during construction is not considered to cause adverse environmental impacts, therefore no adverse environmental impacts are considered likely should maintenance and repair be required.

5 PROTECTION MEASURES AND ANY FURTHER IMPLICATIONS

5.1 ENVIRONMENTAL PROTECTION MEASURES

5.1.1 Construction Phase

Minimal disturbance is anticipated during construction of the Project. Nevertheless, some specific measures have been proposed to minimise any potential impacts to water quality, marine ecology and fisheries (refer to *Annexes A, Annex B, Annex C* as well as *Annex F Environmental Monitoring & Audit* for full details). In addition, some minor precautionary measures have been proposed for the land and shore-end cable installation, as detailed in *Annex F Environmental Monitoring & Audit*.

5.1.2 Operation Phase

Since no operational impact is anticipated due to the Project, no environmental protection measures are required.

Should repair operation be required, protection and mitigation measures proposed during construction phase will be put in place, as detailed in *Annex F Environmental Monitoring & Audit*.

5.2 POSSIBLE SEVERITY, DISTRIBUTION AND DURATION OF ENVIRONMENTAL EFFECTS

The actual installation of the submarine cable system in Hong Kong SAR waters (not including preparation for cable installation or any weather downtime) is expected to take up to 30 working days. The residual environmental impacts of the works activities are predicted to be localised to the immediate vicinity of the cable alignment, of low severity and acceptable.

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

5.3 CUMULATIVE IMPACTS

There are no known projects that have been approved for construction that would be undertaken concurrently with the construction of the HKA cable system. Therefore, no cumulative impacts are predicted to occur.

5.4 FURTHER IMPLICATIONS

As Sha Shek Tan, CHK is already the landing site of a number of submarine cable systems, the geotechnical environment at the proposed landing point is considered to be suitable for submarine cable installation. The site has already been used for other systems under Environmental Permit, which indicates there are no adverse effects to the surrounding environment from the operation of the submarine cables.

The methods used for burying the HKA cable, as described above, have been used in Hong Kong and around the world for many years and are widely accepted to have very little impact on the surrounding marine environment. The working period is normally very short and no waste or contaminant disposal issues or excessive noise will be generated by such an operation.

No unacceptable environmental impacts have been identified due to the Project. However, as precautionary measures, it is recommended to carry out water quality monitoring, some site inspections, coral monitoring and to implement a marine mammal exclusion zone during construction, to verify and confirm that the project works will not result in any unacceptable impacts during construction. Should repair works be necessary during operation of the cable system, appropriate mitigation measures as proposed for the construction phase will be implemented.

The Project Proponent will engage an Environmental Team (ET) to carry out the Environmental Monitoring & Audit (EM&A) requirements as set out fully in *Annex F*. The ET shall not be in an associated body of the Project Proponent, any works contractors or the Independent Environmental Checker (IEC). The ET shall be headed by an ET Leader who has at least 7 years of experience in EM&A or environmental management.

In addition to the ET, the Project Proponent will engage an IEC. The IEC shall not be an associated body of the Permit Holder, the works contractors or the ET. The IEC shall have at least 7 years of experience in EM&A or environmental management. The IEC shall audit the overall EM&A performance of the Project, including the Contractor's implementation of all environmental mitigation measures.

Sha Shek Tan, Chung Hom Kok (CHK) is already the landing site of several submarine cable systems including GB21's C2C Cable network Segments 1, 2A and 7; and NEC's SJC Segment 10. Two New T&T cables also land at a separate location on the CHK peninsular. Project Profiles were prepared under the EIAO for these cable systems as detailed below.

- The Project Profile for China Telecom (Hong Kong) International Limited's project, entitled "*South-East Asia Japan Cable System (SJC) Hong Kong Segment*" was submitted to EPD on 28 September 2011 (AEP-423/2011). The approximate length of the cable in HKSAR waters was around 37 km. The study concluded that there would be no adverse long term or cumulative effects/impacts to the environment and the Environmental Permit was granted on 24 October 2011 (EP-423/2011).

- The Project Profile for GB21's project, entitled "*C2C Cable Network - Hong Kong Section: Chung Hom Kok*" was submitted to EPD in December 2000 (AEP-087/2001). The approximate length of each cable in HKSAR waters was around 30 km. 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 16 February 2001 (EP-087/2001).

- The Project Profile for New T&T's *New T&T Hong Kong Limited: Domestic Cable Route* was submitted to EPD in December 2000 (AEP-086/2001). The total length of the Chung Hom Kok to Cheung Sha cable was approximately 37 km and the Chung Hom Kok to Sandy Bay cable was approximately 32 km in length. 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 16 February 2001 (EP-086/2001).

Other similar projects that have been conducted in the HKSAR include the following:

- *Pacific Light Cable Network (PLCN) – Deep Water Bay*, PCCW Global (HK) Limited. The Project Profile for this study was submitted to EPD in June 2017 (AEP-539/2017). The length of the cable in HKSAR waters is approximately 40 km. The study concluded that there would be no unacceptable, adverse impacts to the environment and the Environmental Permit was granted in July 2017 (EP-539/2017).

- *Asia-Africa-Europe-1 (AAE-1) Cable System*, PCCW Global (HK) Limited. The Project Profile for this study was submitted to EPD in January 2016 (AEP-508/2016). The approximate length of the cable in HKSAR waters is approximately 27.7 km and involves installation using HDD, surface laying by diver and cable burial tool techniques. The study concluded that there would be no unacceptable, adverse impacts to the environment and the Environmental Permit was granted in April 2016 (EP-508/2016).

- *Tseung Kwan O Express – Cable System,* PCCW Global (HK) Limited. The Project Profile for this study was submitted to EPD on 16 December 2015 (AEP-243/2015). The approximate length of the cable in HKSAR waters is approximately 2.7 km and involves installation using HDD and direct burial techniques (by a cable laying vessel and cable burial tool). The study concluded that there would be no unacceptable, adverse impacts to the environment and the Environmental Permit was granted on 20 May 2016 (EP-509/2016).

- *Asia Pacific Gateway (APG) – Tseung Kwan O*, China Mobile International Ltd. The Project Profile was submitted to EPD on 9 October 2013 (PP-496/2013). The length of cable in Hong Kong waters is around 35 km. The study concluded that there would be no adverse long-term or cumulative effects/impacts to the environment. The EP was granted on 18 February 2014 (EP-485/2014).

- *Replacement of the Existing 11KV Submarine Cable Circuit Connecting Liu Ko Ngam and Pak Sha Tau Tsui at Kat O,* CLP Hong Kong Limited. The Project Profile for this study was submitted to EPD on 30 May 2013 (AEP-461/2013). The approximate length of the cable in HKSAR waters was around 880m. The study concluded that there would be no adverse long term or cumulative effects/impacts to the environment and the Environmental Permit was granted on 27 August 2013 (EP-461/2013).

- *Asia Submarine-cable Express (ASE) - Tseung Kwan O*, NTT Com Asia Limited. The Project Profile for this study was submitted to EPD on 29 November 2011 (AEP-433/2011). The approximate length of the cable in HKSAR waters was around 33.5 km. The study concluded that there would be no adverse long term or cumulative effects/impacts to the environment and the Environmental Permit was granted on 20 December 2011 (EP-433/2011).

- *Asia-America Gateway (AAG) Cable Network, South Lantau,* Reach Networks Hong Kong Ltd. The Project Profile for this study was submitted to EPD on 5 October 2007 (AEP-298/2007). The length of cable in Hong Kong waters is around 10 km. The study concluded that there would be no adverse long term or cumulative effects/impacts to the environment and the Environmental Permit granted on 20 December 2007 (EP-298/2007).

- *VSNL Intra Asia Submarine Cable System – Deep Water Bay,* Videsh Sanchar Nigam Ltd (VSNL) (AEP-294/2007). The approximate length of the cable in HKSAR waters was around 40 km. The Project Profile was submitted in August 2007 and the study concluded that there would be no adverse long term or cumulative effects/impacts to the environment. The Environmental Permit was granted on 23 November 2007 (EP-294/2007)

- *Proposed 132kV Submarine Cable Route for Airport "A" to Castle Peak Power Station Cable Circuit*, CLP Power (AEP 267/2007). The approximate length of the cable in HKSAR waters was around 6.2 km. 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 29 March 2007 (EP-267/2007).

- *132kV Submarine Cable Installation for Wong Chuk Hang - Chung Hom Kok 132kV Circuits,* for Hongkong Electric Co., Ltd. Despite the name, the cable linked between Deep Water Bay and South Bay over a distance of approximately 2.9 km. The Project Profile was submitted to the EPD in January 2002 (AEP-132-2002). The study concluded that no unacceptable environmental impacts were predicted during the installation of the submarine cables and no environmental monitoring and audit measures were recommended as being necessary for the project. The Environmental Permit was granted on 16 April 2002 (EP 132/2002).

- *HGC Optical Fibre Submarine Cable System between Tuen Mun and Chek Lap Kok,* Hutchison Global Crossing Ltd. The Project Profile was submitted on 19 April 2001 (PP-127/2001). The length of the cable in Hong Kong waters is around 500 m. The study concluded that there would be no adverse long-term or cumulative effects/impacts on the environment. The EP was granted on 9 June 2001 (EP-106/2001).

- *FLAG North Asian Loop,* FLAG Telecom Asia Limited. The Project Profile for this Study was submitted to EPD in March 2001 (AEP-099/2001). The total length of the cable in HKSAR waters was approximately 10 km. 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 18 June 2001 (EP-099/2001).

- *East Asian Crossing (EAC) Cable System (TKO)*, Asia Global Crossing Limited (AGC). The Project Profile for this Study was submitted to EPD in July 2000 (AEP-081/2000). The total length of the cable in HKSAR waters was approximately 25 km. 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 Limited (AGC). The Project Profile for this Study was submitted to EPD on 21 June 2000 (AEP-079/2000). The total length of the cable within HKSAR waters was approximately 25 km. 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,* Cable and Wireless HKT International Ltd. The Project Profile for this Study was submitted to EPD in May 2000 (AEP-069/2000). The total length of the cables in HKSAR waters was approximately 9 km. 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 26 July 2000 (EP-069/2000).

- *Telecommunication Installation at Lot 591SA in DD328, 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*, Level 3 Communications Ltd. The Project Profile for this Study was submitted to EPD in March 2000 (AEP-064/2000). The total length of the cable in HKSAR waters was approximately 10 km. The Study concluded that there would be no adverse long term or cumulative effects/impacts on 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 International Limited. The Project Profile 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 and the Environmental Permit was granted on 27 July 1998 (EP-001/1998).

Annex A

Assessment of Potential Impacts to Water Quality

CONTENTS

A1 INTRODUCTION

This *Annex* presents an evaluation of the potential water quality impacts associated with the construction and operation (including maintenance) of the proposed HKA Submarine Cable – Chung Hom Kok (the Project). The cable will travel from Sha Shek Tan of Chung Hom Kok (CHK) southward, exiting Stanley Bay turning east near the Stanley Peninsula and past Cape d'Aguilar, continuing eastward north of Beaufort and Sung Kong Islands, to the eastern boundary of HKSAR waters where it will enter the South China Sea (See ***Figure A1***).

Once installed, the cable is not expected to result in any water quality impacts during normal operation and the focus of this water quality assessment is on the potential impacts during the construction (ie cable laying and burial) phase. There is a potential requirement for maintenance work (ie cable repair at particular fault location due to unexpected damage) to be carried out during operation, and the potential water quality impacts associated with these maintenance/ repair works are also considered in this *Annex*.

A2 RELEVANT LEGISLATION AND ASSESSMENT CRITERIA

The following legislation and associated guidance or non-statuary guidelines are applicable to the evaluation of water quality impacts associated with the construction of the proposed submarine cable system.

- *Water Pollution Control Ordinance (WPCO)*;
- *Environmental Impact Assessment Ordinance (Cap. 499. S.16)* and the *Technical Memorandum on EIA Process (EIAO-TM), Annexes 6* and *14*;
- *Technical Memorandum for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters (TM- ICW)*; and,
- *Professional Persons Environmental Consultative Committee Practice Notes, Construction Site Drainage* (*ProPECC PN1/94*).

A2.1 WPCO

The *WPCO* is the primary legislation for the control of water pollution and water quality in Hong Kong. Under the *WPCO*, HKSAR waters are divided into 10 Water Control Zones (WCZs). Each WCZ has a designated set of statutory Water Quality Objectives (WQOs). The route for the proposed submarine cable system passes through the Southern and Mirs Bay WCZs (***Figure A1***) while the 7 km Study Area also covers the Eastern Buffer WCZ. A summary of the WQOs for these WCZs is presented in *Table A1*, and the WQOs are applicable as evaluation criteria for assessing the compliance of any discharge from the proposed Project.

Table A1 Summary of Water Quality Objectives for the Eastern Buffer, Southern and Mirs Bay WCZs

Parameter	Eastern Buffer, Southern and Mirs Bay WCZs*
Temperature	Change due to waste discharge not to exceed 2°C
Salinity	Change due to waste discharge not to exceed 10% of natural ambient level
pH	To be in the range 6.5 - 8.5, change due to waste discharge not to exceed 0.2
Suspended Solids (SS)	Waste discharge not to raise the natural ambient level by 30% nor cause the accumulation of suspended solids which may adversely affect aquatic communities
Dissolved Oxygen (DO)	
Bottom	Not less than 2 mg L^{-1} for 90% samples
Depth-averaged	Not less than 4 mg L^{-1} for 90% samples
Nutrients (measured as total inorganic nitrogen)	Eastern Buffer WCZ: Not to exceed 0.4 mg L^{-1} (annual mean depth-averaged)
	Mirs Bay WCZs: Not to exceed 0.3 mg L^{-1} (annual mean depth-averaged)
	Southern WCZ: Not to exceed 0.1 mg L^{-1} (annual mean depth-averaged)

Parameter	Eastern Buffer, Southern and Mirs Bay WCZs*
Unionised Ammonia	Not to exceed 0.021 mg L^{-1} (annual mean)
Toxicants	Not to be present at levels producing significant toxic effect
E.coli	Annual geometric mean not to exceed 610 cfu/100mL (secondary contact recreation subzones in Mirs Bay and Southern WCZs, and fish culture subzones in Mirs Bay, Southern and Eastern Buffer WCZs)

* Unless specified, Water Quality Objectives for each parameter are the same for Eastern Buffer, Southern and Mirs Bay WCZs

A2.2 EIAO - TM

Annex 6 and *Annex 14* of the *EIAO-TM* (*Criteria for Evaluating Water Pollution* and *Guidelines for Assessment of Water Pollution*) provide general guidelines and criteria to be used in assessing water quality impacts. The *EIAO-TM* recognises that, in the application of the above water quality criteria, it may not be possible to achieve WQOs at the point of discharge as there are areas which are subjected to greater impacts (which are termed by the EPD as the mixing zones), where the initial dilution of an input of pollutants takes place. The definition of this area is determined on a case-by-case basis. In general, the criteria for acceptance of the initial dilution area are that it must not impair the integrity of the water body as a whole and must not damage the ecosystem.

A2.3 WSD SEAWATER INTAKES

Quality of seawater intake should comply with the relevant Water Quality Objectives established by the Water Supply Department (*Table A2*).

Table A2 ***WSD Water Quality Objectives for Seawater for Flushing Supply at Intake Point***

Parameter	Target*
Colour (H.U.)	<20
Turbidity (N.T.U.)	<10
Threshold Odour No. (T.O.N.)	<100
Ammoniacal N	<1
Suspended Solids	<10
Dissolved Oxygen	>2
Biochemical Oxygen Demand	<10
Synthetic Detergents	<5
E.coli / 100 mL	<20,000

Notes:
***:** Chemical values are expressed in mg/L (parts per million).

A2.4 PROPECC PN 1/94

Apart from the above statutory requirements, the *Professional Persons Environmental Consultative Committee Practice Notes*, *Construction Site Drainage* (*ProPECC PN 1/94*), issued by EPD in 1994, shall also be followed to prevent water pollution associated with construction activities. The applicable measures from *ProPECC PN 1/94* are listed in *Section A4.4*.

A3 DESCRIPTION OF THE ENVIRONMENT

A3.1 HYDRODYNAMICS

The first part of the proposed cable system is sheltered from tidal currents as it lies within Stanley Bay. The cable which lies beyond Stanley Bay is mainly influenced by the oceanic water from South China Sea.

A3.2 WATER QUALITY

The proposed route for the submarine cable system passes through the Southern and Mirs Bay WCZs. There are eight EPD routine water quality monitoring stations in the cable route Study Area, including (from west to east) SM4, SM3, SM2, SM19, SM1, EM3, MM8 and MM13. Water quality data for these stations, which were collected between 2012 and 2016 (1) and are the most up to date published data, are summarised in *Table A3*. The locations of the stations are shown in ***Figure A1***.

The data show that the annual mean for both depth-averaged and bottom dissolved oxygen complied with the WQO during 2012 – 2016. Compliance of total inorganic nitrogen remains low for the Southern WCZ during these past five years, with decreasing Total Inorganic Nitrogen (TIN) level from the west to the east. On the other hand, compliance of unionised ammonia is observed at all stations throughout the period. The SS concentrations show a wide range from 0.5 mg/L at SM1 to 28.0 mg/L at MM13. *E.coli* levels are also in compliance with the WQO at all stations between 2012 and 2016. The maximum *E.coli* level could be up to 3,133 cfu/100 mL^{-1} (at SM4).

A3.3 SEDIMENT QUALITY

There are five (5) EPD routine sediment quality monitoring stations in the vicinity of the proposed cable alignment: (from west to east) SS2, SS1, ES2, MS8 and MS13. Sediment quality data for these stations are available for 2012-2016 (2) and are summarised in *Table A4*. The locations of the sediment quality monitoring stations are also shown on ***Figure A1***.

Sediment quality, management and classification specified under *Works Bureau Technical Circular (Works) No. 34/2002 Management of Dredged/Excavated Sediment* comprise two criteria for a broad range of Contaminants of Concern. The lower criterion is referred to as the Lower Chemical Exceedance Limit (LCEL) and the upper criterion is referred to as the Upper Chemical Exceedance Limit (UCEL). The above data (mean values) show that there were no exceedances of the LCEL at the above sediment quality monitoring stations and the sediment in the vicinity of the proposed cable route was not contaminated based on the existing sediment classification guidelines.

(1) EPD, Marine Water Quality in Hong Kong. Data from 2012-2016.

(2) EPD. Marine Water Quality for Hong Kong. Data from 2012-2016.

Table A3 EPD Routine Water Quality Monitoring Data along the Cable Route (2012 - 2016)

WQ Parameter	SM4	SM3	SM2	SM19	SM1	EM3	MM8	MM13
	East Lamma Channel		**Hong Kong Island (South)**			**Tathong Channel**	**Waglan Island**	**Mirs Bay (South)**
Temperature (^{o}C)	23.3 (16.2-28.8)	23.0 (15.7-28.8)	23.2 (15.7-28.8)	23.0 (15.2-28.8)	23.1 (15.3-28.8)	22.8 (14.9-28.8)	22.7 (15.3-28.4)	22.9 (15.3-28.1)
Salinity (ppt)	31.3 (26.2-33.5)	32.0 (29.8-33.6)	31.7 (26.9-33.7)	32.0 (26.6-33.8)	31.9 (26.3-33.7)	32.4 (29.5-33.7)	32.4 (29.8-34.0)	32.6 (30.5-34.7)
pH	7.9 (7.5-8.3)	7.9 (7.4-8.3)	8.0 (7.6-8.4)	8.0 (7.6-8.4)	8.0 (7.5-8.4)	7.9 (7.5-8.3)	8.0 (7.1-8.3)	8.0 (7.0-8.4)
Dissolved Oxygen – Depth-averaged (mg L^{-1})	6.5 (4.4-9.0)	6.3 (4.0-8.5)	6.6 (4.5-9.4)	6.7 (4.7-9.8)	6.7 (4.5-9.1)	6.5 (4.2-9.7)	6.4 (3.9-8.5)	6.5 (4.3-9.2)
Dissolved Oxygen - Bottom (mg L^{-1})	6.3 (2.6-8.7)	6.0 (2.3-8.6)	6.2 (2.5-9.3)	6.0 (2.7-8.4)	6.3 (2.1-8.5)	6.2 (3.0-9.7)	5.8 (2.0-8.2)	6.1 (2.0-8.6)
BOD_5 (mg L^{-1})	0.8 (0.2-3.5)	0.7 (0.2-3.7)	0.8 (0.1-4.8)	0.6 (0.1-2.0)	0.8 (0.1-3.0)	0.8 (0.2-4.9)	0.5 (0.1-1.6)	0.5 (0.1-2.0)
Suspended Solids (mg L^{-1})	3.9 (0.7-21.0)	3.3 (0.7-7.0)	4.6 (0.7-26.3)	4.6 (0.8-26.7)	3.9 (0.5-25.0)	3.9 (0.6-14.0)	4.3 (0.6-24.7)	4.2 (0.8-28.0)
Total Inorganic Nitrogen (mg L^{-1})	**0.21** (0.02-0.55)	**0.17** (0.01-0.40)	**0.16** (0.03-0.54)	**0.13** (0.02-0.36)	**0.12** (0.02-0.40)	0.12 (0.02-0.28)	0.11 (0.01-0.31)	0.09 (0.01-0.27)
Unionised Ammonia (mg L^{-1})	0.002 (0.001-0.009)	0.002 (0.001-0.009)	0.002 (0.001-0.009)	0.002 (0.001-0.007)	0.002 (0.001-0.008)	0.002 (0.001-0.007)	0.002 (0.001-0.004)	0.002 (0.001-0.006)
Chlorophyll-*a* (microgram L^{-1})	4.1 (0.3-20.0)	2.9 (0.5-10.9)	3.9 (0.4-16.5)	3.2 (0.5-22.7)	3.1 (0.4-12.6)	2.7 (0.4-12.8)	2.1 (0.4-13.0)	2.1 (0.3-14.4)
Escherichia coli (cfu $100mL^{-1}$)	15 (1-3133)	25 (1-370)	30 (1-350)	2 (1-20)	3 (1-51)	7 (1-619)	2 (1-16)	2 (1-21)

Notes

1. Data presented are five-year annual arithmetic means of the depth-averaged results except for *E. coli* which are annual geometric means.
2. Data in brackets indicate the ranges

Table A4 EPD Routine Sediment Quality Monitoring Data in the Vicinity of the Cable Route (2012 – 2016)

Parameter	LCEL	UCEL	SS2	SS1	ES2	MS8	MS13
COD (mg kg-1)	-	-	11610 (9100 - 15000)	9560 (8300 - 11000)	9770 (7300 - 13000)	10140 (8600 - 12000)	8260 (6400 - 10000)
TKN (mg kg-1)	-	-	530 (410 - 600)	420 (340 - 500)	480 (400 - 650)	490 (400 - 550)	490 (320 - 550)
Cadmium (mg kg-1)	1.5	4	<0.1 (<0.1-0.1)	<0.1 (<0.1-0.1)	<0.1 (<0.1-<0.1)	<0.1 (<0.1-<0.1)	<0.1 (<0.1-<0.1)
Chromium (mg kg-1)	80	160	29 (27-32)	21 (18-23)	28 (19 - 49)	31 (28-33)	30 (24-34)
Copper (mg kg-1)	65	110	18 (15-21)	9 (8-11)	18 (12 - 32)	14 (10-18)	12 (10-17)
Mercury (mg kg-1)	0.5	1	0.09 (0.05-0.13)	0.05 (<0.05-0.07)	0.08 (<0.05-0.13)	0.05 (<0.05-0.06)	0.05 (<0.05-0.07)
Nickel (mg kg-1)	40	40	19 (17-22)	15 (14-17)	18 (12 - 31)	22 (20-24)	22 (19-24)
Lead (mg kg-1)	75	110	32 (20-38)	25 (22-28)	29 (18 - 42)	33 (30-37)	31 (25-35)
Silver (mg kg-1)	1	2	0.2 (<0.2-0.3)	<0.2 (<0.2-0.2)	<0.2 (<0.2 - 0.2)	<0.2 (<0.2-<0.2)	<0.2 (<0.2-<0.2)
Zinc (mg kg-1)	200	270	94 (84-130)	63 (51-70)	75 (48 - 110)	79 (72-89)	78 (62-86)
Arsenic (mg kg-1)	12	42	8.2 (6.6-10.0)	6.5 (5.9 - 7.0)	6.1 (4.5 - 9.5)	7.4 (6.6 – 7.7)	7.7 (6.3 - 8.7)
Low Molecular Weight PAHs (µg kg-1)	550	3160	110 (90-150)	110 (90-180)	100 (90 - 150)	130 (90-260)	150 (90-330)
High Molecular Weight PAHs (µg kg-1)	1700	9600	110 (27-280)	34 (20-50)	72 (38 - 190)	77 (35-310)	49 (27-91)
Total PCBs (µg kg-1)	23	180	18 (18-18)	18 (18-18)	18 (18-18)	18 (18-18)	18 (18-18)

Note – 1. Data presented are five-year arithmetic means; data in brackets indicate ranges.

A3.4 WATER QUALITY SENSITIVE RECEIVERS

Water quality sensitive receivers (WSRs) within the 7 km Study Area of the proposed cable alignment and the landing site have been identified under the broad designations of gazetted bathing beaches, coral sites, intertidal mudflats, fish culture zones, designated marine reserves or sites of high marine ecological importance and seawater intakes.

The identified WSRs in these categories, shown on ***Figure A1*** and expanded on in ***Figure A1a***, are summarised as follows.

- **Gazetted Bathing Beaches:** Deep Water Bay, Repulse Bay, Middle Bay, South Bay, Chung Hom Kok, St. Stephen's Beach, Stanley Main Beach, Hairpin Bay, Turtle Cove, Big Wave Bay, Rocky Bay, and Shek O;

- **Fisheries:** Sok Kwu Wan (F1), Po Toi (F2) and Tung Lung Chau (F3) Fish Culture Zones;

- **Sites of High Ecological Importance:** Cape d'Aguilar Marine Reserve (M3);

- **Coral Communities:** coral sites along the coast of Round Island (C1), Chung Hom Kok (C2), Cape Collinson (C3), Tai Long Pai (C4), Beaufort Island (C5, C12), Po Toi Island (C6), Sung Kong Islet (C7) and Sung Kong (C8), Tung Long Chau (C9), Waglan Island (C10), Ninepin Group (C11), Cape d'Aguilar at Kau Pei Chau (C13);

- **Intertidal Mudflat and Mangrove at Tai Tam** (M1 & M2)**;** and

- **Seawater Intakes:** WSD Flushing Intake of Ap Lei Chau (I1), WSD Flushing Intake of Aberdeen (I2), Ocean Park's Main Seawater Intake (I3), Ocean Park's Training Yard Seawater Intake (I4) and Seawater Intake for The University of Hong Kong Swire Institute of Marine Science (I5).

The distances between the proposed cable alignment and the identified representative sensitive receivers are summarised in *Table A5* and shown in ***Figure A1a***.

Table A5 *Closest Approach of the Proposed Cable Alignment to Water Sensitive Receivers*

ID	Water Quality Sensitive Receivers	Approximate Geodesic Distance ^ to Proposed	
		Cable Alignment / Landing Point (m)	Earth System (m)
DWB	Deep Water Bay Beach	3,810	3,810
RB	Repulse Bay Beach	2,560	2,560
MB	Middle Bay Beach	1,810	1,810
SB	South Bay Beach	1,420	1,420
CHK	Chung Hom Kok Beach	520	520
SSB	Saint Stephen's Beach Boundary	310	630
SMB	Stanley Main Beach	800	840
HB	Hairpin Bay Beach	1,130	1,150
TC	Turtle Cove Beach	2,410	2,440
BWB	Big Wave Bay Beach	5,190	5,250
RKB	Rocky Bay Beach	3,640	4,830
SO	Shek O Beach	3,290	4,640
C1	Coral sites along the coast of Round Island	2,270	2,270
C2	Coral sites along the coast of Chung Hom Kok	1,320	1,160
C3	Coral sites along the coast of Cape Collinson	5,960	6,400
C4	Coral sites along the coast of Tai Long Pai	3,900	6,310
C5	Coral sites along the coast of south & east Beaufort Island	1,230	5,970
C6	Coral sites along the coast of Po Toi Island	1,820	6,980
C7	Coral sites along the coast of Sung Kong Islet	510	7,860
C8	Coral sites along the coast of Sung Kong	720	8,550
C9	Coral sites along the coast of Tung Long Chau	4,400	8,570
C10	Coral sites along the coast of Waglan Island	950	10,580
C11	Coral sites along the coast of Ninepin Group;	6,390	15,160
C12	Coral sites along the coast of north Beaufort Island	840	4,840
C13	Coral sites along the coast of Cape d'Aguilar at Kau Pei Chau	580	5,590
M1	Tai Tam Intertidal Mudflat	3,270	3,280
M2	Tai Tam Mangrove Stand	3,640	3,630
M3	Cape d'Aguilar Marine Reserve	640	5,480
F1	Sok Kwu Wan Fish Culture Zones;	6,570	6,570
F2	Po Toi Fish Culture Zones;	3,640	7,300
F3	Tung Lung Chau Fish Culture Zones;	6,320	8,750
I1	WSD Flushing Intake of Ap Lei Chau	6,000	6,000
I2	WSD Flushing Intake of Aberdeen	5,030	5,030
I3	Ocean Park's Main Seawater Intake	3,950	3,950
I4	Ocean Park's Training Yard Seawater Intake	4,090	4,090
I5	Seawater Intake for The University of Hong Kong Swire Institute of Marine Science	1,190	5,550

Note: ^ Geodesic distance refers to the shortest straight line distance between two locations, without regard on the physical obstacles in between. Also note that distances from earth system to all WSRs are greater than that from the cable alignment.

While the cable landing site is located on the CHK peninsular, at a small, sandy beach (Sha Shek Tan) within Stanley Bay, it is not used as a bathing beach; it is not one of the bathing beaches listed in the *Fourth Schedule to the Public Health and Municipal Services* (Cap. 132) and has no supporting facilities for bathing. In addition, access to the site is only via a semi-paved, rugged and steep footpath or from the sea and there is no road (public or private) access. Based

on site visit observations also, Sha Shek Tan is used for some small boat storage but not for bathing. Sha Shek Tan is therefore not considered a WSR for this Study. The CHK beach listed in *Table A5* above refers to the gazetted bathing beach of Chung Hom Kok, located on the west side of CHK and separated from the landing site by the land mass of CHK peninsular. (See ***Figure A1***)

A4 IMPACT ASSESSMENT

There will be no impacts to water quality from the normal 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 as well as the earth system or from maintenance and repair work during operation have been assessed below.

The cable alignment has been reviewed and optimized taking into consideration existing environmental and physical constraints, in particular noting other submarine cables and pipelines, avoiding major marine vessel fairways, maximising its distance from the environmental sensitive receivers (e.g. corals), minimising disturbance to known marine archaeological resources, and avoiding anchorage areas and rocky outcrop areas, as detailed further in the Main Report *Section 1.5.2.* The effect of the optimized alignment has been taken into account in the assessment in the following section.

A4.1 CABLE INSTALLATION/ OPERATION AT THE LANDING SITE

The extent for landing site works is shown in ***Figure A1***. The potential impacts to water quality during trenching and excavation works on land primarily relate to surface water run-off, both of which may be readily controlled through the measures discussed in *Section A4.4*. This is also relevant should any trenching or excavation works be necessary during operation for repair/maintenance.

A4.2 MARINE CABLE INSTALLATION

Marine sections of the cable will be installed in two ways. From the low water mark (LWM) of Sha Shek Tan up to approximately 260 m of cable from the landing site the cable will be buried by divers using jet probes to transition from the target burial depth of 2 m below the beach to 5 m below the seabed/mudline at a location near the coastline where the installation barge can be set up and deploy the 5 m burial tool (this initial section is the 'inshore cable installation'). Beyond this segment up to the HKSAR boundary (remaining submarine cable installation), the cable will be buried by an "Injector Burial Tool" or "Sledge Tool" to a burial depth of 5 m below the seabed using jetting technique. The extent of marine cable installation and inshore installation are shown in ***Figure A1***.

A4.2.1 Preparation for Cable Installation

Prior to the marine cable burial, Route Clearance (RC) and/or Pre-Lay Grapnel Run (PLGR) will be conducted over the length of the proposed cable route. RC and PLGR are carried out for all cable burial projects and involve grapnels penetrating up to 1.5 m or may be supported by diver hand-jetting as described in the Main Text *Section 2.1.1.* Hand jetting has low jetting power only applying at specific point(s) if needed (see Main Text *Section 4.10* for details), while grapnels simply penetrate the sea bed and are therefore not expected to cause significant sediment plumes. It is therefore anticipated that PLGR/RC will not cause significant water quality impacts.

A4.2.2 *Inshore Cable Installation*

It is anticipated that the burying by divers will not cause significant water quality impacts as only a small area will be disturbed; the length is short and the burial depth is shallow (transitioning from 2 m to 5 m below the sea bed). Further details of the ocean ground bed (OGB) installation inshore for the earth system, are provided below.

A4.2.3 *Ocean Ground Bed Installation*

The earth system for the current project will be an ocean ground bed as detailed in the Main Report, *Section 2.1.4.* Potential impacts to water quality due to land-based works for the installation of earth system cable would be similar to that of the cable trenching works on land, and would also be readily controlled through the measures discussed in *Section A4.4*.

The earth system cable and earth plate will be installed offshore within the Stanley Bay using diver hand held suction method or similar. The installation is expected to result in disturbance of bottom sediment similar to that of cable jetting described in *Section A4.2.3*, i.e. suspended sediment will settle onto the seabed within approximately 180 m from the earth system cable alignment and earth plate. The distances from the earth system to all WSRs identified, are greater than that of the distances from the cable alignment to the WSRs. The WSRs closest to the earth system are the Chung Hom Kok Beach at about 510 m away over land and St. Stephen's Beach Boundary at about 630 m away across the bay. Therefore all the WSRs identified are located over 180 m away and suspended sediment from the marine installation of earth system cable and earth plate using diver hand held suction method is not expected to encroach into the any identified WSRs. No significant SS elevation is therefore expected at these WSRs and hence no unacceptable change in water quality is expected at these WSRs.

A4.2.4 *Remaining Submarine Cable Installation*

These works involving jetting by an injector burial tool or sledge tool have been assessed in a quantitative manner. The approach detailed below has been utilised to calculate the transportation of sediment in suspension in the following project profiles for which Environmental Permits have been issued:

- *Pacific Light Cable Network (PLCN) – Deep Water Bay* (AEP-539/2017). *Environmental Permit* was granted on 10 Jul 2017 (EP-539/2017)
- *Asia-Africa-Europe-1 (AAE-1) Cable System* (AEP-508/2016). *Environmental Permit* was granted on 20 Apr 2016 (EP-508/2016).
- *Tseung Kwan O Express – Cable System* (AEP-243/2015). E*nvironmental Permit* was granted on 20 May 2016 (EP-509/2016).
- *Asia Pacific Gateway (APG) - Tseung Kwan O* (AEP-485/2014). *Environmental Permit* was granted on 18 Feb 2014 (EP-485/2014).

- *Asia Submarine-cable Express (ASE) - Tseung Kwan O* (AEP-433/2011). *Environmental Permit* was granted on 20 December 2011 (EP-433/2011).

- *South-East Asia Japan Cable System (SJC) Hong Kong Segment* (AEP-423/2011). *Environmental Permit* was granted on 24 October 2011 (EP-423/2011).

- *VSNL Intra Asia Submarine Cable System – Deep Water Bay* (AEP-294/2007). *Environmental Permit* was granted on 23 November 2007 (EP-294/2007).

- *Proposed 132kV Submarine Cable Route for Airport "A" to Castle Peak Power Station Cable Circuit* (AEP 267/2007). *Environmental Permit* was granted on 29 March 2007 (EP-267/2007).

- *132kV Submarine Cable Installation for Wong Chuk Hang - Chung Hom Kok 132kV Circuits* (AEP132/2002). *Environmental Permit* was granted on 16 April 2002 (EP-132/2002).

- *FLAG North Asian Loop* (AEP 099/2001). *Environmental Permit* was granted on 18 June 2001 (EP-099/2001).

- *New T&T Hong Kong Limited: Domestic Cable Route* (AEP-086/2001). *Environmental Permit* was granted on 16 February 2001 (EP-086/2001).

- *C2C Cable Network - Hong Kong Section: Chung Hom Kok* (AEP-087/2001). *Environmental Permit* was granted on 16 February 2001 (EP-087/2001).

- *East Asian Crossing (EAC) Cable System (TKO)* (AEP-081/2000). *Environmental Permit* was granted on 4 October 2000 (EP-081/2000).

- *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* (AEP-064/2000). *Environmental Permit* was granted in June 2000 (EP-064/2000).

- *Black Point to Shekou Submarine Cable System, CLP Power.* Gazetted under *Foreshore Seabed (Reclamation) Ordinance* in 2005.

- *11kV Cable Circuits from Tai Mong Tsai to Kiu Tsui, CLP Power.* Gazetted under *Foreshore Seabed (Reclamation) Ordinance* in 2004.

In this method, the cable and injector are lowered to the seabed. The injector 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 injector is 0.21 m and while for this Project the cable will be buried to a depth of 5 m, other cables have been buried up to a maximum depth of 10 m in the past.

During the jetting cable laying process, and to a lesser degree during Route Clearance (RC) and/or Pre-Lay Grapnel Run (PLGR) operation, the seabed

sediments will be disturbed and a small percentage will be lost to suspension in the lower part of the water column in the immediate vicinity of the injector.

The analysis of the potential transport of fine sediments suspended into the water column during the cable laying process has been conducted and is presented in the following paragraphs.

Calculation of Sediment Transport

The rate of sediment lost to suspension is calculated as follows:

Release rate =	=	cross-sectional area of disturbed sediment × speed of cable laying machine × sediment dry density × percentage loss
depth of disturbance	=	5 m (target burial depth of cable)
width of disturbance	=	0.21 m (width of seabed disturbance as cable buried)
maximum cross sectional area	=	1.05 m^2
loss rate	=	20% (majority of sediment not disturbed)
speed of machine	=	0.278 m s^{-1} (1 km hr^{-1})
in-situ dry density	=	600 kg m^{-3} (typical of Hong Kong sediment)
Release Rate	=	**35.028 kg s^{-1}**

During cable laying works, and to a lesser degree during RC and/or PLGR operation, 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 within a much localised area, suspended sediments 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 velocities at the seabed are lower than those near the water surface, due to such effects as bottom friction. For the purposes of the assessment it is assumed that the current velocity is 0.9 m s^{-1}, which is an upper bound estimate of bottom current velocities in the vicinity of the cable works area and conservative [(1)].

Similar impact assessment projects including those listed at the start of this *Section A4.2.3* above have been reviewed and a current velocity of 0.9 m s^{-1} is chosen based on estimated velocity values of currents from projects closest to

(1) ERM- Hong Kong Ltd (2007). VSNL Intra Asia Submarine Cable System – Deep Water Bay. For VSNL International Pte Ltd.

the project area. (1) It is expected that the sediment will initially spread to a maximum of 6 m along the centre-line of the cable alignment, which represents the longitudinal dimension of the injector. The suspended solids will tend to form around the cable laying works, however the potential impacts have been addressed using a conservative assumption that a cross-current carries the sediment towards the sensitive receivers.

Based on the above, and given the worst case scenario that the sediment initially mixes evenly over the lower 1 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 × height of sediment × width of sediment)
release rate	=	35.028 kg s^{-1}
current velocity	=	0.9 m s^{-1}
height of sediment	=	1 m
width of sediment	=	6 m
Initial Concentration	=	**6.4867 kg m^{-3}**

Typically the settling velocity of SS is determined by examining the relationship between SS initial concentrations and the cohesive nature of the sediment being disturbed. This applies in HKSAR and typically, as SS concentration increases, so will settling velocity, as sediment particles flocculate, gain mass and settle faster. However, this relationship does not hold true when initial concentrations exceed values such as 1 kg m^{-3} (2). As the predicted initial concentration exceeds this value for this project, a more conservative settling velocity of 10 mm s^{-1} has been adopted.

As the sediment progressively settles onto the seabed, however, suspended sediment concentrations will gradually reduce. In order to account for the gradually reducing concentrations, the above settling velocity is halved, which gives a value of **5.0 mm s^{-1}**. This is the same approach as was adopted in the EIA for the gas pipeline serving the Lamma Power Station Extension (3).

(1) The bottom current velocity along the proposed cable alignment is examined based on the Update Model (developed, calibrated and verified by EPD in 1998) and for a typical tidal cycle in the dry and wet season respectively. The current velocity within the Stanley Bay is smaller in magnitude than those in the open waters. The Model indicates that maximum bottom current velocity along the proposed cable within the Stanley Bay is would be about 0.3 m/s in both seasons. The maximum bottom current velocity in the open waters (proposed cable alignment from the Stanley Peninsula until east boundary of Hong Kong) would be below 0.6 m/s. If taking these velocities to estimate the sediment travel distance, the travel distance will be generally < 60 m within the Stanley Bay and < 110 m from the Stanley Peninsula until east boundary of Hong Kong. Therefore taking bottom current velocity of 0.9 m/s (sediment travel distance 180 m accordingly) is valid for the entire cable route and a rather conservative assumption.

(2) Hydraulics Research (1988) Estuarine Muds Manual.

(3) ERM - Hong Kong, Ltd (1998) EIA for a 1,800MW Gas-fired Power Station for Lamma Extension. For The Hongkong Electric Co Ltd.

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 = 1 m /0.005 m s^{-1} **= 200 s**

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

Distance Travelled = 200 s x 0.9 m s^{-1} **= 180 m**

The above calculation indicates that the sediments disturbed during cable laying works will settle onto the seabed within approximately **180 m** of the cable alignment.

Using the same calculation for 2 m burial depth, the initial concentration is predicted to be 2.3 kg m^{-3} exceeding 1 kg m^{-3} and hence 10 mm s^{-1} settling velocity was used. Therefore, the distance travelled by the disturbed sediments will also be 180 m from the cable alignment.

Table A6 shows that all WSRs are located beyond the above predicted distance. It is hence expected that the suspended solid in the water column will be back to background level before reaching of these WSRs. No significant elevation is therefore expected at these WSRs and hence no unacceptable change in water quality is expected at these WSRs.

Generally, it is anticipated that the cable installation works will not cause unacceptable adverse impacts to water quality at the WSRs. For areas of high ecological importance and the nursery area of commercial fisheries resources, assessment of associated impacts to marine ecology and fisheries are presented in *Annex B* and *Annex C* respectively.

A4.3 MARINE CABLE OPERATION

It should be noted that in case cable repair work is required during project operation, the recovery of any faulty cable section to the surface would involve similar equipment for fluidizing the sediment that covers the cable. Therefore, the calculation for maximum distance travelled by disturbed sediment above still applies. Since only a short section of faulty cable would need to be removed, the potential extent of impact would be smaller than that of the construction phase (as explained in Main Report, Section 4.10) and the duration of impact would also be shorter. The selection of plant and equipment would be "fit-for-purpose", adopting smaller plants and / or use of divers if considered appropriate, which would reduce potential water quality impacts associated with potential cable repair works. No unacceptable water quality impact to the identified WSRs is expected from the potential cable repair works.

Table A6 Evaluation of Impacts with respect to the Extension of the Sediment Plume

ID	Water Quality Sensitive Receiver	Approx. Geodesic^ Distance to Proposed		Sediment may reach the WSR?	Likelihood of Adverse Impact	Reason
		Cable Alignment / Landing Point (m)	Earth System (m)			
DWB	Deep Water Bay	3,810	3,810	No	No	Sediment would not reach WSR.
RB	Repulse Bay	2,560	2,560	No	No	Sediment would not reach WSR.
MB	Middle Bay	1,810	1,810	No	No	Sediment would not reach WSR.
SB	South Bay	1,420	1,420	No	No	Sediment would not reach WSR.
CHK	Chung Hom Kok	520	520	No	No	Sediment would not reach WSR.
SSB	Saint Stephen's Beach Boundary	310	630	No	No	Sediment would not reach WSR.
SMB	Stanley Main Beach	800	840	No	No	Sediment would not reach WSR.
HB	Hairpin Bay	1,130	1,150	No	No	Sediment would not reach WSR.
TC	Turtle Cove	2,410	2,440	No	No	Sediment would not reach WSR.
BWB	Big Wave Bay	5,190	5,250	No	No	Sediment would not reach WSR.
RB	Rocky Bay	3,640	4,830	No	No	Sediment would not reach WSR.
SO	Shek O	3,290	4,640	No	No	Sediment would not reach WSR.
C1	Coral sites along the coast of Round Island	2,270	2,270	No	No	Sediment would not reach WSR.
C2	Coral sites along the coast of Chung Hom Kok	1,320	1,160	No	No	Sediment would not reach WSR.
C3	Coral sites along the coast of Cape Colinson	5,960	6,400	No	No	Sediment would not reach WSR.
C4	Coral sites along the coast of Tai Long Pai	3,900	6,310	No	No	Sediment would not reach WSR.
C5	Coral sites along the coast of south & east Beaufort Island	1,230	5,970	No	No	Sediment would not reach WSR.
C6	Coral sites along the coast of Po Toi Island	1,820	6,980	No	No	Sediment would not reach WSR.
C7	Coral sites along the coast of Sung Kong Islet	510	7,860	No	No	Sediment would not reach WSR.
C8	Coral sites along the coast of Sung Kong	720	8,550	No	No	Sediment would not reach WSR.
C9	Coral sites along the coast of Tung Long Chau	4,400	8,570	No	No	Sediment would not reach WSR.

ID	Water Quality Sensitive Receiver	Approx. Geodesic^ Distance to Proposed		Sediment may reach the WSR?	Likelihood of Adverse Impact	Reason
		Cable Alignment / Landing Point (m)	Earth System (m)			
C10	Coral sites along the coast of Waglan Island	950	10,580	No	No	Sediment would not reach WSR.
C11	Coral sites along the coast of Ninepin Group;	6,390	15,160	No	No	Sediment would not reach WSR.
C12	Coral site along the coast of north Beaufort Island	840	4,840	No	No	Sediment would not reach WSR.
C13	Coral sites along the coast of Cape d'Aguilar	580	5,590	No	No	Sediment would not reach WSR.
M1	Tai Tam Intertidal Mudflat	3,270	3,280	No	No	Sediment would not reach WSR.
M2	Tai Tam Mangrove Stand	3,640	3,630	No	No	Sediment would not reach WSR.
M3	Cape d'Aguilar Marine Reserve	640	5,480	No	No	Sediment would not reach WSR.
F1	Sok Kwu Wan Fish Culture Zones;	6,570	6,570	No	No	Sediment would not reach WSR.
F2	Po Toi Fish Culture Zones;	3,640	7,300	No	No	Sediment would not reach WSR.
F3	Tung Lung Chau Fish Culture Zones;	6,320	8,750	No	No	Sediment would not reach WSR.
I1	WSD Flushing Intake of Ap Lei Chau	6,000	6,000	No	No	Sediment would not reach WSR.
I2	WSD Flushing Intake of Aberdeen	5,030	5,030	No	No	Sediment would not reach WSR.
I3	Ocean Park's Main Seawater Intake	3,950	3,950	No	No	Sediment would not reach WSR.
I4	Ocean Park's Training Yard Seawater Intake	4,090	4,090	No	No	Sediment would not reach WSR.
I5	Seawater Intake for The University of Hong Kong Swire Institute of Marine Science	1,190	5,550	No	No	Sediment would not reach WSR.

Note: ^ Geodesic distance refers to the shortest straight line distance between two locations, without regard on the physical obstacles in between. Please also note that the distances from the earth system to all other WSRs are greater than that from the cable alignment.

A4.4 MITIGATION MEASURES

A4.4.1 *Land Cable Works*

The potential impacts to water quality during trenching and excavation works on land primarily relate to surface water run-off. These may be readily controlled through water quality protection measures incorporated as part of good working practices:

- The machinery employed will be inspected prior to work commencing to ensure the waters and beach will not be polluted with oil/grease/fuel. No machinery maintenance will be carried out onsite. Oil absorbent materials will be readily placed on site and will be applied immediately should any oil leakage incident occur, to ensure the nearby water quality would not be affected; and

- All construction waste and drainage will be handled and disposed in accordance with the *Waste Disposal Ordinance* and *Practice Note for Professional Persons*, *Construction Site Drainage* (*ProPECC PN1/94*) and in particular the following measures adhered to:

  - 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

  - Best Management Practices (BMPs) will be applied to avoid and minimise contaminated runoff from work sites, marine plants and vessels, including wastewater being properly treated and discharged to storm drain.

A4.4.2 *Inshore Cable Works and Earth System Installation*

During inshore marine based cable laying activities the following mitigation measures will be undertaken:

- Having consulted directly with LCSD, including Southern District Leisure Services Office and St. Stephen's Beach Water Sports Centre, to minimize impact on users of Stanley Bay, no marine installation works will be carried out within Stanley Bay (See ***Figure A2***) from 1 June to 31 August inclusive (1).

- The Project proponent will appoint a liaison officer for the Project, particularly to ensure effective communication during the marine works within Stanley Bay. Prior to the commencement of the work in Stanley Bay the Project proponent will liaise with LCSD and any other relevant parties

(1) 1 June to 31 August inclusive covers the peak bathing season at St. Stephen's Beach (June to August) as confirmed by LCSD and shown at: www.lcsd.gov.hk/en/beach/index/beach-location-hk/beach-address-south.html; as well as peak water sports activity periods within Stanley Bay i.e. from mid-July to end August and all days of dragon boat racing in June

(e.g. District Office regarding Dragon Boat race schedule) to establish an appropriate notification system prior to and during installation;

- To better control the emission of sediments into the water column, the installation works would be conducted using the more controlled method of diver handheld device (which has lower level of sediment disturbance) at the area close to shore. For the area beyond, cable installation (using cable installation barge and jetting machine), would be used but at a controlled forward rate to limit the level of disturbance. Specifically,

  - Jet probe would be used by divers from the LWM of the Sha Shek Tan out to approximately 260 m, for cable installation (See Main Text, ***Figure 1.1***);

  - diver handheld suction method should be adopted for installation of the earth system steel plate; and

  - the forward speed of the cable installation barge will be limited to a maximum of 1 km hr^{-1} throughout all works.

With the implementation of these proposed measures, adverse impact from disturbed sediment during inshore cable work and earth system installation, is not expected to encroach into WSR areas either temporally (i.e. due to avoidance of peak seasons) or spatially (i.e. sediment plume would not reach nearby WSRs due to physical separation).

Nevertheless, as a precautionary measure and following standard practice for submarine cable installation in Hong Kong, to verify that the Project works will not result in any adverse impacts to water quality (and consequently water sensitive receivers, particularly to marine ecology and fisheries), and to rectify any anomalies considered due to the Project, it is recommended that water quality monitoring be carried out, as further detailed in *Annex F*. In case any Limit Levels are exceeded, cable installation/ repair operations will be suspended if considered due to the Project (until the cause of non-compliance is detected and the situation rectified) and appropriate methods of reducing impacts will be discussed including, but not limited to: reduction of speed of cable installation barge; and reduction in jetting water pressure.

A4.4.3 Remaining Submarine Works to boundary of HKSAR

During remaining submarine works to the boundary of HKSAR the following mitigation measures will be undertaken:

- The same measures as outlined in *Section A4.4.2* while the submarine works are located within Stanley Bay (see ***Figure A2***)

- If a specific vessel/barge is used for the transport of debris recovered from the seabed during route clearance/ pre-lay grapnel run in order to prevent leakage of material during loading and transport to the disposal site, it shall:

  - be fitted with tight bottom seals;

- be filled to a level which ensures that material does not spill over during loading and transport; and

- maintain adequate freeboard to ensure that the decks are not washed by wave action.

- To better control the emission of sediments into the water column, the forward speed of the cable installation barge will be limited to a maximum of 1 km hr^{-1}.

With the implementation of these proposed measures, adverse impact from disturbed sediment during the remaining submarine cable work to the boundary to HKSAR is not expected, given enough physical separation and limited level of sediment loss to the water column.

Nevertheless, as a precautionary measure and following standard practice for submarine cable installation in Hong Kong, to verify that the Project works will not result in any impacts to water quality (and consequently to marine ecology and fisheries), and to rectify any anomalies considered due to the Project, it is recommended that water quality monitoring be carried out as further detailed in *Annex F*. In case any Limit Levels are exceeded, cable installation/ repair operations will be suspended if the excess is considered due to the Project (until the cause of non-compliance is detected and the situation rectified) and appropriate methods of reducing impacts will be discussed including, but not limited to: reduction of speed of cable installation barge; and reduction in jetting water pressure.

A4.4.4 Cable Operation (After Installation), including Maintenance and Repair Phase

For any potential maintenance and repair works for the cable and earth system, the mitigation and precautionary measures listed above would generally apply, according to where the maintenance and repair works were located, ie:

- For maintenance/repair operations located in the land cable area, measures outlined in *Section A4.4.1* would generally apply;

- For maintenance/repair operations located in the inshore cable area, measures outlined in *Section A4.4.2* would generally apply, except exceptional circumstances as agreed with EPD, such as:
  - For repair/maintenance operations: such works are usually unexpected and require addressing immediately, and also involve smaller scale works with restricted locations and timeframe, compared to installation works. In the event that any revision to the measure is required, agreement with EPD and other relevant authorities, such as LCSD (concerning in particular bathers at St. Stephen's beach and water sports activity) and Southern District Office (concerning in particular Dragon Boat races) will be sought.

- For maintenance/repair operations located in the remaining submarine works area and outside of Stanley Bay, measures outlined in *Section A4.4.3* would apply.

A5 SUMMARY AND CONCLUSIONS

A review and assessment of water quality impacts associated with construction and operation (including maintenance) of the proposed submarine cable system have been undertaken.

The calculation of sediment transport from the construction works, using a conservative settling velocity, indicates that the sediments disturbed during the cable laying works using jetting technique for injector burial tool or sledge tool, and to a lesser degree during RC and/or PLGR operation, will settle onto the seabed within approximately 180 m from the cable alignment. WSRs have been identified and all of them are located over 180 m away from the proposed cable route, thus the plume of suspended sediments is not anticipated to reach these WSRs. Mitigation measures are recommended, for example, the speed of the installation barge will be limited to 1 km hr^{-1}, and a water quality monitoring programme will be carried out, in order to minimise the water quality impacts and verify that the Project works will not result in any unacceptable adverse impacts to water quality at WSRs. Due to the physical separation of the WSRs from the cable laying works and the short duration of working period, the identified WSRs are unlikely to be affected by adverse changes in water quality within the assessment area and water quality is likely to comply with the WQOs.

Overall, no unacceptable water quality impacts have been identified.

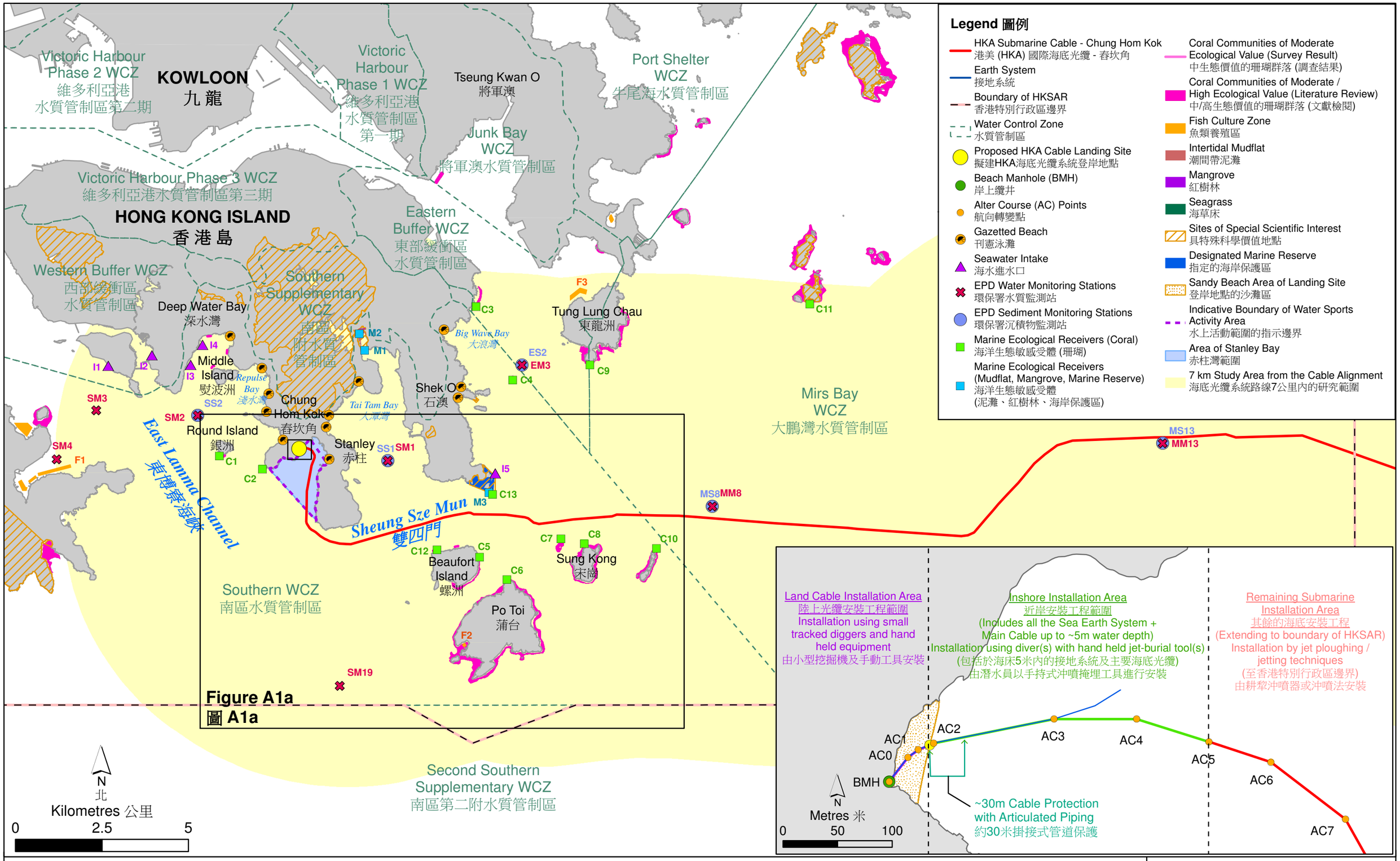

Figure A1
圖 A1

Representative Marine Water Sensitive Receivers & EPD Monitoring Stations in the surrounding of the Proposed HKA Cable System - Chung Hom Kok
在擬建HKA 光纜系統 - 春坎角附近具代表性的海洋水質敏感受體及環保署水質監測站

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Environmental Resources Management
ERM

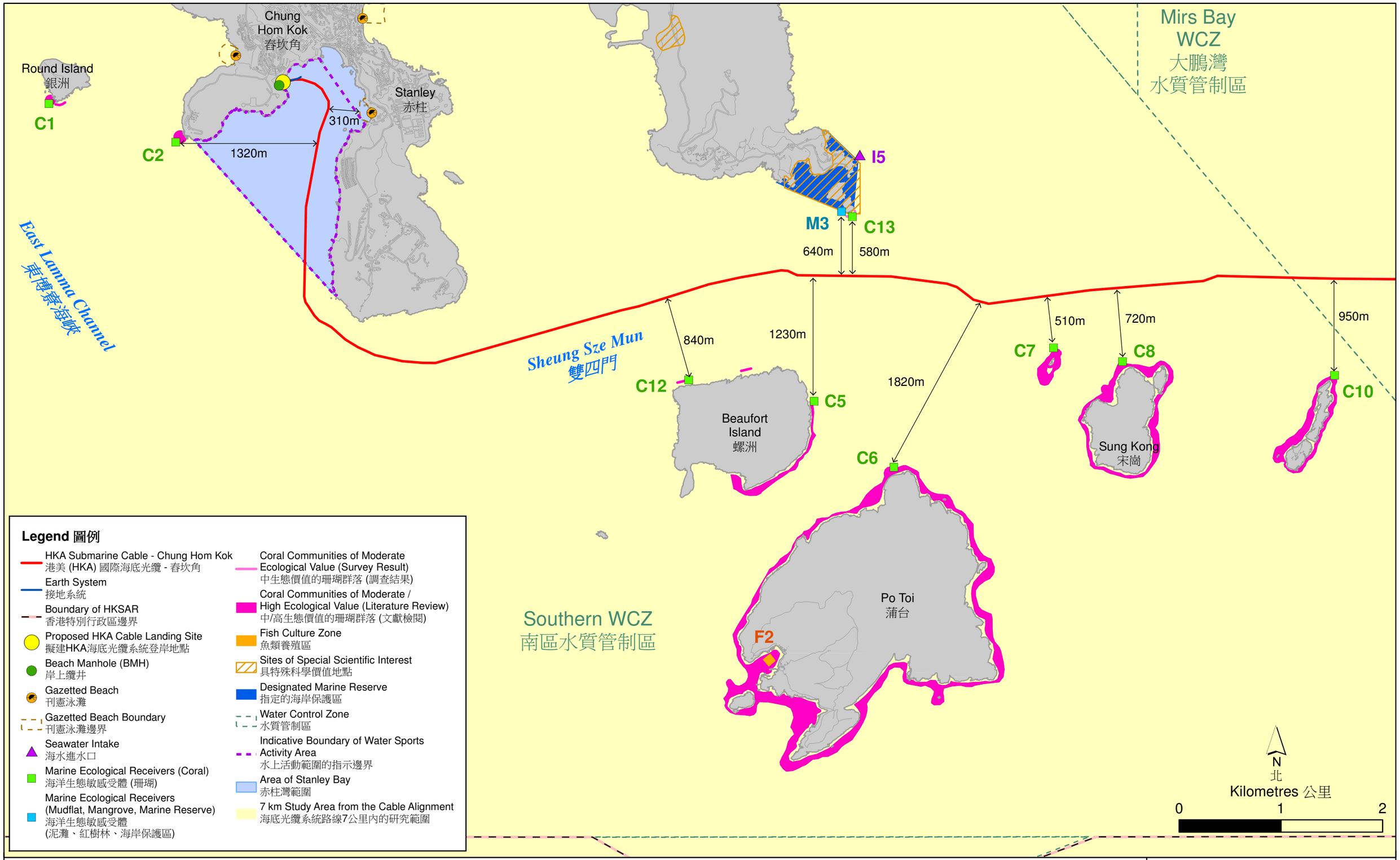

Figure A1a
圖 A1a

Representative Marine Water Sensitive Receivers in the surrounding of the Proposed HKA Cable System - Chung Hom Kok
在擬建HKA 光纜系統 - 春坎角附近具代表性的海洋水質敏感受體

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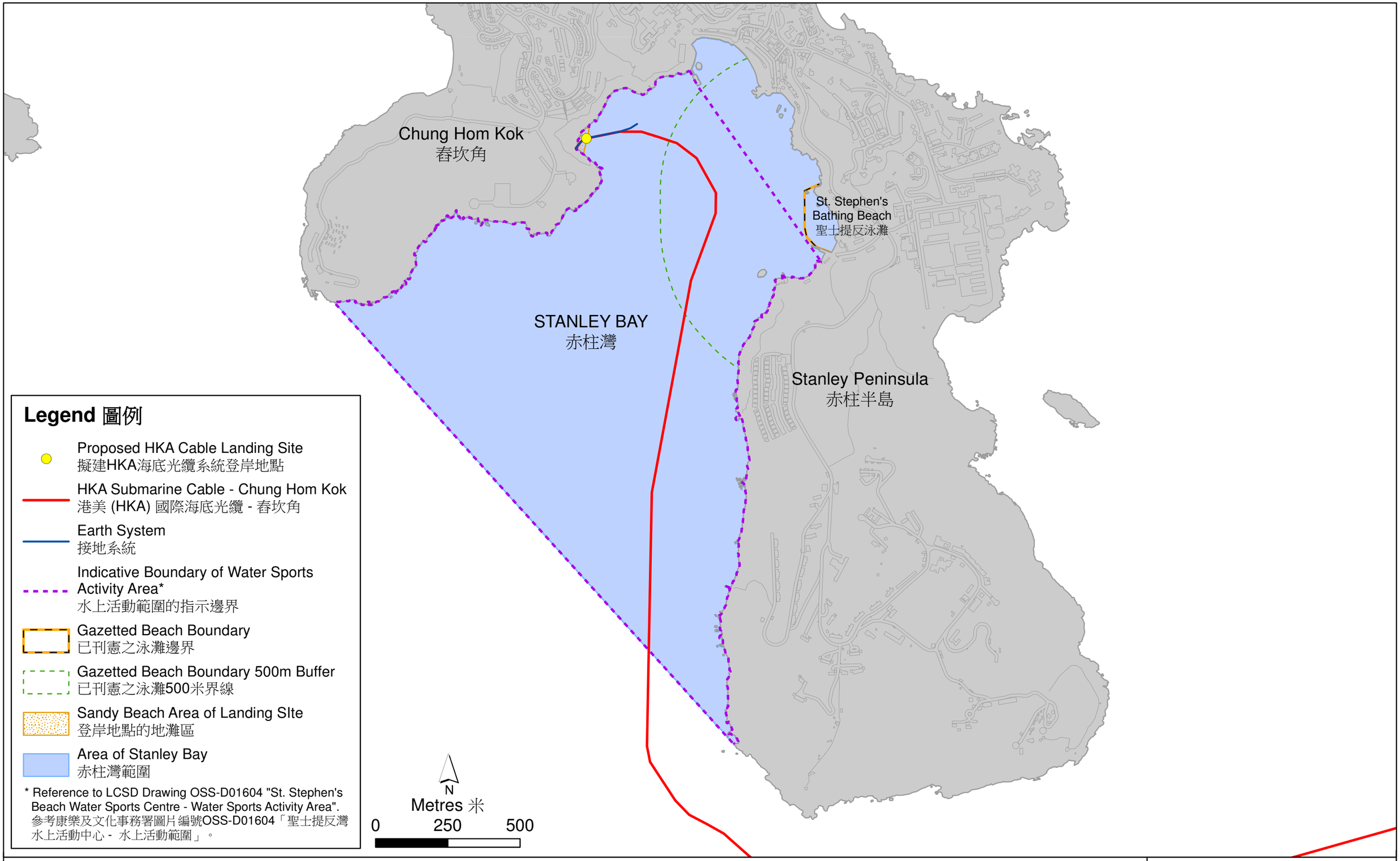

Figure A2
圖 A2

St. Stephen's Beach Boundary and 500m Buffer Area + Stanley Bay Water Sports Activity Area
聖士提反泳灘與其500米邊界及赤柱灣水上活動範圍

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Environmental Resources Management
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Annex B

Assessment of Potential Impacts to Marine Ecology Resources

CONTENTS

B1 INTRODUCTION

This *Annex* presents the baseline conditions of marine ecological resources in the vicinity of the proposed cable alignment which is the footprint of the proposed routing for the HKA Submarine Cable – Chung Hom Kok (the Project) submarine cable network and evaluates the potential for direct and indirect impacts to them during construction and operation (including maintenance) of the Project. Baseline conditions are evaluated based on information from the literature and recent field verification conducted for the purposes of this assessment. Measures required to mitigate identified impacts are recommended, where appropriate.

B2 RELEVANT LEGISLATION AND ASSESSMENT CRITERIA

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

B3 EXISTING MARINE ECOLOGICAL RESOURCES

B3.1 SITES OF SPECIAL SCIENTIFIC INTEREST

One Site of Special Scientific Interest (SSSI) at Cape d'Aguilar (named 'Hok Tsui (Cape D'Aguilar) SSSI' and important both ecologically and geologically), is located approximately 610 m away from the proposed cable alignment at its closest point (***Figure B1***). Other SSSIs with a marine element, such as Tai Tam Harbour (Inner Bay) and Sham Wan SSSI are over 3 km and over 7 km respectively from the proposed cable alignment. As detailed further in *Section B4.1*, no impacts are anticipated to any of these SSSI areas due to the Project.

B3.2 CAPE D'AGUILAR MARINE RESERVE

Cape D'Aguilar Marine Reserve was designated in 1996, comprising 20 ha of marine area, in order to further protect the Hok Tsui (Cape D'Aguilar) SSSI. It was established exclusively for the conservation of marine resources, scientific research and public education. Fishing, collecting animals and plants, as well as certain activities such as water-skiing, boating, swimming and diving are prohibited in the marine reserve. The marine reserve is approximately 640 m to the north of the proposed cable alignment at its closest point (***Figure B1***) and as detailed further in *Section B4.1*, no impacts are anticipated to this area due to the Project.

B3.3 COASTAL PROTECTION AREAS

Designated Costal Protection Areas (CPAs) are located on land above the High Water Mark (HWM) and are discussed in the main text, *Section 3.6*. The intertidal and subtidal hard bottom assemblages below the CPA in the vicinity of the landing site have been assessed in the following sections.

B3.4 INTERTIDAL SOFT BOTTOM ASSEMBLAGES

Information regarding the ecology of sandy shore in the proposed cable landing site (Sha Shek Tan [SST]) is summarized from one study, namely *Project Profile for the C2C Cable Network - Hong Kong Section : Chung Hom Kok*, conducted in 2000 (1). Results from the field surveys conducted in 2000 indicated that SST (the proposed landing site) is a natural, semi-exposed sandy shore with fine sand and small-sized gravels. The habitat appeared to be subject to human disturbance as some remains of village houses were seen at the back of the beach. The intertidal assemblages recorded on the sandy shore were mainly composed of clams with an abundance of 668.4 m^{-2}. The species recorded included *Cancella chinensis*, *Donax cuneatus*, *Donax semigranosus* and *Tapes philippinarum*, which were common species with no conservation importance, found in semi-exposed sandy shores of Hong Kong.

(1) ERM (2000a). Project Profile for C2C Cable Network - Hong Kong Section: Chung Hom Kok. Report for GB21 (Hong Kong) Limited

A qualitative walk-through and quantitative transect survey were conducted in April 2018 along the sandy shore at SST (Station T3 of ***Figure B2***). Similar to the result in the previous studies, two (2) common species of clams, *Cancella chinensis* and *Donax* spp., with an abundance of 354 individuals m^{-2} were recorded during the survey and no species with conservation importance were identified (see *Table B1.1* of *Appendix B1).* Although the abundance of assemblages was considered as high, the diversity was considered low with only two common species recorded. The habitat is thus considered as low ecological value.

B3.5 INTERTIDAL HARD BOTTOM ASSEMBLAGES

Information on the intertidal rocky shore assemblages in the vicinity of the proposed cable landing site is summarized from two consultancy studies, namely *Project Profile for the C2C Cable Network - Hong Kong Section : Chung Hom Kok* conducted in 2000 (1), and *Project Profile for the New T&T Hong Kong Limited Domestic Cable Route* (2) also conducted in 2000. Data extracted from these studies are considered to be representative of the assemblages within, or in close vicinity to, the proposed cable landing site at SST of CHK.

Intertidal surveys were conducted in the vicinity of the proposed cable landing site in the submarine cable installation studies in 2000 (3). Although the full species list on the rocky shore was not reported, the results of the surveys highlighted that the assemblage structure on the shores surveyed was considered to be typical of semi-exposed rocky shores in Hong Kong and no species of conservation importance were recorded. The mean abundances of mobile organisms (limpets and snails) were 16.8 m^{-2} – 102.7 m^{-2} while the mean percentage coverage of sessile organisms (bivalves, barnacles and macroalgae) was 0.01– 1.6 %. In another study performed in the same year (i.e. 2000) (4), intertidal surveys were conducted on the rocky shores along the southern side of CHK Headland area. Whilst the mean abundances of mobile organisms (limpets and snails) were 26.7 m^{-2} – 61.6 m^{-2}, the mean percentage coverage of sessile organisms (bivalves, barnacles and macroalgae) was 2.4– 21.1 %. In addition, it should be noted that no species of conservation importance were recorded.

An updated intertidal survey was conducted in April 2018 along the rocky shores adjacent to the landing site within the Study Area, i.e. SST (Stations T1 and T2 of ***Figure B2***). A total of 37 flora and fauna species were encountered during the qualitative walk-through and quantitative surveys (see *Table B1.1* of *Appendix B1*). These species are all considered as common and widespread species on rocky shores of HKSAR. Dominant organisms recorded included the Periwinkle *Echinolittorina radiata*, topshell *Monodonta labio*, the turban shell *Lunella coronata*, Planaxis snail *Planaxid sulcatus*, the whelk *Reishia clavigera* and

(1) ERM (2000a). *Op cit*

(2) ERM (2000b). Project Profile for the New T&T Hong Kong Limited Domestic Cable Route. Report for New T&T (Hong Kong) Limited

(3) ERM (2000a). *Op cit*

(4) ERM (2000b). *Op cit*

the limpet *Nipponacmea concinna*. Dominant sessile species including the algae *Hildenbrandia rubra* and *Pseudulvella applanata* also presented in the mid to low-shore (0.5-1.0 mCD). Both the abundance/ density of mobile species and percentage cover of sessile species were considered to be low to moderate (mean of 62 – 175 m^{-2} and 24 – 51% respectively).

Overall, results from previous and updated intertidal surveys have shown that the intertidal rocky shores within the Study Area, including the area adjacent to the proposed cable landing site at SST, support generally low to moderate abundances and densities of organisms, and therefore are of low to moderate ecological value. It is also noted that no species of conservation importance were recorded.

B3.6 SUBTIDAL SOFT BOTTOM ASSEMBLAGES

Information on the subtidal soft bottom assemblages in the vicinity of the proposed cable alignment is available from the *Consultancy Study on Marine Benthic Communities in Hong Kong* (1). Twelve (12) sampling stations (Sampling Nos. 63-74) are close to the proposed cable alignment and data extracted from these stations can be considered to be representative of the assemblages along the alignment.

According to the findings of the *Consultancy Study*, the substratum of the 12 sampling stations was covered by very fine sand and/or silt/clay. Their benthic assemblages were typical of Hong Kong waters and similar to benthic assemblages in the majority of other subtidal habitats in Hong Kong. In summer, the average number of species was medium (35 species per 0.5 m^2), while the average number of individuals (170 individuals per m^2) and average wet weight (41.7 g per m^2) were low when compared with average values of Hong Kong (33 species per 0.5 m^2, 540 individuals per m^2 and 71.2 g per m^2). In winter, the average number of species (29 species per 0.5 m^2) and average wet weight (32.0 g per m^2) were medium, while the average number of individuals (170 individuals per m^2) was low in comparison with average values of benthic assemblages in Hong Kong (34 species per 0.5 m^2, 450 individuals per m^2 and 28 g per m^2). Concerning the species diversity in summer, five (5) stations showed high diversity (> 3) while seven (7) of them showed only medium diversity (2 – 3) in comparison to other survey areas. Species diversity was lower in winter with only two (2) stations showing high diversity while others were of medium diversity. In both seasons, no species of conservation importance were found along the proposed cable corridor.

B3.7 SUBTIDAL HARD BOTTOM ASSEMBLAGES

Subtidal marine ecological surveys employing the Rapid Ecological Assessment (REA) technique were carried out at SST of CHK in 2011 (2). The survey results

(1) CityU Professional Services Limited (2002). *Consultancy Study on Marine Benthic Communities in Hong Kong* (Agreement No. CE 69/2000). Final Report submitted to AFCD.

(2) Atkins China Limited (2011) *South-East Asia Japan Cable System (SJC) Hong Kong Segment Project Profile* (DIR-213/2011);

showed that nine (9) hard coral species were recorded and the coverage was <5%. The species recorded included *Favites abdita*, *Porites* sp., *Favites pentagona*, *Plesiastrea versipora*, *Oulastrea crispata*, *Platygyra carnosus*, *Turbinaria peltata*, *Psammocora superficialis* and *Goniopora stutchburyi*.

Another underwater survey conducted in 2000 recorded that both hard coral and octocoral species were identified in the shallow (-2 to -5 mCD) and deep water regions (-6 to -8.5 mCD) of SST and the nearby hard bottom habitats [(1)]. The coverage for both hard and octocoral species in both shallow and deep water regions were reported to be 1 – 10%. For hard coral, there were up to 11 species reported, including *Favia speciosa*, *Favites abdita*, *Goniastrea aspera*, *Platygyra sinensis*, *Stylocoeniella guentheri*, *Goniopora columna*, *Porites* sp., *Psammocora superficialis*, *Oulastrea crispate*, *Coscinaraea columna* and *Cyphastrea* sp., while, for octocoral, *Dendronephthya* spp and other Gorgonians were reported, but most of them were not identified to genus level. It was concluded that the ecological value of the subtidal hard bottom habitat in vicinity of SST of CHK was of low ecological importance.

According to the studies in 2005, 2011 and 2017, coral communities of moderate/ high ecological value were reported along the entire coast of Po Toi, Sung Kong and Waglan Island and along the northern and south-eastern coast of Beaufort Island (***Figure B1***) [(2)(3)(4)]. Approximate distance between the proposed cable alignment and these nearby coral communities with high ecological value are also provided in ***Figure B1*** showing they are all over 500 m from the proposed cable alignment.

Supplementary subtidal dive surveys were conducted in March 2018 for this Project to provide updated information on the status of subtidal hard bottom habitats in the vicinity of the proposed cable alignment and the proposed cable landing site. The dive surveys comprised qualitative spot dive surveys (***Figure B2***) and semi-quantitative REA surveys (***Figure B3***) in:

- the vicinity of the proposed cable route at SST (Stations C1 and C2 for spot dives and R1 and R2 for REA);
- the direct impact area of the proposed cable route at SST (Stations C3 for spot dives and R3 for REA);
- the northwest of Stanley Peninsula (Station C4 for spot dives and R4 for REA);

(1) ERM (2000a). *Op cit*

(2) ERM (2017). Project Profile for the Pacific Light Cable Network (PLCN) – Deep Water Bay. Prepared on behalf of the proponent PCCW Global (HK) Ltd.(3) Chan A, Choi C, McCorry D, Chan K, Lee MW, Ang PO (2005) *Field Guide to Hard Coral of Hong Kong*. Friends of the Country Parks

(3) Chan A, Choi C, McCorry D, Chan K, Lee MW, Ang PO (2005) *Field Guide to Hard Coral of Hong Kong*. Friends of the Country Parks

(4) Goodkin NF, Switzer AD, McCorry D, DeVantier L, True JD, Hughen KA, Angeline N, Yang TT (2011) Coral communities of Hong Kong: long loved corals in a marginal reef environment. Marine Ecology Progrss Series. 426:185-196

- the southwest of Stanley Peninsula (Station C5 for spot dives and R5 for REA); and

- the south of Kau Pei Chau of Cape D'Aguilar (Station C6 for spot dives and R6 for REA).

Data from the qualitative spot dive checks and the REA surveys are presented in *Appendix B2* with some detail for the landing site provided in ***Figure B4***.

Results of qualitative spot dive checks revealed that corals were recorded at shallow depth zone (-2 to -5 mCD) of the monitoring stations C1 - C3 while corals were recorded at both shallow (-3 to -6 mCD) and deep depth zone (-7 to -17 mCD) of the monitoring stations C4 - C6. Semi-quantitative REA surveys were then conducted along each depth zone of the monitoring stations where corals were recorded. The seabed attributes along the REA transect is presented in *Table B2.1* of *Appendix B2* while the coral species recorded during the qualitative spot dive reconnaissance check and semi-quantitative REA surveys are presented in *Table B2.2* of *Appendix B2*. All coral species recorded in the dive surveys are considered as common species and have a widespread distribution throughout HKSAR's nearshore waters.

Results of REA surveys conducted near the proposed landing point at SST (i.e. Stations R1 and R2; ***Figure B3***) showed that the shallow depth zone (- 2 – 5 mCD) was dominated by sands, bedrocks and large boulders at Stations R1 and R2 on either side of the landing site and by sands and rocks at Station R3 near the landing site. A total of six (6), seven (7) and two (2) common hard coral species were recorded at stations R1, R2 and R3, respectively (see *Table B2.2* of *Appendix B2*). The estimated hard coral covers were below 5% at the shallow depth zone of stations R1, R2 and R3. Octocorals and black corals were not recorded at shallow depth zone during the REA surveys at stations R1, R2 and R3. It should be noted that five (5) species of macroalgae were also recorded at these stations, with high estimated cover (i.e. 31 – 75%). The high coverage of macroalgae was mainly due to *Colpomenia sinuosa* and *Sagassum hemiphyllum*. In addition, most individuals of *Sagassum hemiphyllum* were generally large in size with approximately 0.5 –3.0 m in length.

Results of REA surveys conducted at the northwest of Stanley Peninsula (i.e. Station R4; ***Figure B3***) showed that the shallow depth zone (- 3 – 6 mCD) was dominated by large boulders while the deep depth zone (- 6 – 8 mCD) was dominated by boulders and silts. Estimated hard coral cover was less than 5% in both shallow and deep depth zones and encrusting colonies of *Plesiastrea versipora* and *Psammocora superficialis* were commonly recorded amongst the seven (7) hard coral species observed. One (1) species of Octocoral (*Echinomuricea* sp.) and one (1) species of black coral (*Cirripathes sinensis*) were recorded in deep water with less than 5% estimated coverage. Most *Echinomuricea* sp. colonies were small in size with about 5 cm length.

Results of REA surveys conducted at southwest of Stanley Peninsula (i.e. Station R5; ***Figure B3***) showed that shallow depth zone (- 3 – 6 mCD) was dominated by boulders while deep depth zone (- 10 – 14 mCD) was dominated

by large boulders and silt. A total of seven (7) species of encrusting hard corals, such as *Plesiastrea versipora* and *Psammocora superficialis*, with less than 5% coverage were recorded at the shallow depth zone while ahermatypic hard coral, *Tubastrea/ Dendrophyllia* sp, was estimated to have 6-10% coverage at the deep depth zone. A total of six (6) species of Octocorals and three (3) species of black corals were recorded at the deep depth zone with less than 5% cover.

Results of REA surveys conducted south of Kau Pei Chau of Cape D'Aguilar (i.e. Station R6; ***Figure B3***) showed that both shallow (- 4 – 6 mCD) and deep (- 10 – 17 mCD) depth zones were dominated by bedrocks. Hard coral colonies *Plesiastrea versipora* were scattered (i.e. <5% coverage) in shallow water while approximately 11-30% coverage of ahermatypic hard coral, *Tubastrea/ Dendrophyllia* sp, was recorded in the deep water. Approximately 6-10% octocoral and less than 5% black coral were found in the deep depth zone. Octocoral were dominated by *Scleronephthya gracillimum* and *Dendronephthya* sp. amongst five (5) other species, while black coral *Cirripathes* sp. was recorded more than *Antipathes curvata* at this station.

Overall, results of the supplementary dive surveys showed that sparse hard coral colonies of locally common, widely-distributed species are present in the vicinity of the proposed cable landing point, northwest and southwest of Stanley Peninsula and the south of Kau Pei Chau of Cape D'Aguilar. ***Figure B4*** provides further illustration of the location and species of hard coral colonies near the cable alignment as it approaches the landing site (as presented in *Appendix B2*) with two *Favites* spp. colonies recorded, neither in the direct footprint of the proposed cable alignment.

Overall the abundance and diversity of hard corals is considered to be low in the context of subtidal hard bottom habitats in HKSAR, except at the deep water southwest of Stanley Peninsula and south of Kau Pei Chau of Cape D'Aguilar (stations R5 and R6 respectively). However, hard corals recorded in these stations were composed of ahermatypic hard coral, *Tubastrea/ Dendrophyllia* sp., which is commonly recorded in deep water in Hong Kong with low ecological value. Octocoral and black coral coverage and diversity were generally considered to be low except at the deep depth zone of Kau Pei Chau of Cape D'Aguilar Marine Reserve (station R6), where higher abundance and diversity of octocorals was found. Therefore, the ecological value are considered to be low at stations R1 – R5 and moderate at station R6.

B3.8 MARINE MAMMALS

The Chinese White Dolphin (CWD) (*Sousa chinensis*) and the Finless Porpoise (FP) (*Neophocaena phocaenoides*) are the two species of marine mammals that are regularly sighted in Hong Kong waters. Both species are highly mobile and utilise a wide range of areas seasonally.

The population of the CWD is mostly found near the Pearl River Estuary and the major distribution of the CWDs in Hong Kong waters is in West and Northwest Lantau [(1)]. Sightings are most frequent in the western part of these waters around the Sha Chau and Lung Kwu Chau Marine Park and the west coast of Lantau near Tai O. More CWD usage was found in Southwest Lantau areas in recent years [(2)]. The eastern waters of Hong Kong are not considered to represent an important habitat for CWD as only a small number of sightings have been recorded, mainly within the waters of Port Shelter.

The FP is a small cetacean endemic to southern and eastern Asia and is protected under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) Appendix I. FPs are mostly found in the southern waters and occasionally in the eastern waters of Hong Kong. Their distribution and abundance appears to vary spatially and temporally. It was reported that they are mostly recorded during spring in southern waters near Lamma Island. It has been suggested that the important FP habitats are located to the south of Tai A Chau, southwest of Shek Kwu Chau, south of Cheung Chau and the waters between Shek Kwu Chau and Soko Islands in the dry season. FP generally moves eastwards in the wet season with important habitats around Po Toi Islands and at the juncture of Po Toi and Ninepins [(3)].

The above literature review suggests that sightings of FP are infrequent and seasonal along the proposed cable alignment in the eastern and southeastern HKSAR waters, whereas southeast Lantau is already the marginal habitat for the CWD. Therefore, the proposed cable alignment situated in the eastern and south-eastern HKSAR waters is not considered to be a major habitat for cetaceans in HKSAR.

(1) Hung, S.K.Y. (2017). Monitoring of Marine Mammals in Hong Kong Waters (2016-17). Report submitted to Agriculture, Fisheries and Conservation Department.

(2) Hung, S.K.Y. (2017). *Op cit*

(3) Hung, S.K.Y. (2017). *Op cit*

B4 IMPACT ASSESSMENT

B4.1 IMPACT ON SITES OF SPECIAL SCIENTIFIC INTEREST (SSSIS) & MARINE RESERVE

The Hok Tsui (Cape d'Aguilar) SSSI is located approximately 610 m from the closest cable alignment (***Figure B1***), while Tai Tam Harbour (Inner Bay) SSSI and Sham Wan SSSI are over 3 km and 7 km away respectively as indicated in ***Figure B1***. Since the maximum distance of transport of suspended sediments generated by the construction of the Project would be approximately 180 m settling onto the seabed in less than 4 minutes (see *Annex A* for details) and given that all the marine SSSIs in the vicinity are more than 600 m from the closest cable alignment (i.e. over triple the distance that suspended sediments from the Project are anticipated to travel), no direct or indirect impacts are anticipated to SSSIs.

Equally, since the Cape D'Aguilar Marine Reserve is approximately 640 m from the closest cable alignment, no direct or indirect impacts are anticipated at the marine reserve either.

B4.2 DIRECT IMPACTS DURING CONSTRUCTION

Prior to the HKA cable laying and burial, Route Clearance (RC) and/or Pre-Lay Grapnel Run (PLGR) will be conducted over the length of the proposed cable route for burial, to minimize the risk of later damage to the burial equipment and ensure an efficient installation. PLGR is designed to remove any surface debris (e.g. abandoned fishing nets, wire rope or other significant debris on the seabed surface) that would be an obstruction to the simultaneous cable lay and burial process. RC would remove any out-of-service (OOS) cables identified to be crossing or otherwise obstructing the proposed cable route.

The PLGR would be conducted by towing a grapnel along the proposed cable route before the actual cable installation, using grapnel fluke penetrating between 0.2-1 m into the seabed (subject to seabed conditions). The RC would be conducted using specialized grapnel with longer flukes penetrating up to 1.5 m (or may be supported by diver hand-jetting and manual diver cutting during installation where OOS cables buried outside the normal reach of specialized grapnel) and a section of the OOS would be cut/removed to allow the installation and burial process to continue. Typical grapnel gear is presented in the Main Report ***Figure 2.1***.

Afterwards, the proposed cable will be lowered to the seabed and laid beneath the seabed using injection jetting technique using "Injector Burial Tool" or "Sledge Tool" which are designed to simultaneously lay and bury the cable. Using these methods the injector fluidises a trench using high pressure water jets and the cable is immediately laid within the trench. The maximum width of the seabed fluidised by the injector is approximately 0.21 m (although the cable itself is expected to occupy no more than 40 mm width) and the cable will be buried to a depth of 5 m. It should be noted that the seabed can be expected to naturally reinstate to before-work level and condition shortly after completion of the works.

Intertidal Hard Bottom Habitats: The intertidal rocky shore along the shoreline of SST will not be affected as the cable will land via an existing beach manhole (BMH) above the HWM and pass through a newly installed conduit under the concrete ramp at the top of the beach. No direct impacts are therefore expected on the intertidal hard bottom habitat as a result of the inshore construction activities.

Intertidal and Subtidal Soft Bottom Habitats: Short-term direct impacts will occur to soft bottom benthic assemblages present in both the intertidal and subtidal zone along any cable trenches and at the sea earth plate. It is, however, expected that once the cable laying and earth system operations are completed, the soft bottom habitats will be recolonised by benthic fauna which are expected to be similar to the soft bottom benthic assemblages presented before construction (or repair) activities commenced. As a result, direct impacts to intertidal and subtidal soft bottom benthic assemblages are not anticipated to be significant.

Subtidal Hard Bottom Habitats: The subtidal rocky habitat along the coastline of SST will not be affected as the cable will land via an existing BMH and conduit under the concrete ramp at the top of the beach. The cable laying and earth system are planned to be installed to avoid direct impacts on the hard bottom habitats and minimize the impacts on coral communities, including the selection of route in soft bottom habitat with low coral coverage and ecological value and cable installation by diver(s) in shallow waters. Therefore, direct impact to the coral communities in the vicinity of the proposed cable alignment near SST is not anticipated based on the results of the supplementary dive surveys (see ***Figure B4***). No direct impacts are expected to any other coral colonies either including along the northwest and south coast of Stanley Peninsula and the south of Kau Pei Chau of Cape d'Aguilar, given the proposed cable footprint does not directly affect these areas. Nevertheless, pre-installation and post-project coral survey near the landing site has been recommended as a precautionary measure in *Section B5.1* to verify corals near the landing site, if any, would not be directly affected by the Project.

Marine Mammals: In Hong Kong, there have been instances when dolphins have been killed or injured by vessel collisions (1) (2), and it is thought that this risk is mainly associated with high-speed vessels such as ferries. Given the marine vessel to be used for cable installation works is slow moving, the risk of vessel collision with marine mammals is considered to be very small. As such, direct impacts to marine mammals due to vessel collision are not anticipated to be significant.

(1) Parsons ECM, Jefferson TA (2000) Post-mortem investigations on stranded dolphins and porpoises from Hong Kong waters. Journal of Wildlife Diseases 36: 342-356.

(2) Jefferson TA, Curry BE, Kinoshita R (2002) Mortality and morbidity of Hong Kong finless porpoises, with special emphasis on the role of environmental contaminants. Raffles Bulletin of Zoology (Supplement) 10: 161- 171.

B4.3 INDIRECT IMPACTS DURING CONSTRUCTION PHASE

The injection jetting cable laying process, as well as RC/ PLGR operation, will result in the formation of suspended sediment around the Injector Burial Tool or Sledge Tool, which can be expected to remain very close to the seabed and would settle rapidly. An analysis of the potential transport of fine sediments suspended into the water column during the cable laying process has been conducted (*Annex A*) and has determined that the maximum distance of transport for suspended sediments would be 180 m from the cable burial machine, assuming a flat seabed.

Based on the above, indirect impacts may occur through seabed disturbance, resulting in elevation of suspended solids in the water column. Such increase above background suspended solid levels may potentially cause impacts to filter feeders and corals. As the cable installation works will be of a short duration, the increase is not predicted to be high, except for in the immediate vicinity of the cable burial machine; suspended solid levels are expected to settle rapidly back onto the seabed (within 4 minutes) and travel up to 180 m from the cable burial tool (see *Annex A* for details). As such, these impacts will be small scale and of a localised nature. Coral communities of moderate/ high ecological value at Round Island, Po Toi, Sung Kong Islet, Sung Kong, Waglan Island and north Beaufort Island are all considered too remote from the cable route to be adversely affected by the elevation of suspended solids and settlement of sediment due to the works i.e. they are all over 500 m from the alignment as shown in ***Figure B1*** which is over double the distance suspended sediments due the Project are expected to travel. The coral community at the south of Kau Pei Chau of Cape d'Aguilar (considered to have moderate ecological value; see *Section B3.7* above) is located approximately 580 m from the cable alignment (***Figure B1***). The distance of the cable from sensitive receivers such as these has been maximized, as detailed in *Section 1.5* of the main text. Potential disturbance to these corals is therefore also expected to be negligible, given they are over three times the maximum distance of transport for suspended sediments(180 m) and at a different depth. In addition the cable laying works are short term in nature, only lasting within 30 working days for the whole alignment. Therefore, no adverse indirect impacts to coral communities are expected due to the Project.

Marine mammals are highly mobile and are able to swim into open waters to avoid short term and localized seabed disturbance. In addition, they are air breathing and hence SS in the water column have no effect on their respiratory surfaces.

Cable installation works may result in a minor and short-term increase in underwater sound from marine vessels. FP, which are the more abundant marine mammal species in this area, use high frequency ultrasonic clicks for foraging and communication. The low frequency underwater sound associated with vessels, injection jetting and cable laying would thus not be expected to interfere significantly with them. Similarly, although some vessel sounds may be within the audible range of CWD, this is generally for high

speed vessels [1]. The cable installation works will be short-term and temporary and be carried out by one slow moving cable installation vessel/barge. The installation vessel/barge operation for cable laying works will take within 30 working days in HKSAR waters and over this short timeframe are not expected to interfere significantly with this cetacean species either. Therefore no unacceptable adverse impacts to FP and CWD from the Project (e.g. from underwater sounds or the cable laying vessel) are expected to occur.

Overall, no unacceptable adverse impacts to marine ecological resources are expected during the construction phase.

B4.4 OPERATION PHASE

During normal operation of the proposed cable system, impacts to marine ecological resources are not expected to occur. During operation however, there may be a potential requirement for maintenance work (i.e. cable repair at particular fault location due to unexpected damage) to be carried out. For repairs along the inshore and remaining submarine cable alignment, equipment and methods would be similar in nature to that used during cable installation works, but not along the full alignment (i.e. of smaller scale), with the potential to use smaller equipment such as Remotely Operated Vehicles (ROVs) equipped with injector tool and divers with hand held tools. The repair works process for shore end and marine works is therefore expected to have similar or reduced impact as compared to construction phase.

(1) Sims P, Hung S, Würsig B. (2012) High-speed vessel noises in West Hong Kong Waters and Their Contributions Relative to Indo-Pacific Humpback Dolphins (*Sousa chinesnis*). Journal of Marine Biology. Vol. 2012, ID169103, 11pp

B5 EVALUATION OF IMPACTS

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

- *Habitat Quality*: Short-term direct impacts are predicted to occur to subtidal soft bottom habitats along the cable trench. Short-term indirect impacts are also predicted to occur to intertidal/subtidal hard bottom habitats in the vicinity of the cable route such as SST and northwest to southwest of Stanley Peninsular. These subtidal soft bottom habitats which may be directly affected are, however, considered to be of low ecological importance. Since the maximum distance of transport for suspended sediments would be 180 m from the cable burial tool and the cable laying works are over 500 m away from marine sensitive receivers and short-term nature (i.e. within 30 working days for the whole alignment), the potential indirect impacts on the intertidal/subtidal hard bottom habitats are not expected to be significant.

- *Species*: No species that are considered of high ecological value are expected to be directly affected. FP occurs in eastern waters with important habitats around Po Toi Islands and at the juncture of Po Toi and Ninepins. FPs are known to use high frequency ultrasonic clicks for foraging and communication. Given the short timeframe of the Project as well as the cable installation vessel/barge being slow-moving and emitting low frequency underwater sound, no unacceptable adverse impacts to FP from the Project are expected to occur. The coral communities at the south of Kau Pei Chau of Cape d'Aguilar (considered to have moderate ecological value; see *Section B3.7* above) are located more than 500 m from the cable alignment and 400 m or more from the boundary of the dispersal range of suspended sediments generated from the injection jetting method (180 m from the burial tool). In addition, the cable burial works are short-term in nature and overall no unacceptable adverse impacts to the coral communities are expected.

- *Size*: The length of the cable will be approximately 34 km inside HKSAR waters. The cable will be buried using a cable burial machine and will fluidise approximately 0.21 m of the seabed in width along the alignment.

- *Duration*: The duration of the cable laying will be within 30 working days.

- *Reversibility*: Direct impacts to soft bottom marine community are expected to be short-term and re-colonisation of the sediments is expected to occur shortly. Indirect impact to hard bottom marine community is expected to be short-term and reversible.

- *Magnitude:* No unacceptable adverse impacts to ecologically important organisms or habitats are predicted to occur. The magnitude of impacts during the laying of the cables is expected to be of low severity and is considered acceptable, given that the disturbances are of small scale, short-term and localised.

Therefore overall it is considered that the impact of the Project is unlikely to be significantly adverse.

B5.1 MITIGATION MEASURES

In accordance with the guidelines in the *EIAO TM* on marine ecology impact assessment, the general policy for mitigating impacts to marine ecological resources, in order of priority, are:

- **Avoidance:** Potential impacts should be avoided to the maximum extent practicable by adopting suitable alternatives.
- **Minimisation:** Unavoidable impacts should be minimised by taking appropriate and practicable measures such as constraints on intensity of works operations (e.g. dredging rates) or timing or works operations.
- **Compensation:** The loss of important species and habitats may be provided for elsewhere as compensation. Enhancement and other conversation measures should always be considered whenever possible.

Based on the above, mitigation measures are discussed below.

B5.1.1 *Avoidance of Impacts*

Impacts to marine ecological resources have largely been avoided for the cable laying through the selection of a landing site and cable corridor that avoids impacts to coral communities with moderate and high ecological value and through the employment of cable laying techniques that result in little disruption to the marine environment. Due to the confined space along the proposed cable corridor, including due to existing cables, gazetted Sand Dredging and Sediment Disposal Area located at the west of Po Toi, amongst other constraints, the HKA submarine cable routing has been carefully considered (See *Section 1.5* in the main text) including moving away from Cape d'Aguilar to be over 500 m from the Marine Reserve and SSSI there. The proposed cable alignment is located at the furthest distance possible from the known coral communities with moderate/ high ecological value, i.e. Po Toi, Beaufort Island and Sung Kong and Kau Pei Chau of Cape d'Aguilar.

B5.1.2 *Minimisation of Impacts*

Mitigation measures that have been recommended to reduce impacts to water quality and are also expected to control impacts to marine ecological resources (refer to *Annex A*, *Section A4.4*). In particular, for all marine works (both inshore and remaining submarine alignment):

- The maximum speed of the cable laying will not exceed 1 km hr^{-1} so that the amount of seabed sediment disturbed and dispersed during the cable laying process can be kept to a minimum.

- Furthermore, with the implementation of good house-keeping practices, no unacceptable impacts to either water quality or marine ecological resources are expected to occur from land based activities.

Based on the above mitigation measures (refer to *Annex A* for full water quality mitigation measures details), no compensation will be required as no unacceptable residual impacts to marine ecological resources are predicted to occur.

B5.1.3 Precautionary Measures

Water quality monitoring will be carried out as a precautionary measure, to verify that the Project works will not result in any unacceptable impacts to water quality, and consequently to marine ecology and fisheries. Precautionary measures are also recommended for marine mammals (marine mammal exclusion zone) and for coral (pre-installation survey and post-project survey near the landing site) to ensure that no adverse impacts to marine mammals and corals result from cable installation works or repair operations.

The monitoring details for water quality, coral and marine mammals are presented in *Annex F*.

B6 SUMMARY AND CONCLUSIONS

The review of the existing information on the marine ecological resources in the vicinity of the proposed cable landing point and the proposed cable alignment have identified the area to be of generally low to moderate ecological value in terms of supporting marine fauna.

Although intertidal and subtidal soft bottom assemblages will be disturbed during the cable laying works, the habitats will be reinstated by similar communities within a short time and thus the impacts are considered acceptable and unlikely to be adverse.

The rocky shores in the vicinity of the proposed cable landing site at SST of CHK support low to moderate abundance and diversity of intertidal organisms. All of these species are common and widespread on the similar shores in HKSAR and as such, are considered to be of low ecological value. Impacts to these assemblages are, therefore, not regarded as significant.

A few hard coral species have been identified in the vicinity of the proposed cable landing site but in low abundance and diversity. The coral colonies along the shoreline of south of Kau Pei Chau of Cape D'Aguilar are more than 500 m of the proposed cable alignment. In addition, south of Kau Pei Chau is at least 400 m from the boundary of the dispersal range of suspended sediments generated from the injection jetting method. Due to the small scale of the works, the short duration of impacts and the limited dispersion distance of sediment plume, any potential impacts are not considered to be significant and unlikely to be adverse.

The southeastern waters of HKSAR are not considered to be frequently used habitat by the CWD. Sightings of the FP were also found to be seasonal and infrequent along the proposed cable corridor. It is expected that the cable laying works will last for a short duration (within 30 working days) and will involve one main cable installation vessel/barge. Significant disturbance/ adverse impacts to the FP and CWD, in terms of underwater noise, marine traffic and food sources, is therefore not expected.

Impacts to marine ecological resources have largely been avoided through the selection of a landing site and cable corridor that reduce impacts to coral communities and through the employment of techniques that result in little disruption to the marine environment.

Mitigation measures that have been recommended to reduce impacts to water quality are also expected to control any impacts to marine ecological resources, particularly the coral colonies in the vicinity of the cable alignment. These mitigation measures include limiting the maximum speed of the cable laying machine and implementing good house-keeping practices during land-based activities (full details in *Annex A*). As precautionary measures, a water quality monitoring programme has also been recommended and the implementation of pre-installation and post-project coral surveys as well as a marine mammal exclusion zone during cable works. All these measures will ensure that no

adverse impacts to the corals and marine mammals will result from cable installation works or any future maintenance/ repair work that might be required.

The monitoring details for water quality, coral and marine mammals are presented in *Annex F*.

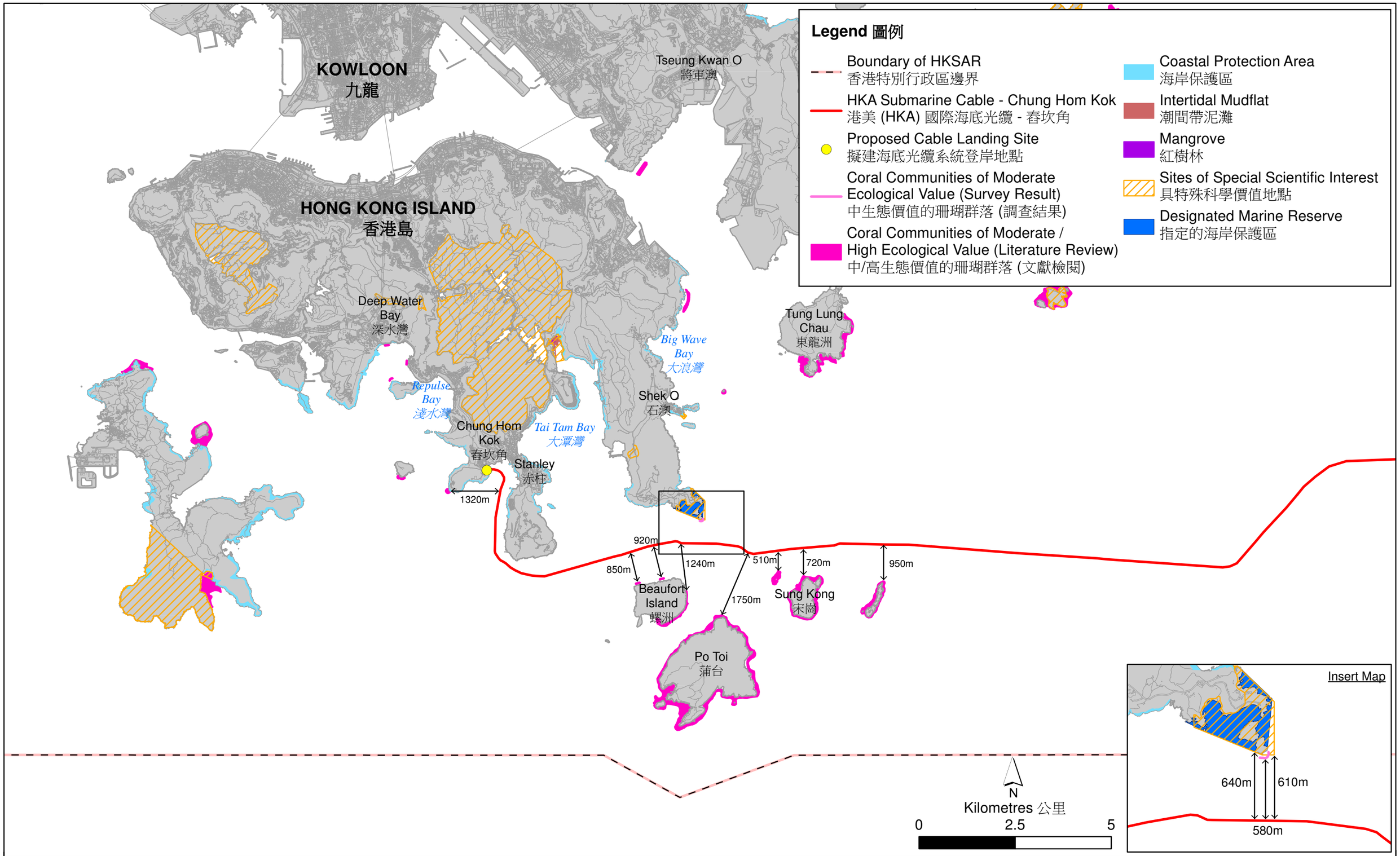

Figure B1
圖 B1

Major Marine Ecological Elements in the Vicinity of the Proposed HKA Cable System - Chung Hom Kok
鄰近擬建HKA海底光纜系統的主要海洋生態要素

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Date: 30/10/2018

Environmental Resources Management
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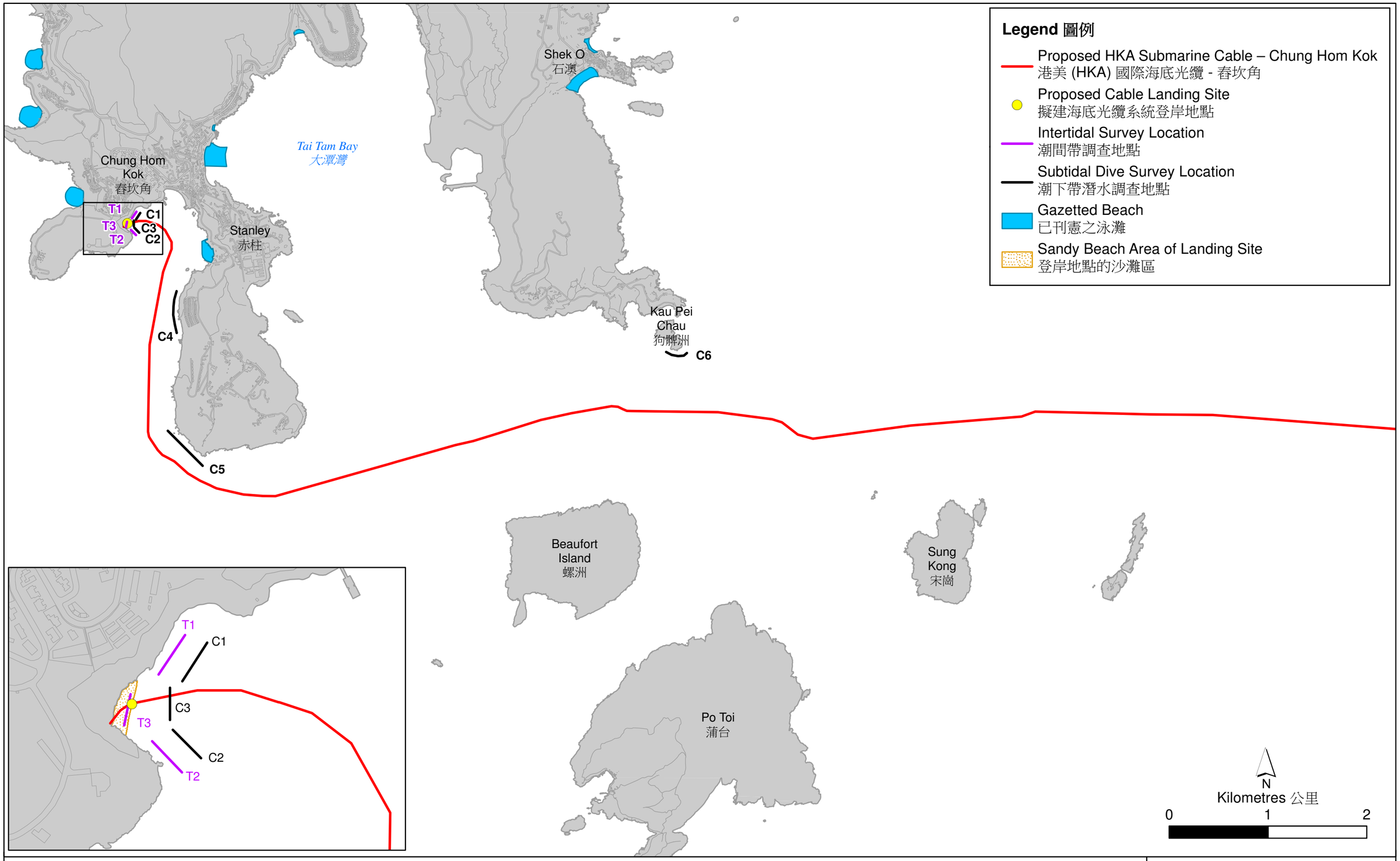

Figure B2
圖 B2

Marine Ecological Survey Locations
海洋生態調查地點

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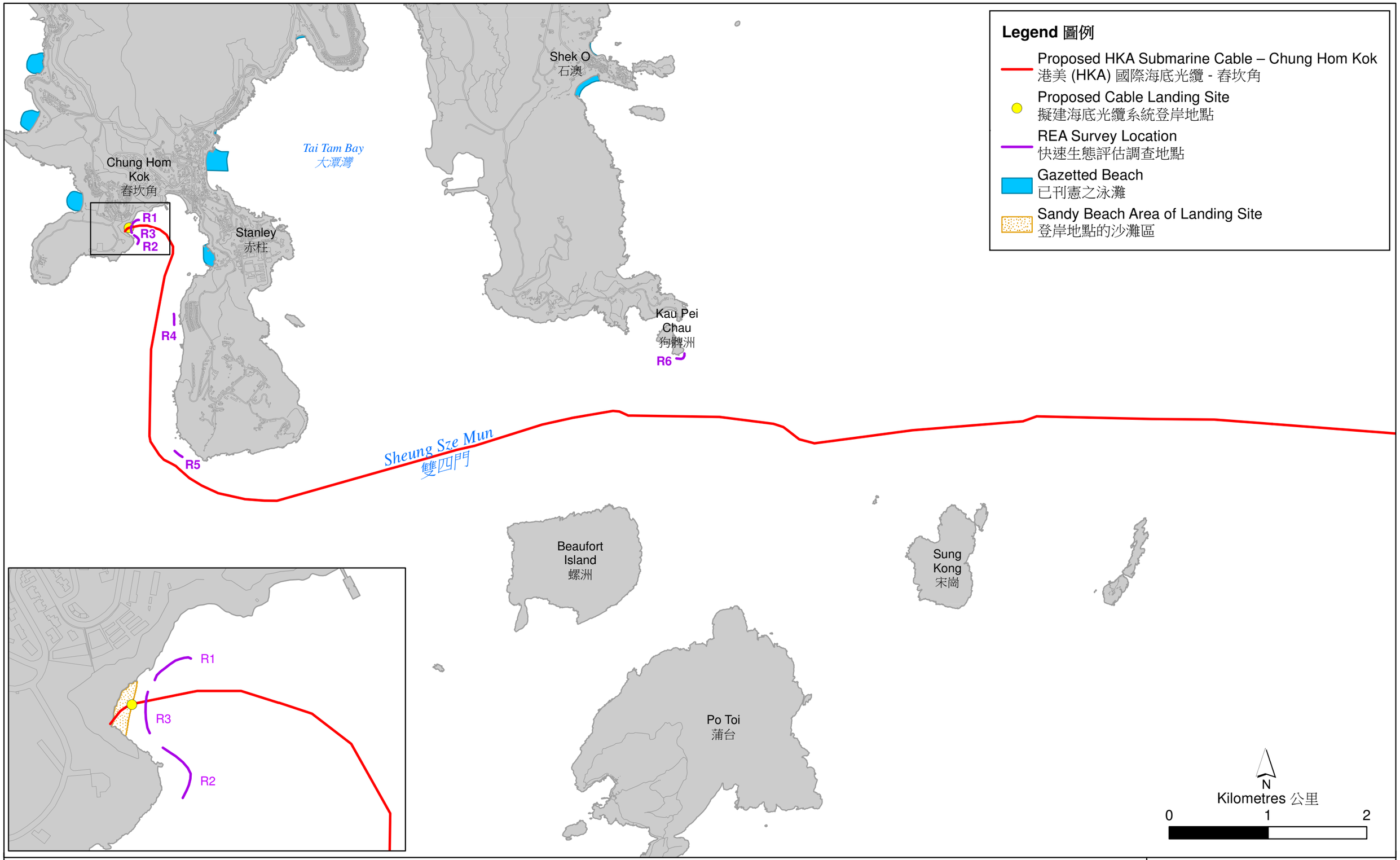

Figure B3
圖 B3

Rapid Ecological Assessment (REA) Survey Locations
快速生態評估調查地點

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Environmental
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Management

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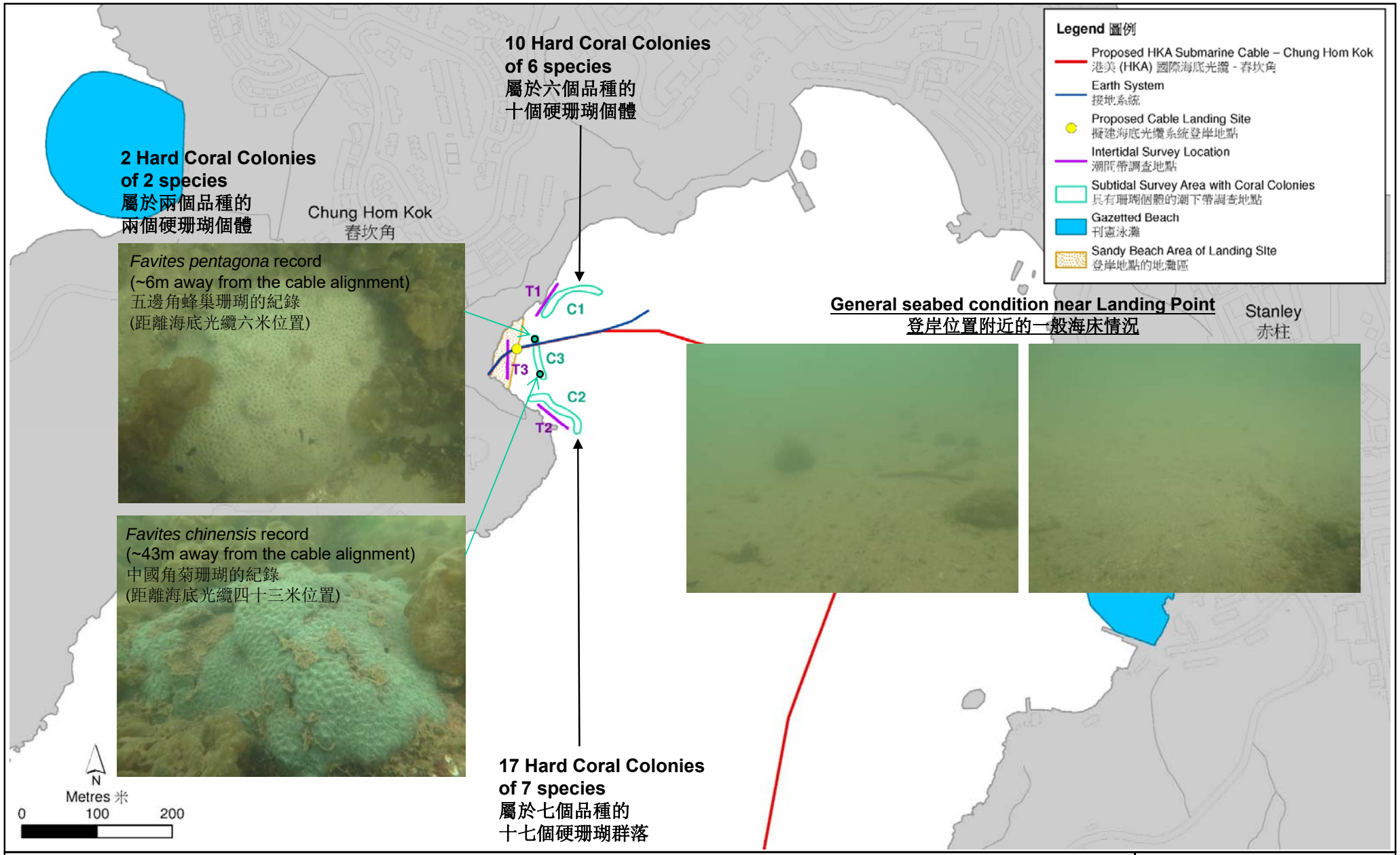

Figure B4
圖 B4

DATE: 31/08/2018

Indicative Subtidal Hard Coral Results and Photographs
指標性的潮下帶硬珊瑚調查結果及圖片

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Appendix B1

Data of Intertidal Surveys

Table B1.1 Faunal Species Recorded during the Qualitative and Quantitative Intertidal Surveys at the Rocky Shores in the vicinity of Sha Shek Tan of Chung Hom Kok

Group	Species	T1-H	T1-M	T1-L	T2-H	T2-M	T2-L	T3-H	T3-M	T3-L
Algae	*Colpomenis sinuosa*	×	×	✓	×	×	✓	×	×	✓
Algae	*Enteromorpha spp.*	✓	×	×	×	×	×	×	×	×
Algae	*Gelidium pusillum*	×	×	✓	×	×	✓	×	×	×
Algae	*Hildenbrandia occidentalis*	×	✓	×	×	×	✓	×	×	×
Algae	*Hildenbrandia rubra*	×	✓	✓	✓	✓	✓	×	×	×
Algae	*Pseudulvella applanata*	×	✓	×	✓	✓	✓	×	×	×
Algae	*Sargassum hemiphyllum*	×	×	✓	×	×	✓	×	×	×
Algae	*Ulva* spp.	×	×	✓	×	✓	✓	×	×	×
Barnacles	*Capitulum mitella*	✓	✓	×	✓	✓	×	×	×	×
Barnacles	*Tetraclita japonica*	×	✓	✓	×	✓	✓	×	×	×
Bivalves	*Barbatia virescens*	×	×	×	×	×	✓	×	×	×
Bivalves	*Cancella chinensis*	×	×	×	×	×	×	✓	✓	✓
Bivalves	*Donax* spp.	×	×	×	×	×	×	✓	✓	×
Bivalves	*Saccostrea cucullata*	✓	✓	✓	×	✓	✓	×	×	×
Bivalves	*Septifer virgatus*	×	×	✓	×	×	✓	×	×	×
Chiton	*Acanthopleura japonica*	×	✓	✓	×	✓	×	×	×	×
Cowrie	*Cypraea arabica*	×	×	✓	×	×	×	×	×	×
Echinoderm	*Polycheira rufescens*	×	×	✓	×	✓	✓	×	×	×
False Limpets	*Siphonaria japonica*	×	×	✓	×	×	×	×	×	×
False Limpets	*Siphonaria laciniosa*	×	✓	×	✓	✓	×	×	×	×
Hermit Crab	*Pagurus dubius*	×	×	✓	×	×	✓	×	×	×
Limpets	*Cellana grata*	×	✓	×	×	✓	×	×	×	×
Limpets	*Cellana toreuma*	×	×	✓	×	×	×	×	×	×
Limpets	*Collisella dorsuosa*	×	×	×	×	×	✓	×	×	×
Limpets	*Nipponacmea concinna*	×	✓	✓	✓	✓	✓	×	×	×
Limpets	*Patelloida pygmaea*	×	×	×	✓	✓	×	×	×	×
Nerites	*Nerita albicilla*	×	✓	✓	×	✓	✓	×	×	×
Periwinkles	*Echinolittorina radiata*	✓	×	×	✓	×	×	×	×	×
Periwinkles	*Echinolittorina trochoides*	✓	✓	×	×	×	×	×	×	×
Periwinkles	*Peasiella* spp.	×	×	×	✓	×	×	×	×	×
Planaxid Snail	*Planaxid sulcatus*	✓	✓	×	×	✓	×	×	×	×
Polychaeta	Playchaete worm	×	×	×	×	×	×	✓	×	×
Polychaeta	Ribbon worm	×	×	×	×	×	×	✓	×	×
Sea slaters	*Ligia exotica*	✓	×	×	✓	×	×	×	×	×
Sea-anemones	*Haliplanella lineata*	×	×	✓	×	×	✓	×	×	×
Topshell	*Monodonta labio*	✓	✓	✓	×	✓	✓	×	×	×
True Crabs	*Hemigragsus sanguineus*	✓	✓	✓	✓	✓	✓	×	×	×
Tuban Shell	*Lunella coronata*	×	✓	✓	×	✓	✓	×	×	×
Whelks	*Reishia clavigera*	×	✓	✓	×	✓	✓	×	×	×
Whelks	*Reishia luteostoma*	×	✓	×	×	×	×	×	×	×
Whelks	*Tenguella musiva*	×	×	✓	×	×	×	×	×	×

Appendix B2

Data of Subtidal Dive Surveys

Table B2.1 Ordinal Rank of Percentage Cover of Seabed Attributed recorded along the Semi-quantitative Rapid Ecological Assessment (REA) Survey Transects

Zone	**R1**	**R2**	**R3**	**R4**		**R5**		**R6**	
Depth [(a)]	**S**	**S**	**S**	**S**	**D**	**S**	**D**	**S**	**D**
Depth (- mCD)	2-5	2-4	2-5	3-5	7-10	3-6	10-14	4-6	10-17
Seabed attributes [(b)]									
Bedrock	0	4	0	0	0	0	0	6	6
Continuous pavement	0	0	0	0	0	0	0	0	0
Large boulders (>50 cm)	5	4	0	6	3	5	3	0	2
Small boulders (<50 cm)	3	3	0	2	2	3	2	0	2
Rocks (<26 cm)	2	2	1	0	1	1	2	0	2
Rubble	1	1	1	0	1	0	1	0	1
Sand	3	3	6	1	0	1	0	0	0
Mud/ Silt	0	0	0	0	5	0	3	0	1
Other	0	0	0	0	0	0	0	0	0
Ecological attributes [(b)]									
Hard coral	1	1	1	1	1	1	2	1	3
Octocoral (Soft corals and Gorgonians)	0	0	0	0	1	0	1	0	2
Black coral	0	0	0	0	1	0	1	0	1
Dead standing coral	0	0	0	0	0	0	1	0	1
Macroalgae	5	4	5	0	0	1	0	5	0
Other Benthos (including sponges, zoanthids, ascidians and bryozoans)	1	1	1	1	0	1	1	3	0

Notes:

(a) S = shallow water; D=deep water

(b) 0 = none record; 1 = <5% Cover, 2= 6-10% Cover, 3 = 11-30% Cover, 4 = 31-50% Cover, 5 = 51-75% Cover, 6= 76-100% Cover.

Table B2.2 Coral Species Recorded during Qualitative Spot Check and along the REA Transects

Family	Species	C1/ R1 S	C2/ R2 S	C3/ R3 S	C4/ R4 S	C4/ R4 D	C5/ R5 S	C5/ R5 D	C6/ R6 S	C6/ R6 D
Hard Coral										
Acroporidae	*Acropora solitaryensis*	0	0	0	0	0	1	0	0	0
Acroporidae	*Alveopora gigas*	0	0	0	1	0	0	0	0	0
Agariciidae	*Pavona decussata*	0	1	0	0	0	0	0	0	0
Dendrophylliidae	*Turbinaria peltata*	0	0	0	0	0	1	0	0	0
Incertae sedis	*Leptastrea pruinosa*	1	0	0	0	0	0	0	0	0
Incertae sedis	*Oulastrea crispata*	0	0	0	2	3	0	0	0	0
Incertae sedis	*Plesiastrea versipora*	1	0	0	1	2	3	0	1	0
Merulinidae	*Dipsastraea rotumana*	0	1	0	0	0	0	0	0	0
Merulinidae	*Favites abdita*	0	1	0	0	0	0	0	0	0
Merulinidae	*Favites chinensis*	1	0	1	0	0	0	0	0	0
Merulinidae	*Favites flexuosa*	2	2	0	0	0	0	0	0	0
Merulinidae	*Favites pentagona*	0	2	1	0	0	1	0	0	0
Merulinidae	*Goniastrea aspera*	0	1	0	0	0	0	0	0	0
Merulinidae	*Platygyra acuta*	1	0	0	0	0	0	0	0	0
Poritidae	*Goniopora planulata*	0	2	0	0	0	0	0	0	0
Poritidae	*Porites lobata*	1	0	0	3	0	2	0	0	0
Psammocoridae	*Psammocora haimiana*	0	0	0	0	0	1	0	0	0
Psammocoridae	*Psammocora profundacella*	0	0	0	1	0	0	0	0	0
Psammocoridae	*Psammocora superficialis*	0	0	0	3	3	4	0	0	0
Siderastreidae	*Coscinaraea* n sp.	0	0	0	0	1	0	0	0	0
Ahermatypic Hard Coral Species										
Dendrophylliidae	*Tubastrea/ Dendrophyllia* sp.	0	0	0	0	0	0	4	0	5
Octocoral										
Alcyoniidae	*Claidella* sp.	0	0	0	0	0	0	2	0	0
Nephtheidae	*Dendronephthya* sp.	0	0	0	0	0	0	2	0	3
Nephtheidae	*Scleronephthya gracillimum*	0	0	0	0	0	0	0	0	4
Acanthogorgiidae	*Anthogorgia* sp.	0	0	0	0	0	0	3	0	0
Plexauridae	*Echinogorgia* sp.	0	0	0	0	0	0	0	0	2
Plexauridae	*Echinomuricea* sp.	0	0	0	0	4	0	3	0	1
Plexauridae	*Euplexaura* sp.	0	0	0	0	0	0	1	0	0
Plexauridae	*Menella* sp. / *Paraplexaura* sp.	0	0	0	0	0	0	1	0	1
Black Coral										
Antipathidae	*Antipathes curvata*	0	0	0	0	0	0	3	0	1
Antipathidae	*Cirripathes sinensis*	0	0	0	0	1	0	1	0	0
Antipathidae	*Cirripathes* sp.	0	0	0	0	0	0	3	0	3
Sea Anemones										
Actiniidae	*Actinia equina*	0	0	0	0	0	0	0	4	0
Actiniidae	*Spheractis cheungae*	0	0	0	0	0	0	0	3	0
Macroalgae										
Scytosiphonaceae	*Colpomenia sinuosa*	5	4	4	0	0	3	0	0	0
Scytosiphonaceae	*Petalonia binghamiae*	2	0	0	0	0	0	0	6	0
Ishigeaceae	*Ishige foliacea*	2	3	0	0	0	0	0	0	0
Sargassaceae	*Sagassum hemiphyllum*	4	4	4	0	0	0	0	0	0
Ulvaceae	*Ulva* spp.	2	2	1	0	0	0	0	0	0
Corallinaceae	*Corallina pilulifera*	3	3	0	0	0	0	0	0	0

Notes:

(a) S = shallow water; D=deep water

(b) 0=absent, 1=rare, 2=uncommon, 3=common, 4=abundant, 5=dominant

(c) The ranks shown in the Table above indicate the relative abundance of each coral in relation to other corals in the community. In other words, these 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. For instance, if a coral is ranked as

'common', it means it was more frequent than other coral species along the transect. It should be borne in mind that coral cover along most of the transects where corals occurred was low (<5% cover).

Annex C

Assessment of Potential Impacts to Fisheries Resources and Fishing Operations

CONTENTS

C1 INTRODUCTION

This *Annex* presents existing information on the fisheries resources/ production and fishing operations within and adjacent to the proposed cable corridor and evaluates the potential for direct and indirect impacts to them during construction and operation (including maintenance) of the Project. The cable is unlikely to be damaged by fishing activity as it will be buried to a depth of up to 5 m under the seabed for the majority of the cable corridor, and the seabed will be reinstated to the before-work level and condition very shortly. During operation, there may be a potential requirement for maintenance work (i.e. cable repair at particular fault location due to unexpected damage) to be carried out. These works will be similar in nature to cable installation works, using similar, if not smaller scale, equipment and methods but for a shorter duration and are also considered in this *Annex*.

The criteria for evaluating fisheries impacts are laid out in *Annex 17* of *Environmental Impact Assessment Ordinance (Cap. 499. S.16)* and the *Technical Memorandum on EIA Process (EIAO-TM)* and *Annex 9* of the *EIAO-TM* recommends some general criteria that can be used for evaluating fisheries impacts. Other legislation which applies to fisheries resources/ production 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 Special Administrative Region (HKSAR), the commercial marine fishing industry is divided into capture and culture fisheries. However, there are no gazetted Fish Culture Zones (FCZs) within 500 m of the proposed cable corridor. As such, culture fisheries are considered unlikely to be affected by the Project and they will thus only be discussed briefly. The following baseline information is focusing on capture fisheries and briefly describing the nearest culture fisheries. The baseline has been derived from the information of the *AFCD Port Survey 2016/17* (1). Information from other relevant studies were also reviewed in order to determine if the waters of the proposed cable corridor are important spawning grounds or nursery areas for commercial fisheries (2). Mariculture information was obtained from the AFCD Annual Reports (3).

C3.1 FISHERIES

C3.1.1 *Capture Fishing Operations*

In the *AFCD Port Survey 2016/17* (4), an interview programme collecting information from local fishermen about their fishing operations and fisheries production in Hong Kong waters was carried out. Based on the information and data collected, figures generally showing the geographical distribution and estimated levels of fishing operations and fisheries production in Hong Kong waters were produced. There are generally low (0 – 50 vessels) and moderate (>200 – 400 vessels) numbers of fishing vessels around the proposed cable route, except for four grids which had higher numbers of fishing vessels (>400 – 600 vessels) operating in waters near Stanley Peninsula, Beaufort Island, Po Toi, Sung Kong and Waglan Island (***Figure C1***). The major type of fishing vessels along the cable route are mostly sampans among all types of fishing vessels (***Figures C2 and C3***).

(1) Agriculture, Fisheries and Conservation Department (2018) Port Survey for year 2016/ 17. Hong Kong SAR Government.
(2) ERM - Hong Kong, Ltd (1998) Fisheries Resources and Operations in Hong Kong Water. Final Report for the Agriculture, Fisheries and Conservation Department. Hong Kong SAR Government.
(3) Agriculture, Fisheries and Conservation Department Annual Report 2016 -2017. Hong Kong SAR Government.
(4) Agriculture, Fisheries and Conservation Department (2018) *Op cit*.

Figure C1 *Distribution of Fishing Operations (Overall) in HKSAR Waters and Locations of the Proposed Cable Corridor in 2016/17 (Source: AFCD Port Survey 2016/17)*

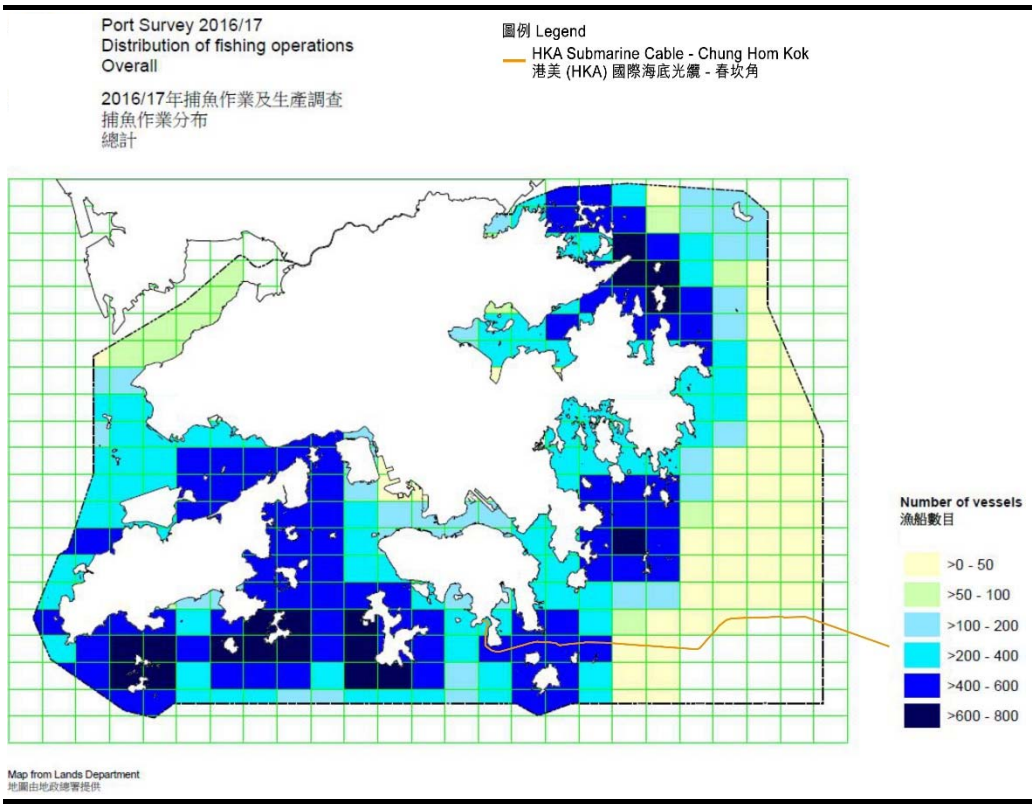


Figure C2 *Distribution of Fishing Operations (Sampan) in HKSAR Waters in 2016/17 (Source: AFCD Port Survey 2016/17)*

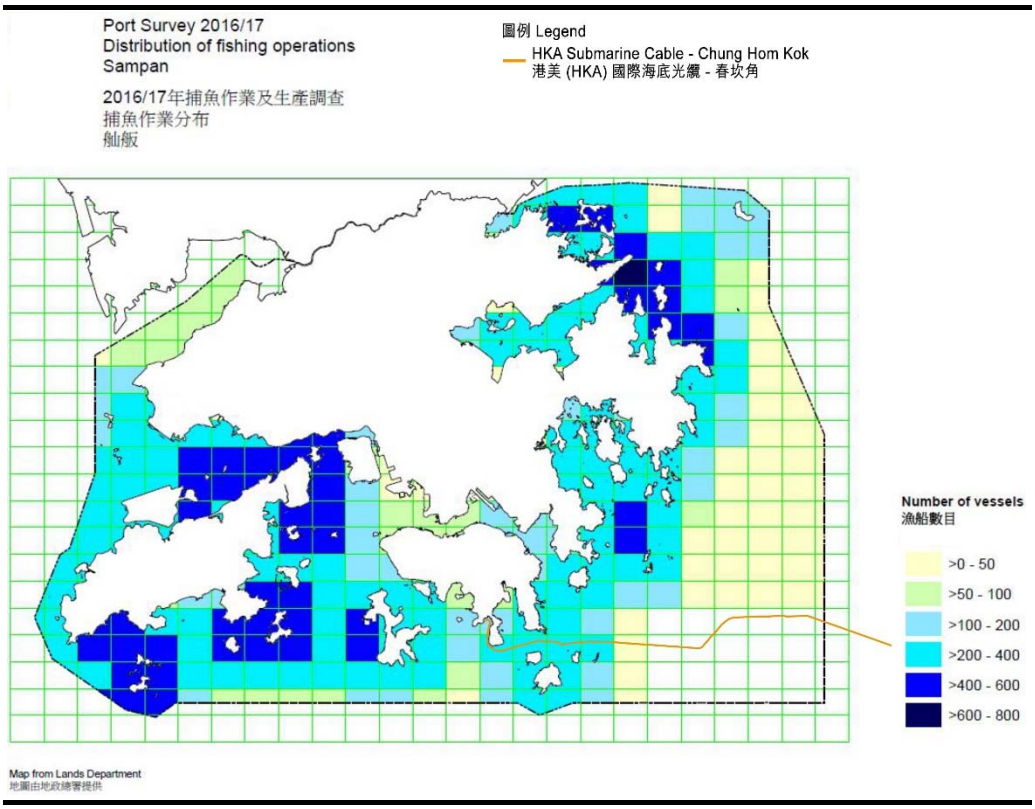
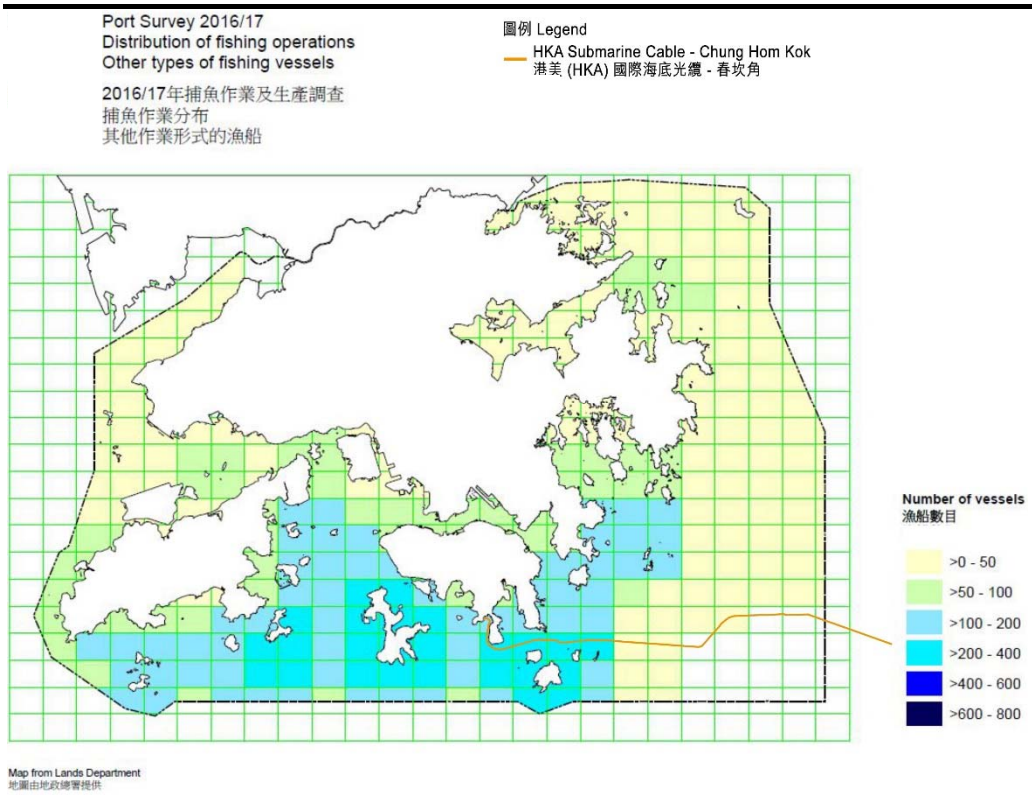


Figure C3 *Distribution of Fishing Operations (Other types of Fishing Vessel) in HKSAR Waters in 2016/17 (Source: AFCD Port Survey 2016/17)*



C3.1.2 *Capture Fisheries Production/ Resources*

Fisheries production from the grids traversed by the cable corridor range from unspecified, to >0 – 50 kg per hectare to >300 – 400 kg per hectare (***Figure C4***). Adult fisheries production (1) in waters traversed by the cable corridor was recorded as the highest (>300 – 400 kg per hectare) in waters north of Beaufort Island, Sung Kong and Waglan Island, with decreasing value in general when moving away from this area.

The top ten families/ groups of fish catch production recorded in the *AFCD Port Survey 2016/17* throughout Hong Kong waters (in terms of weight), are presented in ***Table C1***. Other families/groups of common fish catch include Muraenesocidae (conger-pike eel), Scombridae (mackerel), Polynemidae (threadfin), Scorpaenidae (common rock fish) and Cynoglossidae (tongue sole), etc.. Based on the most recent, publically available fishermen interview data from 2009 about the common catch in the vicinity of the Study Area, the fish composition of the common species included shrimp, crab, tongue sole, flathead, croaker, mackerel promfret, golden thread and hairtail (2).

(1) In AFCD's Port Survey 2016/17, fish fry collection was found negligible.
(2) BMT (2009) EIA for Hong Kong Offshore Wind Farm in Southeastern Waters. Prepared for CLP.

Figure C4 *Distribution of Fisheries Production (Overall) (Adult Fish) in HKSAR Waters in 2016/17 and Location of the Proposed Cable Corridor (Source: AFCD Port Survey 2016/17)*

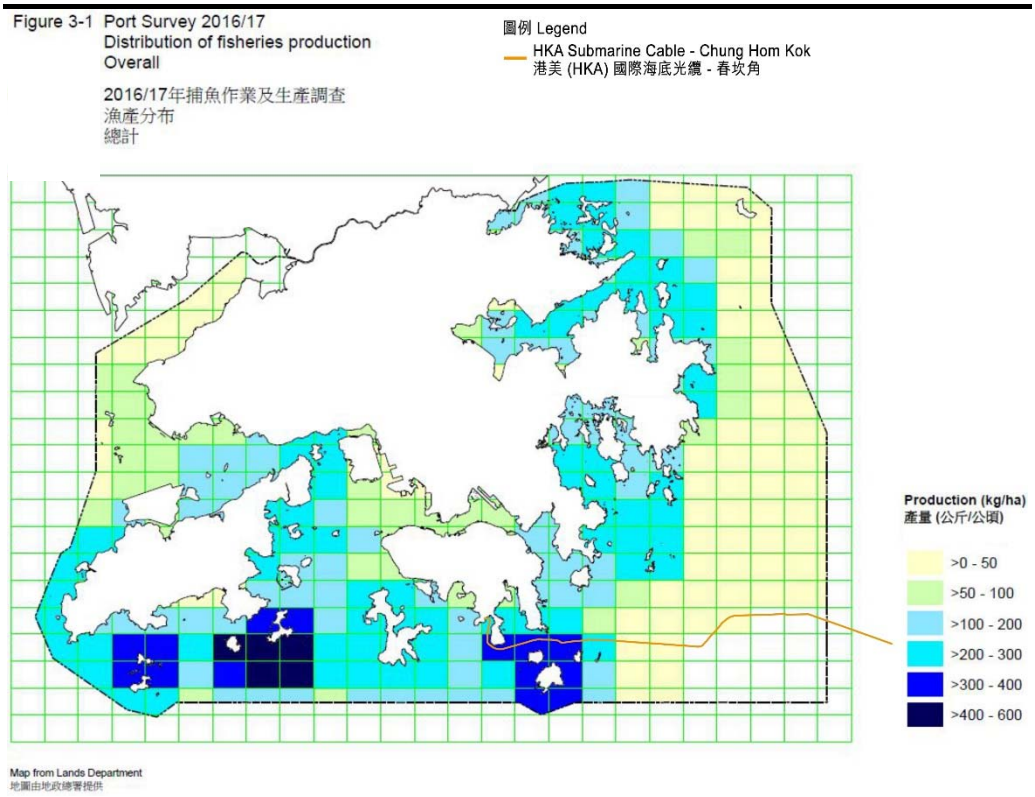


Table C1 *Top 10 Families/ Groups of Fish Catch in Hong Kong Waters (Source: AFCD Port Survey 2016/17)*

Rank*	Family/ Group	Common Name of Fish Catch
1	Mugilidae	Mullet
2	Clupeidae	Sardine, Shad
3	Carangidae	Scad, Jack
4	Sparidae	Seabream
5	Sciaenidae	Croaker
6	Mixed squid	Squid
7	Mixed crab	Crab
8	Siganidae	Rabbitfish
9	Mixed shrimp	Shrimp
10	Platycephalidae	Flathead

*Note: Ranking is based on the estimated weight of production of each family/group of fish catch.

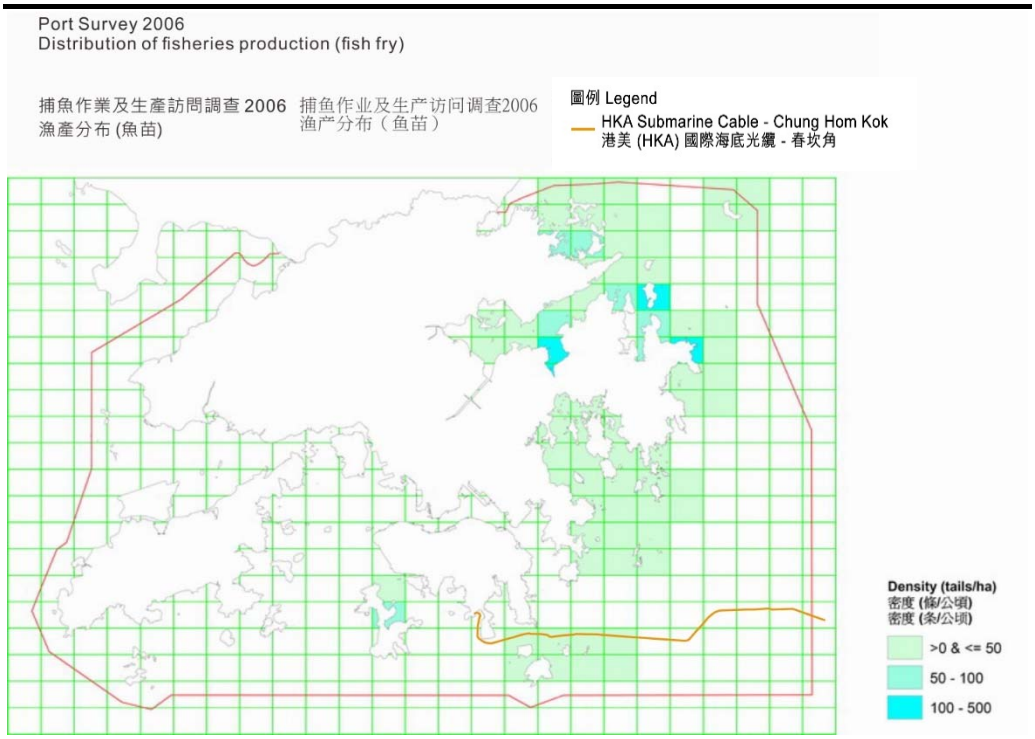
C3.1.3 Culture Fisheries

There are no AFCD gazetted Fish Culture Zone (FCZ) within 500 m of the proposed cable corridor. The closest FCZ is the Po Toi FCZ located just over 3.6 km away from the cable at its closest point. According to the water quality impact assessment in *Annex A*, the maximum travel distance of the sediment plume generated during cable installation is 180 m. As such, no impact is expected on the Po Toi FCZ due to the cable installation/ operation works. As the Po Toi FCZ will not be affected by the proposed Project due to their relative remoteness from the alignment, they will not be discussed further.

C3.1.4 Spawning and Nursery Areas

In *AFCD Port Survey 2016/17*, fish fry collection was recorded to be negligible in all waters in Hong Kong and distribution of fisheries production in HKSAR waters was therefore not provided in a figure [(1)]. The data is consistent with the previous Port Survey in 2006 [(2)] and another fisheries study in 1998 [(3)] which recorded fish fry production within grids and indicated that some grids with the lowest density (>0 – ≤50 tails per hectare) are traversed by the proposed cable corridor (***Figure C5***) and showed that the area traversed by the cable corridor was not being considered as an important nursery area for commercial fish species. However, the cable route passes through waters identified as spawning grounds of commercial fisheries resources [(3)] (refer to ***Figure 3.1*** in the main text).

Figure C5 Distribution of Fisheries Production (Fish Fry) in HKSAR Waters in 2006 and Location of the Proposed Cable Corridor (Source: AFCD Port Survey 2006)



(1) Agriculture, Fisheries and Conservation Department (2018) *Op cit*.
(2) Agriculture, Fisheries and Conservation Department (2006) Port Survey for year 2006. Hong Kong SAR Government.
(3) ERM - Hong Kong (1998) Fisheries Resources and Operations in Hong Kong Waters. *Op cit*.

C4 IMPACT ASSESSMENT

C4.1 DIRECT IMPACTS

The proposed cable will be submerged using injection jetting technique to a depth of 5 m under the seabed. Through the employment of this burial technique, the seabed will be reinstated by resettlement of disturbed sediments and natural erosion from nearby seabed. Recolonisation of the sediments by benthic infauna is expected to occur, therefore providing food for bottom dwelling fisheries resources. In addition, minor interruptions to fishing operations are expected to occur only during the cable installation and potential repair of the proposed Project. These disruptions are, however, expected to be minimal as the duration of time required for cable installation/ repair works will be short (ie for the whole submarine cable system, within 30 working days for cable laying and within an estimated 36 working days for RC/ PLGR, and duration of any cable repair work during operation is anticipated to be of shorter duration) in HKSAR waters and fishing vessels could continue to operate in nearby waters. Therefore, no long-term direct impacts to fisheries resources or fishing operations are expected to occur aside from minor short-term disturbances to the seabed in the immediate vicinity of cable or Ocean Ground Bed (OGB) laying activities and short-term displacement of fishing activities from the works area. These disturbances are not predicted to affect either fisheries resources or fishing operations in an unacceptable manner.

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, OGB and other marine work activities. Although the cable laying works will traverse to waters with moderate capture fisheries production as indicated in the *AFCD Port Survey 2016/17*, the proposed injection jetting technique of burial will only lead to localized disturbance of seabed sediments, and expected to result in short-term SS elevations in the immediate vicinity (within 180 m from the cable alignment as detailed in *Annex A*). 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 (approximately 200 seconds as detailed in *Annex A*). In addition, the cable laying works will only last within approximately 30 working days, with any repair works considered to take less time. Cable laying and burial, and associated OGB installation as well as RC/ PLGR operation, and any repair work during operation, are thus not predicted to cause unacceptable impacts to water quality and consequently unacceptable impacts to fisheries will not occur.

C5 FISHERIES IMPACT EVALUATION

An evaluation of the impact in accordance with the *EIAO-TM Annex 9* is presented as follows:

- *Nature of Impac*t: The Project will involve the laying and operating of a submarine cable connecting to Sha Shek Tan of Chung Hom Kok to the offshore southeast waters of the eastern boundary of HKSAR, before entering the South China Sea. The cable will travel from Sha Shek Tan southward rounding Cape d'Aguilar, then eastward, north of Beaufort and Sung Kong Islands, to the eastern boundary of HKSAR waters, where it will enter the South China Sea. As a result of the small scale and relatively localized disturbances to the seabed, and understanding the duration of time required for cable installation/ repair works will be short (See *Sections C4.1* and *C4.2*), impacts are considered to be temporary and reversible and therefore no unacceptable impacts to fisheries resources and subsequently fishing operations are predicted to occur during the cable laying process or during operation.

- *Size of Affected Area*: The total length of the cable in HKSAR waters is approximately 34 km. The cable will be deployed using the injection jetting method and will not affect fisheries resources or fishing operations. In addition, the maximum works area occupied by the cable installation barge during normal operation will be approximately 30 m either side along the cable route. In view of the small area occupied by the cable installation barge during construction (cable laying works will last up to 30 working days), potential impacts on vessel transit and fishing activities along the cable alignment are not expected.

- *Size of Fisheries Resources/Production*: Fisheries production of the affected areas ranges from >0 – 50 kg per hectare to >300 – 400 kg per hectare, with the majority of them showing fisheries production between >0 and 300 kg per hectare in terms of catch weight of adult fish. Fisheries production (in terms of weight of adult fish) in areas traversed by the cable corridor is highest in waters north of Beaufort Island, Sung Kong and Waglan Island. Fisheries operations and production traversed by the cable corridor is highest in waters north of Beaufort Island, Sung Kong and Waglan Island. Fisheries operation and production then decreases as the cable moves away from this area. Since the cable laying works will only take up to 30 working days (for any repair works, less time), the disturbance on seabed is localized, and the seabed will be reinstated by resettlement of disturbed sediments and natural erosion, no unacceptable impact on the fisheries resources/ production is expected.

- *Destruction and Disturbance of Spawning and Nursery Grounds*: The fish fry production along the proposed cable corridor is negligible, however, a section of the cable route passes through waters identified as spawning grounds of commercial fisheries resources. The cable laying works are of relatively short duration in HKSAR (within approximately 30 working

days), and given that sediment will disperse a maximum of 180 m from the alignment and settle within a short period of time (approximately 200 seconds), the construction and operation of the proposed submarine cable is not expected to result in unacceptable adverse impacts to nursery and spawning grounds in HKSAR waters.

- *Impact on Fishing Activity*: The proposed cable corridor passes through fisheries operation areas which have mostly low to moderate numbers of fishing vessels (>50-400 vessels), except waters near Stanley Peninsula, Beaufort Island, Po Toi, Sung Kong and Waglan Island (>400-600 vessels), and are fished mostly by sampans. The cable laying works will only last within approximately 30 working days, with any repair works considered to take less time. In addition, the disturbance on seabed is localized and the seabed is expected to reinstate naturally to before-work level and condition very shortly. As such, impacts to fishing activities are not expected to occur. It should also be noted that the burial depth of the cable after inshore section is approximately 5 m below the seabed. Damages to fishing gears /tools by the cable are not therefore not expected.

- *Impact on Aquaculture Activity*: The closest Fish Culture Zone (FCZ) is at Po Toi, which is over 3.6 km from the cable alignment at the closest point, and impacts are not predicted to occur at this, or any other, FCZ.

C5.1 MITIGATION MEASURES

As no unacceptable impacts to fisheries resources are expected to occur, no mitigation measures specific to fisheries are required.

C5.2 PRECAUTIONARY MEASURES

Water quality monitoring will be carried out as a precautionary measure, to verify that the Project works will not result in any unacceptable impacts to water quality, and consequently to fisheries. The monitoring details for water quality are presented in *Annex F*.

C6 SUMMARY AND CONCLUSION

A review of existing information on the fisheries resources/ production and fishing operations in the vicinity of the proposed cable corridor has identified the majority of the area as supporting a fishery of low to medium ranking in terms of fisheries operations and production. Given the short duration of works and localized, temporary sediment plume (within 180 m from the cable alignment, settling within approximately 200 seconds) arising from the cable system laying or repair works, no unacceptable impacts have been predicted to occur to fisheries resources or fishing operations as a result of the Project.

Nevertheless water quality monitoring will be carried out as a precautionary measure, to help verify that the Project works will not result in any unacceptable impacts to water quality, and consequently to fisheries, as detailed in *Annex F*.

Annex D

Assessment of Assessment of Potential Noise Impacts

CONTENTS

D1 INTRODUCTION

This *Annex* describes and evaluates the potential noise impacts arising from the construction or repair of with the submarine cable installation and land works for the proposed cable landing site at Sha Shek Tan, Chung Hom Kok.

Noise emissions are not expected from the normal operation of the proposed submarine cable and, therefore, will not be considered further.

The principal legislation relating to the control of construction noise in daytime (ie 0700 to 1900 hours) on any day not being a Sunday or general holiday is the *Environmental Impact Assessment Ordinance* (*EIAO*) (*Cap. 499*). The *Technical Memorandum on Environmental Impact Assessment Process* (*EIAO-TM*), issued under the *EIAO*, provides guidelines and noise criteria for evaluating noise impacts.

The *Noise Control Ordinance* (*Cap. 400*) (*NCO*) also provides means to assess construction noise impacts. Various Technical Memoranda (*TMs*), which stipulate control approaches and criteria, have been issued under the *NCO*. The following TMs are applicable to the control of noise impacts from construction activities:

- *Technical Memorandum on Noise from Construction Work other than Percussive Piling* (*GW-TM*); and
- *Technical Memorandum on Noise from Construction Work in Designated Areas* (*DA-TM*).

The construction works associated with the onshore and offshore submarine cable installation is expected to occur during non-restricted hours, ie 0700 to 1900 hours on any day not being a Sunday or public holiday. If works during restricted hours are later found to be necessary, a Construction Noise Permit (CNP) will be applied for.

Under the *EIAO*, noise impact arising from general construction works during non-restricted hours at openable windows of buildings are to be assessed in accordance with the noise criteria given in *EIAO-TM*. With reference to the *EIAO-TM*, the daytime noise standard for domestic premises is $L_{eq,\ 30\ min}$ 75 dB(A).

D3 ASSESSMENT METHODOLOGY

The assessment of noise impact from the associated cable installation works was undertaken based on the procedure outlined in the *GW-TM*. In general, the procedure to undertake a construction noise assessment is as follows:

- locate representative noise sensitive receivers (NSRs) that may be affected by the works;
- determine construction plants for corresponding construction activities, based on available information;
- assign sound power level (SWL) to the powered mechanical equipment (PME) proposed based on the *GW-TM* or other sources;
- calculate the correction factors based on the distance between the NSRs and the notional noise source positions of the work sites;
- apply corrections such as potential screening effect and acoustic reflection, if any, in the calculations; and
- predict construction noise levels at NSRs.

D4 POTENTIAL NOISE SOURCES

In accordance with *Section 2* of the main body of text, major construction activities will be carried out in the following Works Areas (see ***Figures D1*** and ***D2***):

- Beach Man Hole (BMH) to Cable Landing Station (CLS) – cable laying by hand pulling using existing ducts. Air compressor and generator may be used for clearing the existing ducts, if necessary and these would only be placed at the manhole at the top of the existing ducts at the CLS or at BMH as shown in ***Figure D2***;

- BMH to LWM - new duct installation and reinstatement by using hand-held drill, hand-held grinder and hand-held breaker; beach excavation, cable laying and back filling by small tracked diggers, winch, with some hand digging and hand pulling as required; and

- Marine Cable Installation (cable system laying works between the landing point and offshore HKSAR eastern boundary) – using cable installation barge, divers and work boat.

D5 DESCRIPTION OF THE ENVIRONMENT & IDENTIFICATION OF NOISE SENSITIVE RECEIVERS

The existing noise environment of the proposed work site area is tranquil, reflecting the rural nature of the site and its coastal location. Low density housing developments are located along the low trafficked Chung Hom Kok Road and Cape Road. The Study Area for the noise impact assessment covers a distance of 300 m from the proposed alignment of the cable, as shown in ***Figure D1***.

Only the first layer of NSRs having direct line of sight towards both of the land and marine alignments have been included in the assessment as NSRs behind are located further away or are screened.

The identified representative NSRs, N1 and N2 (equivalent to ID 1 and 3 in ***Figure D1***), are shown in ***Figure D2***. Details of the identified representative NSRs are presented in *Table D1* with their photographs shown in ***Figure D3***. *Table D1* provides distances between the NSRs and specific works areas where more noise may be generated according to the construction plant inventory described in *Section D6*.

Table D1 Representative Noise Sensitive Receivers (NSRs)

NSR	Description	Type of Use	Shortest Distance (m) between specific Works Areas and NSRs		
			Onshore Cable (BMH to CLS)	Onshore Cable (BMH to LWM)	Offshore Submarine Cable
N1	Block 5, 30 Cape Road	Residential	H: 120 S: 126	H: 95 S: 103	H: 95 S: 103
N2	House 2, SCape	Residential	H: 114 S: 122	H: 114 S: 122	H: 111 S: 119

Note:
H – Horizontal distance; S - Slant distance.

An assumed plant inventory has been established and is presented in *Table D2*. The plant inventory was reviewed by the Design Engineer and was confirmed to be suitable for completing the Assignment.

Table D2 Construction Plant Inventory

Item of PME	Identification Code [1]	No. of units	Sound Power Levels (SWL) (dB(A))
Land Cable – BMH to CLS (inventory at one location as indicated in Section D4)			
Air compressor, air flow <= 10m^3/min	CNP 001	1	100
Generator, super silenced	CNP 103	1	95
		Sub-total	**101**
Inshore Cable – Beach area			
Winch	CNP 262	1	95
Generator, super silenced	CNP 103	1	95
Excavator, mini-robot mounted	CNP 081	2	115
Hand-held drill	CNP 065	1	98
Hand-held grinder	CNP 065	1	98
Hand-held breaker, mass <=10kg	CNP 023	1	108
		Sub-total	**116**
Offshore Submarine Cable			
Tug Boat	CNP 221	1	110
Mobile Crane	CNP 048	1	112
		Sub-total	**114**

Note:
[1] PME Identification Codes and Sound Power Levels (SWLs) refer to those provided in EPD's 'Technical Memorandum on Noise from Construction Work other than Percussive Piling' (TM-GW).

Noise levels at the representative NSRs have been predicted based on the above construction plant inventory. The predicted noise levels at the representative NSRs are presented in *Table D3*. Details of the calculation on construction noise impact assessment are given in *Appendix D1*.

Table D3 Predicted Noise Levels at the Representative NSRs

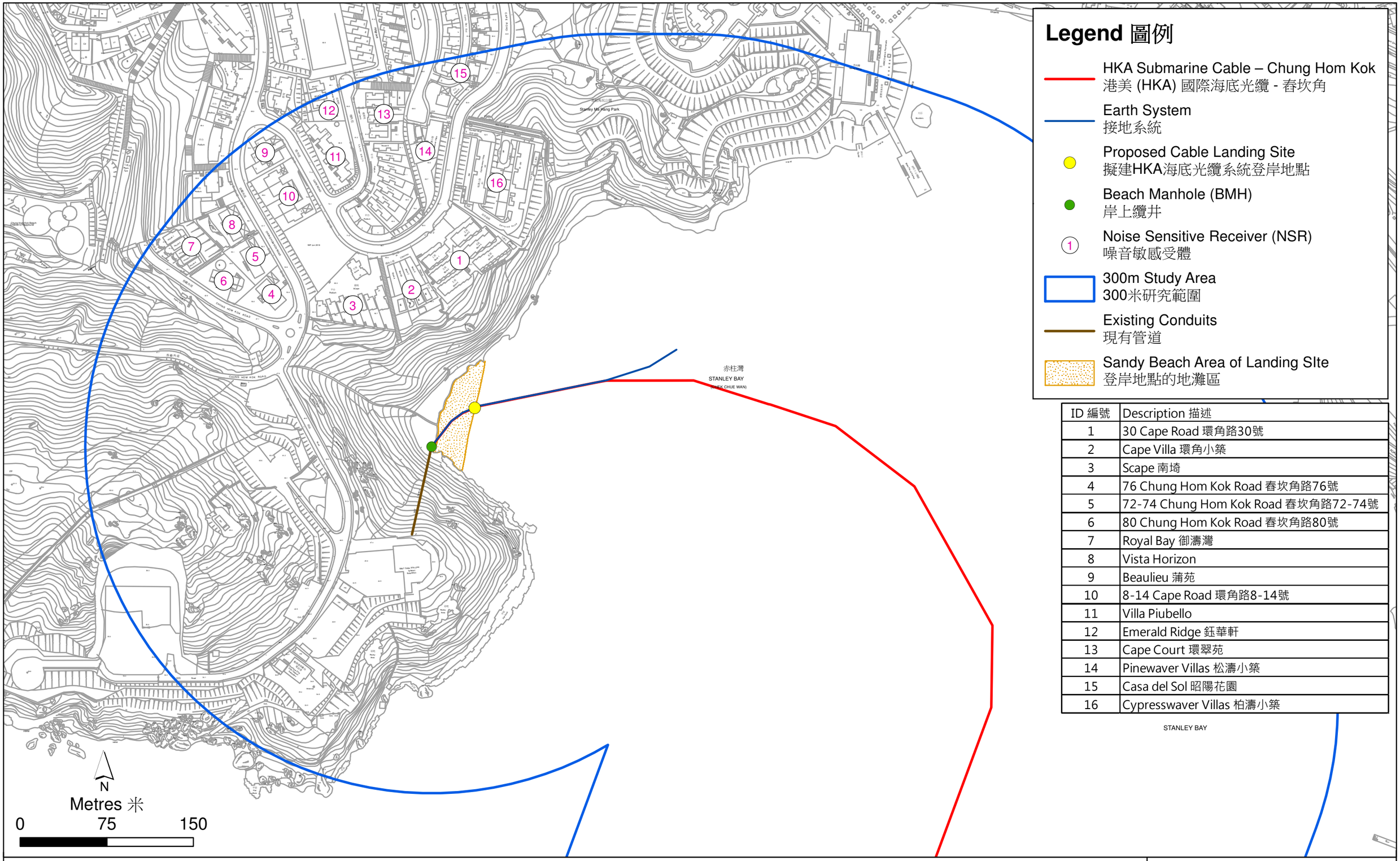
NSR	Predicted Noise Levels (dB(A))	Noise Criterion (dB(A))	Compliance
Land cable – BMH to CLS			
N1	54	75	Yes
N2	54	75	Yes
Inshore cable – BMH to LWM			
N1	71	75	Yes
N2	69	75	Yes
Offshore submarine cable			
N1	69	75	Yes
N2	68	75	Yes

The construction noise levels for land and submarine cable installation are predicted in the range of 54 to 71 dB(A) and comply with the noise criterion. Noise mitigation measures are not required.

D7 CONCLUSION

A noise assessment was undertaken to describe and evaluate the potential noise impacts arising from the land, inshore and remaining submarine works associated with cable installation and operation (including maintenance). It is predicted that noise exceedances would not occur at the identified noise sensitive receivers due to the minor activities for construction or operation (including maintenance).

Cable installation or maintenance and repair work at present is not expected to take place during restricted hours. If restricted hours works are later found to be necessary, a Construction Noise Permit (CNP) will be applied for.



ID 編號	Description 描述
1	30 Cape Road 環角路30號
2	Cape Villa 環角小築
3	Scape 南埼
4	76 Chung Hom Kok Road 春坎角路76號
5	72-74 Chung Hom Kok Road 春坎角路72-74號
6	80 Chung Hom Kok Road 春坎角路80號
7	Royal Bay 御濤灣
8	Vista Horizon
9	Beaulieu 蒲苑
10	8-14 Cape Road 環角路8-14號
11	Villa Piubello
12	Emerald Ridge 鈺華軒
13	Cape Court 環翠苑
14	Pinewaver Villas 松濤小築
15	Casa del Sol 昭陽花園
16	Cypresswaver Villas 柏濤小築

Figure D1
圖 D1

300m Study Area for Noise Impact Assessment
噪音影響評估的300米研究範圍

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Date: 30/10/2018

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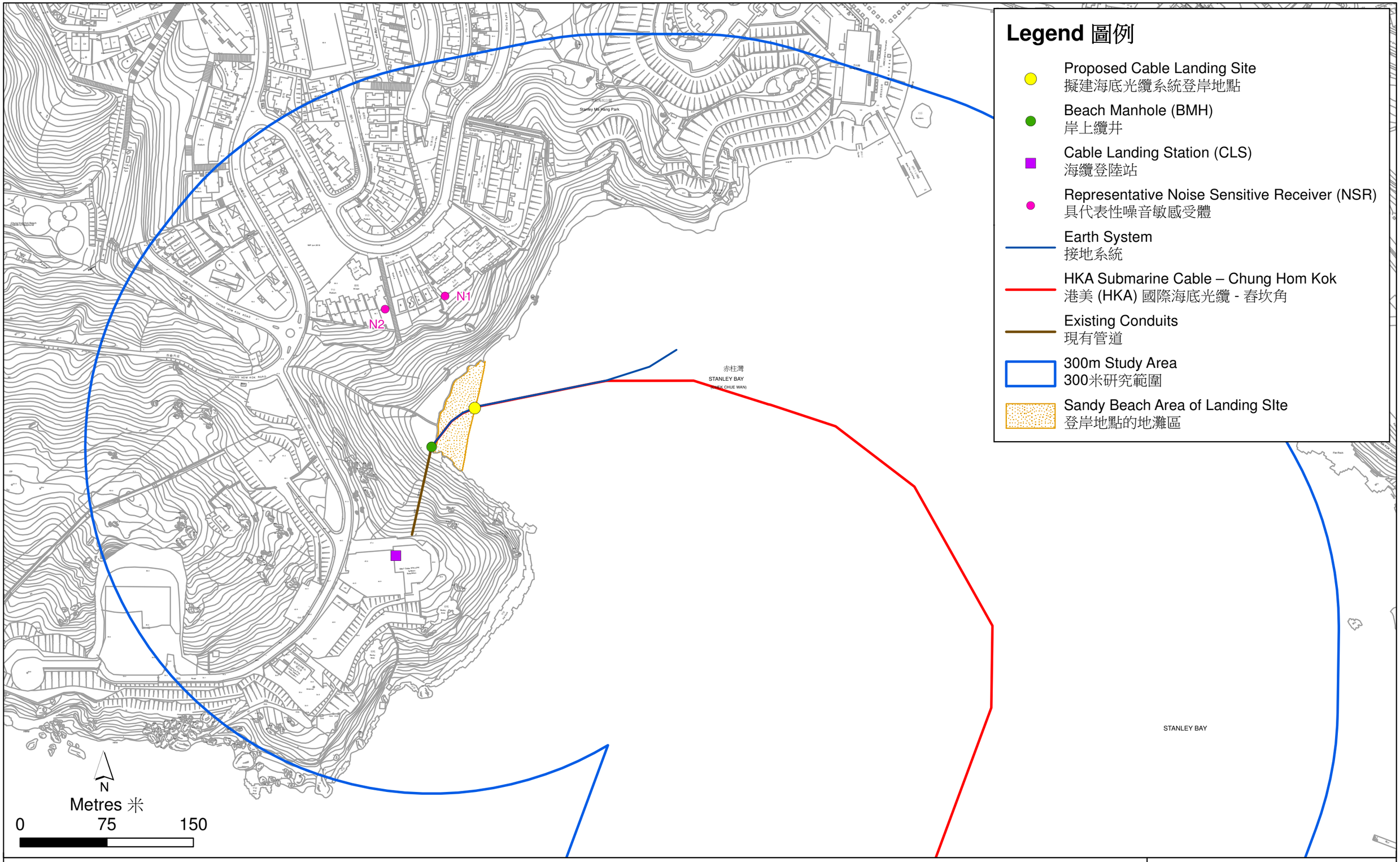

Figure D2
圖 D2

Representative Noise Sensitive Receivers (NSRs)
具代表性噪音敏感受體

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Date: 30/10/2018

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House 2, SCape (N2)
南琦2號屋(N2)

Block 5, 30 Cape Road (N1)
環角道30號, 第5座(N1)

Figure D3
圖D3

DATE: 12/04/2018

Photographs of Representative Noise Sensitive Receiver (NSR)
具代表性的噪音敏感受體的照片

Environmental Resources Management

Appendix D1

Construction Noise Assessment

Appendix D1 - Construction Noise Impact Assessment

A) Calculation of Façade Noise Levels at N1

	x	y
NSR: N1 - Block 5, 30 Cape Road (@ 40 mPD)	839301.5	808627.2
Notional Source Positions (nearest to the NSR):		
Onshore Cable (BMH to CLS)	839286.5	808507.6
Onshore Cable (BMH to LWM)	839326.0	808535.3
Offshore Submarine Cable	839326.0	808535.3

PME	Identification Code (1)	No. of PME	Unit SWL, dB(A)	Horizontal Distance	Slant Distance	Correction, dB(A)				CNL of individual PME, dB(A)	Overall CNL of each Group, dB(A)(2)	Criterion, dB(A)	Compliance
						No. of Plant	Cdist	Cfacade	Barrier				
Onshore Cable - BMH to CLS (@ 3 mPD)													
Air compressor, air flow <= 10m3/min	CNP 001	1	100	120	126	0	-50.0	3	0	53			
Generator, super silenced	CNP 103	1	95	120	126	0	-50.0	3	0	48	54	**75**	**Yes**
Onshore Cable - (BMH to LWM) (@ 0 mPD)													
Winch	CNP 262	1	95	95	103	0	-48.3	3	0	50			
Generator, super silenced	CNP 103	1	95	95	103	0	-48.3	3	0	50			
Excavator, mini-robot mounted	CNP 081	2	112	95	103	3	-48.3	3	0	70			
Hand-held drill	CNP 065	1	98	95	103	0	-48.3	3	0	53			
Hand-held grinder	CNP 065	1	98	95	103	0	-48.3	3	0	53			
Hand-held breaker, mass <=10kg	CNP 023	1	108	95	103	0	-48.3	3	0	63	71	**75**	**Yes**
Offshore Submarine Cable (@ 0 mPD)													
Tug Boat	CNP 221	1	110	95	103	0	-48.3	3	0	65			
Mobile Crane	CNP 048	1	112	95	103	0	-48.3	3	0	67	69	**75**	**Yes**

B) Calculation of Façade Noise Levels at N2

	x	y
NSR: N2 - House 2, SCape (@ 47 mPD)	839249.7	808615.8
Notional Source Positions (nearest to the NSR):		
Onshore Cable (BMH to CLS)	839286.5	808507.6
Onshore Cable (BMH to LWM)	839286.5	808507.6
Offshore Submarine Cable	839326.0	808535.3

PME	Identification Code (1)	No. of PME	Unit SWL, dB(A)	Horizontal Distance	Slant Distance	Correction, dB(A)				CNL of individual PME, dB(A)	Overall CNL of each Group, dB(A)(2)	Criterion, dB(A)	Compliance
						No. of Plant	Cdist	Cfacade	Barrier				
Onshore Cable - BMH to CLS (@ 3 mPD)													
Air compressor, air flow <= 10m3/min	CNP 001	1	100	114	122	0	-49.7	3	0	53			
Generator, super silenced	CNP 103	1	95	114	122	0	-49.7	3	0	48	54	**75**	**Yes**
Onshore Cable - (BMH to LWM) (@ 3 mPD)													
Winch	CNP 262	1	95	114	122	0	-49.7	3	0	48			
Generator, super silenced	CNP 103	1	95	114	122	0	-49.7	3	0	48			
Excavator, mini-robot mounted	CNP 081	2	112	114	122	3	-49.7	3	0	68			
Hand-held drill	CNP 065	1	98	114	122	0	-49.7	3	0	51			
Hand-held grinder	CNP 065	1	98	114	122	0	-49.7	3	0	51			
Hand-held breaker, mass <=10kg	CNP 023	1	108	114	122	0	-49.7	3	0	61	69	**75**	**Yes**
Offshore Submarine Cable (@ 0 mPD)													
Tug Boat	CNP 221	1	110	111	119	0	-49.5	3	0	63			
Mobile Crane	CNP 048	1	112	111	119	0	-49.5	3	0	65	68	**75**	**Yes**

Remarks:

(1) PME Identification Codes and Sound Power Levels (SWLs) refer to those provided in EPD's ' *Technical Memorandum on Noise from Construction Work other than Percussive Piling (GW-TM)* '.

(2) Corrected Noise Level (CNL), dB(A) = SWL + No.of PME correction + barrier correction+ distance correction + façade correction.

Annex E

Assessment of Potential Impact to Marine Archaeological Resources

CONTENTS

E1 INTRODUCTION

This *Annex* presents a marine archaeological assessment as part of the cultural heritage impact assessment of the environmental assessments associated with the installation of the submarine telecommunications cable system within HKSAR, including the connection to land at Chung Hom Kok (CHK). This assessment includes a desktop study, available geophysical surveys results and establishment of archaeological potential and evaluates the potential for direct and indirect adverse impacts to these resources. The marine archaeological assessment area is a 1,000m corridor generally centred on the proposed cable.

E2 RELEVANT LEGISLATION AND ASSESSMENT CRITERIA

The following legislation is applicable to the assessment of archaeological and historic resources in Hong Kong.

E2.1 ENVIRONMENTAL IMPACT ASSESSMENT ORDINANCE TECHNICAL MEMORANDUM ON THE EIA PROCESS

Annex 10 outlines the criteria for assessment of impact on sites of cultural heritage. The general presumption is in favour of the protection and conservation of all sites of cultural heritage. Also, adverse impacts on sites of cultural heritage shall be kept to the absolute minimum.

Annex 19 outlines the approaches required in investigating and assessing the impacts on sites of cultural heritage. There is no quantitative standard in deciding the relative importance of these sites, but in general, sites of unique archaeological, historical or architectural value will be considered as highly significant. Preservation in totality is preferred. If, due to site constraints and other factors, only preservation in part is possible, this must be fully justified with alternative proposals or layout designs, which confirm the impracticability of total preservation.

E2.1.1 Antiquities and Monuments Ordinance (Cap.53)

The *Antiquities and Monuments Ordinance* (*Cap. 53*) (*AM Ordinance*) provides statutory protection against the threat of development on Declared Monuments, historical buildings and sites of archaeological interest to enable their preservation for posterity. The *AM Ordinance* also establishes the statutory procedures to be followed in making such a declaration.

Any person who discovers an antiquity, or supposed antiquity, is required to report the discovery to the Antiquities Authority.

E2.1.2 Land (Miscellaneous Provisions) Ordinance (Cap. 28)

Under this Ordinance, it is required that a permit should be obtained for any excavation within the Government land prior to any excavation work starting.

E2.1.3 Hong Kong Planning Standards and Guidelines

The *Chapter 10*, *Conservation*, of the HKPSG provides general guidelines and measures for the conservation of historical buildings, sites of archaeological interest and other antiquities.

E2.1.4 Marine Archaeological Investigation (MAI) Guidelines

Guidelines for MAI established by AMO detail the standard practice, procedures and methodology which must be undertaken in determining marine archaeological potential, presence of archaeological artefacts and defining suitable mitigation measures. Baseline review, geophysical survey and establishing archaeological potential are considered the first stage of a MAI. Subject to results of the first stage MAI, further investigation may or may not be required.

E3 ASSESSMENT METHODOLOGY

The methodology used in this assessment is in accordance with the Guidelines for MAI established by AMO and comprised the following tasks.

E3.1 ESTABLISH BASELINE CONDITIONS

- Implement Desktop review, comprising, historical documents and United Kingdom Hydrographic Office (UKHO) 'Wreck' files to establish the potential for marine archaeological sites in the marine archaeological assessment area; and

- Review of geophysical survey data of the MAI Study Area to identify the presence of any marine archaeological potential resources.

E3.2 ESTABLISHING ARCHAEOLOGICAL POTENTIAL

The synthesis and analysis of the baseline conditions were used to establish if there were any marine archaeological sites in the marine archaeological assessment area.

E3.3 ASSESS IMPACT AND MAKE RECOMMENDATION

Based on the findings and analysis of the baseline conditions, an assessment was made of the potential impact of the Project on the marine archaeological sites, and recommendations made to mitigate any impact.

E4 DESKTOP RESEARCH

E4.1 TERRESTRIAL CULTURAL HERITAGE SITES

The submarine cable's landing site is at Sha Shek Tan of Chung Hom Kok (CHK). No declared monuments, proposed monuments, graded historic sites / buildings, and government historic sites identified by the Antiquities and Monuments Office are identified within 500 m of the proposed landing site. The Chung Hom Wan Site of Archaeological Interest is located approximately 470 m from the proposed landing site (see *Figure 3.2*).

E4.2 MARINE ARCHAEOLOGICAL RESOURCES

According to a database of the United Kingdom's Hydrographic Office (UKHO), one 'wreck' was found to be within the marine archaeological assessment area (see *Figure 3.2*). It is reported as 'dead' i.e. not detected by repeated surveys, therefore considered not to exist (see *Table E4.1*).

Table E4.1 UKHO Wreck Site in the Marine Archaeological Assessment Area

Wreck number	Description	Status (HK Marine Survey Date)	Geographical Coordinates	Distance from the cable route (m)
W1	An aircraft, sunk in September 1977	Dead (15 October 2008)	22 11'.817 N 114 21'.167 E	418

This is a modern aircraft wreck that is believed to have been totally salvaged (see *Appendix E1*) and therefore the site does not contain any archaeologically significant remains. A review of the seabed in the geophysical data at this location found no trace of the aircraft wreck.

E4.3 PREVIOUS REFERENCE PROJECTS

The baseline review made reference to previous projects in the vicinity, including:

- *South-East Asia Japan Cable System (SJC) Hong Kong Segment Project Profile* (Application No.: *DIR-213/2011*);
- *Asia-Africa-Europe-1 (AAE-1) Cable System Project Profile* (Application No.: *DIR-244/2016*); and
- *Pacific Light Cable Network (PLCN) - Deep Water Bay Project Profile* (Application No.: *DIR-254/2017*).

Their alignments are indicated in *Figure 3.2* and marked as *DIR-213/2011; DIR-244/2016* and *DIR-254/2017*.

Under application *DIR-213/2011*, the section of cable route system from the landing site at Sha Shek Tan of CHK to the water west of Stanley Peninsular fell within the assessment area of the current Project. An MAI including a geophysical survey of the final route alignment was conducted and the results

concluded that there were no features of archaeological value in the vicinity of the route here. No map showing the surveyed area coverage was available in the report. Nevertheless, sonar contacts identified from the geophysical survey were as far as 318 m from the cable route. It is therefore reasonable to deduce that the survey coverage covers at least 320 m from the cable route. Please refer to *Figure 3.2* for the deduced survey area coverage.

Under application *DIR-244/2016*, the section of cable route in the area above Sung Kong and Sung Kong Islet is similar to the current Project. An MAI comprised of baseline review, geophysical survey, establishment of archaeological potential and dive survey was conducted. Results of the MAI only identified modern debris. It was concluded that no marine archaeological resources were located.

Under application *DIR-254/2017*, the section of cable route in the area off Stanley peninsular out to the east boundary of Hong Kong waters is similar to the current Project. An assessment of potential impacts to marine archaeological resources was conducted and it was concluded that the Project would not impact sites or objects of marine archaeological significance.

Based on the MAI and marine archaeological assessment results of these previous applications, up to 60-70% of the marine archaeological assessment area of the HKA submarine cable route has already been assessed previously, with findings that it does not contain sites or objects of marine archaeological significance. As shown in *Figure 3.2*, certain portions of the marine archaeological assessment area of the submarine cable route were not covered by the previous MAIs and marine archaeological assessment, i.e. the yellow areas in *Figure 3.2,* hereafter called the MAI Study Area. This area is the focus of the review of the geophysical survey data of this Project.

E4.4 RESULTS OF GEOPHYSICAL SURVEY

A geophysical survey for the proposed HKA cable alignment was carried out from May to June 2018, which comprised a side scan sonar, seismic boomer, echo sounder and magnetic survey covering the MAI Study Area. The MAI Study Area is shown in the yellow areas at the eastern end and to a lesser extent in the western end of the 500 m survey corridor. The main traverses varied from 30 m – 40 m in the western section of the MAI Study Area (where there is a complex seabed of sand, silt, rocks, debris and dumped materials), to 100 m in the eastern section of the MAI Study Area (where there is a less complex and generally featureless seabed with occasional debris and dumped materials) (see *Figure E1*). There was adequate coverage of the area, as traverses overlapped at least one other traverse and cross traverses were implemented.

The geophysical data was interpreted by the survey team geophysicists and reviewed by Dr. Bill Jeffery, qualified maritime archaeologist. Many sonar contacts were identified in the MAI Study Area, with two being identified for further review as they appear to be possible man-made features that may be of archaeological interest. One was a possible wreck (SC246), potentially a small fishing vessel given the nature of the wreck (see *Figure E2*). Another one

(SC072), is considered to be man-made debris and the Magnetic Survey reading at this location was low. It is therefore not considered as an iron object of archaeological potential (see *Figure E3*). No debris was found within 5 m of the cable.

The location of SC072 and SC246 and their distances from the cable can be seen in *Figure 3.2* and *Table E4.2*. Further details of the geophysical survey results are provided in *Appendix E2,* in *Figures E4-1, E4-2, E4-3* and *E4-4*.

Table E4.2 Sonar Contacts/Debris in the MAI Study Area

Contact No.	Easting	Northing	Dimensions (m)	Distance from the HKA cable route (m)	Description
SC072	2451406.4E	8065105.7N	2.56 x 1.14 x 0.9	38	Debris
SC246	2475298.1E	8067674.6N	21.5 x 3.4 x nmh	198	Possible wreck

Note: nmh= no measurable height

No sub-bottom anomalies of interest were interpreted. The Magnetic Survey was implemented to locate the numerous other cables in the area, and also did not reveal any potentially significant marine archaeological sites or objects.

E5 IMPACT ASSESSMENT

The desktop review found no declared monuments, proposed monuments, graded historic sites / buildings, and government historic sites identified by the Antiquities and Monuments Office fall within 500 m of the landing Site. The Chung Hom Wan Site of Archaeological Interest is approximately 470 m away from the landing site. There will be no adverse impact on the Site of Archaeological Interest. A review of the United Kingdom Hydrographic Office's (UKHO) 'Wrecks' files found one aircraft wreck site within the marine archaeological assessment area, but it has been designated 'Dead', and no longer exists. This was confirmed through not being able to locate any material on the seabed at the wreck location when reviewing the geophysical data.

There is a lot of debris in MAI Study Area of which only one is a possible wreck, being 198 m from the cable (SC246), and one man-made debris, which is 38 m from the cable (SC072). None of the other debris in the MAI Study Area is within 5m of the cable and none of it is considered to be man-made material with archaeological interest. The one possible wreck and one piece of man-made debris upon full review are not considered to be objects of marine archaeological significance.

The cable will be installed using jetting technique and it is expected that the maximum width of the seabed affected will be approximately 105mm either side of the centre line of the proposed cable route (i.e. 210 mm width) (disturbance area) and it will be buried to a depth of 5m. After the installation, the seabed will then be naturally reinstated by currents to before-work level and condition very shortly. Given this minimal disturbance area, and the location of the man-made debris (SC072) and possible wreck (SC246) being outside of this disturbance area, no marine archaeological sites or objects are anticipated to be impacted as a result of this Project.

E6 CONCLUSION AND RECOMMENDATION

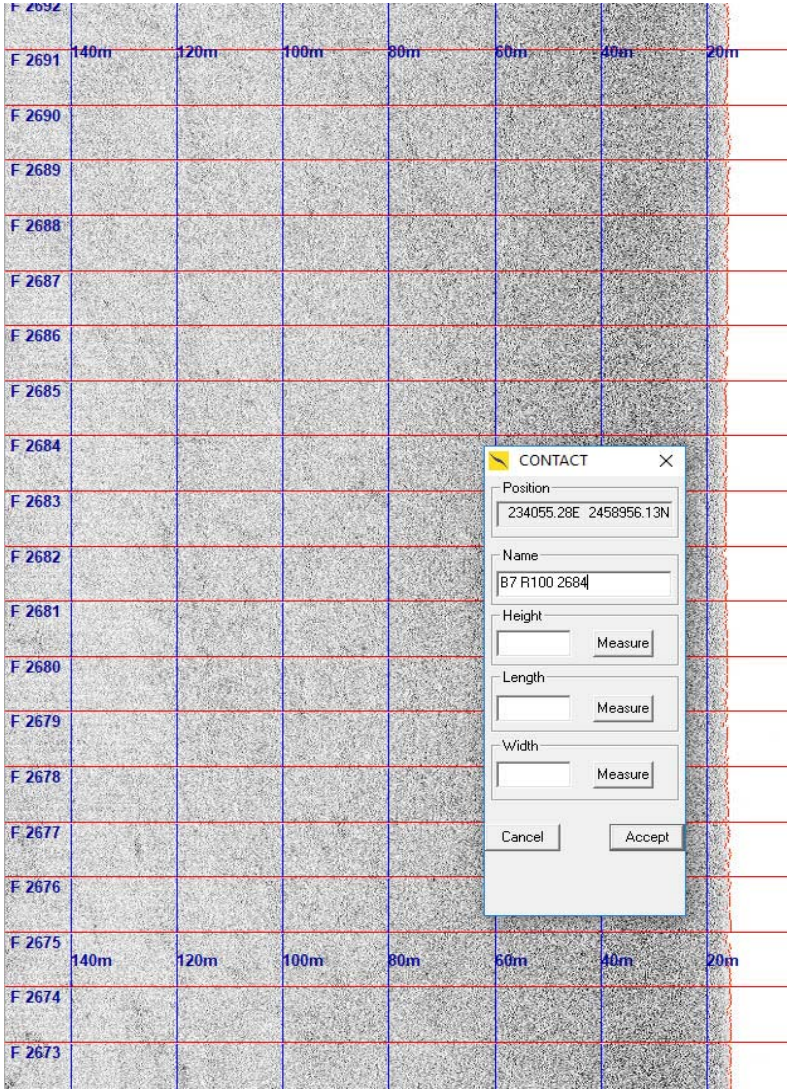
The cultural heritage review identified no cultural heritage resources will be impacted by the Project. The proposed cable will be laid in the proximity of a number of existing cables, where MAIs and marine archaeological assessments have been implemented and found no marine archaeological sites or objects were to be impacted. This MAI focused on an area where there was no overlap with previous MAIs and marine archaeological assessments, called the MAI Study Area. In this MAI Study Area, one sonar contact (SC246) appearing to be a possible wreck, and a man-made debris (SC072) were located. They are not considered of archaeological significance and they will not be impacted by this Project given the distance away from the cable. Thus, no further marine archaeological investigations and no mitigation measures are considered necessary.

E7 REFERENCES

Atkins China Limited (2011) *South-East Asia Japan Cable System (SJC) Hong Kong Segment Project Profile* (DIR-213/2011), viewed on 1 June 2018, from https://www.epd.gov.hk/eia/register/profile/latest/dir213/dir213.pdf;

SMEC Asia Limited (2016), *Asia-Africa-Europe-1 (AAE-1) Cable System Project Profile* (DIR 244/2016), viewed on 1 June 2018, from https://www.epd.gov.hk/eia/register/profile/latest/dir244/dir244.pdf.

ERM (2017), *Pacific Light Cable Network (PLCN) - Deep Water Bay Project Profile* (DIR 254/2017), viewed on 1 June 2018, from https://www.epd.gov.hk/eia/register/profile/latest/dir254/dir254.pdf.



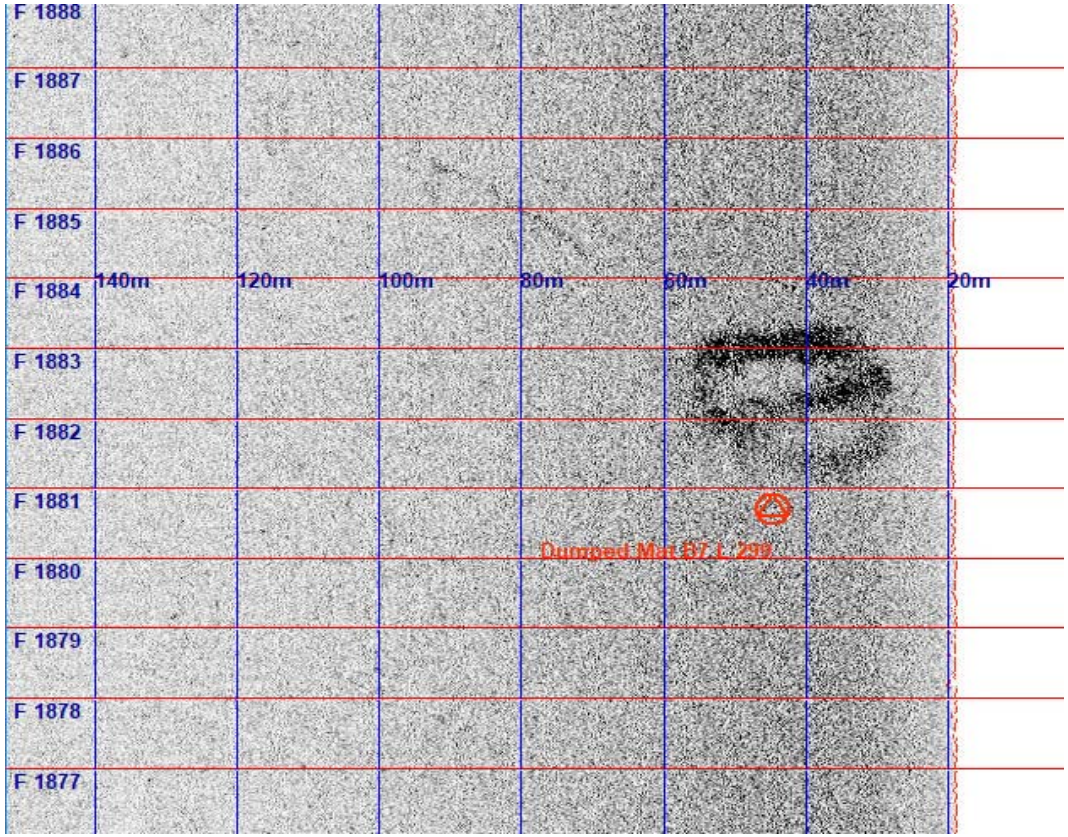


Figure E1
圖 E1

DATE: 22/10/2018

Generally featureless seabed in the eastern section of the Study Area
在研究範圍東部一般沒有特色的海床

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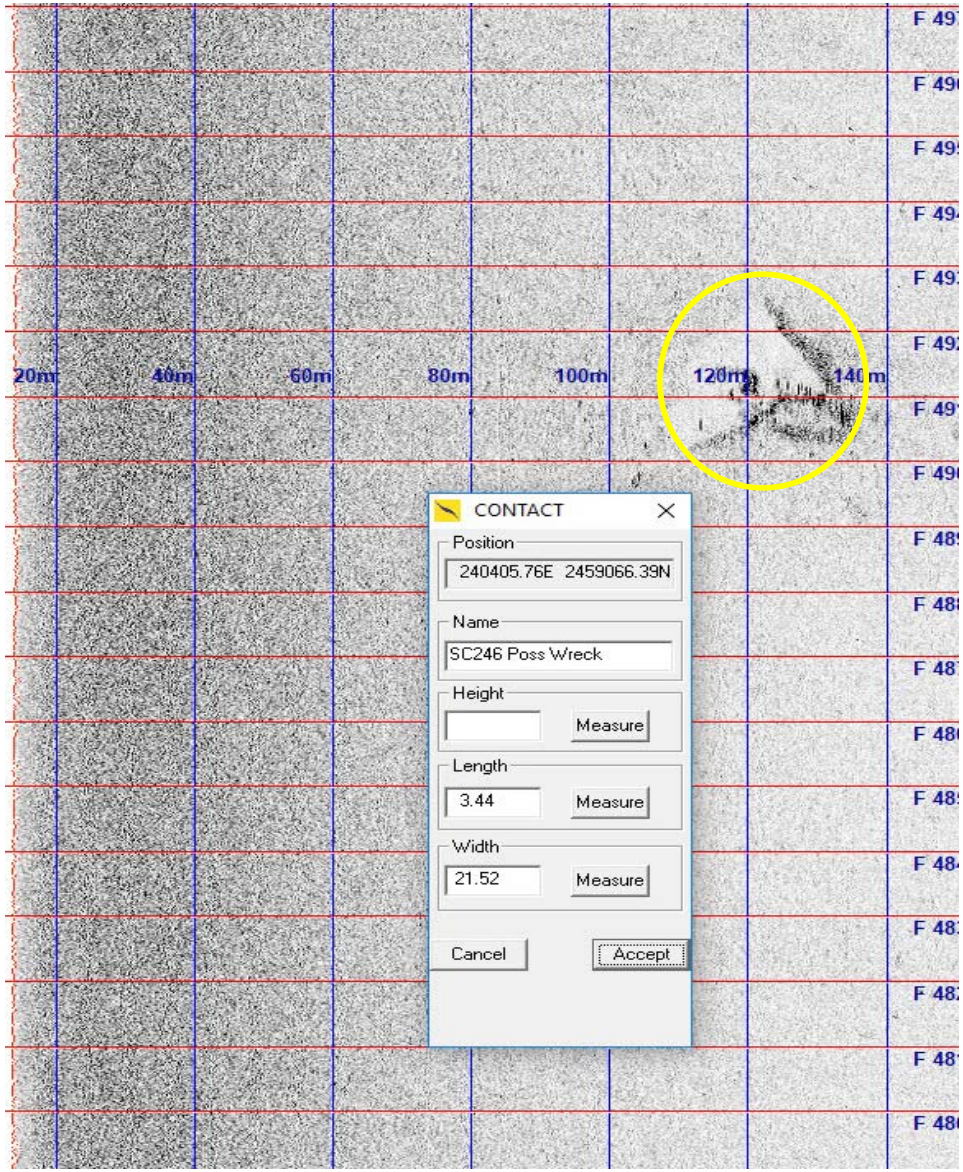


Figure E2
圖 E2

DATE: 22/10/2018

SC246-possible wreck
SC246-可能的沉船

Environmental Resources Management
ERM

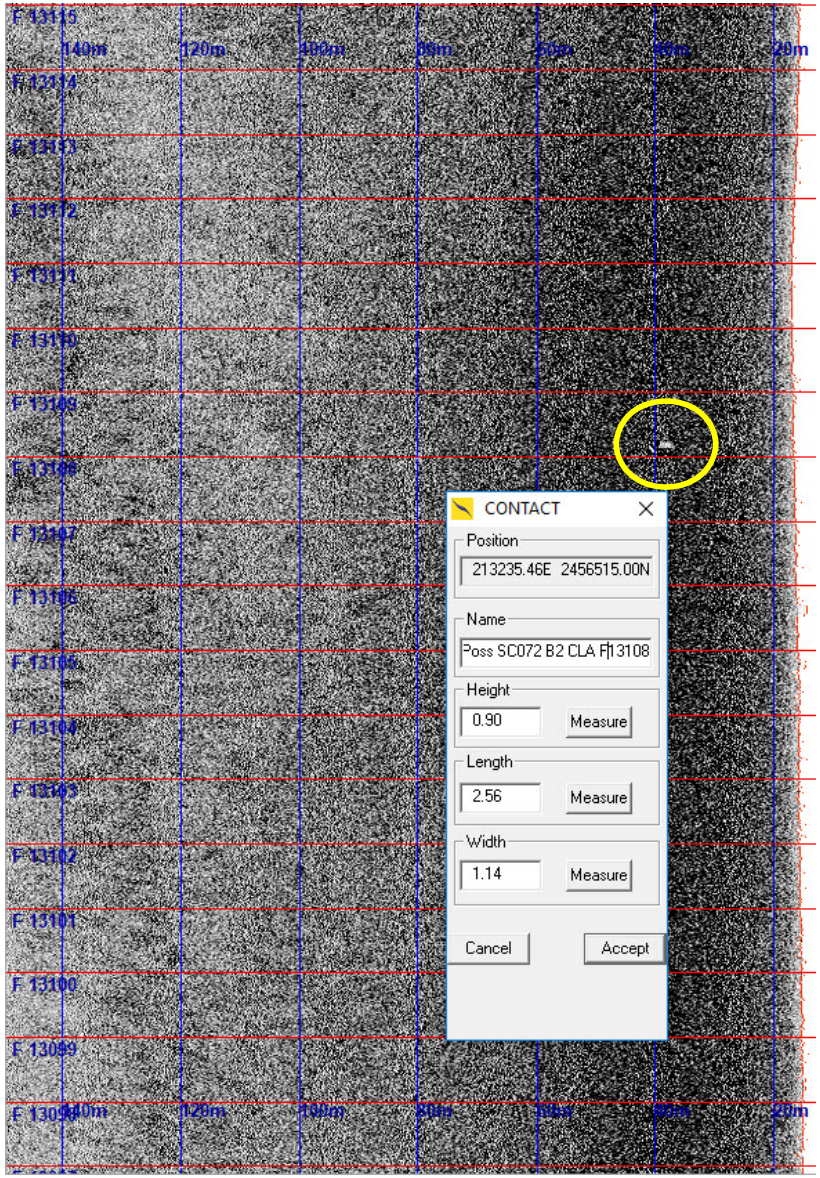


Figure E3
圖 E3

DATE: 22/10/2018

SC072-debris
SC072-碎片

Environmental Resources Management

ERM

Appendix E1

United Kingdom Hydrographic Office Wreck Data

UKHO wreck 72505

Latitude = 22 11'.817 N **Longitude =** 114 21'.167 E [UND] **Square Number =** 1113 **State =** DEAD

Wreck Number 72505 **Classification =** Unclassified
Symbol **Largest Scale Chart =** 4127
Charting Comments TEMPORARY INFORMATION ONLY

Old Number
Category Undefined

WGS84 Position **Latitude =** 22 11'.817 N **Longitude =** 114 21'.167 E
WGS84 Origin Undefined
Horizontal Datum UND UNDETERMINED

Position Method Compass Bearing and Radar Range
Position Quality Precisely known
Position Accuracy
Area at Largest Scale No

Depth
Drying Height
Height
General Depth 31 metres
Vertical Datum Approximate lowest astronomical tide
Depth Method
Depth Quality Depth unknown
Depth Accuracy
Conspic Visual NO **Conspic Radar** NO
Historic NO **Military** NO **Existence Doubtful** NO
Non Sub Contact NO

Last Amended 15/10/2008
Position Last Amended
Position Last **Latitude =** **Longitude =**

Name G-ATZH
Type CARGO AIRCRAFT
Flag BRITISH
Dimensions **Length =** **Beam =** **Draught =**
Tonnage
Cargo CLOTHES
Date Sunk 02/09/1977

Sonar Dimensions **Length =** **Width =** **Shadow Height =**
Orientation

Magnetic Anomaly
Debris Field
Scour **Depth =** **Length =** **Orientation =**

Markers
General Comments

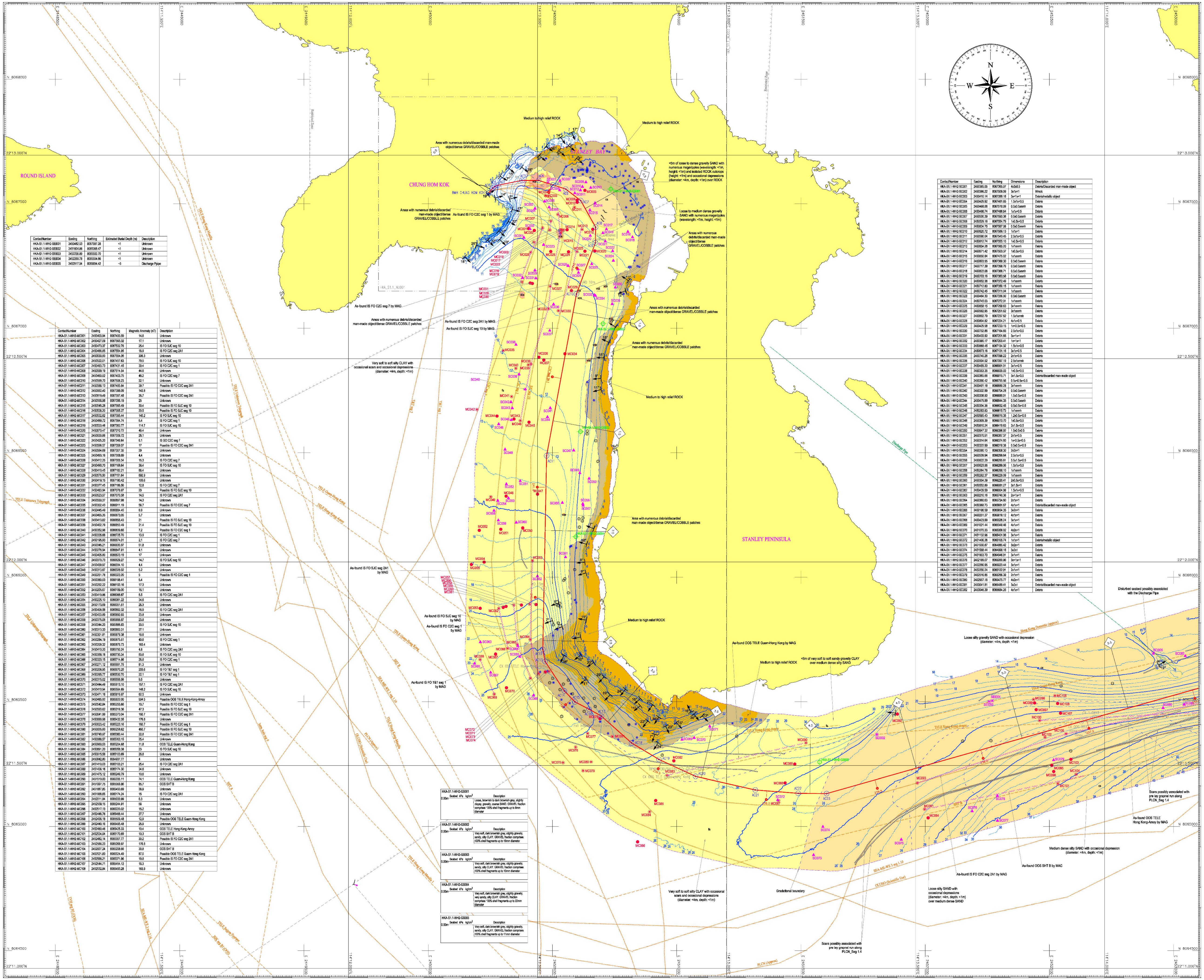
Circumstances of Loss
**CANADAIR BRITANNIA CL44 CARGO AIRCRAFT, OWNED AT TIME OF LOSS BY TRANS MERIDIAN. CRASHED 2M E OF WANGLAN ISLAND, AFTER ENGINE CAUGHT FORE SHORTLY AFTER TAKE-OFF. CREW OF 4 LOST. (LL, 5.9.77)
Surveying Details

**H2666/65 27.9.77 DITCHED APPROX 124DEGS, 4.5M FROM TATHONG PT LT. G SPHERICAL LT BUOY, QKFL.G LAID IN 221149N, 1142110E. SALVAGE CRAFT IN VICINITY. (LL, 5.9.77, HONG KONG SIGNAL 2.9.77, & HONG KONG TNM 69/77) NCA.
**H4668/74 9.10.78 BUOY WITHDRAWN. (HONG KONG SIGNAL 21.9.77) NCA.
**H4668/74 14.11.78 TNM 69/77 CANCELLED. BUOY PERMANENTLY WITHDRAWN. (HONG KONG MARINE DEPT. NM 61/78) AMENDED TO DEAD. NCA.

**H3076/74 22.10.79 OBSTN IN 221149N, 1142110E, MARKED BY G CONL LT BUOY CLOSE SE. (US NM 93733/37/79) LTR TO DMAHTC, WASHINGTON. NCA.

Appendix E2

Figures



ContactNumber	Easting	Northing	Estimated Burial Depth (m)	Description
HKA-S1.1-WH2-SEI001	2450482.53	8067587.28	<1	Unknown
HKA-S1.1-WH2-SEI002	2451804.86	8065368.47	<1	Unknown
HKA-S1.1-WH2-SEI003	2452256.89	8065500.70	<1	Unknown
HKA-S1.1-WH2-SEI004	2452269.78	8065504.66	<1	Unknown
HKA-S1.1-WH2-SEI005	2452917.54	8065694.42	~3	Discharge Ppipe

ContactNumber	Easting	Northing	Magnetic Anomaly (nT)	Description
HKA-S1.1-WH2-MC001	2450403.94	8067400.59	14.6	Unknown
HKA-S1.1-WH2-MC002	2450427.09	8067393.32	17.1	Unknown
HKA-S1.1-WH2-MC003	2450473.37	8067532.76	25.4	IS FO SJC seg 10
HKA-S1.1-WH2-MC004	2450486.85	8067554.95	18.9	IS FO C2C seg 2A1
HKA-S1.1-WH2-MC005	2450630.50	8067554.06	306.3	Unknown
HKA-S1.1-WH2-MC006	2450522.01	8067457.63	79.5	IS FO SJC seg 10
HKA-S1.1-WH2-MC007	2450493.73	8067431.45	30.4	IS FO C2C seg 1
HKA-S1.1-WH2-MC008	2450599.19	8067514.54	44.6	Unknown
HKA-S1.1-WH2-MC009	2450460.52	8067403.75	48.2	IS FO C2C seg 7
HKA-S1.1-WH2-MC010	2450599.70	8067506.23	32.1	Unknown
HKA-S1.1-WH2-MC011	2450588.13	8067485.84	39.7	Possible IS FO C2C seg 2A1
HKA-S1.1-WH2-MC012	2450662.40	8067398.09	143.8	Unknown
HKA-S1.1-WH2-MC013	2450619.49	8067397.48	35.7	Possible IS FO C2C seg 2A1
HKA-S1.1-WH2-MC014	2450558.98	8067396.19	25	Unknown
HKA-S1.1-WH2-MC015	2450545.28	8067395.49	30.4	Possible IS FO SJC seg 10
HKA-S1.1-WH2-MC016	2450538.20	8067395.27	20.5	Possible IS FO SJC seg 10
HKA-S1.1-WH2-MC017	2450532.62	8067395.44	140.2	IS FO SJC seg 10
HKA-S1.1-WH2-MC018	2450489.72	8067394.74	6.4	IS FO C2C seg 1
HKA-S1.1-WH2-MC019	2450533.46	8067383.77	114.7	IS FO SJC seg 10
HKA-S1.1-WH2-MC020	2450670.47	8067310.72	46.4	Unknown
HKA-S1.1-WH2-MC021	2450630.66	8067309.72	28.1	Unknown
HKA-S1.1-WH2-MC022	2450425.20	8067346.64	6.1	IS GO C2C seg 7
HKA-S1.1-WH2-MC023	2450598.57	8067308.07	17	Possible IS FO C2C seg 2A1
HKA-S1.1-WH2-MC024	2450564.69	8067307.35	29	Unknown
HKA-S1.1-WH2-MC025	2450493.16	8067308.69	4.4	Unknown
HKA-S1.1-WH2-MC026	2450412.25	8067305.34	15.3	IS FO C2C seg 7
HKA-S1.1-WH2-MC027	2450490.70	8067168.64	38.4	IS FO SJC seg 10
HKA-S1.1-WH2-MC028	2450410.45	8067182.21	88.4	Unknown
HKA-S1.1-WH2-MC029	2450576.50	8067151.64	892.9	Unknown
HKA-S1.1-WH2-MC030	2450419.15	8067180.42	103.6	Unknown
HKA-S1.1-WH2-MC031	2450377.45	8067186.56	12.8	IS FO C2C seg 7
HKA-S1.1-WH2-MC032	2450483.94	8067078.87	29	Possible IS FO SJC seg 10
HKA-S1.1-WH2-MC033	2450523.57	8067070.58	14.5	IS FO C2C seg 2A1
HKA-S1.1-WH2-MC034	2450550.37	8066897.98	14.3	Unknown
HKA-S1.1-WH2-MC035	2450302.43	8066911.19	56.7	Possible IS FO C2C seg 7
HKA-S1.1-WH2-MC036	2450445.49	8066884.45	8.9	Unknown
HKA-S1.1-WH2-MC037	2450465.35	8066873.05	5.7	Unknown
HKA-S1.1-WH2-MC038	2450413.62	8066856.43	21	Possible IS FO SJC seg 10
HKA-S1.1-WH2-MC039	2450402.79	8066853.49	21.4	Possible IS FO SJC seg 10
HKA-S1.1-WH2-MC040	2450352.96	8066839.65	7.2	Possible IS FO C2C seg 1
HKA-S1.1-WH2-MC041	2450335.68	8066725.70	13.9	IS FO C2C seg 1
HKA-S1.1-WH2-MC042	2450195.93	8066674.01	2.1	IS FO C2C seg 7
HKA-S1.1-WH2-MC043	2450345.21	8066635.97	51.8	Unknown
HKA-S1.1-WH2-MC044	2450276.94	8066647.81	4.1	Unknown
HKA-S1.1-WH2-MC045	2450405.80	8066623.19	17	Unknown
HKA-S1.1-WH2-MC046	2450370.73	8066629.27	14.7	IS FO SJC seg 10
HKA-S1.1-WH2-MC047	2450439.97	8066334.10	4.4	Unknown
HKA-S1.1-WH2-MC048	2450313.67	8066326.02	5.2	Unknown
HKA-S1.1-WH2-MC049	2450251.78	8066323.20	5	Possible IS FO C2C seg 1
HKA-S1.1-WH2-MC050	2450380.53	8066198.41	5.4	Unknown
HKA-S1.1-WH2-MC051	2450292.22	8066193.16	17.3	Unknown
HKA-S1.1-WH2-MC052	2450205.67	8066189.00	16.1	Unknown
HKA-S1.1-WH2-MC053	2450419.86	8066066.67	5.5	IS FO C2C seg 2A1
HKA-S1.1-WH2-MC054	2450225.10	8066061.22	34.6	Unknown
HKA-S1.1-WH2-MC055	2450173.69	8066051.51	26.3	Unknown
HKA-S1.1-WH2-MC056	2450408.56	8065892.32	18.9	IS FO C2C seg 2A1
HKA-S1.1-WH2-MC057	2450433.89	8065890.93	23.8	Unknown
HKA-S1.1-WH2-MC058	2450375.08	8065888.87	23.8	Unknown
HKA-S1.1-WH2-MC059	2450344.20	8065888.83	33.5	IS FO SJC seg 10
HKA-S1.1-WH2-MC060	2450313.33	8065883.31	27.1	Unknown
HKA-S1.1-WH2-MC061	2450301.81	8065879.38	16.6	Unknown
HKA-S1.1-WH2-MC062	2450284.19	8065875.51	40.6	IS FO C2C seg 1
HKA-S1.1-WH2-MC063	2450209.32	8065875.73	163.4	Unknown
HKA-S1.1-WH2-MC064	2450410.20	8065750.24	4.8	IS FO C2C seg 2A1
HKA-S1.1-WH2-MC065	2450358.18	8065730.34	53.6	IS FO SJC seg 10
HKA-S1.1-WH2-MC066	2450320.15	8065714.88	26.8	IS FO C2C seg 1
HKA-S1.1-WH2-MC067	2450271.12	8065691.75	81.3	Unknown
HKA-S1.1-WH2-MC068	2450208.95	8065670.25	203.6	IS FO T&T seg 1
HKA-S1.1-WH2-MC069	2450265.77	8065530.70	22.1	IS FO T&T seg 1
HKA-S1.1-WH2-MC070	2450315.02	8065556.56	9.5	Unknown
HKA-S1.1-WH2-MC071	2450444.49	8065613.10	157.1	IS FO C2C seg 2A1
HKA-S1.1-WH2-MC072	2450410.94	8065594.69	148.2	IS FO SJC seg 10
HKA-S1.1-WH2-MC073	2450471.18	8065619.87	62.5	Unknown
HKA-S1.1-WH2-MC074	2450485.92	8065622.00	504.5	Possible OOS TELE Hong-Kong-Amoy
HKA-S1.1-WH2-MC075	2450542.84	8065255.66	10.7	Possible IS FO C2C seg 1
HKA-S1.1-WH2-MC076	2450593.62	8065318.36	47.3	Possible IS FO SJC seg 10
HKA-S1.1-WH2-MC077	2450641.99	8065373.04	160.7	Possible IS FO C2C seg 2A1
HKA-S1.1-WH2-MC078	2450690.98	8065432.35	176.8	Unknown
HKA-S1.1-WH2-MC079	2450623.42	8065223.16	160.7	Possible IS FO C2C seg 1
HKA-S1.1-WH2-MC080	2450655.60	8065258.62	460.7	Possible IS FO SJC seg 10
HKA-S1.1-WH2-MC081	2450740.97	8065360.44	22.8	Possible IS FO C2C seg 2A1
HKA-S1.1-WH2-MC082	2450988.57	8065263.15	25.4	Unknown
HKA-S1.1-WH2-MC083	2450960.53	8065204.68	11.8	OOS TELE Guam-Hong Kong
HKA-S1.1-WH2-MC084	2450891.20	8065058.38	23	IS FO SJC seg 10
HKA-S1.1-WH2-MC085	2450915.58	8065103.69	26.8	Unknown
HKA-S1.1-WH2-MC086	2450842.80	8064937.77	4	Unknown
HKA-S1.1-WH2-MC087	2451410.03	8065103.21	25.4	IS FO C2C seg 2A1
HKA-S1.1-WH2-MC088	2451436.16	8065174.30	34.6	Unknown
HKA-S1.1-WH2-MC089	2451475.12	8065249.79	10.6	Unknown
HKA-S1.1-WH2-MC090	2451519.83	8065335.11	74.1	OOS TELE Guam-Hong Kong
HKA-S1.1-WH2-MC091	2451997.75	8065068.86	85.7	OOS SHT B
HKA-S1.1-WH2-MC092	2451887.85	8065450.69	38.9	Unknown
HKA-S1.1-WH2-MC093	2451968.65	8065174.24	15	IS FO C2C seg 2A1
HKA-S1.1-WH2-MC094	2452011.84	8065033.99	6.3	Unknown
HKA-S1.1-WH2-MC095	2452509.15	8065244.91	58	Unknown
HKA-S1.1-WH2-MC096	2452517.13	8065220.02	15.2	Unknown
HKA-S1.1-WH2-MC097	2452446.76	8065468.44	27.7	Unknown
HKA-S1.1-WH2-MC098	2452436.18	8065509.48	12.9	Possible OOS TELE Guam-Hong Kong
HKA-S1.1-WH2-MC099	2452440.16	8065485.48	25.9	Unknown
HKA-S1.1-WH2-MC100	2452460.46	8065425.33	10.4	OOS TELE Hong-Kong-Amoy
HKA-S1.1-WH2-MC101	2452534.04	8065170.69	10.3	OOS SHT B
HKA-S1.1-WH2-MC102	2452482.14	8065357.77	30.2	Possible IS FO C2C seg 2A1
HKA-S1.1-WH2-MC103	2452586.23	8065268.97	176.8	Unknown
HKA-S1.1-WH2-MC104	2452607.24	8065208.66	30.8	OOS SHT B
HKA-S1.1-WH2-MC105	2452521.83	8065524.49	87.5	Possible OOS TELE Guam-Hong Kong
HKA-S1.1-WH2-MC106	2452566.21	8065371.96	19.8	Possible IS FO C2C seg 2A1
HKA-S1.1-WH2-MC107	2452544.71	8065454.12	18.3	Unknown
HKA-S1.1-WH2-MC108	2452532.84	8065493.28	183.9	Unknown

ContactNumber	Easting	Northing	Dimensions	Description
HKA-S1.1-WH2-SC001	2450385.05	8067365.07	4x3x0.5	Debris/Discarded man-made object
HKA-S1.1-WH2-SC002	2450386.22	8067509.09	3x1x<1	Wreck
HKA-S1.1-WH2-SC003	2450410.14	8067399.16	3x<1x<1	Debris/metallic object
HKA-S1.1-WH2-SC004	2450429.92	8067481.65	1.5x1x<0.5	Debris
HKA-S1.1-WH2-SC005	2450468.06	8067510.09	0.5x0.5xnmh	Debris
HKA-S1.1-WH2-SC006	2450486.74	8067486.84	1x1x<0.5	Debris
HKA-S1.1-WH2-SC007	2450530.39	8067593.38	0.5x0.5xnmh	Debris
HKA-S1.1-WH2-SC008	2450529.16	8067554.79	1x0.5x<0.5	Debris
HKA-S1.1-WH2-SC009	2450634.75	8067587.08	0.5x0.5xnmh	Debris
HKA-S1.1-WH2-SC010	2450620.72	8067569.13	1x1x<1	Debris
HKA-S1.1-WH2-SC011	2450590.04	8067543.45	2.5x1x<0.5	Debris
HKA-S1.1-WH2-SC012	2450612.74	8067555.10	1x0.5x<0.5	Debris
HKA-S1.1-WH2-SC013	2450654.28	8067565.20	1x1xnmh	Debris
HKA-S1.1-WH2-SC014	2450671.42	8067503.37	1x0.5x<0.5	Debris
HKA-S1.1-WH2-SC015	2450650.84	8067475.02	1x1xnmh	Debris
HKA-S1.1-WH2-SC016	2450803.55	8067388.30	0.5x0.5xnmh	Debris
HKA-S1.1-WH2-SC017	2450717.39	8067398.76	0.5x0.5xnmh	Debris
HKA-S1.1-WH2-SC018	2450822.06	8067366.71	0.5x0.5xnmh	Debris
HKA-S1.1-WH2-SC019	2450703.16	8067383.58	0.5x0.5xnmh	Debris
HKA-S1.1-WH2-SC020	2450652.38	8067372.49	1x1xnmh	Debris
HKA-S1.1-WH2-SC021	2450712.80	8067350.15	1x1xnmh	Debris
HKA-S1.1-WH2-SC022	2450742.45	8067311.04	1x1xnmh	Debris
HKA-S1.1-WH2-SC023	2450464.30	8067336.00	0.5x0.5xnmh	Debris
HKA-S1.1-WH2-SC024	2450745.03	8067272.31	1x1xnmh	Debris
HKA-S1.1-WH2-SC025	2450658.15	8067258.63	3x1xnmh	Debris
HKA-S1.1-WH2-SC026	2450562.95	8067251.62	3x1xnmh	Debris
HKA-S1.1-WH2-SC027	2450602.79	8067237.62	1.5x1xnmh	Debris
HKA-S1.1-WH2-SC028	2450604.82	8067224.21	4x1x<0.5	Debris
HKA-S1.1-WH2-SC029	2450429.58	8067233.15	1x<0.5x<0.5	Debris
HKA-S1.1-WH2-SC030	2450752.86	8067164.65	2.5x1x<0.5	Debris
HKA-S1.1-WH2-SC031	2450433.50	8067201.65	3x<1x<1	Debris
HKA-S1.1-WH2-SC032	2450380.17	8067203.41	1x<1x<1	Debris
HKA-S1.1-WH2-SC033	2450668.45	8067134.32	1.5x1x<0.5	Debris
HKA-S1.1-WH2-SC034	2450673.16	8067131.16	3x1x<0.5	Debris
HKA-S1.1-WH2-SC035	2450740.26	8067098.22	2x1x<0.5	Debris
HKA-S1.1-WH2-SC036	2450504.52	8067097.19	2.5x1xnmh	Debris
HKA-S1.1-WH2-SC037	2450489.20	8066991.01	3x1x<0.5	Debris
HKA-S1.1-WH2-SC038	2450353.35	8066935.03	1x0.5x<0.5	Debris
HKA-S1.1-WH2-SC039	2450365.66	8066815.71	3x1.5x<0.5	Debris/discarded man-made object
HKA-S1.1-WH2-SC040	2450390.42	8066755.56	0.5x<0.5x<0.5	Debris
HKA-S1.1-WH2-SC041	2450491.18	8066680.28	3x1xnmh	Debris
HKA-S1.1-WH2-SC042	2450332.99	8066704.28	0.5x0.5xnmh	Debris
HKA-S1.1-WH2-SC043	2450338.50	8066680.01	1.5x0.5x<0.5	Debris
HKA-S1.1-WH2-SC044	2450479.99	8066644.35	0.5x0.5xnmh	Debris
HKA-S1.1-WH2-SC045	2450334.36	8066632.45	0.5x0.5x<0.5	Debris
HKA-S1.1-WH2-SC046	2450283.83	8066615.73	1x1xnmh	Debris
HKA-S1.1-WH2-SC047	2450585.43	8066510.35	1.2x0.5x<0.5	Debris
HKA-S1.1-WH2-SC048	2450309.39	8066513.70	1x0.5x<0.5	Debris
HKA-S1.1-WH2-SC049	2450610.24	8066419.63	2x1.5x<0.5	Debris
HKA-S1.1-WH2-SC050	2450647.32	8066396.92	1.5x0.5x0.5	Debris
HKA-S1.1-WH2-SC051	2450370.51	8066387.37	2x1x<0.5	Debris
HKA-S1.1-WH2-SC052	2450314.64	8066374.80	1x<0.5x<0.5	Debris
HKA-S1.1-WH2-SC053	2450322.99	8066318.38	0.5x0.5x<0.5	Debris
HKA-S1.1-WH2-SC054	2450280.13	8066308.30	2x2x<1	Debris
HKA-S1.1-WH2-SC055	2450539.94	8066299.84	2.5x1x<0.5	Debris
HKA-S1.1-WH2-SC056	2450622.29	8066295.61	3.5x1.5x<0.5	Debris
HKA-S1.1-WH2-SC057	2450623.55	8066289.06	1.5x1x<0.5	Debris
HKA-S1.1-WH2-SC058	2450264.78	8066268.10	1x1xnmh	Debris
HKA-S1.1-WH2-SC059	2450282.37	8066229.09	1x1xnmh	Debris
HKA-S1.1-WH2-SC060	2450354.39	8066220.41	2x0.5x<0.5	Debris
HKA-S1.1-WH2-SC061	2450552.89	8066081.27	3x1.5x<1	Debris
HKA-S1.1-WH2-SC062	2450439.59	8066004.98	1.5x1x<0.5	Debris
HKA-S1.1-WH2-SC063	2450210.16	8065740.36	2x<1x<1	Debris
HKA-S1.1-WH2-SC064	2450360.63	8065724.80	2x1x<1	Debris
HKA-S1.1-WH2-SC065	2450368.73	8065681.67	4x1x<1	Debris/discarded man-made object
HKA-S1.1-WH2-SC066	2450186.59	8065654.35	3x2x<1	Debris
HKA-S1.1-WH2-SC067	2450251.37	8065618.12	4x1x<1	Debris
HKA-S1.1-WH2-SC068	2450423.99	8065526.24	3x1x<1	Debris
HKA-S1.1-WH2-SC069	2451021.44	8065348.46	4x1x<1	Debris
HKA-S1.1-WH2-SC070	2451070.33	8065356.02	4x2x<1	Debris
HKA-S1.1-WH2-SC071	2451132.96	8065401.98	3x1x<1	Debris
HKA-S1.1-WH2-SC072	2451406.38	8065105.74	1x1x<1	Debris/metallic object
HKA-S1.1-WH2-SC073	2451550.87	8064885.42	3x2x<1	Debris
HKA-S1.1-WH2-SC074	2451588.44	8064998.16	3x2x1	Debris
HKA-S1.1-WH2-SC075	2451903.70	8064946.91	3x1x<1	Debris
HKA-S1.1-WH2-SC076	2452189.07	8065060.96	3x<1x<1	Debris
HKA-S1.1-WH2-SC077	2452290.95	8065023.44	3x1x<1	Debris
HKA-S1.1-WH2-SC078	2452290.24	8065122.91	2x1x<1	Debris
HKA-S1.1-WH2-SC079	2452516.85	8065266.39	2x1x<1	Debris
HKA-S1.1-WH2-SC080	2452957.18	8065475.77	4x2x<1	Debris
HKA-S1.1-WH2-SC081	2453041.81	8065489.41	3x2x1	Debris/discarded man-made object
HKA-S1.1-WH2-SC082	2453046.39	8065684.26	4x1x<1	Debris

HKA-S1.1-WH2-GS001

0.00m	Seabed	kPa	kg/cm^2	Description
				Loose, brownish to dark brownish grey, slightly clayey, gravelly, coarse SAND. GRAVEL fraction comprises 100% shell fragments up to 8mm diameter

HKA-S1.1-WH2-GS002

0.00m	Seabed	kPa	kg/cm^2	Description
				Very soft, dark brownish grey, slightly gravelly, sandy, silty CLAY. GRAVEL fraction comprises 100% shell fragments up to 19mm diameter

HKA-S1.1-WH2-GS003

0.00m	Seabed	kPa	kg/cm^2	Description
				Very soft, dark brownish grey, slightly gravelly, sandy, silty CLAY. GRAVEL fraction comprises 100% shell fragments up to 10mm diameter

HKA-S1.1-WH2-GS004

0.00m	Seabed	kPa	kg/cm^2	Description
				Very soft, dark brownish grey, slightly gravelly, very sandy, silty CLAY. GRAVEL fraction comprises 100% shell fragments up to 22mm diameter

HKA-S1.1-WH2-GS005

0.00m	Seabed	kPa	kg/cm^2	Description
				Very soft, dark brownish grey, slightly gravelly, sandy, silty CLAY. GRAVEL fraction comprises 100% shell fragments up to 11mm diameter

CARTOGRAPHIC SYMBOLS 地圖符號

- Post survey route with kilometre post and reverse kilometre post 公里標及反向公里標的測量路線 (KP, KPR)
- Beach manhole / Alter course 岸上纜井/轉向 (BMH/AC)
- Point on line (POL) 線上點
- Coastline (from Admiralty charts) 海岸線(見於海圖)
- Chart matchline 海圖接駁線
- Telecommunications cable position (taken from alcatel database), In-service/Out of service/Planned (as-found in magenta) 通訊電纜位置(取自Alcatel數據庫)，包括使用中/ 棄置/ 已計劃三種(如在magenta所示的確實位置)
- Pipeline position, In-service/Out of service/Planned (as-found in magenta) 管道位置，包括使用中/棄置/ 已計劃三種 (如在magenta所示的確實位置)
- Power cable position (taken from alcatel database), In-service/Out of service/Planned (as-found in magenta) 電纜(取自Alcatel數據庫)，包括使用中/ 棄置三種(如在magenta 所示的確實位置)
- Maritime boundaries 海洋邊界
- Restricted zones and special areas 限制區及特別區域
- Concession block 特許區塊
- Submerged wreck / Exposed wreck / Obstruction / Well / Platform / Explosives Dumping Ground and symbol or line feature in grey, plotted from desk top study (as-found in magenta). (for general symbols and abbreviations refer to British Admiralty Chart) 淹沒的沉船/ 顯露的沉船/ 障礙物/ 井/平台/炸藥垃圾傾倒區及標記或線形特徵，根據文獻研究結果，以灰色表示。(如在magenta 所示的確實位置)(一般符號及簡稱參見英版海圖)

BATHYMETRY 水深

- Bathymetric contours in metres. Contour interval may be reduced to aid in clarity. 水深等深線，以米為單位。為清晰表示，等深線間距或會減少。 (30)
- Downslope gradient in degrees (°) as measured over the shortest significant distance 下坡坡度，以度為單位，以最短的顯著距離量度 (6°)
- Approximate limit of swath bathymetry coverage (shown only in areas of flat seabed) 條帶式測深的大約限制範圍(只顯示平坦海床的地區)

SEABED FEATURES 海床特質

- cor: CORAL 珊瑚
- fs/cs/vcs: Gas seepage area with predominant sediment classification 氣體滲流為主的沉積物
- fs/cs/vcs: Boulder field with predominant sediment classification 巨石場為主的沉積物

沉積物 Sediments
- fs: Fine sediment (predominantly CLAY/SILT) 幼細沉積物 (以黏土及粉砂為主)
- cs: Coarse sediment (SAND and GRAVEL) 粗沉積物 (沙及礫石)
- vcs: Very coarse sediment (COBBLES and BOULDERS) 極粗沉積物(鵝卵石及巨石)

岩石 Rock
- fs/cs/vcs: Subcropping ROCK with predominant sediment classification (sediment thickness < target burial depth) 隱伏岩石為主的沉積物 (沉積物厚度<目標掩埋深度)
- r: ROCK outcrop (with veneer of sediments) 外露岩石 (並有沉積物的薄層)
- hs: HARDGROUND (very dense/very stiff/consolidated sediments; sediment thickness < target burial depth) 硬底(非常高密度/粉砂/固結沉積物;沉積物厚度<目標掩埋深度)

- Sediment or feature boundary 沉積物或特徵範圍
- Inferred sediment or feature boundary 推斷沉積物或特徵範圍
- Approximate limit of side scan sonar coverage 側掃聲納測探的大約範圍
- Seabed scar (trawl or anchor) 海床斷崖 (拖網或錨)
- Isopach contours shown at 1m interval with labels every 1m 等厚線(各線相距一米) (1, 2)
- BP001 / BS001 Beach Probe (BP); Beach Sample (BS) location with reference number 岸上探測;岸上樣本位置、附參考號碼
- DP001 / DS001 Diver Probe (DP); Diver Sample (DS) location with reference number 潛水探測;潛取樣本位置、附參考號碼
- SC001 5x5x1 Isolated sonar contact with reference number (length x width x height in metres where measurable; nmh = no measurable height) 附參考號碼的個別聲納接觸點(可量度的長x闊x高，以米為單位；nmh=高度不可量度)
- 50x0.5x1 Linear sonar contact, dashed where partially buried 線性的聲納接觸點，部份埋藏以虛線表示
- SEI001 -2.5 Pipeline contact determined by Seismic Profiling System with reference number and description (level at the top of pipeline is stated in metres, +/- equivalent to above or below ambient seabed) 管道接觸由震測剖面系統確定，附參考編號和描述（管道頂部以米為單位，+/-相當海床的上方或下方）
- MC001 5.0 Unidentified magnetic anomaly with reference number and amplitude (in nano-Tesla) 不確定的磁測點，附參考號碼及振幅(以納特斯拉為單位)
- MC002 5.0 Cable/Pipeline position, as determined by magnetometer, with reference number and amplitude (in nano-Tesla) 以磁力儀探測確定的電纜/管道位置，附參考號碼及振幅範圍(以納特斯拉為單位)
- SC001 20x10x7 Located wreck with reference no. (length x width x height in metres where measurable) 探測到的沉船，附參考號碼(可量度的長x 寬x 高，以米為單位)
- GC001 Gravity Core (GC); Grab Sample (GS) location with reference number 重力核心;取樣位置、附參考號碼
- CP001 MiniCPT (CP) location with reference number MiniCPT位置、附參考號碼
- * 0.5 Small ROCK outcrop with height in metres if discernible 可辨別的小型外露岩石及其高度，以米為單位
- d/D Seabed depression or pockmark with diameter (d) and depth (D) in metres, where discernible 海床窪地及錐行陷痕可辨別的直徑(d)及深度(D)，以米為單
- 50/3 General orientation of sandwave crest (Hachures on lee side where observable, with wavelength and height in metres) 沙波的波峰一般方向(刻線在可觀察範圍內背風處，含波長及高度，以米為單位)
- 4/0.8 Orientation of megaripple crest (Hachures on lee side where observable, with wavelength and height in metres) 巨波浪的波峰方向(刻線在可觀察範圍內背風處，含波長及高度，以米為單位)
- Orientation of sediment ribbon 沉積物帶的方向
- -25 Fault with depth below seafloor (Hachures on footwall) 海底以下的斷層深度 (刻線在下盤)

CHART COMMENT 圖表註解:

Cable and Pipelines 電纜及管道

The route makes three crossings with OOS cables. 路線會橫過三次OOS電纜。

Seven IS cables and five OOS cables are mapped by the magnetic survey. 磁力測量顯示七條IS電纜及五條OOS電纜。

Five IS cables run sub-parallel with the route and their as-found alignments were all partially mapped by the magnetic survey. 五條IS電纜與該路線子平行運行，路線並通過磁力測量來部分顯示。

Two BMHs exist in the landing site of the route. 路線的登陸點現有兩個岸上纜井。

Hazards and Obstructions 危險及阻礙

The route descends down gentle slopes throughout the chart. 路線在海圖中緩慢地下坡。

The route runs along gentle slopes at the eastern margin of the chart. 路線沿著海圖東邊的平緩斜坡廷伸。

The route runs on ROCK outcrop and subcrop along the coastline to the west of Bluff Head. 路線在外露及隱伏的岩石上沿著海岸線廷伸至黃竹角嘴的西面。

Isolated ROCK outcrops and some megaripples are observed in the chart. 海圖中觀察到孤立的外露岩石及一些巨波浪。

Some subcropping ROCK is present towards the southern part of the chart. 一些隱伏岩石顯示於海圖的南面。

Seabed depressions are present in the centre and at the southern part of the chart. 海床窪地顯示於海圖的中間及南面。

Numerous patches of debris are present in the survey corridor at the northern part of the chart. 大量岩屑顯示於海圖北面的調查走廊中。

Isolated seabed scars are mapped in the southern part of the chart. 孤立的海底斷崖映射在海圖的南面。

A total of 82 sonar contacts corresponding mostly to debris are observed in this chart. 海圖中總共觀察到82個聲納接觸點主要是岩屑。

One shipwreck is mapped by SSS at the northern part of the chart. SSS在海圖的北部繪製了一隻沉船。

A total of 108 magnetic contacts are mapped in this chart, out of which 58 are identified as IS and OOS cables. 海圖總共顯示了108個磁性觸點，其中58個被確定為IS及OOS電纜。

A total of 5 seismic contacts are mapped in this chart where one contact maps a discharge pipe and the others associated with debris and buried boulders. 海圖總共繪製了5個地震觸點，其中一個觸點顯示了排放管，而其他接觸點顯示了相關的岩屑及埋藏的巨石。

The route exits a declared mine field in the northern part of the chart. 路線將於海圖北面的已公告的礦場離開。

The route exits an inshore traffic zone in the southern part of the chart. 路線於海圖南面的近岸交通區離開。

The route runs within Hong Kong SAR waters. 路線在香港水域內運行。

一般注意事項:
GENERAL NOTES

	INSHORE 近岸
SURVEY VESSEL 調查船	Wing Hung 2
Surface positioning system 表面定位系統	C-Nav 3050 DGPS System QPS QINSy Navigation Software
Underwater positioning System 水下定位系統	-
Bathymetry 水深	R2Sonic Sonic2024 Multibeam Echo Sounder Knudsen 320M Single Beam Echo Sounder
Morphology and stratigraphy 形態及地層	C-Boom Low Voltage Boomer System Innomar SES-2000 light Sub-Bottom Profiler EdgeTech FS4200 Side Scan Sonar System
Magnetometer survey 磁力儀調查	Geometrics G-882 Marine Magnetometer

目標埋藏深度 Target burial depth: 5m burial from LWM to Hong Kong SAR limits 從低潮位至香港限制埋藏5米

描述性的條款及定義 Descriptive Terms and Definitions: The criteria used for interpretations and descriptions are presented in survey reports 解釋及描述的標準展示於調查報告

大地參數 GEODETIC PARAMETERS

橢球參數 Ellipsoidal Parameters
- 參考橢球體 Ellipsoid : WGS84
- 半長軸 Semi-Major Axis (a) (m) : 6378137.000
- 反扁率 Inverse Flattening (1/f) : 298.257223563

投影參數 Projection Parameters
- 投影 Projection : Mercator
- 原點經度 Longitude of Origin : 175°E
- 基準緯度 Standard Parallel : 35°N
- 比例因子 Scale Factor : 1
- 座標西移量 False Easting : 8 000 000
- 座標南移量 False Northing : 6 000 000

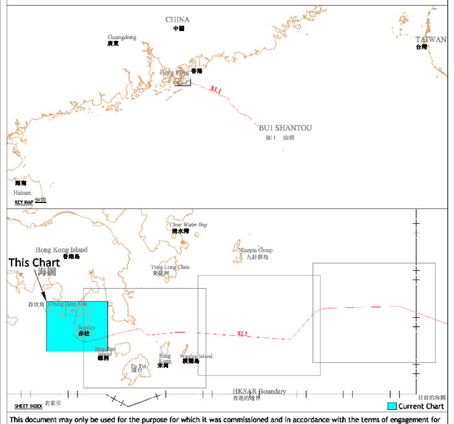
VERTICAL DATUM 高程基準

In Landfall and Inshore survey charts: 初次登陸及近岸調查海圖內:

Bathymetry data has been reduced to Low Astronomical Tide (LAT) using tide gauge at Tai Mui Wan 水深測量數據使用了大梅灣的潮位計來減少至低天文潮位 (LAT)

In Shallow Water survey charts: 淺水調查海圖:

N/A 不適用



測量日期 Survey Date: May - June 2018

Scale : 比例尺:

NATURAL SCALE 1 : 5,000 at 35° N

於海圖的中緯度 (At Mid-Latitude of Chart)
TRUE SCALE 1 : 5647.75 真實比例尺

0 100 200 300 400 500 m

Supplier : 供應商: ALCATEL SUBMARINE NETWORKS

Main Contractor : 主要承辦商: FUGRO

Surveyor : 測量師: EGS EARTH SCIENCES & SURVEYING

Project Name: 項目名稱:

香港-美國海底電纜系統
HONG KONG - AMERICA CABLE SYSTEM
MARINE ROUTE SURVEY
海洋路線調查

Document Title: 文件標題:

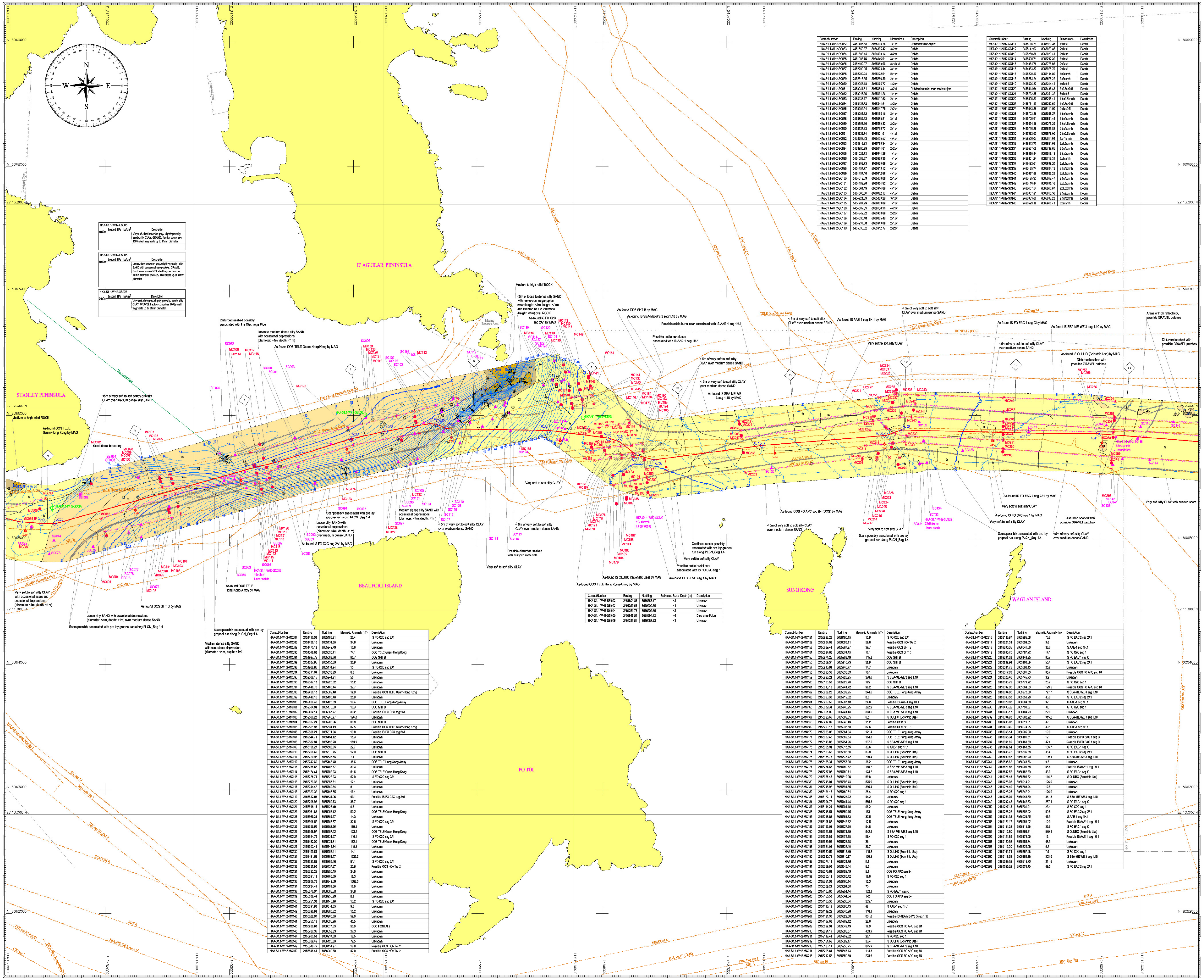
SEGMENT S1.1 (CHUNG HOM KOK - BU1)
NORTH UP CHART
CHART NO. 002 OF 005
(KP 0.00 - KP 5.80)

Rev	Date	Prepared by	Checked by	Approved by
1	Sep 2018	Agnes Siu	Bobby Lee	Y.T. Chan
0	June 2018	Agnes Siu	Claire Lam	Y.T. Chan

Figure E4-1
圖E4-1

Route Based Upon: 路線根據: HKA_SEG1.1_CHUNG HOM KOK TO BU1 SHANTOU_RPL_PSR03_29-AUG-2018.xls

File Name: 文件名稱: HKA_S1-1_NU002_005K



ContactNumber	Easting	Northing	Dimensions	Description
HKA-S1.1-WH2-SC072	2451406.38	8065105.74	1x1x<1	Debris/metallic object
HKA-S1.1-WH2-SC073	2451550.87	8064885.42	3x2x<1	Debris
HKA-S1.1-WH2-SC074	2451588.44	8064998.16	3x2x1	Debris
HKA-S1.1-WH2-SC075	2451803.70	8064946.91	3x1x<1	Debris
HKA-S1.1-WH2-SC076	2452189.07	8065060.96	3x<1x<1	Debris
HKA-S1.1-WH2-SC077	2452290.95	8065023.44	3x1x<1	Debris
HKA-S1.1-WH2-SC078	2452290.24	8065122.91	2x1x<1	Debris
HKA-S1.1-WH2-SC079	2452516.85	8065266.39	2x1x<1	Debris
HKA-S1.1-WH2-SC080	2452957.18	8065475.77	4x2x<1	Debris
HKA-S1.1-WH2-SC081	2453041.81	8065489.41	3x2x1	Debris/discarded man-made object
HKA-S1.1-WH2-SC082	2453046.39	8065684.26	4x1x<1	Debris
HKA-S1.1-WH2-SC083	2453135.17	8065417.50	2x1x<1	Debris
HKA-S1.1-WH2-SC084	2453125.53	8065544.51	3x2x<1	Debris
HKA-S1.1-WH2-SC086	2453209.54	8065447.76	2x2x<1	Debris
HKA-S1.1-WH2-SC087	2453298.82	8065485.16	2x1x<1	Debris
HKA-S1.1-WH2-SC088	2453392.62	8065589.81	3x1x1	Debris
HKA-S1.1-WH2-SC089	2453556.16	8065589.33	2x2x<1	Debris
HKA-S1.1-WH2-SC090	2453537.33	8065735.77	2x1x<1	Debris
HKA-S1.1-WH2-SC091	2453526.74	8065821.01	4x1x1	Debris
HKA-S1.1-WH2-SC092	2453688.93	8065455.57	4x4x<1	Debris
HKA-S1.1-WH2-SC093	2453816.83	8065770.34	2x1x<1	Debris
HKA-S1.1-WH2-SC094	2453900.99	8065644.61	2x2x<1	Debris
HKA-S1.1-WH2-SC095	2454022.73	8065544.25	1x1x<1	Debris
HKA-S1.1-WH2-SC096	2454098.67	8065980.35	1x1x<1	Debris
HKA-S1.1-WH2-SC097	2454359.73	8065625.66	2x1x<1	Debris
HKA-S1.1-WH2-SC098	2454457.77	8065613.12	4x1x<1	Debris
HKA-S1.1-WH2-SC099	2454457.46	8065612.68	4x1x<1	Debris
HKA-S1.1-WH2-SC100	2454513.89	8065650.68	2x1x<1	Debris
HKA-S1.1-WH2-SC101	2454492.86	8065854.92	2x1x<1	Debris
HKA-S1.1-WH2-SC102	2454564.49	8065944.09	4x1x<1	Debris
HKA-S1.1-WH2-SC103	2454660.86	8066062.17	4x1x<1	Debris
HKA-S1.1-WH2-SC104	2454721.89	8065869.29	3x1x<1	Debris
HKA-S1.1-WH2-SC105	2454707.99	8066033.09	1x1x<1	Debris
HKA-S1.1-WH2-SC106	2454802.09	8066138.26	4x2x<1	Debris
HKA-S1.1-WH2-SC107	2454842.32	8065958.69	2x2x<1	Debris
HKA-S1.1-WH2-SC108	2454836.48	8066085.49	2x1x<1	Debris
HKA-S1.1-WH2-SC109	2454937.68	8065943.09	2x1x<1	Debris
HKA-S1.1-WH2-SC110	2455036.52	8065912.77	2x2x<1	Debris

ContactNumber	Easting	Northing	Dimensions	Description
HKA-S1.1-WH2-SC111	2455116.79	8065970.36	1x1x<1	Debris
HKA-S1.1-WH2-SC112	2455142.02	8066070.46	2x1x<1	Debris
HKA-S1.1-WH2-SC113	2455250.36	8066020.41	2x1x<1	Debris
HKA-S1.1-WH2-SC114	2455600.71	8066282.30	3x1x<1	Debris
HKA-S1.1-WH2-SC115	2454854.76	8065776.05	2x2x<1	Debris
HKA-S1.1-WH2-SC116	2454933.37	8065978.79	2x1x<1	Debris
HKA-S1.1-WH2-SC117	2455220.33	8066104.89	4x2xnmh	Debris
HKA-S1.1-WH2-SC118	2455263.24	8065878.22	3x2xnmh	Debris
HKA-S1.1-WH2-SC119	2455526.83	8066244.41	1x1x0.5	Debris
HKA-S1.1-WH2-SC120	2455614.64	8066436.43	3x0.5x<0.5	Debris
HKA-S1.1-WH2-SC121	2455732.85	8066351.32	5x1x0.5	Debris
HKA-S1.1-WH2-SC122	2455695.37	8066286.41	1.5x1.5xnmh	Debris
HKA-S1.1-WH2-SC123	2455731.19	8066250.60	1x0.5x<0.5	Debris
HKA-S1.1-WH2-SC124	2455643.88	8066111.50	2x1x<0.5	Debris
HKA-S1.1-WH2-SC125	2455703.56	8065955.27	1.5x1xnmh	Debris
HKA-S1.1-WH2-SC126	2455700.91	8065891.44	1.5x1xnmh	Debris
HKA-S1.1-WH2-SC127	2455674.16	8066273.29	3.5x1.5xnmh	Debris
HKA-S1.1-WH2-SC128	2455716.26	8065803.88	2.5x1xnmh	Debris
HKA-S1.1-WH2-SC130	2457362.93	8065578.00	2.5x0.5xnmh	Debris
HKA-S1.1-WH2-SC131	2458556.07	8065614.04	1x<1xnmh	Debris
HKA-S1.1-WH2-SC133	2458613.77	8065621.66	6x1.5xnmh	Debris
HKA-S1.1-WH2-SC134	2458587.06	8065797.65	2.5x1xnmh	Debris
HKA-S1.1-WH2-SC135	2458550.94	8065947.13	3.5x2xnmh	Debris
HKA-S1.1-WH2-SC136	2458901.24	8065717.31	3x1xnmh	Debris
HKA-S1.1-WH2-SC137	2459432.61	8065868.20	2x1.5xnmh	Debris
HKA-S1.1-WH2-SC139	2460135.74	8065824.13	2.5x1xnmh	Debris
HKA-S1.1-WH2-SC140	2460057.88	8065923.25	3x1.5xnmh	Debris
HKA-S1.1-WH2-SC141	2460185.93	8065648.47	2.5x1xnmh	Debris
HKA-S1.1-WH2-SC142	2460110.44	8065605.16	2x0.5xnmh	Debris
HKA-S1.1-WH2-SC143	2460407.54	8065640.67	2x1.5xnmh	Debris
HKA-S1.1-WH2-SC144	2460307.81	8065815.30	2.5x2xnmh	Debris
HKA-S1.1-WH2-SC145	2460333.80	8065908.23	2.5x1xnmh	Debris
HKA-S1.1-WH2-SC146	2460599.18	8065946.41	3x2xnmh	Debris

ContactNumber	Easting	Northing	Estimated Burial Depth (m)	Description
HKA-S1.1-WH2-SEI002	2451804.86	8065368.47	<1	Unknown
HKA-S1.1-WH2-SEI003	2452256.89	8065500.70	<1	Unknown
HKA-S1.1-WH2-SEI004	2452269.78	8065504.66	<1	Unknown
HKA-S1.1-WH2-SEI005	2452917.54	8065694.42	~3	Discharge Ppipe
HKA-S1.1-WH2-SEI006	2455215.81	8066083.93	<1	Unknown

ContactNumber	Easting	Northing	Magnetic Anomaly (nT)	Description
HKA-S1.1-WH2-MC087	2451410.03	8065103.21	25.4	IS FO C2C seg 2A1
HKA-S1.1-WH2-MC088	2451436.16	8065174.30	34.6	Unknown
HKA-S1.1-WH2-MC089	2451475.12	8065249.79	10.6	Unknown
HKA-S1.1-WH2-MC090	2451519.83	8065335.11	74.1	OOS TELE Guam-Hong Kong
HKA-S1.1-WH2-MC091	2451997.75	8065068.86	85.7	OOS SHT B
HKA-S1.1-WH2-MC092	2451887.85	8065450.69	38.9	Unknown
HKA-S1.1-WH2-MC093	2451968.65	8065174.24	15	IS FO C2C seg 2A1
HKA-S1.1-WH2-MC094	2452011.84	8065033.99	6.3	Unknown
HKA-S1.1-WH2-MC095	2452509.15	8065244.91	58	Unknown
HKA-S1.1-WH2-MC096	2452517.13	8065220.02	15.2	Unknown
HKA-S1.1-WH2-MC097	2452446.76	8065468.44	27.7	Unknown
HKA-S1.1-WH2-MC098	2452436.18	8065509.48	12.9	Possible OOS TELE Guam-Hong Kong
HKA-S1.1-WH2-MC099	2452440.16	8065495.48	25.9	Unknown
HKA-S1.1-WH2-MC100	2452460.46	8065425.33	10.4	OOS TELE Hong-Kong-Amoy
HKA-S1.1-WH2-MC101	2452534.04	8065170.69	10.3	OOS SHT B
HKA-S1.1-WH2-MC102	2452482.14	8065357.77	30.2	Possible IS FO C2C seg 2A1
HKA-S1.1-WH2-MC103	2452586.23	8065268.97	176.8	Unknown
HKA-S1.1-WH2-MC104	2452607.24	8065208.66	30.8	OOS SHT B
HKA-S1.1-WH2-MC105	2452521.83	8065524.49	87.5	Possible OOS TELE Guam-Hong Kong
HKA-S1.1-WH2-MC106	2452566.21	8065371.96	19.8	Possible IS FO C2C seg 2A1
HKA-S1.1-WH2-MC107	2452544.71	8065454.12	18.3	Unknown
HKA-S1.1-WH2-MC108	2452532.84	8065493.28	183.9	Unknown
HKA-S1.1-WH2-MC109	2453198.23	8065602.05	27.7	Unknown
HKA-S1.1-WH2-MC110	2453266.42	8065370.75	12.9	OOS SHT B
HKA-S1.1-WH2-MC111	2453220.97	8065538.58	7.1	Unknown
HKA-S1.1-WH2-MC112	2453242.69	8065463.40	36.6	OOS TELE Hong-Kong-Amoy
HKA-S1.1-WH2-MC113	2453258.82	8065408.57	89.3	Unknown
HKA-S1.1-WH2-MC114	2453174.44	8065702.93	61.6	OOS TELE Guam-Hong Kong
HKA-S1.1-WH2-MC115	2453228.74	8065522.93	92.9	IS FO C2C seg 2A1
HKA-S1.1-WH2-MC116	2453273.32	8065657.31	12.1	Unknown
HKA-S1.1-WH2-MC117	2453244.47	8065769.34	8	Unknown
HKA-S1.1-WH2-MC118	2453323.32	8065496.55	16.1	Unknown
HKA-S1.1-WH2-MC119	2453312.55	8065534.05	49.1	Possible IS FO C2C seg 2A1
HKA-S1.1-WH2-MC120	2453298.92	8065582.73	35.7	Unknown
HKA-S1.1-WH2-MC121	2453345.15	8065425.19	9.8	Unknown
HKA-S1.1-WH2-MC122	2453951.86	8065905.12	90.2	OOS TELE Guam-Hong Kong
HKA-S1.1-WH2-MC123	2453985.28	8065809.27	14.3	Unknown
HKA-S1.1-WH2-MC124	2453998.67	8065763.77	32.6	IS FO C2C seg 2A1
HKA-S1.1-WH2-MC125	2454385.55	8065802.56	189.3	Unknown
HKA-S1.1-WH2-MC126	2454346.97	8065997.42	173.2	OOS TELE Guam-Hong Kong
HKA-S1.1-WH2-MC127	2454384.76	8065831.57	116.1	IS FO C2C seg 2A1
HKA-S1.1-WH2-MC128	2454482.00	8066031.81	182.1	OOS TELE Guam-Hong Kong
HKA-S1.1-WH2-MC129	2454502.46	8065943.34	118.8	Unknown
HKA-S1.1-WH2-MC130	2454499.89	8065953.21	14.1	Unknown
HKA-S1.1-WH2-MC131	2454491.52	8065989.87	1723.2	Unknown
HKA-S1.1-WH2-MC132	2454527.85	8065855.66	91.1	IS FO C2C seg 2A1
HKA-S1.1-WH2-MC133	2454637.95	8066137.37	23.6	Possible OOS HONTAI 2
HKA-S1.1-WH2-MC134	2455632.25	8066250.40	34.5	Unknown
HKA-S1.1-WH2-MC135	2455691.11	8066406.59	18.3	Unknown
HKA-S1.1-WH2-MC136	2455706.75	8066349.09	1062.5	Unknown
HKA-S1.1-WH2-MC137	2455734.49	8066199.86	12.9	Unknown
HKA-S1.1-WH2-MC138	2455670.07	8066086.58	34.8	Unknown
HKA-S1.1-WH2-MC139	2455809.49	8066255.99	8.9	Unknown
HKA-S1.1-WH2-MC140	2455751.38	8066146.18	13.2	IS FO C2C seg 2A1
HKA-S1.1-WH2-MC141	2455891.88	8066314.55	9.6	Unknown
HKA-S1.1-WH2-MC142	2455890.98	8066300.82	15.2	Unknown
HKA-S1.1-WH2-MC143	2455822.69	8066205.88	59.8	Unknown
HKA-S1.1-WH2-MC144	2455755.19	8066096.96	45.5	Unknown
HKA-S1.1-WH2-MC145	2455760.68	8066077.33	50.9	OOS HONTAI 2
HKA-S1.1-WH2-MC146	2455762.35	8066058.33	22.3	Unknown
HKA-S1.1-WH2-MC147	2455903.53	8066237.60	12.5	Unknown
HKA-S1.1-WH2-MC148	2455839.49	8066128.39	79.5	Unknown
HKA-S1.1-WH2-MC149	2455840.79	8066114.97	18.8	Possible OOS HONTAI 2
HKA-S1.1-WH2-MC150	2455848.41	8066080.50	42.9	Possible OOS HONTAI 2

ContactNumber	Easting	Northing	Magnetic Anomaly (nT)	Description
HKA-S1.1-WH2-MC151	2455922.28	8066160.15	12.9	IS FO C2C seg 2A1
HKA-S1.1-WH2-MC152	2455934.02	8066093.11	59.8	Possible OOS HONTAI 2
HKA-S1.1-WH2-MC153	2455889.41	8065887.27	39.7	Possible OOS SHT B
HKA-S1.1-WH2-MC154	2455894.68	8065874.45	12.1	Possible OOS SHT B
HKA-S1.1-WH2-MC155	2455974.25	8065903.49	115.2	OOS SHT B
HKA-S1.1-WH2-MC156	2456039.37	8065918.73	32.9	OOS SHT B
HKA-S1.1-WH2-MC157	2455915.04	8065746.77	14.7	Unknown
HKA-S1.1-WH2-MC158	2455993.38	8065833.39	16.1	Unknown
HKA-S1.1-WH2-MC159	2455923.24	8065728.95	378.6	IS SEA-ME-WE 3 seg 1.10
HKA-S1.1-WH2-MC160	2456130.58	8065929.76	125	OOS SHT B
HKA-S1.1-WH2-MC161	2456013.18	8065741.72	98.2	IS SEA-ME-WE 3 seg 1.10
HKA-S1.1-WH2-MC162	2455939.28	8065639.25	244.6	OOS TELE Hong-Kong-Amoy
HKA-S1.1-WH2-MC163	2456020.38	8065719.82	6.8	Unknown
HKA-S1.1-WH2-MC164	2456209.55	8065967.10	24.6	Possible IS AAE-1 seg 1H.1
HKA-S1.1-WH2-MC165	2456059.31	8065740.25	292.9	IS SEA-ME-WE 3 seg 1.10
HKA-S1.1-WH2-MC166	2456061.05	8065741.43	303.6	IS SEA-ME-WE 3 seg 1.10
HKA-S1.1-WH2-MC167	2456026.69	8065689.05	6.8	IS OLUHO (Scientific Use)
HKA-S1.1-WH2-MC168	2456217.99	8065945.49	11.2	Possible OOS SHT B
HKA-S1.1-WH2-MC169	2456220.18	8065936.68	82.6	Possible OOS SHT B
HKA-S1.1-WH2-MC170	2456068.02	8065664.04	121.4	OOS TELE Hong-Kong-Amoy
HKA-S1.1-WH2-MC171	2456069.46	8065662.83	164.3	OOS TELE Hong-Kong-Amoy
HKA-S1.1-WH2-MC172	2456148.86	8065754.96	237.5	IS SEA-ME-WE 3 seg 1.10
HKA-S1.1-WH2-MC173	2456306.91	8065916.65	33.6	IS AAE-1 seg 1H.1
HKA-S1.1-WH2-MC174	2456153.65	8065685.58	83.9	IS OLUHO (Scientific Use)
HKA-S1.1-WH2-MC175	2456158.73	8065678.42	796.4	IS OLUHO (Scientific Use)
HKA-S1.1-WH2-MC176	2456155.31	8065657.30	36.2	OOS TELE Hong-Kong-Amoy
HKA-S1.1-WH2-MC177	2456234.88	8065759.52	185.7	IS SEA-ME-WE 3 seg 1.10
HKA-S1.1-WH2-MC178	2456237.07	8065760.71	123.2	IS SEA-ME-WE 3 seg 1.10
HKA-S1.1-WH2-MC179	2456086.46	8065519.96	59.8	Unknown
HKA-S1.1-WH2-MC180	2456245.04	8065696.43	825.9	IS OLUHO (Scientific Use)
HKA-S1.1-WH2-MC181	2456245.92	8065691.85	396.4	IS OLUHO (Scientific Use)
HKA-S1.1-WH2-MC182	2456181.15	8065460.61	25.4	IS FO C2C seg 1
HKA-S1.1-WH2-MC183	2456172.11	8065525.22	44.2	Unknown
HKA-S1.1-WH2-MC184	2456094.77	8065441.44	589.3	IS FO C2C seg 1
HKA-S1.1-WH2-MC185	2456114.29	8065291.10	98.2	Unknown
HKA-S1.1-WH2-MC186	2456248.54	8065669.15	183	OOS TELE Hong-Kong-Amoy
HKA-S1.1-WH2-MC187	2456248.88	8065664.73	37.5	OOS TELE Hong-Kong-Amoy
HKA-S1.1-WH2-MC188	2456196.82	8065342.32	12.5	Unknown
HKA-S1.1-WH2-MC189	2456196.01	8065327.88	84.8	Unknown
HKA-S1.1-WH2-MC190	2456323.63	8065774.39	642.9	IS SEA-ME-WE 3 seg 1.10
HKA-S1.1-WH2-MC191	2456263.83	8065478.38	96.4	IS FO C2C seg 1
HKA-S1.1-WH2-MC192	2456329.95	8065723.18	25	Unknown
HKA-S1.1-WH2-MC193	2456331.03	8065722.40	35.7	Unknown
HKA-S1.1-WH2-MC194	2456330.59	8065712.39	115.2	IS OLUHO (Scientific Use)
HKA-S1.1-WH2-MC195	2456330.71	8065710.27	100.9	IS OLUHO (Scientific Use)
HKA-S1.1-WH2-MC196	2456274.14	8065421.75	6.1	Unknown
HKA-S1.1-WH2-MC197	2456339.08	8065643.44	6.8	Unknown
HKA-S1.1-WH2-MC198	2456275.64	8065402.49	5.4	OOS FO APC seg B4
HKA-S1.1-WH2-MC199	2456355.11	8065505.42	18.8	IS FO C2C seg 1
HKA-S1.1-WH2-MC200	2456361.58	8065460.14	12.3	Unknown
HKA-S1.1-WH2-MC201	2456369.24	8065384.00	75	Unknown
HKA-S1.1-WH2-MC202	2457100.00	8065954.44	132.1	IS FO EAC 1 seg C
HKA-S1.1-WH2-MC203	2457155.58	8065544.84	142	OOS FO APC seg B4
HKA-S1.1-WH2-MC204	2457105.30	8065930.64	335.7	Unknown
HKA-S1.1-WH2-MC205	2457113.19	8065880.43	42	IS AAE-1 seg 1H.1
HKA-S1.1-WH2-MC206	2457119.22	8065840.28	116.1	Unknown
HKA-S1.1-WH2-MC207	2457121.93	8065822.36	651.8	Possible IS SEA-ME-WE 3 seg 1.10
HKA-S1.1-WH2-MC208	2457137.63	8065702.12	22.8	Unknown
HKA-S1.1-WH2-MC209	2458092.94	8065649.49	17.9	Possible OOS FO APC seg B4
HKA-S1.1-WH2-MC210	2458094.19	8065663.67	433.9	Possible OOS FO APC seg B4
HKA-S1.1-WH2-MC211	2458118.41	8065759.32	20.1	IS FO C2C seg 1
HKA-S1.1-WH2-MC212	2458154.62	8065882.17	33.4	IS OLUHO (Scientific Use)
HKA-S1.1-WH2-MC213	2458180.11	8065956.25	825.9	IS SEA-ME-WE 3 seg 1.10
HKA-S1.1-WH2-MC214	2458208.64	8065647.13	114.3	Possible OOS FO APC seg B4
HKA-S1.1-WH2-MC215	2458212.57	8065659.59	278.6	Possible OOS FO APC seg B4

ContactNumber	Easting	Northing	Magnetic Anomaly (m)	Description
HKA-S1.1-WH2-MC216	2458188.97	8065995.08	73.2	IS FO EAC 2 seg 2A1
HKA-S1.1-WH2-MC217	2458221.51	8065694.53	3.8	Unknown
HKA-S1.1-WH2-MC218	2458200.35	8066041.66	36.6	IS AAE-1 seg 1H.1
HKA-S1.1-WH2-MC219	2458243.75	8065767.22	14.1	IS FO C2C seg 1
HKA-S1.1-WH2-MC220	2458231.53	8066144.25	60.7	IS FO EAC 1 seg C
HKA-S1.1-WH2-MC221	2458282.94	8065906.59	55.4	IS FO EAC 2 seg 2A1
HKA-S1.1-WH2-MC222	2458381.75	8065606.15	25.2	Unknown
HKA-S1.1-WH2-MC223	2458312.09	8065661.63	85.7	Possible OOS FO APC seg B4
HKA-S1.1-WH2-MC224	2458328.46	8065745.73	3.2	Unknown
HKA-S1.1-WH2-MC225	2458340.79	8065779.22	23.7	IS FO C2C seg 1
HKA-S1.1-WH2-MC226	2458397.00	8065664.03	129.5	Possible OOS FO APC seg B4
HKA-S1.1-WH2-MC227	2458304.06	8065972.80	727.7	IS SEA-ME-WE 3 seg 1.10
HKA-S1.1-WH2-MC228	2458360.58	8065850.28	43.8	IS FO EAC 2 seg 2A1
HKA-S1.1-WH2-MC229	2458329.68	8066064.50	32	IS AAE-1 seg 1H.1
HKA-S1.1-WH2-MC230	2458433.32	8065790.87	3.6	IS FO C2C seg 1
HKA-S1.1-WH2-MC231	2458338.17	8066104.29	22.8	Unknown
HKA-S1.1-WH2-MC232	2458394.93	8065982.92	915.2	IS SEA-ME-WE 3 seg 1.10
HKA-S1.1-WH2-MC233	2458408.08	8066019.61	4.8	Unknown
HKA-S1.1-WH2-MC234	2458419.49	8066074.95	49.1	IS AAE-1 seg 1H.1
HKA-S1.1-WH2-MC235	2458368.14	8066205.00	10.9	Unknown
HKA-S1.1-WH2-MC236	2458366.34	8066181.61	12	Possible IS FO EAC 1 seg C
HKA-S1.1-WH2-MC237	2458361.62	8066168.60	42.4	Possible IS FO EAC 1 seg C
HKA-S1.1-WH2-MC238	2458447.64	8066168.55	135.7	IS FO EAC 1 seg C
HKA-S1.1-WH2-MC239	2458446.75	8065836.68	38.4	IS FO EAC 2 seg 2A1
HKA-S1.1-WH2-MC240	2458490.87	8065987.20	799.1	IS SEA-ME-WE 3 seg 1.10
HKA-S1.1-WH2-MC241	2458505.62	8066043.66	9.3	Unknown
HKA-S1.1-WH2-MC242	2458521.86	8066090.85	65.6	Possible IS AAE-1 seg 1H.1
HKA-S1.1-WH2-MC243	2458542.52	8066162.89	43.3	IS FO EAC 1 seg C
HKA-S1.1-WH2-MC244	2459226.45	8065886.32	115.2	IS OLUHO (Scientific Use)
HKA-S1.1-WH2-MC245	2459226.93	8065914.21	125.9	Unknown
HKA-S1.1-WH2-MC246	2459224.49	8065708.24	12.5	Unknown
HKA-S1.1-WH2-MC247	2459226.25	8065847.91	125.9	Unknown
HKA-S1.1-WH2-MC248	2459228.09	8065948.39	351.8	IS SEA-ME-WE 3 seg 1.10
HKA-S1.1-WH2-MC249	2459232.43	8066142.53	257.1	IS FO EAC 1 seg C
HKA-S1.1-WH2-MC250	2459227.18	8065731.21	23.4	IS FO C2C seg 1
HKA-S1.1-WH2-MC251	2459228.22	8065802.02	59.8	IS FO EAC 2 seg 2A1
HKA-S1.1-WH2-MC252	2459231.33	8066029.95	46.9	IS AAE-1 seg 1H.1
HKA-S1.1-WH2-MC253	2460121.17	8065988.22	10.9	Possible IS AAE-1 seg 1H.1
HKA-S1.1-WH2-MC254	2460131.32	8066114.86	26.8	IS FO EAC 1 seg C
HKA-S1.1-WH2-MC255	2460112.80	8065866.31	549.1	IS OLUHO (Scientific Use)
HKA-S1.1-WH2-MC256	2460121.88	8065978.06	12	Possible IS AAE-1 seg 1H.1
HKA-S1.1-WH2-MC257	2460120.98	8065958.84	48.9	Unknown
HKA-S1.1-WH2-MC258	2460112.20	8065825.06	6.2	Unknown
HKA-S1.1-WH2-MC259	2460101.71	8065667.98	7.9	IS FO C2C seg 1
HKA-S1.1-WH2-MC260	2460118.59	8065888.98	303.6	IS SEA-ME-WE 3 seg 1.10
HKA-S1.1-WH2-MC261	2460099.38	8065619.80	211.6	Unknown
HKA-S1.1-WH2-MC262	2460096.02	8065574.70	49.5	IS FO EAC 2 seg 2A1

CARTOGRAPHIC SYMBOLS 製圖符號

KP / KPR	Post survey route with kilometre post and reverse kilometre post 公里標及反向公里標的測量路線
BMH/AC	Beach manhole / Alter course 岸上纜井/轉向
POL	Point on line (POL) 線上點
	Coastline (from Admiralty charts) 海岸線(見於海圖)
	Chart matchline 海圖接駁線
	Telecommunications cable position (taken from alcatel database), In-service/Out of service/Planned (as-found in magenta) 通訊電纜位置(取自Alcatel數據庫)，包括使用中/ 棄置/ 已計劃三種(如在magenta所示的確實位置)
	Pipeline position, In-service/Out of service/Planned (as-found in magenta) 管道位置，包括使用中/棄置/ 已計劃三種 (如在magenta所示的確實位置)
	Power cable position (taken from alcatel database), In-service/Out of service/Planned (as-found in magenta) 電纜(取自Alcatel數據庫)，包括使用中/ 棄置/ 已計劃三種(如在magenta 所示的確實位置)
	Maritime boundaries 海洋邊界
	Restricted zones and special areas 限制區及特別區域
	Concession block 特許區塊

Submerged wreck / Exposed wreck / Obstruction / Well / Platform / Explosives Dumping Ground and symbol or line feature in grey, plotted from desk top study (as-found in magenta). (for general symbols and abbreviations refer to British Admiralty Chart) 淹沒的沉船/ 顯露的沉船/ 障礙物/ 井/平台/炸藥垃圾傾倒區及標記或線形特徵，根據文獻研究結果，以灰色表示。(如在magenta 所示的確實位置)(一般符號及簡稱參見英版海圖)

BATHYMETRY 水深

30	Bathymetric contours in metres. Contour interval may be reduced to aid in clarity. 水深等深線，以米為單位。為清晰表示，等深線間距或會減少。
6°	Downslope gradient in degrees (°) as measured over the shortest significant distance 下坡坡度，以度為單位，以最短的顯著距離量度
	Approximate limit of swath bathymetry coverage (shown only in areas of flat seabed) 條帶式測深的大約限制範圍(只顯示平坦海床的地區)

SEABED FEATURES 海床特質

cor	CORAL 珊瑚
fs/cs/vcs	Gas seepage area with predominant sediment classification 氣體滲流為主的沉積物
fs/cs/vcs	Boulder field with predominant sediment classification 巨石場為主的沉積物
fs	Fine sediment (predominantly CLAY/SILT) 幼細沉積物 (以黏土及粉砂為主)
cs	Coarse sediment (SAND and GRAVEL) 粗沉積物 (沙及礫石)
vcs	Very coarse sediment (COBBLES and BOULDERS) 極粗沉積物(鵝卵石及巨石)
fs/cs/vcs	Subcropping ROCK with predominant sediment classification (sediment thickness < target burial depth) 隱伏岩石為主的沉積物 (沉積物厚度<目標掩埋深度)
r	ROCK outcrop (with veneer of sediments) 外露岩石 (並有沉積物的薄層)
hs	HARDGROUND (very dense/very stiff/consolidated sediments; sediment thickness < target burial depth) 硬底(非常高密度/粉砂/固結沉積物;沉積物厚度<目標掩埋深度)
	Sediment or feature boundary 沉積物或特徵範圍
	Inferred sediment or feature boundary 推斷沉積物或特徵範圍
	Approximate limit of side scan sonar coverage 側掃聲納測探的大約範圍
	Seabed scar (trawl or anchor) 海床斷崖 (拖網或錨)
1 / 2	Isopach contours shown at 1m interval with labels every 1m 等厚線(各線相距一米)
BP001 / BS001	Beach Probe (BP); Beach Sample (BS) location with reference number 岸上探測;岸上樣本位置、附參考號碼
DP001 / DS001	Diver Probe (DP); Diver Sample (DS) location with reference number 潛水探測;潛取樣本位置、附參考號碼
SC001 5x5x1	Isolated sonar contact with reference number (length x width x height in metres where measurable; nmh = no measurable height) 附參考號碼的個別聲納接觸點(可量度的長x闊x高、以米為單位; nmh=高度不可量度)
50x0.5x1	Linear sonar contact, dashed where partially buried 線性的聲納接觸點,部份埋藏以虛線表示
SEI001 -2.5	Pipeline contact determined by Seismic Profiling System with reference number and description (level at the top of pipeline is stated in metres, +/- equivalent to above or below ambient seabed) 管道接觸由震測剖面系統確定，附參考編號和描述 (管道頂部以米為單位，+/-相當海床的上方或下方)
MC001 5.0	Unidentified magnetic anomaly with reference number and amplitude (in nano-Tesla) 不確定的磁測點、附參考號碼及振幅 (以納特斯拉為單位)
MC002 5.0	Cable/Pipeline position, as determined by magnetometer, with reference number and amplitude (in nano-Tesla) 以磁力儀探測確定的電纜/管道位置，附參考號碼及振幅範圍(以納特斯拉為單位)
SC001 20x10x7	Located wreck with reference no. (length x width x height in metres where measurable) 探測到的沉船、附參考號碼(可量度的長x 寬x 高、以米為單位)
GC001	Gravity Core (GC); Grab Sample (GS) location with reference number 重力核心;取樣、附參考號碼
CP001	MiniCPT (CP) location with reference number MiniCPT位置、附參考號碼
0.5	Small ROCK outcrop with height in metres if discernible 可辨別的小型外露岩石及其高度，以米為單位
d/D	Seabed depression or pockmark with diameter (d) and depth (D) in metres, where discernible 海床窪地及錐行陷痕可辨別的直徑(d)及深度(D)、以米為單位
50/3	General orientation of sandwave crest (Hachures on lee side where observable, with wavelength and height in metres) 沙波的波峰一般方向(刻線在可觀察範圍內背風處、含波長及高度、以米為單位)
4/0.8	Orientation of megaripple crest (Hachures on lee side where observable, with wavelength and height in metres) 巨波浪的波峰方向(刻線在可觀察範圍內背風處、含波長及高度、以米為單位)
	Orientation of sediment ribbon 沉積物帶的方向
-25	Fault with depth below seafloor (Hachures on footwall) 海底以下的斷層深度 (刻線在下盤)

Sediments 沉積物
Rock 岩石

CHART COMMENT 圖表註解:

Cable and Pipelines 電纜及管道

Seven in-service cables and five OOS cables are mapped by the magnetometer in this chart. 磁力儀在海圖中顯示七條IS電纜和五條OOS電纜。

The route makes: 路線令:

- Three crossing points with IS cables, the EAC2 seg 2A1, SEA-ME-WE 3 seg 1.10 and OLUHO (Scientific Use) IS電纜橫過三點
- Six crossing points with OOS cables OOS電纜橫過六點。

Hazards and Obstructions 危險及阻礙

The route runs along gentle slopes at the western part of the chart, before it descends down steep slopes in the centre of the chart. 路線沿著海圖西面的平緩斜坡延伸，然後在海圖中間的陡峭斜坡下降。

Areas of medium to high relief ROCK are observed in the western margin and at the centre of the chart. 海圖西部邊緣及中間可觀察到中至高地形岩石的區域。

Seabed depressions are observed in the in the western part of the chart. 海圖西面可觀察到海床窪地。

Scars associated with cable burial of various systems are observed in the western and towards the centre of the chart. 海圖西面及中間位置可觀察到與各種掩埋電纜系統相關的痕跡。

Trawl scars are observed in the eastern margin of the chart. 海圖東面可觀察到拖網痕跡。

Localised GRAVEL patches are present in the eastern margin of the chart. 局部礫石展示於海圖東邊。

A total of 71 sonar contacts corresponding to debris are observed in this chart. 海圖中總共觀察到71個聲納觸點主要是碎屑。

A total of 176 magnetic contacts are mapped in this chart, out of which 109 are identified as IS and OOS cables. 海圖總共顯示了176個磁性觸點，其中109個被確定為IS及OOS電纜。

A total of 5 seismic contacts are mapped in this chart where one contact maps a discharge pipe and the others associated with debris and buried boulders. 海圖總共繪製了5個地震觸點，其中一個觸點顯示了排放管、而其他接觸點與碎屑及埋藏巨石相關。

The route runs within Hong Kong SAR waters. 路線在香港水域內運行。

一般注意事項:

GENERAL NOTES

	INSHORE 近岸
SURVEY VESSEL 調查船	Wing Hung 2
Surface positioning system 表面定位系統	C-Nav 3050 DGPS System QPS QINSy Navigation Software
Underwater positioning System 水下定位系統	-
Bathymetry 水深	R2Sonic Sonic2024 Multibeam Echo Sounder Knudsen 320M Single Beam Echo Sounder
Morphology and stratigraphy 形態及地層	C-Boom Low Voltage Boomer System Innomar SES-2000 light Sub-Bottom Profiler EdgeTech FS4200 Side Scan Sonar System
Magnetometer survey 磁力儀調查	Geometrics G-882 Marine Magnetometer

目標埋藏深度 Target burial depth: 5m burial from LWM to Hong Kong SAR limits 從低潮位至香港限制埋藏5米

描述性的條款及定義 Descriptive Terms and Definitions: The criteria used for interpretations and descriptions are presented in survey reports 解釋及描述的標準展示於調查報告

大地參數 GEODETIC PARAMETERS

橢球參數 Ellipsoidal Parameters		投影參數 Projection Parameters			
參考橢球體 Ellipsoid	WGS84	投影 Projection	Mercator	比例因子 Scale Factor	1
半長軸 Semi-Major Axis (a) (m)	6378137.000	原點經度 Longitude of Origin	175°E	座標西移量 False Easting	8 000 000
反扁率 Inverse Flattening (1/f)	298.257223563	基準緯度 Standard Parallel	35°N	座標南移量 False Northing	6 000 000

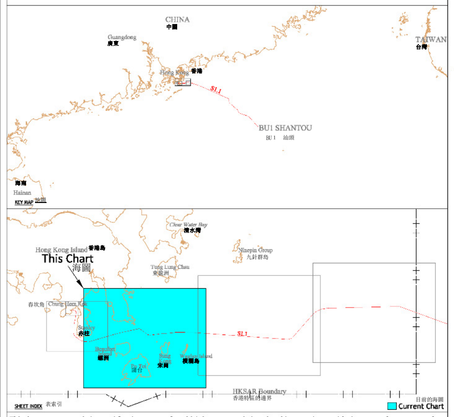
VERTICAL DATUM 高程基準

In Landfall and Inshore survey charts: 初次登陸及近岸調查海圖內:

Bathymetry data has been reduced to Low Astronomical Tide (LAT) using tide gauge at Tai Mui Wan 水深測量數據使用了大梅灣的潮位計來減少至低天文潮位 (LAT)

In Shallow Water survey charts: 淺水調查海圖:

N/A 不適用



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測量日期 Survey Date: May - June 2018

Scale: 比例尺:

NATURAL SCALE 1 : 10,000 at 35° N

於海圖的中緯度 (At Mid-Latitude of Chart)
TRUE SCALE 1 : 11296.28 真實比例尺
0.0 0.2 0.4 0.6 0.8 1.0 km

Supplier: 供應商: ALCATEL SUBMARINE NETWORKS
Main Contractor: 主要承辦商: FUGRO
Surveyor: 測量師: EGS EARTH SCIENCES & SURVEYING

Project Name: 項目名稱:

香港-美國海底電纜系統
HONG KONG - AMERICA CABLE SYSTEM
MARINE ROUTE SURVEY
海洋路線調查

Document Title: 文件標題:

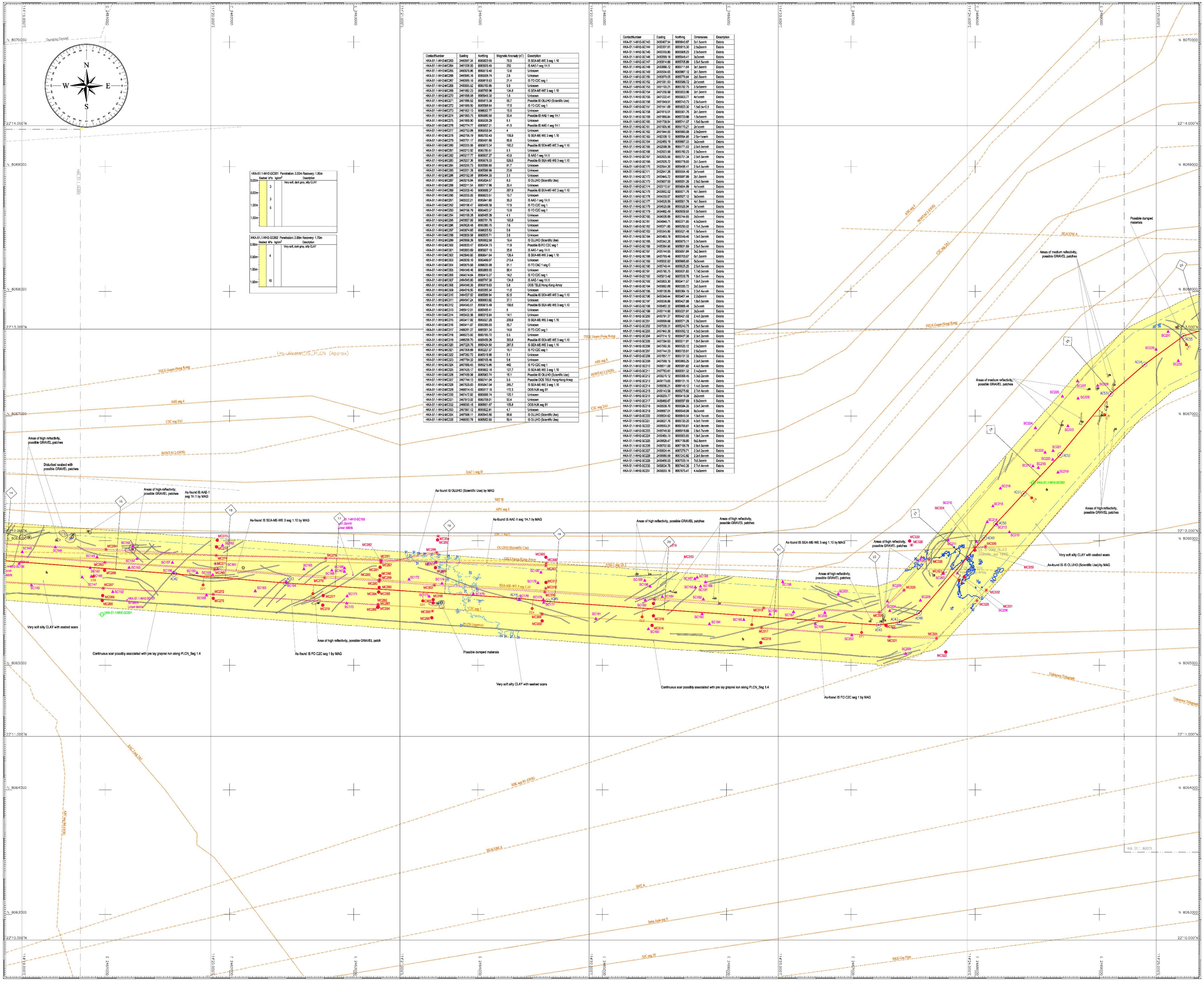
SEGMENT S1.1 (CHUNG HOM KOK - BU1)
NORTH UP CHART
CHART NO. 003 OF 005
(KP 3.58 - KP 14.78)

Rev	Date	Prepared by	Checked by	Approved by
1	Sep 2018	Agnes Siu	Bobby Lee	Y.T. Chan
0	June 2018	Agnes Siu	Claire Lam	Y.T. Chan

路線根據: Route Based Upon: HKA_SEG1.1_CHUNG HOM KOK TO BU1 SHANTOU_RPL_PSR03_29-AUG-2018.xls

Figure E4-2
圖E4-2

File Name: 文件名稱: HKA_S1-1_NU003_010K



HKA-S1.1-WH2-GC001 Penetration: 2.00m Recovery: 1.85m

Depth	Seabed	kPa	kg/cm²	Description
0.00m	fs			Very soft, dark grey, silty CLAY
		3		
0.50m				
		3		
1.00m		5		
1.50m				

HKA-S1.1-WH2-GC002 Penetration: 2.00m Recovery: 1.70m

Depth	Seabed	kPa	kg/cm²	Description
0.00m	fs			Very soft, dark grey, silty CLAY
0.50m		4		
1.00m				
1.50m		10		

ContactNumber	Easting	Northing	Magnetic Anomaly (nT)	Description
HKA-S1.1-WH2-MC263	2460997.34	8065823.55	79.5	IS SEA-ME-WE 3 seg 1.10
HKA-S1.1-WH2-MC264	2461006.00	8065929.45	250	IS AAE-1 seg 1H.1
HKA-S1.1-WH2-MC265	2460976.96	8065519.40	12.6	Unknown
HKA-S1.1-WH2-MC266	2460980.16	8065558.74	2.6	Unknown
HKA-S1.1-WH2-MC267	2460985.15	8065616.53	21.4	IS FO C2C seg 1
HKA-S1.1-WH2-MC268	2460995.52	8065760.95	6.9	Unknown
HKA-S1.1-WH2-MC269	2461882.23	8065765.96	134.8	IS SEA-ME-WE 3 seg 1.10
HKA-S1.1-WH2-MC270	2461896.08	8065949.30	1.8	Unknown
HKA-S1.1-WH2-MC271	2461886.52	8065813.38	56.7	Possible IS OLUHO (Scientific Use)
HKA-S1.1-WH2-MC272	2461869.50	8065568.84	17.5	IS FO C2C seg 1
HKA-S1.1-WH2-MC273	2461902.13	8066002.77	15.5	Unknown
HKA-S1.1-WH2-MC274	2461893.75	8065880.50	50.4	Possible IS AAE-1 seg 1H.1
HKA-S1.1-WH2-MC275	2461869.90	8065536.29	6.1	Unknown
HKA-S1.1-WH2-MC276	2462774.77	8065857.21	41.5	Possible IS AAE-1 seg 1H.1
HKA-S1.1-WH2-MC277	2462753.99	8065558.54	4	Unknown
HKA-S1.1-WH2-MC278	2462766.19	8065700.43	158.9	IS SEA-ME-WE 3 seg 1.10
HKA-S1.1-WH2-MC279	2462751.17	8065481.68	65.6	Unknown
HKA-S1.1-WH2-MC280	2463205.06	8065673.34	190.2	Possible IS SEA-ME-WE 3 seg 1.10
HKA-S1.1-WH2-MC281	2463212.92	8065785.51	6.1	Unknown
HKA-S1.1-WH2-MC282	2463217.77	8065837.27	43.8	IS AAE-1 seg 1H.1
HKA-S1.1-WH2-MC283	2463207.36	8065678.33	629.5	Possible IS SEA-ME-WE 3 seg 1.10
HKA-S1.1-WH2-MC284	2463200.73	8065586.80	81.7	Unknown
HKA-S1.1-WH2-MC285	2463201.26	8065586.99	23.6	Unknown
HKA-S1.1-WH2-MC286	2463192.08	8065464.35	3.1	Unknown
HKA-S1.1-WH2-MC287	2463219.94	8065824.57	8.3	IS OLUHO (Scientific Use)
HKA-S1.1-WH2-MC288	2463211.54	8065717.96	30.4	Unknown
HKA-S1.1-WH2-MC289	2463209.40	8065688.37	267.9	Possible IS SEA-ME-WE 3 seg 1.10
HKA-S1.1-WH2-MC290	2463205.05	8065623.51	15.7	Unknown
HKA-S1.1-WH2-MC291	2463222.21	8065841.60	39.3	IS AAE-1 seg 1H.1
HKA-S1.1-WH2-MC292	2463196.47	8065486.38	17.9	IS FO C2C seg 1
HKA-S1.1-WH2-MC293	2463196.79	8065483.37	12.9	IS FO C2C seg 1
HKA-S1.1-WH2-MC294	2463198.26	8065465.26	4.1	Unknown
HKA-S1.1-WH2-MC295	2463657.85	8065781.78	193.8	Unknown
HKA-S1.1-WH2-MC296	2463628.48	8065380.75	7.6	Unknown
HKA-S1.1-WH2-MC297	2463674.65	8066005.53	5.6	Unknown
HKA-S1.1-WH2-MC298	2463639.58	8065525.71	3.8	Unknown
HKA-S1.1-WH2-MC299	2463668.39	8065902.58	19.4	IS OLUHO (Scientific Use)
HKA-S1.1-WH2-MC300	2463633.47	8065434.73	11.9	Possible IS FO C2C seg 1
HKA-S1.1-WH2-MC301	2463663.69	8065827.10	35.6	IS AAE-1 seg 1H.1
HKA-S1.1-WH2-MC302	2463649.85	8065641.64	138.4	IS SEA-ME-WE 3 seg 1.10
HKA-S1.1-WH2-MC303	2463639.16	8065499.07	213.4	Unknown
HKA-S1.1-WH2-MC304	2463679.88	8066035.09	91.1	IS FO EAC 1 seg C
HKA-S1.1-WH2-MC305	2464546.46	8065866.03	86.4	Unknown
HKA-S1.1-WH2-MC306	2464514.84	8065410.27	14.2	IS FO C2C seg 1
HKA-S1.1-WH2-MC307	2464545.80	8065797.35	134.8	IS AAE-1 seg 1H.1
HKA-S1.1-WH2-MC308	2464548.35	8065818.63	5.8	OOS TELE Hong-Kong-Amoy
HKA-S1.1-WH2-MC309	2464516.50	8065355.34	11.5	Unknown
HKA-S1.1-WH2-MC310	2464537.52	8065586.94	62.5	Possible IS SEA-ME-WE 3 seg 1.10
HKA-S1.1-WH2-MC311	2464547.24	8065663.92	37.1	Unknown
HKA-S1.1-WH2-MC312	2464545.51	8065615.49	199.6	Possible IS SEA-ME-WE 3 seg 1.10
HKA-S1.1-WH2-MC313	2465412.01	8065495.41	8	Unknown
HKA-S1.1-WH2-MC314	2465400.56	8065318.84	14.1	Unknown
HKA-S1.1-WH2-MC315	2465417.92	8065527.28	208.9	IS SEA-ME-WE 3 seg 1.10
HKA-S1.1-WH2-MC316	2465411.87	8065396.03	35.7	Unknown
HKA-S1.1-WH2-MC317	2466281.27	8065301.34	14.8	IS FO C2C seg 1
HKA-S1.1-WH2-MC318	2466275.92	8065180.72	6.5	Unknown
HKA-S1.1-WH2-MC319	2466299.70	8065459.26	393.8	Possible IS SEA-ME-WE 3 seg 1.10
HKA-S1.1-WH2-MC320	2467229.75	8065424.50	287.5	IS SEA-ME-WE 3 seg 1.10
HKA-S1.1-WH2-MC321	2467308.89	8065227.37	16.1	IS FO C2C seg 1
HKA-S1.1-WH2-MC322	2467282.72	8065318.95	5.1	Unknown
HKA-S1.1-WH2-MC323	2467764.33	8065105.46	5.6	Unknown
HKA-S1.1-WH2-MC324	2467689.43	8065215.95	442	IS FO C2C seg 1
HKA-S1.1-WH2-MC325	2467429.17	8065602.18	127.7	IS SEA-ME-WE 3 seg 1.10
HKA-S1.1-WH2-MC326	2467489.06	8065963.74	16.1	Possible IS OLUHO (Scientific Use)
HKA-S1.1-WH2-MC327	2467744.13	8065741.04	9.5	Possible OOS TELE Hong-Kong-Amoy
HKA-S1.1-WH2-MC328	2467629.83	8065847.04	285.7	IS SEA-ME-WE 3 seg 1.10
HKA-S1.1-WH2-MC329	2468014.43	8065517.18	172.3	OOS HJK seg B1
HKA-S1.1-WH2-MC330	2467472.92	8065996.74	120.1	Unknown
HKA-S1.1-WH2-MC331	2467913.02	8065708.01	50.4	Unknown
HKA-S1.1-WH2-MC332	2468090.15	8065601.67	105.8	OOS HJK seg B1
HKA-S1.1-WH2-MC333	2467997.12	8065922.91	4.7	Unknown
HKA-S1.1-WH2-MC334	2467996.11	8065945.55	69.6	IS OLUHO (Scientific Use)
HKA-S1.1-WH2-MC335	2468083.78	8065952.80	59.4	IS OLUHO (Scientific Use)

ContactNumber	Easting	Northing	Dimensions	Description
HKA-S1.1-WH2-SC143	2460407.54	8065640.67	2x1.5xnmh	Debris
HKA-S1.1-WH2-SC144	2460307.81	8065815.30	2.5x2xnmh	Debris
HKA-S1.1-WH2-SC145	2460333.80	8065908.23	2.5x1xnmh	Debris
HKA-S1.1-WH2-SC146	2460599.18	8065946.41	3x2xnmh	Debris
HKA-S1.1-WH2-SC147	2460814.68	8065705.89	3.5x1.5xnmh	Debris
HKA-S1.1-WH2-SC148	2460888.72	8065711.64	3x1.5xnmh	Debris
HKA-S1.1-WH2-SC149	2460934.65	8065867.12	2x1.5xnmh	Debris
HKA-S1.1-WH2-SC150	2460879.05	8065779.84	2x0.5xnmh	Debris
HKA-S1.1-WH2-SC152	2461061.53	8065588.72	2x1xnmh	Debris
HKA-S1.1-WH2-SC153	2461193.21	8065782.75	3.5x1xnmh	Debris
HKA-S1.1-WH2-SC154	2461256.98	8065853.98	2x1.5xnmh	Debris
HKA-S1.1-WH2-SC155	2461222.41	8065953.77	4x1xnmh	Debris
HKA-S1.1-WH2-SC156	2461549.91	8065743.73	2.5x1xnmh	Debris
HKA-S1.1-WH2-SC157	2461541.69	8065823.30	1.5x0.5x<0.5	Debris
HKA-S1.1-WH2-SC158	2461816.01	8065561.76	2x1.5xnmh	Debris
HKA-S1.1-WH2-SC159	2461865.84	8065723.66	1.5x1xnmh	Debris
HKA-S1.1-WH2-SC160	2461739.54	8065741.07	1.5x0.8xnmh	Debris
HKA-S1.1-WH2-SC161	2461905.50	8065770.21	2x1xnmh	Debris
HKA-S1.1-WH2-SC162	2461944.55	8065960.58	2.5x2xnmh	Debris
HKA-S1.1-WH2-SC163	2462206.13	8065594.85	2.5x<1xnmh	Debris
HKA-S1.1-WH2-SC164	2462455.19	8065667.33	3x2xnmh	Debris
HKA-S1.1-WH2-SC165	2462599.39	8065771.53	2.5x1.5xnmh	Debris
HKA-S1.1-WH2-SC166	2462823.98	8065760.23	2.5x2xnmh	Debris
HKA-S1.1-WH2-SC167	2462925.50	8065751.34	2.5x1.5xnmh	Debris
HKA-S1.1-WH2-SC168	2462926.72	8065778.93	2x1.5xnmh	Debris
HKA-S1.1-WH2-SC170	2462944.20	8065496.41	2.5x1.5xnmh	Debris
HKA-S1.1-WH2-SC171	2462947.26	8065554.46	2x1xnmh	Debris
HKA-S1.1-WH2-SC172	2463445.72	8065687.99	2x1.5xnmh	Debris
HKA-S1.1-WH2-SC173	2463607.55	8065551.26	2.5x2.5xnmh	Debris
HKA-S1.1-WH2-SC174	2463710.57	8065654.89	4x1xnmh	Debris
HKA-S1.1-WH2-SC175	2463962.02	8065571.76	4x1.5xnmh	Debris
HKA-S1.1-WH2-SC176	2464333.57	8065527.12	3x2xnmh	Debris
HKA-S1.1-WH2-SC177	2464528.59	8065501.76	4x1.5xnmh	Debris
HKA-S1.1-WH2-SC178	2464525.88	8065526.94	3x1xnmh	Debris
HKA-S1.1-WH2-SC179	2464482.49	8065659.93	1.5x1xnmh	Debris
HKA-S1.1-WH2-SC180	2464506.69	8065744.65	2x2xnmh	Debris
HKA-S1.1-WH2-SC181	2464948.71	8065371.85	4.5x2xnmh	Debris
HKA-S1.1-WH2-SC182	2465371.60	8065290.02	1.7x1.2xnmh	Debris
HKA-S1.1-WH2-SC183	2465345.80	8065521.46	1.6x1xnmh	Debris
HKA-S1.1-WH2-SC184	2465483.78	8065549.40	1.5x1.5xnmh	Debris
HKA-S1.1-WH2-SC185	2465342.20	8065679.11	3.5x1xnmh	Debris
HKA-S1.1-WH2-SC186	2465384.80	8065631.69	2.5x1.5xnmh	Debris
HKA-S1.1-WH2-SC187	2465744.65	8065691.84	3x2.5xnmh	Debris
HKA-S1.1-WH2-SC188	2465763.46	8065703.57	5x1.5xnmh	Debris
HKA-S1.1-WH2-SC189	2465830.82	8065665.85	5x3xnmh	Debris
HKA-S1.1-WH2-SC190	2465748.44	8065625.25	2.5x1.5xnmh	Debris
HKA-S1.1-WH2-SC191	2465790.75	8065631.83	1.7x0.5xnmh	Debris
HKA-S1.1-WH2-SC192	2465813.48	8065528.78	1.8x1.2xnmh	Debris
HKA-S1.1-WH2-SC193	2465803.30	8065411.57	1.9x1.2xnmh	Debris
HKA-S1.1-WH2-SC194	2465862.69	8065330.72	2x0.5xnmh	Debris
HKA-S1.1-WH2-SC195	2466138.89	8065364.15	2.2x1.4xnmh	Debris
HKA-S1.1-WH2-SC196	2466349.44	8065407.44	2.2x2xnmh	Debris
HKA-S1.1-WH2-SC197	2466538.86	8065427.86	1.8x1.5xnmh	Debris
HKA-S1.1-WH2-SC198	2466452.32	8065668.46	2x2xnmh	Debris
HKA-S1.1-WH2-SC199	2466714.60	8065331.91	2x2xnmh	Debris
HKA-S1.1-WH2-SC200	2466791.37	8065421.02	2.4x1.2xnmh	Debris
HKA-S1.1-WH2-SC201	2466899.66	8065571.28	2.5x2xnmh	Debris
HKA-S1.1-WH2-SC202	2467008.31	8065240.75	2.5x1.5xnmh	Debris
HKA-S1.1-WH2-SC203	2467440.30	8065092.12	4.5x3.5xnmh	Debris
HKA-S1.1-WH2-SC204	2467314.12	8065437.38	2.3x1.2xnmh	Debris
HKA-S1.1-WH2-SC205	2467294.63	8065511.91	1.8x1.8xnmh	Debris
HKA-S1.1-WH2-SC206	2467560.35	8065520.12	2.5x2xnmh	Debris
HKA-S1.1-WH2-SC207	2467744.23	8065733.81	2.6x2xnmh	Debris
HKA-S1.1-WH2-SC208	2467857.77	8065737.33	2.8x2xnmh	Debris
HKA-S1.1-WH2-SC209	2467568.15	8065865.25	2.3x1.5xnmh	Debris
HKA-S1.1-WH2-SC210	2468011.00	8065991.62	4.4x1.8xnmh	Debris
HKA-S1.1-WH2-SC211	2467763.61	8066001.32	2.4x2xnmh	Debris
HKA-S1.1-WH2-SC212	2468276.12	8066068.45	3.3x3.2xnmh	Debris
HKA-S1.1-WH2-SC213	2468173.65	8066131.15	1.7x1.4xnmh	Debris
HKA-S1.1-WH2-SC214	2468098.21	8066149.12	1.4x1.2xnmh	Debris
HKA-S1.1-WH2-SC215	2468143.58	8066275.82	2.7x1.4xnmh	Debris
HKA-S1.1-WH2-SC216	2468203.77	8066419.39	2x2xnmh	Debris
HKA-S1.1-WH2-SC217	2468465.67	8066597.69	6.5x2xnmh	Debris
HKA-S1.1-WH2-SC218	2468508.70	8066584.35	3.5x1.3xnmh	Debris
HKA-S1.1-WH2-SC219	2468667.01	8066546.99	6x2xnmh	Debris
HKA-S1.1-WH2-SC220	2468624.62	8066649.54	1.9x1.7xnmh	Debris
HKA-S1.1-WH2-SC221	2468627.76	8066720.20	4.5x1.7xnmh	Debris
HKA-S1.1-WH2-SC222	2468563.31	8066706.61	4.9x1.9xnmh	Debris
HKA-S1.1-WH2-SC223	2468746.93	8066918.68	2.8x1.7xnmh	Debris
HKA-S1.1-WH2-SC224	2468485.75	8066903.83	1.9x1.2xnmh	Debris
HKA-S1.1-WH2-SC225	2468828.47	8067139.80	6x2.8xnmh	Debris
HKA-S1.1-WH2-SC226	2468702.93	8067156.78	2.8x1.5xnmh	Debris
HKA-S1.1-WH2-SC227	2468824.44	8067279.71	2.3x1.2xnmh	Debris
HKA-S1.1-WH2-SC228	2468986.59	8067242.82	2.2x1.8xnmh	Debris
HKA-S1.1-WH2-SC229	2469456.03	8067533.14	7x3.3xnmh	Debris
HKA-S1.1-WH2-SC230	2469634.78	8067442.35	2.7x1.4xnmh	Debris
HKA-S1.1-WH2-SC231	2469553.16	8067675.41	4.4x3xnmh	Debris

CARTOGRAPHIC SYMBOLS 製圖符號

- KP / KPR: Post survey route with kilometre post and reverse kilometre post 公里標及反向公里標的測量路線
- BMH/AC: Beach manhole / Alter course 岸上纜井/轉向
- POL: Point on line (POL) 線上點
- Coastline (from Admiralty charts) 海岸線(見於海圖)
- Chart matchline 海圖接駁線
- Submerged wreck / Exposed wreck / Obstruction / Well / Platform / Explosives Dumping Ground and symbol or line feature in grey, plotted from desk top study (as-found in magenta). (for general symbols and abbreviations refer to British Admiralty Chart) 淹沒的沉船/ 顯露的沉船/ 障礙物/ 井/平台/炸藥垃圾傾倒區及標記或線形特徵，根據文獻研究結果，以灰色表示。(如在magenta 所示的確實位置)(一般符號及簡稱參見英版海圖)
- Telecommunications cable position (taken from alcatel database), In-service/Out of service/Planned (as-found in magenta) 通訊電纜位置(取自Alcatel數據庫)，包括使用中/ 棄置/ 已計劃三種(如在magenta所示的確實位置)
- Pipeline position, In-service/Out of service/Planned (as-found in magenta) 管道位置，包括使用中/棄置/ 已計劃三種 (如在magenta所示的確實位置)
- Power cable position (taken from alcatel database), In-service/Out of service/Planned (as-found in magenta) 電纜(取自Alcatel數據庫)，包括使用中/ 棄置三種(如在magenta 所示的確實位置)
- Maritime boundaries 海洋邊界
- Restricted zones and special areas 限制區及特別區域
- Concession block 特許區塊

BATHYMETRY 水深

- 30: Bathymetric contours in metres. Contour interval may be reduced to aid in clarity. 水深等深線，以米為單位。為清晰表示，等深線間距或會減少。
- 6°: Downslope gradient in degrees (°) as measured over the shortest significant distance 下坡坡度，以度為單位，以最短的顯著距離量度
- Approximate limit of swath bathymetry coverage (shown only in areas of flat seabed) 條帶式測深的大約限制範圍(只顯示平坦海床的地區)

SEABED FEATURES 海床特質

- cor: CORAL 珊瑚
- fs/cs/vcs: Gas seepage area with predominant sediment classification 氣體滲流為主的沉積物
- fs/cs/vcs: Boulder field with predominant sediment classification 巨石場為主的沉積物
- 沉積物 Sediments
  - fs: Fine sediment (predominantly CLAY/SILT) 幼細沉積物 (以黏土及粉砂為主)
  - cs: Coarse sediment (SAND and GRAVEL) 粗沉積物 (沙及礫石)
  - vcs: Very coarse sediment (COBBLES and BOULDERS) 極粗沉積物(鵝卵石及巨石)
- 岩石 Rock
  - fs/cs/vcs: Subcropping ROCK with predominant sediment classification (sediment thickness < target burial depth) 隱伏岩石為主的沉積物 (沉積物厚度<目標掩埋深度)
  - r: ROCK outcrop (with veneer of sediments) 外露岩石 (並有沉積物的薄層)
  - hs: HARDGROUND (very dense/very stiff/consolidated sediments; sediment thickness < target burial depth) 硬底(非常高密度/粉砂/固結沉積物;沉積物厚度<目標掩埋深度)
- Sediment or feature boundary 沉積物或特徵範圍
- Inferred sediment or feature boundary 推斷的沉積物或特徵範圍
- Approximate limit of side scan sonar coverage 側掃聲納測探的大約範圍
- Seabed scar (trawl or anchor) 海床斷崖 (拖網或錨)
- 1 2: Isopach contours shown at 1m interval with labels every 1m 等厚線(各線相距一米)
- BP001 / BS001: Beach Probe (BP); Beach Sample (BS) location with reference number 岸上探測;岸上樣本位置、附參考號碼
- DP001 / DS001: Diver Probe (DP); Diver Sample (DS) location with reference number 潛水探測;潛取樣本位置、附參考號碼
- SC001 5x5x1: Isolated sonar contact with reference number (length x width x height in metres where measurable; nmh = no measurable height) 附參考號碼的個別聲納接觸點(可量度的長x闊x高，以米為單位; nmh=高度不可量度)
- 50x0.5x1: Linear sonar contact, dashed where partially buried 線性的聲納接觸點，部份埋藏以虛線表示
- SEI001 -2.5: Pipeline contact determined by Seismic Profiling System with reference number and description (level at the top of pipeline is stated in metres, +/- equivalent to above or below ambient seabed) 管道接觸由震測剖面系統確定，附參考編號和描述（管道頂部以米為單位，+/-相當海床的上方或下方）
- MC001 5.0: Unidentified magnetic anomaly with reference number and amplitude (in nano-Tesla) 不確定的磁測點，附參考號碼及振幅(以納特斯拉為單位)
- MC002 5.0: Cable/Pipeline position, as determined by magnetometer, with reference number and amplitude (in nano-Tesla) 以磁力儀探測確定的電纜/管道位置，附參考號碼及振幅範圍(以納特斯拉為單位)
- SC001 20x10x7: Located wreck with reference no. (length x width x height in metres where measurable) 探測到的沉船，附參考號碼(可量度的長x 寬x 高，以米為單位)
- GC001: Gravity Core (GC); Grab Sample (GS) location with reference number 重力核心;取樣、附參考號碼
- CP001: MiniCPT (CP) location with reference number MiniCPT(CP)位置、附參考號碼
- 0.5: Small ROCK outcrop with height in metres if discernible 可辨別的小型外露岩石及其高度，以米為單位
- d/D: Seabed depression or pockmark with diameter (d) and depth (D) in metres, where discernible 海床窪地及錐行陷痕可辨別的直徑(d)及深度(D)，以米為單位
- 50/3: General orientation of sandwave crest (Hachures on lee side where observable, with wavelength and height in metres) 沙波的波峰一般方向(刻線在可觀察範圍內背風處，含波長及高度，以米為單位)
- 4/0.8: Orientation of megaripple crest (Hachures on lee side where observable, with wavelength and height in metres) 巨波浪的波峰方向(刻線在可觀察範圍內背風處，含波長及高度，以米為單位)
- Orientation of sediment ribbon 沉積物帶的方向
- -25: Fault with depth below seafloor (Hachures on footwall) 海底以下的斷層深度 (刻線在下盤)

CHART COMMENT 圖表註解:

Cable and Pipelines 電纜及管道

The route makes two crossing points with OOS cables. OOS電纜會在路線橫過兩點。

Five IS cables and two OOS cables are mapped by the magnetometer in this chart. 磁力儀在海圖顯示五條IS電纜及兩條OOS電纜。

Hazards and Obstructions 危險及阻礙

Numerous trawl scars on the seabed are observed throughout the chart. 海圖可觀察到大量拖網痕跡。

Occasional areas of loose GRAVEL/COBBLE or dumped materials are throughout the chart. 海圖部分地區出現鬆散的礫石/鵝卵石或傾倒物料。

A total of 85 sonar contacts corresponding to debris are observed in this chart. 海圖中總共觀察到85個聲納觸點主要是碎屑。

A total of 73 magnetic contacts are mapped in this chart, out of which 41 are identified as IS and OOS cables. 海圖總共顯示了73個磁性觸點，其中41個被確定為IS及OOS電纜。

The route runs within Hong Kong SAR waters. 路線在香港水域內運行。

一般注意事項:

GENERAL NOTES

SURVEY VESSEL 調查船	INSHORE 近岸
	Wing Hung 2
Surface positioning system 表面定位系統	C-Nav 3050 DGPS System QPS QINSy Navigation Software
Underwater positioning System 水下定位系統	-
Bathymetry 水深	R2Sonic Sonic2024 Multibeam Echo Sounder Knudsen 320M Single Beam Echo Sounder
Morphology and stratigraphy 形態及地層	C-Boom Low Voltage Boomer System Innomar SES-2000 light Sub-Bottom Profiler EdgeTech FS4200 Side Scan Sonar System
Magnetometer survey 磁力儀調查	Geometrics G-882 Marine Magnetometer

目標埋藏深度 Target burial depth: 5m burial from LWM to Hong Kong SAR limits 從低潮位至香港限制埋藏5米

描述性的條款及定義 Descriptive Terms and Definitions: The criteria used for interpretations and descriptions are presented in survey reports 解釋及描述的標準可見於調查結果

大地參數 GEODETIC PARAMETERS

橢球參數 Ellipsoidal Parameters	投影參數 Projection Parameters	
參考橢球體 Ellipsoid : WGS84	投影 Projection : Mercator	比例因子 Scale Factor : 1
半長軸 Semi-Major Axis (a) (m) : 6378137.000	原點經度 Longitude of Origin : 175°E	座標西移量 False Easting : 8 000 000
反扁率 Inverse Flattening (1/f) : 298.257223563	基準緯度 Standard Parallel : 35°N	座標南移量 False Northing : 6 000 000

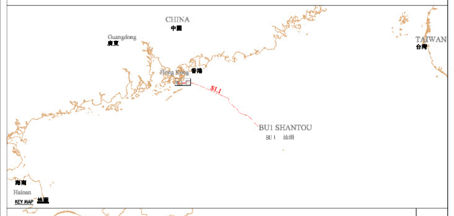
VERTICAL DATUM 高程基準

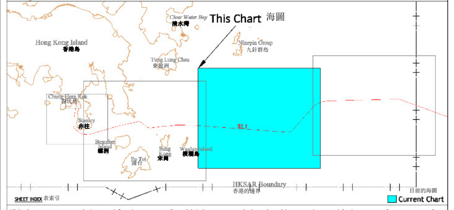
In Landfall and Inshore survey charts: 初次登陸及近岸調查海圖內:

Bathymetry data has been reduced to Low Astronomical Tide (LAT) using tide gauge at Tai Mui Wan 水深測量數據使用了大梅灣的潮位計來減少至低天文潮位（LAT）

In Shallow Water survey charts: 淺水調查海圖:

N/A 不適用





SHEET INDEX 表索引

測量日期 Survey Date: May - June 2018

Scale : 比例尺:

NATURAL SCALE 1 : 10,000 at 35° N

於海圖的中緯度 (At Mid-Latitude of Chart)

TRUE SCALE 1 : 11295.46 真實比例尺

0.0 0.2 0.4 0.6 0.8 1.0 km

Supplier : 供應商: ALCATEL SUBMARINE NETWORKS

Main Contractor : 主要承辦商: FUGRO

Surveyor : 測量師: EGS EARTH SCIENCES & SURVEYING

Project Name: 項目名稱:

香港-美國海底電纜系統
HONG KONG - AMERICA CABLE SYSTEM
MARINE ROUTE SURVEY
海洋路線調查

Document Title: 文件標題:

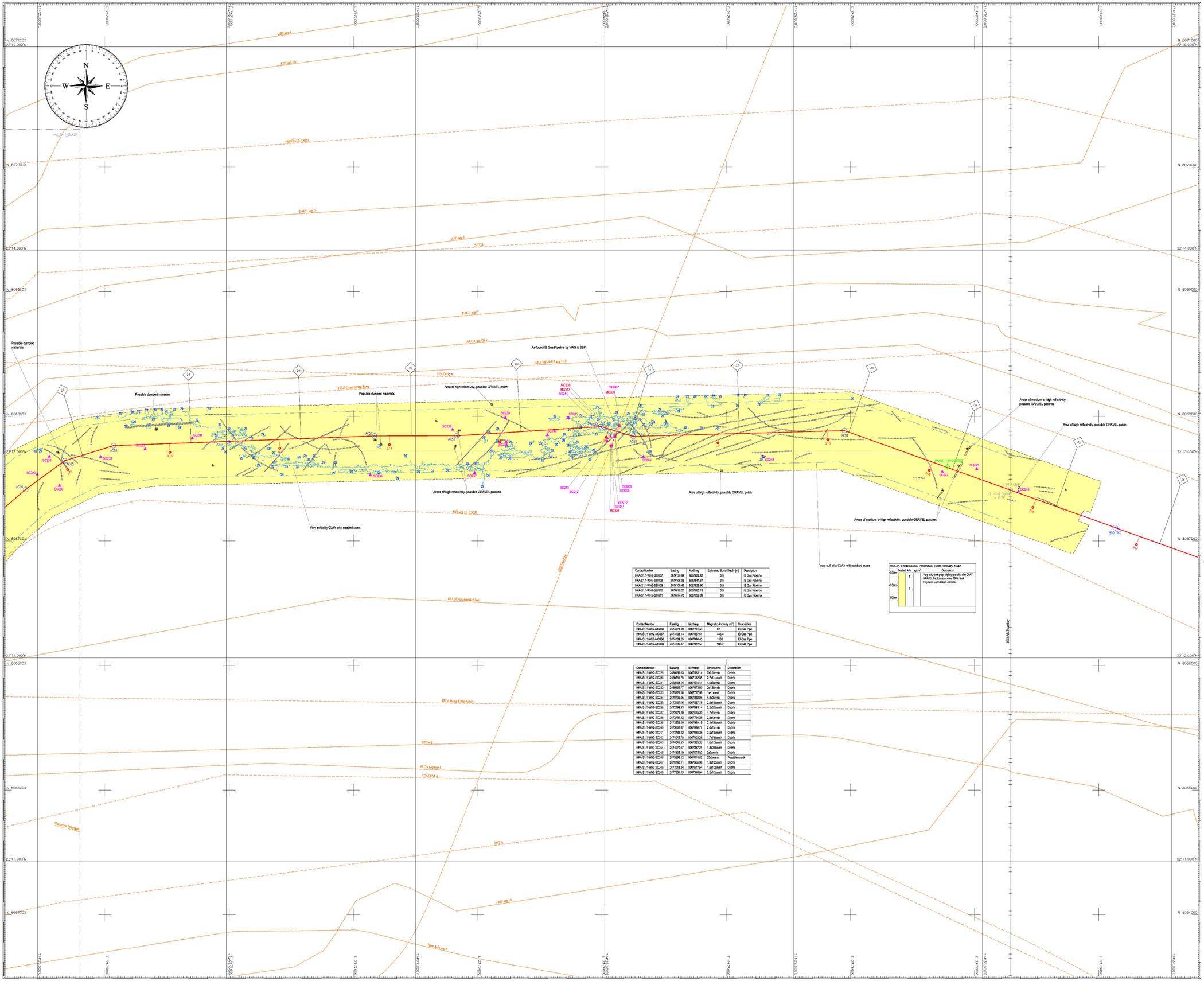
SEGMENT S1.1 (CHUNG HOM KOK - BU1)
NORTH UP CHART
CHART NO. 004 OF 005
(KP 14.10 - KP 26.05)

Rev	Date	Prepared by	Checked by	Approved by
1	Sep 2018	Agnes Siu	Bobby Lee	Y.T. Chan
0	June 2018	Agnes Siu	Claire Lam	Y.T. Chan

Route Based Upon: 路線根據: HKA_SEG1.1_CHUNG HOM KOK TO BU1
SHANTOU_RPL_PSR03_29-AUG-2018.xls

Figure E4-3
圖E4-3

File Name: 文件名稱: HKA_S1-1_NU004_010K



CARTOGRAPHIC SYMBOLS 製圖符號

- Post survey route with kilometre post and reverse kilometre post
- Beach manhole / Alter course
- Point on line (POL)
- Coastline (from Admiralty charts)
- Chart matchline
- Telecommunications cable position (taken from alcatel database), In-service/Out of service/Planned (as-found in magenta)
- Pipeline position, In-service/Out of service/Planned (as-found in magenta)
- Power cable position (taken from alcatel database), In-service/Out of service/Planned (as-found in magenta)
- Maritime boundaries
- Restricted zones and special areas
- Concession block
- Submerged wreck / Exposed wreck / Obstruction / Well / Platform / Explosives Dumping Ground and symbol or line feature in grey, plotted from desk top study (as-found in magenta). (for general symbols and abbreviations refer to British Admiralty Chart)

BATHYMETRY 水深

- Bathymetric contours in metres. Contour interval may be reduced to show detail.
- Downslope gradient in degrees (°) as measured over the shortest significant distance
- Approximate limit of swath bathymetry coverage (shown only in areas of flat seabed)

SEABED FEATURES 海底特貌

- CORAL
- Gas seepage area with predominant sediment classification
- Boulder field with predominant sediment classification
- Fine sediment (predominantly CLAY/SILT)
- Coarse sediment (SAND and GRAVEL)
- Very coarse sediment (COBBLES and BOULDERS)
- Subcropping ROCK with predominant sediment classification (sediment thickness < target burial depth)
- ROCK outcrop (with veneer of sediments)
- HARDGROUND (very dense/very stiff/consolidated sediments; sediment thickness < target burial depth)
- Sediment or feature boundary
- Inferred sediment or feature boundary
- Approximate limit of side scan sonar coverage
- Seabed scar (trawl or anchor)
- Isopach contours shown at 1m intervals with labels every 1m
- Beach Probe (BP); Beach Sample (BS) location with reference number
- Diver Probe (SP); Diver Sampler (DS) location with reference number
- Isolated sonar contact with reference number (length x width x height in metres where measurable; nnn = no measurable height)
- Linear sonar contact, dashed where partially buried
- Pipeline contact determined by Seismic Profiling System with reference number and description (level at the top of pipeline is stated in metres, +/- equivalent to above or below ambient seabed)
- Unidentified magnetic anomaly with reference number and amplitude (in nano-Tesla)
- Cable/Pipeline position, as determined by magnetometer, with reference number and amplitude (in nano-Tesla)
- Located wreck with reference no. (length x width x height in metres where measurable)
- Gravity Core (GC); Grab Sample (GS) location with reference number
- MiniCPT (CP) location with reference number
- Small ROCK outcrop with height in metres if discernible
- Seabed depression or pockmark with diameter (d) and depth (D) in metres, where discernible
- General orientation of sandwave crest (flachures on lee side where observable, with wavelength and height in metres)
- Orientation of megaripple crest (flachures on lee side where observable, with wavelength and height in metres)
- Orientation of sediment ribbon
- Fault with depth below seafloor (hachures on footwall)

CHART COMMENT 圖表註解:

Cable and Pipelines 海纜及管線

The route makes one crossing with the IS HKE Gas Pipe.

One pipe is mapped by SSS and the magnetometer, and burial depths were determined in four locations by the high frequency SBP.

Hazards and Obstructions 障礙及障礙物

Numerous trawl scars are observed throughout the chart.

Localised GRAVEL patches are observed throughout the chart.

A total of 21 sonar contacts are observed in this chart, mostly corresponding to debris.

A total of 4 magnetic contacts are mapped in this chart and are all corresponding to the IS pipeline.

A total of 5 seismic contacts are mapped in this chart corresponding to the IS pipeline.

A possible wreck is mapped in this chart.

The route exits Hong Kong SAR waters and enters China Territorial Sea in the eastern part of the chart.

一般註意事項:

GENERAL NOTES

SURVEY VESSEL 調查船	INSHORE 近岸: Wing Hung 2
Surface positioning system 表面定位系統	C-Nav 3050 DGPS System; QPS QINSy Navigation Software
Underwater positioning System	-
Bathymetry 水深	R2Sonic Sonic2024 Multibeam Echo Sounder; Knudsen 320N Single Beam Echo Sounder
Morphology and stratigraphy 形態及地層	C-Boom Low Voltage Boomer System; Innomar SES-2000 light Sub-Bottom Profiler; EdgeTech FS4200 Side Scan Sonar System
Magnetometer survey 磁力儀調查	Geometrics G-882 Marine Magnetometer

Target burial depth: 5m burial from LWM to Hong Kong SAR limits

Descriptive Terms and Definitions: The criteria used for interpretations and descriptions are presented in survey reports

GEODETIC PARAMETERS

Ellipsoidal Parameters	Projection Parameters
Ellipsoid : WGS84	Projection : Mercator
Semi-Major Axis (a) (m) : 6378137.000	Longitude of Origin : 175° E
Inverse Flattening (1/f) : 298.257223563	Standard Parallel : 35°N

Scale Factor : 1
False Easting : 8 000 000
False Northing : 6 000 000

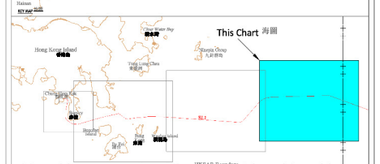
VERTICAL DATUM 垂直基準

In Landfall and Inshore survey charts:

Bathymetry data has been reduced to Low Astronomical Tide (LAT) using tide gauge at Tai Mui Wan

In Shallow Water survey charts:

N/A



Survey Date: May - June 2018

Scale : NATURAL SCALE 1 : 10,000 at 35° N

(At Mid-Latitude of Chart)
TRUE SCALE 1 : 11294.65

0.0 0.2 0.4 0.6 0.8 1.0 km

Supplier: ALCATEL SUBMARINE NETWORKS

Main Contractor: FUGRO

Surveyor: EGS EARTH SCIENCES & SURVEYING

Project Name: 香港-美國海底電纜系統
HONG KONG - AMERICA CABLE SYSTEM
MARINE ROUTE SURVEY

Document Title:
SEGMENT S1.1 (CHUNG HOM KOK - BU1)
NORTH UP CHART
CHART NO. 005 OF 005
(KP 25.25 - KP 36.43)

Rev	Date	Prepared by	Checked by	Approved by
1	Sep 2018	Agnes Siu	Bobby Lee	Y.T. Chan
0	June 2018	Agnes Siu	Claire Lam	Y.T. Chan

Route Based Upon: HKA_SEG1.1_CHUNG HOM KOK TO BU1 SHANTOU_RPL_PSR03_29-AUG-2018.db

File Name: HKA_S1-1_NUK005_010K

Figure E4-4
圖E4-4

Annex F

Environmental Monitoring & Audit Programme

CONTENTS

F1 EM&A PROGRAMME

This *Environmental Monitoring and Audit Programme* section has been prepared to:

- verify whether the monitoring results are in line with the predicted impact;
- monitor the implementation and effectiveness of the control measures employed during the Project works;
- verify that the Project works are not resulting in any adverse impacts to water quality, especially at water sensitive receivers, to marine mammals and at the land installation site at Sha Shek Tan, Chung Hom Kok; and
- ensure that any adverse impacts are detected during the cable laying process/ operation and that appropriate action is undertaken in the event that impacts are identified to sensitive receivers and are found to be associated with the cable works.

As noted in the Main Report, the Project proponent will engage an Environmental Team (ET) to carry out the Environmental Monitoring & Audit (EM&A) requirements as set out fully in this annex. The ET shall not be in an associated body of the Project Proponent, any works contractors or the Independent Environmental Checker (IEC). The ET shall be headed by an ET Leader who has at least 7 years of experience in EM&A or environmental management.

In addition to the ET, the Project Proponent will engage an IEC. The IEC shall not be an associated body of the Permit Holder, the works contractors or the ET. The IEC shall have at least 7 years of experience in EM&A or environmental management. The IEC shall audit the overall EM&A performance of the Project, including the Contractor's implementation of all environmental mitigation measures.

The Project proponent will also appoint a liaison officer for the Project, whose contact details will be made known to both EPD and the public, to ensure effective communication during the marine works within Stanley Bay.

F2 WATER QUALITY MONITORING

Potential impacts on water quality associated with the construction and operation of the Project have been identified in *Annex A* and mitigation measures have been recommended, including limiting the speed of the cable installation barge and undertaking a water quality monitoring programme. The following section provides details of the water quality monitoring during the installation of the submarine cable. The necessity of implementing these measures should also be reviewed if repair operation of the cable system is carried out.

F2.1 SAMPLING AND TESTING METHODOLOGY

F2.1.1 Parameters Measured

The parameters to be measured *in situ* are:

- dissolved oxygen (DO) (% saturation and mgL^{-1})
- temperature (°C)
- turbidity (NTU)
- salinity (‰ or ppt)

The only parameter to be measured in the laboratory is:

- suspended solids (SS) (mgL^{-1})

In addition to the water quality parameters, other relevant data shall also be measured and recorded in field logs, including the location of the sampling stations and cable vessel/ burial machine at the time of sampling, water depth, time, weather conditions, sea conditions, tidal state, current direction and speed, special phenomena and work activities undertaken around the monitoring and works area that may influence the monitoring results.

F2.1.2 Equipment

For water quality monitoring, the following equipment shall be supplied and used by the environmental contractor.

- ***Dissolved Oxygen and Temperature Measuring Equipment*** - The instrument shall be a portable, weatherproof dissolved oxygen measuring instrument complete with cable, sensor, comprehensive operation manuals, and shall be operable from a DC power source. It shall be capable of measuring: dissolved oxygen levels in the range of 0 – 20 mgL^{-1} and 0-200% saturation; and a temperature of 0-45 degrees Celsius.

  It shall have a membrane electrode with automatic temperature compensation complete with a cable of not less than 35 m in length. Sufficient stocks of spare electrodes and cable shall be available for

replacement where necessary (for example, YSI model 59 meter, YSI 5739 probe, YSI 5795A submersible stirrer with reel and cable or an approved similar instrument).

- ***Turbidity Measurement Equipment*** - Turbidity should be measured from a split water sample from the SS sample. A suitable turbidity test kit should be used to measure the turbidity level.

- ***Salinity Measurement Instrument*** - A portable salinometer capable of measuring salinity in the range of 0-40 ppt shall be provided for measuring salinity of the water at each monitoring location.

- ***Water Depth Gauge*** - No specific equipment is recommended for measuring the water depth. However, water depth gauge affixed to bottom of the water quality monitoring vessel is preferred. The environmental contractor shall seek approval of their proposed equipment with the client prior to deployment.

- ***Current Velocity and Direction*** – No specific equipment is recommended for measuring the current velocity and direction. However, the environmental contractor shall seek approval of their proposed equipment with the client prior to deployment.

- ***Positioning Device*** - A Global Positioning System (GPS) shall be used during monitoring to ensure the accurate recording of the position of the monitoring vessel before taking measurements. The use of DGPS is preferred for positioning device, which should be well calibrated at appropriate checkpoint (e.g. Quarry Bay Survey Nail).

- ***Water Sampling Equipment*** - A water sampler, consisting of a transparent PVC or glass cylinder of not less than two litres, which can be effectively sealed with cups at both ends, shall be used (Kahlsico Water Sampler 13SWB203 or an approved similar instrument). The water sampler shall have a positive latching system to keep it open and prevent premature closure until released by a messenger when the sampler is at the selected water depth.

F2.1.3 Sampling/Testing Protocols

All *in situ* monitoring instruments shall be checked, calibrated and certified by a laboratory accredited under HOKLAS or any other international accreditation scheme before use, and subsequently re-calibrated at-monthly intervals throughout all stages of the water quality monitoring. Responses of sensors and electrodes shall be checked with certified standard solutions before each use.

For the on-site calibration of field equipment, the BS 1427: 1993, *Guide to Field and On-Site Test Methods for the Analysis of Waters* shall be observed. Sufficient stocks of spare parts shall be maintained for replacements when necessary. Backup monitoring equipment shall also be made available so that monitoring

can proceed uninterrupted even when equipment is under maintenance, calibration etc.

Water samples for SS measurements shall be collected in high density polythene bottles, packed in ice (cooled to 4° C without being frozen), and delivered to a HOKLAS laboratory as soon as possible after collection.

At least two (2) replicate samples should be collected from each of the monitoring events for *in situ* measurement and lab analysis.

F2.1.4 Laboratory Analysis

All laboratory work shall be carried out in a HOKLAS accredited laboratory. Water samples of about 1,000 mL shall be collected at the monitoring, gradient and control stations for carrying out the laboratory determinations. The determination work shall start within the next working day after collection of the water samples. The SS laboratory measurements shall be provided to the client within five (5) days of the sampling event. The analyses shall follow the standard methods as described in *APHA Standard Methods for the Examination of Water and Wastewater, 19th Edition*, unless otherwise specified (APHA 2540D for SS).

The submitted information should include pre-treatment procedures, instrument use, Quality Assurance/Quality Control (QA/QC) details (such as blank, spike recovery, number of duplicate samples per-batch etc), detection limits and accuracy. The QA/QC details shall be in accordance with requirements of HOKLAS or another internationally accredited scheme.

F2.2 MONITORING LOCATIONS

The monitoring station locations have been established to identify potential impacts to water, ecological sensitive receivers and fisheries sensitive receivers. The proposed monitoring stations are shown in ***Figure F1*** and detailed in *Table F1*. These monitoring stations are selected considering proximity to the proposed cable alignment the identified water, ecology and fisheries sensitive receivers shown in ***Annex A, Figure A1***, the spawning ground of commercial fisheries resources shown in ***Figure 3.1*** and the cable alignment. The monitoring stations are selected in the vicinity of sensitive receivers nearest to the cable (i.e. IM1 - IM7) and within the spawning grounds of commercial fisheries resources (i.e. C1, G2-G3, E1, F1, IM3 - IM7) and are considered to provide representative sampling results to verify potential impacts to sensitive receivers that may be further from the cable e.g. the FCZ at Po Toi. The selected sensitive receivers are more likely to be impacted (compared with those further away) should any exceedances occur due to the Project, and monitoring at these stations would allow water quality impact, if any, to be observed early and close to the source, thus allowing control and additional mitigation to be put in place quickly before the impact could potentially reach a wider area covering other water, ecology and fisheries sensitive receivers further away.

Prior to, during, and after the installation of the cable, water quality sampling will be undertaken at stations situated around the cable laying works (shown in *Table F1*, and ***Figure F1***). The monitoring at those stations is to ensure the construction works of the Project do not affect sensitive areas nearby or further afield as explained above. Similarly water quality sampling should be undertaken prior to, during and after any necessary repair operation.

The monitoring stations are divided into two areas is shown in ***Figure F1***: a number of monitoring stations are located close to the cable alignment from Chung Hom Kok to Stanley Peninsular, defined as Zone A; and monitoring stations close to cable works from north of Beaufort Island to just east of Waglan Island are defined as Zone B. The monitoring stations within Zone A should be monitored for all works between the landing point to the boundary of cable segment within Zone A (HK Grid coordinate 839544.426E 806852.911N/ At 2.088 km from the landing point). The monitoring stations within Zone B should be monitored for all cable works between the western end (HK Grid coordinate 842031.328E 806115.630N/ at 5.293 km from the landing point) and the eastern end (HK Grid coordinate 850625.141E 806564.218N/ at 14.189k km from the landing point) of the cable alignment in this Zone. Outside Zone A and Zone B, the cable works are considered too far away from any identified sensitive receivers for any potential impact, and water quality monitoring is not required.

The contractor should inform the ET every day of the expected cable segment which would be installed/ repaired in the next working day to allow the ET to plan ahead the required extent of water quality survey.

The suggested co-ordinates of these monitoring stations are listed in *Table F1* below. The exact co-ordinates should be confirmed before commencement of Baseline Monitoring (prior to cable installation/ repair operation).

The monitoring stations shall be sampled for marine cable jetting tool work, during Baseline Monitoring (prior to cable installation/ repair operation), Impact Monitoring (during works related to the cable installation/repair operation) and Post Project Monitoring (after completion of the cable installation/repair operation).

Table F1 Co-ordinates of Sampling Stations (HK Grid)

Station	Nature	Approx. Geodesic Distance ^ to Proposed Cable Alignment (m)	Easting	Northing
Zone **A**: The waters near Stanley Bay Covers the cable alignment between Chainage 0 and 2.088 km.				
IM1	Coral sites along the coast of Chung Hom Kok	1,320	838275	807941
IM2	Saint Stephen's Beach	430	840199	808226
G1	Gradient Stations (Between Saint Stephen's Beach and cable alignment)	190	839961	808225
C1*	Control Station for Zone A	1120	838426	806996
Zone **B**: The waters from Beaufort Island to Waglan Island where a number of sensitive receivers are located close to the cable alignment. Covers the cable alignment between Chainage 5.293 km and 14.189 km.				
IM3*	Coral site along the coast of north Beaufort Island	840	843316	805606
IM4*	Coral sites along the coast of Cape d'Aguilar at Kau Pei Chau	580	844923	807208
IM5*	Coral sites along the coast of Sung Kong Islet	510	846901	805922
IM6*	Coral sites along the coast of Sung Kong	720	847579	805787
IM7*	Coral sites along the coast of Waglan Island	950	849664	805649
G2*	Gradient Stations (Between Coral sites along the coast of Cape d'Aguilar at Kau Pei Chau and cable alignment)	440	844962	807066
G3*	Gradient Stations (Between Coral sites along the coast of Sung Kong Islet)	260	846868	806175
E1*	Control Station for Zone B in Ebb Tide	1,310	842161	804794
F1*	Control Station for Zone B in Flood Tide	2,920	849986	803673

Note: ^ Geodesic distance refers to the shortest straight line distance between two locations, without regard on the physical obstacles in between.
* These stations are also considered to fall within the spawning grounds of commercial fisheries resources.

F2.3 SAMPLING PROCEDURES

The proposed monitoring frequency and arrangements were stipulated below. Reference is made to the "EM&A Guidelines for Development Projects in Hong Kong, Appendix D2: General Technical Requirements of Environmental Monitoring" and other recently approved submarine cable installation projects such as DIR-244/2016 *Asia-Africa-Europe-1 (AAE-1) Cable System* andDIR-254/2017 *Pacific Light Cable Network (PLCN) – Deep Water Bay*.

F2.3.1 *Monitoring Frequency*

The environmental contractor will be responsible for liaison with the engineering contractor to ensure water quality sampling is being conducted at appropriate times, including when installation/ repair operation works are being undertaken.

The monitoring frequency and timing for baseline, impact and post monitoring is detailed below and summarized in *Table F2*. Tidal range for flood and ebb tides should not be less than 0.5 m for capturing representative tides.

Baseline Monitoring

Baseline Monitoring will comprise sampling of three days per week for <u>four</u> consecutive weeks, before the commencement of cable installation. Given the shorter timeframe of maintenance/ repair work relative to installation work, the representative pre-project period for baseline monitoring will comprise sampling of three days per week for <u>two</u> consecutive weeks. The interval between two sets of monitoring shall not be less than 36 hours and samples will be taken twice during a 4 hour window of 2 hours before and 2 hours after a mid-flood and mid-ebb tidal state on each sampling occasion.

The baseline monitoring will be undertaken at the monitoring stations as shown in *Table F1*.

For any cable installation/ repair works, baseline monitoring will be undertaken according to whether the works fall within Zone A and/or Zone B (see ***Figure F1***) and will be carried out at the four (4) monitoring stations of Zone A prior to commencement of marine works located within Zone A, at the nine (9) monitoring stations of Zone B prior to commencement of marine works located within Zone B.

Impact Monitoring

Impact Monitoring will comprise sampling of three days per week during cable marine installation/ repair operation work in Zone A and/or Zone B. The interval between two sets of monitoring shall not be less than 36 hours and samples will be taken daily during a 4 hour window of 2 hours before and 2 hours after a mid-flood and mid-ebb tidal state.

Impact monitoring should be conducted at all monitoring stations three times a week in Zone A (four (4) monitoring stations) if cable installation/ repair operation works would be conducted within Zone A. Similarly impact monitoring should be conducted at all monitoring stations three times a week in Zone B (nine (9) monitoring stations) if cable installation/ repair operation works would be conducted within Zone B.

Post Project Monitoring

After completion of the cable marine installation/ repair operation works in a particular Zone, post project monitoring will be carried out for one week in that Zone in the same manner as the impact monitoring.

The stations monitored should be consistent with the corresponding Baseline Monitoring exercise.

Table F2 ***Summary of Monitoring Frequency***

Zone	Baseline	Impact	Post
Zone A: Impact stations IM1, IM2, Gradient Station G1 and Control station C1.	Installation On three (3) days per week for four weeks, twice in a day (4 hour window of 2 hours before and 2 hours after mid flood and mid-ebb tides). Maintenance/Repair On three (3) days per week for two weeks, twice in a day (4 hour window of 2 hours before and 2 hours after mid flood and mid-ebb tides).	For three days per week, twice in a day (4 hour window of 2 hours before and 2 hours after mid flood and mid-ebb tides) when cable installation/repair works is in Zone A.	On three (3) days over one week, twice in a day (a 4 hour window of 2 hours before and 2 hours after mid flood and mid-ebb tides) upon completion or works in a particular Zone.
Zone B: Impact stations IM3, IM4, IM5, IM6, IM7, Gradient Stations G2, G3 and Control stations E1 and F1.		For three days per week, twice in a day (4 hour window of 2 hours before and 2 hours after mid flood and mid-ebb tides) when cable installation/repair works is in Zone B.	

F2.3.2 Depths

Each station will be sampled and measurements will be taken at three depths, namely 1 m below the sea surface, mid-depth and 1 m above the seabed. For stations that are less than 3 m in depth, only the mid depth sample shall be taken. For stations that are less than 6 m in depth, only the surface and seabed sample shall be taken.

F2.4 COMPLIANCE/ACTION EVENT PLAN

Water quality monitoring results will be evaluated against Action and Limit levels shown in *Table F3*.

Table F3 *Action and Limit Level for Water Quality (based on the result of the Baseline Report)*

Parameter	Action Level	Limit Level
SS in mgL^{-1} (Depth-averaged)	95%-ile of baseline data, or 20% exceedance of value at any impact station compared with corresponding data from control station, whichever monitoring result is higher	99%-ile of baseline data, or 30% exceedance of value at any impact station compared with corresponding data from control station, whichever monitoring result is higher
DO in mgL^{-1}	Surface and Middle 5%-ile of baseline data for surface or middle layer Bottom 5%-ile of baseline data for bottom layers	Surface and Middle 4mg/L or 1%-ile of baseline for surface and middle layer, whichever is lower Bottom 2mg/L or 1%-ile of baseline data for bottom layer whichever is lower
Turbidity in NTU (Depth-averaged)	95%-ile of baseline data, or 20% exceedance of value at any impact station compared with corresponding data from control station, whichever monitoring result is higher	99%-ile of baseline data, or 30% exceedance of value at any impact station compared with corresponding data from control station, whichever monitoring result is higher

Notes:

a. For DO, non-compliance of the water quality limits occurs when the monitoring result is lower than the limits.

b. "Depth-averaged" is calculated by taking the arithmetic means of reading of all sampled depths.

c. For SS and turbidity, non-compliance of the water quality limits occurs when monitoring result is higher than the limits.

d. Limit level for DO was derived from the Water Quality Objectives (WQO) for Southern, Eastern Buffer, and Mirs Bay Water Control Zones under the Water Pollution Control Ordinance (WPCO) Chapters 358L, 358Y, and 358I respectively.

The measures that will be undertaken in the event that the Action or Limit Levels are exceeded are shown in *Table F4*.

Table F4 *Event Action Plan for Water Quality*

Event	Contractor
Action Level Exceedance	**Step 1** - repeat sampling event. Where applicable, review results of gradient station(s) to confirm the source of impact. **Step 2 –** Inform EPD and AFCD and confirm notification of the non-compliance in writing; **Step 3** - discuss with cable installation/ repair operation contractor the most appropriate method of reducing suspended solids during cable installation/ repair operation (e.g. reduce cable laying speed/pressure in jetting water) and agree with EPD. **Step 4** - repeat measurements after implementation of mitigation for confirmation of compliance. **Step 5** - if non-compliance continues - increase measures in Step 3 and repeat measurements in Step 4. If non-compliance occurs a third time, suspend cable installation/ repair operations.

Event	Contractor
Limit Level Exceedance	**Step 1 -** Suspend cable installation/repair operations immediately (until the cause of the non-compliance is detected and the situation is rectified).
	Step 2 - repeat sampling event. Where applicable, review results of gradient station(s) to confirm the source of impact.
	Step 3 – Inform EPD and AFCD and confirm notification of the non-compliance in writing
	Step 4 - discuss immediately with cable installation/ repair operation contractor the most appropriate method of reducing suspended solids during cable installation/ repair operation (e.g. reduce cable laying speed/pressure in jetting water) and agree with EPD.
	Step 5 - repeat measurements after implementation of mitigation or suitable time has elapsed since suspension of cable installation/ repair operations, for confirmation of compliance.
	Step 6 -. Repeat Step 5 until measurements show compliance.

F2.5 REPORTING

Schedule for baseline and start of impact monitoring should be submitted to the Environmental Protection Department (EPD) approximately one week before commencement of the monitoring works for agreement.

The reports to be provided shall include:

- Baseline Monitoring Report(s);
- Weekly Impact Monitoring Reports; and
- Post Project Monitoring Report(s).

The draft Baseline Monitoring Report, reviewed by the IEC, shall be provided to EPD no later than two weeks before the cable installation/ repair operation work, for agreement on the Action/Limit Levels prior to installation work commencing.

The Impact Monitoring Report will be provided weekly within five days after the relevant monitoring data are collected or become available during the cable installation/ repair operation work, having been reviewed by the IEC. The Post Project Monitoring Report to review the environmental status after cable installation/ repair operation and compare with the results as presented in the Baseline Monitoring Report and Impact Monitoring Reports where appropriate. It shall be provided within one month after completion of the marine works.

The Baseline Monitoring Report shall include the following details:

- brief project background information;

- drawings showing locations of the baseline monitoring stations;
- an updated construction/ repair operation programme with milestones of environmental protection/mitigation activities annotated;
- monitoring results together with the information including monitoring methodology, parameters monitored, monitoring locations (and depth), monitoring date, time, frequency and duration;
- details on influencing factors, including major activities, if any, being carried out on the Site during the period, weather conditions during the period and other factors which might affect the results;
- determination of the Action and Limit Levels for each monitoring parameter and statistical analysis of the baseline data, the analysis shall conclude if there is any significant difference between control and impact stations for the parameters monitored; and
- comments and conclusions.

The Weekly Impact Monitoring shall include, but not be limited to, the following details:

- Basic Project Information - construction/ repair operation programme with fine tuning of activities showing the inter-relationship with environmental protection/mitigation measures for the week and works undertaken during the week;
- Operating practices of the cable installation/ repair machinery during sampling (including: position, and cable burial depth during installation and repair operations where relevant) and an interpretation of monitoring results; and
- The monitoring data should be provided graphically to show the relationship between the Control and the Impact monitoring stations and compliance or non-compliance with respect to the Action/Limit Levels.

The Post Project Monitoring Report shall include the following details:

- brief project background information;
- drawings showing locations of the post-project monitoring stations;
- full construction/ repair operation programme with milestones of environmental protection/mitigation activities annotated;
- monitoring results together with the information including monitoring methodology, parameters monitored, monitoring locations (and depth), monitoring date, time, frequency and duration. Monitoring results

should show relationship between Control and Impact monitoring stations;

- review the environmental status after the cable installation/ repair operation and compare with the results as presented in the Baseline Monitoring Report and Impact Monitoring Reports where appropriate; and

- comments and conclusions.

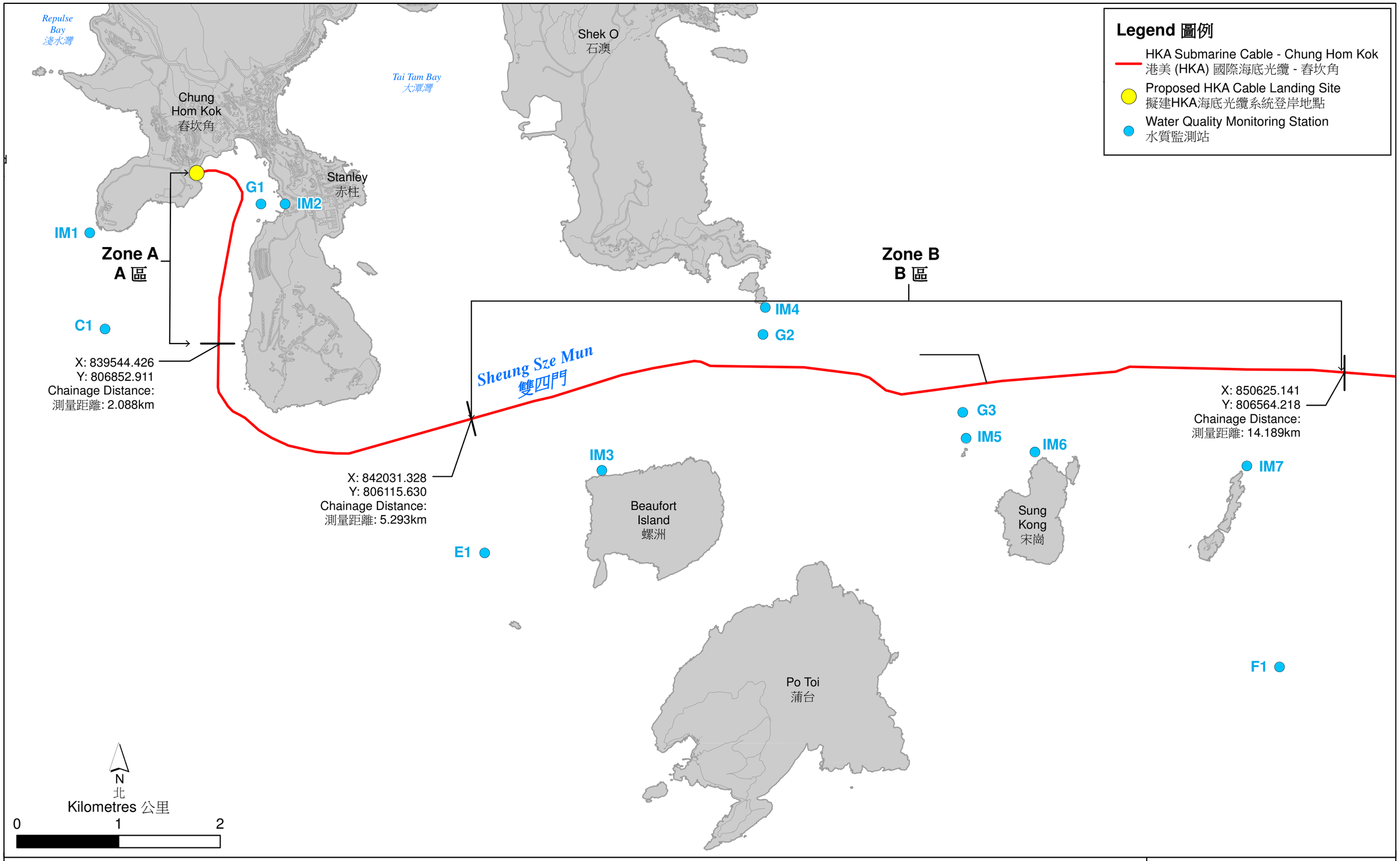


Figure F1
圖 F1

Water Quality Monitoring Stations
水質監測站

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Date: 23/10/2018

Environmental Resources Management

ERM

F3 CORAL MONITORING

F3.1 OBJECTIVES AND APPROACH

Direct impact to the coral communities are not anticipated due to the construction or operation of the proposed cable. According to results of the recent subtidal spot dive and REA surveys however, two common hard coral colonies were found in the vicinity of the cable landing alignment approaching Sha Shek Tan (SST) of Chung Hom Kok. As such, the following coral surveys have been recommended as precautionary measures:

- A Pre-installation coral survey will be conducted within a month before any jetting works for the cable installation. The objective of the Pre-installation coral survey is to identify the locations of corals recorded within and in the vicinity of the landing site area and confirm no corals will be directly impacted; and

- A Post-project coral survey will be conducted within a month after completion of the cable installation. The objective of the Post-project coral survey is to verify the corals identified during the Pre-installation coral survey would not be directly impacted after completion of the cable installation.

These precautionary measures aim to verify coral colonies are not significantly impacted by the Project. If any coral colonies are identified to be directly impacted during the Pre-Installation coral survey, a coral translocation proposal will be deposited after the Pre-installation coral survey, if coral translocation is considered feasible.

F3.2 PRE-INSTALLATION CORAL SURVEY

F3.2.1 *Methodology*

One subtidal spot dive survey will be conducted over the location specified below, prior to the installation of the proposed cable. For each coral colony found, the following data should be recorded:

- GPS location;
- Species identification to genus or species level, as far as practicable;
- Size (e.g. maximum diameter) and health of identified corals (e.g. degree of sedimentation, partial mortality, sign of bleaching); and Photographic record.

Additional information such as the survey date, time, underwater visibility, atmospheric, sea and tidal conditions should also be recorded.

F3.2.2 Location

The subtidal dive survey should be undertaken near the landing site area (equivalent to Location C3 in ***Figure B2***).

F3.3 POST-PROJECT CORAL SURVEY

F3.3.1 Methodology

One subtidal spot dive survey will be conducted over the location specified below, within one month after the completion of installation of the proposed cable, focussing on the coral colonies identified during the Pre-installation coral survey. For each coral colony found, the following data should be recorded:

- GPS location;
- Species identification to genus or species level, as far as practicable;
- Size (e.g. maximum diameter) and health of identified corals (e.g. degree of sedimentation, partial mortality, sign of bleaching); and
- Photographic record.

Additional information such as the survey date, time, underwater visibility, atmospheric, sea and tidal conditions should also be recorded.

F3.3.2 Location

The Post-project coral survey should be undertaken near the landing site area (equivalent to Location C3 in ***Figure B2***), in particular at the locations where coral colonies are identified during the Pre-installation coral survey.

F3.4 REPORTING

A Pre-installation coral survey report shall be provided to AFCD and EPD no later than 2 weeks before the cable laying work is scheduled to commence, presenting the results of the Pre-installation coral survey and additional

mitigation / precautionary measure(s) (e.g. coral translocation), if found to be necessary.

A Post-project coral survey report shall be provided to AFCD and EPD within one month after the completion of Post-project coral survey, presenting the results of the Post-project coral survey, comparison of the results collected in the Pre-installation coral survey as well as discussion of any adverse direct impacts to the identified coral communities within and in the vicinity of the landing site area as a result of the cable installation work.

Cable installation/ repair operation works may result in a minor and short term increase in underwater sound from marine vessels. Given that Finless Porpoises and Chinese White Dolphins use high frequency ultrasonic clicks for foraging and communication, the low frequency underwater sound associated with vessels, jetting and cable laying are not expected to interfere significantly with these two species of cetaceans. No unacceptable adverse impacts to Finless Porpoises and Chinese White Dolphins from underwater sounds are expected to occur during either cable installation or repair operations. The cable installation works will be short-term and temporary, and be carried by one cable installation barge within a total of approximately 30 working days in HKSAR waters. The Finless Porpoises and Chinese White Dolphins are hence not expected to be disturbed by the cable laying vessel. Any cable repair works are expected to of shorter-term than initial cable installation works and therefore also not expected to disturb Finless Porpoise or Chinese White Dolphins

However, additional precautionary measure will be implemented for marine mammals during the cable installation works and as required during cable repair operations.

A marine mammal exclusion zone within a radius of 250 m from the cable installation/repair operation vessel will be implemented during the cable installation/repair operation works taking place in daylight hours along the section starting at Zone B (Chainage distance 5.293 km. For location refer to ***Figure F1***). The marine mammal exclusion zone will be monitored by qualified observer(s) (1) with an unobstructed, elevated view of the area. The view will be undertaken from the cable installation/repair operation vessel. The viewpoint will be proposed by the IEC.

Qualified observer(s) will stand on the open upper decks of the vessel, allowing for observer eye heights of 4 to 5 m above water level and relatively unobstructed 180° visibility. Vessel-based observation by the observer(s) shall be conducted by searching an 180° swath where the installation/repair works are being conducted at the centre, with appropriate marine binoculars, scanning the same area with the naked eyes and occasional binocular check.

Qualified observer(s) will scan the 250 m exclusion zone for at least 30 minutes prior to the start of cable installation/repair works. If marine mammals are observed in the exclusion zone, cable installation/repair works will be delayed until they have left the area. This measure will confirm that the area

(1) The qualification and experience of the qualified observer(s) shall be to the satisfaction of the Director of Agriculture, Fisheries and Conservation (DAFC). The qualified observer(s) for the marine mammal monitoring must be suitably trained to conduct the visual monitoring works. CVs of the qualified observer(s) will be provided to the DAFC prior to commencement of monitoring surveys.

in the vicinity of the cable installation/repair work is clear of marine mammals prior to the commencement of works and will serve to reduce any disturbance to marine mammals. As per previous practice in HKSAR, should cetaceans move into the works area during cable installation/repair operation vessel, it is considered that cetaceans will have acclimatised themselves to the works therefore cessation of cable installation is not required [1].

The marine mammal exclusion zone monitoring will be required during periods when there are cable installation works or repair operation works as necessary. Daily monitoring will be conducted until the completion of cable installation works or repair operation works as agreed.

(1) This precautionary measure is consistent with conditions for grab dredging works inside the Sha Chau and Lung Kwu Chau Marine Park included in the issued Environmental Permit for the Permanent Aviation Fuel Facility for Hong Kong International Airport project

F5 SITE INSPECTIONS

Site inspections should be undertaken at the landing point (ie from LWM to Beach Manhole (BMH) at Sha Shek Tan, Chung Hom Kok) during cable installation/ repair operations in this area (ie during Land cable works) at least once prior to cable installation/ repair, once per week during installation and once after cable installation work in this area. The objective is to ensure that appropriate environmental protection and precautionary measures outlined in the Project Profile Main Text are properly implemented.

F5.1 ENVIRONMENTAL PROTECTION AND PRECAUTIONARY MEASURES

F5.1.1 Prior to Cable Installation/ Repair at Land and Shore-End

- In order to minimise the risk of disturbance to the existing utilities, the Contractor should confirm the location of all the utilities within the works area with the relevant departments, for example, but not limited to, Drainage Services Department, Architectural Services Department, Water Services Department and other departments/companies.

- The Project proponent will ensure there will be no sand lost during the construction/ repair works here. The beach will be photographed prior to the commencement of the works (and after the restoration of the site) in order to assure the beach will be reinstated to the pre-works conditions.

- Legible notices will be put on site to show the commencement and completion dates of the land and shore-end works, daily working hours and emergency contact person and number.

F5.1.2 Land and Inshore Cable Installation/ Repair Period

Site inspections should ensure the following measures are being adhered to:

- On shore, the work area, including open trench area, will be clearly demarcated using warning tape/ markers and marshals, and fenced off with barriers to ensure the public are kept clear.

- Trenching works will take place during non-restricted hours, ie 0700 to 1900 hours on any day not being a Sunday or public holiday. If works during restricted hours are later found to be necessary, a Construction Noise Permit (CNP) will be applied for displayed on site.

- Where feasible, silencers or mufflers on construction equipment should be utilised and should be properly maintained during the construction programme.

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F5.1.3 Post-Cable Installation/ Repair at Land and Shore-End

- The Project proponent will ensure there will be no sand lost during the cable installation/ repair works. The beach will be photographed (prior to the commencement of the works and) after the restoration of the site in order to assure the beach will be reinstated to the pre-works conditions.

F5.2 REPORTING

Site inspection results should be submitted to the Project Proponent and the Contractor(s) within 72 hours. Should actions be necessary, the Environmental Team will follow up with recommendations on improvements and will submit these recommendations in a timely manner to the Project Proponent and the Contractor(s). The Contractor(s) will follow the procedures and time frame stipulated in the environmental site inspection for the implementation of mitigation proposal and the resolution of deficiencies. An action reporting system shall be formulated and implemented to report on any remedial measures implemented subsequent to the site inspections.

F6 ENVIRONMENTAL COMPLAINTS

An Environmental Team (ET) will undertake the following procedures (***Figure F2***) upon receipt of a complaint:

i. log complaint and date of receipt into the complaint database;

ii. investigate the complaint and discuss with the Contractor(s) and Project Proponent to determine its validity and to assess whether the source of the issue is due to works activities;

iii. if a complaint is considered valid due to the works , the ET will identify mitigation measures in consultation with the Contractor(s) and Project Proponent;

iv. if mitigation measures are required, the ET will advise the Contractor(s) accordingly;

v. review the Contractor(s)'s response on the identified mitigation measures and the updated situation;

vi. if the complaint is transferred from EPD, an interim report will be submitted to EPD on the status of the complaint investigation and follow-up action within the time frame assigned by EPD;

vii. undertake additional monitoring and audit to verify the situation if necessary and ensure that any valid reason for complaint does not recur;

viii. report the investigation results and the subsequent actions on the source of the complaint for responding to complainant. If the source of complaint is EPD, the results should be reported within the time frame assigned by EPD; and

ix. record the complaint, investigation, the subsequent actions and the results in the EM&A report.

During the complaint investigation work, the Contractor(s) and Project Proponent will cooperate with the ET in providing the necessary information and assistance for completion of the investigation. If mitigation measures are identified in the investigation, the Contractor(s) will promptly carry out the mitigation measures. The Project Proponent will approve the proposed mitigation measures and the ET will check that the measures have been carried out by the Contractor(s).

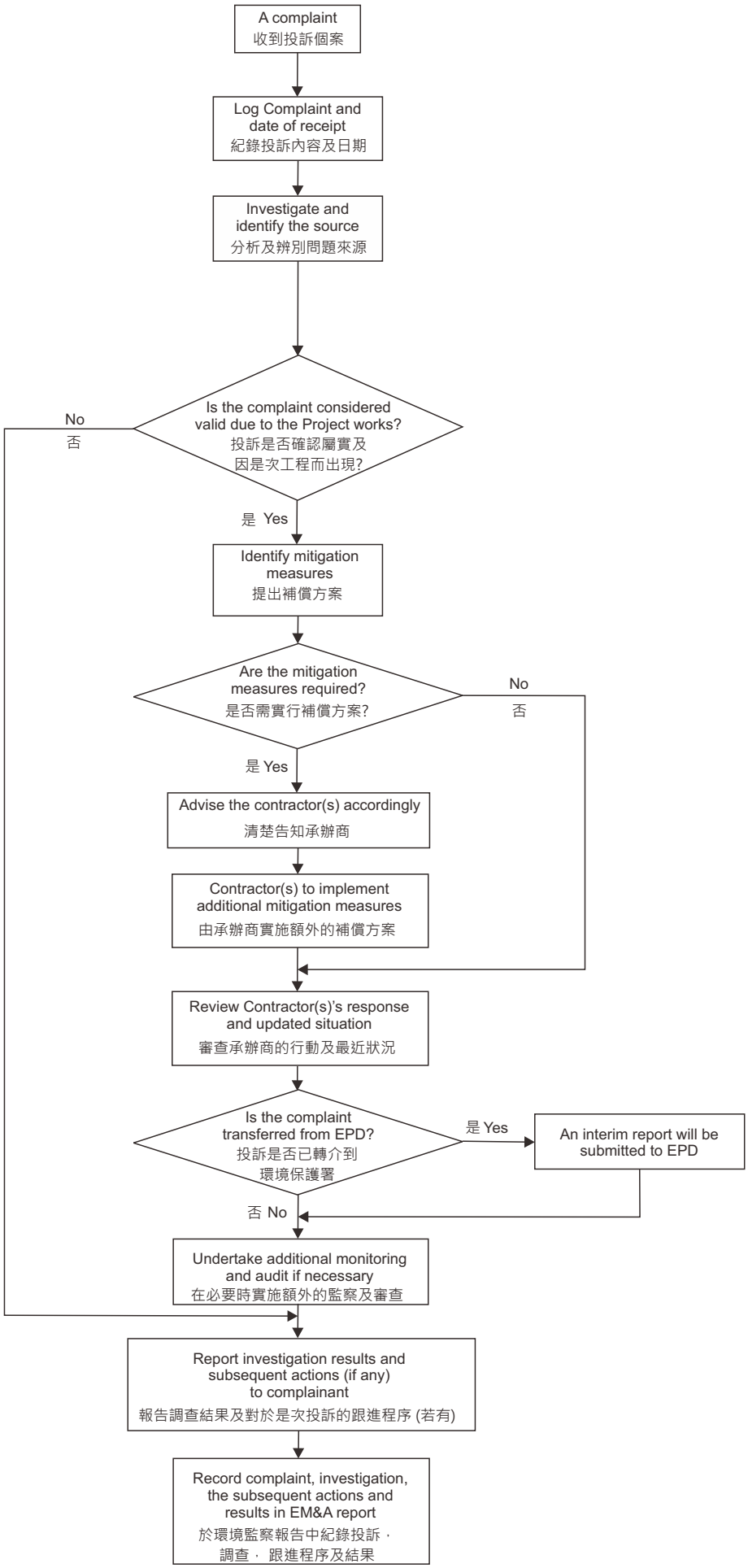

Figure F2
圖 F 2

Flow Chart for Handling Environmental Complaints
處理環境問題投訴之流程圖

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