Asia Pacific Gateway (APG) – Tseung Kwan O

Asia Pacific Gateway (APG) – 將軍澳

Project Profile
工程項目簡介

8 October 2013
2013 年 10 月 8 日

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This document presents the Project Profile for the submarine cable system Asia Pacific Gateway (APG) – Tseung Kwan O. 本報告是海底光纜系統 Asia Pacific Gateway (APG) – 將軍澳項目的工程項目簡介。	Approved by 批核: *Terence Fong* *方靜威* *Partner* *合夥人*

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Project Profile

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1 BASIC INFORMATION

1.1 PROJECT TITLE

The title of the project is 'Asia Pacific Gateway (APG) – Tseung Kwan O' (hereafter referred to as the Project).

1.2 PURPOSE AND NATURE OF THE PROJECT

In order to help meet the tremendous telecommunication services requirements for intra-Asia connectivity between South East Asia and North Asia, the **APG Consortium** has decided to build a submarine telecommunication cable system, which will be approximately 10,400 km in length, connecting the major business hubs across the region. The cable will link up with several countries, including Malaysia, Singapore, Vietnam, Taiwan, Mainland China, Japan, Korea and the Hong Kong Special Administrative Region (HKSAR).

There will also be branching units which connect to Tseung Kwan O (TKO) within the HKSAR. As one of the APG Consortium members, **China Mobile International Limited (CMI Ltd)** is responsible for the cable landing within Hong Kong.

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

1.3 NAME OF PROJECT PROPONENT

As one of the APG Consortium members, **China Mobile International Limited (CMI Ltd)** is responsible for the cable landing issue within HKSAR and is therefore the Project proponent. Contact details are:

China Mobile International Limited
Level 30, Tower 1, Kowloon Commerce Centre
No. 51 Kwai Cheong Road
Kwai Chung
New Territories
Hong Kong

1.4 *Location and Scale of the Project and History of the Site*

1.4.1 *Location*

The route of the proposed APG submarine cable system within HKSAR is depicted in *Figure 1.1*. The APG landing site is situated within the TKO Industrial Estate, behind a rubble mound sea wall, on the reclaimed land (See *Figure 1.2*). The proposed cable would land via an existing Beach Manhole (BMH) and ultimately connect with a Cable Landing Station in the TKO Industrial Estate which is presently under construction and has been approved by the Buildings Department (BD no. 2/9229/11 (P)). The Cable Landing Station is scheduled for completion in 2014. The shore end of the APG cable segment will connect to the existing BMH via the existing conduit laid under the seawall. In order to complete the link between the BMH and the Cable Landing Station, the land cable will be installed in a conduit along the terrestrial route. Part of the underground cable conduit from the BMH to Chun Yat Street already exists but along Chun Yat Street to the Cable Landing Station the underground cable conduit will have to be newly installed (See *Figure 1.2*).

The proposed submarine cable will travel west and southward from TKO as it approaches the Tathong Channel. After crossing the Tathong Channel and near to Cape Collinson, the cable then runs approximately parallel to the Tathong Channel until north of Sung Kong Island where it then turns eastward to the boundary of HKSAR waters where it enters the South China Sea. *Figure 1.1* depicts the proposed APG submarine cable route.

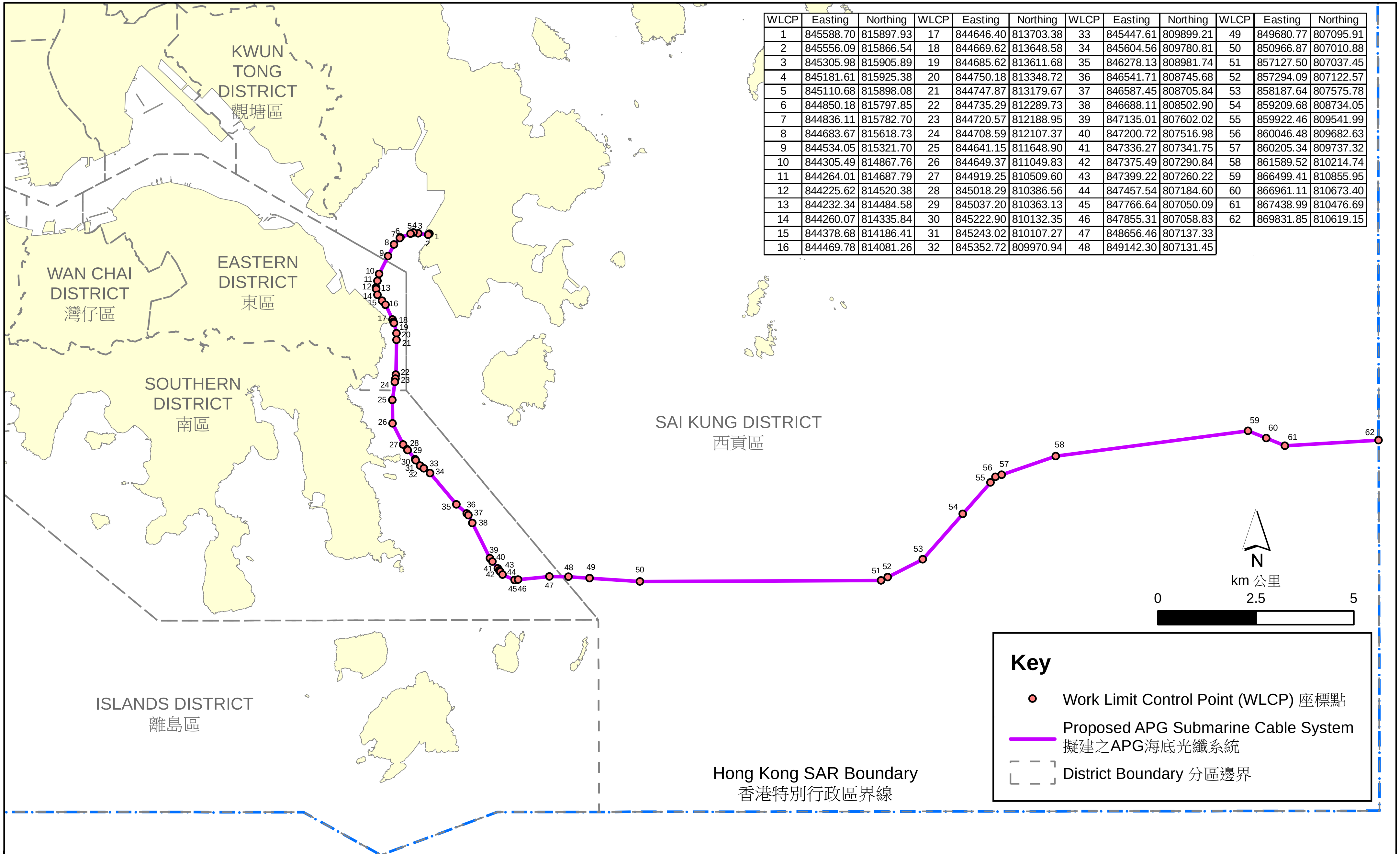
1.4.2 *Scale of Project*

The APG submarine cable in HKSAR waters, has an intended burial depth of up to 5 m until the cable reaches approximately 20 m from the end point of the conduit under the seawall of the TKO Industrial Estate (burial depth of ~2 m). The total length of the submarine cable within HKSAR waters is approximately 35 km.

The terrestrial cable link in the underground conduit between the BMH and the Cable Landing Station is approximately 220 m along the existing underground conduit from the BMH to the street and approximately 970 m in the new underground conduit from the street to the proposed Cable Landing Station.

1.4.3 *History of the Site*

The TKO Industrial Estate is situated on recently reclaimed land (1993/1994), facing the South Eastern Approach to Victoria Harbour and the principal shipping fairway, the Tathong Channel. Specifically it is situated between the former landfill sites and one of HKSAR's strategic landfill sites, the South East New Territories (SENT) Landfill, which is presently proposed to be extended to the south of its existing boundary. The area presently holds industrial type land uses (such as offices for Hong Kong Oxygen, Next Media,



WLCP	Easting	Northing	WLCP	Easting	Northing	WLCP	Easting	Northing	WLCP	Easting	Northing
1	845588.70	815897.93	17	844646.40	813703.38	33	845447.61	809899.21	49	849680.77	807095.91
2	845556.09	815866.54	18	844669.62	813648.58	34	845604.56	809780.81	50	850966.87	807010.88
3	845305.98	815905.89	19	844685.62	813611.68	35	846278.13	808981.74	51	857127.50	807037.45
4	845181.61	815925.38	20	844750.18	813348.72	36	846541.71	808745.68	52	857294.09	807122.57
5	845110.68	815898.08	21	844747.87	813179.67	37	846587.45	808705.84	53	858187.64	807575.78
6	844850.18	815797.85	22	844735.29	812289.73	38	846688.11	808502.90	54	859209.68	808734.05
7	844836.11	815782.70	23	844720.57	812188.95	39	847135.01	807602.02	55	859922.46	809541.99
8	844683.67	815618.73	24	844708.59	812107.37	40	847200.72	807516.98	56	860046.48	809682.63
9	844534.05	815321.70	25	844641.15	811648.90	41	847336.27	807341.75	57	860205.34	809737.32
10	844305.49	814867.76	26	844649.37	811049.83	42	847375.49	807290.84	58	861589.52	810214.74
11	844264.01	814687.79	27	844919.25	810509.60	43	847399.22	807260.22	59	866499.41	810855.95
12	844225.62	814520.38	28	845018.29	810386.56	44	847457.54	807184.60	60	866961.11	810673.40
13	844232.34	814484.58	29	845037.20	810363.13	45	847766.64	807050.09	61	867438.99	810476.69
14	844260.07	814335.84	30	845222.90	810132.35	46	847855.31	807058.83	62	869831.85	810619.15
15	844378.68	814186.41	31	845243.02	810107.27	47	848656.46	807137.33			
16	844469.78	814081.26	32	845352.72	809970.94	48	849142.30	807131.45			

Figure 1.1
圖 1.1

Proposed APG Submarine Cable System
擬建之APG海底光纖系統

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Apple Daily, Welcome Company Headquarters, Hitachi, ASB Biodiesel, Tseung Kwan O TVB City, etc).

It should be noted that TKO Industrial Estate is currently the landing site for a number of telecommunication submarine cables, and the APG cable will be the fifth cable to land into the area. There are four cables (three for East Asia Crossing (EAC) cable system [sharing the same BMH] and one for Asia Submarine-cable Express (ASE) cable system [using a separate BMH]) landing at this region and APG will share the same BMH as ASE. There is also an established cable landing station, belonging to Pacnet (formerly Asia Netcom) and a Data Centre belonging to NTT there.

With regards to the proposed APG submarine cable route, there are several existing submarine cables and pipelines situated along the proposed APG cable route, from its entrance into HKSAR waters through the eastern and southern waters. The seabed in the general vicinity of the proposed APG cable within the Tathong Channel up to the landing site has been disturbed from previous use as a designated Marine Borrow Area.

1.5 *CABLE ROUTE SELECTION PROCESS*

1.5.1 *Landing Site Selection*

In 2011, CMI Ltd signed a contract with the Hong Kong Science and Technology Parks (HKSTP) to build a Submarine Cable Landing Station inside the TKO Industrial Estate. It is HKSTP policy to provide common telecommunication submarine cable landing facilities for those operators who plan to build a submarine cable landing station at TKO Industrial Estate and therefore HKSTP reserved a submarine cable landing facility for CMI Ltd, the location of which is shown in *Figure 1.2*.

It should also be noted that TKO Industrial Estate is currently the landing site for a number of telecommunication submarine cables, including three for East Asia Crossing (EAC) and one for Asia Submarine-cable Express (ASE) and the geotechnical environment at the proposed landing point is considered to be suitable for telecommunication submarine cable installation. There is also an established cable landing station belonging to Pacnet (formerly Asia Netcom) and a Data Centre belonging to NTT at the TKO Industrial Estate and if setting up a submarine cable landing in Kowloon East, TKO industrial Estate is the preferred location. In addition, there has been no record of complaint or incident that indicates adverse effects to the surrounding environment from the installation or operation of the telecommunication submarine cables from other cable systems at the site.

Due to all these considerations, the site shown in *Figure 1.2* at TKO Industrial Estate is the selected landing site for the APG cable system in HKSAR.

1.5.2 *Marine Route Planning Considerations*

There are several existing environmental and physical constraints to the APG submarine cable route which confine its possible alignments. The cable must preferably be routed to avoid all known key environmental sensitive receivers/ areas, such as Fish Culture Zones (FCZs), Coral Communities of High Ecological Value, Coastal Protection Areas (CPAs), a Gazetted Artificial Reef, Mudflats in the marine environment (for details refer to *Section 3* and *Figure 3.1*), and be as far as possible from any land-based sensitive receivers such as Declared Monuments, sites of archaeological interest, and Sites of Special Scientific Interest (SSSI). The route must also aim to minimize disturbance to existing submarine cables and pipelines, thereby ensuring that the APG cable laying operations do not compromise their integrity. In addition, the proposed route must aim to minimize disturbance to the existing sea bottom.

Particularly with regard to the approach to the TKO landing site, a number of alternative APG submarine cable routes have been considered (*Figure 1.3*). The following text explains the specific considerations that have been taken into account in finalising the proposed APG submarine route as it approaches the TKO landing site. *Figure 1.3* shows the four alternative submarine cable routes considered (Options 1 to 4) and the key environmental and physical constraints in determining the final proposed option. *Figure 1.4* illustrates all the physical constraints of the proposed option (Option 2) and *Figure 3.1* shows the locations of the major environmental elements in the vicinity of the proposed cable system (Option 2).

1. The landing site cannot be approached from the west as this would involve traversing through the main Victoria Harbour, crossing pipelines, tunnels and anchorage areas to reach the open sea. It must therefore be approached from the south, via the Tathong Channel.

2. The chosen route must avoid the gazetted Sand Dredging and Mud Disposal Area located South and East of Tung Lung Chau. Therefore all options are forced to be routed to the west side of the Tathong channel off Shek O in this area.

3. West of Fat Tong Chau the route is physically constricted by existing cables and the Drainage Services Department (DSD) Sewage Pipeline and the proposed route aims to minimise multiple crossings with other submarine cables and pipelines. International Cable Protection Committee (ICPC) guidelines state that if possible a cable should not be laid within a distance of three (3) times the water depth from an existing cable; pipeline operators commonly specify a 500 m exclusion zone, but in any event a new cable should not be laid within the zone affected by rock dumping over the pipeline.

    - Option 4 routes to the east of the existing three EAC cables, but since the BMH it will use is located to the west of the BMH used by EAC cables, it would have to cross the three EAC cables near the BHM

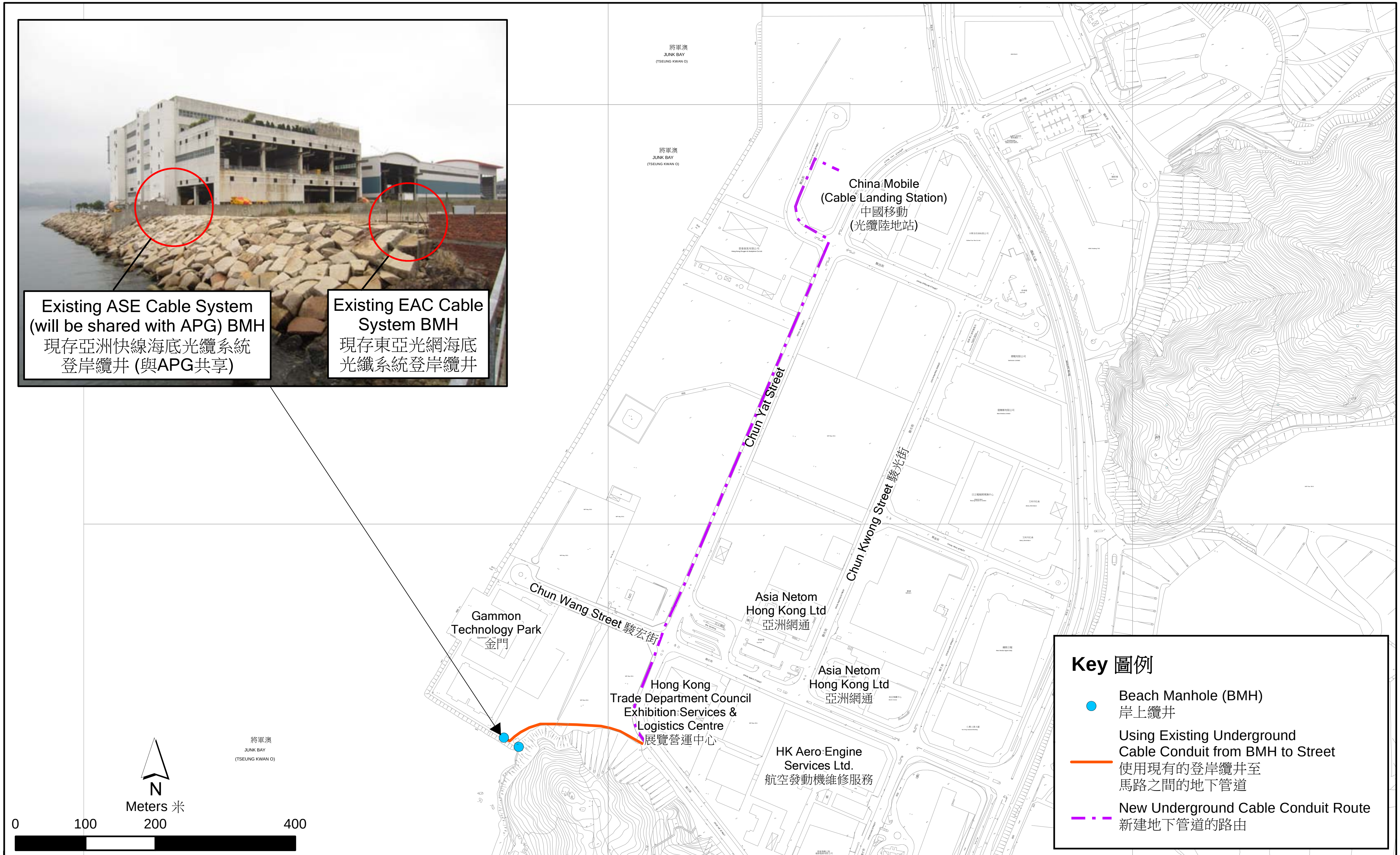

Figure 1.2
圖 1.2

Location of APG Landing Site and Terrestrial Cable Route
APG海底光纖系統登岸地點及陸上路由

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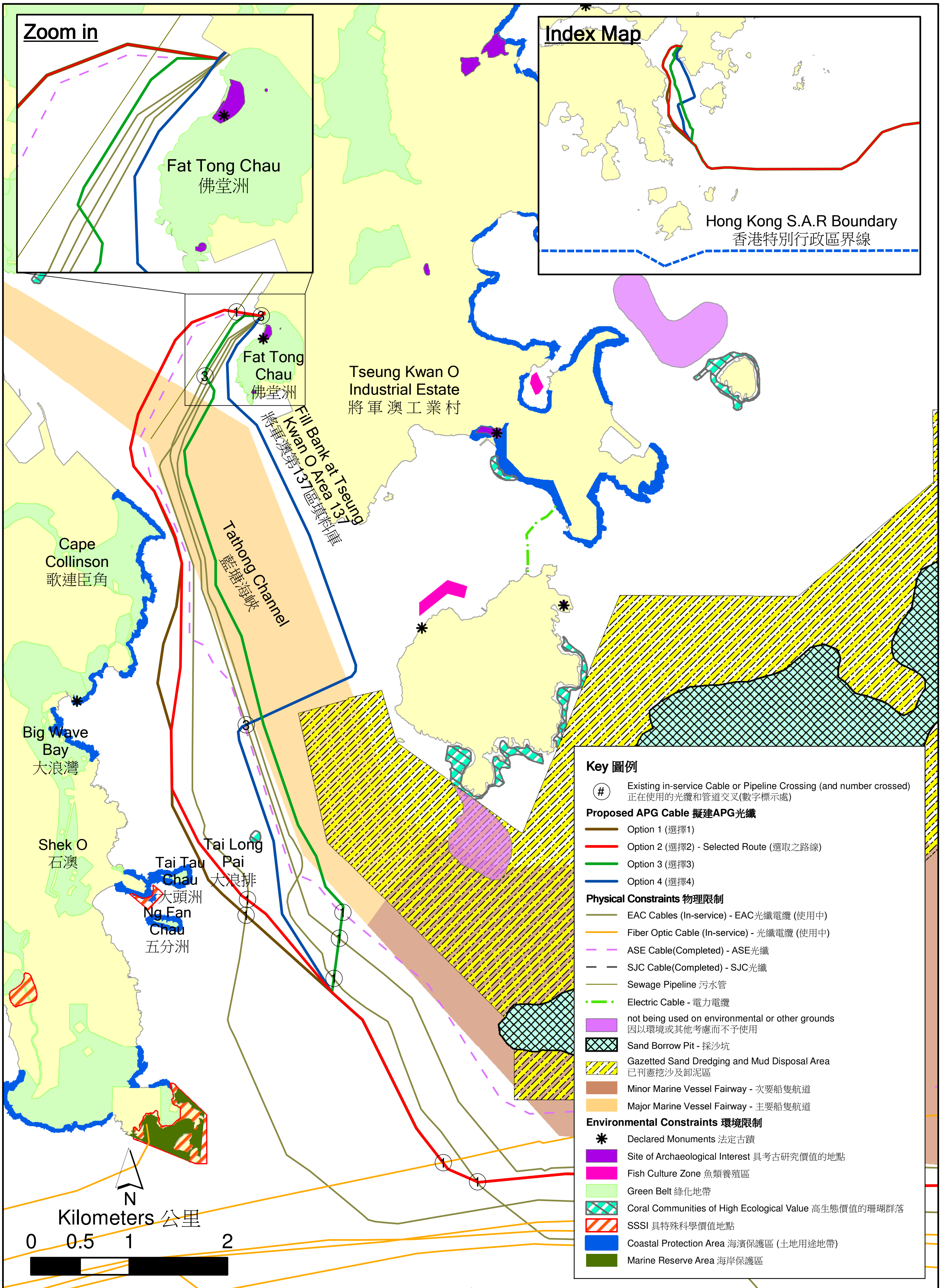

Figure 1.3
圖 1.3

Key Physical and Environmental Constraints in the Cable Route Selection Process
在光纜路線選擇時主要的物理與環境限制

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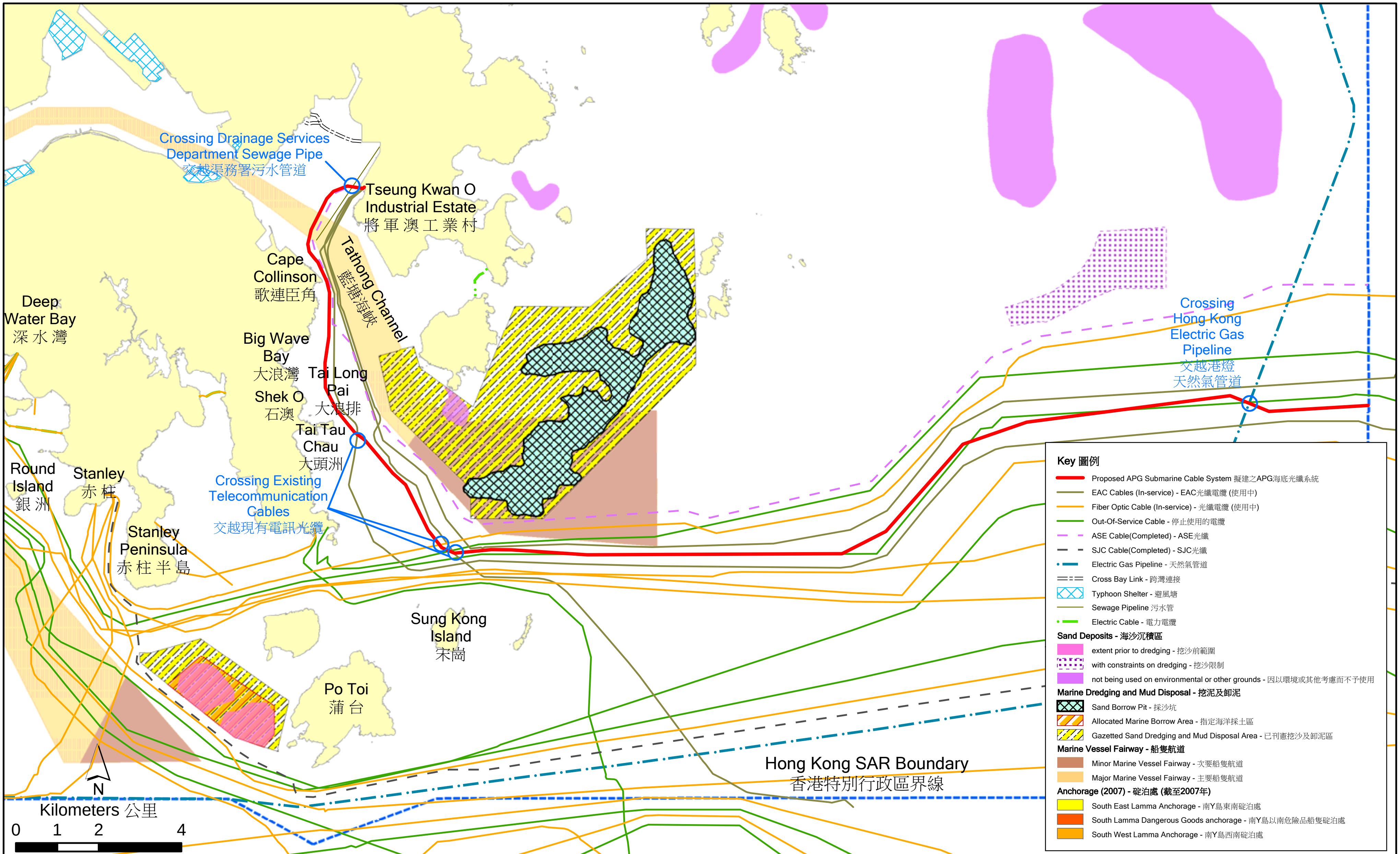

Figure 1.4
圖 1.4

Existing Physical Constraints for the Proposed Cable System
擬建的光纖的現有實質限制

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(Zoom In in *Figure 1.3*). The EAC cables near the BMH are only shallow buried (usually less than 2 m depth on approach to BMHs) and if using this Option 4, the APG cable would be above the existing seabed level, imposing a higher chance of damage during installation and future maintenance operation. It should also be noted that crossing outside BMH is not a common practice for cable installation.

- There is insufficient room between the DSD sewage pipeline and existing EAC cables for the safe installation of the APG cable immediately west of the existing EAC cables (Option 3). An offset of 50 m from the existing cables would be considered safe, but this would put the APG cable within the area potentially affected by rock dumping over the DSD sewage pipeline, resulting in a risk to cable burial equipment.

- Both Options 1 and 2 avoid crossing existing cables at the cable landing site and in Tathong Channel initially but do cross the DSD sewage pipeline. Further south they both cross existing in-service cables outside Tathong Channel in three (3) places as indicated in *Figure 1.3*.

- In summary, until the options start to follow the same route towards the south of the Tathong Channel, Options 1 and 2 cross existing in-service cables or pipelines a total of two times at two locations, Option 3 crosses existing in-service cables a total of six times at four locations and Option 4 crosses existing in-service cables a total of six times at two locations. In addition both Option 3 and Option 4 pose higher risks to installation or operation. Options 1 and 2 therefore appear the most favourable if considering only avoidance of existing submarine cables and pipelines close the TKO landing site and in the more northern Tathong Channel.

4. The Major Marine Vessel Fairway has a Traffic Separation Scheme (TSS) and this fairway/ TSS should be avoided where possible, so as to minimise impacts on marine traffic and maximise the safety of the APG cable laying operations.

   - Although Option 3 avoids existing cables running within the TSS fairway, it still runs along this major marine vessel fairway for over 4 km and health and safety considerations during installation as well as marine traffic considerations, this route is highly unfavourable.

   - Option 4 follows the east side of the major marine vessel fairway until forced to cross due to the Gazetted Sand Dredging and Mud Disposal area which must be avoided. It therefore crosses the major marine vessel fairway at one of its widest points, making it a less favourable option than Options 1 and 2 which cross further north at a narrower point, similar to where existing cable systems cross.

- In summary, Options 1 and 2 are preferred considering the minimization of health and safety during installation and minimization of disturbance in the TSS.

5. 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. The key areas of rocky outcrops that differentiate between the options are those either side of the Tathong Channel, to the west off Cape Collinson and to the east off Fat Tong Chau and the Fill Bank at TKO Area 137.

   - Option 4 is the only option to pass close the east coast of the Tathong Channel and the length of rocky outcrops on the seabed it would have to cross is very approximately 2.5 km in this area.

   - Option 3 does not cross rocky outcrop areas and hence is less likely to suffer damage once installed, despite a large segment being within the TSS where there is a high volume of large marine vessel traffic.

   - Options 1 and 2 cross rocky outcrop areas on the seabed off Cape Collinson to the west of the Tathong Channel. Very approximately 500 m of the cable route following these Options 1 and 2 may be affected by rock outcrops, on current estimates, and would need to be surface laid.

   - In summary, Option 4 is the least favourable considering the length of rocky outcrops crossed. Option 3 is the most favourable if only considering rock outcrops, as it does not cross any rocky outcrop areas.

6. Apart from the Major Marine Vessel Fairway/ TSS, other marine vessel fairways and anchorage sites should be considered.

   - Option 4 passes close by the Fill Bank at TKO Area 137. In view of potential traffic and environmental concerns associated with the trucks using the fill bank, a barging facility was established for TKO Area 137, to allow transport of public fill to/from the site by marine access [(1)]. Barge access to TKO Area 137 is therefore critical to its operation and it is likely that high numbers visiting the barging point daily. This area is also an area of rocky outcrop, so the cable for Option 4 would have to be surface laid or shallow buried passing this area of high barge traffic volume, making the chance of operation damage to the cable by barges dropping anchor etc, higher. None of the other options pass close enough to the TKO Area 137 for this consideration to be a concern.

(1) EIA for Fill Bank at Tseung Kwan O Area 137 (AEIAR-060/2002). Available at http://www.epd.gov.hk/eia/register/report/eiareport/eia_0762002/pdf%20file/EIA/toc.pdf [Accessed May 2013]

- In summary, considering just proximity to the Fill Bank at TKO Area 137, Option 4 is the least favourable option whereas all other options are equally favourable.

7. Impacts to sensitive coral habitats at Tai Long Pai islet and South and East of Tung Lung Chau must be avoided and the distance between the cable and these habitats maximised. Routes to the west of Tai Long Pai islet also need to consider the EAC cable here, which restricts potential route options here to a narrow channel.

   - Option 4 is the closest of all the options to the Tai Long Pai islet, passing approximately 105 m from it. Options 3 and 2 pass approximately 395 m to the east and 425 m to the west of Tai Long Pai islet respectively. Option 1 is approximately 550 m from Tai Long Pai islet and hence further away than Option 2, but therefore passes closer to the Shek O Headland SSSI and Costal Protection Area.

   - With regards to the sensitive coral habitats south and east of Tung Lung Chau, these are partly shielded by the gazetted Sand Dredging and Mud Disposal Area which all options must avoid (See *Figure 1.3*). Option 4 comes closest to this sensitive coral habitat, passing approximately 1,205 m from it just before it turns west to cross the Tathong Channel. Route 3 passes approximately 1,560 m to it at the closest point, where it runs within the Tathong Channel. Options 1 and 2 are furthest from this sensitive coral habitat, being approximately 2,395 m and 2,300 m at their closest points respectively.

   - In summary all options are over 1,200 m from the sensitive coral habitats south and east of Tung Lung Chau although Option 4 passes the closest to it. Option 1 is the furthest from all the recognised sensitive coral habitats and the most favourable taking only this consideration into account.

8. The proposed route should be as far as possible from any FCZs . Particularly there is a FCZ on the north of Tung Lung Chau in Joss House Bay.

   - Of all the options, Option 4 routes closest to the FCZ at Tung Lung Chau (approximately 780 m at its closest point). Options 1, 2 and 3 are approximately 2,460 m, 2,450 m and 1,800 m respectively from the FCZ at Tung Lung Chau and therefore are all considered to be far enough away that neither their construction nor operation would have any effect on it.

   - In summary, considering just the FCZ at Tung Lung Chau, Options 1-3 are preferable and Option 4 is not preferred.

9. The proposed route should be as far as possible from any land-based sensitive receivers such as Declared Monuments, sites of archaeological interest, and Sites of Special Scientific Interest (SSSI) which may be land and marine based.

   - The TKO landing site itself is close by a Declared Monument at Fat Tau Chau (Site of Chinese Customs Station) and two sites of archaeological interest (Fat Tau Chau Site of Archaeological Interest, and Fat Tau Chau Qing Dynasty Gravestone). Therefore all options are equidistance from these sensitive receivers at the landing point. Option 4 however, routing to the east of existing EAC cables and the TSS, passes closest of all the options to these sensitive receivers and in addition passes close (approximately 205 m at the closest point) to one more site of cultural heritage, the Fat Tau Chau House Ruin (locations are shown on *Figure 1.3*). Option 3 passes relatively close to the Declared Monument and two sites of archaeological interest compared to Options 1 and 2 which are the furthest away. Option 3 also passes approximately 380 m from the site of cultural heritage at Fat Tau Chau House at its closest point.

   - There is an SSSI at Shek O Headland which contains marine waters within its boundary. Options 3 and 4 are located furthest from this SSSI. Option 1 is closest (480 m ie less than 500 m) and Option 2 has been routed to maximize the distance between the proposed cable route and the SSSI (approximately 560 m at its closest point), although this distance is constrained from being bigger by having an existing cable to the east.

   - In summary considering just Declared Monuments, sites of archaeological interest, and SSSI, Option 1 is the only option that falls within 500 m of an SSSI, making it the least favourable option. All other options are equidistant to a Declared Monument and two sites of archaeological interest at the landing point, but Option 4 routes closest to them as it approaches the landing point and Options 3 and 4 also routes close to an additional site of archaeological interest (less than 500 m) making them less favourable. Therefore Options 2 is the more favourable option given just the considerations of land based sensitive receivers.

10. The proposed route should be as far as possible from any Coastal Protection Areas (CPAs) and Green Belt (GB) zoning. The CPAs at Shek O Headland (including Tai Tau Chau and Ng Fan Chau) and between Big Wave Bay and Cape Collinson are all considered during cable route selection. The CPA at the base of Cape D'Aguilar Peninsula is over 500 m from all the options and is therefore not discussed. The coastal area near Cape Collinson is zoned as GB and considered along with the Cape Collinson CPA during route selection, and an additional GB area on Fat Tong Chau is also considered.

- All options are over 500 m from the section of CPA and GB at Big Wave Bay, but further north in this CPA and GB zone, Options 1 and 2 approach within 500 m of the CPA at Cape Collinson and GB here (both approximately 90 m from the CPA at their closest points). Options 1 and 2 also pass approximately 140 m and 230 m respectively from the Shek O Headland CPA and GB at Tai Tau Chau at their closest points. Greater separation from the shoreline is prevented by these routes being planned to avoid the TSS as well as existing cables preventing the route being located further east but still outside the TSS. Following the ICPC guidelines, the cable owners of ASE and EAC (the cables landed at TKO Industrial Estate) requested minimum distance separation of 50 m in order to avoid potential damage of the existing cables due to the new cable installation. Since the clearance between the existing ASE and EAC (western cable) cables is less than 100m in most of the area, Options 1 and 2 cannot be installed between these cables at the section near Cape Collinson. Consequently, Options 1 and 2 must be routed to the west of ASE cable with a minimum of 50 m separation, and with a target moving further away from the shoreline at Cape Collinson.

- Although Options 3 is approximately 1,180 m from Shek O Headland CPA, it is approximately 410 m (ie within 500 m) from Cape Collinson CPA and GB zone at its closest point.

- Option 4 is over 500 m from all the CPAs in the area but is closest to the GB zone at Fat Tong Chau as it approaches the landing site. Option 3 is approximately over 200 m from this GB zone and Options 1 and 2 remain over 500 m from it for most of the route until they approach the landing site, which is itself very close the GB zone.

- In summary, although all options land near the GB zone in Fat Tong Chau, Option 4 passes closest to this zone (within 500 m) for longer than all other options. Option 4, however, avoids coming within 500 m of all other GB zones and the CPAs. Option 3 falls within 500 m of the Cape Collinson CPA and GB zone but is over 500 m from the Shek O Headland CPA and GB zone, whereas Options 1 and 2 route within 500 m of both Cape Collinson and Shek O Headland CPAs and GB zones. Option 1 is closer than Option 2 to Shek O Headland CPA and GB zone and both options are equidistant from the Cape Collinson CPA at their closet point, but Option 1 stays closer to the CPA and GB for longer than Option 2. No option is clearly favourable given just this consideration, as they all fall within 500 m of at least one CPA and/or GB zone.

In summary:

Options 3 and 4 are not preferred. Option 3 route along the TSS for a relatively much longer distance than any of the other options (which is not preferred from a marine traffic and safety point of view), and passes approximately 410 m (ie within 500 m) from the Cape Collinson CPA and GB zone at its closest point. It would also put burial equipment at risk to the west of Fat Tong Chau as it is so close to the DSD Sewage Pipieline. Option 4 passes very close to a sensitive coral habitat at Tai Long Pai. It is also the route that crosses the longest length of rocky outcrops where only shallow burial will be possible and therefore where the risk of operational damage is higher, particularly near the barging point for Fill Bank at TKO Area 137. Additionally Option 4 passes closest of all the options to the only FCZ in the area. Options 3 and 4 also route within 500 m of an additional site of archaeological interest compared to Options 1 and 2.

Generally given all the considerations, Options 1 and 2 are preferred and Option 2 is recommended as it maximizes the offset from the Cape Collinson and Shek O Headland CPAs and GB zones as well as being over 500 m from the Shek O Headland SSSI (which Option 1 is not). In addition, Option 2 maximizes the distance of the cable alignment from the identified coral communities of ecologically concern at Cape Collinson (~190m) and Tai Long Pai (~490 m) as discussed in *Section 3.10* .

1.6 NUMBER AND TYPES OF DESIGNATED PROJECTS TO BE COVERED BY THE PROJECT PROFILE

The installation works of a submarine cable system is classified as a Designated Project (DP) under the *Environmental Impact Assessment Ordinance (EIAO)* as specified below:

- 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 (ii) site of cultural heritage and (vii) coastal protection area. The coastlines (above high water marks) from Cape Collinson to Big Wave Bay and around Shek O are designated as "Coastal Protection Area (CPA)", and the shortest distance from the cable alignment to the Cape Collinson and Shek O CPAs are approximately 90 m and 230 m, respectively. One Declared Monument (Site of Chinese Customs Station (佛頭洲稅關遺址)) is located on the land side and within 500 m of the cable route.

1.7 NAME AND TELEPHONE NUMBER OF CONTACT PERSON

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

All queries regarding the project can be addressed to:

Environmental Resources Management
16/F DCH Commercial Centre
25 Westlands Road
Quarry Bay, Hong Kong
Attention: Partner (Landscape and Ecology)
Telephone: (852) 2271 3000
Fax: (852) 2723 5660

and

Axon Consultancy Ltd - APG Project Office
Unit 5B, 5/F, Worldwide Centre
No. 123 Tung Chau Street
Kowloon, Hong Kong
Attention: APG Project Manager
Telephone: (852) 2258 6392
Fax: (852) 3020 0321
and

China Mobile International Limited
Level 30, Tower 1, Kowloon Commerce Centre
No. 51 Kwai Cheong Road
Kwai Chung, New Territories
Hong Kong
Attention: Director
Telephone: (852) 3975 6688
Fax: (852) 3188 0374

2 OUTLINE OF PLANNING AND IMPLEMENTATION PROGRAMME

2.1 PROJECT PLANNING AND IMPLEMENTATION

The Project will be led and managed by CMI Ltd. Planning and construction of the submarine cable system will be undertaken by NEC Corporation on behalf of CMI Ltd.

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

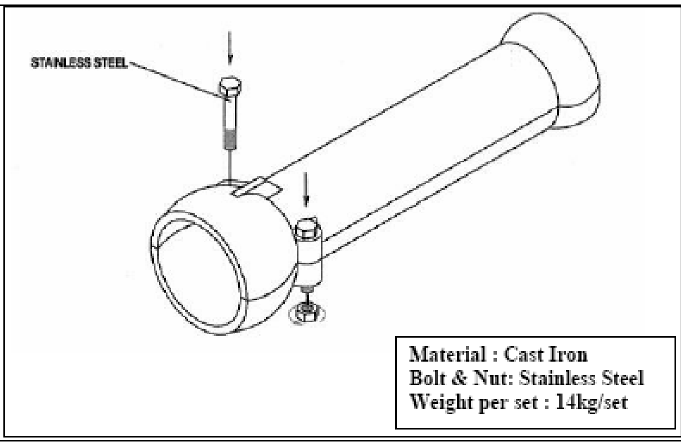
2.1.1 Land Cable Installation

The shore end of the APG cable segment will connect to the existing BMH via the existing conduit laid under the seawall. The seawall will not be disturbed during the cable installation. In order to complete the link between the BMH and the Cable Landing Station, the land cable will be installed in the conduit along the terrestrial route. Trenches for land cable laying will be excavated by open cutting. After laying the cables and fittings, the trench will be reinstated to the original condition. The trench will be constructed in one pass. The cable installation will typically be either by winch or hand pulling. This work will normally take approximately 45 days.

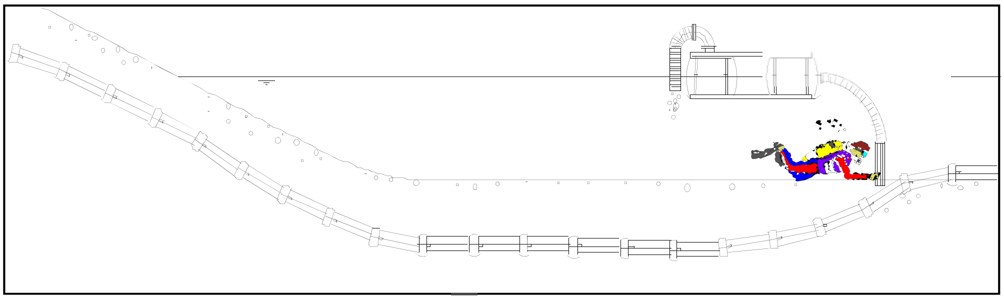
2.1.2 Shore End Cable Installation

The installation works will primarily involve two methods, divers and jetting technique depending on the workable water depth limitation for each technique. Approximately 20 m out from the exit of the conduit under the seawall at TKO, the target burial depth of the cable is approximately 2 m below the seabed. Cable burial for this segment will be undertaken by divers using jet probes to sink the cable (with articulated pipe protection) into the sediment (*Figure 2.1*).

Figure 2.1 *Typical Articulated pipe and Cable burial by Divers using Jet Probes*



Typical Articulated pipe

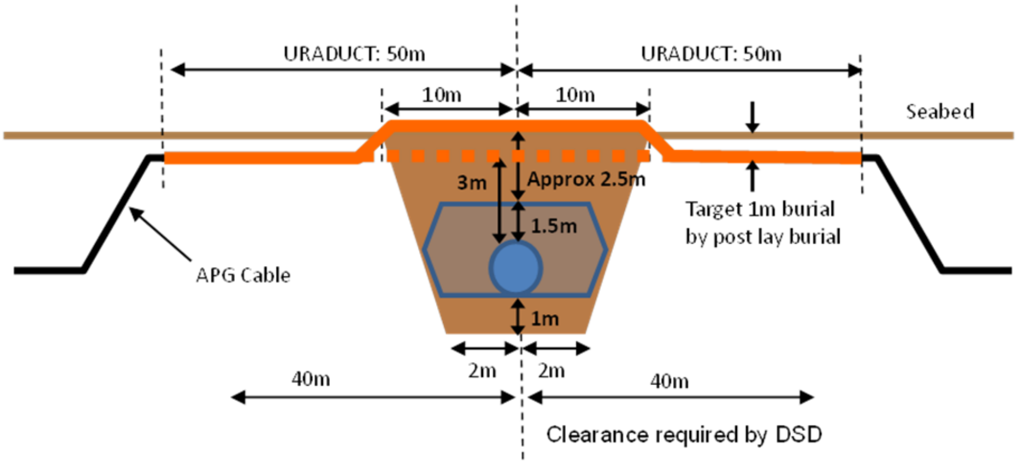


Diver jetting burial

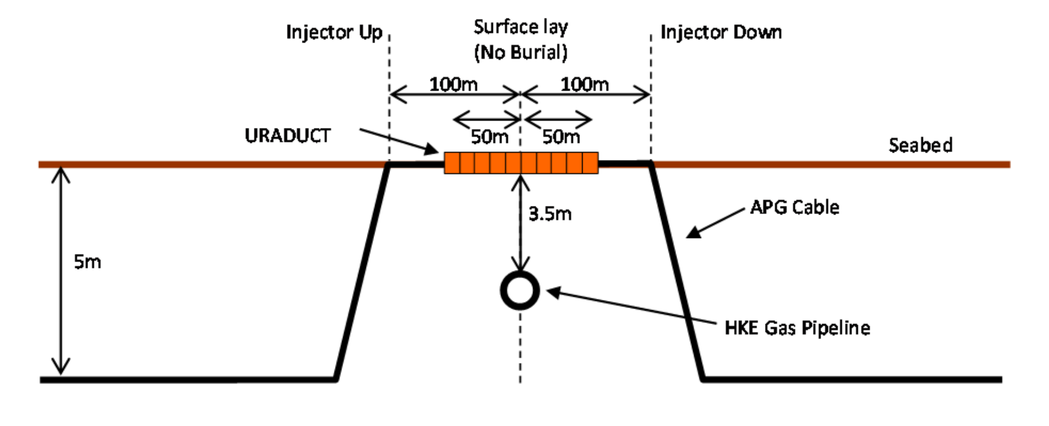
2.1.3 *Submarine Cable Installation*

Where the cable crosses the DSD sewage pipe and, closer to the boundary of HKSAR waters, the Hong Kong Electric Gas Pipeline, it will be surface laid and have a shallow burial for a distance of 50 m and 100 m centred on the crossing point respectively (*Figure 2.2*). The surface laid cable will be protected by URADUCT (*Figure 2.3*) which will not affect the existing seabed level or the utility that is crossed.

Figure 2.2 *Typical Crossing of Sewage Pipe and Gas Pipeline*



Crossing Section of Sewage Pipe Crossing



Crossing Section of Gas Pipeline Crossing

Figure 2.3 *Typical URADUCT Details*

ITEM	SPECIFICATION
Color	Orange
Material Density	1108 kg/m^3
Cable Outer Diameter	DA 47 mm
Uraduct Inner Diameter	49 mm
Uraduct Outer Diameter	99 mm
Wall Thickness	25 mm
Uraduct Half Shell Length	2000 mm
Minimum bend radius	1.05 m
Individual half shell weight	6.5 kg
Wait in air	6.5 kg/m
Wait in water	0.5 kg/m

Beyond this segment up to the HKSAR boundary, the target burial depth is approximately 5 m below the seabed.

Crossing existing telecommunication cables is expected to involve shallow burial, subject to the as-built burial depth of the existing cables. A cable localization operation will be performed at cable crossing points. To localize the exact cable location, a tone/magnet detector survey (using vessel) or diver survey with localised hand jetting will be conducted. The diver survey with localised hand jetting will only be conducted for existing cables that have been buried more than 2.5 m. 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.

The cable installation will be conducted by purposely built cable installation barge and cable burial machine. This section of the marine cable burial works will be conducted using the jetting technique. This method uses "Injector Burial Tool" or "Sledge Tool" which are designed to simultaneously lay and bury the cable (*Figures 2.4 & 2.5*). 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 0.5 m and the cable is buried to a maximum 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.

Figure 2.4 Simultaneous Cable Lay and Burial Operation using "Injector Burial Tool"

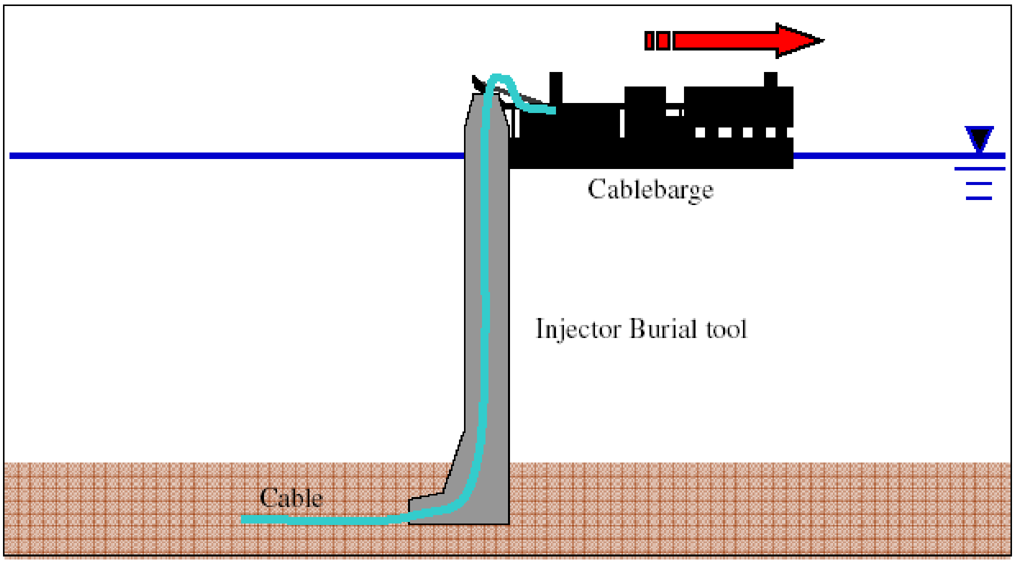
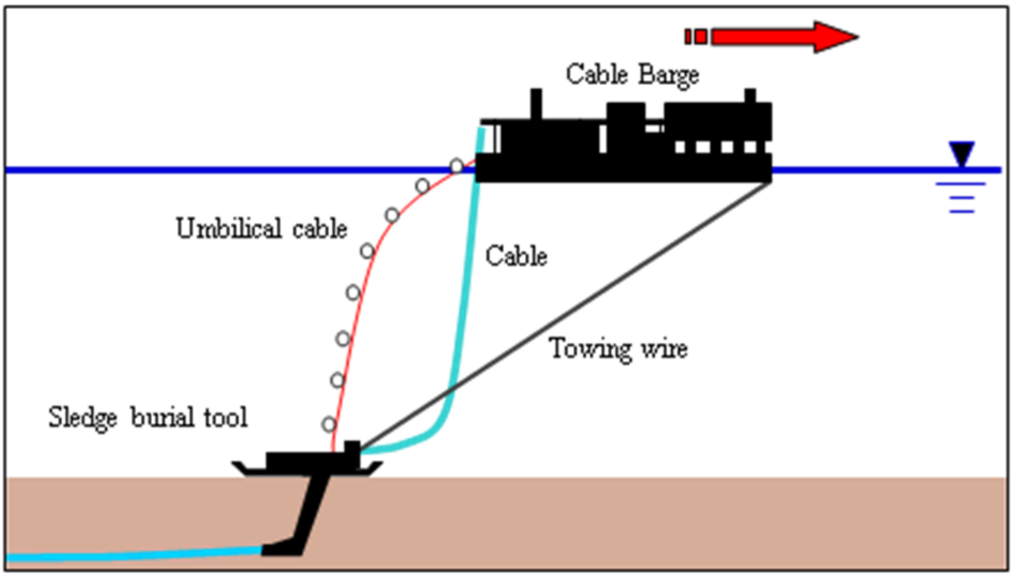


Figure 2.5 Simultaneous Cable Lay and Burial Operation using "Sledge Tool"



As part of the installation of the APG cable, the Route Clearance Operation (RC) and Pre-lay Grapnel Run (PLGR) over part of the proposed cable route where cable burial section will be conducted. The RC and PLGR operations will be scheduled to take place before the actual cable laying operation. The aim of RC and PLGR are to remove any Out of Service Cables, debris or obstacles deposited in the cable corridor, which may pose a threat to the cable or the burial machine. The penetration of grapnel fluke will not be more than 0.8 m. The clearance area for the RC and PLGR operations will cover 5 m on both sides of the cable (i.e. a total width of 10 m). All debris recovered from the seabed will be disposed to the approved dumping ground. In all circumstances, no towed equipment shall be used within 50 m of any pipeline or in-service submarine cable system identified by the tone/magnet detector survey. Since the RC and PLGR operation will only be carried out by mechanical towing over a very short period of time and restricted to limited areas, impacts to the marine environment are not anticipated. Photographic records of a typical Cable Installation Barge, Injection Burial Tool, Sledge Tool and Grapnel Anchor are presented in *Figure 2.6*.

Figure 2.6 ***Photographic Records of Typical Cable Installation Barge, Injector Burial Tool and Grapnel Anchor***

Typical Cable Installation Barge using Sledge Tool

Typical Sledge Tool

Typical Cable Installation Barge using Injector Burial Tool

Typical Grapnel Anchor

Typical Injector Burial Tool

2.2 *PROJECT PROGRAMME*

The APG cable system is provisionally scheduled to be landed and installed at TKO in the first or second quarter of 2014. The expected construction schedule within the HKSAR is as follows:

- Land Cable Installation ~45 working days
- Shore End Installation – Shallow burial by divers ~2 working days
- Shore End Installation/ Submarine Cable Installation – Deep burial by injector/ sledge, including detection of existing cables, route ~60 working days

clearance, cable installation and contingency. The actual cable installation (not include any weather downtime) will expect to be around 15 days.

All onshore installation works are expected to be undertaken during normal working hours. If evening or night-time works are later found to be necessary, a Construction Noise Permit (CNP) will be applied for.

3 MAJOR ELEMENTS OF THE SURROUNDING ENVIRONMENT

3.1 SHIPPING FAIRWAYS

The Tathong Channel Principal Fairway is a major vessel fairway. The cable corridor has been selected so as to reduce the length of the section crossing the Fairway (*Figure 1.3*).

3.2 CABLE, PIPELINES AND OUTFALLS

There are four existing submarine tele-communication cables and one sewage pipeline located at the cable landing site at Tseung Kwan O, and one gas pipeline near the HKSAR boundary. The proposed routing of the cable corridor reduces the number of crossings of existing cables and pipelines (*Figures 1.3* and *1.4*).

3.3 OTHER PROPOSED FACILITIES OR AMENITIES

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

3.4 GAZETTED BATHING BEACHES

The closest Gazetted Bathing Beaches are Big Wave Bay, Rocky Bay and Shek O, which are approximately 1,150 m, 880 m, and 1,120 m, respectively, from the closest segment of the proposed cable (*Figure 3.1*). These beaches will be unaffected by the cable installation works.

3.5 SEAWATER INTAKE

There is a Water Services Department (WSD) seawater intake in the inner part of Junk Bay and Siu Sai Wan, approximately 1,140 m and 740 m to the north of the closest segment of the cable respectively (*Figure 3.1*). A Cooling Water Intake of Pamela Youde Nethersole Eastern Hospital is located at Heng Fa Chuen approximately 1,320 m from the closest segment of the cable. These intakes will unlikely be affected by the cable installation works.

3.6 SITES OF SPECIAL SCIENTIFIC INTEREST

The closest Site of Special Scientific Interest (SSSI) is the Shek O Headland SSSI, approximately 560 m from the closest cable segment. The Hok Tsui (Cape d' Aguilar) and Ninepin Group SSSIs are situated about 1,750 m and 5,750 m from the closest cable segment, respectively (*Figure 3.1*). Hok Tsui (Cape d'Aguilar) SSSI is partially located in marine water but would be unlikely to be affected due to the long distance (over 1.7 km) from the closest cable segment. Ninepin Group SSSI is located on land and it will thus not be affected by the cable installation works. All the SSSIs in the vicinity are therefore more than 500 m from the closest cable segment and are not considered to be affected by the Project.

3.7 *MARINE PARK OR MARINE RESERVES*

The Cape d' Aguilar Marine Reserve is about 1,750 m from the closest proposed cable segment (*Figure 3.1*) and will not be affected by the cable installation works.

3.8 *FISH CULTURE ZONE*

The nearest FCZ is Tung Lung Chau FCZ, which is situated approximately 2,450 m from the closest cable segment (*Figure 3.1*). Tung Lung Chau and Po Toi FCZs (approximately 5,390 m from the closest cable segment) are not expected to be affected by the cable installation works.

3.9 *COASTAL PROTECTION AND CONSERVATION AREAS*

A small strip of land along Hong Kong Island and Fat Tong Chau (Junk Island), within 500 m of the cable alignment is designated as "Green Belt".

The coastline of Shek O Headland, Tai Tau Chau and Ng Fan Chau is designated as Coastal Protection Area "CPA", and the shortest distance from the cable alignment to this CPA is around 230 m. In addition, most of the coastline from Cape Collinson to Big Wave Bay is designated as CPA as well, and the shortest distance from the CPA to the cable alignment is 90 m. The project is thus classified as a DP under *EIAO 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 (vii) coastal protection area.

Given that the designated CPAs are located on land, it is anticipated that direct or indirect impacts from the cable laying works at the seabed are unlikely to occur to the CPAs at Shek O Headland, Tai Tau Chau, Ng Fan Chau and Cape Collinson to Big Wave Bay.

3.10 *CORAL COMMUNITIES*

There are coral communities of ecological concern along the entire coast of Ninepin Group SSSI, Po Toi, Sung Kong and Waglan Island and along the south-eastern coast of Tung Lung Chau at Tai Long Pai as well as along Cape Collinson. Coral communities of ecological concern are also present at the southwest of the Junk Bay (*Figure 3.1*). The shortest distance from the cable alignment to any of these ecologically concern coral communities, is approximately 190m and 490 m from those at Cape Collinson and Tai Long Pai respectively. Shortest distances between the proposed cable alignment and the other ecologically important coral habitats are all over 1 km.

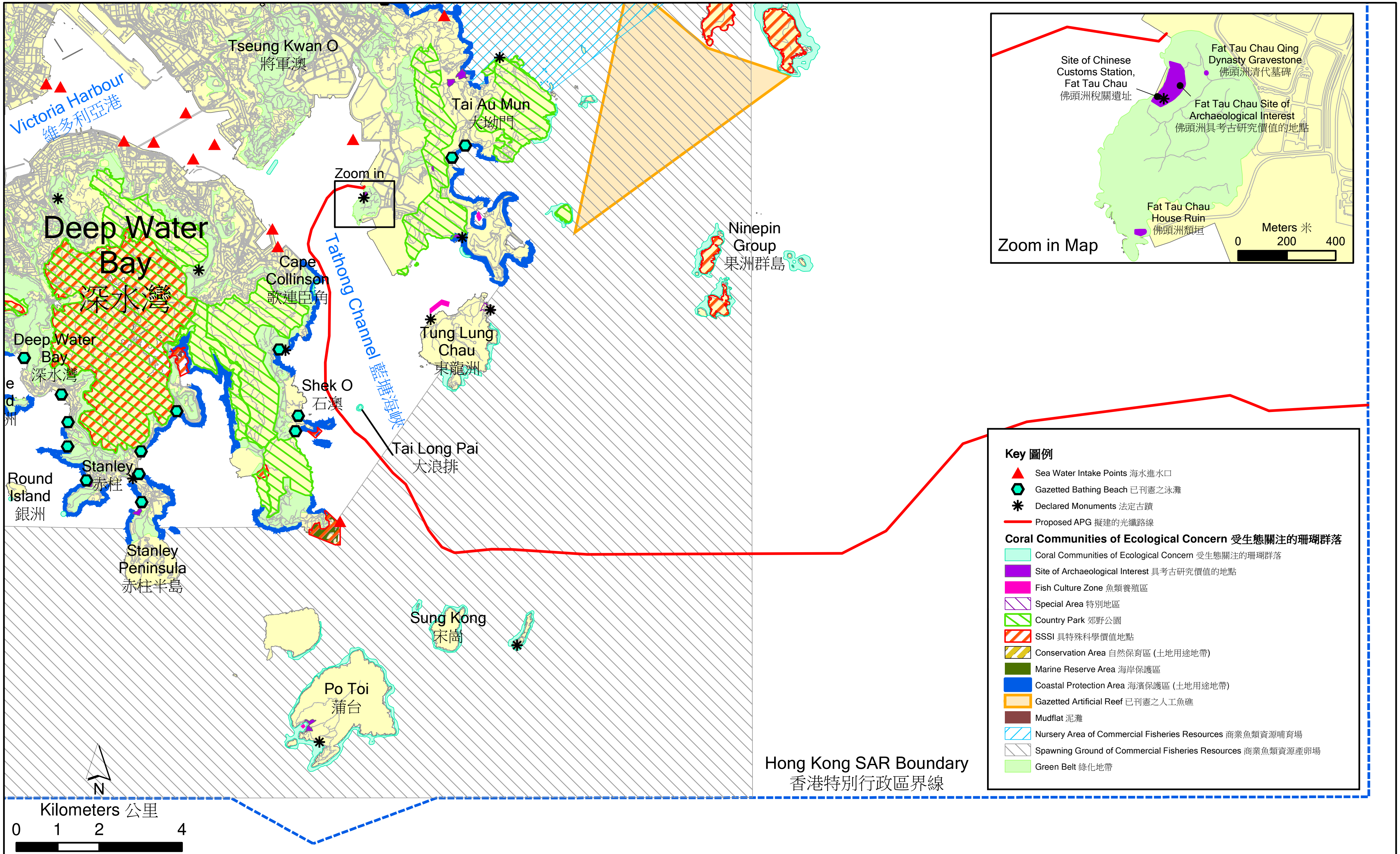


Figure 3.1
圖 3.1

Major Environmental Elements of the Areas in Vincinity of the Proposed Cable System
擬 建 光 纖 周 圍 的 環 境 要 素

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Date: 26/9/2013

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AXON CONSULTANCY
Environmental Resources Management
ERM

3.11 *CULTURAL HERITAGE*

A Declared Monument, Site of Chinese Customs Station (佛頭洲稅關遺址) on Junk Island (Fat Tau Chau), is situated at approximately 240 m south away from the landing site of the cable route. Besides, according to the *List of Sites of Archaeological Interest in Hong Kong (as at November 2012)*, there are two sites of archaeological interest located within 500 m of the cable routes on the land side, namely Fat Tau Chau Site of Archaeological Interest (佛頭洲具考古研究價值的地點) and Fat Tau Chau Qing Dynasty Gravestone (佛頭洲清代墓碑). The project is classified as a DP under *EIAO* 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 (ii) site of cultural heritage. However, all of these on land 'Declared Monument' and 'sites of archaeological interest' are expected to be unaffected by the cable installation works.

The routing of the proposed submarine APG cable system is very similar to the Asia Submarine-cable Express (ASE) and certain sections fall within the geophysical survey area conducted under the ASE marine archaeological investigation (MAI). Therefore reference has been made to the findings from the ASE MAI (1).

Three shipwrecks on the United Kingdom Hydrographic Office's (UKHO) Wreck database were reported to be located in the Study Area; two were found not to exist; and the third is located 205 m north east of the proposed cable position and lying very close to an in-service cable, therefore possibly a recent shipwreck and of no archaeological interest. Seven sonar contacts lying on the seabed, between 156 – 396 m from the cable position, were interpreted as dumped material/debris, and the recent UKHO shipwreck. No sub-bottom contacts were interpreted as sites of archaeological interest.

(1) ERM-Hong Kong Limited, 2011, Project Profile for the Asia Submarine-cable Express - Tseung Kwan O for NTT Com Asia Ltd.

4 POSSIBLE IMPACTS ON THE ENVIRONMENT

4.1 SUMMARY OF POTENTIAL ENVIRONMENTAL IMPACTS

The cable laying process will only require minor works within the marine environment and only small scale construction works are required at the cable landing site to enable the cable to enter the existing BMH and connect to the Cable Landing Station at TKO Industrial Estate. The construction impacts associated with the proposed APG cable system are summarised in *Table 4.1* and are described in further detail in the following sections.

There are no environmental impacts that are expected to occur during the operation of the submarine cable system.

Table 4.1 Potential Sources of Environmental Impacts

Potential Impact	
• 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	×
• Risk of Accidents Which Result in Pollution or Hazard	×
• Disposal of Spoil Material, Including Potentially Contaminated Materials	×

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

4.2 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:

- 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;
- 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
- Best Management Practices (BMPs) will be applied to avoid and minimise contaminated runoff from work sites, marine plants and vessels.

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.

4.2.2 *Marine Based Activities*

The marine based construction activities involve route clearance and burying the cables below the existing seabed as elaborated in *Section 2.1*. Minimal water quality impact is anticipated during route clearance. The cable will be buried to an intended depth of 5 m below the seabed using a barge mounted injection tool along most of the route. The immediate shore end section (~20 m from end point of conduit under the seawall of the TKO Industrial Estate) will be buried approximately 2 m below the seabed (by divers). The burial depth is necessary to provide protection to the cable. The injection jetting tool utilises water injection technology to fluidise the sediments, which enables the tool to penetrate the seabed to the desired depth and so to lay the cable. The cable burial works in HKSAR waters are expected to be completed in an approximate 15 day period, while the overall marine works including detection of existing cables, route clearance, cable installation and contingency may be up to 62 days (including 2 days of shallow burial by divers). The maximum speed of the cable installation barge during cable laying will be approximately 1 km $hour^{-1}$.

Cable laying works will result in the temporary formation of an area of suspended sediments around the injection tool, which will remain close to the seabed and settle out quickly. The sediments disturbed during cable laying works will remain in suspension for a short period of time, and hence the potential for the release of any contaminants from sediments and exertion of an oxygen demand on the receiving waters will be limited and are not expected to cause adverse impacts to water quality.

Analysis of the potential transport of fine sediments suspended in the water column during cable burial works was undertaken and it was determined that the sediments would settle onto the seabed in less than 4 minutes (see *Section A4.2* of *Annex A*). The maximum distance of transport for the suspended sediments would be approximately 180 m (see *Annex A*). It is hence expected that a plume of suspended sediments would not reach the WSD seawater intakes at Inner Junk Bay and Siu Sai Wan, nor the Shek O Headland SSSI or ecologically important coral colonies along the Tung Lung Chau coast or at Tai Long Pai. As presented in *Annex B*, it is anticipated that the amount of suspended sediments in the water column would be back to the natural background level before reaching the coral community at the south Cape Collinson (concerning the area with relatively higher coral diversity; see *Section B1.2.7* of *Annex B*) which is located at 190m away from the nearest cable alignment. The potential disturbance to corals are expected to be limited and transient given the short-term nature of the cable laying works which will only last for a total of approximately 15 working days for the whole alignment. With the provision of silt curtains as precautionary measure, unacceptable impacts to the coral community at the south of Cape Collinson are not expected to occur.

It is also predicted that no unacceptable adverse impacts will be posed to water quality at any gazetted Bathing Beaches, FCZ and Cape d' Aguilar Marine Reserve, as they are all located over 1 km from the closest segment of the cable.

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 will occur during or after the marine works.

The operation of the cable will not result in any pollutant emissions into the surrounding waters.

4.3 Disruption of Water Movement or Bottom Sediment

There will be small scale temporary displacement of bottom sediment during the laying of the APG 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

A review of the existing information on the marine ecological resources surrounding the cable route and landing site has identified the area as supporting benthic fauna which can be considered as typical for Hong Kong waters and, therefore, of generally low ecological value (see *Annex B*).

Although these bottom assemblages will be disturbed during the cable laying works, the impacts are expected to be rather localized and short term in duration and rapid reinstatement of the seabed will result in the area being available for prompt recolonisation. Hence, no unacceptable impacts are likely to occur.

No coral communities of ecological importance have been identified within the cable corridor or at the landing site (see *Annex B*). Coral assemblages of high ecological value have been identified around Ninepin Group Site of Special Scientific Interest (SSSI), Po Toi, Sung Kong, Waglan Island and Tung Lung Chau, which is more than 1,170 m from the proposed cable route (see *Figure 3.1*). As the dispersion of the sediment plume is predicted to be no more than 180 m from the cable burial tool (Injector Burial Tool), the coral communities are not expected to be affected by the Project (see *Annexes A* and *B*). The coral communities at Fat Tong Chau, Tai Long Pai, and the south of Cape Collinson (concerning the area with relatively higher coral diversity; see *Section B1.2.7*) which are located approximately 695 m, 490 m and 190 m, respectively, from the cable alignment, will not expect to experience unacceptable disturbance during the cable laying works (see *Annex B* and *Section 4.2* above).

As mentioned in Section 3.6, the Hok Tsui (Cape d'Aguilar) and Ninepin Group SSSIs are situated about 1,750 m and 5,750 m from the closest cable segment, respectively (*Figure 3.1*). Hok Tsui (Cape d'Aguilar) SSSI is partially located in marine water but would be unlikely to be affected due to the long distance (over 1.7 km) from the closest cable segment. Ninepin Group SSSI is located on land and it will thus not be affected by the cable installation works. The closest SSSI is the Shek O Headland SSSI, approximately 560 m from the closest cable segment. Since the maximum distance of transport for the suspended sediments would be approximately 180 m (see *Annex A*) and all the SSSIs in the vicinity are more than 500 m from the closest cable segment and are not considered to be affected by the Project.

The south eastern waters of Hong Kong are not considered to be a frequently used habitat for the Indo-pacific Humpbacked Dolphin, however, the Finless Porpoise has been regularly sighted in the area, particularly during the summer season. The cable installation works involve very few vessels, typically just one, which is slow moving (1 km $hour^{-1}$) during short-term installation works (about 15 working days in HKSAR waters). Given that any sediment plumes generated by the works will remain in close proximity to the seabed and travel no more than 180 m from the works and, that the vessel involved in the work is slow moving, disturbances to Finless Porpoises (or any Indo-pacific Humpbacked Dolphin in the area) arising from cable laying vessel in the area are not expected (*Annex B*).

Cable laying works using burial machine 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 sounds generated during the works. Given that Finless Porpoises (the more abundant of the two marine mammal species in this area) use high frequency ultrasonic clicks for foraging and communication, the low frequency underwater sound associated with vessels, jetting and cable laying would not be expected to interfere significantly with them. Equally, although some vessel sounds may be within the audible range of Indo-pacific Humpbacked Dolphins, 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 barge. Moreover, barge operation for installation works will take a total of approximately 15 working days in HKSAR waters and over this short timeframe is not expected to interfere significantly with Indo-pacific Humpbacked Dolphins either. Therefore no unacceptable adverse impacts to Finless Porpoises (or Indo-pacific Humpbacked Dolphins in the area) from underwater sounds are expected to occur.

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

The land-based CPAs would unlikely be affected by the marine construction activities. As there are no unacceptable impacts predicted to occur to marine ecological resources, no mitigation measures are recommended other than those proposed to minimise potential impacts to water quality. However, additional precautionary measure (implementation of marine mammal exclusion zone) will be implemented for marine mammals during the cable installation works (*Annex E*).

4.5 *FISHERIES*

A review of the existing information on the fisheries resources and fishing operations surrounding the cable route has identified along the majority of the route it is mostly at a low to moderate level of fisheries production (0 - 200 kg of adult fish per hectare; $0 - $5,000 of adult fish and fish fry per hectare) in HKSAR waters in terms of catch weight and value.

In addition, the increase in suspended solids concentrations will be localised, occurring within 180 m of the cable alignment, and the marine works will last for a total of approximately 15 working days. 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 and subsequently fisheries resources or fishing operations (see *Annex C*).

There are no AFCD gazetted FCZs within 500 m of the proposed cable route. The Tung Lung Chau FCZ, which is the closest FCZ to the cable, is located about 2,450 m away from the cable route. No specific fisheries mitigation measures have been recommended as no impacts to fisheries resources have been identified.

(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

It should also be noted that the maximum works area occupied by the cable installation barge during normal operation will be approximately 125m x 200m. In view of the small area occupied by the cable installation barge during operation (marine works will last for a total of approximately 15 working days), potential impacts on vessel transit and fishing activities along the cable alignment are not expect to be anticipated.

4.6 *NOISE*

There are no Noise Sensitive Receivers in the TKO Industrial Estate and thus noise generated during construction of the cable landing site and connection with the existing BMH will not result in noise impacts.

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

Cable laying and burial is at present not expected to take place at night. If evening or night-time works are later found to be necessary, a Construction Noise Permit (CNP) will be applied for.

4.7 *CULTURAL HERITAGE*

A literature review identified that a Declared Monument (Site of Chinese Customs Station (佛頭洲稅關遺址) on Junk Island (Fat Tau Chau) is located approximately 240 m south of the proposed landing site and two sites of archaeological interest (Fat Tau Chau Site of Archaeological Interest (佛頭洲具考古研究價值的地點) and Fat Tau Chau Qing Dynasty Gravestone (佛頭洲清代墓碑)) are located approximately 120 m and 240 m respectively southeast of the proposed landing site. Nevertheless, these sites are located outside the reclaimed land area where the proposed landing site will be situated; these identified sites will not be impacted by the construction work of the landing site. No graded historic buildings recorded by the AMO are located within 500 m of the cable route, thus impact on graded historic buildings is not anticipated.

No impact on terrestrial archaeological resources from this project is anticipated as the proposed landing site is situated on reclaimed land without archaeological potential and historical structures.

A marine archaeological investigation conducted by a qualified marine archaeologist, as detailed *Annex D*, has concluded that two shipwrecks were found not to exist though reported in United Kingdom Hydrographic Office's (UKHO) Wreck database. The third reported shipwreck is located 205 m north east of the proposed cable position and lying very close to an in-service cable, therefore is possibly a recent shipwreck and of no archaeological interest. Seven sonar contacts lying on the seabed of between 156 – 396 m from the cable position were interpreted as dumped material/debris, and the recent UKHO shipwreck. No sub-bottom contacts were interpreted as sites of archaeological interest and therefore impacts on sites of marine archaeological interest are not anticipated.

4.8 OTHERS

Waste Management: During the cable landing work, no waste material will be generated at the site, other than general construction waste materials which will be handled and disposed of in accordance with the *Waste Disposal Ordinance*. There will be no dredged materials and any excavated material generated during the new street conduit installation works will be balanced on site and will be used for *in-situ* backfilling. Therefore, no adverse waste impacts (either direct or indirect) will be generated from cable installation and construction of the new cable conduit.

Landscape and Visual: Since the cable conduit is laid under the sea-shore wall and under the Street, and the submarine cable is buried in the seabed, it will not cause any visual obstruction or inconvenience to the public.

Terrestrial Ecology: No impacts to terrestrial ecology will arise from the construction and operation of the submarine cable.

Dust: Dust is expected to be negligible due to the limited area, small quantity of earth to be excavated/moved, and short duration of the cable installation works.

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. These emissions will not impact Air Sensitive Receivers.

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

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

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

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

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

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

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

5 PROTECTION MEASURES AND ANY FURTHER IMPLICATIONS

5.1 ENVIRONMENTAL PROTECTION MEASURES

5.1.1 Construction Phase

Potential water quality impacts associated with the Project during the construction phase may involve minimal disturbances to the nearest coral communities at the south of Cape Collinson (concerning the area with relatively higher coral diversity; see *Section B1.2.7* in *Annex B*), and Tai Long Pai (approximately 190 m, and 490 m to the closest section of the proposed cable alignment respectively). Potential water quality impacts may also lead to potential disturbance to SSSI at Shek O Headland (approximately 560 m to the closest section of the proposed cable alignment). The sediment plume calculation indicates that the corals and the SSSI are not expected to be affected by the cable laying activities (it is anticipated that the amount of suspended sediments in the water column would be back to the natural background level at 180m away from the nearest cable alignment).

Specific measures have been proposed to minimise the impacts to water quality and marine ecology during the construction phase (refer to *Annexes A & B*). Silt curtain of multi-layers has been proposed as a precautionary measure for the coral community at the south of Cape Collinson and details refer to *Figure A3 of Annex A*.

5.1.2 Operation Phase

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

5.2 POSSIBLE SEVERITY, DISTRIBUTION AND DURATION OF ENVIRONMENTAL EFFECTS

The installation of the submarine cable system in HKSAR waters is expected to take approximately 62 days (including 2 days of shallow burial by divers) and the land cable installation is expected to take approximately 45 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

At present there are no planned concurrent projects in vicinity of the proposed cable route, and therefore no cumulative impact is expected during the construction and operation of the Project.

5.4 *FURTHER IMPLICATIONS*

As TKO Industrial Estate 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 and there has been no record of complaint or incident that indicates adverse effects to the surrounding environment from the installation or operation of the submarine cables.

The methods used for burying the APG cable system, as described above, have been used in HKSAR 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.

6 ENVIRONMENTAL MONITORING & AUDIT

Although no unacceptable environmental impacts have been identified, it is recommended to carry out water quality monitoring and coral monitoring and to implement a marine mammal exclusion zone to verify and ensure that the project works will not result in any impacts to water quality, marine ecology and fisheries. The Environmental Monitoring & Audit (EM&A) requirements are discussed in *Annex E*.

Tseung Kwan O Industrial Estate is already the landing site of several submarine cable systems, which provide connectivity between major countries in Asia Pacific. EIA Reports were not prepared under the EIAO for these cable systems, with the exception of the SEA-ME-WE 3 Fibre Optic Submarine Cable System. It is assumed that permissions for the majority of the cable systems were given before the *EIAO* process was instigated in 1997. The project profile of the Hong Kong Telecom International Limited's project, entitled "*Cable Landing Work in Deep Water Bay for SEA-ME-WE 3 Fibre Optic Submarine Cable System*", 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).

Two Project Profiles for the Asia Global Crossing, entitled "*East Asian Crossing (EAC) Cable System*" and "*East Asian Crossing (EAC) Cable System (TKO)*" were submitted to the EPD in June 2000 (AEP-079/2000) and July 2000 (AEP-081/2000) respectively. The Project Profile for NTT Com Asia Limited entitled *"Asia Submarine-cable Express (ASE) - Tseung Kwan O "*was submitted to the EPD in November 2011 (AEP-433/2011). The landing site for all three of these submarine cable systems was also in Tseung Kwan O Industrial Estate. The studies 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 Permits were granted on 6 September 2000 (EP-079/2000), 4 October 2000 (EP-081/2000) and 20 December 2011 (EP-433/2011).

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

- *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).

- *South-East Asia Japan Cable System (SJC) Hong Kong Segment*, China Telecom (Hong Kong) International Limited. The Project Profile for this study 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).

- *VSNL Intra Asia Submarine Cable System - Deep Water Bay,* Videsh Sanchar Nigam Ltd. The Project Profile for this study was submitted to EPD on 31 August 2007 (AEP-294/2007). 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 23 November 2007 (EP-294/2007).

- *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 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).

- *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).

- *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).

- *New T&T Hong Kong Limited: Domestic Cable Route,* New T&T. The Project Profile for this Study 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).

- *C2C Cable Network - Hong Kong Section: Chung Hom Kok,* GB21, Hong Kong Limited. The Project Profile for this Study 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).

- *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).

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1 *基本資料*

1.1 *工程項目名稱*

本工程項目的名稱是"Asia Pacific Gateway（APG）–將軍澳"（以下簡稱"本工程項目"）。

1.2 *工程項目的目的和性質*

為了滿足東南亞和北亞之間龐大的遠程通訊服務需要，APG聯盟決定建造一條海底遠程通訊光纜系統，全長約10,400千米，連接區內各個主要商業樞紐。這條光纜會連接多個國家，包括馬來西亞、新加坡、越南、台灣、中國大陸、日本、韓國和香港特別行政區。

此外，光纜亦會有支線連接至在香港境內的將軍澳。中國移動國際有限公司（CMI）作為APG聯盟的成員之一，將負責香港境內的登岸工程。

本項目簡介包含了對在香港境內鋪設這條海底光纜系統，以及在將軍澳的登岸接駁工程的潛在環境影響評估。這項評估是根據項目倡議者所提供的預期施工情況資料而作出的。在鋪設完成後，該光纜在運作期間不會對環境造成任何影響。

1.3 *工程項目倡議人名稱*

中國移動國際有限公司（CMI）作為APG聯盟的成員之一，負責香港境內的光纜登岸事宜，因此是本工程項目的倡議人。聯絡方法如下：

中國移動國際有限公司
九龍貿易中心1座30樓
葵昌路51號
葵涌
新界
香港

1.4 *工程項目的地點、規模及工地簡史*

1.4.1 *地點*

擬建的APG海底光纜系統在香港境內的路線，請參閱*圖1.1*。該光纜系統的登岸地點位於將軍澳工業邨內一條堆石海堤之後的填海區（見*圖1.2*）。擬建光纜會從一個現存的岸上纜井登岸，然後最終接駁至將軍澳工業邨內的光纜登岸站。該站已獲屋宇署批准（屋宇署編號2/9229/11 (P)），目前在興建中，預計將於2014年竣工。岸端的一段APG海底光纜系統，會經過鋪設於海堤下的現有導線管連接至現有的岸上纜井。從岸

上纜井連接至光纜登岸站的一段陸上光纜，會裝設於一條沿著陸地路綫伸延的導管內。從岸上纜井至駿日街的一段地下光纜導線管已經存在，但沿著駿日街至光纜登岸站的地下光纜導線管則需新建（見*圖1.2*）。

擬議鋪設的海底光纜會從將軍澳向西伸延，並在接近藍塘海峽時向南伸延。在光纜橫過藍塘海峽後，並伸延至靠近歌連臣角時，便會大致上與藍塘海峽平行地伸延，直至到達宋崗島以北才向東伸延至香港特別行政區海域的邊界，並進入南中國海。*圖1.1*描述了擬建APG海底光纜系統的路線。

1.4.2 *項目規模*

在香港海域內鋪設的APG海底光纜系統的預計掩埋深度為5米，直至到達將軍澳工業邨海堤下的導線管尾端前約20米處（掩埋深度約為2米）。在香港海域內的海底光纜總長度約35千米。

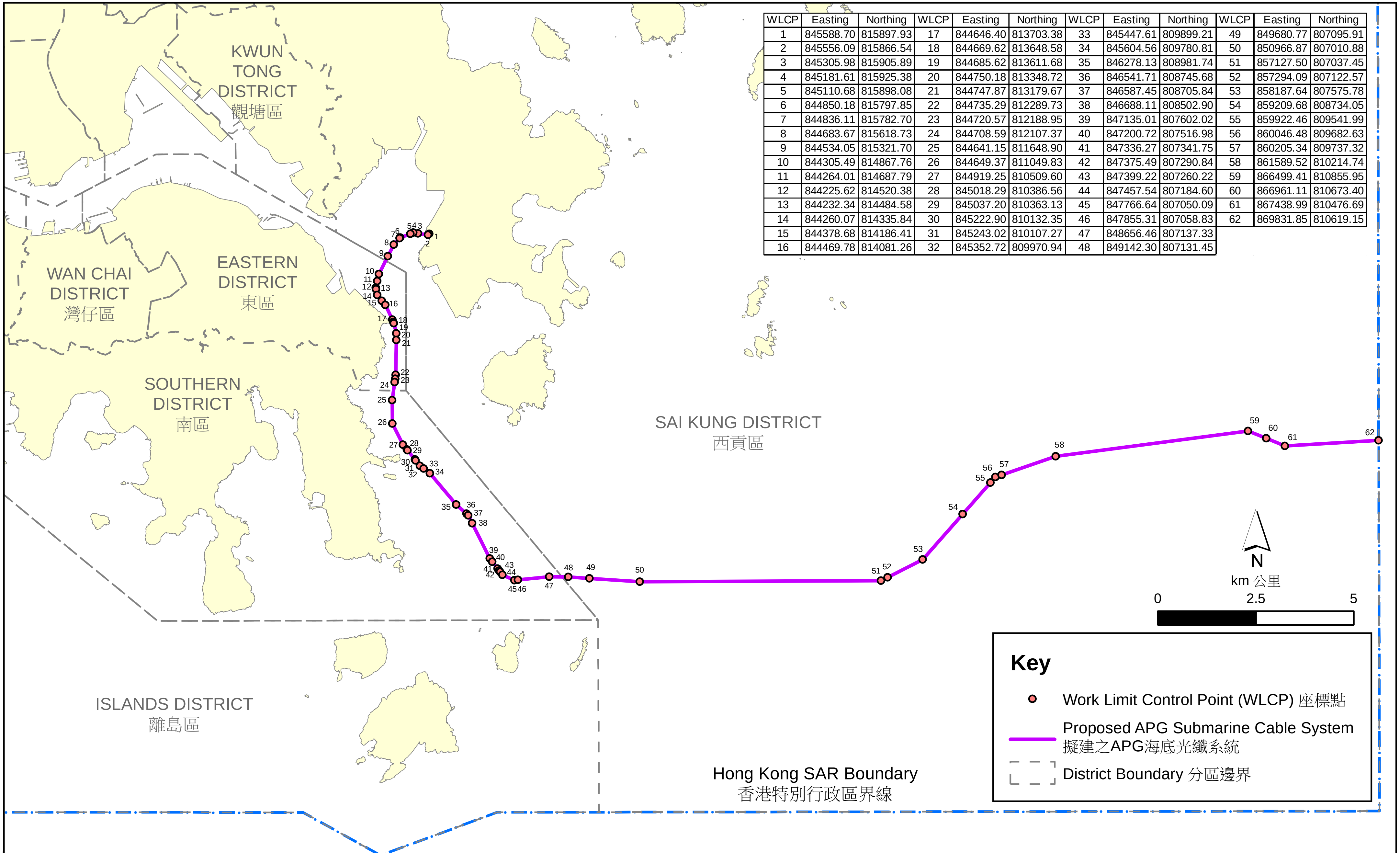
從岸上纜井至光纜登岸站之間，位於地下導管內的陸上光纜線，約有220米會位於岸上纜井至駿日街的現有地下導管內，另外約有970米會位於由駿日街至擬建光纜登岸站的新建地底導管內。

1.4.3 *項目地點簡史*

將軍澳工業邨位於一片新近填海而成的土地上（1993/1994），面向維多利亞港的東南進出航道和藍塘海峽這條主要航道。具體而言，它位於舊堆填區和新界東南堆填區之間。現時有建議要把後者向南面擴建。該區現時的土地用途多屬工業類（例如香港氧氣、壹傳媒、蘋果日報、惠康總部、日立、ASB生物柴油、將軍澳電視廣播城等）。

應予注意的是將軍澳工業邨現時是多條遠程通訊光纜的登岸地點。APG海底光纜系統將會是第五條於該區登岸的光纜。其他四條於該區登岸的光纜當中，有三條屬東亞海底通訊光纜 (EAC光纜)系統（共用同一個岸上纜井），另一條則屬於亞洲快線海底光纜系統 (ASE)（使用另一個岸上纜井）。APG海底光纜系統會與亞洲快線海底光纜系統共用同一個岸上纜井。該處有一個已建成的光纜登岸站，屬於Pacnet所有（其前身為亞洲網通）；另外還有一個屬於NTT的數據中心。

APG海底光纜系統進入香港海域後，會經過東面和南面海域。在這條擬鋪設路線上，沿途有多條現有海底光纜和管道。在藍塘海峽起，直至登岸點止，擬建光纜附近的海床都曾屬指定海洋採泥區，因此都已受干擾。



WLCP	Easting	Northing	WLCP	Easting	Northing	WLCP	Easting	Northing	WLCP	Easting	Northing
1	845588.70	815897.93	17	844646.40	813703.38	33	845447.61	809899.21	49	849680.77	807095.91
2	845556.09	815866.54	18	844669.62	813648.58	34	845604.56	809780.81	50	850966.87	807010.88
3	845305.98	815905.89	19	844685.62	813611.68	35	846278.13	808981.74	51	857127.50	807037.45
4	845181.61	815925.38	20	844750.18	813348.72	36	846541.71	808745.68	52	857294.09	807122.57
5	845110.68	815898.08	21	844747.87	813179.67	37	846587.45	808705.84	53	858187.64	807575.78
6	844850.18	815797.85	22	844735.29	812289.73	38	846688.11	808502.90	54	859209.68	808734.05
7	844836.11	815782.70	23	844720.57	812188.95	39	847135.01	807602.02	55	859922.46	809541.99
8	844683.67	815618.73	24	844708.59	812107.37	40	847200.72	807516.98	56	860046.48	809682.63
9	844534.05	815321.70	25	844641.15	811648.90	41	847336.27	807341.75	57	860205.34	809737.32
10	844305.49	814867.76	26	844649.37	811049.83	42	847375.49	807290.84	58	861589.52	810214.74
11	844264.01	814687.79	27	844919.25	810509.60	43	847399.22	807260.22	59	866499.41	810855.95
12	844225.62	814520.38	28	845018.29	810386.56	44	847457.54	807184.60	60	866961.11	810673.40
13	844232.34	814484.58	29	845037.20	810363.13	45	847766.64	807050.09	61	867438.99	810476.69
14	844260.07	814335.84	30	845222.90	810132.35	46	847855.31	807058.83	62	869831.85	810619.15
15	844378.68	814186.41	31	845243.02	810107.27	47	848656.46	807137.33			
16	844469.78	814081.26	32	845352.72	809970.94	48	849142.30	807131.45			

Figure 1.1
圖 1.1

Proposed APG Submarine Cable System
擬建之APG海底光纖系統

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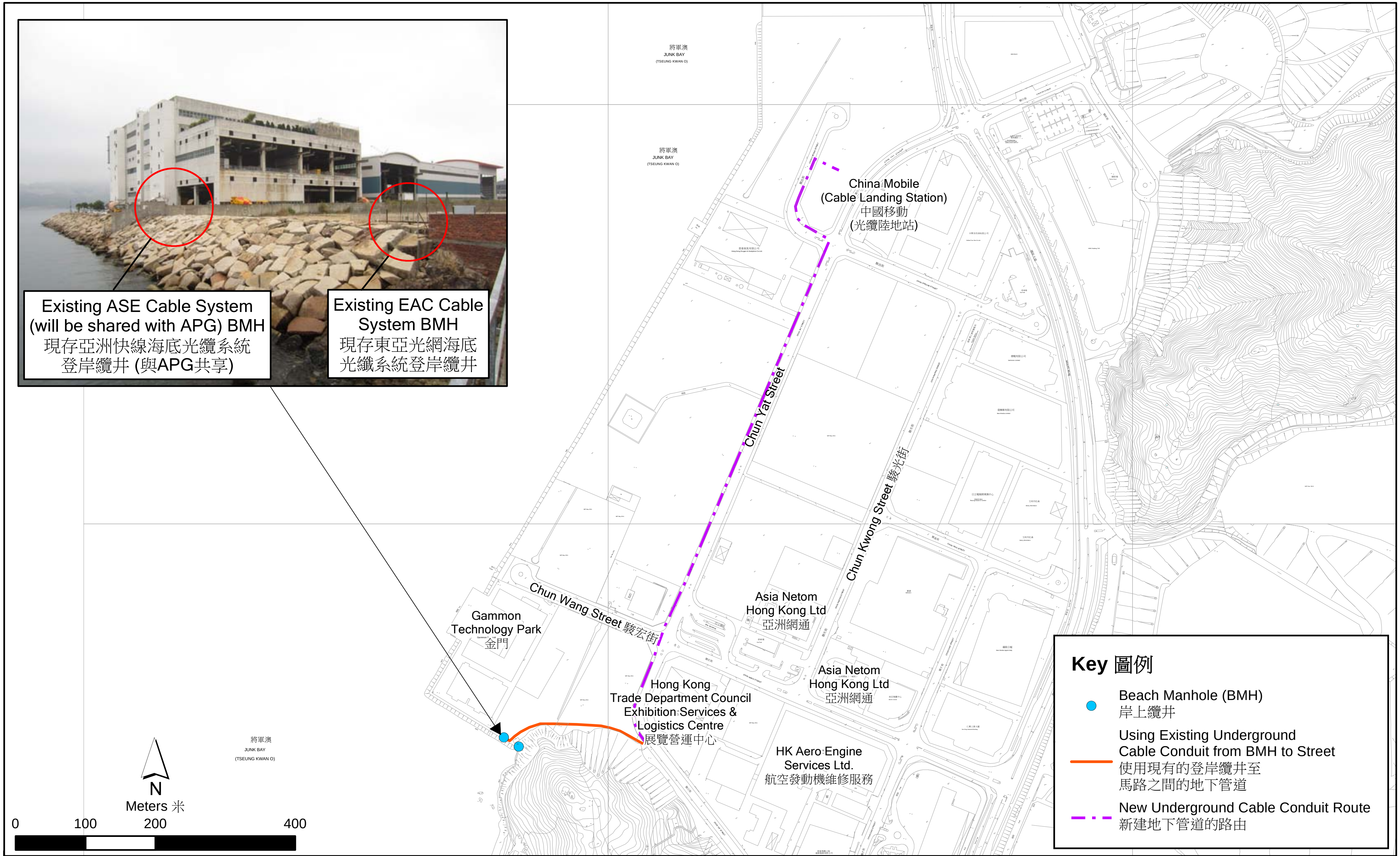

Figure 1.2
圖 1.2

Location of APG Landing Site and Terrestrial Cable Route
APG海底光纖系統登岸地點及陸上路由

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1.5 *光纜路線篩選程序*

1.5.1 *登岸地點的篩選*

CMI於2011年與香港科技園簽訂合約，在將軍澳工業邨內建造一個海底光纜登岸站。香港科技園的政策是打算為在將軍澳工業邨建造海底光纜登岸站的營運商提供共用的遠程通訊海底光纜登岸設施，因此，香港科技園為CMI保留了一個海底光纜登岸設施，其位置見*圖1.2*。

應予注意的是，將軍澳工業邨現時是多條遠程通訊海底光纜的登岸地點，其中包括屬於EAC電纜的三條，以及屬於亞洲快線海底光纜系統的一條。而且，擬議登岸點的岩土環境亦適合安裝遠程通訊海底光纜。將軍澳工業邨內亦已建有一個屬於Pacnet（其前身為亞洲網通）的光纜登岸站，以及一個屬於NTT的數據中心。若要在九龍東部設置一個海底光纜登岸設施，將軍澳工業邨是優先考慮的位置。此外，到目前為止都沒有任何關於這些遠程通訊海底光纜的安裝或運作對附近環境造成任何不良影響的投訴或事故。

基於上述各項考慮，*圖1.2*所展示的將軍澳工業邨地點，被選定為APG海底光纜系統在香港境內的登岸地點。

1.5.2 *海洋路綫的規劃考慮*

APG海底光纜系統所經過的路線有多項現存的環境及物理限制，因而限制了光纜路綫的選擇。光纜應該避開所有已知的主要海洋環境敏感受體／地區，例如海上魚類養殖區、具高生態價值的珊瑚群落、海濱保護區、已刊憲的人工魚礁、泥灘（詳情請參閱*第3章*及*圖3.1*），以及盡可能遠離在陸上的敏感受體，例如法定古蹟、具考古價值所在地和具特殊科學價值地點。被選定的路線亦必須盡量減少干擾現有的光纜和管道，務求在鋪設APG海底光纜系統時，不會對它們造成損害。此外，建議的路線必須盡量減少對現有海底的干擾。

特別是海底光纜接近將軍澳登岸地點的部份，有多條鋪設路線都曾被考慮。下文闡述了在為APG海底光纜系統決定其進入將軍澳登岸地點的路線時，所考慮過的具體事項。*圖1.3*展示了曾被考慮的四條海底光纜路線（方案1至4），以及在決定最終建議方案時所須考慮的主要環境及物理限制。*圖1.4*說明了建議方案（方案2）的各項物理限制，而*圖3.1*則展示了擬議光纜系統（方案2）附近各項主要環境元素的位置。

1. 光纜不能從西面進入登岸地點，因為這條路線需要橫過維多利亞港的主要區域，亦需要橫過多條管道、隊道和碇舶區，然後才到達開闊海域。因此，光纜鋪設路線必須通過藍塘海峽從南面進入登岸地點。

2. 被選定的鋪設路線必須避開已於憲報公佈的，位於東龍洲南面和東面的挖沙區和卸泥區。因此，所有方案在這個地區的路線，都只能沿著藍塘海峽西側，在石澳對開海域伸延。

3. 在佛堂洲西面的路線受到現有光纜和渠務署排污管道的限制，而建議的路線旨在減少橫過其他光纜和管道的次數。根據國際光纜保護委員會的指引，一條新鋪設的光纜與現有光纜之間的距離，應該盡可能大於水深的三倍；管道營運商通常都會指定一個 500 米的專用區，但無論如何，一條新光纜都不應該鋪設在可能會受到管道上的堆石影響的範圍內。

   - 方案 4 的路線位於現有的三條 EAC 光纜的東側，但它將會使用的岸上纜井卻位於這些 EAC 光纜所用的岸上纜井的西面，因此，它必須在岸上纜井附近橫跨三條 EAC 光纜（*圖 1.3* 的放大圖）。由於 EAC 光纜在岸上纜井附近淺埋（在接近岸上纜井時的深度通常小於 2 米），因此，若採用方案 4，APG 海底光纜系統便在現有海床高度之上，從而令它在安裝和運作維修期間更容易受損。也應該注意，在岸上纜井外面的光纜交叠是不常見的操作。

   - 在渠務署排污渠與現有 EAC 光纜之間的空間，不足以將 APG 海底光纜安全地鋪設在現有 EAC 光纜的正西面(方案 3)。按照安全考慮，新光纜的鋪設位置應該與現有光纜相距 50 米，但這樣便會令 APG 海底光纜鋪設在可能受到渠務署排污管道上的石堆影響的範圍內，令光纜掩埋設備有受損的風險。

   - 方案 1 和 2 都避免在光纜登岸地點和在藍塘海峽初段跨過現有光纜，但都有跨過渠務署的排污管道。兩個方案在藍塘海峽外的更南面，如*圖 1.3* 所顯示的三個地方跨過現有使用中的光纜。

   - 總體而言，在各個方案在藍塘海峽南面依循同一路線之前，方案 1 和 2 都在兩個地方跨過了現有的使用中光纜或管道兩次；方案 3 則在四個地方跨過現有的使用中光纜共六次；而方案 4 亦在兩個地方跨過現有的使用中光纜共六次。此外，方案 3 和方案 4 都會令光纜的安裝或運作面對更大風險。故此，倘若只考慮避開位於將軍澳登岸地點附近和在藍塘海峽較北面的現有海底光纜和管道，方案 1 和 2 都較可取。

4. 主要航道內有一個分道航行制，因此應該盡可能避開這條航道／分道航行制，藉此減少對來往船隻的影響，並最可能強化光纜鋪設工程的安全程度。

   - 雖然方案 3 避開了在分道航行制航道內的現有光纜，但仍沿著這條主要輪船航道伸延超過 4 千米，再加上在安裝時的健康和安全考慮，以及在航運交通方面的考慮，因此，這條鋪設路線十分不可取。

   - 方案 4 是沿著主要航道的東側伸延，直至因為必須避開已刊憲的採沙區和卸泥區而不得不橫過該航道為止。所以，這個方案是在

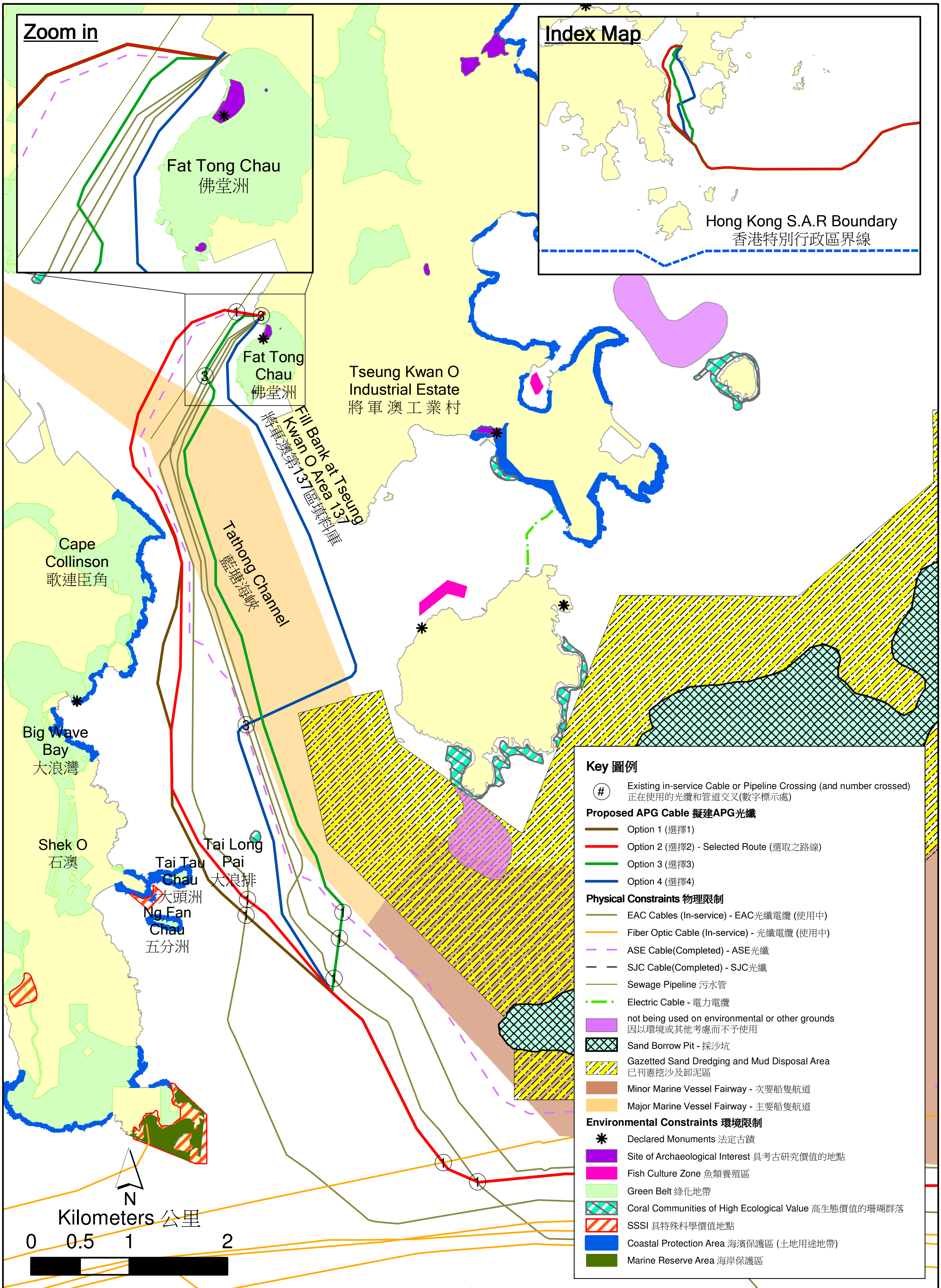

Figure 1.3
圖 1.3

Key Physical and Environmental Constraints in the Cable Route Selection Process
在光纜路線選擇時主要的物理與環境限制

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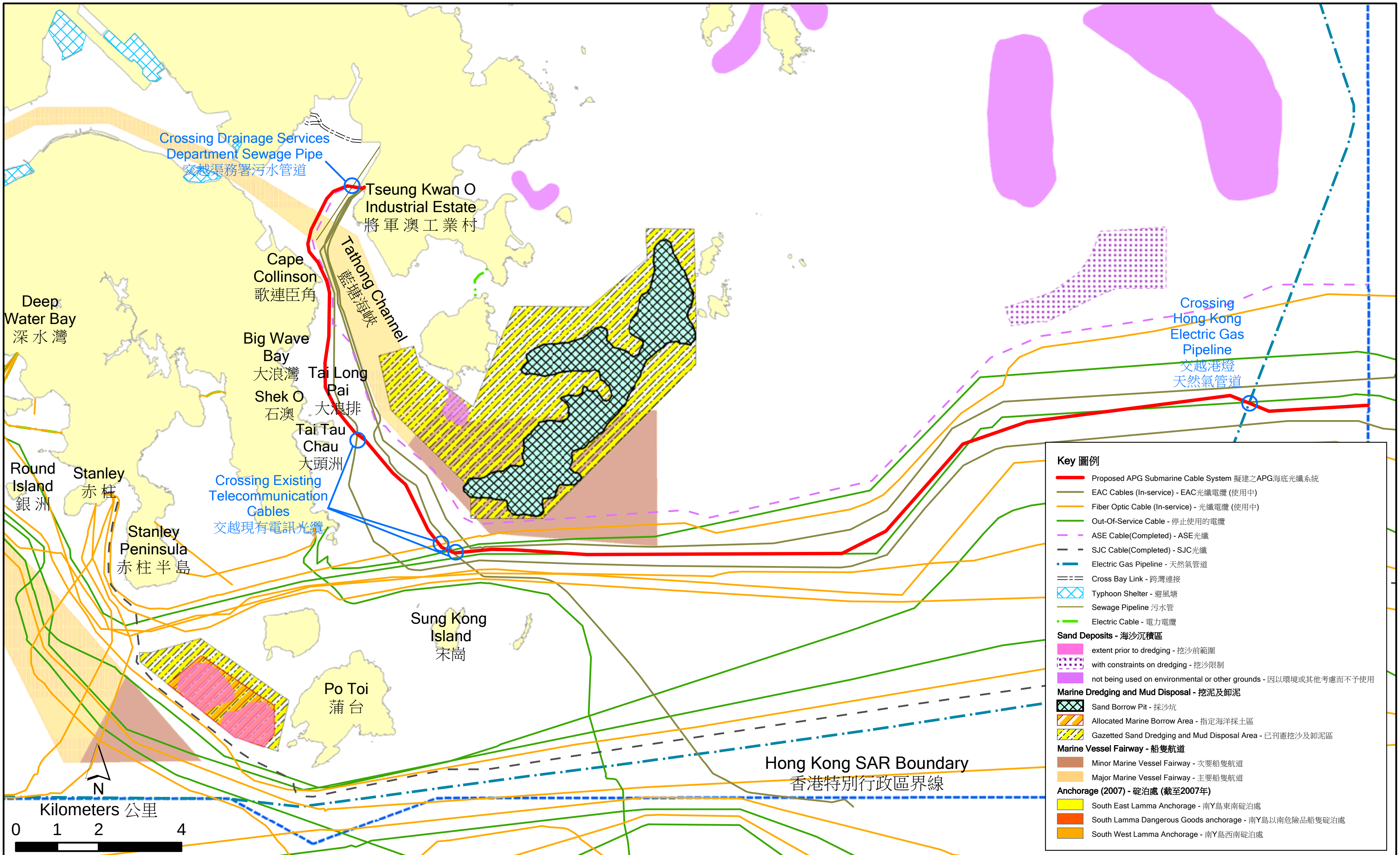

Figure 1.4
圖 1.4

Existing Physical Constraints for the Proposed Cable System
擬建的光纖的現有實質限制

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主要航道最闊的位置橫跨，不如方案 1 和 2，因為方案 1 和 2 都是在偏北的較窄地方橫過該航道，與現有光纜系統橫過航道的位置相若。

- 總體而言，在抑減安裝光纜時的健康和安全問題方面，以及抑減工程對分道航行制的干擾方面，方案 1 和 2 都較可取。

5. 盡量避免把光纜鋪設在海床上有岩石外露的地區，因為光纜在這種地區必須鋪設在海床表面或只作淺層埋藏，從而增加了光纜在運作期間受到船錨和捕漁活動破壞的風險。令各個方案出現差異的主要岩石外露區包括：在藍塘海峽兩側的地區、在歌連臣角以西及佛堂洲以東的地區，以及在將軍澳 137 區的填料庫。

   - 方案 4 是唯一在貼近藍塘海峽東側經過的方案，而它橫過海床外露岩石區的長度接近 2.5 千米。

   - 方案 3 不會橫過任何岩石外露區，因此，雖然它有一大段光纜位於海運交通繁忙的分道航行制航道內，但在鋪設後，光纜受損的機會便較少。

   - 方案 1 和 2 都在藍塘海峽西側，歌連臣角對開的海床上橫過岩石外露區。根據現時的估計，在方案 1 和 2 的光纜鋪設路線上，約有 500 米會受到外露的岩石影響，因此需要把光纜鋪設在海床表面。

   - 總體而言，考慮橫過外露岩石區的長度，方案 4 最不可取。在這方面，方案 3 是最可取的，因為它不會橫過任何岩石外露區。

6. 除了主要航道／分道航行制之外，也應該考慮其他海運航道和錨固地點。

   - 方案 4 非常接近將軍澳 137 區的填料庫。鑑於使用該填料庫的卡車可能會造成交通及環境問題，因此，有關方面在將軍澳 137 區建造了一個躉船轉運站，以便用海運方式把公眾填土運往或運離該處 [1]。因此，這個填料庫的運作有賴於躉船能夠暢順地往來將軍澳 137 區。所以每天應會有大量躉船往來於這個轉運站。然而，這個地區也是一個岩石外露區，令方案 4 的光纜只能在海床表面鋪設或以淺埋方式經過這個躉船交通頻繁的地區，因而令光纜因為躉船下錨等運作而受損的機會亦較高。其他方案不會很接近將軍澳 137 區。

   - 總體而言，若只考慮接近將軍澳 137 區填料庫這個因素，方案 4 是最不可取的方案，而其他所有方案都是同等地可取。

[1] 將軍澳137區填料庫環境影響評估 (AEIAR-060/2002)。可於以下網址取得：http://www.epd.gov.hk/eia/register/report/eiareport/eia_0762002/pdf%20file/EIA/toc.pdf [於2013年5月瀏覽]

7. 光纜的鋪設工程亦必須避免影響位於大浪排小島和東龍洲南面和東南的珊瑚棲息地，並盡量增加這些棲息地與光纜之間的距離。倘若鋪設路線會通過大浪排島西面，便必須考慮該處的 EAC 光纜會把可能的路線局限在一條狹窄通道內。

   - 方案 4 是所有方案中最接近大浪排的一個，在距離該島約 105 米處經過。方案 3 和方案 2 則分別在該島的東面約 395 米和西面約 425 米處經過。方案 1 約在距離大浪排島的 550 米處經過，比方案 2 還要遠，卻因此比較接近石澳海角具特殊科學價值地點和海濱保護區。

   - 至於在東龍洲南面和東面的珊瑚棲息地，它們都受已刊憲的採沙區和卸泥區的部份遮蔽。所有方案都必須避開這些已刊憲地區（見*圖 1.3*）。方案 4 距離這個珊瑚棲息地最近，大約在離它 1205 米處經過，然後轉向西面橫過藍塘海峽。方案 3 離它最近的一點是位於藍塘海峽內的一段，距離珊瑚礁約有 1560 米。方案 1 和 2 距離這個敏感珊瑚棲息地，最近的距離分別是 2395 米和 2300 米。

   - 總體而言，各個方案距離東龍洲南面和東面敏感珊瑚棲息地的距離都超過 1200 米，其中最接近的是方案 4。方案 1 與所有已知的敏感珊瑚棲息地距離都最遠。因此，若只考慮這項因素，方案 1 是最可取的方案。

8. 建議光纜鋪設路線應該盡量遠離任何魚類養殖區。特別是在東龍洲北面的大廟灣有一個魚類養殖區。

   - 在各個方案中，方案 4 距離東龍洲的魚類養殖區最近（最近點的距離約為 780 米）。方案 1、2 和 3 與東龍洲魚類養殖區的距離分別約 2460 米、2450 米和 1800 米，因此在施工和運作階段都不會對該養殖區造成任何影響。

   - 總體而言，因只考慮東龍洲魚類養殖區這項因素，方案 1-3 都可取，而方案 4 則不可取。

9. 建議的光纜鋪設路線應該盡量遠離陸上的敏感受體，例如法定古蹟、具考古研究價值地點和具特殊科學價值地點（具特殊科學價值地點既可能在陸地上，也可能在海洋中）。

   - 在將軍澳登岸地點附近的佛頭洲便有一項法定古蹟（中國稅關遺址）和兩個具考古研究價值地點（佛頭洲具考古研究價值的地點和佛頭洲清代墓碑）。因此，在這個登岸點的位置，各個方案與這些敏感受體的距離都相等。然而，方案 4 會在現有的 EAC 光纜和分道航行制航道的東側伸延，因此會比其他方案更接近這些受體，而且會很接近另一個具考古研究價值地點–佛頭洲頹垣

（最近點的距離約為 205 米）， 位置如*圖 1.3* 所示。相對於距離最遠的方案 1 和 2 而言，方案 3 比較接近法定古蹟和兩個具考古研究價值地點；而它在經過佛頭洲頹垣這個具考古研究價值地點時，最近點的距離約是 380 米。

- 在石澳海角有一個具特殊科學價值地點，部分位於水中。方案 3 和 4 都離它最遠。方案 1 則最接近（480 米，即少於 500 米），而方案 2 的擬議光纜鋪設路線則盡可能遠離具特殊科學價值地點（最近點的距離約為 560 米），但由於受到東面的現有光纜限制，這個距離沒法再擴大。

- 總體而言，若只考慮法定古蹟，具考古研究價值地點和具特殊科學價值地點，方案 1 是唯一一個位於具特殊科學價值地點 500 米範圍內的方案，因此是最不可取的方案。其他各個方案在登岸點的位置上，與法定古蹟和兩個具考古研究價值地點的距離都相等；但方案 4 在接近登岸點時與它們的距離最近，同時方案 3 和 4 的路線亦會接近另一個具考古研究價值地點（少於 500 米），因此令它們較不可取。因此，若只考慮陸上敏感受體這項因素，方案 2 是最可取的方案。

10. 建議的光纜鋪設路線應該盡量遠離任何海濱保護區和綠化地帶。在選擇光纜鋪設路線時，亦有考慮位於石澳海角的海濱保護區（包括大頭洲和五分洲），以及在大浪灣和歌連臣角之間的海濱保護區。位於鶴咀半島的海濱保護區與所有方案的距離都超過 500 米，因此無需探討。在歌連臣角附近的海岸區屬於綠化地帶，在選擇路線時，是與歌連臣角海濱保護區一起考慮；而位於佛堂洲的另一個綠化地帶亦有被考慮。

    - 各個方案與位於大浪灣的海濱保護區和綠化地帶的距離都超過 500 米，但在這個海濱保護區和綠化地帶分區的再北面，方案 1 和 2 與歌連臣角海濱保護區和綠化地帶的距離在 500 米內（兩個方案的最近點與海濱保護區之間的距離都約為 90 米）。方案 1 和 2 的最近點與石澳海角海濱保護區和位於大頭洲的綠化地帶之間的距離，亦分別約為 140 米和 230 米。由於這些路線的安排都是要避開分道航行制航道，因此與海岸線之間的距離不能更遠，而且，現有光纜亦令這些路線不能位於更東面但仍在分道航行制航道以外的位置。亞洲快線海底光纜（ASE）和東亞海底通訊光纜（EAC）（登陸於將軍澳的光纜系統）的持有人在根據國際光纜保護委員會的指引下，要求路線至少相距 50 米，以免新光纜鋪設影響現有的光纜系統。由於位於歌連臣角附近現有的 ASE 和 EAC（位於西面的）光纜大部分的段落之間相距少於 100 米，方案 1 和方案 2 所建議的路線都不能鋪設在這些光纜之間。因此，方案 1 和方案 2 所建議之路線必須位於 ASE 的西邊並相距至少 50 米，同時以進一步遠離歌連臣角的海岸線作為目標。

- 雖然方案 3 距離石澳海角海濱保護區約有 1180 米，但它與歌連臣角海濱保護區和綠化地帶之間的最近點，則只相距 410 米（在 500 米範圍內）。

- 方案 4 與該區所有海濱保護區的距離都超過 500 米，但在接近登岸地點時，距離佛堂洲的綠化地帶卻是最近。方案 3 與這個綠化地帶分區距離大約超過 200 米，而方案 1 和 2 的大部份路線與它的距離都超過 500 米，直至接近登岸地點為止，因為登岸地點本身很接近該綠化地帶分區。

- 總體而言，雖然所有方案都與佛堂洲的綠化地帶區很接近，但方案 4 是各個方案當中，有最長的路段與該分區距離最近的一個。然而，方案 4 與其他綠化地帶分區和海濱保護區之間的距離，都超過 500 米。方案 3 位於歌連臣角海濱保護區和綠化地帶分區的 500 米範圍內，但與石澳海角海濱保護區和綠化地帶分區的距離則超過 500 米；而方案 1 和 2 的部份路線卻位於歌連臣角和石澳海角的海濱保護區和綠化地帶分區的 500 米範圍內。方案 1 比方案 2 更接近石澳海角海濱保護區和綠化地帶分區，而兩個方案的最近點與歌連臣角海濱保護區的距離都一樣，但方案 1 距離海濱保護區和綠化地帶較近的部份比方案 2 較長。若只考慮這個因素，沒有任何方案明顯地較可取，因為它們全都位於最少一個海濱保護區及／或綠化地帶分區的 500 米範圍內。

總體而言：

方案3與方案4不可取。方案3在分道航行制航道內伸延的長度比其他方案都長（從海運交通和安全角度而言並不可取）並且與歌連臣角海濱保護區和綠化地帶之間的最近點只相距約410米（即在500米範圍內）。方案3也會令掩埋設備在佛堂洲西面有受損的風險，因為它在該區非常接近渠務署的排污管道。方案4非常接近一個位於大浪排的敏感珊瑚棲息地。方案4橫過岩石外露的部份亦是各方案中最長的一個，光纜在這些地區只能作淺層掩埋，因此受到破壞的風險亦較大，特別是在將軍澳137區填料庫附近的躉船轉運站附近地區。此外，方案4在所有方案中最接近魚類養殖區。方案3和方案4與方案1和方案2相比，距離具考古研究價值地點少於500米的具考古研究價值地點數目多一個。

綜合考慮各個因素，方案1與方案2可取並且推薦方案2，因爲方案2盡可能遠離歌連臣角和石澳海角的海濱保護區和綠化地帶，同時距離石澳海角的具科學價值地點距離超過500米（方案1距離石澳海角具特殊科學價值地點地點距離小於500米）。此外，如*章節3.10*所提及，方案2的路線已經盡量遠離位於歌連臣角（約190米）及大浪排（約490米）具生態關注性的珊瑚群落。

1.6 *工程項目簡介涵蓋的指定工程項目數目及種類*

根據*《環境影響評估條例》*的規定，海底光纜系統的裝設工程屬於指定工程項目，詳情如下：

- 《環評條例》附表 2（第 I 部）C.12 項：(a) 距離一個現有的或計劃中的 (ii) 文化遺產地點和 (vii) 海濱保護區的最近界線少於 500 米的挖泥作業。從歌連臣角至大浪灣之間及石澳附近的海岸線（在高水位線以上），均被指定為"海濱保護區"，而從光纜走線至歌連臣角和石澳的海濱保護區之間的最短距離分別約為 90 米和 230 米。在岸上和在光纜路線 500 米範圍內有一項法定古蹟（佛頭洲稅關遺址）。

1.7 *聯絡人姓名及電話號碼*

香港環境資源管理顧問有限公司已受CMI委托，負責為本項目申請環境許可證。

有關本項目的查詢，請聯絡：

環境資源管理顧問有限公司
香港鰂魚涌華蘭路25號
大昌行商業中心16樓
聯絡人：　合夥人（景觀與生態）
電話：　(852) 2271 3000
傳真：　(852) 2723 5660

及

Axon Consultancy Ltd - APG項目辦公室
香港九龍通州街123號
國貿中心5樓5B室
聯絡人：　APG海底光纜系統工程項目經理
電話：　(852) 2258 6392
傳真：　(852) 3020 0321

及

中國移動國際有限公司
香港新界葵涌葵昌路51號
九龍貿易中心1座30樓
聯絡人：　總監
電話：　(852) 3975 6688
傳真：　(852) 3188 0374

2 *計劃大綱及計劃的執行*

2.1 *項目規劃和執行*

本項目將會由CMI領導和管理。海底光纜系統的規劃和施工，將會由NEC Corporation代表CMI進行。

預計本項目不會與任何其他項目互相影響，並會分為下列階段施工：

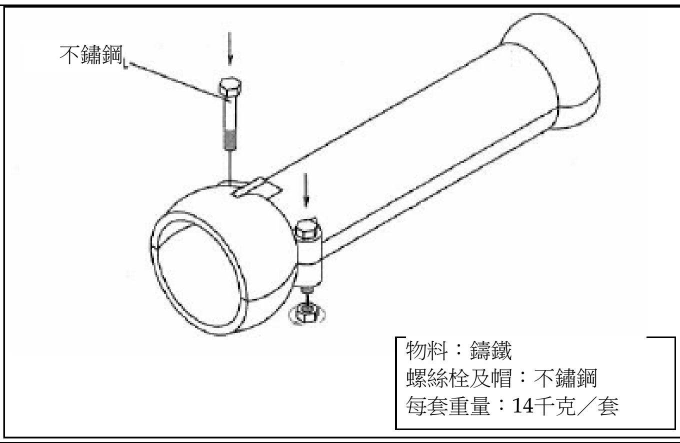
2.1.1 *陸上光纜安裝*

岸端的一段APG海底光纜系統，會經過敷設於海堤下的現有導線管連接至現有的岸上纜井。在鋪設光纜時不會滋擾海堤。爲了完成從岸上纜井至光纜登岸站的連接，陸上光纜會鋪設於一條管道內，並沿著陸地路線伸延。鋪設陸上光纜所需的槽溝會以明挖方法建造。在敷設光纜和相關配件後，會把漕溝恢復至原來狀況。有關的漕構會一次建成。光纜的安裝一般都會用絞車或手拉方式進行。這項工作通常需時約45天。

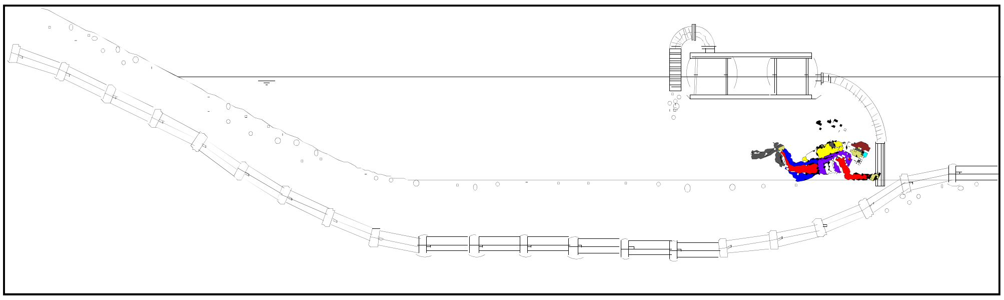
2.1.2 *岸端光纜安裝工程*

這種安裝工程主要會使用兩種方法：潛水員和沖噴法，視乎每種方法的水深限制而定。距將軍澳海堤下導管出口約20米處的光纜目標掩埋深度約為海床下2米。這一段光纜的掩埋工程會由潛水員用沖噴器將光纜埋到海底沉積物中。（光纜裝有掛接式管段作為保護裝置）（*圖2.1*）。

圖2.1 典型的掛接式管段及以潛水員使用沖噴器掩埋光纜



典型的掛接式管段

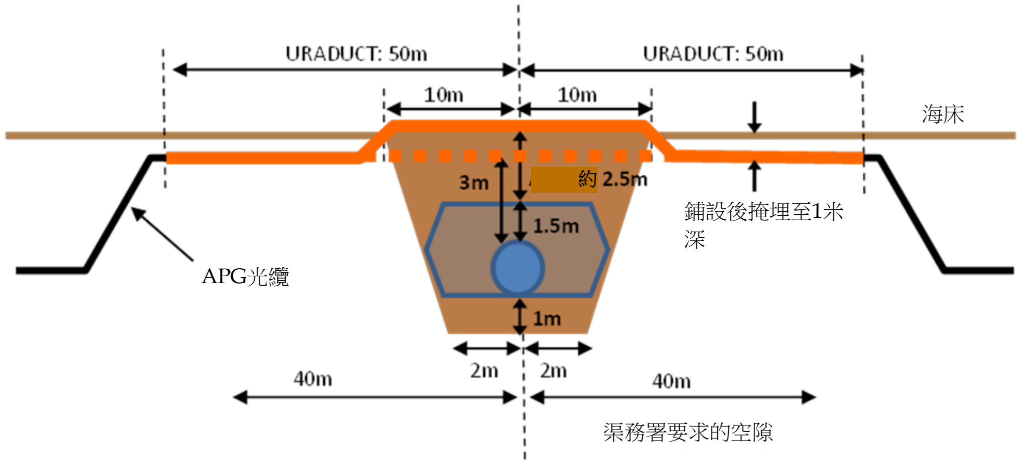


潛水員以沖噴法掩埋光纜

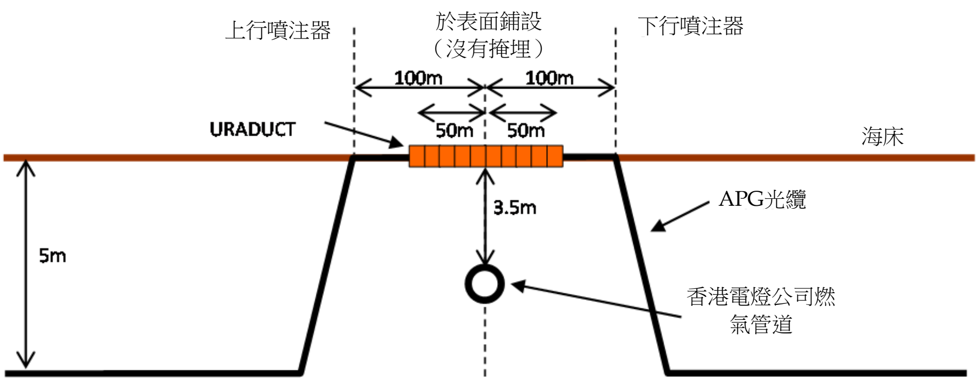
2.1.3 *海底光纜安裝*

當光纜橫過渠務署的污水管，以及在更靠近香港海域邊界的地方橫過香港電燈公司燃氣管道時，會採用表面敷設和淺埋敷設，並與該兩條管道的中心分別保持50米和100米（*圖2.2*）。採用表面鋪設的光纜會以URADUCT保護（*圖2.3*），但不會影響現有的海床高度或它所橫過的設施。

圖2.2 *污水管和輸氣管的典型剖面*



排污管道橫過安排之剖面圖



輸氣管道橫過安排之剖面圖

圖2.3 *典型的URADUCT詳情*

項目	規格
顏色	橙色
物料密度	1108 千克/立方米
光纜外直徑	DA 47 毫米
Uraduct內直徑	49 毫米
Uraduct外直徑	99 毫米
壁厚	25 毫米
Uraduct半殼長度	2000 毫米
最小彎曲半徑	1.05 米
單個半殼重量	6.5 千克
空氣中重量	6.5 千克/米
水中重量	0.5 千克/米

在這一段光纜之後，直至香港海域邊界的光纜掩埋深度，都約為海床下5米。

在橫過現有遠程通訊光纜時，視乎現有光纜的實際掩埋深度而定，可能需要採用淺埋法。在每個光纜橫過點都會進行光纜定位。為了找出光纜的準確位置，會以探音器／探磁器進行調查（在船隻上）或由潛水員運用手攜沖噴器進行定位。這種由潛水員配備手攜沖噴器進行的定位調查工作，只會在現有光纜的掩埋深度超過2.5米時才會進行。這項作業會安排在真正的光纜敷設工程前進行。為了確保調查工作能夠順利進行，所有光纜橫過點都會在調查前先行確定。

光纜鋪設工程會使用特製的光纜鋪設躉船和光纜掩埋機進行；掩埋工程則會採用沖噴技術。這個方法所用的"沖噴式掩埋器"或"雪橇式掩埋器"都經過特別設計，可以同時鋪設和掩埋光纜（*圖2.4*和*2.5*）。這些方法都是以沖噴器用高壓水柱把沉積物沖出一條纜槽，同時馬上把光纜敷設於槽內。沖噴器衝擊海床的最大闊度是0.5米，並可以把光纜掩埋至最深5米。應予注意的是，預計在工程完成後很短時間內，海床便可以自然地回復至工程前的高度和狀況。

圖2.4　　　　使用"沖噴式掩埋器"同時敷設和掩埋光纜

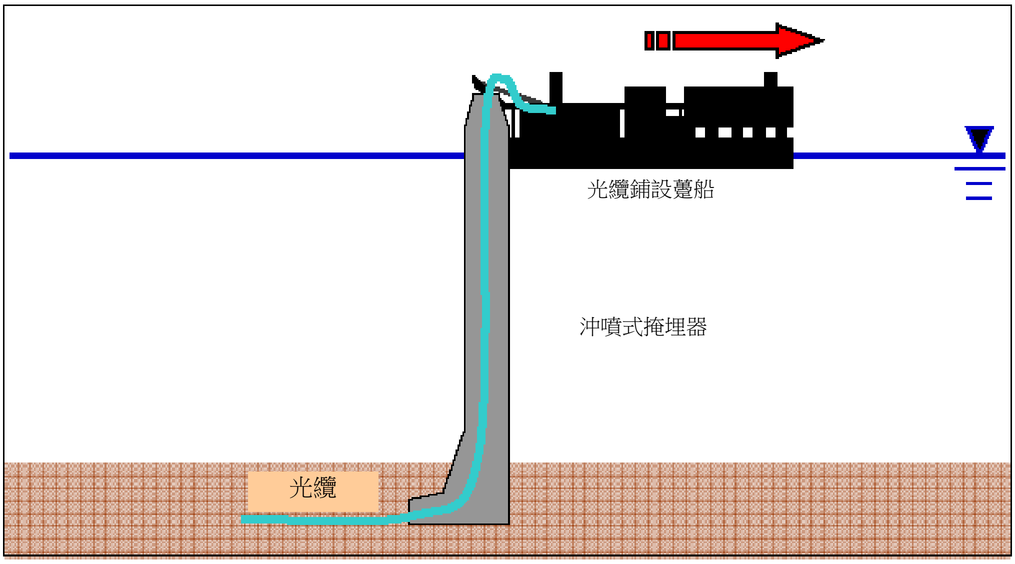
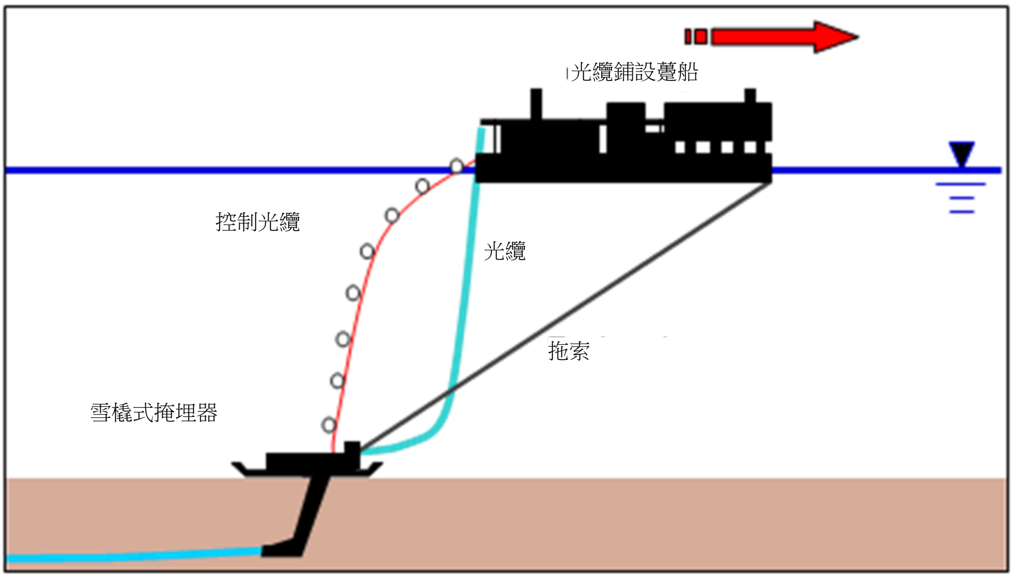


圖2.5　　　　使用"雪橇式掩埋器"同時敷設和掩埋光纜



在鋪設APG海底光纜系統時，會在擬議光纜鋪設路線上需要掩埋光纜的段落，一併進行"路線清理"和"鋪設前掃海"作業。這兩項作業都會安排在真正的光纜敷設工程前進行。進行"路線清理"和"鋪設前掃海"作業的目的，是要清除所有在光纜走廊內的已棄用光纜、碎物或阻障物。這些東西都會對光纜或鋪設機器造成威脅。抓鈎的爪的插入深度不會超過0.8米。由"路線清理"和"鋪設前掃海"兩項作業所清理的範圍，會覆蓋光纜兩側各5米（即合共闊10米）。從海床回收到的碎物都會被棄置於已獲批准的傾倒場。在使用探音器／探磁器進行調查時所找到的管道或使用中的海底光纜系統，無論在任何情況下，都不可以在其50米範圍內使用拖行的設備。由於"路線清理"和"鋪設前掃海"作業都會在十分短的時間內由機械拖曳進行，並限制在有限範圍內，因此預計不會對海洋環境造成影響。*圖2.6*所示，是典型的光纜裝設躉船、沖噴式掩埋器、雪橇式掩埋器和爪錨的照片。

圖2.6　典型的光纜鋪設躉船、沖噴式掩埋器和爪錨的照片

使用雪橇式掩埋器的典型光纜鋪設躉船

典型的雪橇式掩埋器

使用沖噴式掩埋器的典型光纜鋪設躉船

典型爪錨

典型沖噴式掩埋器

2.2　*項目計劃*

APG海底光纜系統暫訂於2014年第一季或第二季於將軍澳登岸，並完成安裝。在香港境內的暫訂施工時間表如下：

- 陸上光纜鋪設工程　約45個工作天
- 岸端鋪設工程–以潛水員進行淺埋　約2個工作天
- 岸端鋪設工程／海底光纜鋪設工程–以沖噴器／雪橇式掩埋器進行深埋工程，包括偵測現有光纜、路線清理、光纜鋪設和突發事情。預計真正的光纜鋪設工程（不包括天氣造成的停工）約需15 天。　約60個工作天

預計所有岸上鋪設工程均會在正常工作時段內進行。倘若稍後發現有需要在黃昏或晚間進行工程，便會申請建築噪音許可證。

3　周圍環境的主要元素

3.1　海運航道

藍塘海峽主航道是主要的船隻往來通道。現時所選擇的光纜走廊，能夠縮短橫過航道的距離（*圖1.3*）。

3.2　光纜、管道及渠口

在將軍澳的光纜登岸地點有四條現有的海底通訊光纜和一條污水管道。此外，在香港邊界附近還有一條輸氣管道。目前建議的光纜走廊路線，能夠減少跨過現有光纜和管道的次數（*圖1.3*和*圖1.4*）。

3.3　其他擬議設施或市容建築

光纜走廊現時不會跨過任何擬建的海事設施。

3.4　已刊憲的泳灘

最接近的已刊憲泳灘是大浪灣泳灘、石澳後灘和石澳泳灘，距離最近的一段擬建光纜分別約1,150米、880米和1,120米（*圖3.1*）。這些泳灘都不會受到光纜鋪設工程影響。

3.5　海水進水口

在光纜北面的將軍澳內灣和小西灣，都有水務署的海水進水口，與最近的一段光纜分別距離約1,140米和740米（*圖3.1*）。位於杏花村的東區尤德夫人那打素醫院的冷卻水入口則距離最近的一段光纜約1,320米。這些海水進水口都不會受到光纜鋪設工程影響。

3.6　具特殊科學價值地點

距光纜最接近的特殊科學價值地點是石澳海角具特殊科學價值地點，距離最近的一段光纜約560米。鶴咀和果洲群島具特殊科學價值地點，距離最近的一段光纜分別約有1,750米和5,750米（*圖3.1*）。部分鶴咀具特殊科學價值地點位於海中，但是由於距離最近的一段光纜遠(超過1.7千米)，所以不會受到光纜鋪設工程影響。果洲具特殊科學價值地點亦位於陸上，因此不會受到光纜鋪設工程影響。這些特殊科學價值地點均距離最近的一段光纜500米以上，預計不會受到光纜鋪設工程影響。

3.7 *海岸公園或海岸保護區*

鶴咀海岸保護區距離最近的一段擬建光纜約有1,750米（*圖3.1*）。海岸保護區不會被光纜安裝工程影響。

3.8 *魚類養殖區*

最接近的魚類養殖區是東龍洲魚類養殖區，距離最近的一段光纜約有2,450米（*圖3.1*）。因此，預計東龍洲魚類養殖區以及蒲台魚類養殖區（距離最近的一段約5,390米）不會受到光纜鋪設工程影響。

3.9 *海濱保護區和自然保育區*

在香港島和佛堂洲沿岸，均有一小片被指定為"綠化地帶"的狹長土地，位於距離光纜走線的500米範圍內。

石澳海角、大頭洲和五分洲的海岸綫被指定為海濱保護區，從光纜到這段海濱保護區的最近距離為230米。此外，從歌連臣角至大浪灣的海岸綫也被指定為海濱保護區，距離光纜最短的距離為90米。根據*《環評條例》附表2（第I部）C.12(a)* 項所述的：距離一個現有的或計劃中的 (vii) 海濱保護區的最近界線少於500米的挖泥作業，所以本項目是一個指定工程項目。

由於指定的海濱保護區位於陸地上，預計光纜鋪設工程不會對石澳海角、大頭洲和五分洲的海濱保護區，和歌連臣角至大浪灣的海濱保護區產生直接或間接的影響。

3.10 *珊瑚群落*

在果洲群島具特殊科學價值地點、蒲台、宋崗和橫瀾島的整個海岸，東龍洲的東南海岸、大浪排和歌連臣角沿岸，都是具生態關注性的珊瑚群落。將軍澳西南也存在具生態關注性的珊瑚群落（*圖3.1*）。光纜距離這些具生態關注性的珊瑚群落的最短距離是從歌連臣角沿岸以及大浪排的珊瑚群落到擬建光纜走廊之間的距離，分別約為190米和490米。光纜與其它具生態關注性的珊瑚群落之間的最近距離都超過1千米。

3.11 *文化遺產地點*

在佛頭洲上有一個名為佛頭洲稅關遺址的法定古蹟，位於光纜系統登岸點以南約240米。此外，根據*《香港具考古研究價值的地點（2012年11月）》*，在光纜路線近岸一側的500米範圍內，有兩個具考古研究價值的地點，即：佛頭洲具考古研究價值的地點和佛頭洲清代墓碑。因此，本項目是《環評條例》附表2（第I部）C.12(a) 項所述的：距離一個現有的

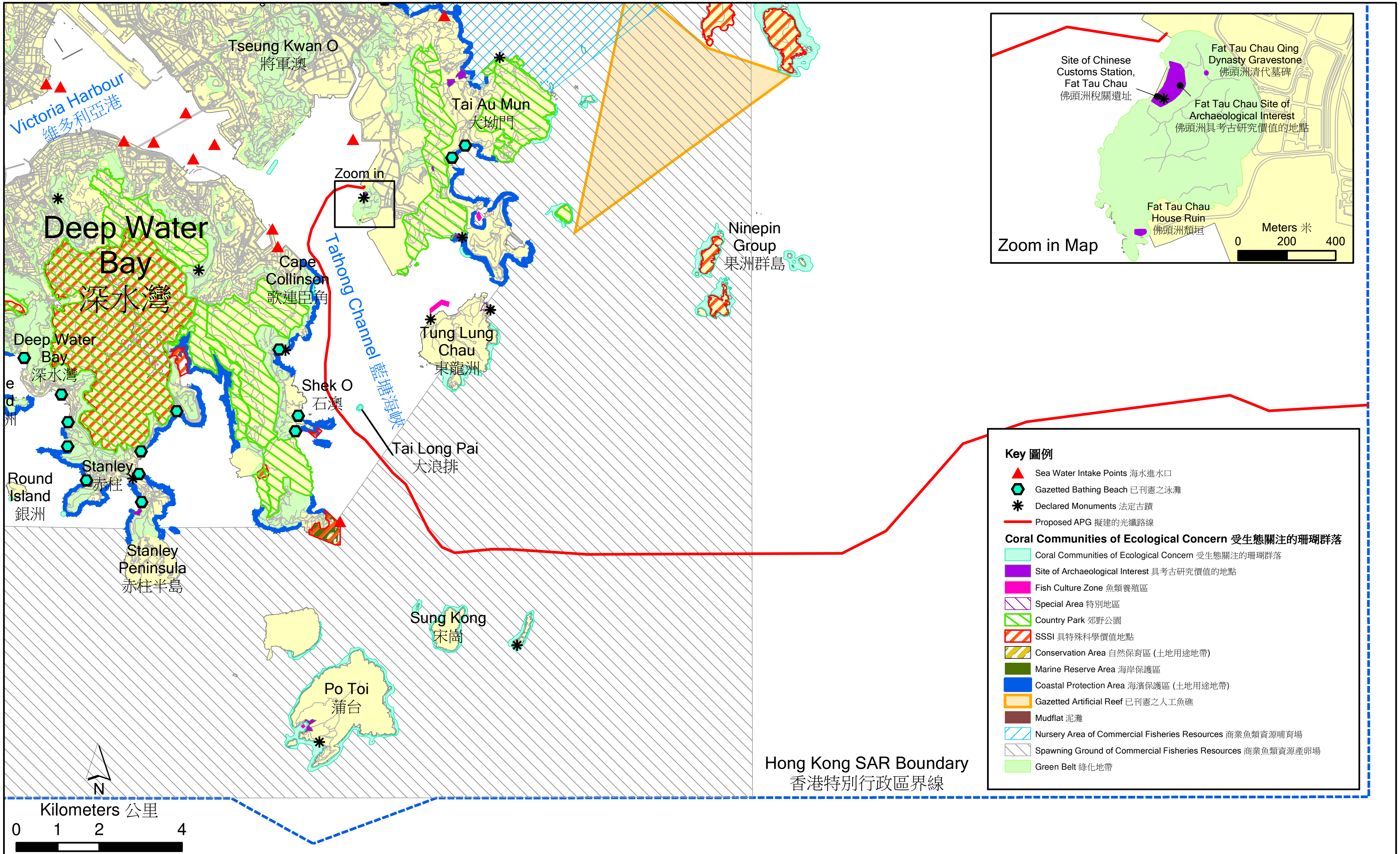


Figure 3.1
圖 3.1

Major Environmental Elements of the Areas in Vincinity of the Proposed Cable System
擬 建 光 纖 周 圍 的 環 境 要 素

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或計劃中的 (ii) 文化遺產地點的最近界線少於500米的挖泥作業。所以本項目是一個指定工程項目。然而，這些陸上的法定古蹟和具考古研究價值地點，全都不會受到鋪設光纜系統工程的影響。

APG海底光纜系統的路綫與亞洲快線海底光纜系統（ASE）的路綫非常相似，並且部分APG光纜位于ASE海洋考古調查時的地球物理測量範圍內。因此，ASE海洋考古調查的結果可以作爲參考 (1)。

根據英國海道測量部（UKHO）的沉船數據庫顯示，調查範圍內共有三處沉船；其中兩個不存在。第三個沉船距離擬建的光纜東北205米，並且距離正在使用的光纜非常近，所以可能是最近的沉船，認爲沒有考古價值。距離擬建光纜150米-396米處，發現七個聲納接觸點，認爲是傾倒材料/碎片，以及最近UKHO沉船。認爲淺底層接觸不具有考古價值。

(1) 香港環境資源管理顧問有限公司，2011，亞洲快綫海底光纜系統 – 將軍澳項目的工程項目簡介 （為NTT Com Asia Ltd 申請）

4 *對環境可能造成的影響*

4.1 *潛在環境影響摘要*

海底光纜的鋪設只需要在海洋環境中進行小型工程，並且光纜登岸地點只需要小規模的施工使光纜進入現有的岸上纜井並連接到將軍澳工業邨的光纜陸地站。擬建的APG海底光纜系統在施工時可能造成的影響，均摘述於*表4.1*，並在下文深入詳述。

該光纜系統在運作期間預計不會造成任何環境影響。

表4.1 環境影響的潛在來源

潛在影響	
• 液體流出物、排放物，或受污染的徑流	×
• 水流或海底沉積物受到干擾	✓
• 產生廢物或副產品	×
• 不悅目的外觀	×
• 生態影響：	
- 陸地	×
- 海洋	✓
- 漁業	✓
• 塵埃	×
• 噪音	✓
• 文化遺產	×
• 氣體排放物	×
• 氣味	×
• 晚間運作	×
• 產生交通	×
• 製造、儲存、使用、處理、運輸或棄置危險物品	×
• 危險物料或廢物	×
• 可能發生會造成污染或危險的意外	×
• 棄置廢舊物料，包括可能已受污染的物料	×
註： ✓ = 有可能造成不良影響； × = 預計不會造成不良影響	

4.2 *水質*

4.2.1 *陸上活動*

在進行陸上光纜鋪設工作時對水質可能造成的影響主要來自地面的徑流。然而，各項陸基建築活動均會納入下列措施，以防止對水質造成任何不良影響。

- 物料堆會以帆布或相近布料覆蓋，以減少雨季時的徑流；
- 小心進行光纜登岸和建造工程，以免有任何溢出物料流入附近的海域，並確保不會把棄舊物料排進附近水域；

- 所有建築廢物和排出物，都會按照*《廢物處置條例》*和*《環保事務諮詢委員會－建築工地排水設施專業人員工作守則》*的規定，作妥善處理和棄置；及

- 採用最佳管理方法來避免和減少來自工地、海上機器和船隻的受污染徑流。

上述各項措施足以防止岸上光纜鋪設工程對水質造成任何不良影響。因此，預計這些活動都不會對水質造成任何不良影響（無論是直接或間接）。

4.2.2 *海上活動*

海上的建設活動包括路線清理和把光纜掩埋於現有海床下，如章節2.1所述。預計在進行路線清理時，只會對水質造成極輕微的影響。在大部份路線上，都會以裝有沖噴器的躉船，把光纜掩埋海床下5米。岸端的一段光纜（距離將軍澳工業邨海堤下的導管末端約20米）會被掩埋至海床下大約2米的深度（由潛水員進行）。為了保護光纜，這個掩埋深度是必要的。沖噴器是利用水力沖噴技術把沉積物液化，從而讓工具鑽入海床至所需深度，然後鋪設光纜。在香港海域內的光纜掩埋工程需時約15天完成，而整個海事工程，包括偵測現有光纜、沿線清理、光纜安裝和其他突發性事情等，可能需時約62天。鋪設期間，躉船最高速度約為每小時1千米。

在鋪設光纜時，會短暫地在沖噴器四周形成懸浮沉積物。它們會貼近海床，而且會迅速地重新沉積。在鋪設光纜時受滋擾的沉積物會在一段短時間內保持懸浮狀態，因此，從沉積物中釋出污染物的可能性較低，而且令接收海域增加需氧量的幅度亦有限。所以，預計這項工程不會對水質造成不良影響。

對於光纜掩埋工程所造成懸浮於水中的幼細沉積物隨水漂移的可能性進行了分析，沉積物預計在不足4分鐘內沉積回海床（*附件A,章節A4.2*）。懸浮沉積物最遠的漂移距離約180米（見*附件A*）。因此，預計懸浮沉積物的捲流不會到達將軍澳內灣和小西灣的水務署海水進水口，石澳海角具特殊科學價值地點，以及在東龍洲沿岸，或在大浪排的具有生態重要性的珊瑚群落。根據附件B，水中懸浮沉積物的濃度預計會在到達南歌連臣角珊瑚群落（具有較高的珊瑚多樣性，見*附件B章節B1.2.7*）之前會回落至自然背景值（最近的珊瑚群落距離光纜約190米）。基於光纜在香港範圍的總鋪設時間只會持續約15天，預計對於珊瑚的潛在干擾是有限和短暫的。隨著提供隔泥幕作為預防措施，預計光纜鋪設工程不會對歌連臣角南的珊瑚群落產生不可接受的不良影響。

此外，根據預測，各個已刊憲的泳灘、魚類養殖區和鶴咀海岸保護區的水質都不會受到不可接受的不良影響，因為它們距離最近的一段光纜全都超過1千米。

本項目不會對海底沉積物造成長遠滋擾，亦不會干擾水流。在海事工程進行期間及在竣工後，都不會對水質造成不良影響。

光纜在運作期間，不會向四周海域排放任何污染物。

4.3 *對水流或海底沉積物的滋擾*

在以光纜掩埋工具鋪設APG海底光纜系統時，海底沉積物會出現小規模的短暫移位。不過，在光纜鋪設妥當後，海底沉積物便會自然地重新沉積（見*附件A,章節A4.2*）。

4.4 *海洋生態*

在檢閱過有關光纜路線和登岸點附近海洋生態資源的現有資料後，發現該區有香港海域常見的底棲動物種類，因此只具較低的生態價值（見*附件B*）。

雖然這些軟底生物群落在進行光纜鋪設工程時都會受到干擾，不過，由於干擾的範圍較小，時間短，而且海床會迅速回復原貌，因此該區會很快適合生物重新聚集。所以，有關的工程不會造成不可接受的影響。

在光纜走廊和登岸地點都沒有發現任何具重要生態價值的珊瑚群落（見*附件B*）。在距離擬議光纜鋪設路線超過1,170米的果洲群島具特殊科學價值地點、蒲台、宋崗、橫瀾島和東龍洲，都發現具高生態價值的珊瑚群落（見*圖3.1*）。然而根據預測，沉積物捲流從光纜掩埋工具（沖噴式掩埋器）向外擴散的距離不會超過180米，因此這些珊瑚群落不會受到影響（見*附件A*和*B*）。分別距離光纜走廊約695米、490米和190米的佛堂洲、大浪排和達歌連臣角南的珊瑚群落預計並不會因光纜鋪設而受到不可接受的干擾（見*附件B*和上面的*章節4.2*）。

正如*章節3.6*中提到，鶴咀和果洲群島具特殊科學價值地點，距離光纜最近的段落分別約有1,750米和5,750米（*圖3.1*）。部分鶴咀具特殊科學價值地點位於海中，但是由於距離光纜較遠(最近的段落也超過1.7千米)，所以不大會受到光纜鋪設工程影響。果洲群島具特殊科學價值地點位於陸上，因此不會受到光纜鋪設工程影響。跟光纜最接近的具特殊科學價值地點是石澳海角具特殊科學價值地點，距離光纜最近約560米。由於懸浮沉積物向外擴散的最大距離約180米（見*附件A*），以及這些具特殊科學價值地點均距離光纜最少500米以上，預計不會受到光纜鋪設工程影響。

香港東南面的海域並非中華白海豚經常使用的棲息地，卻經常發現江豚在該區出沒，特別是在夏季。光纜安裝工程需要很少的船隻，通常都是一艘，而且在進行短暫的安裝工程（香港水域總共工作15個工作日）時會緩慢行駛（每小時1千米）。由於有關工程所產生的沉積物捲流會留在海床附近，而且漂移離開工程地點不會超過180米；再加上工程所需船隻

都會緩慢行駛，因此，預計有關的工程不會對區內的江豚（或該區域內任何中華白海豚）造成滋擾（*附件B*）。

由於掩埋器所噴出的水柱位於海洋沉積物內，會抑制聲音，所以這些工具在使用時不會對海洋哺乳動物產生不可接受的聲音增強。由於江豚(兩種出沒於此水域的海洋哺乳動物而數量較多的一種)使用頻率較高的超聲波來覓食和溝通，船隻噴射和光纜鋪設的低頻聲預計不會對牠們造成顯著干擾。落入中華白海豚可聽範圍內的多數是高速船發出的聲音 (1)。預計光纜安裝屬短暫和臨時性的工程，會由慢速移動的躉船進行。香港水域的光纜安裝工程為期約15個工作日，在這短時間內預計不會對中華白海豚有顯著干擾。。因此，預計這項工程的水下聲音不會對江豚（或中華白海豚）產生不可接受的不良影響。

根據這種情況，再加上預測的局部和十分短暫的水質影響，預料這項工程不會對海洋哺乳類動物造成不良影響。

以陸地為基礎的海濱保護區不會受到海洋工程建設的影響。由於海洋生態資源不會受到不可接受的影響，因此，除了各項減少潛在水質影響的建議措施之外，無需再實施其他緩解措施。然而在光纜鋪設期間，會為海洋哺乳類動物實施額外的預防措施（海洋哺乳類動物觀察區）（*附件E*）。

4.5 *漁業*

根據現有光纜沿線漁業資源和捕漁作業的資料，沿光纜綫大部份地方的漁獲，無論是按重量或價值計算，都屬於偏低至中等水平（每公頃0-200公斤已成長魚類；每公頃0 - $5,000的已成長魚類和魚苗）。

此外，懸浮固體濃度的增加是局部的，只會出現於距離光纜走廊180米範圍內，而且海事工程需時約15個工作日。海床會在很短時間內，回復工程前的高度和狀況。因此，這項工程不會對水質、漁業資源和捕漁作業造成不可接受的影響（見*附件C*）。

在擬議光纜鋪設路線的500米內，並沒有漁護署的已刊憲魚類養殖區。東龍洲魚類養殖區距離光纜路線最近，約2,450米。由於沒有發現任何漁業資源會受到影響，因此沒有實施任何緩解措施的建議。

還應當指出的是，光纜安裝躉船在正常操作期間的最大工作佔用範圍將約125米 x 200米。鑑於光纜安裝躉船在操作過程中總佔用面積小（海上工程將持續約15個工作日），預料在光纜沿線的船隻航行和捕魚活動將不會受到影響。

(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

4.6 *噪音*

將軍澳工業邨內沒有任何噪音敏感受體，因此在建造光纜登岸點和連接現有纜井時所產生的噪音，不會造成噪音影響。

在鋪設光纜的過程中，躉船和光纜鋪設設備都只會產生極少噪音。這些噪音與區內現有海運船隻所發出的噪音相若，因此不會影響附近的噪音敏感受體。有鑑於此，本項目不會產生直接或間接的不良噪音影響。

現時預計不會在晚間進行光纜鋪設和掩埋工程。倘若稍後發現有需要在黃昏或晚間進行工程，便會申請建築噪音許可證。

4.7 *文化遺產*

根據文獻檢閱的結果，在擬鋪設光纜的登岸地點以南約240米處的佛頭洲，一個名為佛頭洲稅關遺址的法定古蹟；此外位於擬鋪設光纜的登岸地點的東南面亦有兩處具考古研究價值的地點（佛頭洲具考古研究價值的地點及佛頭洲清代墓碑），分別距離登岸地點東南約120米和240米。然而，這些地點都位於擬鋪設的光纜系統登岸地點的填海區以外，因此，這些地點都不會受到登岸地點施工的影響。在光纜系統沿線500米範圍內，並沒有古物古蹟辦事處記錄到的已評級歷史建築物，因此，預計本項目不會影響歷史建築物資源。

擬鋪設的光纜系統登岸地點位於沒有任何考古潛力及歷史建築物的填海區上，因此，預計本項目不會影響任何陸地考古資源。

根據一位合資格的水下考古學家所進行的水下考古調查（詳情請參閱*附件D*），英國海道測量部（UKHO）的沉船數據庫記錄的兩處沉船並不存在。第三個沉船距離擬建的光纜東北205米，並且距離正在使用的光纜非常近，所以可能是最近的沉船，沒有考古價值。距離擬建光纜156米-396米處，在海床上發現七個聲納接觸點，估計為傾倒的材料/碎片，以及最近UKHO沉船。沒有淺底層接觸被認爲為具考古價值，因此預計工程不會對具有海洋考古價值地點產生影響。

4.8 *其他*

廢物管理：在進行光纜登岸工程時，除了一般建築廢物之外，現場不會產生其他廢物。有關的廢物都會按照*《廢物處置條例》*進行處理和棄置。本項目不會產生挖出物料，而在安裝新道路光纜導槽時所產生的掘出物料，會在現場作原地回填，並盡量令產生量和再用量保持平衡。因此，光纜安裝工程和新的光纜導槽建造工程都不會產生（直接或間接的）不良廢物影響。

景觀和視覺：由於光纜導槽是鋪設在海岸和路面之下，而海底光纜則是埋在海床裏，因此不會對公眾造成任何視野障礙或任何不便。

陸地生態：海底光纜的施工和運作都不會造成陸地生態影響。

塵埃：由於本項目的工程範圍有限、所需的掘土量／動土量較小，而且光纜安裝工程為時很短，因此，只會產生微不足道的塵埃。

氣體排放物：在為光纜登岸地點建造纜漕時所使用的柴油驅動設備，只會產生小量的氣體排放物（二氧化硫和氮氧化物）。這些排放物都不會影響空氣質素敏感受體。

氣味：預計本項目在施工和運作階段都不會造成任何氣味影響。

晚間運作：預計所有光纜鋪設和掩埋工作都會在正常工作時段內進行。倘若需要在黃昏或晚間進行任何工程，都會事先申請建築噪音許可證。

產生交通：本項目只會令海上交通量有極輕微的增加，而且為時短暫，因此不會產生顯著的噪音或氣體排放物。

危險物品：本項目在施工和運作階段都不會涉及危險物品。

危險物料或廢物：本項目不會產生任何危險物料或廢物。

導致污染或危害的意外：本項目不會出現可能導致污染或危害的意外。

棄舊或受污染物料的處置：本項目無需處置任何廢舊或受污染物料，因此不會造成任何影響。

5 保護措施及其他事宜

5.1 環境保護措施

5.1.1 施工階段

本項目在施工階段產生的水質影響可能對歌連臣角南（具有較高的珊瑚多樣性；見*附件B*的*章節B1.2.7*）和大浪排的珊瑚群落構成輕微干擾（與最近一段擬建光纜距離分別約190米及490米）。潛在的水質影響也可能對石澳海角具特殊科學價值地點構成潛在干擾（與最近一段擬建光纜距離約560米）。根據有關沉積物捲流的計算結果，預測珊瑚群落和特殊科學價值地點不會受到光纜鋪設工程的影響（預計水中懸浮沉積物的濃度會在距離光纜約180米處回落至自然背景值）。

建議在安裝光纜期間實施具體措施，務求使水質以及對四周海洋生物群落的影響最小化（參考*附件A和B*）。同時亦建議在歌連臣角南部的珊瑚群落外設置多層隔泥幕作為一項預防措施，詳見*附件A圖A3*。

5.1.2 運作階段

本項目不會造成任何運作影響，因此無需實施任何環境保護措施。

5.2 環境影響的可能嚴重程度、分布及持續時間

在香港海域內鋪設海底光纜系統需時約62天（包括由潛水員進行淺埋工程需時2天），以及陸上光纜安裝工程約45天。預料這些工程所造成的剩餘環境影響只會局限於光纜沿線四周，而且嚴重程度很低，也在可接受水平。

海底光纜在運作期間則不會造成任何環境影響。

5.3 累積影響

目前本項目附近沒有任何已規劃會於同期進行的項目，因此，預計本項目在施工和運作期間，都不會造成累積影響。

5.4 未來影響

將軍澳工業邨已經是多條海底光纜系統的登岸地點，因此本項擬議登岸地點的岩土環境適合安裝海底光纜。該處已經被其他系統使用，但沒有錄得任何投訴或事故，顯示這些系統在安裝或運作時對附近環境造成不良影響。

APG海底光纜系統所採用的光纜掩埋方法（如上文所述）已於香港和世界各地應用多年，而且被廣泛接受為一種對四周海洋環境影響極小的方法。這套方法的工程期一般都很短，而且在操作時不會產生需予處置的廢物或污染物，或過量噪音的問題。

6 *環境監測與審核*

雖然本項目沒有已知和不可接受的環境影響，但仍建議實施水質監測，珊瑚監測及海洋哺乳類動物觀察區，務求核實本項目的工程不會對水質、海洋生態和漁業造成任何影響。有關環境監察與審核的要求，均在*附件E*探討。

將軍澳工業邨是多個海底光纜系統的登岸地點。這些系統為亞太地區的主要國家提供通訊連接。當中除了SEA-ME-WE 3光纖海底光纜系統之外，這些光纜系統都沒有按照《環境影響評估條例》來準備環評報告。相信這些光纜系統的許可證大都是在1997年推動環境影響評估程序前發出的。香港國際電訊有限公司於1998年5月，向環保署提交了一份名為"亞歐海底光纜系統—深水灣安裝工程"的工程項目簡介（AEP-001/1998）。該項研究認為，該項目不會對環境造成長遠或累積的不良影響。該項目於1998年7月27日獲發環境許可證（EP-001/1998）。

亞洲環球電訊分別於2000年6月和2000年7月向環保署提交了工程項目簡介，分別名為*《東亞海底通訊電纜系統》*（AEP-079/2000）和*《東亞海底通訊電纜系統（將軍澳）》*（AEP-081/2000）。NTT Com Asia Limited於2011年11月向環保署提交了一份工程項目簡介，名為*《亞洲快線海底光纜系統 – 將軍澳》*（AEP-433/2011）。這三條海底光纜系統的登岸地點也是在將軍澳工業邨。這些研究認為，這些光纜在安裝期間不會對環境造成不可接受的環境影響，因此無需實施任何環境監測與審核措施。這些項目獲發環境許可證的日期分別是2000年9月6日（EP-079/2000），2000年10月4日（EP-081/2000）和2011年12月20日（EP-433/2011）。

近期在香港進行的相似項目包括：

- *連接了哥岩與吉澳白沙頭咀之現有11千伏海底電纜更換工程*（中電）在2013年5月30日提交（AEP-461/2013）。電纜在香港水域內的長度約為880米。該項研究認為，該項目不會對環境造成長遠或累積的不良影響。該項目於2013年8月27日獲發環境許可證（EP-461/2013）。

- *亞洲快綫海底光纜系統 – 將軍澳*（NTT Com Asia Limited）。工程項目簡介（AEP-433/2011）在2011年11月29日提交。光纜在香港水域內的長度約為33.5千米。該項研究認為，該項目不會對環境造成長遠或累積的不良影響。該項目於2011年12月20日獲發環境許可證（EP-433/2011）。

- *東南亞日本海底光纜網絡工程香港段*（中國電信）。工程項目簡介（AEP-433/2011）在2011年9月28日提交。光纜在香港水域內的長度約為37千米。該項研究認為，該項目不會對環境造成長遠或累積的不良影響。該項目於2011年10月24日獲發環境許可證（EP-423/2011）。

- *VSNL 亞洲區內海底通訊電纜–深水灣段*（Videsh Sanchar Nigam Ltd.）這項研究於 2007 年 8 月 31 日向環保署提交工程項目簡介

（AEP-294/2007）。該項研究認為，該項目不會對環境造成長遠或累積的不良影響。該項目於 2007 年 11 月 23 日獲發環境許可證（EP-294/2007）。

- *南大嶼山亞美海底光纜系統*（Reach Networks Hong Kong Ltd.）這項研究於 2007 年 10 月 5 日向環保署提交工程項目簡介（AEP-298/2007）。該項研究認為，該項目不會對環境造成長遠或累積的不良影響。該項目於 2007 年 12 月 20 日獲發環境許可證（EP-298/2007）。

- *擬鋪設 132 千伏青山發電站至機場"A"變電站電纜線路之海底電纜分段*（中華電力有限公司）（AEP 267/2007）。該條電纜在香港海域內的長度約為 6.2 千米。該項研究認為，該項目不會對環境造成長遠或累積的不良影響。該項目於 2007 年 3 月 29 日獲發環境許可證（EP-267/2007）。

- *FLAG 北亞光纖環系統*（FLAG Telecom Asia Limited）。這項研究於 2001 年 3 月向環保署提交工程項目簡介（AEP-099/2001）。該條電纜在香港海域內的總長度約為 10 千米。該項研究認為，該項目不會對環境造成長遠或累積的不良影響。該項目於 2001 年 6 月 18 日獲發環境許可證（EP-099/2001）。

- *香港新電訊有限公司：本地通訊電纜*（香港新電訊有限公司）。這項研究於 2000 年 12 月向環保署提交工程項目簡介（AEP-086/2001）。從舂坎角至長沙的一段電纜總長度約為 37 千米，而舂坎角至沙灣的一段電纜的長度則約達 32 千米。該項研究認為，該項目不會對環境造成長遠或累積的不良影響。該項目於 2001 年 2 月 16 日獲發環境許可證（EP-086/2001）。

- *C2C 通訊電纜網絡—香港段：舂坎角*（GB21〔香港〕有限公司）。這項研究於 2000 年 12 月向環保署提交工程項目簡介（AEP-087/2001）。每條電纜在香港海域內的長度約為 30 千米。該項研究認為，該項目不會對環境造成長遠或累積的不良影響。該項目於 2001 年 2 月 16 日獲發環境許可證（EP-087/2001）。

- *東亞海底通訊電纜系統（將軍澳）*（亞洲環球電訊）。這項研究於 2000 年 7 月向環保署提交工程項目簡介（AEP-081/2000）。該條電纜在香港海域內的總長度約為 25 千米。該項研究認為，該項目不會對環境造成長遠或累積的不良影響。該項目於 2000 年 10 月 4 日獲發環境許可證（EP-081/2000）。

- *東亞海底通訊電纜系統*（亞洲環球電訊）。這項研究於 2000 年 6 月 21 日向環保署提交工程項目簡介（AEP-079/2000）。該條電纜在香港海域內的總長度約為 25 千米。該項研究認為，該項目不會對環境

造成長遠或累積的不良影響。該項目於 2000 年 9 月 6 日獲發環境許可證（EP-079/2000）。

- *亞太 2 號(APCN2)海底光纜系統塘福登陸段光纜鋪設工程*（香港國際電訊有限公司）。這項研究於 2000 年 5 月向環保署提交工程項目簡介（AEP-069/2000）。該條電纜在香港海域內的總長度約為 9 千米。該項研究認為，該項目不會對環境造成長遠或累積的不良影響。該項目於 2000 年 7 月 26 日獲發環境許可證（EP-069/2000）。

- *位於大嶼山南岸塘福第 328 段約第 591SA 地段之北亞海底光纖通訊電纜系統遠程通訊設施及相關之電纜登岸工程*（Level 3 Communications Ltd）。這項研究於 2000 年 3 月向環保署提交工程項目簡介（AEP-064/2000）。該條電纜在香港海域內的總長度約為 10 千米。該項研究認為，該項目不會對環境造成長遠或累積的不良影響。該項目於 2000 年 6 月 5 日獲發環境許可證（EP-064/2000）。

Annex A

Assessment of Potential Impacts to Water Quality

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A1 INTRODUCTION

This *Annex* presents an evaluation of the potential water quality impacts associated with the construction of the proposed Asia Pacific Gateway (APG) – Tseung Kwan O submarine cable system. The cable will travel from Tseung Kwan O (TKO) Industrial Estate to offshore eastern waters through Hong Kong Special Administrative Region (HKSAR) waters and enter the South China Sea. Once installed, the cable is not expected to result in any water quality impacts during operation and hence the focus of this water quality assessment is on the potential impacts during the construction (i.e. cable lay and burial) phase.

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 Junk Bay, Eastern Buffer, Southern and Mirs Bay WCZs (*Figure A1*). 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 during the construction phase of the proposed APG submarine cable system.

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

Parameter	Junk Bay, 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)
	Junk Bay and 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	Junk Bay, Eastern Buffer, Southern and Mirs Bay WCZs*
Unionised Ammonia	Not to exceed 0.021 mg L^{-1} (annual mean)
Chlorophyll-*a*	No criteria established for Junk Bay, Mirs Bay, Southern and Easter Buffer WCZs
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 WCZ and fish culture subzones in Junk Bay, Mirs Bay, Southern and Eastern Buffer WCZs)

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

A2.2 EIAO - TM

Annexes 6 and *14* of the *EIAO-TM* 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 TM- ICW

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

A2.4 SEAWATER INTAKES

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

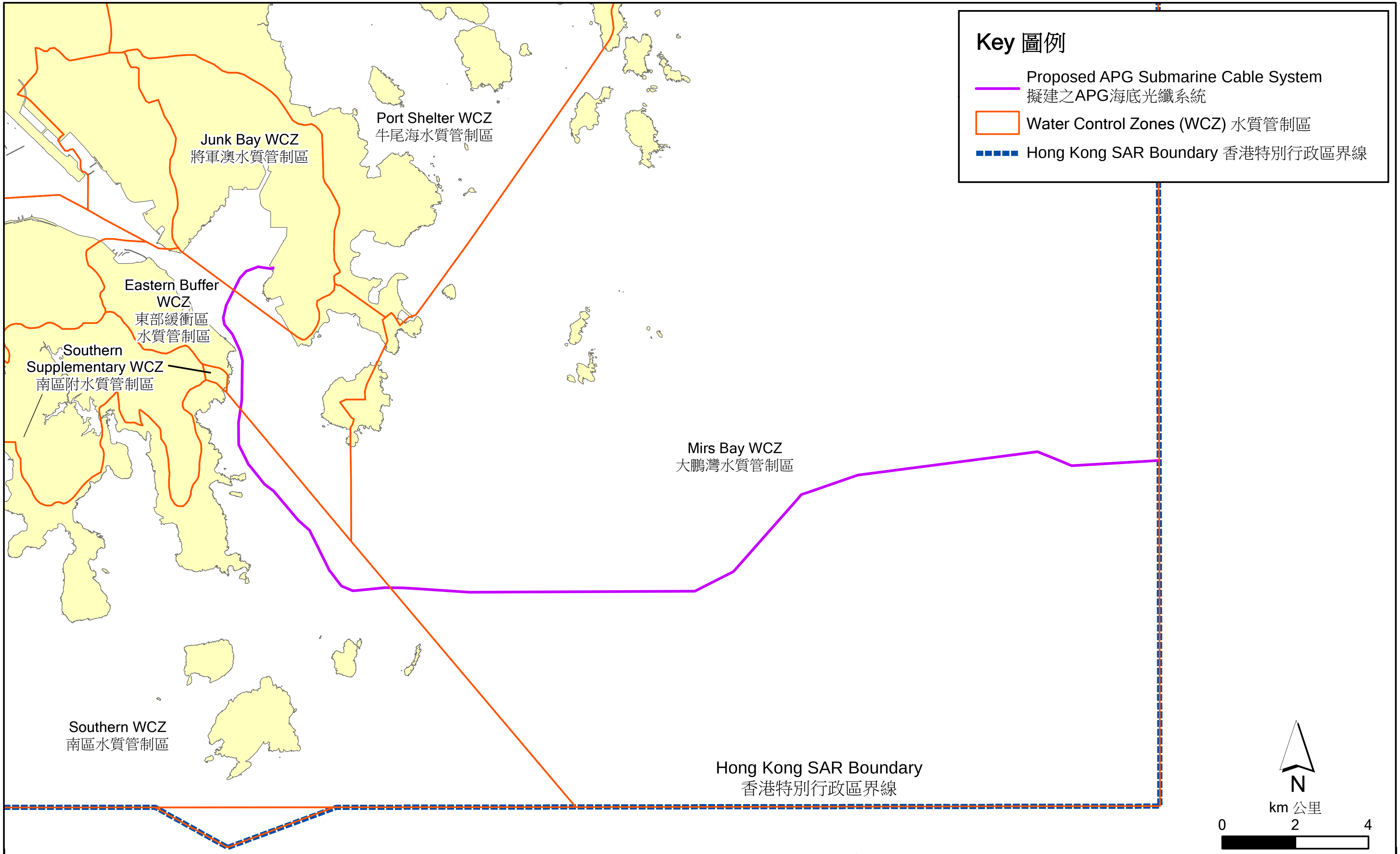

Figure A1
圖 A1

Water Control Zones (WCZs) Passed through by APG Submarine Cable System
APG 海底光纖系統經過的水質管制區

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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
Ammonical 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).

A2.5 *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, also provides useful guidelines on water pollution associated with construction activities.

A3 DESCRIPTION OF THE ENVIRONMENT

A3.1 HYDRODYNAMICS

The first section of the proposed cable system lies in the inner part of Junk Bay and is therefore sheltered from tidal currents. Others sections of the cable system located in the south-eastern waters (*Figure A1*) are mainly influenced by the oceanic water from South China Sea.

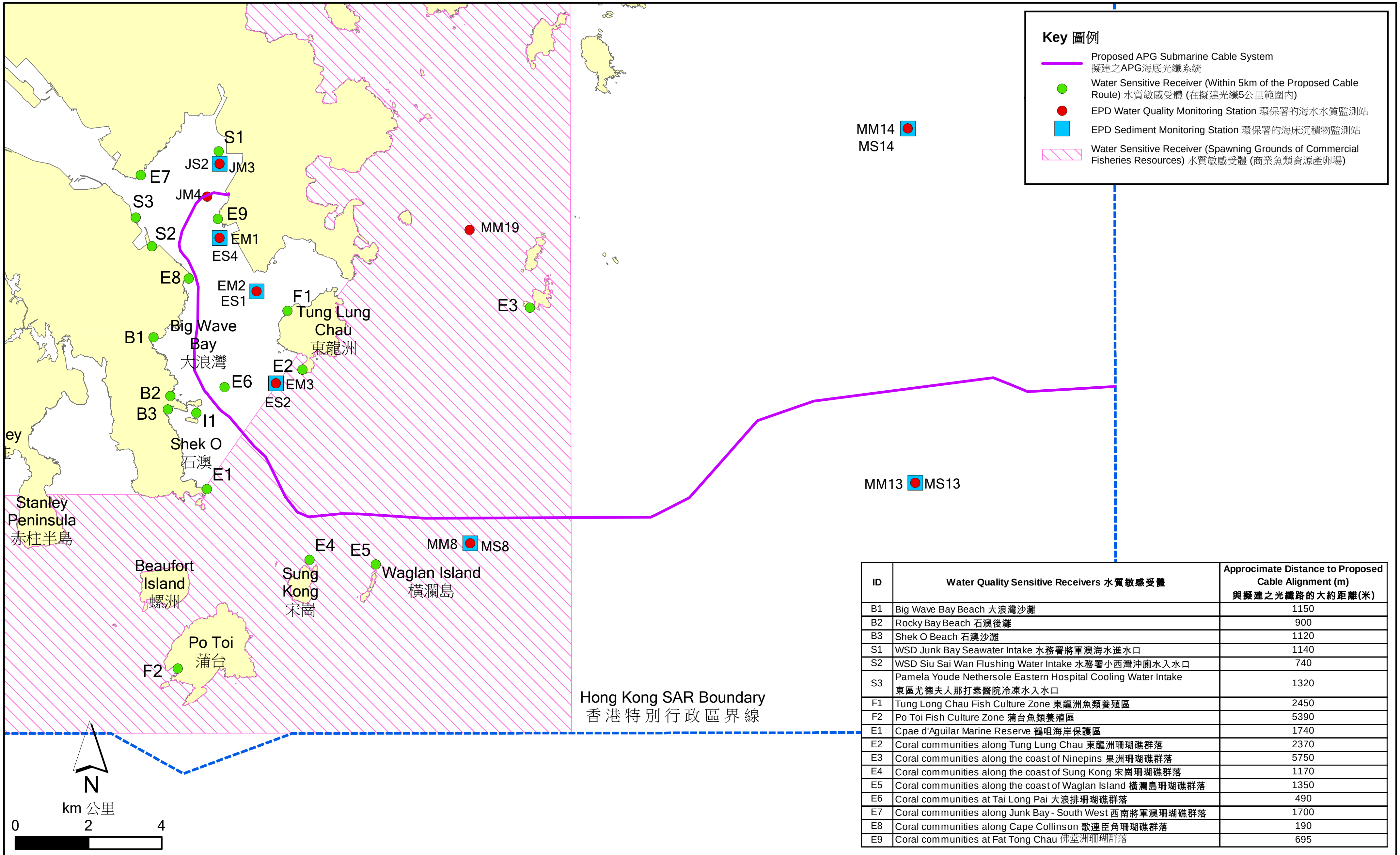
A3.2 WATER QUALITY

The proposed route for the submarine cable system passes through the Junk Bay, Eastern Buffer, Southern and Mirs Bay WCZs (*Figure A1*). There are nine EPD routine water quality monitoring stations in the vicinity of the cable route. Water quality data for these stations, which were collected between 2006 and 2011 [(1)] and are the most up to date published data, and are summarised in *Table A3.* The locations of the stations are shown in *Figure A2.*

(1) EPD, Marine Water Quality in Hong Kong in 2006 - 2011.

Table A3 EPD Routine Water Quality Monitoring Data along the Cable Route (2006 - 2011)

WQ Parameter	JM3 Junk Bay	JM4 Junk Bay	EM1 Chai Wan	EM2 Tathong Channel	EM3 Tathong Channel	MM8 Waglan Island	MM13 Mirs Bay (South)	MM14 Mirs Bay (Central)	MM19 Ninepin Group
Temperature (°C)	23.2 (15.6-29.1)	23.0 (15.4-29.1)	23.0 (15.4-29.2)	23.0 (15.4-29.0)	22.9 (15.3-28.9)	22.7 (138-29.0)	22.8 (13.3-29.1)	22.6 (13.7-29.0)	22.6 (14.1-29.1)
Salinity	32.3 (27.7-33.9)	32.5 (29.2-34.0)	32.6 (30.1-34.0)	32.6 (25.7-34.1)	32.8 (29.1-34.2)	32.9 (30.0-34.5)	33.0 (27.8-34.5)	33.1 (30.4-34.4)	33.0 (30.3-34.0)
pH	8.0 (7.6-8.4)	8.0 (7.6-8.4)	8.0 (7.6-8.3)	8.0 (7.6-8.3)	8.0 (7.6-8.4)	8.1 (7.6-8.4)	8.1 (7.6-8.6)	8.1 (7.5-8.5)	8.1 (7.6-8.4)
Dissolved Oxygen – Depth-averaged (mg L^{-1})	6.3 (4.1-8.1)	6.1 (3.9-8.0)	5.9 (3.4-8.0)	6.1 (3.9-8.1)	6.3 (4.1-8.2)	6.5 (3.3-8.9)	6.6 (3.7-9.1)	6.5 (3.7-8.8)	6.5 (3.6-9.6)
Dissolved Oxygen - Bottom (mg L^{-1})	5.9 (2.9-8.2)	5.8 (2.7-8.0)	5.7 (2.6-8.0)	5.8 (3.1-8.2)	5.9 (2.5-8.2)	6.1 (2.7-8.9)	6.2 (3.1-9.1)	6.2 (2.8-8.8)	6.1 (2.5-9.2)
BOD_5 (mg L^{-1})	0.9 (0.2-3.6)	0.8 (<0.1-1.9)	0.7 (<0.1-1.8)	0.7 (<0.1-2.3)	0.6 (<0.1-2.8)	0.5 (<0.1-1.5)	0.5 (<0.1-1.8)	0.5 (<0.1-2.0)	0.6 (<0.1-1.9)
Suspended Solids (mg L^{-1})	3.5 (0.8-11.6)	4.0 (1.3-19.0)	3.9 (1.3-13.2)	4.0 (1.3-15.7)	4.1 (1.2-25.3)	3.6 (0.9-15.2)	3.7 (0.7-19.3)	3.4 (0.5-15.5)	2.9 (0.8-13.7)
Total Inorganic Nitrogen (mg L^{-1})	0.16 (0.01-0.44)	0.15 (0.04-0.33)	0.16 (0.04-0.45)	0.14 (0.02-0.47)	0.10 (0.01-0.33)	0.09 (0.01-0.29)	0.08 (0.01-0.31)	0.08 (0.01-0.24)	0.08 (0.01-0.22)
Unionised Ammonia (mg L^{-1})	0.003 (0.001-0.009)	0.003 (0.001-0.008)	0.003 (0.001-0.007)	0.002 (0.001-0.005)	0.002 (0.001-0.005)	0.001 (0.001-0.005)	0.001 (0.001-0.008)	0.001 (0.001-0.005)	0.001 (0.001-0.004)
Chlorophyll-*a* (microgram L^{-1})	4.4 (0.2-22.4)	3.5 (0.3-14.3)	3.4 (0.2-24.3)	2.8 (0.4-10.7)	2.3 (0.4-9.3)	2.3 (0.3-11.3)	2.2 (0.3-12.0)	2.0 (0.3-7.7)	2.3 (0.5-10.1)
Escherichia coli (cfu 100mL^{-1})	47 (2-817)	57 (2-697)	61 (<1-1900)	29 (<1-1000)	4 (<1-850)	1 (<1-267)	1 (<1-301)	1 (<1-1234)	1 (<1-204)



ID	Water Quality Sensitive Receivers 水質敏感受體	Approcimate Distance to Proposed Cable Alignment (m) 與擬建之光纖路的大約距離(米)
B1	Big Wave Bay Beach 大浪灣沙灘	1150
B2	Rocky Bay Beach 石澳後灘	900
B3	Shek O Beach 石澳沙灘	1120
S1	WSD Junk Bay Seawater Intake 水務署將軍澳海水進水口	1140
S2	WSD Siu Sai Wan Flushing Water Intake 水務署小西灣沖廁水入水口	740
S3	Pamela Youde Nethersole Eastern Hospital Cooling Water Intake 東區尤德夫人那打素醫院冷凍水入水口	1320
F1	Tung Long Chau Fish Culture Zone 東龍洲魚類養殖區	2450
F2	Po Toi Fish Culture Zone 蒲台魚類養殖區	5390
E1	Cpae d'Aguilar Marine Reserve 鶴咀海岸保護區	1740
E2	Coral communities along Tung Lung Chau 東龍洲珊瑚礁群落	2370
E3	Coral communities along the coast of Ninepins 果洲珊瑚礁群落	5750
E4	Coral communities along the coast of Sung Kong 宋崗珊瑚礁群落	1170
E5	Coral communities along the coast of Waglan Island 橫瀾島珊瑚礁群落	1350
E6	Coral communities at Tai Long Pai 大浪排珊瑚礁群落	490
E7	Coral communities along Junk Bay - South West 西南將軍澳珊瑚礁群落	1700
E8	Coral communities along Cape Collinson 歌連臣角珊瑚礁群落	190
E9	Coral communities at Fat Tong Chau 佛堂洲珊瑚群落	695

Figure A2
圖 A2

EPD Monitoring Stations and Water Quality Sensitive Receivers
環保署水質監測站及水質敏感受體

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WQ Parameter	JM3 Junk Bay	JM4 Junk Bay	EM1 Chai Wan	EM2 Tathong Channel	EM3 Tathong Channel	MM8 Waglan Island	MM13 Mirs Bay (South)	MM14 Mirs Bay (Central)	MM19 Ninepin Group

Notes:

a) The EPD routine water quality monitoring stations in the vicinity of the proposed cable corridor are located in the Junk Bay, Eastern Buffer and Mirs Bay WCZs and none are in the Southern WCZ.

b) Except as specified, data presented are depth-averaged.

c) Data presented are annual arithmetic means except for *E. coli* which are geometric means.

d) Data enclosed in brackets indicate the range.

e) Bolded text indicates non-compliance with the WQOs.

The data showed that the annual mean for both depth-averaged and bottom dissolved oxygen complied with the WQO during 2006 – 2011. Full compliance (100%) was also achieved with the WQOs for total inorganic nitrogen and unionised ammonia at all stations. The levels of total inorganic nitrogen were observed to fluctuate at all stations from 2006 to 2011. The levels of unionised ammonia showed a decreasing trend at Stations JM3 and JM4 during 2006 – 2011, whilst it fluctuated at the other stations (EM1, EM2, EM3, MM6, MM13, MM14, and MM19). The SS concentrations were within a wide range at all monitoring stations, with a maximum value reaching up to 25.3 mg L^{-1} at Station EM3. *E.coli* levels also stayed in compliance with the WQO at all stations between 2006 and 2011, though a wide range of *E.coli* concentrations was observed. The maximum *E.coli* level achieved was 1900 cfu $100mL^{-1}$ at Station EM1.

A3.3 SEDIMENT QUALITY

There are seven EPD routine sediment quality monitoring stations in the vicinity of the cable corridor: JS2, ES1, ES2, ES4, MS8, MS13, and MS14. Sediment quality data for these stations are available for 2006-2011 (1) and are summarised in *Table A4*. The locations of the sediment quality monitoring stations are shown on *Figure A2*.

(1) EPD. Marine Water Quality for Hong Kong in 2011.

Table A4 EPD Routine Sediment Quality Monitoring Data in the Vicinity of the Cable Route (2006 – 2011)

Parameter	LCEL	UCEL	JS2	ES1	ES2	ES4	MS8	MS13	MS14
COD (mg kg^{-1})	-	-	15000 (11000-19000)	10700 (8700-14000)	10858 (6700-15000)	12417 (10000-15000)	11275 (8800-18000)	10425 (8100-18000)	10767 (7700-18000)
TKN (mg kg^{-1})	-	-	460 (320-550)	302 (190-420)	372 (210-590)	379 (200-530)	425 (270-480)	366 (200-530)	399 (200-510)
Cadmium (mg kg^{-1})	1.5	4	0.1 (0.1-0.2)	<0.1 (<0.1-<0.1)	<0.1 (<0.1-0.2)	<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	44 (39-49)	21 (16-29)	26 (17-41)	26 (21-38)	31 (25-35)	31 (27-37)	31 (28-34)
Copper (mg kg^{-1})	65	110	87 (73-100)	26 (21-29)	21 (9-54)	45 (32-56)	12 (8-16)	11 (9-14)	11 (7-13)
Mercury (mg kg^{-1})	0.5	1	0.25 (0.17-0.41)	0.10 (0.07-0.14)	0.07 (<0.05-0.17)	0.17 (0.10-0.36)	0.05 (<0.05-0.06)	0.05 (<0.05-0.07)	0.05 (<0.05-0.05)
Nickel (mg kg^{-1})	40	40	23 (19-31)	13 (10-17)	17 (12-27)	14 (11-21)	23 (18-29)	24 (20-27)	23 (19-27)
Lead (mg kg^{-1})	75	110	49 (41-54)	26 (22-32)	28 (18-50)	30 (23-41)	33 (29-42)	32 (27-38)	32 (29-36)
Silver (mg kg^{-1})	1	2	1.8 (1.0-2.0)	0.8 (0-1.0)	0.1 (0-1.0)	1.0 (1.0-1.0)	0 (0-0)	0 (0-0)	0 (0-0)
Zinc (mg kg^{-1})	200	270	141 (110-160)	66 (56-79)	74 (40-120)	82 (69-110)	81 (64-100)	81 (71-94)	80 (66-92)
Arsenic (mg kg^{-1})	12	42	7.4 (6.7-8.5)	4.8 (3.6-6.2)	6.1 (4.4-8.9)	4.6 (3.4-6.3)	6.5 (5.4-7.2)	7.0 (5.7-8.1)	6.9 (5.7-8.3)
Low Molecular Weight PAHs (µg kg^{-1})	550	3160	97 (90-110)	96 (90-93)	93 (90-110)	100 (90-170)	93 (90-160)	90 (90-95)	90 (90-97)

Parameter	LCEL	UCEL	JS2	ES1	ES2	ES4	MS8	MS13	MS14
High Molecular Weight PAHs (μg kg^{-1})	1700	9600	245 (90-430)	121 (21-840)	76 (24-300)	283 (62-1700)	37 (17-120)	31 (19-59)	25 (18-40)
Total PCBs (μg kg^{-1})	23	180	18 (18-20)	18 (18-18)	18 (18-18)	18 (18-18)	18 (18-18)	18 (18-18)	18 (18-18)

Notes:

a) The EPD routine sediment quality monitoring stations in the vicinity of the proposed cable corridor are located in the Junk Bay, Eastern Buffer and Mirs Bay WCZs and none are in the Southern WCZ.

b) Data presented are arithmetic mean; ranges are enclosed in brackets.

c) Results are based on laboratory analysis of bulk samples, which are collected twice per year from each sampling location.

d) LCEL denotes Lower Chemical Exceedance Level; UCEL denotes Upper Chemical Exceedance Level.

e) If the concentration is below report limit (RL), the result will be taken as ½ x RL in the calculation.

f) Bolded text indicates exceedance of the LCEL; bolded and italic text indicates exceedance of the UCEL.

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 except for copper and silver at JS2, indicating slight sediment contamination in the vicinity of Junk Bay. Except this, the sediment in the vicinity of the proposed cable route was not contaminated based on the existing sediment classification guidelines.

A3.4 WATER QUALITY SENSITIVE RECEIVERS

Water quality sensitive receivers (WSRs) in the vicinity of the cable corridor and the landing site have been identified under the broad designations of gazetted bathing beaches, water intakes, fisheries and areas of high ecological importance.

Coastal Protection Area (CPA) from Cape Collinson to Tso Tui Wan comprises mainly areas of natural coastal lines with attractive coastal features such as boulders and rocky shore in reference to *Approved Chai Wan Outline Zoning Plan* (No. S/H20/21) and CPA at Shek O Headland, Tai Tau Chau and Ng Fan Chau also comprises mainly areas of boulders, rocky shore and sand beaches in reference to *Approved Tai Tam & Shek O Outline Zoning Plan* (No. S/H18/10). Given that the CPA from Cape Collinson to Tso Tui Wan mainly comprises outcrop rocks and sub-tidal coral communities at Cape Collison is already set as separate WSRs, this designated CPA is not considered as WSR. Similarly, the CPA around Shek O Headland, Tai Tau Chau and Ng Fan Chau also mainly comprises outcrop rocks, and gazetted beaches at Shek O and Rocky Bay and SSSI at Shek O Headland where water quality impacts are of concern are already taken as WSRs, thus the CPA is not considered as a separate WSR.

The identified WSRs in these categories, shown on *Figure A2* are summarised as follows.

- **Gazetted Bathing Beaches:** Big Wave Bay, Rocky Bay, and Shek O;
- **Seawater Intakes:** Water Services Department (WSD) Seawater Intakes at the Junk Bay and Siu Sai Wan; Pamela Youde Nethersole Eastern Hospital Cooling Water Intake at Heng Fa Chuen;
- **Fisheries:** Tung Lung Chau Fish Culture Zone and Po Toi Fish Culture Zone;
- **Sites of High Ecological Importance:** Cape d'Aguilar Marine Reserve, coral communities along the coast of Ninepins, Po Toi, Sung Kong and Waglan Island, along the south-eastern coast of Tung Lung Chau, at Tai Long Pai, at the southwest coast of Junk Bay, and along Cape Collinson

(coral community along Cape Collinson is not of high ecological value but has higher coral diversity when compared to adjacent coastal areas.); and

- **Sites of Special Scientific Interest:** Shek O Headland SSSI.

The distances between the cable corridor and the identified representative sensitive receivers are summarised in *Table A5*.

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

ID	Water Quality Sensitive Receivers	Approximate Distance to Proposed Cable Alignment (m)
B1	Big Wave Bay Beach	1,150
B2	Rocky Bay Beach	880
B3	Shek O Beach	1,120
S1	WSD Junk Bay Seawater Intake	1,140
S2	WSD Siu Sai Wan Flushing Water Intake	740
S3	Pamela Youde Nethersole Eastern Hospital Cooling Water Intake	1,320
F1	Tung Long Chau Fish Culture Zone	2,450
F2	Po Toi Fish Culture Zone	5,390
E1	Cape d'Aguilar Marine Reserve	1,750
E2	Coral communities along Tung Lung Chau	2,300*
E3	Coral communities along the coast of Ninepins	5,750*
E4	Coral communities along the coast of Sung Kong	1,170*
E5	Coral communities along the coast of Waglan Island	1,350*
E6	Coral communities at Tai Long Pai	490*
E7	Coral communities at South West Junk Bay	1,700*
E8	Coral communities at Cape Collinson	190*
E9	Coral communities at Fat Tong Chau	695*
I1	Site of Special Scientific Interest at Shek O Headland	560

Note: * the distance has been estimated from the outermost point of the coral communities' boundary to the closest point of the cable alignment.

It should be noted that the actual distances from water sensitive receivers may be greater than those presented in *Table A5*, depending on the deployed position of the cable within the works area.

A4 IMPACT ASSESSMENT

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

A4.1 LAYING OF THE CABLE AT THE LANDING SITE

The potential impacts to water quality during the trenching works on land primarily relate to surface water run-off and the discharge of pumped water, both of which may be readily controlled through the measures discussed in *Section A4.3*.

A4.2 INSTALLATION OF THE MARINE SECTIONS OF THE CABLE

The marine sections of the cable will be installed in two ways. At approximately 20 m from the seawall at TKO Industrial Estate (the end of the existing conduit), the cable will be buried to a depth of approximately 2 m by divers. Beyond this segment up to the HKSAR boundary, the cable will be buried by an "Injector Burial Tool" or "Sledge Tool" to a target burial depth of 5 m below the seabed using jetting technique.

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 (approximately 20-30 m) and the burial depth is shallow (usually less than 2 m).

The works involving jetting by an injector 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:

- *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 0.5 m and the cable is buried to a maximum depth of 5 m.

During the jetting cable laying process 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:

<u>Release rate</u> =	=	cross-sectional area of disturbed sediment x speed of cable laying machine x sediment dry density x percentage loss
<u>depth of disturbance</u>	=	5 m (burial depth of cable)
<u>width of disturbance</u>	=	0.5 m (width of seabed disturbance as cable buried)

maximum cross sectional area = 2.5 m^2

loss rate = 20% (majority of sediment not disturbed)

speed of machine = 0.278 m s^{-1} (1 km hour^{-1})

in-situ dry density = 600 kg m^{-3} (typical of Hong Kong sediment)

Release Rate = **83.4 kg s^{-1}**

During cable laying works, 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 in *Section A4.2* 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 the project area. 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 x height of sediment x width of sediment)

release rate = 83.4 kg s^{-1}

current velocity = 0.9 m s^{-1}

height of sediment = 1 m

(1) ERM- Hong Kong Ltd (2000). New T&T Hong Kong Limited Domestic Cable Route. For New T&T Hong Kong Ltd.

width of sediment = 6 m

Initial Concentration = 15.44 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} (1). As the predicted initial concentration exceeds this value for this project, a more conservative settling velocity of 10 mms^{-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 (2).

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 mms^{-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 of the WSRs are located beyond the above predicted distance, it is hence expected that the suspended solid in water column will be back to background level before reaching these WSRs including the nearest WSR E8 (coral communities at the south of Cape Collinson) with the closest distance approximately 190 m from the proposed cable corridor. It should be noted that the distance of the cable alignment from the WSR E8 can be confirmed on the mapping system. An enlarged plan showing the coordinates and location of the WSR E8 and cable alignment will be prepared before commence of construction. Differential Global Positioning System

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

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

(DGPS) of typical real time horizontal accuracy within ±10cm will be used for the navigation system of the Cable Installation Barge. The jetting method will either use Sledge Tool or Injector Burial Tool to lay and bury the cable (*Figures 2.4 & 2.5*). In case Sledge Tool is applied for the installation, underwater positioning system will be used for the burial tool positioning. In case Injector Burial Tool is applied, the tool is vertically down to the seabed so that ship position will be used for the positioning. In order to maintain the cable alignment, vessel position is controlled by Dynamic Positioning (DP) system. During the cable installation, burial tool position will be logged automatically. This tracking record will be plotted on the Map and will demonstrate the cable alignment has a distance of 190m away from the WSR E8. An as-built plan can be prepared after the construction.

The potential disturbance to WSR E8 are expected to be limited and transient given the short-term nature of the cable laying works which will only last for a total of approximately 15 working days for the whole alignment. It should also be noted that there may be shallow burial or surface lay with protection (ie Uraduct) at the cable section near the coastline of Cape Collinson because of the potential shallow rocky sea bottom with thin sediment layer. With the provision of silt curtains as precautionary measure, unacceptable adverse impacts to the coral community at the south of Cape Collinson are not expected to occur.

A Route Clearance Operation (RC) and Pre-lay Grapnel Run (PLGR) over part of the proposed cable route (cable burial section) will be conducted. RC and PLGR of a similar scale were also conducted in *Asia Submarine-cable Express (ASE) - Tseung Kwan O* (1) within HKSAR. Given that PLCR will only be dragged on the seafloor to remove large substances on the seabed and referring to past project experience in HKSAR, the RC and PLGR are not expected to cause unacceptable impact on the 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.

(1) ERM – Hong Kong, Ltd (2011) DIR for Asia Submarine-cable Express (ASE) – Tseung Kwan O. For NTT COM Asia Ltd.

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

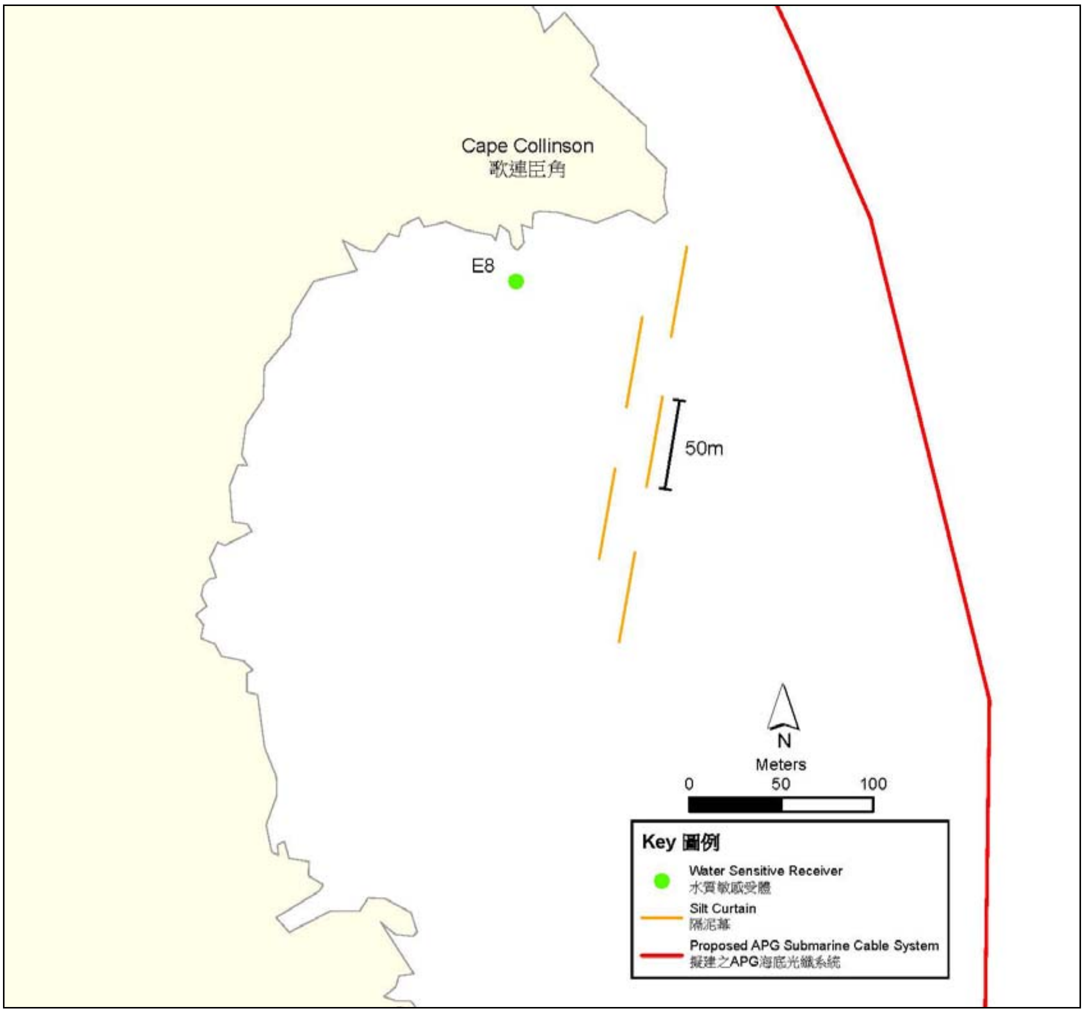
ID	Water Quality Sensitive Receiver	Approx. Distance to Proposed Cable Corridor/ Landing Point (m)	Sediment may reach the WSR?	Likelihood of Adverse Impact	Reason
B1	Big Wave Bay Beach	1,150	No	Unlikely	Sediment plume unlikely to reach the WSR.
B2	Rocky Bay Beach	880	No	Unlikely	Sediment plume unlikely to reach the WSR.
B3	Shek O Beach	1,120	No	Unlikely	Sediment plume unlikely to reach the WSR.
S1	WSD Junk Bay Seawater Intake	1,140	No	Unlikely	Sediment plume unlikely to reach the WSR.
S2	WSD Siu Sai Wan Flushing Water Intake	740	No	Unlikely	Sediment plume unlikely to reach the WSR.
S3	Pamela Youde Nethersole Eastern Hospital Cooling Water Intake	1,320	No	Unlikely	Sediment plume unlikely to reach the WSR.
F1	Tung Long Chau Fish Culture Zone	2,450	No	Unlikely	Sediment plume unlikely to reach the WSR.
F2	Po Toi Fish Culture Zone	5,390	No	Unlikely	Sediment plume unlikely to reach the WSR.
E1	Cape d'Aguilar Marine Reserve	1,750	No	Unlikely	Sediment plume unlikely to reach the WSR.
E2	Coral communities along Tung Lung Chau	2,300	No	Unlikely	Sediment plume unlikely to reach the WSR.
E3	Coral communities along the coast of Ninepins	5,750	No	Unlikely	Sediment plume unlikely to reach the WSR.
E4	Coral communities along the coast of Sung Kong	1,170	No	Unlikely	Sediment plume unlikely to reach the WSR.
E5	Coral communities along the coast of Waglan Island	1,350	No	Unlikely	Sediment plume unlikely to reach the WSR.
E6	Coral communities at Tai Long Pai	490	No	Unlikely	Sediment plume unlikely to reach the WSR.
E7	Coral communities at South West Junk Bay	1,700	No	Unlikely	Sediment plume unlikely to reach the WSR.
E8	Coral communities at Cape Collinson	190	No	Unlikely	Sediment plume unlikely to reach the WSR but silt curtains will be provided as precautionary measure.
E9	Coral communities at Fat Tong Chau	695	No	Unlikely	Sediment plume unlikely to reach the WSR.
I1	Site of Special Scientific Interest at Shek O Headland	560	No	Unlikely	Sediment plume unlikely to reach the WSR.

A4.3 *MITIGATION MEASURES DURING CABLE LAYING*

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

- Silt curtain of multi-layers shall be provided as precautionary measure for the closest water sensitive receiver E8 at the south of Cape Collinson (location refer to *Figure A3*);

Figure A3 Indicative Location of Silt Curtain proposed for WSR E8



- The crane barge used for the transport of debris recovered from the seabed during route clearance shall be fitted with tight bottom seals in order to prevent leakage of material during loading and transport;

- The crane barge should be filled to a level which ensures that material does not spill over during loading and transport to the disposal site and that adequate freeboard is maintained to ensure that the decks are not washed by wave actions;

- The forward speed of the installation barge will be limited to a maximum of 1 km $hour^{-1}$; and

- Water quality monitoring will be carried out to verify that the Project works will not result in any impacts to water quality, and consequently to marine ecology and fisheries.

In addition to the above, water quality protection measures during land based cable installation will also be incorporated as part of good working practices:

- 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;

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

- Best Management Practices (BMPs) will be applied to avoid and minimise contaminated runoff from work sites, marine plants and vessels.

A5 SUMMARY AND CONCLUSIONS

A review and assessment of water quality impacts associated with cable laying works along the proposed cable alignment have been undertaken.

The calculation of sediment transport from the construction works indicates that the sediments disturbed during the cable laying works will settle onto the seabed within approximately 180 m from the cable alignment. Water quality sensitive receivers (WSRs) have been identified and all of them are located at the distance greater than 180 m from the proposed cable route thus plume of suspended sediments would not reach these WSRs. The potential disturbance to the nearest WSR E8 ie coral communities at the south of Cape Collinson (the closest distance is approximately 190 m from the proposed cable route) are expected to be limited and transient given the short-term nature of the cable laying works which will only last for a total of approximately 15 working days for the whole alignment. With the provision of silt curtains as precautionary measure, unacceptable adverse impacts to the coral community at the south of Cape Collinson are not expected to occur. It is concluded that no unacceptable water quality impacts have been identified. Mitigation measures are recommended, for example, the speed of the installation barge will be limited to 1 km $hour^{-1}$, and a water quality monitoring programme will be carried out, in order to minimise the water quality impacts at the water sensitive receivers if any, and verify that the Project works will not result in any unacceptable adverse impacts to water quality at WSRs. Due to the remoteness of the water quality sensitive receivers from the cable laying works and the short duration of working period, the identified water quality sensitive receivers 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.

附件 A

水質潛在影響評估

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A1 引言

本附件闡述了擬建的Asia Pacific Gateway（APG）– 將軍澳在施工期間可能造成的潛在水質影響評估。該條光纜將從將軍澳工業邨開始，一直伸延至香港東面邊界的離岸海域，然後進入南中國海。完成安裝後，這條光纜在運作階段預計不會造成任何環境影響。因此，這項水質評估將集中在施工階段（即鋪設和埋藏光纜）時產生的潛在影響。

A2 *相關的法例和評估準則*

下列法例及相關指引或一般指引，均適用於評估擬建海底光纜系統在施工期間可能造成的水質影響。

- *《水污染管制條例》；*
- *《環境影響評估條例》第 499 章第 16 條及《環境影響評估程序的技術備忘錄》附件 6 和 14（以下簡稱《環評技術備忘錄》）；*
- *《技術備忘錄：排放入排水及排污系統、內陸及海岸水域的流出物的標準》（以下簡稱《流出物標準技術備忘錄》）；及*
- *《環保事務諮詢委員會－建築工地排水設施專業人員工作守則》（以下簡稱《專業守則 PN1/94》）。*

A2.1 *《水污染管制條例》*

*《水污染管制條例》*是香港控制水污染和水質的主要法例。按照該條例，香港海域被分成10個水質管制區。每個水質管制區都有一套特定的法定水質指標。擬建的海底光纜系統會經過將軍澳、東部緩衝區、南區和大鵬灣水質管制區（*圖A1*）。*表A1*羅列了這些水質管制區的水質指標。這些指標都是評估擬建的APG海底光纜系統在施工階段的排放物是否符合相關規定的準則。

表A1　將軍澳、東部緩衝區、南區和大鵬灣水質管制區的水質指標摘要

參數	將軍澳、東部緩衝區、南區和大鵬灣水質管制區*
溫度	排出的廢物不可令周邊溫度改變超過2°C
鹽度	排出的廢物不可令天然的周邊鹽度改變超過10%
酸鹼度	需保持在6.5-8.5範圍內，排出的廢物不可令周邊改變超過0.2
懸浮固體	排出的廢物不可令天然周邊水平升高超過30%，也不可以導致懸浮固體的累積，從而對水生生物群落產生不良影響
溶解氧	
• 海底	90%的樣本都不低於每公升2毫克
• 深度平均	90%的樣本都不低於每公升4毫克
營養物（以總無機氮量度）	東部緩衝水質管制區：不可超過每公升0.4毫克（深度平均值的年平均值）
	將軍澳和大鵬灣水質管制區：不可超過每公升0.3毫克（深度平均值的年平均值）
	南區水質管制區：不可超過每公升0.1毫克（深度平均值的年平均值）
非離子氨氮	不可超過每公升0.021毫克（年平均值）
葉綠素-a	將軍澳、東部緩衝區、南區和大鵬灣水質管制區尚未確立準則
有毒物質	有毒質的含量不可引起顯著的毒效

參數	將軍澳、東部緩衝區、南區和大鵬灣水質管制區*
大腸桿菌	年幾何平均數不可超過每100毫升610個菌落數（大鵬灣水質管制區內次級接觸康樂活動分區，將軍澳、大鵬灣、南區及東部緩衝區水質管制區內魚類養殖分區）

* 除非特別指出，將軍澳、東部緩衝區、南區和大鵬灣水質管制區的水質指標是相同的。

A2.2 *《環評技術備忘錄》*

*《環評技術備忘錄》*的*附件*6和*14都是評估水質影響的一般指引和準則。* *《環評技術備忘錄》*承認，當應用上述水質準則時，在排放點上可能沒法達到水質指標，因為有些範圍會受到較大影響（環保署稱之為混合區），該等範圍是污染物在剛進入時開始被稀釋的地方。這個範圍會按每個案例分別界定。大致上，初步稀釋區的可接受準則是：它不能損害一個水體的整體性，亦不可破壞其生態系統。

A2.3 *《廢水排放技術備忘錄》*

擬建海底光纜系統在施工和運行階段的所有排放物，都必須符合根據*《水污染管制條例》*第21條而頒佈的*《廢水排放技術備忘錄》*。該備忘錄為各種接收水體界定了可接受的排放限度。根據*《廢水排放技術備忘錄》*，排入排水管和污水收集系統、內陸水體和水質管制區的近岸水域的排出物，都必須符合特定排放量的污染物濃度標準。這些標準都是由環保署界定，並在新發出的水質管制區排放執照上註明。

A2.4 *海水進水口*

從海水進水口抽取的水的水質應符合水務署的相關水質指標（*表A2*）。

表2 *水務署關於海水進水口抽取水的水質準則*

參數	目標*
色度（H.U.）	<20
混濁度（N.T.U.）	<10
氣味閾值（T.O.N.）	<100
氨態氮	<1
懸浮固形物	<10
溶解氧	>2
生化需氧量	<10
合成清潔劑	<5
大腸桿菌（每100毫升）	<20,000

註：

* 以上化學數據單位為毫升每升（百萬分之）。

A2.5 *《專業守則 1/94》*

除了上述法定要求外，由環保署於1994頒佈的*《專業人士環保事務諮詢委員會守則－建築工地的排水渠》*（*《專業守則PN1/94》*），也為建築工作造成的水污染提供有用的指引。

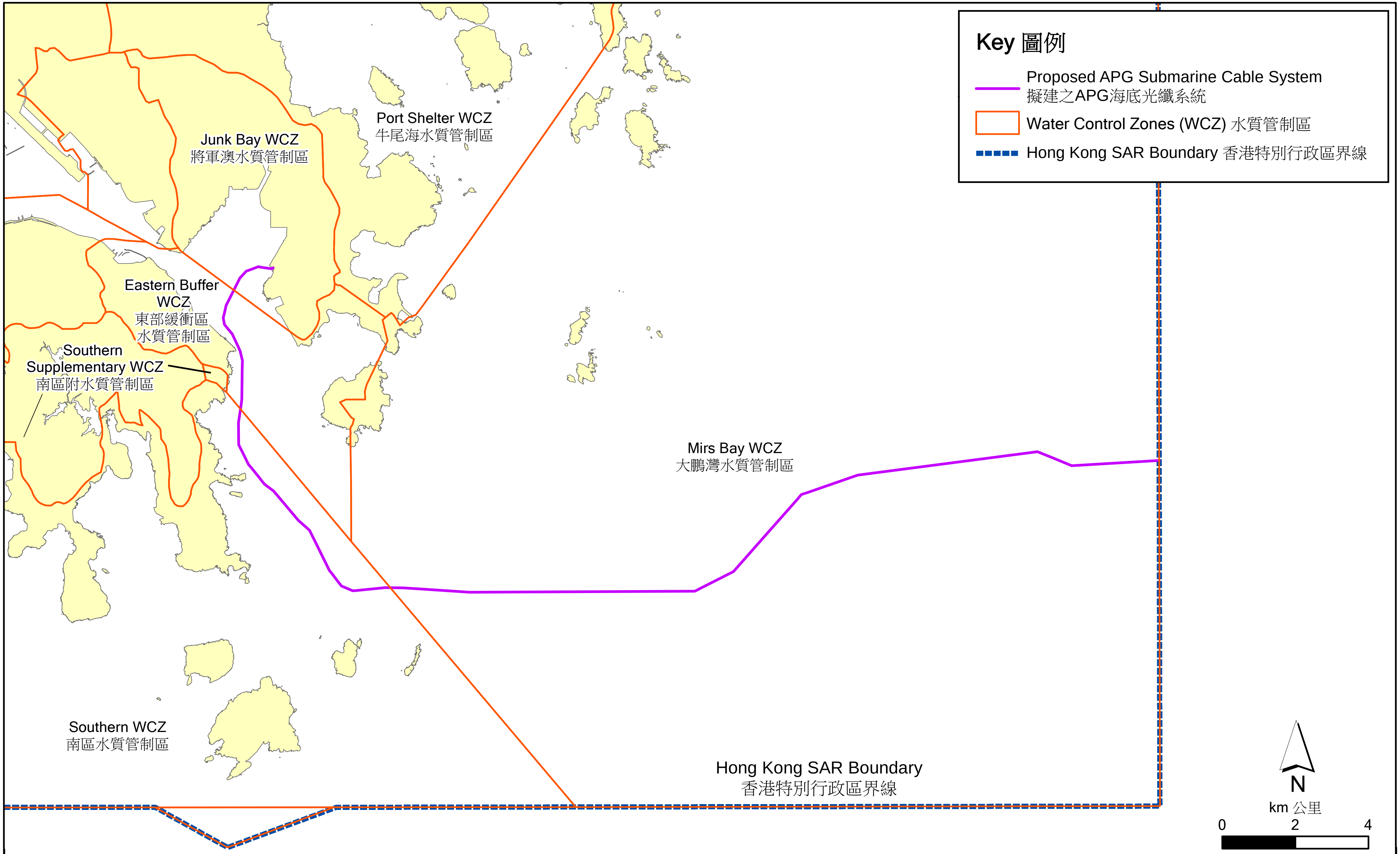

Figure A1
圖 A1

Water Control Zones (WCZs) Passed through by APG Submarine Cable System
APG 海底光纖系統經過的水質管制區

File: T:\GIS\CONTRACT\0174917\Mxd\0174917_APG_Water_Control_Zone.mxd
Date: 28/08/2013

中国移动通信 CHINA MOBILE
AXON CONSULTANCY
Environmental Resources Management
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A3 環境描述

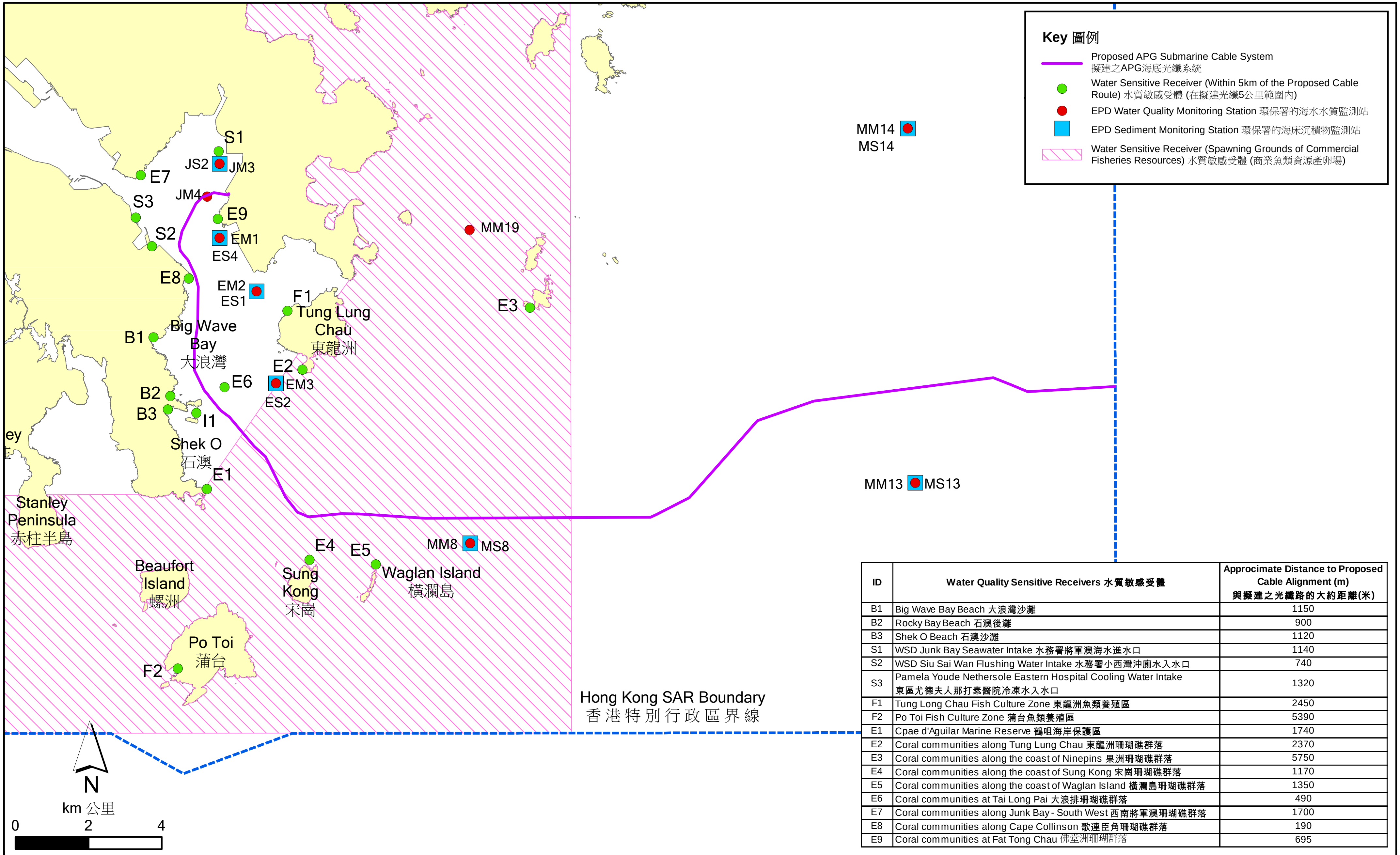
A3.1 水流力學

擬建光纜系統的第一部份位於將軍澳內，不受潮水影響。其它部分的光纜位於香港東南海域（*圖A1*），會主要受到南中國海的洋流影響。

A3.2 水質

擬建的海底光纜系統會經過將軍澳、東部緩衝區、南區和大鵬灣水質管制區（*圖A1*）。光纜沿線附近共有九個環保署的例行水質監測站。這些監測站的水質數據是從2006年至2011年間收集到 [(1)]，而且是最新的已發表數據，詳見*表A3*。各個監測站的位置均展示於*圖A2*。

(1) 環保署。2006-2011年香港海水水質。



ID	Water Quality Sensitive Receivers 水質敏感受體	Approcimate Distance to Proposed Cable Alignment (m) 與擬建之光纖路的大約距離(米)
B1	Big Wave Bay Beach 大浪灣沙灘	1150
B2	Rocky Bay Beach 石澳後灘	900
B3	Shek O Beach 石澳沙灘	1120
S1	WSD Junk Bay Seawater Intake 水務署將軍澳海水進水口	1140
S2	WSD Siu Sai Wan Flushing Water Intake 水務署小西灣沖廁水入水口	740
S3	Pamela Youde Nethersole Eastern Hospital Cooling Water Intake 東區尤德夫人那打素醫院冷凍水入水口	1320
F1	Tung Long Chau Fish Culture Zone 東龍洲魚類養殖區	2450
F2	Po Toi Fish Culture Zone 蒲台魚類養殖區	5390
E1	Cpae d'Aguilar Marine Reserve 鶴咀海岸保護區	1740
E2	Coral communities along Tung Lung Chau 東龍洲珊瑚礁群落	2370
E3	Coral communities along the coast of Ninepins 果洲珊瑚礁群落	5750
E4	Coral communities along the coast of Sung Kong 宋崗珊瑚礁群落	1170
E5	Coral communities along the coast of Waglan Island 橫瀾島珊瑚礁群落	1350
E6	Coral communities at Tai Long Pai 大浪排珊瑚礁群落	490
E7	Coral communities along Junk Bay - South West 西南將軍澳珊瑚礁群落	1700
E8	Coral communities along Cape Collinson 歌連臣角珊瑚礁群落	190
E9	Coral communities at Fat Tong Chau 佛堂洲珊瑚群落	695

Figure A2
圖 A2

EPD Monitoring Stations and Water Quality Sensitive Receivers
環保署水質監測站及水質敏感受體

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表 A3　　　位於光纜沿線的環保署水質監察站所收集的例行水質監察數據（2006 - 2011）

水質參數	**JM3** 將軍澳	**JM4** 將軍澳	**EM1** 柴灣	**EM2** 藍塘海峽	**EM3** 藍塘海峽	**MM8** 橫瀾島	**MM13** 大鵬灣（南）	**MM14** 大鵬灣（中）	**MM19** 果洲群島
溫度(℃)	23.2 (15.6-29.1)	23.0 (15.4-29.1)	23.0 (15.4-29.2)	23.0 (15.4-29.0)	22.9 (15.3-28.9)	22.7 (138-29.0)	22.8 (13.3-29.1)	22.6 (13.7-29.0)	22.6 (14.1-29.1)
鹽度	32.3 (27.7-33.9)	32.5 (29.2-34.0)	32.6 (30.1-34.0)	32.6 (25.7-34.1)	32.8 (29.1-34.2)	32.9 (30.0-34.5)	33.0 (27.8-34.5)	33.1 (30.4-34.4)	33.0 (30.3-34.0)
酸鹼度	8.0 (7.6-8.4)	8.0 (7.6-8.4)	8.0 (7.6-8.3)	8.0 (7.6-8.3)	8.0 (7.6-8.4)	8.1 (7.6-8.4)	8.1 (7.6-8.6)	8.1 (7.5-8.5)	8.1 (7.6-8.4)
溶解氧－深度平均值（每公升毫克數）	6.3 (4.1-8.1)	6.1 (3.9-8.0)	5.9 (3.4-8.0)	6.1 (3.9-8.1)	6.3 (4.1-8.2)	6.5 (3.3-8.9)	6.6 (3.7-9.1)	6.5 (3.7-8.8)	6.5 (3.6-9.6)
溶解氧－海底（每公升毫克數）	5.9 (2.9-8.2)	5.8 (2.7-8.0)	5.7 (2.6-8.0)	5.8 (3.1-8.2)	5.9 (2.5-8.2)	6.1 (2.7-8.9)	6.2 (3.1-9.1)	6.2 (2.8-8.8)	6.1 (2.5-9.2)
5日生化需氧量（每公升毫克數）	0.9 (0.2-3.6)	0.8 (<0.1-1.9)	0.7 (<0.1-1.8)	0.7 (<0.1-2.3)	0.6 (<0.1-2.8)	0.5 (<0.1-1.5)	0.5 (<0.1-1.8)	0.5 (<0.1-2.0)	0.6 (<0.1-1.9)
懸浮固體（每公升毫克數）	3.5 (0.8-11.6)	4.0 (1.3-19.0)	3.9 (1.3-13.2)	4.0 (1.3-15.7)	4.1 (1.2-25.3)	3.6 (0.9-15.2)	3.7 (0.7-19.3)	3.4 (0.5-15.5)	2.9 (0.8-13.7)
總無機氮（每公升毫克數）	0.16 (0.01-0.44)	0.15 (0.04-0.33)	0.16 (0.04-0.45)	0.14 (0.02-0.47)	0.10 (0.01-0.33)	0.09 (0.01-0.29)	0.08 (0.01-0.31)	0.08 (0.01-0.24)	0.08 (0.01-0.22)
非離子氨氮（每公升毫克數）	0.003 (0.001-0.009)	0.003 (0.001-0.008)	0.003 (0.001-0.007)	0.002 (0.001-0.005)	0.002 (0.001-0.005)	0.001 (0.001-0.005)	0.001 (0.001-0.008)	0.001 (0.001-0.005)	0.001 (0.001-0.004)
葉綠素-a（每公升微克數）	4.4 (0.2-22.4)	3.5 (0.3-14.3)	3.4 (0.2-24.3)	2.8 (0.4-10.7)	2.3 (0.4-9.3)	2.3 (0.3-11.3)	2.2 (0.3-12.0)	2.0 (0.3-7.7)	2.3 (0.5-10.1)
大腸桿菌（每100毫升菌落數）	47 (2-817)	57 (2-697)	61 (<1-1900)	29 (<1-1000)	4 (<1-850)	1 (<1-267)	1 (<1-301)	1 (<1-1234)	1 (<1-204)

水質參數	**JM3** 將軍澳	**JM4** 將軍澳	**EM1** 柴灣	**EM2** 藍塘海峽	**EM3** 藍塘海峽	**MM8** 橫瀾島	**MM13** 大鵬灣（南）	**MM14** 大鵬灣（中）	**MM19** 果洲群島

註：

a) 光纜沿線的環保署水質監察站均位於將軍澳，東部緩衝區和大鵬灣水質管制區，不在南區水質管制區。

b) 除了另有註明外，表中數據均為深度平均值。

c) 除了大腸桿菌的數據是幾何平均值之外，表中的數據都是年度算術平均值。

d) 括號內的數據代表一個範圍。

e) 以粗體字顯示的數據表示不符合水質指標。

這些數據顯示，2006年至2011年期間，深度平均溶解氧和海底溶解氧的年平均值都符合水質指標。所有監察站所錄得的總無機氮、非離子氨氮也全部符合水質指標。2006年至2011年間的總無機氮濃度存在波動。2006年至2011年期間，監測站JM3和JM4所錄得的非離子氨氮濃度呈現下降的趨勢，然而其他檢測站（EM1, EM2, EM3, MM6, MM13, MM14, and MM19）的非離子氨氮濃度存在波動。懸浮固體濃度的變化範圍很大，其中的最大值是在監察站EM3所錄得的每公升25.3毫克。2006年至2011年間，雖然大腸桿菌濃度的變化範圍很大，但是所有監察站所錄得的大腸桿菌全部符合水質指標。監察站EM3監測到大腸桿菌最大值，為每100毫升1900個菌落。

A3.3 沉積物質素

在光纜走廊附近，共有七個環保署的例行沉積物質量監測站，即：JS2、ES1、ES2、ES4、MS8、MS13和MS14。這些監察站記錄了2006-2011年的沉積物質量數據 [1] ，並總結在*表A4*。各個監察站的位置見*圖A2*。

(1) 環保署。2006-2011年香港海水水質

表A4　光纜沿線附近的環保署例行沉積物質量監察數據（2006 – 2011）

參數	化學超標下限	化學超標上限	JS2	ES1	ES2	ES4	MS8	MS13	MS14
化學需氧量（每公斤毫克數）	-	-	15000 (11000-19000)	10700 (8700-14000)	10858 (6700-15000)	12417 (10000-15000)	11275 (8800-18000)	10425 (8100-18000)	10767 (7700-18000)
總克氏氮（每公斤毫克數）	-	-	460 (320-550)	302 (190-420)	372 (210-590)	379 (200-530)	425 (270-480)	366 (200-530)	399 (200-510)
鎘（每公斤毫克數）	1.5	4	0.1 (0.1-0.2)	<0.1 (<0.1-<0.1)	<0.1 (<0.1-0.2)	<0.1 (<0.1-0.1)	<0.1 (<0.1-<0.1)	<0.1 (<0.1-<0.1)	<0.1 (<0.1-<0.1)
鉻（每公斤毫克數）	80	160	44 (39-49)	21 (16-29)	26 (17-41)	26 (21-38)	31 (25-35)	31 (27-37)	31 (28-34)
銅（每公斤毫克數）	65	110	87 (73-100)	26 (21-29)	21 (9-54)	45 (32-56)	12 (8-16)	11 (9-14)	11 (7-13)
汞（每公斤毫克數）	0.5	1	0.25 (0.17-0.41)	0.10 (0.07-0.14)	0.07 (<0.05-0.17)	0.17 (0.10-0.36)	0.05 (<0.05-0.06)	0.05 (<0.05-0.07)	0.05 (<0.05-0.05)
鎳（每公斤毫克數）	40	40	23 (19-31)	13 (10-17)	17 (12-27)	14 (11-21)	23 (18-29)	24 (20-27)	23 (19-27)
鉛（每公斤毫克數）	75	110	49 (41-54)	26 (22-32)	28 (18-50)	30 (23-41)	33 (29-42)	32 (27-38)	32 (29-36)
銀（每公斤毫克數）	1	2	1.8 (1.0-2.0)	0.8 (0-1.0)	0.1 (0-1.0)	1.0 (1.0-1.0)	0 (0-0)	0 (0-0)	0 (0-0)
鋅（每公斤毫克數）	200	270	141 (110-160)	66 (56-79)	74 (40-120)	82 (69-110)	81 (64-100)	81 (71-94)	80 (66-92)
砷（每公斤毫克數）	12	42	7.4 (6.7-8.5)	4.8 (3.6-6.2)	6.1 (4.4-8.9)	4.6 (3.4-6.3)	6.5 (5.4-7.2)	7.0 (5.7-8.1)	6.9 (5.7-8.3)
低份子量多環芳烴	550	3160	97	96	93	100	93	90	90

參數	化學超標下限	化學超標上限	JS2	ES1	ES2	ES4	MS8	MS13	MS14
（每公斤微克數）			(90-110)	(90-93)	(90-110)	(90-170)	(90-160)	(90-95)	(90-97)
高份子量多環芳烴（每公斤微克數）	1700	9600	245 (90-430)	121 (21-840)	76 (24-300)	283 (62-1700)	37 (17-120)	31 (19-59)	25 (18-40)
總多氯聯苯（每公斤微克數）	23	180	18 (18-20)	18 (18-18)	18 (18-18)	18 (18-18)	18 (18-18)	18 (18-18)	18 (18-18)

注:

a) 光纜沿線的環保署沉積物質量監察站均位於將軍澳，東部緩衝區和大鵬灣水質管制區，不在南區水質管制區。

b) 表中所列數據均屬算術平均值；括號內則是一個範圍的高低值。

c) 表中所列結果,是根據實驗室分析大量樣本而得出。該等樣本是從每個取樣地點每年收集兩次。

d) 倘若濃度低於報告下限（RL），便會採用 ½ x RL 進行計算。

e) 粗體字代表該數值已超出化學超標下限；粗體加上斜體字則代表該數值已超出化學超標上限。

*《工務技術通告（工務）編號34/2002：挖出／掘出沉積物的管理》*所闡述的沉積物質量、管理和分類，包含了為多種目標污染物而制定的兩項準則。較低的準則稱為"化學超標下限"，而較高的準則稱為"化學超標上限"。上表所列數據（平均值）顯示，表中的沉積物質量監察站所收集到的數據都沒有超出化學超標下限，但JS2的銅和銀屬例外，顯示出將軍澳附近的沉積物受輕微污染的情況。除此之外，根據現有的沉積物分類指引，擬議光纜鋪設路線附近的沉積物都沒有受到污染。

A3.4 水質敏感受體

在光纜走廊和登岸地點附近的水質敏感受體種類包括已刊憲泳灘、海水入口、漁業和具高生態價值的地區。

根據《柴灣分區計劃大綱核准圖編號. S/H20/21》，從歌連臣角到草堆灣的海濱保護區主要是具有獨特欣賞性的自然海岸線，如巨石和岩岸；根據《大潭及石澳分區計劃大綱核准圖編號S/H18/10》，石澳、大頭洲和五分洲的海濱保護區主要由巨石、岩岸和沙灘構成。考慮到從歌連臣角到草堆灣的海濱保護區主要由露出水面的岩石構成，而且位於歌連臣角潮下帶的珊瑚群落已經被單獨列爲水質敏感受體，這個指定的海濱保護區不被列爲水質敏感受體。類似的，石澳、大頭洲和五分洲的海濱保護區主要由露出水面的岩石構成；石澳泳灘、石澳後灘和石澳海角具特殊科學價值地點附近的水質是本項目關注的，而且他們已經被單獨列爲水質敏感受體，所以這個指定的海濱保護區也不被列爲水質敏感受體。

這些已知的水質敏感受體已經分類，展示於*圖A2*中，並在下文摘述。

- **已刊憲泳灘**：大浪灣、石澳後灘和石澳；
- **海水進水口**：水務署位於將軍澳和小西灣的海水進水口；位於杏花村的東區尤德夫人那打素醫院冷卻水入口；
- **漁業**：東龍洲魚類養殖區，浦台魚類養殖區；
- **具高生態價值的地點**：鶴咀海濱保護區；以及位於果洲、蒲台、宋崗和橫瀾島沿岸、東龍洲東南、大浪排、將軍澳西南海岸和歌連臣角的珊瑚群落（歌連臣角的珊瑚群落不具有高生態價值，但與附近的海岸綫比，具有較高的珊瑚多樣性）；及
- **具特殊科學價值地點**：石澳海角具特殊科學價值地點。

*表A5*羅列了光纜和已知的具代表性敏感受體之間的距離。

表A5 擬議光纜與水敏感受體之間的最近距離

識別號	水質敏感受體	與擬議光纜的大約距離（米）
B1	大浪灣海灘	1,150
B2	石澳後灘	880
B3	石澳海灘	1,120

識別號	水質敏感受體	與擬議光纜的大約距離（米）
S1	水務署將軍澳海水進水口	1,140
S2	水務署小西灣沖廁水入口	740
S3	東區尤德夫人那打素醫院冷卻水入口	1,320
F1	東龍洲魚類養殖區	2,450
F2	蒲台魚類養殖區	5,390
E1	鶴咀海岸保護區	1,750
E2	東龍洲沿岸的珊瑚群落	2,300*
E3	果洲沿岸的珊瑚群落	5,750*
E4	宋崗沿岸的珊瑚群落	1,170*
E5	橫瀾島沿岸的珊瑚群落	1,350*
E6	大浪排的珊瑚群落	490*
E7	將軍澳西南的珊瑚群落	1,700*
E8	歌連臣角的珊瑚群落	190*
E9	佛堂洲的珊瑚群落	695*
I1	石澳海角具特殊科學價值地點	560

註: *此距離以珊瑚群落最外圍的邊界量度至最接近光纜走線位置所得。

應予注意的是敏感受體和光纜之間的真實距離可能比*表A5*所列出的更遠，視乎光纜在工程區內的鋪設位置而定。

A4 影響評估

海底光纜系統在運作期間不會對水質造成影響。下文闡述了該系統在施工期間對水質可能造成的直接或間接不良影響。

A4.1 陸地光纜鋪設工程

在陸地進行導槽工程時對水質可能造成的影響主要來自地面水的逕流和積水的排放。這兩個潛在的影響源頭，都可以通過*章節A4.3*所探討的措施加以控制。

A4.2 海底光纜的安裝工程

海底光纜有兩種安裝方法。在距離將軍澳工業邨海堤至大約20米處（導管末端），光纜會由潛水員掩埋，其深度約為2米。從這一段起直至香港邊界的光纜，透過雪橇式或沖噴式掩埋器，利用沖噴犁挖法把光纜埋藏至目標深度(即海床下5米)。

因為受滋擾的範圍較小，即長度（約20-30米）和深度（2米）都較小，預計由潛水員進行的掩埋工程不會對水質造成顯著影響。

該項工程需要以沖噴器運用沖噴犁挖法進行，其潛在影響亦已進行了定量評估。下列各項已獲發環境許可證的工程項目簡介，都曾運用下文所述的方法來計算懸浮沉積物隨水漂移的情況：

- *亞洲快綫海底光纜系統 – 將軍澳*（AEP-433/2011）。於 2011 年 12 月 20 日獲發*環境許可證*（EP-433/2011）。
- *東南亞日本海底光纜網絡工程香港段*（AEP-423/2011）。於 2011 年 10 月 24 日獲發*環境許可證*（EP-423/2011）。
- *VSNL 亞洲區內海底通訊電纜–深水灣段*（AEP-294/2007）。於 2007 年 11 月 23 日獲發*環境許可證*（EP-294/2007）。
- *擬敷設 132 千伏青山發電站至機場"A"變電站電纜線路之海底電纜分段*（AEP 267/2007）。於 2007 年 3 月 29 日獲發*環境許可證*（EP-267/2007）。
- *黃竹坑－舂坎角 132kV 電路之 132kV 海底電纜敷設工程*（AEP132/2002）。於 2002 年 4 月 16 日獲發環*境許可證*（EP-132/2002）。
- *FLAG 北亞光纖環系統*（AEP 099/2001）。於 2001 年 6 月 18 日獲發*環境許可證*（EP-099/2001）。

- *香港新電訊有限公司：本地通訊電纜*（AEP-086/2001）。於 2001 年 2 月 16 日獲發*環境許可證*（EP-086/2001）。

- *C2C 通訊電纜網絡─香港段：春坎角*（AEP-087/2001）。於 2000 年 2 月 16 日獲發*環境許可證*（EP-087/2001）。

- *東亞海底通訊電纜系統（將軍澳）*（AEP-081/2000）。於 2000 年 10 月 4 日獲發*環境許可證*（EP-081/2000）。

- *位於大嶼山南岸塘福第 328 段約第 591SA 地段之北亞海底光纖通訊電纜系統遠程通訊設施及相關之電纜登岸工程*，（AEP-064/2000）。於 2000 年 6 月獲發*環境許可證*（EP-064/2000）。

- *龍鼓灘至蛇口海底電纜系統*。根據*《前濱及海床（填海工程）條例》*於 2005 年刊憲。

- *大網仔至橋咀之 11kV 電纜*。根據*《前濱及海床（填海工程）條例》*於 2004 年刊憲。

按照這個方法，光纜和沖噴器都放到海床上。沖噴器使用高壓水柱在海床沖出一條纜槽，同時馬上把光纜鋪設於槽內。纜槽兩側會向光纜滑動，從而將光纜掩埋，並在海床上留下一個淺坑，最後被天然的沉積過程填平。沖噴器在海床沖出的纜槽最大闊度是0.5米，並可以把光纜掩埋至最深5米。

在以沖噴犁挖法鋪設光纜的過程中，海床上的沉積物會受到滋擾。其中一小部份會沉積物被揚起，並懸浮於沖噴器附近水體的較低部份。

下文所述，是這些懸浮於水中的幼細沉積物可能在光纜鋪設過程中隨水漂移的情況分析。

沉積物漂移計算

沉積物懸浮速度的計算如下：

釋放速度	=	受滋擾沉積物的橫截面面積 x 光纜鋪設機的速度 x 沉積物的乾密度 x 懸浮百分比
滋擾深度	=	5米（光纜的掩埋深度）
滋擾寬度	=	0.5 米（掩埋光纜時海床受滋擾的寬度）
最大橫截面面積	=	2.5 平方米
懸浮率	=	20%（大部份沉積物沒有受到滋擾）
機器速度	=	每秒0.278米（每小時1千米）

原地乾密度 = 每立方米600千克（香港沉積物的典型乾密度）

釋放速度 = 每秒83.4千克

在鋪設光纜時，海床上的沉積物會被釋出至水體底部，因而形成局部懸浮沉積物濃度偏高，以及較高的沉積速度。這是因為，若在一個很局部的範圍內出現高濃度的情況，懸浮沉積物便會逐漸凝聚成較大沉積物顆粒（絮凝過程），因此會比個別沉積物顆粒的沉積速度較高。

儘管由於海底的摩擦力等因素海床上的水流速度會比近海平面的水流速度低，預計無論水深多少，懸浮沉積物都會逗留在海床上1米的範圍內。爲了進行評估，假設了水流速度是每秒0.9米，這是光纜工程區附近海底水流速度估計值的上限，而且也較為審慎[1]。

本項目參考了與本項目研究範圍接近、與本項目類似的其他環境影響評估項目（如A4.2段所列），採用0.9米每秒作為估計的水流速度。預計沉積物最初會沿著光纜走線的中軸綫（也是沖噴器的縱軸方向）擴散至最遠6米的地方。懸浮固體可能會在光纜鋪設工程四周形成，然而在評估潛在影響時用了一個較審慎的假設，即有一股橫向水流把沉積物帶向敏感受體處。

根據以上假設的最壞情況，即沉積物最初在水體較低的1米範圍以及在最初的擴散長度內均勻地混合，懸浮沉積物的初始濃度如下：

初始濃度 = 釋放速度／（水流速度 x 沉積物高度 x 沉積物寬度）

釋放速度 = 每秒83.4千克

水流速度 = 每秒0.9米

沉積物高度 = 1米

沉積物寬度 = 6米

初始濃度 = 每立方米15.44千克

在一般情況下，懸浮固體的沉積速度可以透過檢查懸浮固體初始濃度和該沉積物的凝聚性之間的關係來確定。這是香港常見的情況，即：當懸浮固體濃度增加，其沉積速度也會增加，因為沉積物的顆粒發生絮凝，令質量增加，因而沉積較快。然而，當初始濃度超過一定數值，例如每

(1) 香港環境資源管理顧問有限公司（2000）。香港新電訊有限公司：本地通訊電纜。為香港新電訊有限公司進行。

立方米1公斤，這種關係便不能再維持[1]。由於本項目的預測初始濃度超過這個數值，因此採用了一個更為保守的沉積速度，即每秒10毫米。

不過，當沉積物逐漸沉積至海床上，懸浮沉積物的濃度便會逐漸減少。為了反映逐漸降低的濃度，上述沉積速度需要減半，變作每秒5.0毫米。這個做法與南丫發電廠擴建部份的輸氣管道環評所採用的方法相同[2]。

因此，沉積物降回海床所需的時間便是：沉積物的最大高度除以平均沉積速度。

沉積時間= 1米 /0.005 米 秒 $^{-1}$ **= 200 秒**

因此，沉積物漂移的距離便等於沉積時間乘以水流速度。

漂移距離 **=** 200秒 x 0.9米 秒$^{-1}$ **= 180 米**

根據上述計算結果，在鋪設光纜時被揚起的沉積物，會在距離光纜走廊的大約**180米**內沉積回海床。

把同樣的計算方法應用於掩埋深度為2米的情況，預測初始濃度是每立方米2.3千克，即超過了每立方米1公斤的數值，因此也採用了每秒10毫米的沉積速度。所以，被揚起沉積物的漂移距離也是距離光纜走線的180米內。

*表A6*顯示所有水質敏感受體到光纜的距離都超過上述預測距離，因此預計水中懸浮沉積物的濃度會在到達這些水質敏感受體，包括距離光纜走廊最近約190米的水質敏感受體E8（南歌連臣角珊瑚群落），之前回落至自然背景值。應予注意的是水質敏感受體E8與光纜走線之間的距離可經由地圖系統所得知。而水質敏感受體E8與光纜走線的坐標和位置亦會在施工前顯示於放大的地圖上。差分全球定位系統(一般的實時水平精確度在 ±10cm 以內)會用以作為鋪纜躉船的導航系統。光纜會以雪橇式或沖噴式掩埋器埋藏 (圖2.4及2.5)。若使用雪橇式掩埋器埋藏光纜，水底定位系統會使用作定位之用。如若使用沖噴式掩埋器，此掩埋器會垂直下降至海床位置，使用船舶的位置便可作其定位之用。而動力定位系統(DP)會用作維持光纜走線的位置。在安裝光纜期間，掩埋器的位置會被自動紀錄。此追蹤紀錄將會繪製在地圖上以便展示光纜走線與水質敏感受體E8之間的距離有190米。竣工圖則會在完工後製備。

由於工程只屬短期性質，總鋪設時間約15天，預計對於水質敏感受體E8的潛在干擾是有限和短暫的。另外，在歌連臣角海岸線附近，因為沉積物薄層下有潛在的淺層海底岩石，該段光纜會採用加護表面敷設(以URADUCT保護)或淺埋敷設。隨著提供隔泥幕作為預防措施，預計光纜鋪設工程不會對歌連臣角南的珊瑚群落產生不可接受的不良影響。

(1) Hydraulics Research (1988) Estuarine Muds Manual.〔沉積泥手冊〕

(2) 香港環境資源管理顧問有限公司 (1998) 南丫島擴建部份之1,800MW燃氣發電廠（為香港電燈有限公司進行）。

在擬建之光纜路綫（掩埋光纜的段落）上，會進行“路線清理”和“鋪設前掃海”作業。具有相同規模的“路線清理”和“鋪設前掃海”作業曾經在*亞洲快綫海底光纜系統 – 將軍澳* (1) 項目中實施。考慮到“鋪設前掃海”只在海床表面進行，移除海床上的大型物體，並參考香港過去的類似工程項目的經驗，“路線清理”和“鋪設前掃海”作業不會對水質敏感受體產生不可接受的影響。

預計這項工程不會對這些水質敏感受體附近的水質造成不可接受的不良影響。有關具有較高生態價值的地區和商業漁業資源育苗區的影響評估，請分別參閱*附件B*和*附件C*。

表 A6　　沉積物捲流伸延的影響評估

識別號	水質敏感受體	與擬議光纜走廊／登岸點的大約距離（米）	沉積物會否到達水質敏感受體？	造成不良影響的可能性	理由
B1	大浪灣海灘	1,150	不會	不可能	沉積物捲流不可能到達水質敏感受體
B2	石澳後灘	880	不會	不可能	沉積物捲流不可能到達水質敏感受體
B3	石澳海灘	1,120	不會	不可能	沉積物捲流不可能到達水質敏感受體
S1	水務署將軍澳海水進水口	1,140	不會	不可能	沉積物捲流不可能到達水質敏感受體
S2	水務署小西灣沖廁水入口	740	不會	不可能	沉積物捲流不可能到達水質敏感受體
S3	東區尤德夫人那打素醫院冷卻水入口	1,320	不會	不可能	沉積物捲流不可能到達水質敏感受體
F1	東龍洲魚類養殖區	2,450	不會	不可能	沉積物捲流不可能到達水質敏感受體
F2	蒲台魚類養殖區	5,390	不會	不可能	沉積物捲流不可能到達水質敏感受體
E1	鶴咀海岸保護區	1,750	不會	不可能	沉積物捲流不可能到達水質敏感受體
E2	東龍洲沿岸的珊瑚群落	2,300	不會	不可能	沉積物捲流不可能到達水質敏感受體
E3	果洲沿岸的珊瑚群落	5,750	不會	不可能	沉積物捲流不可能到達水質敏感受體
E4	宋崗沿岸的珊瑚群落	1,170	不會	不可能	沉積物捲流不可能到達水質敏感受體
E5	橫瀾島沿岸的珊瑚群落	1,350	不會	不可能	沉積物捲流不可能到達水質敏感受體
E6	大浪排的珊瑚群落	490	不會	不可能	沉積物捲流不可能到達水質敏感受體
E7	將軍澳西南的珊瑚群落	1,700	不會	不可能	沉積物捲流不可能到達水質敏感受體

(1) 香港環境資源管理顧問有限公司 (2011) 申請批准直接申請環境許可證：亞洲快綫海底光纜系統 – 將軍澳 （NTT COM Asia Ltd進行）。.

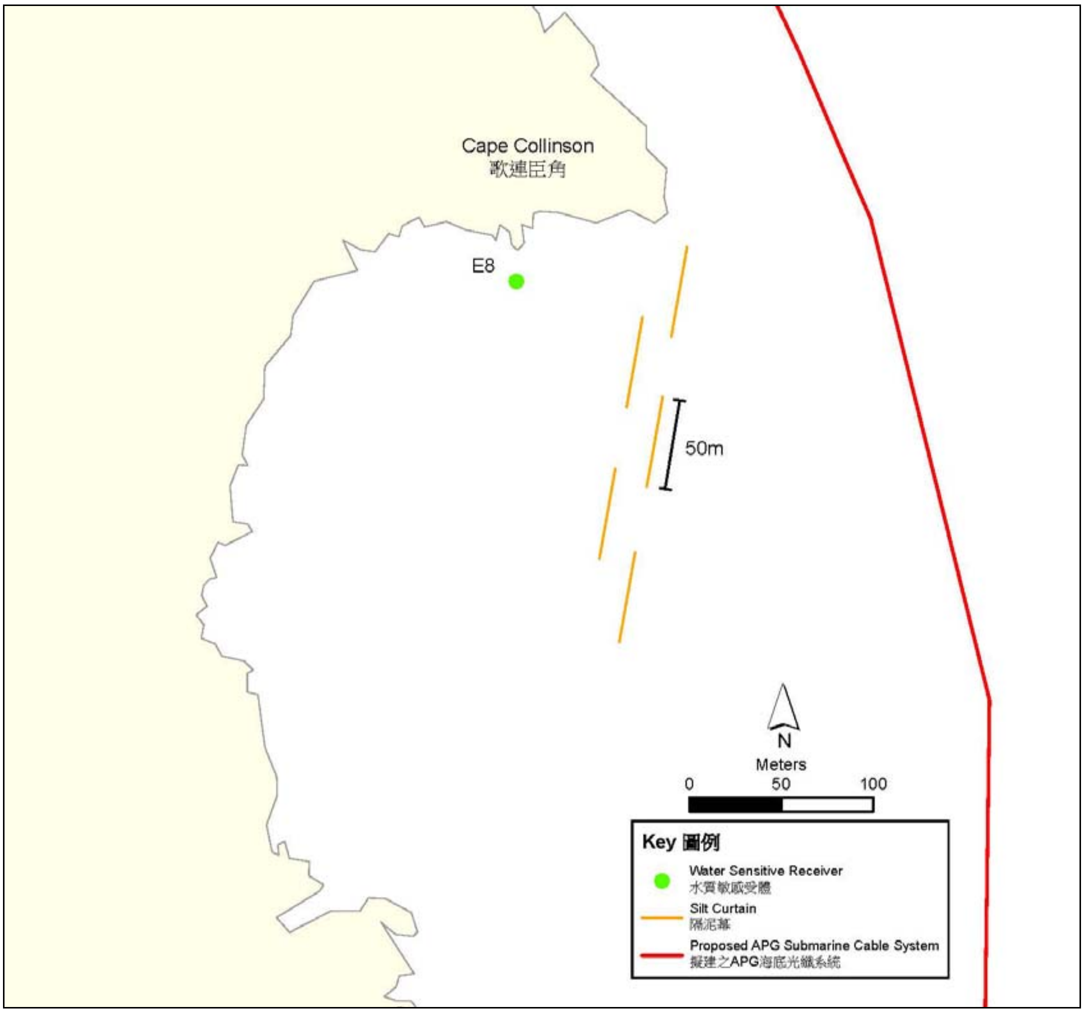
識別號	水質敏感受體	與擬議光纜走廊／登岸點的大約距離（米）	沉積物會否到達水質敏感受體？	造成不良影響的可能性	理由
E8	歌連臣角的珊瑚群落	190	不會	不可能	沉積物捲流預計不會到達水質敏感受體但將提供隔泥幕作預防措施
E9	佛堂洲的珊瑚群落	695	不會	不可能	沉積物捲流不可能到達水質敏感受體
I1	石澳海角具特殊科學價值地點	560	不會	不可能	沉積物捲流不可能到達水質敏感受體

A4.3 光纜鋪設期間的緩解措施

在鋪設光纜期間，會實施下列措施：

- 應在歌連臣角以南為最近的水質敏感受體 E8 提供多層隔泥幕作為預防措施（位置參見圖 A3）；

圖A3 為水質敏感受體 E8所建議的隔泥幕指示位置



- 運送海床路綫清理中掘出物料的起重躉船必須鋪設艙底密封裝置，以防止在裝卸和運送期間漏出物料；
- 起重躉船裝載物料的數量不應過多，以確保在裝卸和運送時，物料都不會溢出；還應保留一定的乾舷，以確保甲板不會被海浪沖刷；
- 鋪纜躉船的前進速度會被限制在最高每小時 1 千米；及
- 將會實施水質監察，以核實本項目的工程不會影響水質、海洋生態和漁業資源。

除了上述各項外，鋪設陸地上的光纜時也會納入水質保護措施，作為良好施工方法的一部份：

- 物料堆會以帆布或相近布料覆蓋，以減少雨季時的徑流；
- 小心進行光纜登岸和建造工程，以免有任何溢出物料流入附近的海洋水域，並確保不會把棄舊物料排進附近水域；
- 所有建築廢物和排出物，都會按照*《專業人士環保事務諮詢委員會守則－建築工地的排水渠》（《專業守則 PN1/94》）*；及
- 採用最佳管理方法來避免和減少來自工地、海上機器和船隻的受污染徑流。

A5 總結

本簡介檢討和評估了光纜鋪設工程產生的水質影響。

有關建築工程令沉積物漂移的情況，根據計算結果，在鋪設光纜時被揚起的沉積物，會在距離光纜沿線約180米範圍內沉積回到海床。全部已識別的水質敏感受體皆位於擬議光纜鋪設路線的180米範圍外，沉積物捲流亦因而不可能到達水質敏感受體。加上光纜在香港範圍的總鋪設時間只會持續約15天，預計對於水質敏感受體E8(與光纜路線最近的距離約190米)即歌連臣角南的珊瑚群落的潛在干擾是有限和短暫的。隨著提供隔泥幕作為預防措施，預計光纜鋪設工程不會對歌連臣角南的珊瑚群落產生不可接受的不良影響。結論是沒有不可接受的水質影響被識別出來。本項目簡介也建議了多項緩解措施，例如限制鋪纜躉船的速度為每小時1千米，以及實施水質監測計劃等，藉以減少本項目對水質敏感受體區域的水質影響（如有）。由於水質敏感受體與光纜鋪設工程距離較遠，而且工程為時短暫，這些受體不會因為評估區內水質惡化而受到影響，同時這些受體附近的水質將會符合水質指標。

Annex B

Assessment of Potential Impacts to Marine Ecology Resources

CONTENTS

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APPENDIX

APPENDIX B1   Data of Subtidal Dive Surveys

B1 INTRODUCTION

This *Annex* presents the baseline conditions of marine ecological resources in the vicinity of the proposed submarine cable system and landing point as well as results of the assessment of the potential marine ecological impacts from the construction and operation of the Asia Pacific Gateway (APG) – Tseung Kwan O submarine cable system. 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.

B1.1 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.

B1.2 EXISTING MARINE ECOLOGICAL RESOURCES

B1.2.1 *Sites of Special Scientific Interest*

The closest Site of Special Scientific Interest (SSSI) is the Shek O Headland SSSI, approximately 560 m from the closest cable segment, and the Hok Tsui (Cape d'Aguilar) and Ninepin Group SSSIs are situated about 1,750 m and 5,750 m from the closest cable segment, respectively. Hok Tsui (Cape d'Aguilar) SSSI is partially located in marine water but would not be affected due to the long distance from the closest cable segment. Ninepin Group SSSI is located on land and it will thus not be affected by the submarine cable installation works.

B1.2.2 *Cape d'Aguilar Marine Reserve*

The Cape d' Aguilar Marine Reserve is designated to protect the diverse marine life and the ecologically important habitats such as coral community. As it is located over 1,750 m from the closest proposed cable segment, it is not expected to be affected by the Project.

B1.2.3 *Coastal Protection and Conservation Areas*

Within 500 m zone from the proposed cable segment (hereafter called the Study Area), a small strip of land along Hong Kong Island and Fat Tong Chau (Junk Island) is designated as Green Belt, though this classification does not represent a designated conservation area.

The coastline of Shek O Headland, including Tai Tau Chau and Ng Fan Chau is designated as "Coastal Protection Area (CPA)", and the shortest distance from the cable alignment to this CPA is around 230 m. In addition, the coastline from Cape Collinson to Big Wave Bay is designated as CPA as well, and the shortest distance from this CPA to the cable alignment is approximately 90 m. Hence, the Project is classified as a DP under *EIAO 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 (vii) coastal protection area.

Given that the designated CPAs are located on land, it is anticipated that no unacceptable impacts would occur to the CPAs at Shek O Headland (including Tai Tau Chau and Ng Fan Chau) and Cape Collinson to Big Wave Bay. The intertidal and subtidal hard bottom assemblages below the CPA zone have been assessed in the following sections.

B1.2.4 Intertidal Soft Bottom Assemblages

Within the Study Area, a small area of sandy shore is located to the south of the proposed cable landing point at TKO Industrial Estate and to the east of the proposed cable segment at Shek O Headland. However, information regarding the ecology of these sandy shores is not available. Nonetheless, sandy shores are, in general, known to be mobile and unstable environments that are subject to constant water movement and wave action. Since few intertidal organisms are able to tolerate these conditions, sandy shores in HKSAR may appear devoid of intertidal life (1).

B1.2.5 Intertidal Hard Bottom Assemblages

Intertidal surveys had previously been conducted at the artificial seawall of the proposed landing site at TKO Industrial Estate, as well as at the natural rocky shore of Fat Tong Chau near the landing site (2) (3) and along the Cape Collinson Headland near the cable alignment (4).

Findings from the intertidal survey undertaken in the wet season of 2008 (5) indicated that the assemblage structure on the natural rocky shore at Fat Tong Chau and on the artificial seawall at TKO Industrial Estate was considered to be typical of sheltered to semi-exposed rocky shores and artificial seawall in HKSAR. The artificial seawall exhibited a low diversity of species. Animals recorded were mainly the rock oyster *Saccostrea cucullata*, periwinkles *Echinolittorina radiata* and *E. trochoides*, and limpets *Nipponacmea concinna* and *Patelloida pygmaea*. Dominant species of the natural rocky shore recorded from the same survey included the rock oyster *Saccostrea cucullata*, periwinkles *Echinolittorina radiata* and *E. trochoides*, limpets *Nipponacmea concinna* and

(1) Morton B, Morton J (1983). The Sea Shore Ecology of Hong Kong.

(2) ERM (2008) Development of a Biodiesel Plant at Tseung Kwan O Industrial Estate. Final EIA Report for the ASB Biodiesel (Hong Kong) Limited.

(3) ERM (2011) Asia Submarine-cable Express (ASE) – Tseung Kwan O. Project Profile for the NTT Com Asia Limited. Project Profiles submitted for Applications for Permission to Apply Directly for an Environmental Permit (DIR-217/2011).

(4) ERM (2011) *Ibid.*

(5) ERM (2008) *Ibid.*

topshell *Monodonta labio*. These species are all common species on natural rocky shores of HKSAR.

In 2011, intertidal surveys were undertaken along the seawall of TKO Industrial Estate (including the proposed landing site of the APG cable system) and on the shorelines along the northwest side of Cape Collinson Headland using qualitative spot checks and standard quantitative belt transect method. Results of the 2011 intertidal surveys were similar to those obtained by the 2008 surveys, which revealed that the artificial seawall of the Study Area exhibited a low diversity of species. A total of 14 faunal taxa and one encrusting alga were encountered during the qualitative spot checks. These species are all very common and widespread species on artificial shores/ wharfs of HKSAR. For natural rocky shores along Cape Collinson Headland, dominant organisms recorded included the periwinkles *Echinolittorina* spp. in the high-shore, the topshell *Monodonta labio* and the limpet *Siphonaria japonica* in the mid-shore, and the limpet *Cellana toreuma* and the chiton *Acanthopleura japonica* in the low-shore. Sessile species including the barnacle *Tetraclita* spp. were also present in the low-shore. Both the abundance/ density of mobile species and percentage cover of sessile species were considered to be low to moderate (mean of 65 – 80 m^{-2} and 2 – 42% m^{-2} respectively).

Overall, results from previous intertidal surveys have shown that the intertidal rocky shores and artificial seawall within the Study Area, including the proposed cable landing point at TKO Industrial Estate, supported generally low abundances and densities of organisms, and therefore of low ecological value. It is also noted that no species of conservation importance were recorded. In addition, the land-based CPA is not expected to be affected by the marine construction activities.

B1.2.6 *Subtidal Soft Bottom Assemblages*

Information on the subtidal soft bottom assemblages in the vicinity of the proposed cable corridor is available from the *Consultancy Study on Marine Benthic Communities in Hong Kong* (1). Six sampling stations are close to the proposed area of works and data extracted from them can be considered to be representative of the assemblages in the vicinity of the proposed cable alignment.

According to their findings, the substratum of the six sampling stations is covered by medium/fine/very fine sand. Their benthic assemblages are typical of HKSAR waters and similar to benthic assemblages in majority of other subtidal habitats in HKSAR. In summer, the average number of species is higher (51 species per 0.5 m^2), while the average number of individuals (487 individuals per m^2) and average wet weight (32.3 g per m^2) are lower than the average values of HKSAR (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 (50 species per 0.5 m^2), average wet weight (33 g per m^2) and the

(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.

average number of individuals (605 individuals per m^2) are higher than the average values of benthic assemblages in HKSAR (34 species per 0.5 m^2, 28 g per m^2 and 450 individuals per m^2). In both seasons, no species of conservation concern were found along the proposed cable alignment.

B1.2.7 Subtidal Hard Bottom Assemblages

Several studies undertaken in the period of 2007 to 2013 provide relevant information on subtidal hard bottom habitats within the Study Area (1)(2)(3)(4)(5)(6)(7)(8). The surveyed subtidal hard bottom habitats included those located at Fat Tong Chau and TKO Industrial Estate in close vicinity to the proposed cable landing site and near the proposed cable alignment at Cape Collinson, Ngan Wan and Tai Long Pai. Overall, results of these surveys showed that generally very sparse colonies of locally common, widespread hard coral species were present in the vicinity of the proposed cable alignment, and their abundance and diversity were considered to be very low in the context of subtidal coral assemblages in HKSAR. Octocoral assemblages' cover and diversity were low to moderate along the shoreline of Cape Collinson Headland, however, high abundance and diversity of octocoral assemblages was found at the deep depth region of Tai Long Pai.

Supplementary dive surveys were conducted in September and October 2012 and February 2013 for this Project to provide updated information on the status of subtidal hard bottom habitats in the vicinity of the proposed cable alignment and at the proposed cable landing site (*Figure B1*). The dive surveys comprised qualitative spot dive surveys and semi-quantitative Rapid Ecological Assessment (REA) surveys at TKO Industrial Estate and Fat Tong Chau (ie near the proposed cable landing point), as well as at Cape Collinson Headland, Ngan Wan, Shek O Headland and Tai Long Pai (ie in the vicinity of the proposed cable route). Data from the qualitative spot dive checks are presented in *Tables B1.1-1.4* while data from the REA surveys are presented in *Table B1.5* in *Appendix B1*.

Results of surveys conducted near the proposed landing point at TKO Industrial Estate and Fat Tong Chau showed that both hard coral and octocoral covers were below 5% with five (5) hermatypic hard coral species, one (1) ahermatypic hard coral species and two (2) octocoral species being recorded. All hard coral colonies recorded were less than 10 cm in diameter

(1) ERM (2007). South East New Territories (SENT) Landfill Extension - Feasibility Study: Environmental Impact Assessment Report.

(2) ERM (2008). *Ibid.*

(3) CUHK (2011). Additional Works for Provision of Services on Reference Collection and Study on Octocorals and Black Corals in Hong Kong Waters. Final Report submitted to AFCD.

(4) BMT Asia Pacific Ltd (2009). Environmental Impact Assessment of Hong Kong Offshore Wind Farm in Southeastern Waters. Final Report for The Hongkong Electric Co., Ltd.

(5) Area 131 Further Ecological Study Report (1999) and HATS Dive Survey Report (2003).

(6) ERM (2011). *Op. cit.*

(7) ERM (2012). Asia Submarine-cable Express (ASE) – Tseung Kwan O. Baseline Coral Monitoring Survey Report.

(8) ERM (2013). Asia Submarine-cable Express (ASE) – Tseung Kwan O. Post Project Coral Monitoring Survey Report.

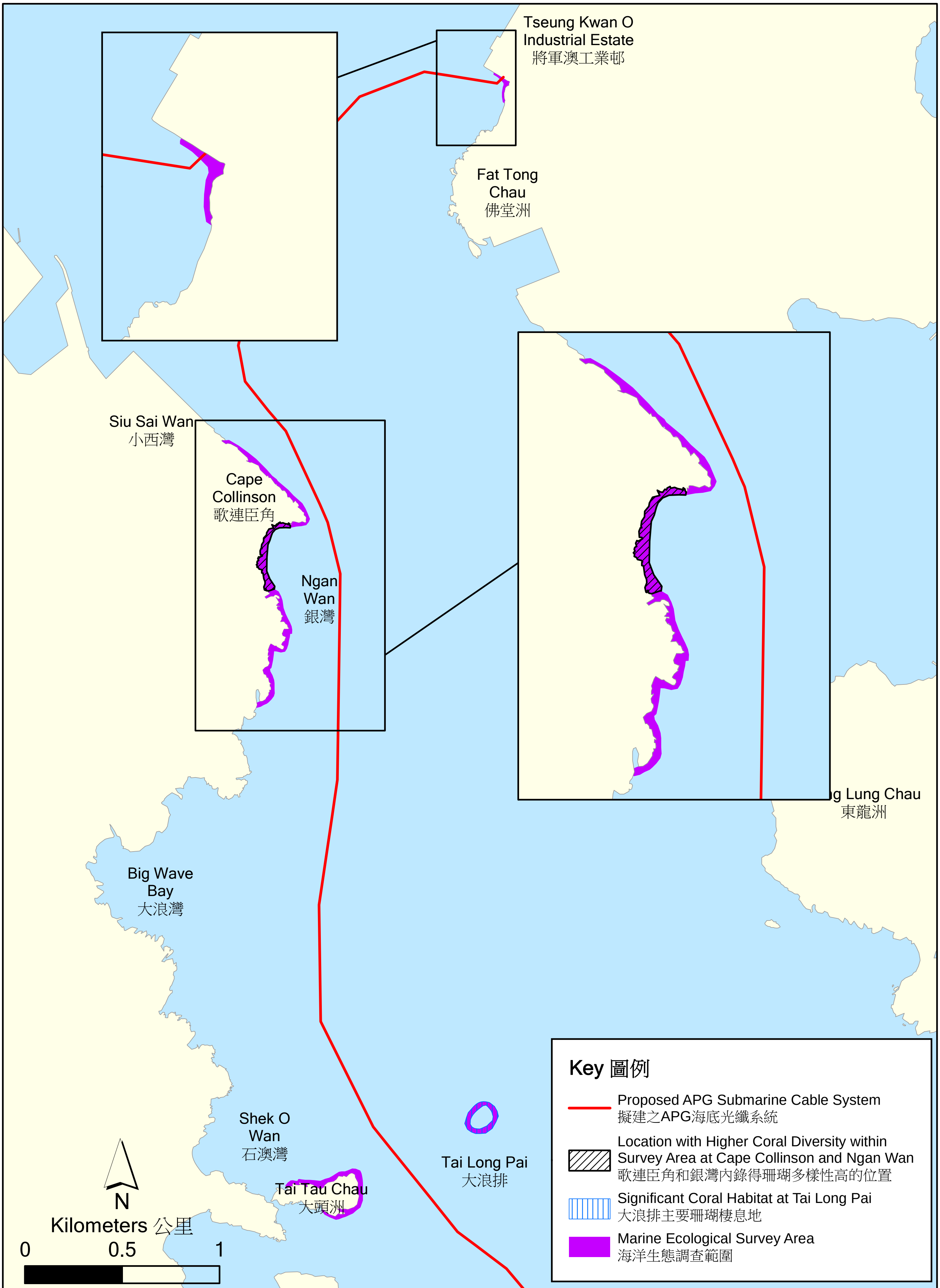

Figure B1
圖 B1

Locations of Marine Ecological Survey
海 洋 生 態 調 查 位 置

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Date: 28/8/2013

中国移动通信 CHINA MOBILE
AXON CONSULTANCY
Environmental Resources Management
ERM

and octocoral colonies were about 10 cm in height. All coral species recorded are considered as common and widespread in HKSAR's nearshore waters.

Results of the surveys confirmed that the seabed from Cape Collinson Headland to Ngan Wan was mainly composed of hard bottom substrate (ie ~60% cover of bedrock). The estimated hard coral cover was less than 5% in the shallow depth zone (-3-5 m CD) with eight (8) species recorded. Octocoral cover was between 6-10% with a total of six (6) species recorded. To the south of Cape Collinson and at the northern part of Ngan Wan, more hard coral species and larger hard coral colonies were found. This area is considered as an area of relatively higher coral diversity although the estimated coral cover and number of octocoral species recorded were similar to the adjacent area (*Figure B1*).

At Shek O Headland, the seabed was observed to be mainly composed of boulders and rocks in the shallow depth zone (-3-5 m CD) while sand was the major abiotic benthic attribute covering the seabed in the deep depth zone (-5-10 m CD). Results also indicated that both hard coral and octocoral covers were very low (<1%) at both shallow and deep water zones. Three (3) hermatypic hard coral species, one (1) ahermatypic hard coral species and four (4) octocorals species were recorded.

At Tai Long Pai, results of the dive surveys confirmed that the seabed was mainly composed of hard bottom substrates (ie mostly bedrock). Hard coral cover was very low (ie < 5%) with seven (7) hermatypic hard coral species and one (1) ahermatypic hard coral species recorded. A total of seven (7) octocoral species and two (2) black coral species were recorded along the shoreline of Tai Long Pai with an estimated cover of 5-10% in shallow depth zone (-2-5 m CD) and 11-30% in deep depth zone (beyond -5 m CD). All coral species recorded in the dive surveys are considered as common species and have a widespread distribution throughout HKSAR's nearshore waters. Due to the relatively high octocoral abundance and diversity recorded at Tai Long Pai, it is being considered as a significant coral habitat in the area.

Overall, results of the supplementary dive surveys showed that sparse hard coral colonies of locally common, widely-distributed species were recorded in the vicinity of the proposed cable landing point and the proposed cable alignment. The abundance and diversity of hard corals were considered to be very low in the context of subtidal hard bottom habitats in HKSAR. Octocoral coverage and diversity were generally considered to be low except at the deep depth zone of Tai Long Pai where higher abundance and diversity of octocorals were found.

B1.2.8 Marine Mammals

Literature reviews indicated that the Indo-Pacific Hump-backed Dolphin (*Sousa chinensis*) and the Finless Porpoise (*Neophocaena phocaenoides*) were the two species of marine mammals regularly sighted in HKSAR waters. The population of *Sousa chinensis* is reported to be centred around the Pearl River Estuary, in the waters between Lung Kwu Chau and Black Point, near Sha

Chau, the South Brothers in the north Lantau as well as in the west and southwest Lantau. Over the past decade areas surveyed in northwest, northeast and south west Lantau in have shown an overall decline in abundance (1). Southeast Lantau is considered to be the marginal habitat for the Indo-pacific Humpbacked Dolphins (2). The eastern waters of HKSAR are not considered to represent an important habitat for the Indo-pacific Humpbacked Dolphins as only a small number of sightings have been recorded, mainly within the waters of Port Shelter.

The Finless Porpoise, *Neophocaena phocaenoides*, is the most common and important species of cetacean in the southern waters of HKSAR. The distribution of this species appears to vary on both a temporal and spatial basis. Overall, abundance in Hong Kong appears to peak in spring and be lowest in the autumn (4). In winter, Finless Porpoises appear to be mostly present in the central and western survey areas of South Lantau, East Lantau and Lamma while summer results in a dramatic decrease in abundance in South Lantau and Lamma but increase in abundance in some south-eastern areas such as Po Toi and Ninepins. Abundance also appears to decrease everywhere in the autumn and is low in most areas except Po Toi and, to a lesser extent, Ninepins. Therefore in the summer and autumn Finless Porpoises can be found in the eastern waters of Po Toi, Ninepins and Sai Kung, although less abundantly in the autumn (5) (6).

The above literature review suggests that sightings of Finless Porpoises 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 Indo-pacific Humpbacked Dolphins. Therefore, the proposed cable alignment situated in the eastern and southeastern HKSAR waters is not considered to be a major habitat for cetaceans in HKSAR.

B1.3 IMPACT ASSESSMENT

B1.3.1 Impact on Sites of Scientific Interest (SSSIs)

The Hok Tsui (Cape d'Aguilar) and Ninepin Group Site of Special Scientific Interest (SSSIs) are situated about 1,750 m and 5,750 m from the closest cable segment, respectively (*Figure 3.1*). Hok Tsui (Cape d'Aguilar) SSSI is

(1) Hung SK (2013) Monitoring of Marine Mammals in Hong Kong Waters: Final Report (2012-13). An unpublished report submitted to the Agriculture, Fisheries and Conservation Department of Hong Kong SAR Government, 117 pp.

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

(4) Jefferson TA, Hung SK, Law L, Torey M, Tregenza N (2002) Distribution and abundance of finless porpoises in Hong Kong and adjacent waters of China. Raffles Bulletin of Zoology, Supplement 10: 43-55

(5) Hung SK (2013) *Op. cit.*

(6) Jefferson TA, *et al.* (2002) *Op. cit.*

(5) BMT Asia Pacific Ltd (2009). Environmental Impact Assessment of Hong Kong Offshore Wind Farm in Southeastern Waters. Final Report for the Hong Kong Electric Co., Ltd.

partially located in marine water but would be unlikely to be affected due to the long distance (over 1.7 km) from the closest cable segment. Ninepin Group SSSI is located on land and it will thus not be affected by the cable installation works. The closest SSSI is the Shek O Headland SSSI, approximately 560 m from the closest cable segment. Since the maximum distance of transport for the suspended sediments would be approximately 180 m (see *Annex A*) and all the SSSIs in the vicinity are more than 500 m from the closest cable segment, no direct or indirect impact are anticipated.

B1.3.2 Direct Impacts during Construction

As part of the installation of the APG cable, the Route Clearance Operation (RC) and Pre-lay Grapnel Run (PLGR) will be scheduled to remove any Out of Service Cables, debris or obstacles deposited in the cable corridor. The clearance area for the RC and PLGR operations will cover 5m on both sides of the cable (i.e. a total width of 10 m). Afterwards, the proposed cable will be laid beneath the seabed using the jetting technique for the cable burial. In this method, the cable is lowered to the seabed by "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 0.5 m and the cable is buried to a maximum 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 Habitats: The artificial seawall along the seawall of TKO Industrial Estate will not be affected as the cable will land via an existing beach manhole (BMH) and conduit under the seawall. No direct impacts are therefore expected as a result of the shore-end construction activities.

Subtidal Soft Bottom Habitats: Short term direct impacts will occur to soft bottom benthic assemblages present along the cable trench. It is, however, expected that once the cable laying operations are completed, the soft bottom habitats will be recolonised by benthic fauna which are expected to be similar to the assemblages presented before construction activities commenced. As a result, direct impacts to soft bottom benthic assemblages are not anticipated to be significant.

Subtidal Hard Bottom Habitats: The artificial seawall along the seawall of TKO Industrial Estate will not be affected as the cable will land via an existing beach manhole (BMH) and conduit under the seawall. There will be no direct impact to the coral communities in the vicinity of the proposed cable alignment near Fat Tong Chau, Cape Collinson Headland, Ngan Wan, Shek O Headland and Tai Long Pai.

B1.3.3 Indirect Impacts during Construction Phase

The jetting cable laying process will result in the formation of resuspended sediment around the Injector Burial Tool or Sledge Tool, which can be expected to remain very close to the seabed and would thus 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.

Based on the above, indirect impacts may occur through seabed disturbance, resulting in increases in suspended solids in the water column. Such increases above background suspended solid levels may potentially cause impacts to filter feeders. As the cable installation works will be of a short duration, the increases are not predicted to be high except for in the immediate vicinity of the cable burial machine and are expected to settle rapidly back onto the seabed. As such, these impacts will be small scale and of a localised nature. Coral communities of high ecological values at Ninepines, Po Tai, Sung Kong, Waglan Island and Tung Lung Chau are too remote (over 1.9 km) from the cable route to be adversely affected by the increases in suspended solids and settlement of sediment due to the works. During cable laying, it is expected that there will only be minimal disturbance to the coral communities at Fat Tong Chau, Tai Long Pai and the south of Cape Collinson (concerning the area with relatively higher coral diversity; see *Section B1.2.7* above) which are located approximately 695 m, 490 m and 190 m respectively, from the cable alignment. Potential disturbance to corals are expected to be limited and transient given the short-term nature of the cable laying works which will only last for a total of 15 working days for the whole alignment. It should also be noted that there may be shallow burial or surface lay with protection (ie Uraduct) at the cable section near the coastline of Cape Collinson because of the potential shallow rocky sea bottom with thin sediment layer. With the provision of silt curtains as precautionary measure at the south of Cape Collinson, no unacceptable adverse impacts to marine ecological resources are predicted to occur.

Cable installation works may result in a minor and short term increase in underwater sound from marine vessels. Finless Porpoises, which are the more abundance of the two marine mammal species in this area, use high frequency ultrasonic clicks for foraging and communication and the low frequency underwater sound associated with vessels, jetting and cable laying would not be expected to interfere significantly with them. Equally, although some vessel sounds may be within the audible range of Indo-pacific Humpbacked Dolphins, 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 barge. Barge operation for installation works will take a total of approximately 15 working days in HKSAR waters and over this short timeframe is not expected to interfere significantly with this cetacean species either.

(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

Therefore overall no unacceptable adverse impacts to Finless Porpoises and Indo-pacific Humpbacked Dolphins from the Project (e.g. from underwater sounds or the cable laying vessel) are expected to occur.

B1.3.4 Operation Phase

During the operation of the proposed cable, impacts to marine ecological resources are not expected to be caused by the operational activities.

B1.4 IMPACT EVALUATION

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 and short-term indirect impacts to intertidal/subtidal hard bottom habitats in the vicinity of the cable route such as TKO Industrial Estate and Cape Collinson Headland. The habitats of direct impact are, however, considered to be of low ecological importance and 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 have been identified within or in close proximity to the proposed cable corridor that will be directly affected. Although the coral community at the south of Cape Collinson (concerning the area with relatively higher coral diversity; see *Section B1.2.7* above) is located at the boundary of the dispersal range of suspended sediments generated from the jetting works, no unacceptable adverse impacts to corals are expected since the suspended sediment level in the water column is anticipated to be similar to the natural background level at the limit of the dispersal range and the potential impacts would be transient in nature.

- *Size*: The length of the cable will be approximately 35 km inside HKSAR waters. The cable will be buried using a cable burial machine and will affect approximately 0.5 m of the seabed in width along the alignment.

- *Duration*: The duration of the cable laying will be for a total of approximately 15 working days.

- *Reversibility*: Impacts to both the hard and soft bottom marine communities are expected to be short term and recolonisation of the sediments and hard substrates is expected to occur.

- *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.

B1.5 *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 (eg 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.

B1.5.1 *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 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 Mud Disposal Area located at South and East of Tung Lung Chau and the Major Marine Vessel Fairway in Tathong Channel amongst other constraints, the APG cable routing has been carefully considered (See *Section 1.5* in the Main Project Profile Report). The proposed cable alignment is located at the furthest distance from the known coral communities as practicable, ie south of Cape Collinson, Tung Lung Chau and Tai Long Pai.

Silt curtain of multi-layers shall be used as precautionary measure for the closest coral community at the south of Cape Collinson. Indicative location of the silt curtain is shown in *Figure A3* of *Annex A*. Coral monitoring works shall be carried out at Cape Collinson and Tai Long Pai (shown in *Figure E5*) which are in the vicinity of the cable alignment and at a Control station (Tung Lung Chau) to ensure corals (ie hard corals, octocorals and black corals) will not be affected by the cable laying works as well as confirming the effectiveness of the precautionary measure (provision of silt curtain).

B1.5.2 *Minimisation of Impacts*

Mitigation measures that have been recommended to minimise impacts to water quality are also expected to control impacts to marine ecological resources.

- 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 impacts to either water quality or marine ecological resources are expected to occur from land based activities.

Based on the above mitigation measures, no compensation will be required as no unacceptable residual impacts to marine ecological resources are predicted to occur.

Although no unacceptable marine ecological impacts are predicted, water quality monitoring will be carried out when the cable installation barge travels near the coral communities at Cape Collinsion, Tung Lung Chau and Tai Long Pai. In addition, precautionary measures for marine mammals (marine mammal exclusion zone) will be implemented during the cable installation works. This will ensure that no adverse impacts to the corals and marine mammals will result from cable installation works. The monitoring details are presented in *Annex E*.

B1.6 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 ecological value in terms of supporting marine fauna.

Although 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.

The rocky shores in the vicinity of the proposed cable landing point off Fat Tong Chau and along the proposed cable alignment near Cape Collinson Headland support low abundance and diversity of intertidal organisms. Most 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 at the proposed cable landing point but in very low abundance and diversity. The coral colonies along the shoreline of Cape Collinson, Ngan Wan, Shek O Headland and Tai Long Pai in the vicinity of the proposed cable alignment may experience indirect disturbance through changes in water quality. Due to the small scale of the works, the short duration of impacts and the limited dispersion of sediment plume, any potential impacts are not considered to be significant.

The southeastern waters of HKSAR are not considered to be frequently used habitat by the Indo-pacific Humpbacked Dolphin. Sightings of the Finless Porpoise 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 15 working days in total) and will involve one main cable installation barge. Significant disturbance to the Finless Porpoises and Indo-pacific Humpbacked Dolphins, in terms of underwater noise, marine traffic and food sources, is therefore not expected.

Impacts to marine ecological resources have largely been avoided during cable laying through the selection of a landing site and cable corridor that minimise 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 minimise 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, implementing a marine mammal exclusion zone during cable installation works and implementing good house-keeping practices during land based activities.

附件 B

海洋生態評估

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附錄

附錄 B1 潛水調查數據

B1 引言

本附件闡述了擬建海底光纜系統及其登岸點附近的海洋生態資源的基線情況，以及 Asia Pacific Gateway (APG) – 將軍澳在施工和運作時的潛在生態影響評估結果。基線情況的評估，是根據文獻的資料，以及近期為是項評估進行實地核查的結果而作出。此外，亦在適當地方建議了多項措施來緩解已知的影響。

B1.1 相關的法例和評估準則

評估海洋生態影響的準則都在《環評技術備忘錄》中闡述。該《備忘錄》的*附件 16* 闡述了對一個項目或建議可能造成的海洋生態資源影響的一般評估方法，務求能夠完整和客觀地識別、預測和評估有關的影響。《備忘錄》的*附件 8* 則建議了一些在評估這些影響時可以採用的準則。

B1.2 現有的海洋生態資源

B1.2.1 具特殊科學價值地點

最接近的具特殊科學價值地點是石澳海角具特殊科學價值地點，距離最近的一段光纜約 560 米。此外還有鶴咀和果洲群島具特殊科學價值地點分別與最近的一段光纜距離約 1,750 米和 5,750 米。鶴咀具特殊科學價值地點部份屬於海上範圍而果洲群島具特殊科學價值地點屬於陸上範圍，由於它們跟最近的擬建海底光纜分段也相距甚遠，因此不會受海底光纜鋪設工程影響。

B1.2.2 鶴咀海岸保護區

設立鶴咀海岸保護區的目的，是要保護其多樣化的海洋生物，以及具重要生態價值的生境，例如珊瑚群落。由於鶴咀海岸保護區位於最近的擬建海底光纜分段約 1,750 米，預計不會受到工程影響。

B1.2.3 海濱保護區和自然保育區

距離擬建光纜 500 米範圍內(此後稱為研究範圍)，在香港島和佛堂洲（佛頭洲）沿岸，均有一小片被指定為“綠化地帶”的狹長土地。不過，這個類別並非指定的保育區。

石澳海角的沿岸包括大頭洲和五分洲以及北面由歌連臣角至大浪灣的沿岸均被定為海濱保護區，前者離最接近擬建海底光纜分段為 230 米，後者則為 90 米。根據《環境影響評估條例》*附表 2*（第一部分）項目 *C.12* 指出，有關的挖泥作業會被定為指定項目，如果（a）距離一個現有的或計劃中的(vii) 海濱保護區的最近界線少於 500 米，因此此工程被定為一項指定項目。

由於以上的海濱保護區均位於陸上，擬建海底光纜系統工程預計不會對其造成不可接受的影響。

B1.2.4 *潮間軟底生物群落*

在研究區內有一小片沙質海岸位於擬議登岸點(將軍澳工業邨)以南的佛堂洲以及在擬建海底光纜分段以東的石澳海角。現時沒有任何關於這片沙質海岸的資料。不過，一般而言，沙質海岸大都是流動和不穩定的環境，而且經常受到水流和海浪影響。由於很少潮間生物能夠承受這些條件，因此，香港的沙質海岸都比較少發現潮間生物存在 [(1)]。

B1.2.5 *潮間硬底生物群落*

較早前在將軍澳工業邨擬議光纜登陸點的人工海堤、附近的佛堂洲的天然岩岸[(2)] [(3)]和在擬建光纜路線旁的歌連臣角進行了潮間帶研究[(4)]。

在 2008 年的濕季進行過一項潮間生態調查 [(5)]顯示位於佛堂洲附近光纜天然石質海岸和將軍澳工業邨人工海堤的海岸生物群落結構，實屬香港一般被遮蔽至半外露的石質海岸和人工海堤常見的結構。人工海堤的物種多樣化程度偏低。該次調查記錄到的動物主要有僧帽牡蠣（*Saccostrea cucullata*）、玉黍螺（*Echinolittorina radiata* 和 *E. trochoides*），以及帽貝（*Nipponacmea concinna* 和 *Patelloida pygmaea*）。該次調查在天然石質海岸記錄到的主要物種包括：僧帽牡蠣（*Saccostrea cucullata*）、玉黍螺（*Echinolittorina radiata* 和 *E. trochoides*），以及帽貝（*Nipponacmea concinna*）和單齒螺（*Monodonta labio*）。這些品種都是香港的天然石質海岸常見的種類。天然石質海岸的物種多樣化程度比人工海岸較高。

為了更新這個生境的資料和現狀，本項目對將軍澳工業邨的海堤（包括亞洲快線海底光纜系統的擬議登岸點），以及歌連臣角西北面的海岸線，於 2011 年進行了補充性的潮間調查，所用的方法包括定點檢查和標準的帶形採樣線方法（*圖 B1*）。

2011 年的調查結果跟 2008 年調查結果相似，顯示研究區內的垂直式人工海堤的物種多樣化程度偏低。在進行定性的定點檢查時，合共見到 14 種動物和一種成薄殼狀的藻類。這些品種都是香港的人工海岸／碼頭十分常見和分佈很廣的種類。在歌連臣角天然石質海岸記錄到的主要生物包括：高岸區的玉黍螺（*Echinolittorina* spp.），中岸區的單齒螺（*Monodonta labio*）和帽貝（*Siphonaria japonica*），以及低岸區的帽貝（*Cellana toreuma*）和石鱉（*Acanthopleura japonica*）。低岸區亦有一些

(1) Morton B, Morton J (1983)。 《香港的海岸生態》。

(2) 香港環境資源管理顧問有限公司（2008）。 《將軍澳工業邨生物柴油廠發展計劃》。 為 ASB Biodiesel (Hong Kong) Limited 撰寫的最後環評報告。

(3) 香港環境資源管理顧問有限公司(2011)。 亞洲快線海底光纜系統- 將軍澳 。申請直接申請環境許可證批准的工程項目簡介 (DIR-217/2011)。

(4) 香港環境資源管理顧問有限公司(2011)。*同上.*

(5) 香港環境資源管理顧問有限公司（2008）。*同上*

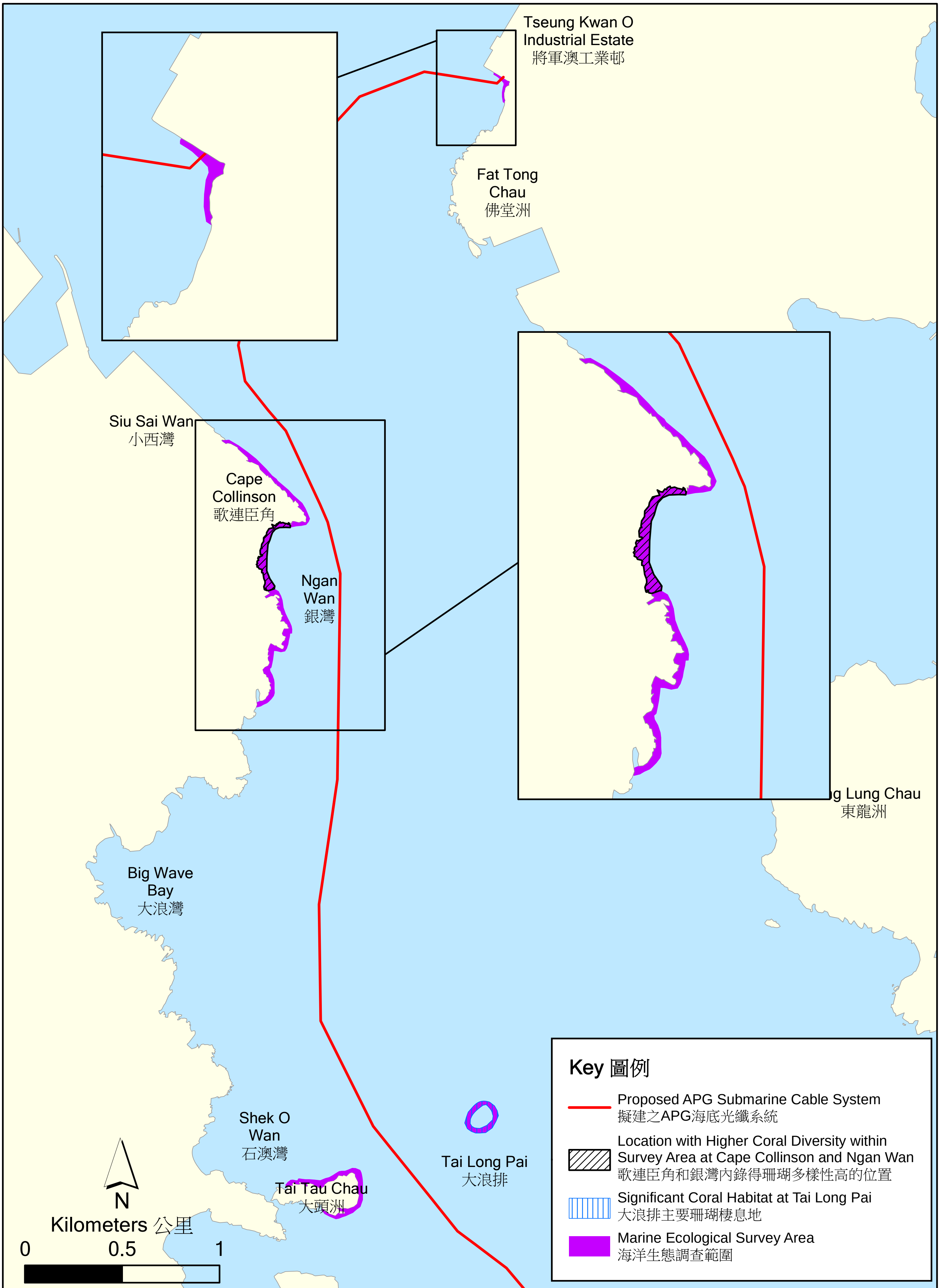

Figure B1
圖 B1

Locations of Marine Ecological Survey
海 洋 生 態 調 查 位 置

File: T:\GIS\CONTRACT\0174917\Mxd\0174917_Locations_of_Marine_Ecology_Survey.mxd
Date: 28/8/2013

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座生物種，包括藤壺（*Tetraclita* spp.）。移動物種的數量／密度，以及座生物種的覆蓋率都屬偏低至中等（其平均值分別是每平方米 65 – 80 個和每平方米 2 – 42%）。

這些結果顯示，在研究區內的潮間石質海岸，包括位於將軍澳工業邨內的擬建光纜登岸點，大致上只有數量較少和密度較低的生物，因此只具有較低的生態價值。此外，這些調查並沒有記錄到任何具保育價值的物種。而海濱保護區均位於陸上，擬建海底光纜系統工程預計不會對其造成不可接受的影響。

B1.2.6 *潮下軟底生物群落*

有關擬建光纜走廊附近的潮下軟底生物群落的資料，可以從《香港海洋底棲生物調查研究》(1) 取得。其中有六個樣本收集站貼近擬議工程區。它們所收集到的數據可以反映擬議光纜沿線的生物群落。

根據研究結果，這六個樣本收集站的基底是由中沙／細沙／極細沙所覆蓋。它們的底棲生物群落都是香港海域常見的物種，而且與香港大部份其他潮下生境的底棲生物相若。在夏季時，物種的平均數目比較多（每 0.5 平方米有 51 個物種），而個體的平均數目（每平方米有 487 個）和平均濕重（每平方米 32.3 克）都低於香港的平均值（每 0.5 平方米有 33 個物種、每平方米有 540 個個體、每平方米有 71.2 克）。在冬天，物種的平均數目（每 0.5 平方米有 50 個物種）、平均濕重（每平方米有 33 克）和平均個體數目（每平方米有 605 個個體），都高於香港底棲生物群落的平均值（每 0.5 平方米有 34 個物種、每平方米有 450 個個體、每平方米有 28 克）。在擬議光纜的走線上，兩個季節都沒有發現具保育價值的物種。

B1.2.7 *潮下硬底生物群落*

在 2007 年至 2013 年間，在本工程之研究範圍內的潮下硬底生境已被調查(2)(3)(4)(5)(6)(7)(8)(9)。調查範圍包括擬建光纜登岸點附近的佛堂洲和將軍澳工業邨以及在擬建海底光纜分段附近的歌連臣角、銀灣和大浪排。調查結果錄得零星的硬珊瑚群落，而這些硬珊瑚都是香港常見的品種，並且在全港的近岸海域內都有廣泛分佈。歌連臣角海域錄得低至中等的八放

(1) 香港城市大學專業顧問公司 (2002)。 香港海洋底棲生物調查研究（顧問合約 No.：CE 69/2000） 呈交香港漁農自然護理署之最後報告。

(2) 香港資源管理顧問有限公司 (2007)。 新界東南堆填區擴建可行性研究：環境影響評估報告。

(3) 香港資源管理顧問有限公司 (2008)。 *同上*

(4) 香港中文大學 (2008)。 為香港政府漁農自然護理署進行的《香港水域的八效珊瑚和黑珊瑚的參考文學和研究》（最後報告）。

(5) BMT Asia Pacific Ltd (2009)。香港東南海域內的香港離岸風力發電場環境影響評估報告。 為香港電燈公司草擬的最後報告。

(6) Area 131 Further Ecological Study Report (1999) and HATS Dive Survey Report (2003).

(7) 香港環境資源管理顧問有限公司(2011)。*同上.*

(8) 香港資源管理顧問有限公司(2012)。 亞洲快線海底光纜系統- 將軍澳。基線珊瑚監察報告。

(9) 香港資源管理顧問有限公司(2013)。亞洲快線海底光纜系統- 將軍澳。工程後珊瑚監察報告。

珊瑚覆蓋率和多樣性，而大浪排深水區域的八放珊瑚則有較高的覆蓋率和多樣性。

本項目也於 2012 年 9 月和 10 月和 2013 年 2 月進行了補充性的快速生態評估調查，務求能夠為擬建海底光纜沿線和登岸地點（*圖 B1*）的珊瑚現況提供最新資料。這項潛水調查包括在擬建光纜登岸點附近的將軍澳工業邨和佛堂洲以及

在擬建海底光纜分段附近的歌連臣角、銀灣、石澳海角和大浪排進行定性的定點潛水調查和半定量的快速生態評估調查。定點潛水調查的結果可參考*附件 B1 表 B1.1-1.4*，而快速生態評估調查結果可參考*附件 B1 表 B1.5*。

潛水調查顯示，在擬建光纜登岸點附近的將軍澳工業邨的人工海堤和佛堂洲的天然海岸錄得的硬珊瑚和八放珊瑚覆蓋率均低於 5%，只記錄到五個造礁珊瑚品種、一個非造礁珊瑚品種和兩個八放珊瑚品種。所有硬珊瑚群落的直徑和八放珊瑚的高度均少於 10 厘米。所有錄得的珊瑚都是香港常見並廣泛分佈的品種。

歌連臣角南至銀灣的海床是硬質基岩為主(覆蓋率為 60%)，該處淺水區（海圖深度基準面-3 米至-5 米）的硬珊瑚覆蓋率少於 5%，當中錄得八個品種；而八放珊瑚覆蓋率則是 6-10%，錄得六個品種。在歌連臣角南部和銀灣北部，錄得較多硬珊瑚品種和較大的硬珊瑚群落。。這個區域考慮定其為擁有相對較高的珊瑚多樣性，儘管珊瑚覆蓋率和八放珊瑚的品種數類則與鄰近區域相約。

石澳海角的淺水區（海圖深度基準面-3 米至-5 米）海床以巨礫和石塊為主，以深水區（海圖深度基準面-5 米至-10 米）則主要為非生物底棲性的沙。淺水和深水區的硬珊瑚和八放珊瑚覆蓋率均偏低(<1%)，錄得三個造礁珊瑚品種、一個非造礁珊瑚品種以及四個八放珊瑚品種。所有錄得的珊瑚都是香港常見並廣泛分佈的品種。

大浪排的潛水調查確定海床均屬硬質並以巨礫和石塊為主。硬珊瑚覆蓋率非常低(<5%)，沿大浪排海岸線錄得七個造礁珊瑚品種、一個非造礁珊瑚品種。總共七個八放珊瑚品種以及兩個黑珊瑚品種約覆蓋 5-10%的淺水區（海圖深度基準面-2 米至-5 米）和 11-30%深水區（海圖深度基準面-5 米。所有錄得的珊瑚都是香港近岸海域常見並廣泛分佈的品種。由於大浪排錄得較多八放珊瑚數量和較高的多樣性，該區被評為重要珊瑚棲息地。

總括而言，補充潛水調查結果顯示，擬建光纜登岸點和海底光纜沿線附近所記錄得的硬珊瑚均屬於本地常見和分佈廣泛的品種。其硬珊瑚數量和多樣性在全港而言屬於偏低。除了大浪排深水區錄得較高的八放珊瑚覆蓋率和多樣性，其他調查地區均屬偏低。

B1.2.8 *海洋哺乳類動物*

中華白海豚（*Sousa chinensis*）和江豚（*Neophocaena phocaenoides*）都是香港海域內經常見到的海洋哺乳類動物。據報，中華白海豚是以珠江口為中心，常出沒於龍鼓洲及龍鼓灘之間的水域、北大嶼山沙洲、大小磨刀附近，以及大嶼山西部和西南部。過去十年在西北、東北和西南大嶼山進行的調查均顯示海洋哺乳類動物數目有下滑趨勢(1)。大嶼山東南部被認為是中華白海豚的邊緣棲息地(2)。香港東部海域並不是中華白海豚的重要生境，因為看見牠們的次數不多，而且主要是在牛尾海範圍內。

江豚是香港南部海域最常見和最重要的鯨類物種。這個物種在時間和區域上出現不同的分佈變化。總體而言，江豚在香港水域的數目在春季達到高峰，在秋季錄得最低數目(3)。在冬季，江豚大多出現在南大嶼山的中部和西部、東大嶼山及南丫島一帶；在夏季，江豚在南大嶼山及南丫島的數目急劇減少，但多出沒於東南部水域，例如：蒲台島、果洲群島。除了蒲台島一帶，江豚數目於秋季開始在其他水域均出現下降趨勢，在果洲群島附近水域則有較小的下降幅度。因此，江豚在夏季和秋季大多出沒於東部海域，蒲台島、果洲群島及西貢(4) (5)。

在 2006 至 2007 年的 12 個月內，一項海洋哺乳類動物調查於工程研究範圍內(藍塘海峽東南、果洲群島及牛尾海水域)進行，合共的七次出沒次數中只有 33 條江豚記錄(6)。

根據上述資料，在擬建光纜沿線的香港東部和東南部海域所發現的江豚，都屬於偶然和季節性的發現（主要是在冬、春兩季）；而大嶼山東南部海域已是中華白海豚的邊緣棲息地。因此，擬建光纜沿線地區並非牠們的重要生境。

B1.3 *影響評估*

B1.3.1 *對具特殊科學價值地點的影響*

鶴咀和果洲群島具特殊科學價值地點，距離最近的一段光纜分別約有 1,750 米和 5,750 米（*圖 3.1*）。部分鶴咀具特殊科學價值地點位於海中，但是由於距離最近的一段光纜遠(超過 1.7 千米)，所以不會受到光纜鋪設工程影響。果洲群島具特殊科學價值地點都位於陸上，因此不會受到光

(1) Hung SK (2013) Monitoring of Marine Mammals in Hong Kong Waters: Final Report (2012-13). An unpublished report submitted to the Agriculture, Fisheries and Conservation Department of Hong Kong SAR Government, 117 pp.

(2) Jefferson TA (1998). 為香港政府漁農自然護理署進行的《香港海域內的中華白海豚群體生物學研究（*Sousa chinensis*, Osbeck 1765）》（最後報告）。

(3) Jefferson TA, Hung SK, Law L, Torey M, Tregenza N (2002) Distribution and abundance of finless porpoises in Hong Kong and adjacent waters of China. Raffles Bulletin of Zoology, Supplement 10: 43-55

(4) Hung SK (2013) *同上*

(5) Jefferson TA, *et al.* (2002) *同上*

(6) BMT Asia Pacific Ltd (2009). Environmental Impact Assessment of Hong Kong Offshore Wind Farm in Southeastern Waters. Final Report for the Hong Kong Electric Co., Ltd.

纜鋪設工程影響。距光纜最接近的具特殊科學價值地點是石澳海角具特殊科學價值地點，距離最近的一段光纜約 560 米。由於懸浮沉積物向外擴散的最大距離約 180 米（見附錄 A），以及這些具特殊科學價值地點均距離最近的一段光纜 500 米以上，預計不會受到光纜鋪設工程的直接和間接影響。

B1.3.2 *施工期間的直接影響*

作為光纜安裝工程的一部份，路線清理作業及預鋪抓鉤運行作業會為擬建光纜走廊清除已停用的光纜、沉積碎屑以及障礙物，此清除範圍會覆蓋擬建光纜兩側約 5 米(總闊 10 米)。除了一段短距離的接引走線外，擬建的光纜都會以沖噴技術，把光纜掩埋於海床下。這個方法是把光纜和沖噴式掩埋器都放到海床上。沖噴式掩埋器會利用高壓水柱把沉積物液化，並用水柱沖噴來形成槽溝。然後立即把光纜鋪設在槽溝內。槽溝的兩側會滑開並繞過光纜，因此把它掩埋，並在海床上留下一個淺坑，最後被天然的沉積過程填平。沖噴器把海床液化的最大闊度是 0.5 米，並可以把光纜掩埋至最深 5 米。

潮間生境：根據預測，由於擬建光纜將會通過現有的沙灘沙井和海堤下的導管登陸，擬議岸端的施工活動預料不會對將軍澳工業邨海堤的潮間生境造成顯著的直接影響。

潮下軟底生境：光纜導槽一帶的軟底底棲生物會受到短期直接影響。然而，當這些光纜鋪設工程完成後，在施工前出沒該區的同類底棲生物會在這些基質重新聚集。因此，預計這些生物群落所受到的直接影響不會顯著。

潮下硬底生境：由於擬建光纜將會通過現有的沙灘沙井和海堤下的導管登陸，將軍澳工業邨海堤不會受到影響。預計在佛堂洲、歌連臣角、銀灣、石澳海角和大浪排的珊瑚群落，不會受到直接影響。

B1.3.3 *施工階段的間接影響*

沖噴式的光纜鋪設過程，會令沖噴式掩埋器四周的沉積物成為懸浮狀態，但它們會貼近海床，而且迅速重新沉積。根據分析，在鋪設光纜的過程中，光纜掩埋器所形成的懸浮沉積物隨水漂移的最遠距離是 180 米。

基於上述情況，鋪設光纜時會干擾海床，因而令水體的懸浮固體增加。在這種懸浮固體含量比背景含量高的情況下，濾食動物便可能受到影響。由於光纜安裝工程為時短暫，因此，除了光纜掩埋器四周之外，預測懸浮固體的增幅不會很高，而且會迅速沉回海床。所以，這項工程只會造成小規模影響，而且屬局部性質。位於果洲群島、蒲台、宋崗、橫瀾島和東龍洲的高生態價值珊瑚距離光纜鋪設路線太遠（超過 1.9 公里），因此不會因為光纜鋪設工程令懸浮固體增加和沉積物重新沉積而受到任何不良影響。此外，分別位於距離光纜鋪設路線外最少 695 米的

佛堂洲、最少 490 米的大浪排、最少 190 米歌連臣角以南的珊瑚群落（這個區域擁有相對較高的珊瑚多樣性，見 *B1.2.7*）也只會受到光纜鋪設工程極輕微的干擾。再者，預期光纜鋪設工程對珊瑚潛在的間接影響將是有限和短暫的，基於整個鋪設工程只持續 15 個工作日。還應指出，在歌連臣角海岸線附近，光纜有可能只作淺層埋藏或加護設置於海床表面(以 URADUCT 保護)，這是因為那裡可能只有一層淺沙於海底岩石之上。隨著於歌連臣角以南提供隔泥幕作為預防措施，預計光纜鋪設工程不會對海洋生態資源產生不可接受的不良影響。

光纜安裝工程所使用的船隻可能會令水底聲音有輕微和短暫的增加。由於江豚(兩種出沒於此水域的海洋哺乳動物而數量較多的一種)使用頻率較高的超聲波來覓食和溝通，船隻噴射和光纜鋪設的低頻聲預計不會對牠們造成顯著干擾。落入中華白海豚的可聽範圍內的多數是高速船發出的聲音 (1)。預計光纜安裝屬短暫和臨時性的工程，會由慢速移動的躉船進行。香港水域的光纜安裝工程為期約 15 個工作日，在這短時間內預計不會對鯨類有顯著干擾。由於江豚覓食和中華白海豚溝通所用的，是高頻超聲波的“咔嚓”聲，而船隻、沖噴器和光纜鋪設工作等所發出的，是低頻水底聲音，因此，預料兩類鯨豚皆不會受到顯著干擾。

光纜安裝工程會是短期和暫時的事件，而且會由一艘光纜安裝躉船在約 15 個工作天內，於香港海域進行。江豚，這是兩個海洋哺乳類動物在這方面的內容更豐富，使用頻率較高的超聲波點擊覓食和溝通，與血管相關的低頻水下聲，噴射和電纜鋪設預計不會顯著干擾與他們。所以，預計江豚和中華白海豚不會因為光纜鋪設船隻發出的水底聲音而受到不可接受的不良影響。光纜

B1.3.4 *光纜光纜運作階段*

擬建的光纜在運作期間不會干擾海床和沉積物，因此不會影響海洋生態資源，也不會令水質改變而造成間接影響。

B1.4 *影響評估*

下文闡述了按照《環評技術備忘錄》*附件 8 表 1* 的要求而進行的影響評估。

- *生境質素：*預測光纜槽一帶的潮下軟底生境，以及光纜登岸地點附近(如將軍澳工業邨和歌連臣角)的潮間／潮下硬底生境，都會受到短期的直接影響。然而，這些生境的生態價值都屬於偏低因此預計不會對潮間/潮下硬底生境構成重要的潛在間接影響。

(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

- *物種：*在擬議光纜走廊附近沒有發現具高生態價值的物種。雖然在歌連臣角南部的珊瑚群落（關於珊瑚多樣性較高的區域，見上文段落 B1.2.7）是位於在噴射工程產生的懸浮固體的擴散範圍的邊界，預料沒有不可接受的負面影響珊瑚，因為在水柱中的懸浮固體量預計於散佈範圍的邊界將接近天然背景水平而且性質短暫。

- *生境面積：*在香港海域內的光纜長約 35 公里。會採用光纜掩埋器把光纜掩埋。在光纜沿線闊約 0.5 米的海床會因此受到影響。

- *影響期：*鋪設光纜大約需要 15 個工作天。

- *可逆轉性：*預計硬底和軟底海洋生物所受到的影響會是短期性質，而且，受影響的生物會重新聚集於沉積物和硬基質上。

- *環境改變的大小：*預測不會對具高生態價值的生物或生境會受到不良影響。由於鋪設光纜的干擾只屬短期和局部性質，所以預計影響程度會較低，而且會在可接受範圍。

B1.5 緩解措施

根據《環評技術備忘錄》有關海洋生態影響評估的指引，緩解海洋生態資源影響的一般政策，按優先次序闡述如下：

- **避免**：透過採用其他適當的方法，盡可能避免潛在影響。

- **抑減**：對於無可避免的影響，應該以適當和可行的措施來盡量減少，例如限制工程強度（例如挖泥速度）或時間或工程作業。

- **彌補**：重要物種和生境的損失，可以在其他地方提供同樣的物種或生境作為彌補。如可能的話，應要考慮採取可以豐富物種及生境的措施，以及其他保育措施。

根據以上所述，下文探討有關的緩解措施。

B1.5.1 避免影響

本項目透過選擇可以減少影響珊瑚群落的光纜登岸地點和光纜走廊，以及採用可以減少滋擾海洋環境的光纜鋪設技術，從而避免了大部份鋪纜工程可能對海洋生態資源造成的影響。擬議的光纜路線受著空間上的限制，當中包括現有的海底光纜、憲報公佈的東龍洲以南和以東的挖沙和卸泥區及藍塘海峽的主要船隻航道。（請參見項目簡介報告第 1.5 節）現選取的擬建光纜路線已盡可能遠離位於歌連臣角南部、東龍洲和大浪排的已知珊瑚群落。另外，應在鋪設光纜走線附近的歌連臣角和大浪排以及對照站(東龍洲)進行珊瑚群落監察(參見圖 E5)，從而確保珊瑚(如硬珊瑚、八放珊瑚和黑珊瑚)不會因鋪設光纜的工程而受到影響，並確認隔泥幕作為預防措施的成效。

B1.5.2 *抑減影響*

用於減少水質影響的建議緩解措施也可以控制海洋生態資源所受到的影響。

- 光纜鋪設速度不會超過每小時 1 公里，務求能夠減少鋪設光纜時所引起的海床沉積物滋擾和擴散程度。
- 此外，在實施良好的工地管理方法後，陸上工程應不會對水質或海洋資源造成影響。

基於上述各項緩解措施，預測海洋生態資源不會受到不可接受的剩餘影響，因此無需實施任何彌補措施。

雖然預測本項目不會造成不可接受的海洋生態影響，但當光纜安裝躉船駛近東龍洲、佛頭洲和大浪排的珊瑚群落時，仍會進行水質監察。此外，在光纜鋪設期間，會為海洋哺乳類動物實施額外的預防措施（海洋哺乳類動物觀察區）。以上的措施可確保光纜安裝工程不會對珊瑚及海洋哺乳動物造成任何不良影響。監察詳情均在*附件 E* 闡述。

B1.6 *總結*

根據有關擬議光纜走線地區及擬議登岸點附近的海洋生態資源現存資料，區內生態價值一般較低。

雖然軟底生物群落會在鋪設光纜時受到滋擾，但預測會有相近的生物群落在短時間內重新聚集該區的生境，因此有關的影響並非不可接受。

位於擬議登岸點附近的佛堂洲對開的岩岸及沿擬建的光纜走線附近的歌連臣角石質海岸均有小量品種不多的潮間生物。這些生物都是香港其他相似海岸所常見和分佈很廣的物種，只具有偏低的生態價值。因此，這些生物群落所受到的影響並不顯著。

在擬議光纜登岸點發現有一些硬珊瑚，但數量和多樣性都很低。在建議的光纜走線附近，沿歌連臣角海岸線、銀灣、石澳海角及大浪排的珊瑚群落可能會因水質變化而受到間接干擾。光纜然而，由於工程規模細小，影響的時間短暫，而且沉積物捲流的擴散範圍亦有限，所以這些影響都不會顯著。

香港東南面的海域並非中華白海豚經常使用的生境。擬議光纜走廊一帶也並非經常發現江豚。同時，預計光纜安裝工程只需要進行一段短時間（約 15 個工作天），而且只使用一艘主要的光纜安裝躉船。因此，預計江豚和中華白海豚不會受到水底噪音、海運交通和食物來源等方面的顯著干擾。

本項目透過選擇可以減少影響珊瑚群落的光纜登岸地點和光纜走廊，以及採用可以減少干擾海洋環境的光纜鋪設技術，從而避免了鋪纜工程可能對海洋生態資源造成的大部份影響。

用於減少水質影響的建議緩解措施也可以控制海洋生態資源所受到的影響，特別是對光纜沿線珊瑚群落的影響。這些緩解措施包括限制光纜鋪設機的最高速度，以及在進行陸上工程時實施良好的管理方法。

Appendix B1

Data of Subtidal Dive Surveys

B1 RESULTS OF DIVE SURVEY

Table B1.1 Coral Species Recorded near the Proposed Cable Landing Point (including the Artificial Seawall off TKO Industrial Estate and the Natural Rocky Shore near Fat Tong Chau)

Taxon	Family	Species
Hermatypic Hard Coral Species	Poritidae	*Goniopora stutchburyi*
		Porites lobata
	Faviidae	*Favites pentagona*
		Oulastrea crispata
	Fungiidae	*Lithophyllon undulatum*
Ahermatypic Hard Coral Species	Dendrophyllidae	*Tubastrea/ Dendrophyllia* sp.
Octocoral Species	Plexauridae	*Echinomuricea* sp.
	Nephtheidae	*Dendronephthya* sp.

Table B1.2 Coral Species Recorded at Cape Collinson Headland and Ngan Wan

Taxon	Family	Species
Hermatypic Hard Coral Species	Acroporidae	*Montipora mollis*
	Coscinaraea	*Coscinaraea* n sp.
	Dendrophyllidae	*Turbinaria peltata*
	Faviidae	*Plesiastrea versipora*
		Favia rotumana
	Poritidae	*Goniopora stutchburyi*
		Porites lobata
	Siderastreidae	*Psammocora superficialis*
Octocoral Species	Plexauridae	*Menella* sp.
		Paraplexaura sp.
		Echinomuricea sp.
	Ellisellidea	*Ellisella* sp.
	Alcyoniidae	*Sinularia* sp.
	Nephtheidae	*Dendronephthya* sp.

Table B1.3 Coral Species Recorded at Shek O Headland

Taxon	Family	Species
Hermatypic Hard Coral Species	Faviidae	*Plesiastrea versipora*
	Poritidae	*Goniopora stutchburyi*
		Porites lobata
Ahermatypic Hard Coral Species	Dendrophyllidae	*Tubastrea/ Dendrophyllia* sp.
Octocoral Species	Plexauridae	*Menella* sp.
		Paraplexaura sp.
		Echinomuricea sp.
	Ellisellidea	*Ellisella* sp.

Table B1.4 *Coral Species Recorded at Tai Long Pai*

Taxon	Family	Species
Hermatypic Hard Coral Species	Acroporidae	*Montipora mollis*
	Faviidae	*Cyphastrea chalcidicum*
		Favites abdita
		Plesiastrea versipora
	Poritidae	*Goniopora stutchburyi*
		Porites lobata
	Siderastreidae	*Psammocora superficialis*
Ahermatypic Hard Coral Species	Dendrophyllidae	*Tubastrea/ Dendrophyllia* sp.
Octocoral Species	Plexauridae	*Echinomuricea* sp.
		Euplexaura sp.
		Paraplexaura sp.
		Menella sp.
	Acanthogorgiidae	*Anthogorgia* sp.
	Nephtheidae	*Dendronephthya* sp.
	Elliseillidae	*Verrucella* sp.
Black Coral Species	Antipathidae	*Antipathes curvata*
		Cirrhipathes sp.

Table B1.5 *Ordinal Rank of Percentage Cover of Seabed Attributed recorded along the REA Survey Transects during the Coral Survey*

Zone	Fat Chau Tong and TKO Industrial Estate				Cape Collinson Headland and Ngan Wan						Shek O Headland				Tai Long Pai			
Depth (a)	S1	S2	D1	D2	S1	S2	S3	D1	D2	D3	S1	S2	D1	D2	S1	S2	D1	D2
Seabed attributes (b)																		
Bedrock	0	0	0	0	0	5	4	1	5	5	0	0	0	0	6	6	6	6
Boulders – large	6	4	0	3	3	2	3	2	3	3	3	1	1	1	1	2	3	3
Boulders – small	2	3	2	2	3	2	3	3	3	2	2	3	2	3	1	1	2	2
Rock	2	0	0	0	1	1	1	1	1	1	5	3	2	2	0	0	0	0
Rubble	0	0	0	0	3	2	1	2	1	1	0	0	0	0	1	1	1	1
Sand	0	3	0	3	2	1	1	4	1	1	0	4	5	5	1	1	1	1
Silt	0	0	6	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ecological attributes (b)																		
Hard coral	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1
Dead standing coral	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Octocoral	0	0	0	1	1	1	1	2	2	2	0	0	1	1	1	1	3	3
Black coral	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Turf algae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Macroalgae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coralline algae	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Notes:

(a) s = shallow water; m = mid water; d=deep water

(b) 1=<5% Cover, 2= 6-10% Cover, 3 = 11-30% Cover, 4 = 31-50% Cover, 5 = 51-75% Cover, 6 = 76-100% Cover.

附錄 B1

潛水調查數據

B1 潛水調查結果

表 B1.1 建議海底光纖電纜登陸點附近錄得的珊瑚品種（包括將軍澳工業邨的人工海堤和佛堂洲附近的天然岩岸）

類群	科	品種
造礁石珊瑚品種	濱珊瑚科	*Goniopora stutchburyi*
		Porites lobata
	菊珊瑚科	*Favites pentagona*
		Oulastrea crispata
	石芝珊瑚科	*Lithophyllon undulatum*
非造礁石珊瑚品種	樹珊瑚科	*Tubastrea/ Dendrophyllia* sp.
八放珊瑚品種	叢柳珊瑚科	*Echinomuricea* sp.
	穗軟珊瑚科	*Dendronephthya* sp.

表 B1.2 在歌連臣角和銀灣錄得的珊瑚品種

類群	科	品種
造礁石珊瑚品種	鹿角珊瑚科	*Montipora mollis*
	篩珊瑚科	*Coscinaraea* n sp.
	木珊瑚科	*Turbinaria peltata*
	菊珊瑚科	*Plesiastrea versipora*
		Favia rotumana
	濱珊瑚科	*Goniopora stutchburyi*
		Porites lobata
	鐵星珊瑚科	*Psammocora superficialis*
八放珊瑚品種	網柳珊瑚科	*Menella* sp.
		Paraplexaura sp.
		Echinomuricea sp.
	鞭珊瑚科	*Ellisella* sp.
	軟珊瑚科	*Sinularia* sp.
	穗軟珊瑚科	*Dendronephthya* sp.

表 B1.3 在石澳山仔錄得的珊瑚品種

類群	科	品種
造礁石珊瑚品種	菊珊瑚科	*Plesiastrea versipora*
	濱珊瑚科	*Goniopora stutchburyi*
		Porites lobata
非造礁石珊瑚品種	樹珊瑚科	*Tubastrea/ Dendrophyllia* sp.
八放珊瑚品種	網柳珊瑚科	*Menella* sp.
		Paraplexaura sp.
		Echinomuricea sp.
	鞭珊瑚科	*Ellisella* sp.

表 B1.4　　大浪排錄得的珊瑚品種

類群	科	品種
造礁石珊瑚品種	鹿角珊瑚科	*Montipora mollis*
	菊珊瑚科	*Cyphastrea chalcidicum*
		Favites abdita
		Plesiastrea versipora
	濱珊瑚科	*Goniopora stutchburyi*
		Porites lobata
	鐵星珊瑚科	*Psammocora superficialis*
非造礁石珊瑚品種	樹珊瑚科	*Tubastrea/ Dendrophyllia* sp.
八放珊瑚品種	網柳珊瑚科	*Echinomuricea* sp.
		Euplexaura sp.
		Paraplexaura sp.
		Menella sp.
	棘柳珊瑚科	*Anthogorgia* sp.
	穗軟珊瑚科	*Dendronephthya* sp.
	鞭珊瑚科	*Verrucella* sp.
黑珊瑚品種	黑珊瑚科	*Antipathes curvata*
		Cirrhipathes sp.

表 B1.5　　快速生態評估調查樣線錄得海床底棲覆蓋率之排名次序

區域	佛堂洲和將軍澳工業邨				歌連臣角和銀灣						石澳山仔				大浪排			
深度 [(a)]	S1	S2	D1	D2	S1	S2	S3	D1	D2	D3	S1	S2	D1	D2	S1	S2	D1	D2
海床特性[(b)]																		
基岩	0	0	0	0	0	5	4	1	5	5	0	0	0	0	6	6	6	6
石礫- 大	6	4	0	3	3	2	3	2	3	3	3	1	1	1	1	2	3	3
石礫- 小	2	3	2	2	3	2	3	3	3	2	2	3	2	3	1	1	2	2
岩石	2	0	0	0	1	1	1	1	1	1	5	3	2	2	0	0	0	0
碎石	0	0	0	0	3	2	1	2	1	1	0	0	0	0	1	1	1	1
沙	0	3	0	3	2	1	1	4	1	1	0	4	5	5	1	1	1	1
淤泥	0	0	6	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
生態特性[(b)]																		
硬珊瑚	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1
已死的珊瑚	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
八放珊瑚	0	0	0	1	1	1	1	2	2	2	0	0	1	1	1	1	3	3
黑珊瑚	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
草皮狀海藻	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
大型海藻	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
珊瑚海藻	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

註釋:

(a)　s = 淺水區; d=深水區

(b)　1=<5%　覆蓋率, 2= 6-10%覆蓋率, 3 = 11-30%覆蓋率, 4 = 31-50%覆蓋率, 5 = 51-75%覆蓋率, 6 = 76-100%覆蓋率.

Annex C

Assessment of Potential Impacts to Fisheries Resources and Fishing Operations

CONTENTS

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C1.5	*FISHERIES IMPACT EVALUATION*	*7*
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C1 INTRODUCTION

This *Annex* presents information on the existing fisheries resources and fishing operations within and adjacent to the proposed cable corridor and evaluates the potential for direct and indirect impacts to these resources. No impacts are expected to occur during the operation of the submarine cable. The cable is unlikely to be damaged by fishing activity, as it will be buried to a depth of not less than 5 m within the seabed for the majority of the cable corridor, and the seabed will be reinstated to the before-work level and condition very shortly. As a result, impacts to fisheries resources during the operation of the cable will not be discussed further.

C1.1 RELEVANT LEGISLATION AND ASSESSMENT CRITERIA

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 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.

C1.2 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 AFCD gazetted Fish Culture Zones (FCZs) within 500 m of the proposed cable corridor and since no culture fisheries are considered to be affected by the Project, they will only be discussed briefly. The following baseline information is therefore presented under the umbrella heading of Fisheries, focusing on capture fisheries and briefly describing the nearest culture fisheries. The baseline has been derived from the most up-to-date information on the HKSAR fishery [(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 Agriculture, Fisheries and Conservation Department (AFCD) Annual Reports [(3)]

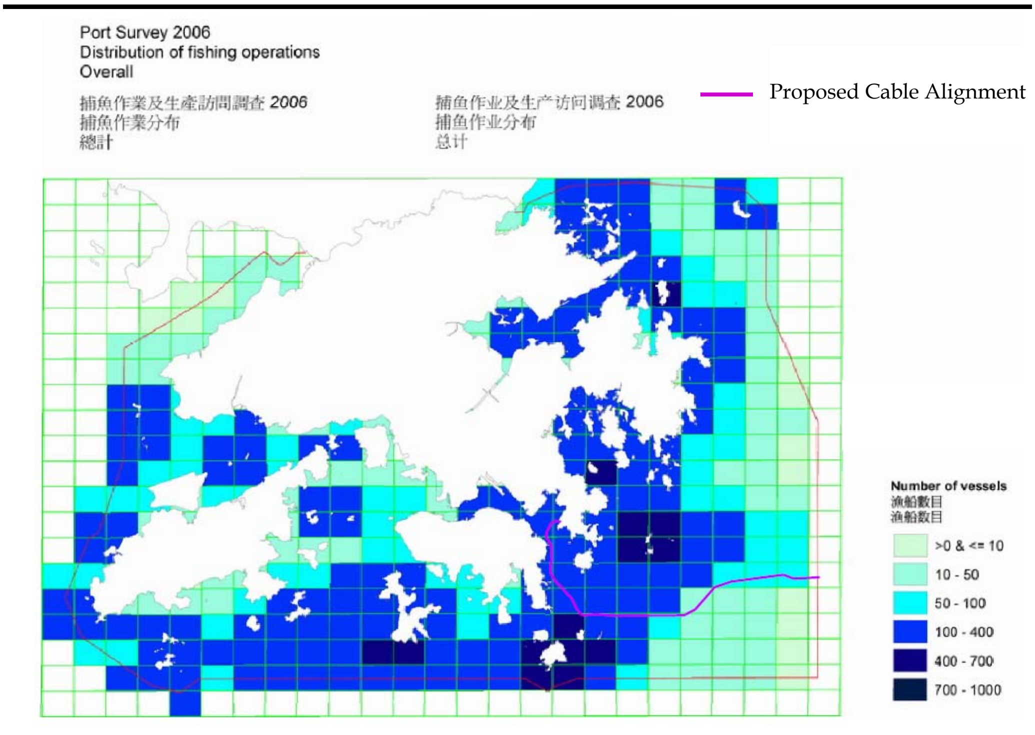
(1) Agriculture, Fisheries and Conservation Department (2006) Port Survey for year 2005. Hong Kong SAR Government.
(2) ERM - Hong Kong, Ltd (1998) Fisheries Resources and Operations in Hong Kong Water. Final Report for the Agriculture, Fisheries and Conservation Department. Hong Kong SAR Government.
(3) Agriculture, Fisheries and Conservation Department Annual Report 2005 -2006. Hong Kong SAR Government.

C1.3 *FISHERIES*

C1.3.1 Capture Fishing Operations

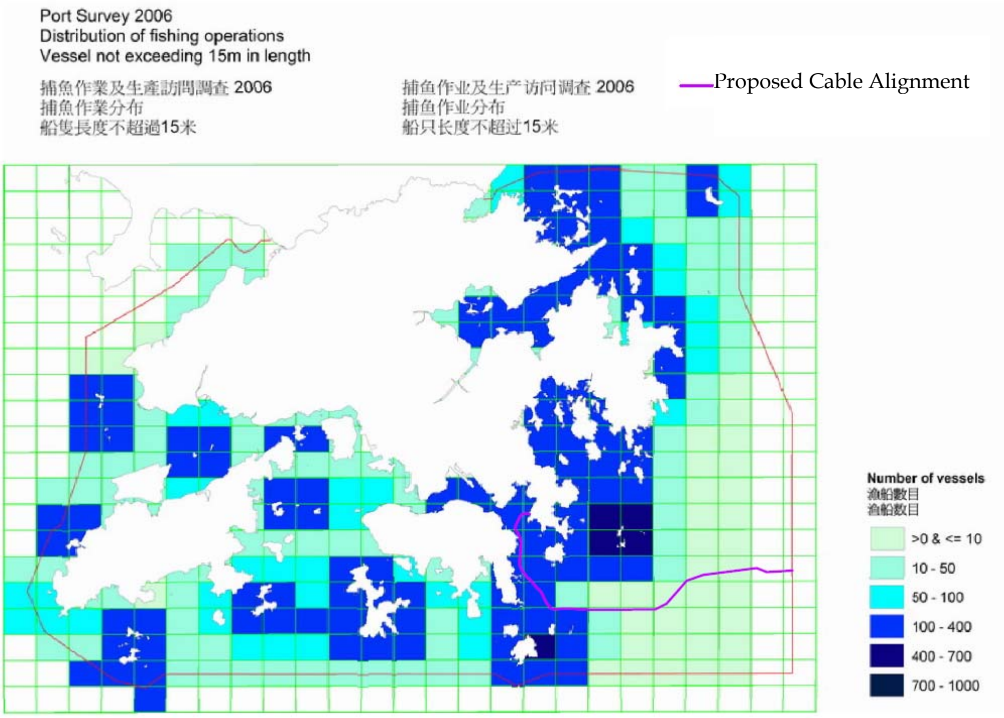
In 1989 - 1991 AFCD devised a system whereby the waters of HKSAR were divided up into individual Fishing Zones [1]. Data were gathered at that time on the catches of HKSAR fleet derived from these Fishing Zones. Since this first HKSAR wide survey, AFCD kept updating the information by performing similar Port Survey. The most updated Port Survey was carried out in 2005 - 2006 [2] in which grid analysis of fishing operations was performed, with each grid cover an area of one 720 hectare. Moderate numbers of fishing vessels (100 – 400 vessels), mostly sampans, operated in waters around the proposed cable route (*Figure C1*). These vessels, which are no longer than 15 m in length, are the major type of fishing operation vessels along the cable route (*Figure C2*).

Figure C1 ***Distribution of Fishing Operations in HKSAR Waters and Locations of the Proposed Cable Corridor***



(1) Agriculture, Fisheries and Conservation Department (1991) Port Survey 1989 - 1991. Hong Kong SAR Government.
(2) Agriculture, Fisheries and Conservation Department (2002) *Op cit.*

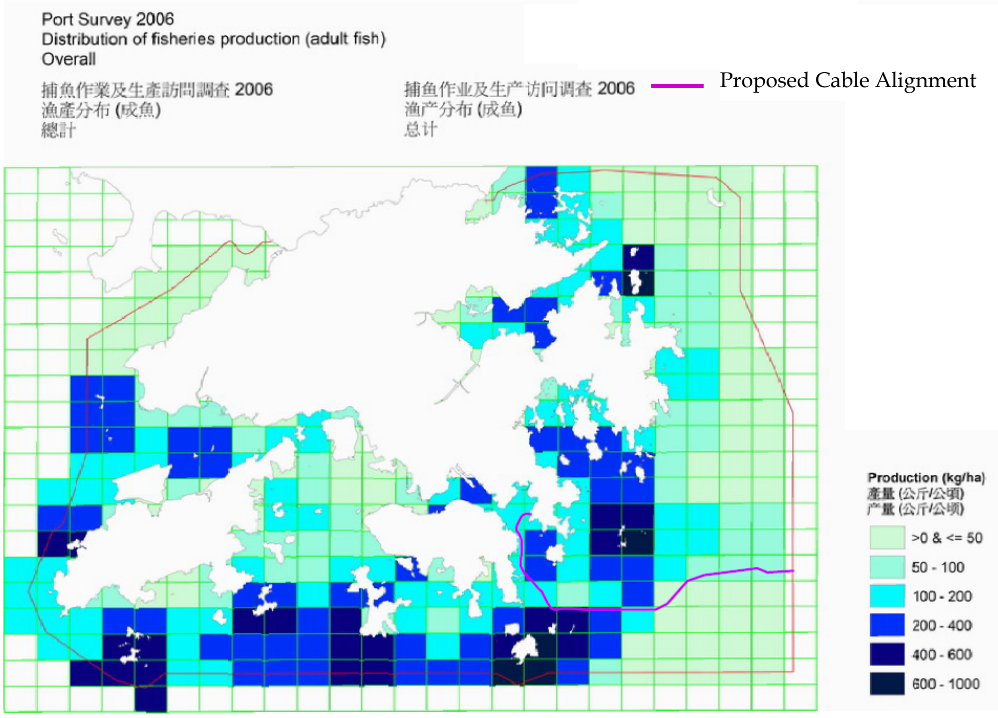
Figure C2 *Distribution of Fishing Operations (vessel not exceeding 15 m in length) in HKSAR Waters*



C1.3.2 *Capture Fisheries Resources*

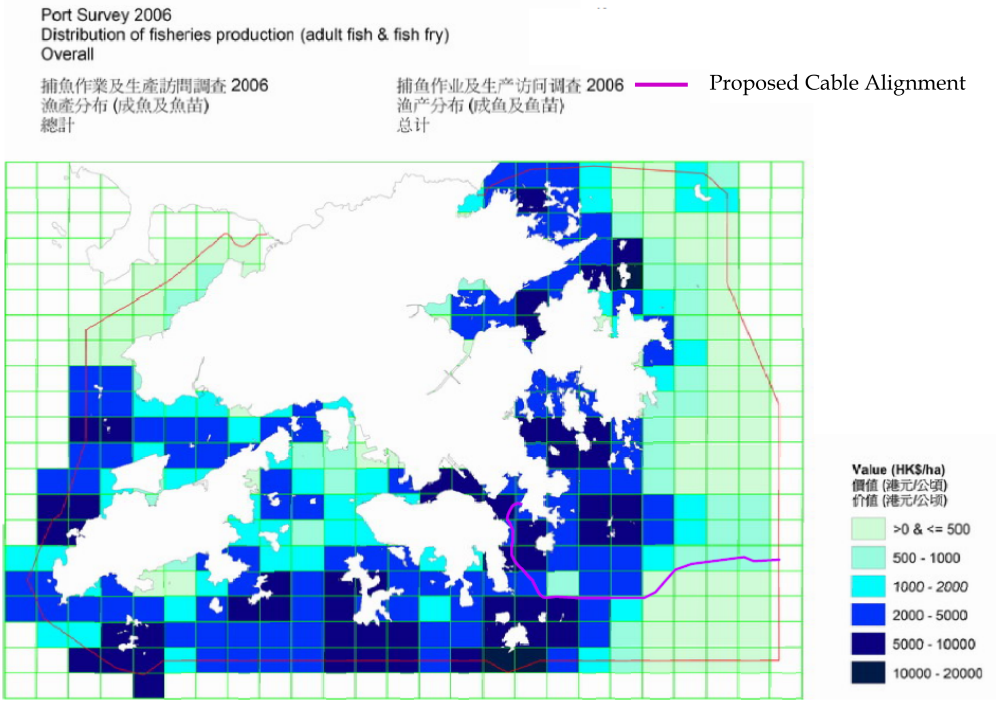
Fisheries production from the grids traversed by the cable corridor range from > 0 – 50 kg per hectare to 400 – 600 kg per hectare (*Figure C3*). Adult fish production was recorded as the highest (400 – 600 kg per hectare) in waters north to Sung Kong and Waglan Island with decreasing value in general when moving away from this area, in which majority of the grids showing >0 kg to 200 kg per hectare.

Figure C3 *Distribution of Fisheries Production (Adult Fish) in HKSAR Waters and Location of the Proposed Cable Corridor*



Fisheries production values (adult fish and fish fry) from the grids traversed by the cable corridor range from > $0 – $500 per hectare to $5,000 – $10,000 per hectare (*Figure C4*). Adult fish and fish fry was highest ($5,000 – $10,000 per hectare) in waters west to Tung Lung Chau, north of Sung Kong and Waglan Island with decreasing value when moving away from this area, in which majority of the grid was in the range of > $0 to $5,000 per hectare (*Figure C4*).

Figure C4 *Distribution of Fisheries Production (Adult Fish and Fish Fry) in HKSAR Waters (in terms of value) and Location of the Proposed Cable Corridor*



C1.3.3 Culture Fisheries

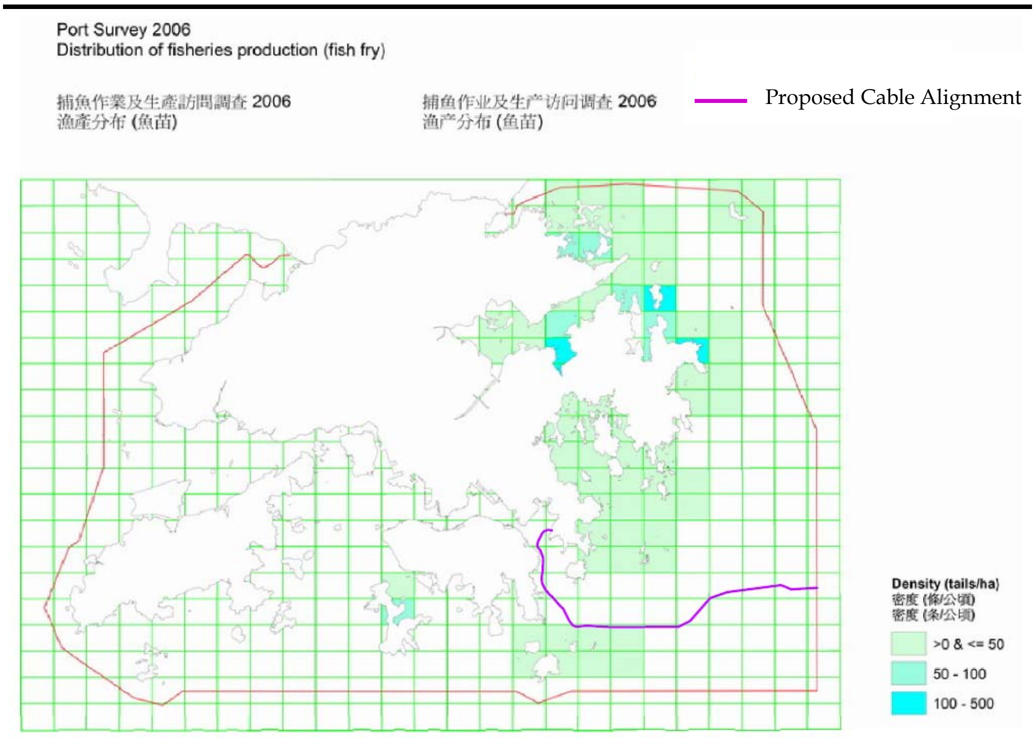
There are no AFCD gazetted Fish Culture Zone (FCZ) within 500 m of the proposed cable corridor. The closest FCZ is the Tung Lung Chau FCZ located approximately 2,450 m away from the cable corridor at the closest point (*Figure 3.1* of the main text). According to the water quality impact assessment in *Annex A*, the maximum travel distance of the sediment plume generated during cable installation is 180m, hence no impact is expected on the Tung Lung Chau FCZs. As the Tung Lung Chau FCZs will not be affected by the proposed project due to their relative remoteness from the alignment, they will not be discussed further.

C1.3.4 Spawning and Nursery Areas

The Port Survey 2006 (1) records fish fry production within grids and indicates that some grids with the lowest density (>0 – 50 tails per hectare) are marginally traversed by the proposed cable corridor (*Figure C5*); this is so marginal that it is not expected to be significant. This conclusion agrees with the finding of another fisheries study in 1998, which showed that the area transversed by a cable corridor was not considered as an important nursery area for commercial fish species (2). However, a section of the cable route passes through waters identified as spawning grounds of commercial fisheries resources (refer to *Figure 3.1*) (2).

(1) Agriculture, Fisheries and Conservation Department (2006) *Op cit.*
(2) ERM - Hong Kong (1998) Fisheries Resources and Operations in Hong Kong Waters. *Op cit.*

Figure C5 *Distribution of Fisheries Production (Fish Fry) in HKSAR Waters and Location of the Proposed Cable Corridor*



C1.4 IMPACT ASSESSMENT

C1.4.1 *Direct Impacts*

The proposed cables will be submerged through the injection jetting technique to a maximum depth of 5 m within the seabed. Through the employment of this burial technique, the seabed will be reinstated by resettlement of disturbed sediments and natural erosion. Recolonisation of the sediments by benthic infauna is expected to occur, therefore providing food for bottom dwelling fisheries resources. Minor interruptions to fishing operations are expected to occur only during the cable installation phase of the proposed Project. These disruptions are, however, minimal as the duration of time required for cable installation has been determined to be a total of approximately 15 working days in HKSAR 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 laying activities. These disturbances are not predicted to affect either fisheries resources or fishing operations.

C1.4.2 *Indirect Impacts*

Indirect impacts may occur through elevation in suspended solids (SS) resulting from the disturbance of the seabed through the burial of the cables. However, the proposed injection jetting technique of burial will disturb only localized sediments, resulting in only short-term SS elevations in the immediate vicinity (within 180 m from the cable alignment). 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 200s). Cable laying and burial at the shore is not predicted to cause unacceptable impacts to water quality and consequently unacceptable impacts to fisheries will not occur. As a result, indirect impacts to fisheries resources are predicted to be minimal.

C1.5 FISHERIES IMPACT EVALUATION

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

- *Nature of Impact*: The Project will involve the laying of a submarine cable in HKSAR water, landing at TKO Industrial Estate and travelling west, south, then east to the HKSAR boundary before entering the South China Sea. As a result of the small scale and relatively localized disturbances to the seabed, no adverse 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 35 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 125m x 200m. In view of the small area occupied by the cable installation barge during operation (marine works will last for a total of approximately 15 working days), potential impacts on vessel transit and fishing activities along the cable alignment are not expect to be anticipated.

- *Size of Fisheries Resources/Production*: Fisheries production of the affected areas ranges from > 0 – 50 kg per hectare to 400 – 600 kg per hectare, with the majority of them showing fisheries production between > 0 and 200 kg per hectare in terms of catch weight of adult fish. For fisheries production of adult fish and fish fry, the value ranges from > $0 – $500 per hectare to $5,000 – $10,000 per hectare, and the majority of the grids were in the range of > $0 to $5,000 per hectare. Fisheries production (in terms of weight of adult fish) in areas traversed by the cable corridor is highest in waters north of Sung Kong and Waglan Island. Fisheries production (in terms of value of adult fish and fish fry) traversed by cable corridor is highest in waters west to Tung Lung Chau, north of Sung Kong and Waglan Island. It is then decreases as the cable moves away from this area. Since the cable laying works will only last for approximately 15 working days and the disturbance on seabed is localized, and the seabed will be reinstated by resettlement of disturbed sediments and natural erosion. Therefore, no unacceptable impact on the fisheries resources/ production is expected

- *Destruction and Disturbance of Spawning and Nursery Grounds*: The proposed cable corridor marginally passes through waters that have been identified as a nursery ground (>0 – 50 tails per hectare) which is not considered important, but 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 (a total of approximately 15 working days), and given that sediment will disperse a maximum of 180 m from the alignment, the construction and operation of the proposed submarine cables 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 mostly have moderate numbers of fishing vessels (100-400 vessels per hectare) and are mostly fished by vessels less than 15 m in length. Since the cable laying works will only last for approximately 15 working days and the disturbance on seabed is localized and the seabed is expected to reinstate naturally to the 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 target burial depth of the cable after shore-end section is approximately 5 m below the seabed. Damages on the fishing gears /tools by the cable are not expect to be anticipated.

- *Impact on Aquaculture Activity*: Impacts to the closest Fish Culture Zone at Tung Lung Chau, which is approximately 2,450 m from the cable corridor at the closest point, are not predicted to occur.

C1.6 *MITIGATION MEASURES*

As no adverse impacts to water quality or fisheries resources are expected to occur, no mitigation measures specific to fisheries are required.

C1.7 *CONCLUSION*

A review of existing information on the fisheries resources 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 production. Given the short duration of works and small sediment plume (within 180 m from the cable alignment) arising from the cable laying works, no unacceptable impacts have been predicted to occur to fisheries resources or fishing operations as a result of the Project.

附件 C

漁業資源及捕漁作業潛在影響評估

目錄

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C1.1	*相關的法例和評估準則*	***1***
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C1.3	*捕撈漁業*	***1***
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C1.5	*漁業影響評估*	***6***
C1.6	*緩解措施*	***7***
C1.7	*總結*	***7***

C1 *引言*

本*附件*闡述了擬議光纜走廊之內及附近的現有漁業資源和捕漁作業情況，並評估了本項目對這些資源可能造成的直接或間接影響。該光纜系統在運作期間則不會造成任何影響。由於大部份光纜都會被掩埋在海床下不少於 5 米的深度，而海床亦會在很短時間內被修復至工程前的高度和狀況，因此，光纜不會受到捕漁活動破壞。因此，本附件不會再探討光纜在運作期間對漁業資源的影響。

C1.1 *相關的法例和評估準則*

《環境影響評估條例（499 章）第 16 節》及《環評技術備忘錄》的*附件 17* 列出了評估漁業影響的指引，而*附件 9* 則建議了一些評估漁業影響的一般準則。其他適用於漁業資源的法例包括：《漁業保護條例（171 章）1987》規定有關魚類和其他水中生物的保育，並規管捕漁方法；此外，《海魚養殖條例（353 章）1983》規管和保護海魚養殖及其他相關活動。

C1.2 *環境說明*

在香港特別行政區的商業海魚業可以分成捕撈和養殖兩大類。因此，以下的基線情況資料是以“捕撈漁業”和“水產養殖業”為標題闡述。然而，由於沒有漁護署刊憲的魚類養殖區在建議光纜走廊的 500 米範圍內，因此養殖漁業被認為是不受影響之項目，它們只會被簡單討論。以下的基線資料重點介紹香港的捕撈漁業和簡單介紹最接近的水產養殖業。這些基線情況是根據香港漁業的最新資料整理而成 (1)。此外，亦檢視了其他相關研究的資料，務求確定擬議光纜走廊所經過的海域是否屬於商業漁業的重要產卵場或哺育區 (2)。有關海魚養殖的資料，是取自漁農自然護理署（漁護署）年報 (3)。

C1.3 *捕撈漁業*

C1.3.1 *捕撈作業*

漁護署於 1989 – 1991 年期間設計了一個系統，把香港的海域分為個別捕撈區 (4)。然後收集有關香港漁船當時從這些捕撈區所取得的魚獲數據。自從進行了首個全港調查之後，漁護署持續地進行類似的“捕漁作業及生產調查”來更新這些資料。最新的一次“捕漁作業及生產調查”是在

(1) 漁農自然護理署（2006）。《2005 年捕漁作業及生產調查》。香港特別行政區政府。

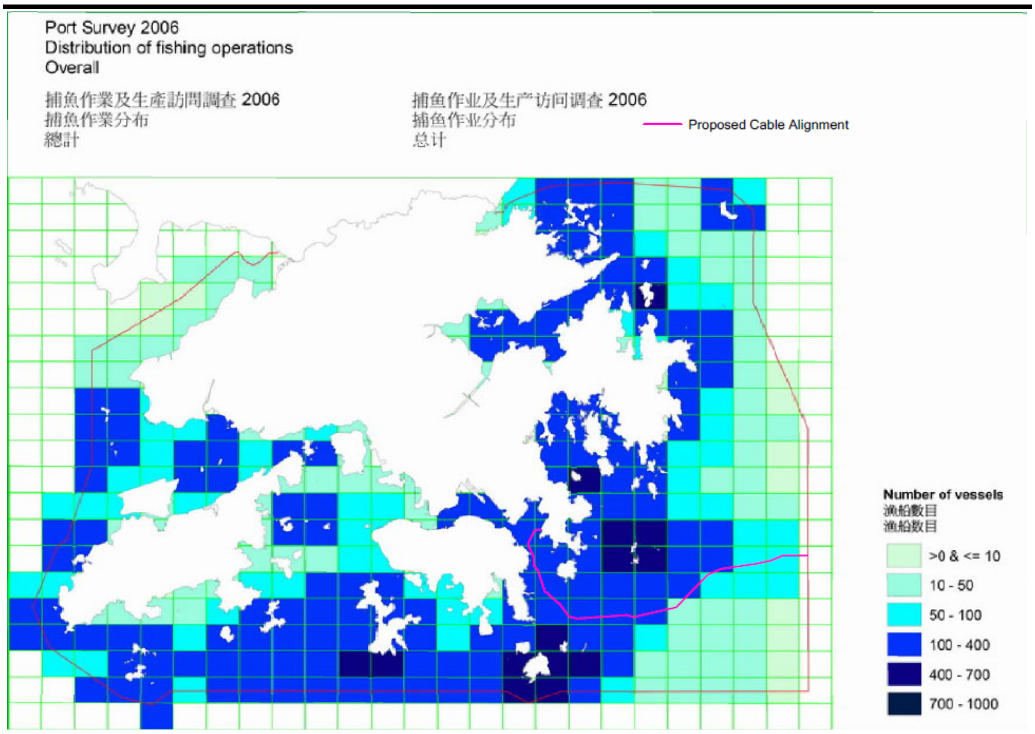
(2) 香港環境資源管理顧問有限公司（1998）。《香港海域的漁業資源和作業》。為漁農自然護理署撰寫的最後報告。香港特別行政區政府。

(3) 漁農自然護理署 2005-2006 年報。香港特別行政區政府。

(4) 漁農自然護理署（1991）。《1989-1991 年捕漁作業及生產調查》。香港特別行政區政府。

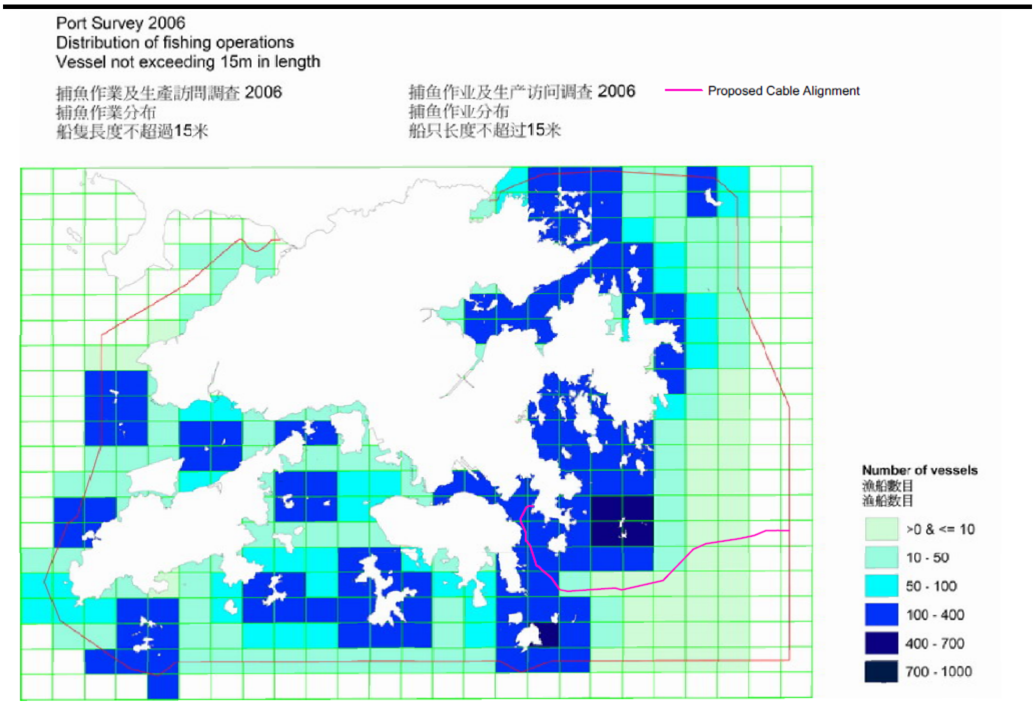
2005 – 2006 年進行 [1]，運用了網格分析法來分析捕撈作業，其中的每一格覆蓋 720 一公頃的範圍。在 2005 年時，有中等數量的漁船（100 – 400 艘，大都是舢舨）在擬議光纜鋪設路線所經過的海域內作業（*圖 C1*）。這些長度不足 15 米的船隻，是光纜路線一帶的主要作業漁船（*圖 C2*）。

圖 C1　　捕撈作業在香港海域的分佈及擬議光纜走廊位置



(1)　漁農自然護理署（2002）。*同上*。

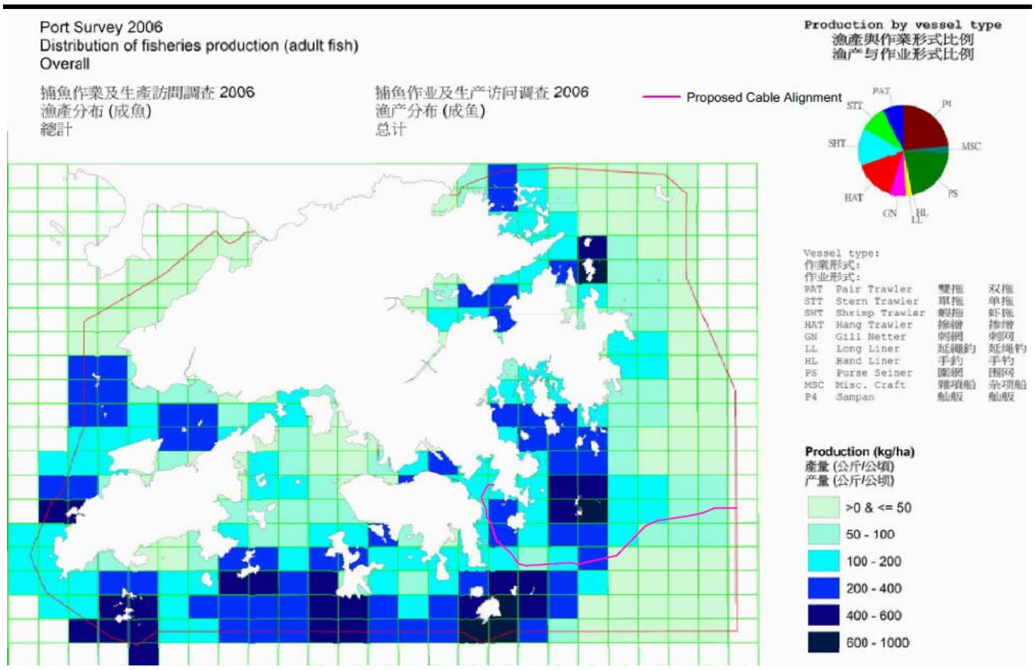
圖 C2　　捕撈作業（長度不超過 15 米的船隻）在香港海域的分佈



C1.3.2　　捕撈漁業資源

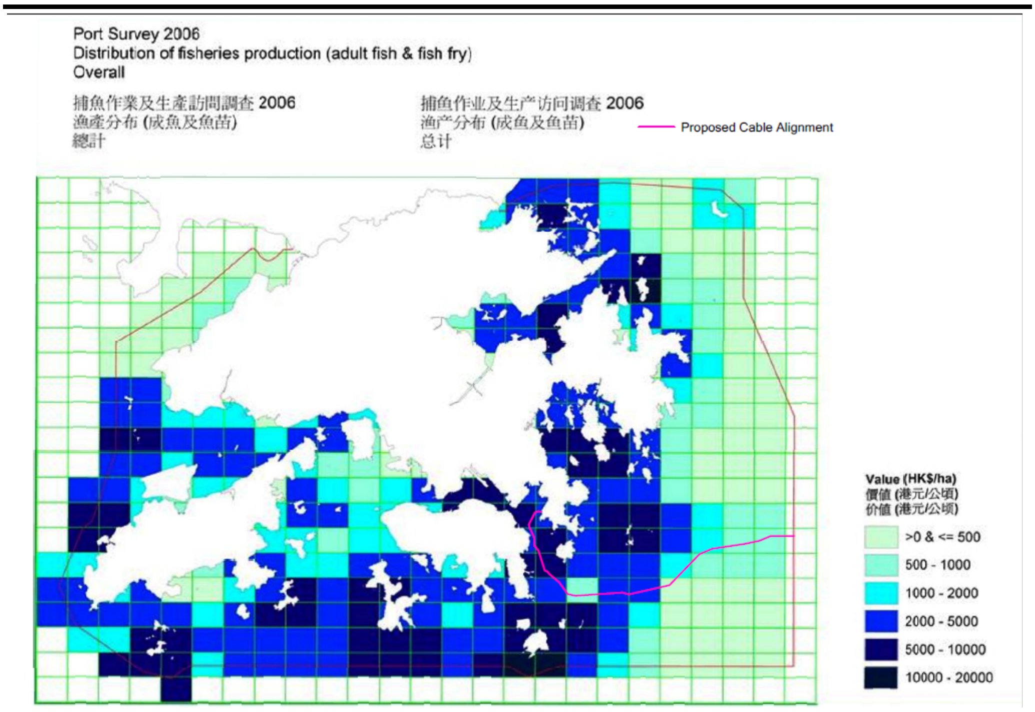
光纜走廊所經過的網格的漁獲量是介乎每公頃 > 0 – 50 公斤至每公頃 400 – 600 公斤（*圖 C3*）。最高的成魚漁獲是在東龍洲西部（每公頃 400 – 600 公斤），而且，隨著與這一區的距離增加，漁獲大致上也逐漸減少，其中大部份網格都顯示每公頃漁獲介乎 >0 公斤至 200 公斤。

圖 C3　　漁獲（成魚）在香港海域的分佈及擬議光纜走廊位置



光纜走廊所經過的網格的漁獲量是介乎每公頃 > $0 – $500 至每公頃 $5,000 – $10,000（*圖 C4*）最高漁獲(成魚和魚苗)都是在東龍洲、西貢以北及橫瀾島（每公頃$5,000 – $10,000），而且，隨著與這區的距離增加，漁獲大致上會逐漸減少，其中大部份網格都顯示每公頃漁獲介乎 >$0 至$5,000（*圖 C4*）。

圖 C4 *漁獲（已成長魚及魚苗）在香港海域的分佈（按價值）及擬議光纜走廊位置*



C1.3.3 *水產養殖業*

在擬建光纜走廊的 500 米內，並沒有漁護署的已刊憲魚類養殖區。最近的魚類養殖區是東龍洲魚類養殖區，位於光纜走廊約 2,450 米外（正文的*圖 3.1*）。根據附件 A 的水質影響評估，被揚起沉積物的最大漂移距離是 180 米，所以預計工程對東龍洲魚類養殖區不會受到影響。由於東龍洲魚類養殖區與光纜距離較遠，不會受到本項目影響，因此本附件不會再作探討。

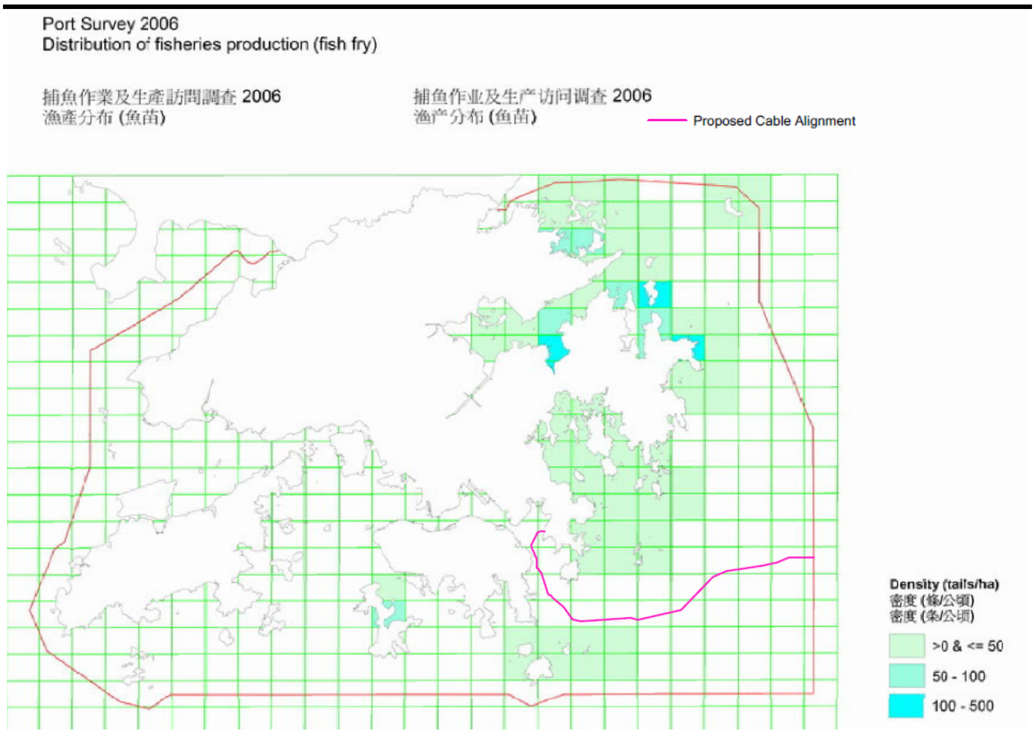
C1.3.4 *產卵及育苗區*

《2006 年捕漁作業及生產調查》[1] 顯示在建議的光纜走廊邊界的魚苗生產力為該次調查中記錄到的最低密度區（每公頃 >0 - 50 尾；*圖 C5*），亦因此被視為並不重要。以上的調查結果與另一個在 1998 年進行的漁業研究結果脗合，因此光纜走廊所經過的地區並非商業魚類的重要哺育區 [2]。但是部分光纜走廊經過商業魚類的重要產卵區海域（參*圖 3.1*）。

(1) *漁農自然護理署（2006）。同上。*

(2) 香港環境資源管理顧問有限公司（1998）。《香港海域的漁業資源和作業》。 *同上*

圖 C5　　漁獲（魚苗）在香港海域的分佈及擬議光纜走廊位置



C1.4　　影響評估

C1.4.1　　直接影響

本項目會運用沖噴技術來把擬建的光纜掩埋在海床下最深達 5 米的地方。透過這種掩埋技術，海床會因為翻起的沉積物重新沉積和天然侵蝕作用而恢復原貌。預計底棲動物會重新在沉積物內聚集，從而為底棲的漁業資源提供食物。預計本項目只有在光纜安裝階段會對捕撈作業造成輕微干擾。然而，這些干擾都很輕微，因為在香港海域安裝光纜只需約 15 個工作天。因此，除了在光纜鋪設工程區附近的海床會受到一些短期滋擾外，漁業資源或捕撈作業都不會受到長期的直接影響。而且，這些短期滋擾也不會影響漁業資源或捕撈作業。

C1.4.2　　間接影響

在掩埋光纜期間，海床會受到干擾，因而令懸浮固體增加，並對漁業造成間接影響。然而，建議用於掩埋光纜的沖噴法只會干擾到局部地方的沉積物，因此只有在附近的範圍才會有懸浮固體增加（在光纜沿線的 180 米範圍內）。被揚起成懸浮狀的沉積物大都會逗留在水體的底部，並會在短時間內重新沉回海床(需時大約 200 秒)。因此，光纜在海岸的鋪設和掩埋工程不會對水質造成不可接受的影響，也因此不會對漁業造成不可接受的影響。所以，預計漁業資源只會受到極輕微的間接影響。

C1.5 漁業影響評估

下文闡述了按照《環評技術備忘錄》附件 9 的要求而進行的影響評估：

- 影響性質：本項目涉及在香港水域鋪設海底光纜，在將軍澳工業邨登岸，先向西，再向南，最後向東到達香港特區的邊界，進入中國南海。因規模小和相對本地化的干擾到海底，無不良影響漁業資源和隨後預計捕撈作業過程中發生光纜敷設過程中，或在操作過程中。由於本項目規模細小，而且海床所受到的干擾比較局部，因此，在鋪設光纜和運作期間，漁業資源和捕撈作業都不會受到不良影響。

- 受影響的面積：位於香港海域內的光纜全長約 35 公里。本項目會以沖噴法來鋪設和掩埋光纜，因此不會影響漁業資源和捕撈作業。此外，光纜安裝躉船在正常操作期間的最大工作佔用範圍將約 125 米 x 200 米。鑑於光纜安裝躉船在操作過程中總佔用面積小（海上工程將持續約 15 個工作日），預料光纜沿線的船隻航行和捕魚活動將沒有潛在的影響。

- 漁業資源／產量大小：受影響地區的漁獲量（按捕撈到的已成長魚重量計算）是介乎每公頃 > 0 – 50 公斤至每公頃 400 – 600 公斤之間，其中大都是介乎每公頃 > 0 和 200 公斤之間。至於成魚和魚苗的魚獲量，按價值計算則介乎每公頃 >$0 - $500 至每公頃 $5,000 - $10,000 之間，其中大部份網格都是介乎每公頃 >$0 至 $5,000 之間。漁獲量（按已成長魚的重量，以及已成長魚和魚苗的價值計算）最高的地區是東龍洲、西貢以北和橫瀾島，並在遠離這個地區時逐漸減少。由於光纜鋪設工程將只持續約 15 天以及對海床的干擾是局部的，而海床亦會因為翻起的沉積物重新沉積和天然侵蝕作用而恢復原貌，因此，預計對漁業資源 / 生產產生沒有不可接受的影響，

- 毀壞及干擾哺育場及產卵場：擬建的光纜走廊會經過已知但並非重要的哺育場海域（每公頃 >0 - 50 尾），但部分光纜走廊經過商業魚類的重要產卵區海域。在香港進行的光纜鋪設工程需時比較短，只有大約 15 個工作天；再加上沉積物從光纜擴散的最遠距離只有 180 米，因此估計，這條海底光纜在施工和運作期間，都不會對香港海域內的哺育和產卵場造成不良影響。

- 對捕漁活動的影響：擬建的光纜走廊所經過的漁業作業區大都具有中等數量的漁船（每公頃 100-400 艘），而且大都是由長度少於 15 米的船隻在作業。由於光纜鋪設工程將只持續約 15 天以及對海床的干擾是局部的，預計海床會在很短時間內自然地恢復至工程前的高度和情況。因此，預計不會對捕撈活動造成影響。還應當指出的是，除岸端的一段光纜外，光纜埋藏深度目標約為 5 米以下的海底，預計漁具 / 工具不會因光纜受到損害。

- 對水產養殖活動的影響：預計本項目不會對最近的東龍洲魚類養殖區（與光纜走廊的最短距離約有 2,450 米）造成任何影響。

C1.6 緩解措施

預計本項目對水質或漁業資源不會造成不良影響，因此無需實施特別為漁業而設的緩解措施。

C1.7 總結

根據現存有關光纜沿線漁業資源和捕漁作業的資料，沿線大部份地方的漁獲，無論是按重量或價值計算，都屬於偏低至中等水平。鑑於光纜鋪設工程為時短暫，而且沉積物捲流細小（在光纜走線 180 米以內），因此預測本項目對漁業資源和捕漁作業都不會造成不可接受的影響。

Annex D

Assessment of Potential Impacts to Marine Archaeological Resources

CONTENT

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APPENDIX

APPENDIX D1 GUIDELINES FOR MARINE ARCHAEOLOGICAL INVESTIGATION

APPENDIX D2 UNITED KINGDOM HYDROGRAPHIC OFFICE WRECK DATABASE FOR SURVEY AREA

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D1 INTRODUCTION

D1.1 THE PROJECT BACKGROUND

A new Telecommunication Cable System is to land at Tseung Kwan O, taking a similar route to some other cables from the eastern border of the Hong Kong Special Administrative Region (HKSAR) waters (see *Figure 1.1*).

In accordance with the environmental permit application for HKSAR, a Marine Archaeological Investigation (MAI) is required of the cable route as part of an environmental assessment.

D1.2 OBJECTIVES OF THE MARINE ARCHAEOLOGICAL INVESTIGATION

The objectives of the Marine Archaeological Investigation (MAI) are to include a phased review/investigation of a Study Area in accordance with the MAI Guidelines as issue by the HKSAR Antiquities and Monuments Office (AM0) (*Appendix D1*) and the MAI should include, but not be limited to, the following:

Phase I

1. Desktop review of the Study Area;
2. Review of Geophysical Survey data;
3. Establish marine archaeological potential;
4. Conduct marine archaeological impact assessment; and
5. Prepare MAI report to present on the above findings, assessment results and provide necessary recommendations.

Phase II

1. Remote Operated Vehicle/Visual Diver Survey/Watching Brief if potential sites are identified during *Phase I* work;
2. Provide a Report on these aspects.

This report represents the results of *Phase I*.

D1.3 REPORT STRUCTURE

Following this introductory section, the remainder of the report has been structured as follows:

Section D2 The legislative framework for the marine archaeological assessments in HKSAR;

Section D3 The methodology used in this survey;

Section D4 The findings of the baseline conditions (desktop and geophysical surveys) for the Study Area;

Section D5 Establish archaeological potential of the Study Area;

Section D6 Assessment of the impact on the archaeological resources and recommendations.

D2 LEGISLATIVE REQUIREMENTS AND EVALUATION CRITERIA

The following legislation and guidelines are applicable to the assessment of marine archaeological sites in Hong Kong:

- *Environmental Impact Assessment Ordinance (Cap. 499) and the associated Technical Memorandum on the EIA Process (EIAO-TM);*
- *Antiquities and Monuments Ordinance (Cap. 53);*
- *Land (Miscellaneous Provisions) Ordinance (Cap. 28);*
- *Hong Kong Planning Standards and Guidelines; and*
- *Guidelines for Marine Archaeological Investigation prepared by AMO.*

D2.1 ENVIRONMENTAL IMPACT ASSESSMENT ORDINANCE TECHNICAL MEMORANDUM ON THE EIA PROCESS

The *EIAO-TM* outlines the approaches required in investigating and assessing the impacts on marine archaeological sites. The following sections of the *EIAO – TM* are applicable:

Annex 19: "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. A baseline study shall be conducted: (a) to compile a comprehensive inventory of places, buildings, sites and structures of architectural, archaeological and historical value within the proposed project area; and (b) to identify possible threats of, and their physical extent, destruction in whole or in part of sites of cultural heritage arising from the proposed project."

The *EIAO – TM* also outlines the criteria for assessment of impact on sites of cultural heritage as follows:

Annex 10: "The criteria for evaluating impact on sites of cultural heritage includes: (a) The general presumption in favour of the protection and conservation of all sites of cultural heritage because they provide an essential, finite and irreplaceable link between the past and the future and are points of reference and identity for culture and tradition; (b) Adverse impacts on sites of cultural heritage shall be kept to the absolute minimum."

The *EIAO – TM* also outlines the approach in regard to the preservation in totality; and in part to cultural resources:

Annex 19: "Preservation in totality will be a beneficial impact and will enhance the cultural and socio-economical environment if suitable measures to integrate the sites of cultural heritage into the proposed project are carried out. 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."

D2.2 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.

"*This Ordinance provides for the preservation of objects of historical, archaeological and palaeontological interest…*"

The Ordinance defines an antiquity as a relic (a movable object made before 1800) and a place, building, site or structure erected, formed or built by human agency before the year 1800. The Ordinance also states, amongst other things, that the discovery of an antiquity shall be reported to the Authority (Secretary for Home Affairs); that ownership of all relics discovered after 1976 shall be vested in the Government; that the Authority can declare a place, building, site or structure to be a monument, historical building or archaeological or palaeontological site or structure (and therefore introducing certain additional controls for these sites); and that licences and permits can be granted for excavation and for other work.

Over the years, surveys have been undertaken to identify sites of archaeological interest in HKSAR. The AMO has established boundaries for the identified sites and a set of administrative procedures for the protection of the known sites of archaeological interest. However, the present record of sites of archaeological interest is known to be incomplete as many areas have not yet been surveyed. There is a need therefore to ensure that the procedures and mechanisms, which enable the preservation or formal notification of previously unknown archaeological resources that may be revealed or discovered during project assessment or construction, are identified and implemented at an early stage of the planning of a project.

Section 11 of the *AM Ordinance* requires any person who discovers an antiquity, or supposed antiquity, to report the discovery to the Antiquities Authority. By implication, construction projects need to ensure that the Antiquities Authority, the Antiquities Advisory Board (AAB)[(1)], is formally notified of archaeological resource which are discovered during the assessment or construction of a project.

D2.3 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 commencing.

(1) The Antiquities and Monuments Office is the entry point to pass information to the AAB. The AAB is a statutory body consisting of expertise in relevant fields to advise on any matters relating to antiquities and monuments.

D2.4 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.

D2.5 MARINE ARCHAEOLOGICAL INVESTIGATION (MAI) GUIDELINES

Guidelines for MAI which detail the standard practice, procedures and methodology which must be undertaken in determining the marine archaeological potential, presence of archaeological artefacts and defining suitable mitigation measures can be found in *Appendix D1*. Baseline review, geophysical survey and establishing archaeological potential are considered the first stage of a MAI. Subject to the results of the first stage MAI, further investigation may or may not be required.

D3 ASSESSMENT METHODOLOGY

The methodology used in this assessment followed the Guidelines for MAIs as prepared by AMO and comprised the following tasks (see *Appendix D1*).

D3.1 ESTABLISH BASELINE CONDITIONS

- Implement Desktop Research, comprising a review of geotechnical survey data, historical documents and United Kingdom Hydrographic Office (UKHO) 'Wreck' files to establish the potential for marine archaeological sites in the Survey Area;
- Examination of the seabed and below seabed using geophysical survey equipment in order to locate and define any sites of archaeological potential in the Survey Area.

D3.2 ESTABLISH ARCHAEOLOGICAL POTENTIAL

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

D3.3 ASSESS IMPACT AND MAKE RECOMMENDATIONS

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.

D4 BASELINE REVIEW

D4.1 DESKTOP RESEARCH

D4.1.1 Geotechnical Data

The submarine deposits in the HKSAR region are subdivided into two formations, Chek Lap Kok Formations and the overlying Hang Hau Formations.

The Chek Lap Kok Formations, the lowest part of the Quaternary succession, are considered to be Middle to Late Pleistocene in age and consist of colluvium, alluvium and lacustrine sediments (Fyfe *et al*. 2000). The marine sediments on top of this formation are sediments related to the Holocene period (from about 13,000 BP to the present day) and referred to as the Hang Hau Formations consisting of clayey silt sediments and some sand (mud, sandy mud).

The Sham Wat Formation, found between Chek Lap Kok Formations and Hang Hau Formations is considered to be the Eemian deposit of uncertain age and consists of soft to firm silty clays with yellowish mottling. This formation is presently not widespread but only in subcrop beneath the Hang Hau Formation (Fyfe et al. 2000).

The sediments of the Late Holocene period, considered to be relatively homogenous very soft to soft silty clay and with high moisture content, offer the greatest potential (as compared to the surface of the seabed which is often found to have been disturbed by fishing and other shipping related activities) to include well preserved remains associated with the occupation and use of the islands in HKSAR waters. These remains could include shipwrecks.

D4.1.2 Review of Historical documents

Archaeological evidence indicates that seafarers have used the waters of HKSAR for around 6,000 years (Bard 1988). In Chau (1993) it is reported that:

In the past decade, a great number of prehistoric sites have been discovered in the coastal sandbars which represent the opening up of the coastal and offshore island areas by the early settlers. Around six thousand years ago, the Neolithic folks had already settled in the coastal area of South China.

The submarine cable's landing site is at a seawall in what is now called Junk Bay. Junk Bay received its name from the many junks that sheltered in the bay (Aijmer 1984 cited in Maunsell Consultants 2005), although it was formerly known as Fat Tong Mun. The bay and Tathong Channel to the south were used from the Song Dynasty during trading activities that connected Guangzhou and northern China and given this waterway is the eastern entrance to Victoria Harbour it has continued since then to the present day to be an important waterway for many vessels of all sizes (Maunsell Consultants 2005).

The coastline of Junk Bay now extends much further seaward as a large amount of the seabed has been reclaimed from the 1970s onwards, thus pushing coastal villages back inland and covering evidence of early coastal use and settlement. Tseung Kwan O village, originally located on the north eastern coastline of Junk Bay is one of the oldest settlements in the region, dating back to the early Ming Dynasty. Other villages in the region, e.g. Hang Hau, were settled later, in the 18th Century, and it became an important market place for fishers, thus the bay became a popular place for fishers to anchor their boats. The bay has also served as a well-used ferry connection between Hong Kong Island and Sai Kung (Maunsell Consultants 2005).

The coastline and inshore waterways (the north western section of the Survey Area) have seen considerable marine activity since the Song Dynasty, with perhaps a lull during the early Ching Dynasty when people moved away from the coast. The outer, eastern sections of the Survey Area would have seen much less activity although later trade and fishing would have occurred in this region.

D4.1.3 United Kingdom's Hydrographic Office 'Wreck' Files

The United Kingdom Hydrographic Office (UKHO) in Taunton maintains a database of known shipwrecks and other underwater obstructions in the HKSAR. *Appendix D2* provides a list of these sites and which are summarised in the following manner and can be seen in context with the cable route and other Sonar and Magnetic Contacts in *Figure D4.1*.

A total of 16 UKHO sites were found to be in a very broad area that included the cable route. Three of these sites were found to be within the Study Area and only one was reported as 'live' (to exist). The other two were reported as 'dead' (not detected by repeated surveys, therefore considered not to exist) (*Table D4.1*).

Table D4.1 UKHO wrecks in the Survey Area

UKHO Wreck number	Status	Geographical Coordinates
62014	Live	22.223433N; 114.272983E
65706	Dead	22.272500N; 114.254450E
65708	Dead	22.268050N; 114.257217E

D4.2 BASELINE REVIEW FINDINGS

The baseline review of the literature found the Survey Area has the potential to contain underwater cultural heritage sites, and the UKHO database revealed the potential that one to five sites may exist within the Survey Area.

D4.3 GEOPHYSICAL SURVEYS

D4.3.1 Introduction

The objective of the geophysical survey was to define the areas/sites of greatest archaeological potential and which would encompass an assessment of the depth and nature of the seabed sediments and map any seabed and sub-bottom anomalies which may be archaeological material. This information is provided below.

D4.3.2 Survey Methodology

EGS (Asia) Limited undertook a seismic profiler, multibeam sonar, echo sounder, magnetometer and side scan sonar survey of the 34.5 km long Study Area from 11 October and 14 October 2012. Additional cross surveys (perpendicular to the cable route), and sampling operations were finished on 13 November and 22 November 2012 respectively.

A 650 metre (m) wide survey corridor centred on the proposed cable route was surveyed, although the cable burial depth is just 5 m and the width of seabed disturbance when laying the cable is about 0.5 m. The main survey traverses were carried out in an East-West orientation 75 m apart which allowed for an overlap of at least 100% between tracks and a comprehensive assessment of the seabed and below the seabed (see *Figure D4.1*).

A total of 8 gravity core samples and 1 grab sample were collected at 8 locations, their locations can be seen in *Figures D3-1 to D3-8, APG_S6_NU001-NU008* in *Appendix D3.*

These combined surveys allowed for a comprehensive investigation of the seabed, and below the seabed. The depth of water in the Study Area varied from c. 5 to 31 m (see *Figures D3-1 to D3-8, APG_S6_NU001-NU008* in *Appendix D3*).

D4.3.3 Equipment Used

The following equipment was employed during the geophysical surveys:

- C-Nav GcGPS (Globally corrected GPS)
- Single-beam Echo Sounder
- Multi-beam Echo Sounder
- Side Scan Sonar System
- Seismic Boomer Sub-bottom Profiler
- Marine Magnetometer System

D4.3.4 Review of Geophysical Survey Results

The geophysical survey data obtained by EGS were processed by in house geophysicists and reviewed by a qualified marine archaeologist.

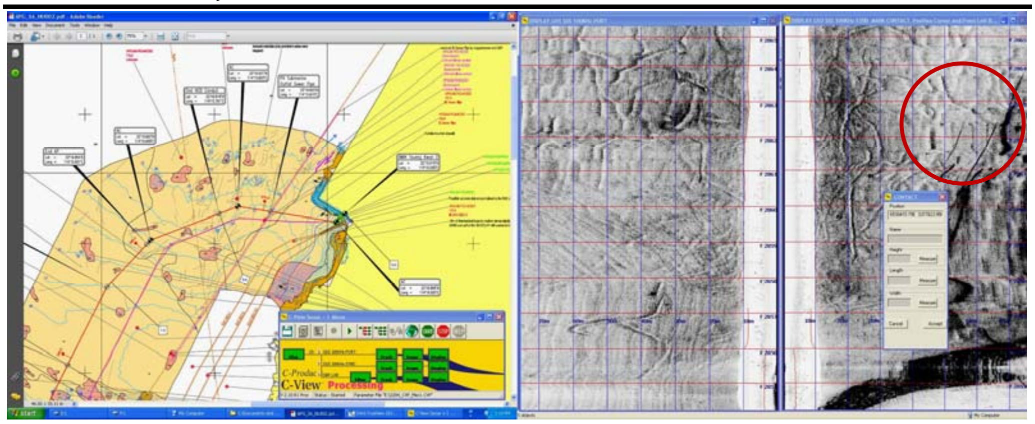
Side Scan Sonar Survey

The Study Area does not include any official dumping zones within the inshore survey area. However, some dumped materials were found by the side scan sonar survey along the length of the whole Study Area, and in particular from Kilometre Post (KP) 0 to c. KP 9. The currently gazetted sand dredging and sediment disposal zone is about 800 m away to the north east of the Study Area, between KP 5 and KP 13.

The Study Area also crosses a declared minefield area, from KP 3 to KP 9, along Tathong Channel within the inshore survey area. The route also crosses two suspended marine borrow areas of which one was observed to contain evidence of past dredging.

The seabed in the Study Area comprises more than 5 m in depth of loose to medium dense silty, gravelly sand and soft to firm silt/clay with numerous trawler or anchor scars and very coarse dumped materials, particularly at the landward end of the Study Area (*Figure D3-2, APG_S6_NU002* in *Appendix D3*). It also crosses areas of scattered low to medium relief rock with intermittent loose sand/gravel in a number of places in the first 10km of the Study Area. At about KP 10.3, the seabed flattens out (and for the remainder of the 24 km of the Study Area) with a water depth of 28m - 31 m, and the geology comprises very thick (>5 m) homogenous very soft silty clay with some scattered dump materials and trawler scars, laying on top of firmer silt/clays and coarse sand/gravel.

Figure D4.2 ***The seabed showing the scars from trawling and anchoring and the three unknown linear features (SC001, SC002, SC003)***



The side scan sonar survey also located a number of seabed features (dumped materials, unknown linear features and one shipwreck) and identified them as Sonar Contacts (SC) (*Table D4.2* and *Figure D4.1*).

Table D4.2 ***Sonar Contacts***

Sonar Contact number	Latitude Longitude	Easting Northing	Size (m)	Description	KP RPL offset
SC001	22° 17.017' N 114° 15.994' E	6539425.4E 3377804.9N	62xnmwxnmh	Unknown Linear	-0.074 202 m N
SC002	22° 17.001' N	6539395.3E	80xnmwxnmh	Unknown	0.148

Sonar Contact number	Latitude Longitude	Easting Northing	Size (m)	Description	KP RPL offset
	114° 15.977' E	3377773.5N		Linear	174 m N
SC003	22° 17.017' N	6539398.0E	20xnmwxnmh	Unknown	0.150
	114° 15.978' E	3377804.1N		Linear	204 m N
SC004	22° 13.404' N	6540100.0E	19x7x7	Shipwreck	8.004
	114° 16.381' E	3371035.0N			205 m NE
SC005	22° 12.266' N	6544384.0E	5.9x4.5xnmh	Dumped	13.520
	114° 18.837' E	3368902.0N		materials	271 m N
SC006	22° 13.946' N	6556221.0E	4.6x2.7x0.7	Dumped	26.367
	114° 25.624' E	3372049.0N		materials	157 m N
SC007	22° 14.211' N	6562735.0E	1.5x1.3x<0.5	Tyre	32.793
	114° 29.359' E	3372546.0N			396 m N

All the sonar contacts are from 157 m - 396 m away from the proposed cable position and will not be impacted by it. The unknown linear contacts can be seen in *Figure D4.2* (within the circled area) and are possibly chain or some other construction materials related to the seawall.

The shipwreck SC004 is 205 m from the cable position and is laying on top of another cable, indicating it was deposited there only in recent times, i.e. after the cable was laid (*Figure D4.3*). The position of this shipwreck agrees with the UKHO position for shipwreck number 62014 which is described as a 'live' and 'dangerous wreck' but with no other details (see *Appendix D2*). SC005 appears to be some small dumped materials (*Figure D4.4*), as does SC006 (*Figure D4.5*).

Figure D4.3 The side scan sonar image of SC 004 (UKHO 62014) and its location in the Study Area and positioned above an in-service cable

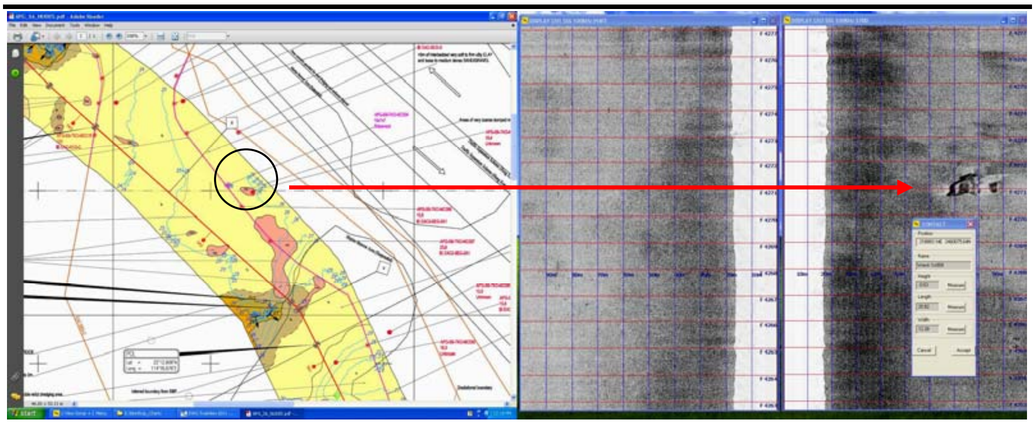


Figure D4.4 SC005

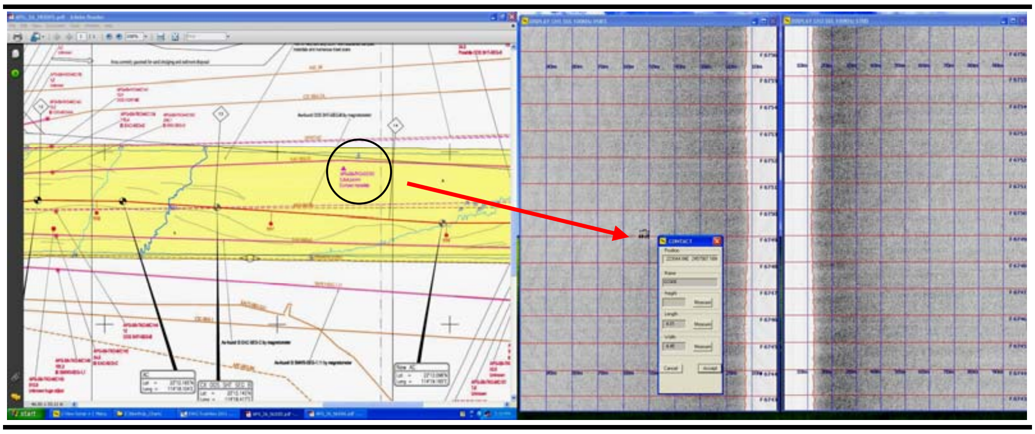
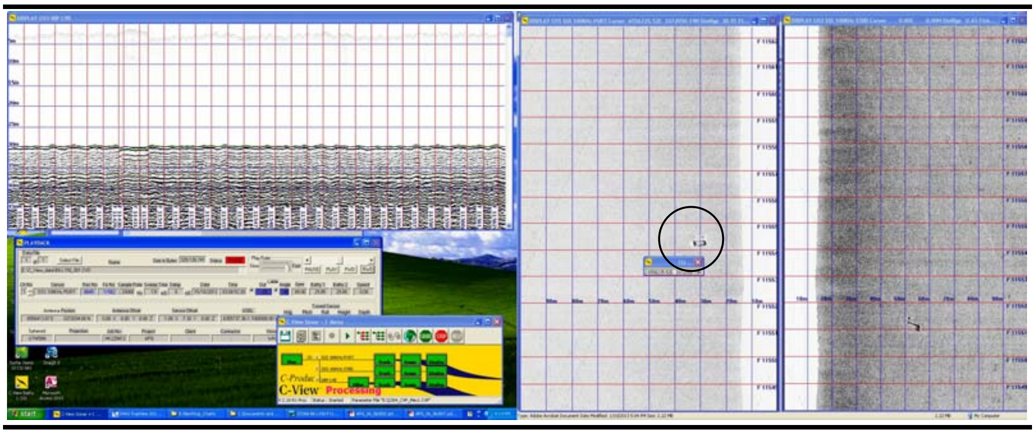


Figure D4.5 SC006



No features that could be interpreted as shipwrecks or other underwater cultural heritage sites were observed from a review of the geophysical data in the vicinity of the coordinates for UKHO 65706 and 65708 (and 57736 which is outside of the Study Area), which is consistent with the UKHO information that they are 'dead' sites, i.e. they do not exist (see *Figures D4.6* and *D4.7*).

Figure D4.6 Dumped materials on the seabed in the vicinity of UKHO 65706, but no shipwreck

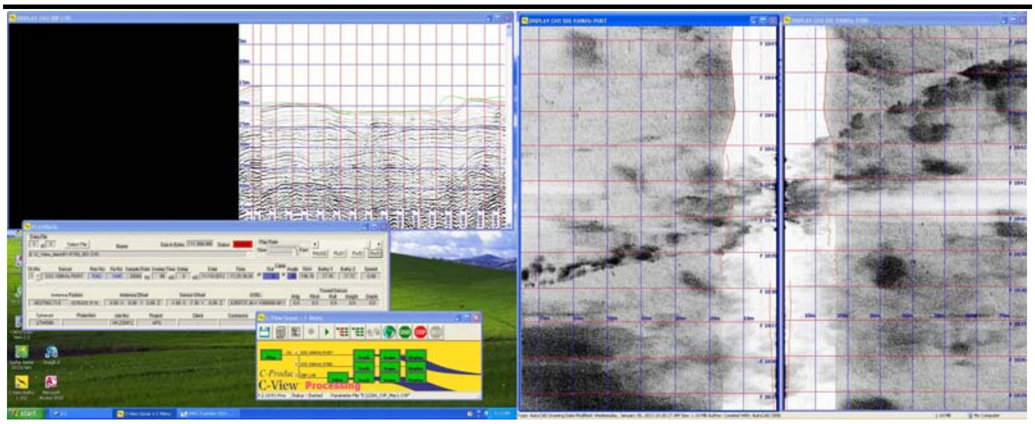
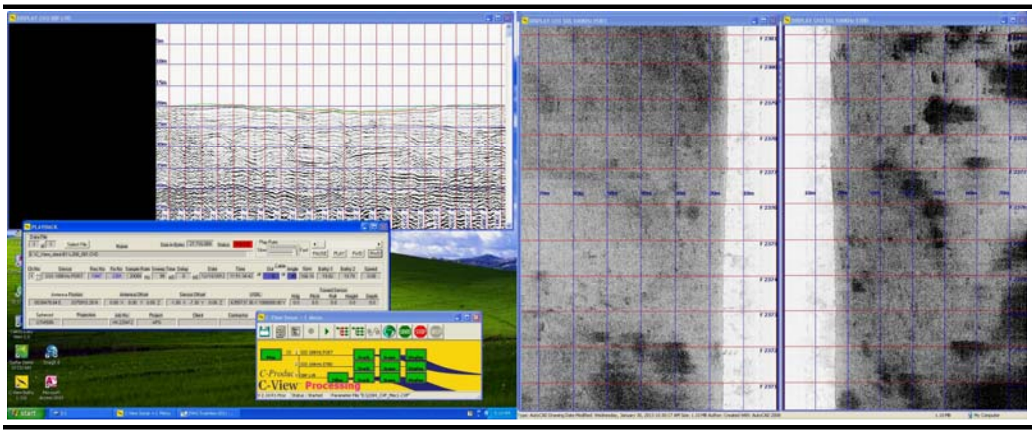


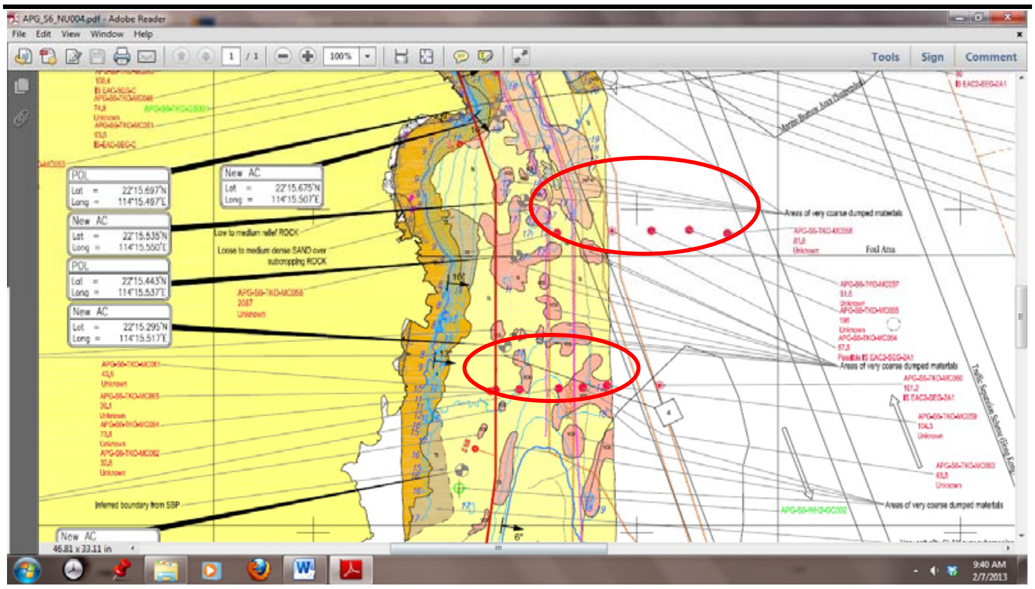
Figure D4.7 ***Dumped materials in the vicinity of UKHO 65078 and 57736, but no shipwreck***



Sub-bottom survey

The sub-bottom and magnetic surveys were carried out to locate sub-bottom materials including the existing cables and pipelines, and three (3) in-service cables, two (2) out of service cables, one (1) planned power cable and two (2) pipelines were identified in the Study Area (see *Figures D3-1 to D3-8, APG_S6_NU001-NU008* in *Appendix D3*).The majority of the observed magnetic anomalies relate to these cables and pipelines but some others were of an unknown origin, although they would appear to be related to 'man-made' features given they are consistently orientated in straight lined-groups over several hundreds of metres (see *Figure D4.8*).

Figure D4.8 ***Unknown magnetic contacts lined up in a straight line***



Some of the unknown magnetic anomalies located within the Study Area and within a few metres of the proposed cable position were more closely investigated (see *Table 4.3* and *Figure D4.1*) and they were found to be associated with dumped materials (*Figures D4.9* and *4.10*), and of an unknown origin but considered to be of modern in nature or a combination of both, but not considered to be archaeological material.

Figure D4.9 Magnetic contacts 041, 042, 046 associated with dumped materials, and/or associated with modern sub-bottom materials

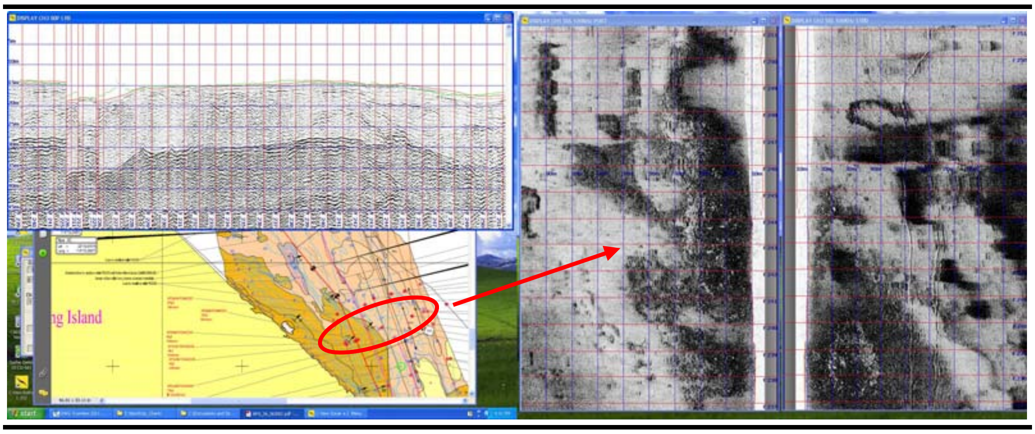


Figure D4.10 Magnetic contacts 061, 064, 065 associated with dumped materials, and/or associated with modern sub-bottom materials

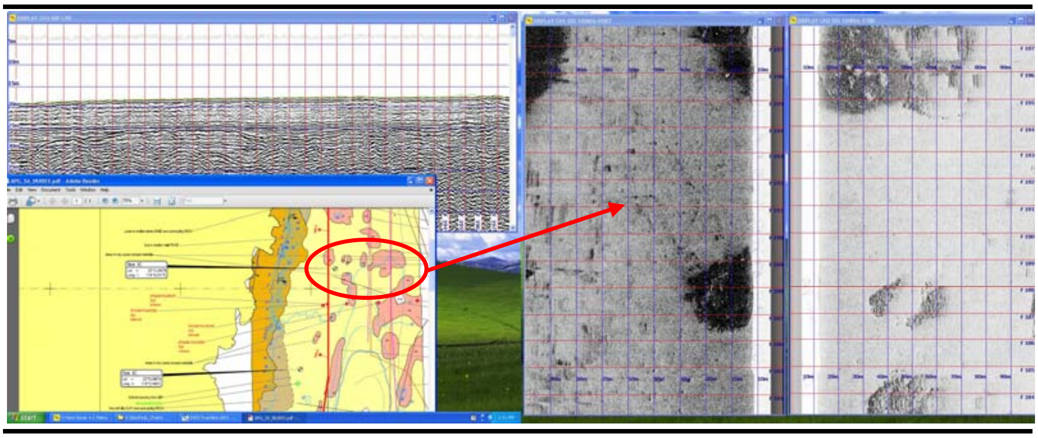


Figure D4.11 Magnetic contact 133 considered to be associated with modern sub-bottom materials

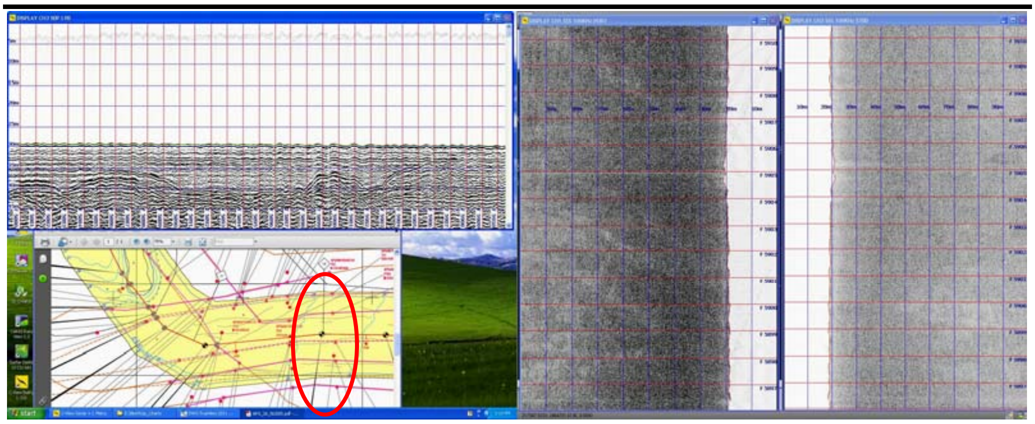
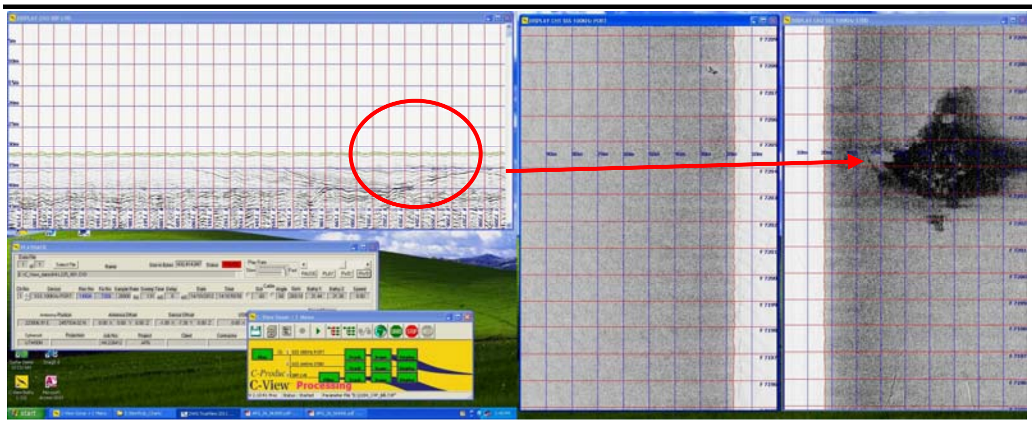


Table D4.3 Unknown Magnetic Contacts

Contact number	**Latitude Longitude**	**KP RPL offset**	**Magnetic Anomaly (nT)**	**Description**
MC041	22° 15.56.099″ N 114° 15.17.177″ E	2.866 3 m NE	185.3	Unknown
MC042	22° 15.55.933″ N 114° 15.16.809″ E	2.867 9 m SW	84.9	Unknown
MC046	22° 15.54.968″N 114° 15.18.750″ E	2.916 29 m NE	74.9	Unknown
MC061	22° 15.18.842″ N 114° 15.21.164″ E	4.033 77 m W	43.5	Unknown
MC064	22° 15.18.902″N 114° 15.23.684″ E	4.034 5 m E	73.6	Unknown
MC065	22° 15.18.722″ N 114° 15.20.564″E	4.036 94 m W	36.1	Unknown
MC133	22° 12.15.068″ N 114° 17.32.026″ E	11.534 7 m N	23.8	Unknown

Other sub-bottom anomalies not associated with an increase in magnetic values appear to be associated with dumped materials (see *Figure D4.12*).

Figure D4.12 Sub-bottom anomalies associated with dumped materials



D5 MARINE ARCHAEOLOGICAL POTENTIAL

D5.1 BASELINE REVIEW AND GEOPHYSICAL SURVEYS

The review of the historical documents and literature indicate the waterways in the western section of the Study Area were well used from the Song Dynasty and given the area is at the eastern entrance to Victoria Harbour, it has remained as a busy waterway. The coastal region (in Junk Bay) was partly occupied from at least the Ming Dynasty and it has increased in coastal/marine activity brought on by fishers using the bay and the establishment of more coastal villages from the 18th Century. The popularity of the bay as a haven for vessels during bad weather can be seen in it being named Junk Bay. The reclamation of vast parts of the bay from the 1970s has greatly reduced the size of the bay and in the process disturbed and buried coastal archaeological sites.

The geophysical surveys revealed that the western section of the Study Area has been heavily impacted from trawling and the dumping of materials. It also found the nature of the sediments to be coarse sediments in the western section of the Study Area and more, fine clay/silt sediments in the east; the coarser sediments being less conducive to preserving organic archaeological material, such as wooden shipwrecks.

A review of the UKHO wrecks database revealed three shipwrecks/ underwater obstructions to be located within the Study Area. The geophysical surveys revealed one of the UKHO sites (62014) to be an existing shipwreck, located 205 m northeast of the proposed cable position and coinciding with Sonar Contact 004. The geophysical survey found this shipwreck to be lying above an in-service power cable which points to the shipwreck as having been deposited after the cable was laid, i.e. in recent times.

No geophysical data could be observed at the location for the other two sites (UKHO 65706 and 65708) which supports the UKHO documents that they are 'dead' sites and do not exist.

A number of Magnetic Contacts and Sub-bottom anomalies were also located during the geophysical surveys. They have been assessed as related to cables, pipelines, and dumped materials/debris given their association with these types of seabed features.

D6 ASSESSMENT OF IMPACT AND RECOMMENDATIONS

D6.1 RECOMMENDATIONS

The findings of this MAI are that there are no archaeological sites or antiquities as defined under the *Antiquities and Monuments Ordinance (Cap. 53)* (*AM Ordinance*) in the Study Area.

No mitigation measures need to be put in place.

D7 REFERENCES

Bard, 1988, In Search of the past: A guide to Antiquities of Hong Kong

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附件 D

水下考古資源潛在影響評估

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附錄 D3 *圖*

D1 引言

D1.1 項目背景

一條新鋪設的遠程通訊光纜系統會在將軍澳登岸，所採用的路線，與其他從香港東部水域登岸的部份光纜路線相近（見*圖 1.1*）。

按照香港特別行政區申請環境許可證的要求，在進行環境評估時，必須對光纜路線進行水下考古調查。

D1.2 水下考古調查的目的

水下考古調查的目的，是要按照香港特別行政區古物古蹟辦事處所發出的《水下考古調查指引》（*附錄 D1*），對一個調查範圍進行分階段的檢閱／調查，其中應包括，但不限於下列各項：

階段 I

1. 有關調查範圍的文獻檢閱；
2. 檢閱地球物理調查數據；
3. 確定水下考古研究潛力；
4. 進行水下考古影響評估；及
5. 準備水下考古調查報告，闡述上述各項調查和評估結果，並提出必要的建議。

階段 II

1. 倘若階段 I 找到具考古潛質的地點，便需以遙控載具或潛水員進行目視調查或從旁監察；
2. 就這些範疇提交報告。

本報告是*階段 I* 的結果。

D1.3 報告結構

在這節引言之後，本報告其餘部份的結構如下：

第 D2 章 香港水下考古評估工作的法律架構；

第 D3 章 這次調查所採用的方法；

第 D4 章 調查範圍的基線情況結果（桌面文獻檢閱和地球物理調查）；

第 D5 章 確定調查範圍的考古研究潛質；及

第 D6 章 評估本項目對考古資源的影響及提出建議。

D2 法定要求及評估準則

下列法例和指引都適用於評估香港的水下考古遺址：

- 《環境影響評估條例（499 章）》及其附屬的《環境影響評估程序技術備忘錄》（環評技術備忘錄）；
- 《古物及古蹟條例（53 章）》；
- 《土地（雜項條文）條例（28 章）》；
- 《香港規劃標準與準則》；及
- 由古物古蹟辦事處釐訂的《水下考古調查指引》。

D2.1 環境影響評估程序技術備忘錄

《環評技術備忘錄》闡述了為水下考古遺址進行調查和評估時所需依循的方法。《環評技術備忘錄》的下列章節適用於本項目：

附件 19：“現時沒有量化的標準，決定這些地點的相對重要性，但一般而言，具有獨特考古歷史價值或建築學上的價值的地點，會視為非常重要。須進行基線研究： (a) 就擬議的工程項目範圍，編制一份詳盡的清單具有建築學上、考古學上及歷史上價值的地方、建築物、場地及構築物；及 (b) 確定擬議工程項目所帶來對文化遺產地點可能造成的威脅、其程度、全面或部分損壞。”

《環評技術備忘錄》也闡述了文化遺產地點的影響評估準則：

附件 10：“評估對文化遺產地點影響的準則包括：(a) 一般假設為贊同保護及存護所有文化遺產地點，由於其提供基本、有限和不可替代的對古今的連繫，是文化和傳統的參考點和身分。(b) 對文化遺產地點的不良影響應減至最低。”

《環評技術備忘錄》也闡述了整體保存和部份保存文化資源的方法：

附件 19：“整體保存會是有利的影響，如果採取適當的措施把文化遺產地點與擬議的工程項目結合，可以改善文化及社會經濟環境。如果基於地點的限制或其他因素只可作部分保存，必須考慮其他建議或規劃設計，證明全面保存並不可行。”

D2.2 古物及古蹟條例（53 章）

《古物及古蹟條例（53 章）》所提供的法律保護，可以防止法定古蹟、歷史建築和具考古研究價值的地點受到發展威脅，讓它們得以保存，供子孫後代享用。這條例的下列聲明也確立了須予遵循的法定程序。

“本條例旨在就保存具有歷史、考古及古生物學價值的物體…訂定條文。”

該條例把"古物"界定為一項古代遺物（在 1800 年以前製成的可移動物體）及在 1800 年前人為建立、闢設或建造的地方、建築物、地點或構築物。該條例亦指定：發現任何古物都必須向當局（民政事務局局長）報告；在 1976 年之後發現的古代遺物的擁有權屬於政府；當局可以宣佈一個地方、建築物、地點或構築物為一項古蹟、歷史建築物、考古或古生物地點或構築物（並因此為這些地點引入額外控制）；及可以就挖掘和其他工作發出執照和許可證。

多年來，香港進行過很多調查，務求找出具考古研究價值的地點。古物古蹟辦事處已經為已知的地點定立邊界和行政程序，藉此保護已知的具考古研究價值地點。然而，目前有關具考古研究價值地點的記錄尚不完整，因為有很多地區仍未進行調查。因此，有必要確保在一個項目規劃的初期便找出和實施適當的程序和機制，來讓先前未知，但在進行項目評估或施工時可能被發現的考古資源得以保存，或作出正式通知。

《古物及古蹟條例》第 11 條規定，任何人發現古物或假定古物，須向古物事務監督報告。據此推論，當一個項目在進行評估或施工時若發現考古資源，便必須正式知會古物事務監督和古物諮詢委員會[(1)]。

D2.3 土地（雜項條文）條例（28 章）

根據這條例，若要在政府土地上進行挖掘，便必須在動工前領取許可證。

D2.4 香港規劃標準與準則

《香港規劃標準與準則》"第十章：自然保育及文物保護"為保護歷史建築、具考古研究價值的地點和其他古物，提供了一般指引和措施。

D2.5 水下考古調查指引

附錄 D1 闡述了有關水下考古調查的指引，當中詳述了在決定水下考古潛質、考古文物的存在和界定適當緩解措施時必須依循的標準做法、程序和方法。水下考古調查的第一階段工作包括：基線情況檢閱、地球物理調查和確定考古研究的潛質。視乎第一階段的結果而定，可能需要或不需要再作深入調查。

(1) 古物古蹟辦事處是向古物諮詢委員會傳遞資訊的門戶。古物諮詢委員會是一個法定機構，由各個相關界別的專門人材組成，向政府提供有關古物和古蹟事項的意見。

D3 評估方法

這項評估工作所採用的方法，是依照古物古蹟辦事處所釐訂的指引，當中包括下列具體任務（見*附錄 D1*）。

D3.1 確立基線情況

- 進行桌面研究，其中包括檢閱土力調查數據、歷史文獻和英國海道測量部的沉船檔案，以確定調查範圍內具潛質的水下考古遺址。
- 運用地球物理調查儀器，檢查海床和海床下的情況，以便找出和界定調查範圍內具考古潛質的地點。

D3.2 確定考古研究潛力

根據基線情況的綜合和分析結果，確定調查範圍是否有任何水下考古遺址存在。

D3.3 評估影響及作出建議

根據各項基線情況分析結果，評估本項目對水下考古遺址的潛在影響，並建議緩解影響的措施。

D4 檢討基線情況

D4.1 桌面研究

D4.1.1 土力數據

香港地區的海底沉積層可以細分為兩個地層：赤鱲角地層及其上的坑口地層。

赤鱲角地層是第四紀最底部的地層，其年代大約是更新世的中期至晚期，其成份則包括崩積層、沖積層和湖泊沉積物（Fyfe 等人的 2000 年著作）。在這個地層之上的海洋沉積物大概屬於全新世時期（從約 13,000 年前至今天），名為"坑口地層"，其成份有黏質粉土沉積物和沙（泥、沙質泥）。

在赤鱲角地層和坑口地層之間的深屈地層是屬於伊姆間冰期的沉積層，其年期尚未確定，而成份則有帶黃斑的軟質至結實粉質黏土。這個地層現時分佈不廣，只有在坑口地層下面的地下露頭處發現（Fyfe 等人的 2000 年著作）。

全新世晚期的沉積物（比較同質的十分軟質至軟質的粉質泥，含水量較高）最有機會（與通常都已受捕漁和其他航運活動滋擾的海床表面比較）含有保存較好的古物。這些古物可能包括沉船。

D4.1.2 檢閱歷史文獻

考古證據顯示，航海人員利用香港海域已近 6,000 年（Bard 1988）。在 Chau (1993) 的著作中有如下描述：

過去十年，在沿岸沙洲發現了多個史前遺址，代表早期移民對沿岸和離岸海島的開發。大約六千年前，新石器時代的人已經居住在華南沿岸地區。

是項海底光纜系統的登岸地點位於現時名叫將軍澳（Junk Bay）的一條海堤。Junk Bay（將軍澳）原名佛堂門，後來是因為很多帆船 (junks) 停靠該灣，因而得名（茂盛顧問公司 2005 年的報告引用 Aijmer 1984 年的著作）。該海灣和南面的藍塘海峽在宋朝時已經在廣州和華北的貿易中被使用。該海峽是進入維多利亞港的東面入口，所以直到今天，仍然是各類船隻的重要航道（茂盛顧問公司 2005）。

將軍澳 (Junk Bay) 的海岸線現在已向海伸延很多，因為從 1970 年代起，大片海床已經被填成陸地，既把多條沿岸村落推向內陸，也把早期沿岸的用途和聚居證據掩埋掉。將軍澳村，原本位於將軍澳東北岸，是區內最古老的聚居地之一，可上溯至明朝。區內其他村落，例如坑口，都是在稍後，即到了十八世紀才成為聚居地。該處便逐漸成為漁民的重要市集，而該海灣也成為漁民喜歡停泊船隻的地方。此外，該海灣也是香港島和西貢之間使用頗多的渡輪接駁點（茂盛顧問公司 2005）。

從宋朝起，該區的海岸線和近岸水道（調查範圍的西北部）都見證了不少海事活動。只有在清朝初年下令沿海居民內遷時，可能有過一段沉寂期。調查範圍的東面外圍地區的活動可能較少，雖然這裏稍後也有貿易和捕漁活動。

D4.1.3　英國海道測量部的沉船檔案

英國水文局位於湯頓市的英國海道測量部保管著一個數據庫，記錄了香港的已知沉船和其他水底障礙物的了資料。*附錄 D2* 是這些地點的清單，按下列方式羅列。這些地點都可以與光纜路線及其他聲納和磁場接觸點一併在*圖 D4.1* 上觀看。

清單中共有 16 個地點，分佈在十分廣闊的地區，其中包括光纜路線。這些地點中，有三個位於調查範圍內，其中只有一個據報仍"活著"（仍存在），而其他兩個則據報"已死"（重複調查時未能偵測到，因此被認為不再存在）（*表 D4.1*）。

表 D4.1　英國海道測量部的記錄中位於調查範圍內的沉船

英國海道測量部沉船編號	現況	地理座標
62014	活著	22.223433N; 114.272983E
65706	已死	22.272500N; 114.254450E
65708	已死	22.268050N; 114.257217E

D4.2　基線檢討結果

根據基線檢閱的結果，調查範圍內可能有水下文化遺產地點存在；而英國海道測量部的數據顯示，調查範圍內可能有一至五個文化遺產地點。

D4.3　地球物理調查

D4.3.1　引言

地球物理調查的目的，是要界定最有考古研究潛質的地區／地點。這類調查還會評估海床沉積物的深度和性質，並會在地圖上標出海床和淺層地底可能是考古物料的異常點。下文闡述了這項資料。

D4.3.2　調查方法

EGS (Asia) Limited 在 2012 年 10 月 11 日及 10 月 14 日，對 34.5 公里長的調查範圍進行了多種儀器的地球物理調查，包括地震剖面儀、多波束聲納、回聲探測器、磁動計和旁測聲納。此外，亦分別於 2012 年 11 月 13 及 11 月 22 日完成了額外的橫截調查（垂直於光纜路線）和樣本收集工作。

雖然光纜的掩埋深度只有 5 米，而在掩埋光纜時所滋擾的海床闊度亦只有約 0.5 米，但是次研究對一條以擬議光纜鋪設路線為中心，闊約 650 米的調查走廊進行了調查。主要的測量導線採用東西走向，相隔 75 米，這樣便容許路徑之間最少 100%重疊，而且可以對海床和海床下面進行全面評估（見圖 *D4.1*）。

這次調查共在 8 個位置收集了 8 個重力取樣樣本和 1 個隨機取樣的樣本。有關這些位置的詳情，請參閱*附錄件 D3* 內 *APG_S6_NU001-NU008* 的*圖 D3-1* 至 *D3-8*。

這些縱合式調查可以對海床和海床下的部份進行全面調查。調查範圍的水深介乎 5 至 31 米（見*附錄 D3* 內 *APG_S6_NU001-NU008* 的*圖 D3-1* 至 *D3-8*）。

D4.3.3 使用設備

地球物理調查所用的設備如下：

- C-Nav GcGPS（全球校正式全球定位系統）
- 單波束回聲探測器
- 多波束回聲探測器
- 旁測聲納系統
- 淺層地底地震剖面儀
- 海洋磁動計系統

D4.3.4 檢閱"地球物理調查"結果

EGS 搜集到的地球物理調查數據先由內部的地球物理學家處理，再由一名合資格的水下考古學家檢閱。

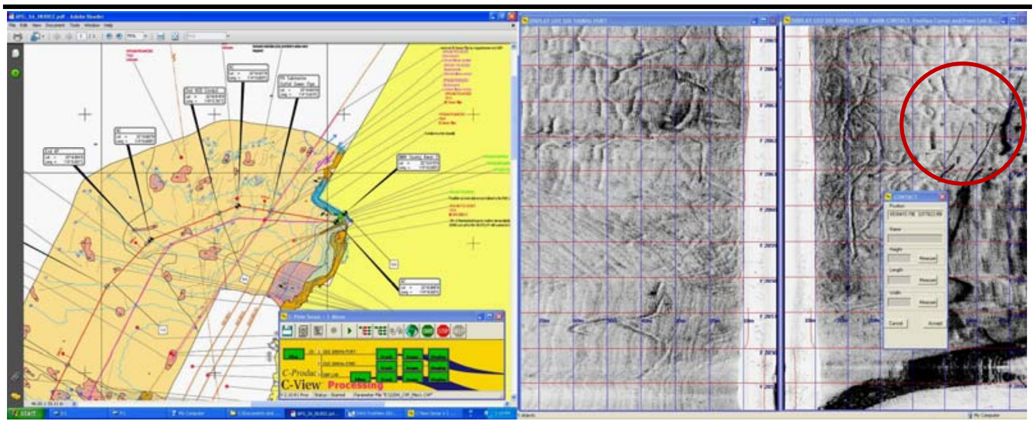
旁測聲納調查

在研究範圍的近岸調查範圍內，沒有任何正式的物料傾倒區。然而，旁測聲納調查在整個研究範圍內都發現一些被傾倒的物料，特別是在千米標（KP）0 至 c. KP9 的範圍。現時已刊憲的挖沙區和沉積物卸置區，均位於研究範圍東北方約 800 米，介乎 KP 5 和 KP 13 之間的地方。

研究範圍亦橫過一個已公布的水雷區。它位於近岸調查範圍的藍塘海峽內，介乎 KP 3 與 KP 9 之間。光纜鋪設路線也會橫過兩個暫停使用的水下採泥區，其中一個有挖泥痕跡。

研究範圍內的海床，是由超過 5 米厚的物料組成，其中包括鬆散至中等稠度的粉質沙及礫質沙，以及軟質至硬質的粉土／黏土，表面還有很多拖網或船錨造成的痕跡，以及十分粗糙的被傾倒物料，特別是在研究範圍的向陸一端（*附錄 D3* 內 *APG_S6_NU002* 的*圖 D3-2*）。它亦橫過一些有零星小石和中石的地區，而且，在研究範圍的首 10 公里內，有部份地方亦間雜著鬆散的砂／礫。在接近 KP 10.3 的地方，海床開始變得平坦（而且在研究範圍的其餘的 24 公里內都保持平坦），水深則介乎 28 米至 31 米之間，而地質成份是很厚（超過 5 米）的均勻鬆軟粉質黏土，偶爾有一些傾倒物料和由拖網漁船造成的痕跡出現在較硬的粉土／黏土和粗砂／礫之上。

圖 D4.2　　*在海床上由拖網和船錨造成的痕跡及三個不明的線型特色（SC001、SC002、SC003）*



旁測聲納調查亦發現多項海床特色（被傾倒物料、不明線型特色和一處沉船）並把它們稱為“聲納接觸點”(SC)（見*表 D4.2* 和*圖 D4.1*）。

表 D4.2　　***聲納接觸點***

接觸點編號	緯度 經度	東向值 北向值	大小（米）	說明	千米標 與 **RPL** 距離
SC001	北緯 22° 17.017' 東經 114° 15.994'	6539425.4E 3377804.9N	62x 沒有量度闊度及高度	未明綿型	-0.074 北面 202 米
SC002	北緯 22˚ 17.001' 東經 114˚ 15.977'	6539395.3E 3377773.5N	80x 沒有量度闊度及高度	未明線型	0.148 北面 174 米
SC003	北緯 22˚ 17.017' 東經 114˚ 15.978'	6539398.0E 3377804.1N	20x 沒有量度闊度及高度	未明線型	0.150 北面 204 米
SC004	北緯 22˚ 13.404' 東經 114˚ 16.381'	6540100.0E 3371035.0N	19x7x7	沉船	8.004 東北面 205 米
SC005	北緯 22˚ 12.266' 東經 114˚ 18.837'	6544384.0E 3368902.0N	5.9x4.5x 沒有量度高度	被傾倒物料	13.520 北面 271 米
SC006	北緯 22˚ 13.946' 東經 114˚ 25.624'	6556221.0E 3372049.0N	4.6x2.7x0.7	被傾倒物料	26.367 北面 157 米
SC007	北緯 22˚ 14.211' 東經 114˚ 29.359'	6562735.0E 3372546.0N	1.5x1.3x<0.5	輪胎	32.793 北面 396 米

所有聲納接觸點都位於距離擬鋪設的光纜位置 157 米至 396 米的地方，不會受擬鋪設的光纜影響。各個未明的線型接觸點均展示於*圖 D4.2*（在被圈起的範圍內）。它們可能是鎖鏈或其他與海堤有關的建築物料。

SC004 號接觸點的沉船與光纜位置相距 205 米，是位於另一條光纜之上，說明它是在另一條光纜被鋪設後，於近期才被放置在那裏（*圖 D4.3*）。這個沉船位置與英國海道測量部編號 62014 的沉船位置脗合，而資料上只說明它是一艘“活著”和“危險的沉船”，沒有其他細節（*附錄 D2*）。SC005 號接觸點則似乎是一些細小的被傾倒物料（*圖 D4.4*）；SC006 號接觸點也一樣（*圖 D4.5*）。

圖 D4.3 *SC004 號接解點（英國海道測量部編號 62014）的旁測聲納影像及其在研究範圍內的位置（位於一條使用中光纜之上）*

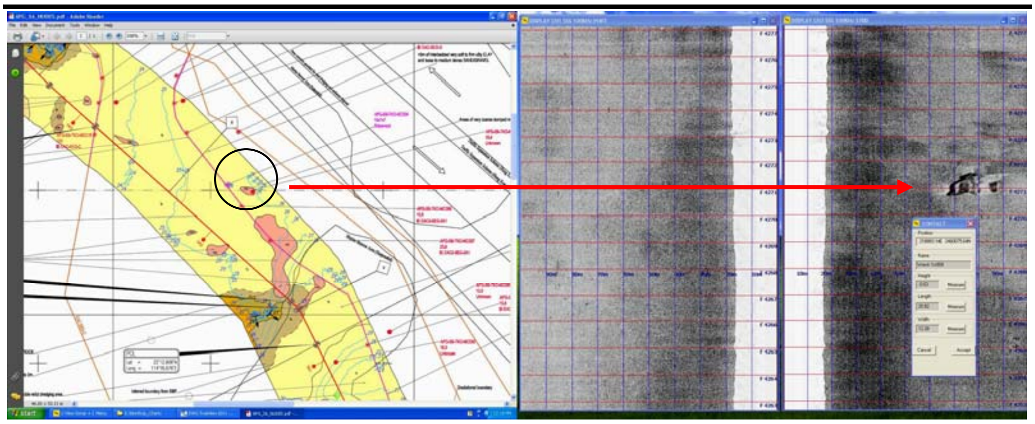


圖 D4.4 *SC005*

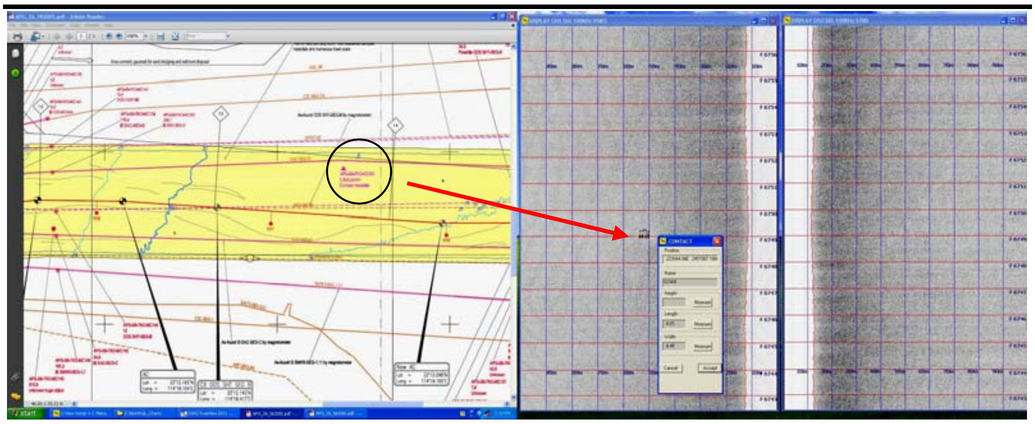
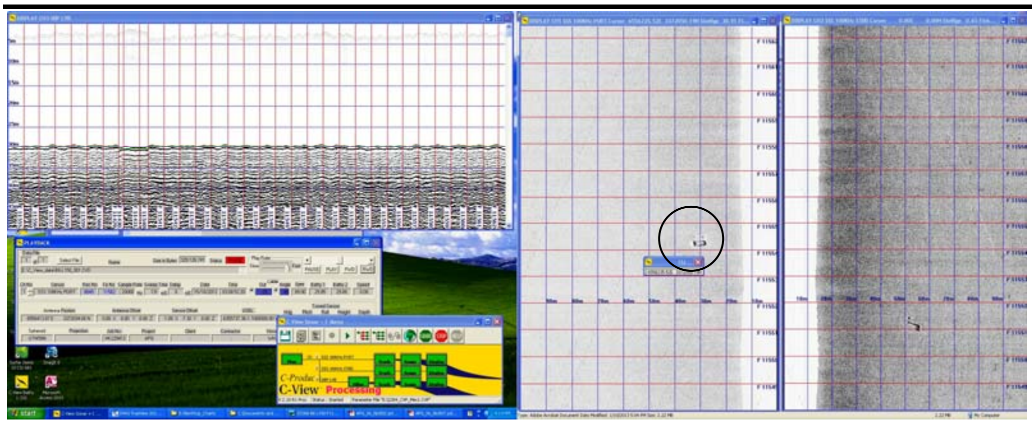


圖 D4.5 *SC006*



在再次檢閱英國海道測量部 65706 號和 65708 號（及在研究範圍外的 57736 號）位置附近的地球物理數據後，沒有發現可以被詮釋為沉船或其他水底文化遺產的地點。這種判斷與英國海道測量部的資料一致；該局的資料是把這些位置列為“已死”的地點，即不再存在（見*圖 D4.6* 和 *D4.7*）。

圖 D4.6　　*在英國海道測量部 65706 號位置附近海床上的被傾倒物品，但沒有沉船*

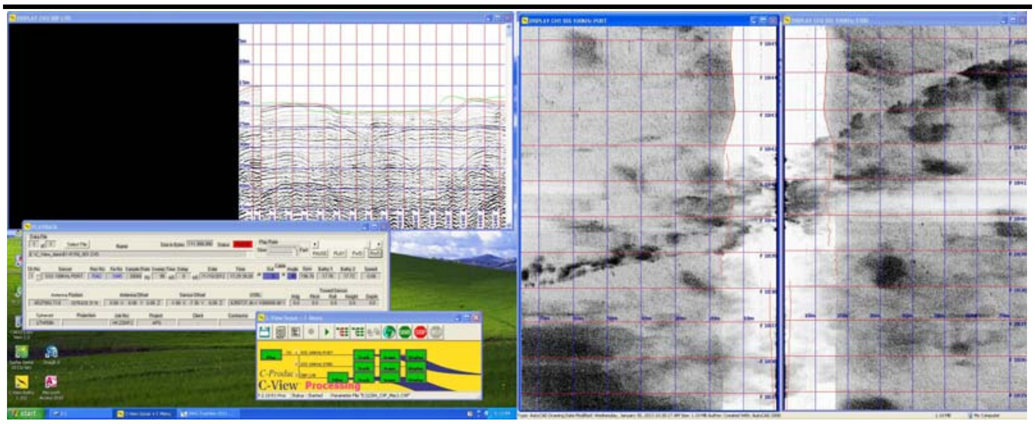
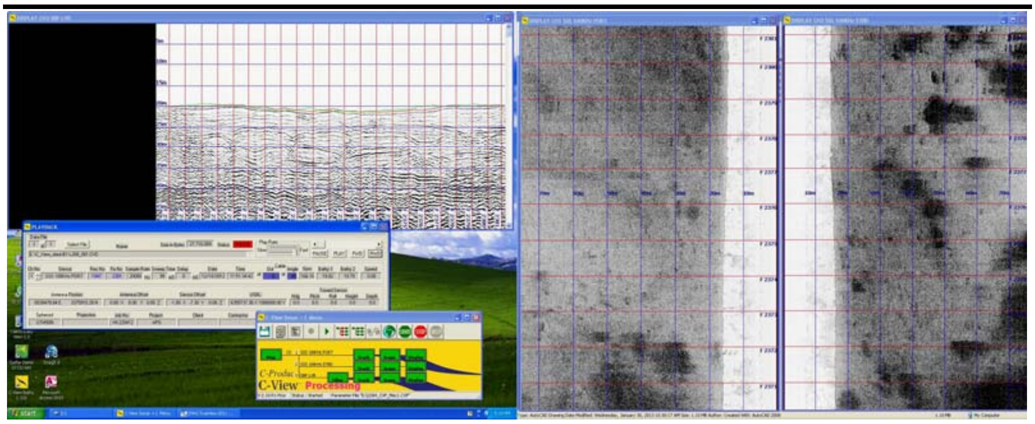


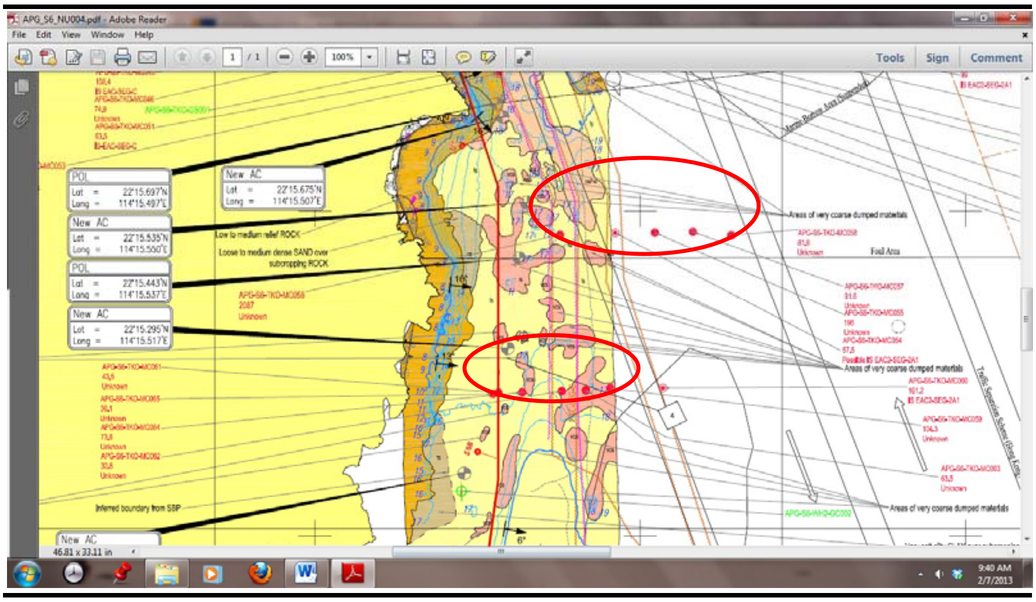
圖 D4.7　　*在英國海道測量部 65078 號和 57736 位置附近海床上的被傾倒物品，但沒有沉船*



淺層地底調查

是次研究所進行的淺層地底調查和磁力調查，是要找出淺層地底物品的位置，其中包括現有的光纜和管道；而兩項調查在研究範圍內共找到三條使用中的光纜、兩條已棄用的光纜、一條計劃中的供電光纜和兩條管道（見*附錄 D3* 內 *APG_S6_NU001-NU008* 的*圖 D3-1* 至 *D3-8*）。在觀察到的磁力異常情況中，大都與這些光纜和管道有關。其他異常情況的確實原因雖然並不清楚，但似乎都是人工造成的特色，因為它們都很一致地，以直線群的形式，向同一個方向伸延數百米（見*圖 D4.8*）。

圖 D4.8 *情況未明的磁力接觸點排列成直線*



是次研究對位於研究範圍內和在擬鋪設的光纜位置附近的部份情況未明磁力異常地點，都進行了更仔細的調查（見*表 4.3* 和*圖 D4.1*），並發現它們都與被傾倒的物品有關（*圖 D4.9* 和 *4.10*）。這些物品的來源不明，但應屬現代物品，或兩種成份都有，但未非考古文物。

圖 D4.9 ***磁力接觸點 041、042、046 都與被傾倒物料有關，及／或與現代淺層地底物品有關***

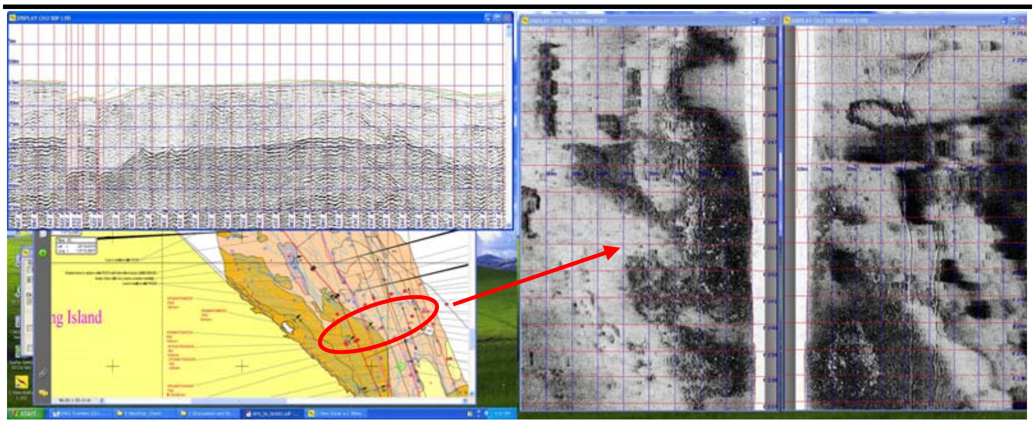


圖 D4.10　　磁力接觸點 061、064、065 號都與被傾倒物料有關，及／或與現代淺層地底物品有關

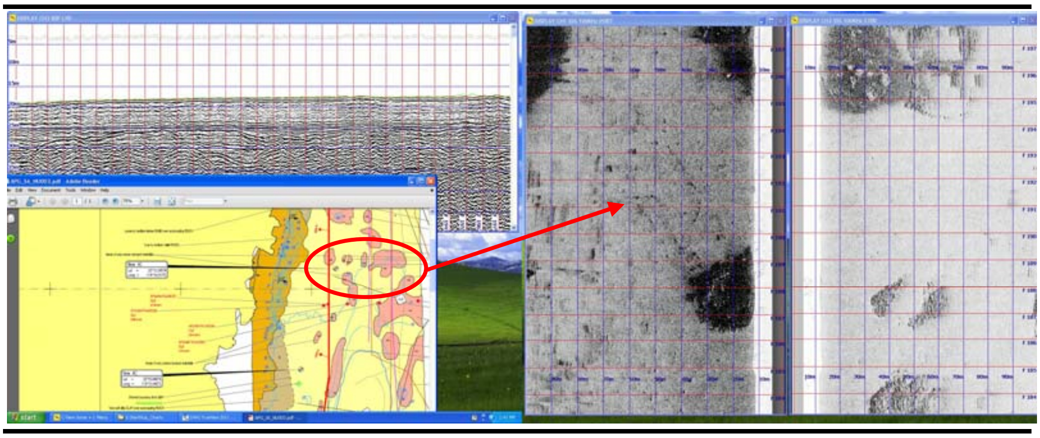


圖 D4.11　　磁力接觸點 133 號與現代淺層地底物品有關

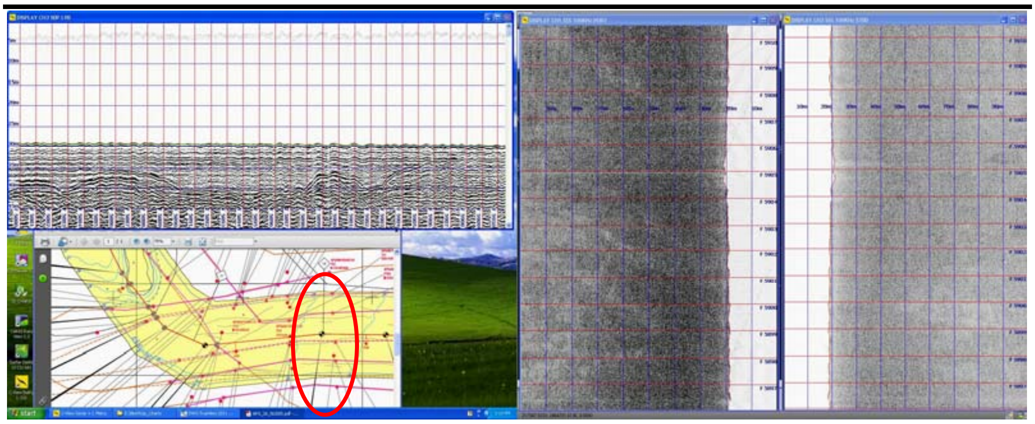
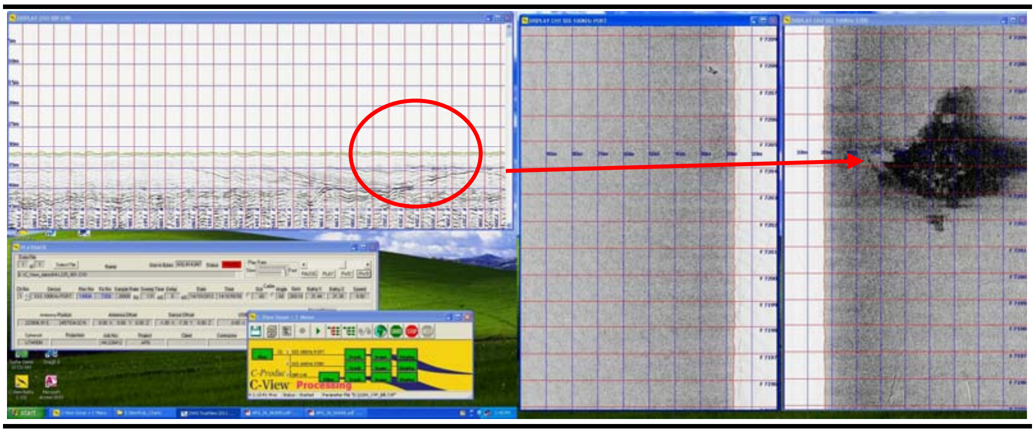


表 D4.3　　情況未明的磁力接觸點

接觸點編號	緯度 經度	千米標 與**RPL**距離	磁力異常情況 (毫微)	說明
MC041	北緯22° 15.56.099″ 東經114° 15.434'	2.866 東北面3米	185.3	未明
MC042	北緯22° 15.55.933″ 東經114° 15.16.809″	2.867 西南面9米	84.9	未明
MC046	北緯22° 15. 54.968″ 東經114° 15. 18.750″	2.916 東北面29米	74.9	未明
MC061	北緯22° 15. 18.842″ 東經114° 15. 21.164″	4.033 西面77米	43.5	未明
MC064	北緯22° 15. 18.902″ 東經114° 15. 23.684″	4.034 東面5米	73.6	未明
MC065	北緯22° 15. 18.722″ 東經114° 15. 20.564″	4.036 西面94米	36.1	未明
MC133	北緯22° 12.15068″ 東經114° 17. 32.026″	11.534 北面7米	23.8	未明

其他與磁力增加無關的淺層地底異常情況，似乎都是由被傾倒的物料造成（見*圖 D4.12*）。

圖 D4.12　　與被傾倒物料有關的淺層地底異常情況



D5 水下考古研究潛質

D5.1 基線情況檢閱及地球物理調查

根據歷史檔案和文獻記載之檢閱，調查範圍西部的水道在宋朝時已經被頻繁使用。由於該區是進入維多利亞港的東面入口，所以一直都是繁忙的水道。沿岸地區（在將軍澳海灣內）至少從明朝起便被部份使用。到了 18 世紀，更多沿岸村落建立後，漁民便更多地使用海灣和沿岸村落所提供的設施，因此沿岸和海上活動都日漸頻繁。從該海灣被稱作 Junk Bay（船隻的海灣）可見，將軍澳在當時是一個往來船隻喜歡使用的避風港。從 1970 年代開始在該海灣進行大幅填海，把海灣的面積大幅縮小，同時也令沿岸的考古遺址受到滋擾和掩埋。

地球物理調查的資料顯示，調查範圍西部曾被拖網和傾倒物料嚴重影響。此外，也發現調查範圍西部的沉積物屬於粗糙沉積物，而東面則有較多黏土／粉土沉積物；而粗糙沉積物較難保存有機考古物料，例如木質沉船。

根據英國海道測量部的沉船數據庫顯示，調查範圍內共有三處沉船／水下障礙物。根據地球物理調查的結果，英國海道測量部所記錄的其中一個地點（編號 62014）是一艘現有的沉船，位於擬鋪設的光纜位置東北面 205 米的地方，並與聲納接觸點 004 號重疊。地球物理調查發現這艘沉船是位於一條使用中的光纜之上，說明它是在光纜被鋪設後，亦即是近期才沉在該處。

在其他兩個地點（英國海道測量部編號 65706 和 65708）沒有觀察到任何地球物理數據，與英國海道測量部文件指它們是“已死”而且並不存在的說法相符。

地球物理調查也發現多處磁力接觸點和淺層地底異常地點。基於它們位於這類海床特色附近，因此，評估結果認為它們與光纜、管道和被棄置物料／碎物有關。

D6 影響評估和相關建議

D6.1 建議

這次水下考古調查的結果顯示，在研究範圍內沒有《古物及古蹟條例（第 53 章）》所界定的考古遺址或古物。

因此無需實施任何緩解措施。

D7　　参考資料

Bard, 1988, In Search of the past: A guide to Antiquities of Hong Kong

Chau, Hing-wah, (ed) 1993, *Collected essays on the culture of the Ancient Yue People in South China.* Hong Kong Museum of History. Hong Kong.

Fyfe, J.A., Shaw, R., Campbell, S.D.G., Lai, K.W. and Kirk, L.A., 2000, *The Quaternary Geology of Hong Kong.* Hong Kong Geological Survey, Geotechnical Engineering Office, Civil Engineering Department, The Government of Hong Kong SAR.

Maunsell Consultants Asia Ltd., 2005, Further Development of Tseung Kwan O, Feasibility Study, Environmental Impact Assessment, Impact on Cultural Heritage. Civil Engineering and Development Department. Hong Kong.

Appendix D1

Guidelines for Marine Archaeological Investigation

<u>Guidelines for Marine Archaeological Investigation (MAI)</u>
(As at August 2008)

The standard practice for MAI should consist of four separate tasks, i.e. (1) Baseline Review, (2) Geophysical Survey, (3) Establishing Archaeological Potential and (4) Remote Operated Vehicle (ROV)/Visual Diver Survey/Watching Brief.

(1) Baseline Review

1.1 A baseline review should be conducted to collate the existing information in order to identify the potential for archaeological resources and, if identified, their likely character, extent, quality and value.

1.2 The baseline review will focus on known sources of archive data. It will include:

a. Geotechnical Engineering Office (GEO) – the Department holds extensive seabed survey data collected from previous geological research.

b. Marine Department, Hydrographic Office – the Department holds a substantial archive of hydrographic data and charts.

c. The Royal Naval Hydrographic Department in the UK – the Department maintains an archive of all survey data collected by naval hydrographers.

d. Relevant government departments should be consulted in order to obtain the information of dredging history (if any) on the proposed project area. Area for sand dredging, mud disposal and allocated marine borrow area within Hong Kong should also be considered during the review.

1.3 The above data sources will provide historical records and more detailed geological analysis of submarine features which may have been subsequently masked by more recent sediment deposits and accumulated debris.

(2) Geophysical Survey

2.1 Extensive geophysical survey of the study area should deploy high resolution boomer, side scan sonar and an echo sounder and high resolution multi beam sonar. The multi beam data must be presented as processed digital terrain models to facilitate the archaeological analysis. The data received from the survey would be analysed in detail to provide:

a. Exact definition of the areas of greatest archaeological potential.
b. Assessment of the depth and nature of the seabed sediments to define which areas consist of suitable material to bury and preserve archaeological material.

c. Detailed examination of the boomer and side scan sonar records to map anomalies on the seabed which may be archaeological material.

d. Detailed examination of the multi beam sonar data to assess the archaeological potential of the sonar contacts.

(3) Establishing Archaeological Potential

3.1 The data examined during Task 1 and 2 will be analysed to provide an indication of the likely character and extent of archaeological resources within the study area. This would facilitate formulation of a strategy for investigation.

3.2 The results would be presented as a written report and charts. If there is no indication of archaeological material there would be no need for further work.

3.3 Charts should be presented at 1:500 scale and show each survey contact. Its dimensions and exact location should also be shown.

(4) Remote Operated Vehicle (ROV)/Visual Diver Survey/Watching Brief

4.1 Subject to the outcome of Task 1, 2 and 3, accepted marine archaeological practice would be to plan a field evaluation programme to acquire more detailed data on areas identified as having archaeological potential. The areas of archaeological interest can be inspected by ROV or divers. ROV or a team of divers with both still and video cameras would be used to record all seabed features of archaeological interest.

4.2 Owing to the heavy marine traffic in Hong Kong, the ROV/visual diver survey may not be feasible to achieve the target. If that is the case, an archaeological watching brief is the most appropriate way to monitor the dredging operations in areas of identified high potential to obtain physical archaeological information.

4.3 A sampling strategy for an archaeological watching brief would be prepared based on the results of Task 1, 2 and 3 to focus work on the areas of greatest archaeological potential. Careful monitoring of the dredging operations would enable immediate identification and salvage of archaeological material. If archaeological material is found, the AMO should be contacted immediately to seek guidance on its significance and appropriate mitigation measures would be prepared.

4.4 If Task 4 is undertaken, the results would be presented in a written report with charts.

Reports

Five copies of the final report should be submitted to AMO for record.

附件D1

水下考古調查指引

水下考古調查指引
（2008年8月最後修訂）

標準的水下考古調查方法應包括四項工作，即 (1) 檢閱基線；(2) 地球物理調查；(3) 確定考古潛質及 (4) 以遙控載具或潛水員進行目視調查或從旁監察。

(1) 檢閱基線情況

1.1 應該進行基線檢閱，務求搜集現有資料，以便找出可能存在的考古資源，以及它們的特點、範圍、質量和價值。

1.2 基線檢閱會集中於已知的數據來源，其中包括

a. 土力工程處－該處保存大量過去地質研究所搜集的海床調查數據。

b. 海事署海道測量部－該署保存大量水文數據和海圖。

c. 英國海軍海道測量署－該署保存了所有由海軍海道測量師搜集的調查數據。

d. 應該諮詢相關的政府部門，以便取得有關擬建工程範圍的疏浚歷史資料（若有）。在檢視這些資料時，也應該顧及香港境內各個挖沙區、卸泥區和指定海洋採泥區。

1.3 上述數據來源會就各項可能已被近期沉積物和碎物掩蓋的海底特色，提供相關的歷史記錄和詳細地質分析。

(2) 地球物理調查

2.1 在對研究區進行廣泛的地球物理調查時，應該配備高解像度探測器、旁測聲納和回聲測深儀，以及高解像度多波束聲納。為了方便進行考古分析，多波束聲納所收集到的數據必須轉換成為數碼地勢模型。這項調查所收集到的數據會被詳細分析，以便提供下列資料：

a. 具有最大考古潛質的位置的確實範圍。

b. 評估海床沉積物的深度和性質，以便界定有合適的物質可以掩埋和保存考古物品的地區。

c. 詳細檢閱探測器和旁測聲納的記錄，以便在地圖上標出海床上可能是考古物品的異常地點。

d. 詳細檢閱多波束聲納的數據，以便評估這些聲納接觸點的考古潛質。

(3) **確定考古潛質**

3.1 對於項目1和2檢閱過的數據加以分析，以便就研究區的考古資源提供有關其性質和範圍的指標。這樣會有助於擬訂調查策略。

3.2 有關的結果都應該以書面報告和圖表的形式表達。倘若沒有任何指標顯示區內有考古物品，便無需進行進一步工作。

3.3 有關的圖表應該以1:500的比例表達，並應顯示每項調查的接觸點，包括其大小和確實位置。

(4) **遙控載具／潛水員目測調查／從旁監察**

4.1 視乎前三項工作的結果而定，一般獲接受的水下考古方法會計劃進行實地評估，以便對那些被認為具有考古潛質的地區搜集更詳細的數據。具考古價值的地區可以由遙控載具或潛水員予以調查。無論是遙控載具或潛水隊，都會配備照相機和錄影機，以便記錄所有具考古價值的海床特色。

4.2 然而，香港的海上交通繁忙，無論是使用遙控載具或潛水員目測調查可能都不是可行的做法。倘若真的如此，最適當的方法便是進行旁觀式的考古監察，以監察具高潛力的地區的挖掘工作來取得實地考古資料。

4.3 這樣便應該根據前三項工作的結果，擬訂考古監察的採樣策略，以便把工作重點集中於具有最高考古潛力的地區。若能小心監察各項挖掘工作，便可以馬上發現和搶救考古物品。倘若發現考古物品，便應該立即聯絡古物古蹟辦事處，並尋求有關該等發現的重要性的指引，以便擬訂適當的緩解措施。

4.4 倘若進行了項目4，便應把有關的結果以書面報告和圖表的形式表達。

報告

應該向古物古蹟辦事處提交一式五份的最後報告，以便記錄。

Appendix D2

United Kingdom Hydrographic Office Wreck database for Survey Area

附件　D2

調查範圍內在英國海道測量部沉船資料庫有記錄之沉船 (只有英文版)

Latitude = 22 13'.688 N **Longitude** = 114 17'.454 E [WGD] **Square Number** = 1113
State = LIVE

Wreck Number 50333 **Classification** = Unclassified
Symbol WK 19.3 **Largest Scale Chart** = 4127
Charting Comments

Old Number 122802561
Category Dangerous wreck

WGS84 Position **Latitude** = 22 13'.688 N **Longitude** = 114 17'.454 E
WGS84 Origin Original
Horizontal Datum WGD WGS (1984)

Position Method
Position Quality Surveyed
Position Accuracy
Area at Largest Scale No

Depth 19.3 metres
Drying Height
Height
General Depth 27 metres
Vertical Datum Approximate lowest astronomical tide
Depth Method
Depth Quality Least depth known
Depth Accuracy
Conspic Visual NO **Conspic Radar** NO
Historic NO **Military** NO **Existence Doubtful** NO
Non Sub Contact NO

Last Amended 14/10/2008
Position Last Amended 14/07/2000
Position Last **Latitude** = 22 13'.689 N **Longitude** = 114 17'.455 E
Name
Type
Flag
Dimensions **Length** = **Beam** = **Draught** =
Tonnage
Cargo
Date Sunk

Sonar Dimensions **Length** = 50.3 metres **Width** = 6.7 metres **Shadow Height** =
Orientation

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

Markers DIMENSIONS BY DIVER
General Comments
Circumstances of Loss

Surveying Details
**HH550/412/02 12.6.00 WK LOCATED IN 2213.689N, 11417.455E [WGD]. CONFIRMED BY DIVERS TO BE A CARGO SHIP OF LENGTH 50.3MTRS, BREADTH 6.7MTRS. LEAST DEPTH IS 16.4MTRS. (HONG KONG, CHINA, MARINE DEPT, FAX DTD 8.6.00). - NM 2789/00.
**HH550/412/02 14.7.00 NOW WK 17.8MTRS IN 2213.688N, 11417.454E [WGD]. FURTHER WORK WILL BE CARRIED OUT TO INCREASE WATER DEPTH. (HONG KONG, CHINA, MARINE DEPT, FAX DTD 13.7.00). BR STD.
**HH550/412/02 1.8.00 NO FURTHER REMOVAL WORK WILL TAKE PLACE. (HONG KONG HYDROGRAPHIC OFFICE, EMAIL DTD 29.7.00). AMEND TO WK 17.8MTRS. - NM 3490/00.
**14.10.08 SHOWN AS WK 19.3MTRS ON HONG KONG 2502 [AUG '08 EDN, LARGEST SCALE ADOPTION]. NE 4127.
**HH550/434/01 28.10.08 NM ACTION FOR OTHER SCALES. - NM 6261/08.

Latitude = 22 15'.872 N **Longitude** = 114 26'.710 E [WGD] **Square Number** = 1113
State = LIVE

Wreck Number 57262 **Classification** = Unclassified
Symbol WK 19.0 **Largest Scale Chart** = 4126
Charting Comments

Old Number
Category Dangerous wreck

WGS84 Position **Latitude** = 22 15'.872 N **Longitude** = 114 26'.710 E
WGS84 Origin Original
Horizontal Datum WGD WGS (1984)

Position Method
Position Quality Surveyed
Position Accuracy
Area at Largest Scale No

Depth 19.0 metres
Drying Height
Height
General Depth 27 metres
Vertical Datum Lowest astronomical tide
Depth Method
Depth Quality Least depth known
Depth Accuracy
Conspic Visual NO **Conspic Radar** NO
Historic NO **Military** NO **Existence Doubtful** NO
Non Sub Contact NO

Last Amended 23/10/2000
Position Last Amended 23/10/2000
Position Last **Latitude** = 22 15'.875 N **Longitude** = 114 26'.692 E

Name QUAN TAI
Type M GENERAL CARGO
Flag CHINA
Dimensions **Length** = 62.8 metres **Beam** = 9.3 metres **Draught** =
Tonnage 499 Gross
Cargo BUILDING MATERIALS
Date Sunk 06/03/1999

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

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

Markers
General Comments

Circumstances of Loss
**SANK AFTER COLLISION WITH M GEN CARGO VESSEL 'XING LONG'. TWO CREW RESCUED, 6 DEAD, 1 MISSING. PASSAGE GUANZHOU FOR SHANGHAI.
Surveying Details
**HH548/436/04 19.3.99 SANK IN 2250.42N, 11426.36E [UND] OR 4 MILES E OF THE NINEPIN ISLANDS. (LL 10.3.99). THIS POSN PLOTS ASHORE. AMENDED TO 2215.42N, 11426.36E [WGD] FOR FILING. AWAIT FURTHER, POSN FOR FILING ONLY. NCA.
**HH550/412/02 25.3.99 LOCATED IN 2215.875N, 11426.692E [WGD]. LEAST DEPTH 13.7MTRS. VESSEL LENGTH 62.8MTRS, BEAM 9.25MTRS. 499 GRT. (HONG KONG, CHINA, MARINE DEPT FAX DTD 24.3.99) NOW MARKED BY ISO DANGER BUOY, FL(2), [PERIOD NOT STATED] IN 2215.851N, 11426.701E [WGD]. (HONG KONG, CHINA, MARINE DEPT FAX DTD 25.3.99). - NM 1634/99.
**HH550/414/02 12.10.99 WK, LEAST DEPTH 13.7MTRS, IN 2215.870N, 11426.660E [CHINESE CHART DATUM]. (CHINESE NM 17/219/99). - NFA.
**HH550/414/02 23.10.00 PART OF SUPERSTRUCTURE HAS BEEN REMOVED. LEAST DEPTH NOW 19.0MTRS IN 2215.872N, 11426.710E [WGD]. BUOY HAS BEEN RECOVERED. (C M CHAU, MARINE DEPARTMENT, HONG KONG, EMAIL DTD 19.10.00). - NM 4598/00.
**18.6.02 SHOWN AS WK LEAST DEPTH 13.7MTRS AND MARKED BY ISO DANGER BUOY ON PRC CHART 15020 [2001 EDN]. FORMER AMENDMENT TO 19.0MTRS, BASED ON MARINE DEPARTMENT HK EMAIL DTD 19.10.00, ALMOST CERTAINLY SUPERCEDES THIS DEPICTION. NO CHART ACTION.
**HH550/414/03 5.2.03 WK 19MTRS IN 2215.870N, 11426.710E [?WGD]. DELETE WK 13.7MTRS AND ISO DANGER BUOY, FL(2) 10 SEC, CLOSE BY. (CHINESE NM 1/4/04). NCA.

Latitude = 22 13'.406 N **Longitude =** 114 16'.379 E [WGD] **Square Number =** 1113
State = LIVE

Wreck Number 62014 **Classification =**
Unclassified
Symbol WK 21.0 **Largest Scale Chart =** 4127
Charting Comments
Old Number
Category Dangerous wreck

WGS84 Position **Latitude =** 22 13'.406 N **Longitude =** 114 16'.379 E
WGS84 Origin Original
Horizontal Datum WGD WGS (1984)

Position Method
Position Quality Precisely known
Position Accuracy
Area at Largest Scale No

Depth 21.0 metres
Drying Height
Height
General Depth 25 metres
Vertical Datum Approximate lowest astronomical tide
Depth Method
Depth Quality Least depth known
Depth Accuracy
Conspic Visual NO **Conspic Radar** NO
Historic NO **Military** NO **Existence**
Doubtful NO
Non Sub Contact NO

Last Amended 27/10/2008
Position Last Amended
Position Last **Latitude =** **Longitude =**

Name
Type
Flag
Dimensions **Length =** **Beam =** **Draught =**
Tonnage
Cargo
Date Sunk

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

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

Markers
General Comments

Circumstances of Loss

Surveying Details
**HH550/412/03 12.2.03 WK 20.4MTRS IN 2213.406N, 11416.379E [WGD]. (HONG KONG NM 3/9/03). - NM 1324/03.
**14.10.08 SHOWN AS WK 21MTRS ON HONG KONG 2502 [AUG '08 EDN, LARGEST SCALE ADOPTION]. NE 4127.

Wreck Number 68779 **Classification** =
Unclassified
Symbol WK 20.5 **Largest Scale Chart** = 4127
Charting Comments
Old Number
Category Dangerous wreck

WGS84 Position **Latitude** = 22 13'.260 N **Longitude** = 114 19'.780 E
WGS84 Origin Original
Horizontal Datum WGD WGS (1984)

Position Method
Position Quality Precisely known
Position Accuracy
Area at Largest Scale No

Depth 20.5 metres
Drying Height
Height
General Depth 29 metres
Vertical Datum Approximate lowest astronomical tide
Depth Method
Depth Quality Depth known
Depth Accuracy
Conspic Visual NO **Conspic Radar** NO

Historic NO **Military** NO **Existence**
Doubtful NO
Non Sub Contact NO

Last Amended 23/11/2006
Position Last Amended
Position Last **Latitude** = **Longitude** =

Name
Type
Flag
Dimensions **Length** = **Beam** = **Draught** =
Tonnage
Cargo
Date Sunk

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

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

Markers
General Comments

Circumstances of Loss

Surveying Details
**HH550/434/01 23.11.06 WK 20.5MTRS IN 2213.26N, 11419.78E [WGD]. (HONG KONG, CHINA, NMS 20/25-26/06). - NM 5588/06.

Latitude = 22 12'.400 N **Longitude =** 114 26'.083 E [HKE] **Square Number =** 1113
State = DEAD

Wreck Number 46637 **Classification =** Unclassified
Symbol DW PA **Largest Scale Chart =** 937
Charting Comments

Old Number 111301622
Category Dangerous wreck

WGS84 Position **Latitude =** 22 12'.310 N **Longitude =** 114 26'.233 E
WGS84 Origin Block Shift
Horizontal Datum HKE HONG KONG (1980)

Position Method
Position Quality Approximate
Position Accuracy
Area at Largest Scale No

Depth
Drying Height
Height
General Depth 29 metres
Vertical Datum 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 02/03/2006
Position Last Amended 18/06/1992
Position Last **Latitude =** 22 12'.300 N **Longitude =** 114 26'.200 E
Name
Type
Flag
Dimensions **Length =** **Beam =** **Draught =**
Tonnage
Cargo
Date Sunk

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

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

Markers
General Comments

Circumstances of Loss

Surveying Details
**HH550/412/01 18.6.92 WK, DANGEROUS TO NAVIGATION, IN 221218N, 1142612E, APPROX. (PRC NM 52/92). [HKE] DATUM POSN: 221224N, 1142605E. - NM 1915/92.

POSITIONS BELOW THIS POINT ARE IN DEGREES, MINUTES AND DECIMALS OF A MINUTE
**HH550/434/01 2.3.06 NOT LOCATED DURING SURVEY CARRIED OUT IN 2004. (MARINE DEPT, HONG KONG E-MAIL DTD 2.3.06). DELETE. - NM 1666/06.

Latitude = 22 14'.833 N **Longitude =** 114 27'.000 E [UND] **Square Number =** 1113
State = DEAD

Wreck Number 46644 **Classification =** Unclassified
Symbol **Largest Scale Chart =** 937
Charting Comments POSN FOR FILING ONLY

Old Number 111301701
Category Undefined

WGS84 Position **Latitude =** 22 14'.833 N **Longitude =** 114 27'.000 E
WGS84 Origin Undefined
Horizontal Datum UND UNDETERMINED

Position Method
Position Quality Unreliable
Position Accuracy
Area at Largest Scale No

Depth
Drying Height
Height
General Depth 27 metres
Vertical Datum 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 20/01/2006
Position Last Amended
Position Last **Latitude =** **Longitude =**

Name
Type
Flag
Dimensions **Length =** **Beam =** **Draught =**
Tonnage
Cargo
Date Sunk

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

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

Markers
General Comments

Circumstances of Loss

Surveying Details
**3.9.80 WK PA SHOWN IN 221450N, 1142700E ON US 93036 [APR'80 EDN, 1:1M]. PLOTS IN 27MTRS. NCA.
**24.11.89 NOT SHOWN ON PRC CHARTS TO 1986.
**8.11.94 NOT SHOWN ON US 93036 [1993 EDN].

Latitude = 22 17'.000 N **Longitude =** 114 16'.000 E [HKD] **Square Number =** 1113
State = DEAD

Wreck Number 46674 **Classification =** Unclassified
Symbol **Largest Scale Chart =** 4117
Charting Comments POSN FOR FILING ONLY

Old Number 111302043
Category Wreck showing any portion of hull/superstructure

WGS84 Position **Latitude =** 22 16'.910 N **Longitude =** 114 16'.150 E
WGS84 Origin Block Shift
Horizontal Datum HKD HONG KONG (1963)

Position Method
Position Quality Unreliable
Position Accuracy
Area at Largest Scale No

Depth
Drying Height
Height
General Depth 2 metres
Vertical Datum 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 12/06/2000
Position Last Amended
Position Last **Latitude =** **Longitude =**

Name NEW ORIENT PRINCESS
Type RO RO M FERRY
Flag PANAMANIAN
Dimensions **Length =** 125.0 metres **Beam =** 19.5 metres **Draught =** 5.2 metres
Tonnage 4843 Gross
Cargo
Date Sunk 26/08/1993

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

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

Markers
General Comments

Circumstances of Loss
**CAUGHT FIRE WHILE PROCEEDING ON A 'GAMBLING EXCURSION'. WAS ABANDONED BY PASSENGERS AND MOST OF CREW AND WAS BEACHED TO PREVENT HER SINKING.

Surveying Details
**HH550/402/02 13.9.93 BEACHED ON SANDS OF FAT TONG CHAU (JUNK ISLAND) IN EASTERN APPROACHES TO VICTORIA HARBOUR, HONG KONG. HAS SLIGHT STARBOARD LIST. (LL 30.8.93, 2 & 6.9.93). NCA YET.
**5.8.94 APPROX SITE OF BEACHING OF WRECK NOW RECLAIMED. NE1917.

POSITIONS BELOW THIS POINT ARE IN DEGREES, MINUTES AND DECIMALS OF A MINUTE
**12.6.0 AMENDED TO DEAD. NCA.

Latitude = 22 13'.775 N **Longitude =** 114 22'.733 E [WGD] **Square Number =** 1113
State = DEAD

Wreck Number 46760 **Classification =** Unclassified
Symbol DW **Largest Scale Chart =** 4127
Charting Comments

Old Number 111302997
Category Dangerous wreck

WGS84 Position **Latitude =** 22 13'.775 N **Longitude =** 114 22'.733 E
WGS84 Origin Undefined
Horizontal Datum WGD WGS (1984)

Position Method
Position Quality Precisely known
Position Accuracy
Area at Largest Scale No

Depth
Drying Height
Height
General Depth 29 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 19/03/2001
Position Last Amended 12/09/1998
Position Last **Latitude =** 22 13'.858 N **Longitude =** 114 22'.583 E

Name TAI CHI NO.2
Type ?FISHING VESSEL
Flag MACAU
Dimensions **Length =** 35.7 metres **Beam =** 3.7 metres **Draught =**
Tonnage 234 Gross
Cargo
Date Sunk 20/05/1996

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

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

Markers
General Comments

Circumstances of Loss
**SANK, CAUSE UNKNOWN.

Surveying Details
**HH550/412/02 21.6.96 SANK IN 221351.5N, 1142235E. WILL BE SURVEYED. (HONG KONG MARINE DEPT, FAX DTD 19.6.96) INS AS DW. - NM 2440/96.
**HH550/412/02 10.4.97 DW IN 221345.6N, 1142241.8E. (CHINESE NM 1/3/97) NFA.
**12.9.98 WGD POSN: 221346N, 1142244E. NE 1917.

POSITIONS BELOW THIS POINT ARE IN DEGREES, MINUTES AND DECIMALS OF A MINUTE
**19.3.01 NOT SHOWN ON HONG KONG 2502 [DEC '00 EDN, SOURCE DATA DIAGRAM SHOWS AREA SURVEYED 1999-2000]. AMENDED TO DEAD. DELETE. BR STD.

Latitude = 22 16'.190 N **Longitude =** 114 15'.370 E [UND] **Square Number =** 1113
State = DEAD

Wreck Number 57736 **Classification =** Unclassified
Symbol OB **Largest Scale Chart =** 4117
Charting Comments
Old Number
Category Undefined

WGS84 Position **Latitude =** 22 16'.190 N **Longitude =** 114 15'.370 E
WGS84 Origin Undefined
Horizontal Datum UND UNDETERMINED

Position Method
Position Quality Precisely known
Position Accuracy
Area at Largest Scale No

Depth
Drying Height
Height
General Depth 14 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 04/10/1999
Position Last Amended
Position Last **Latitude =** **Longitude =**

Name
Type
Flag
Dimensions **Length =** **Beam =** **Draught =**
Tonnage
Cargo
Date Sunk

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

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

Markers
General Comments

Circumstances of Loss

Surveying Details
**HH550/402/05 17.9.99 OBSTN (NO DEPTH SPECIFIED) IN 2216.190N, 11415.370E [UND]. (CHINESE NM 16/190/99). BR STD.
**HH550/402/05 4.10.99 DELETED. (CHINESE NM 17/223/99). AMENDED TO DEAD. DELETE. BR STD.

Latitude = 22 17'.000 N **Longitude =** 114 16'.500 E [UND] **Square Number =** 1113
State = DEAD

Wreck Number 65704 **Classification =** Unclassified
Symbol ST **Largest Scale Chart =** 4117
Charting Comments
Old Number
Category Wreck showing any portion of hull/superstructure

WGS84 Position **Latitude =** 22 17'.000 N **Longitude =** 114 16'.500 E
WGS84 Origin Undefined
Horizontal Datum UND UNDETERMINED

Position Method
Position Quality
Position Accuracy
Area at Largest Scale No

Depth
Drying Height
Height
General Depth 11 metres
Vertical Datum 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 09/04/2005
Position Last Amended
Position Last **Latitude =** **Longitude =**

Name OLYMPIC DALE
Type STEAM TANKER
Flag
Dimensions **Length =** **Beam =** **Draught =**
Tonnage
Cargo
Date Sunk 19/09/1976

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

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

Markers

General Comments

Circumstances of Loss
**VESSEL WAS MOORED IN JUNK BAY UNDER GOING DEMOLITION WHICH COMMENCED AUG'76. BROKE MOORING IN TYPHOON IRIS IN SEP'76 AND GROUNDED DAMAGING A FISH FARM. OWNED BY FUJI MARDEN & CO LTD. (LLOYDS VOL. 225 & 228)
Surveying Details
**22.9.76 RAN AGROUND IN JUNK BAY. (LL, 21.9.76) NCA, POSN 221700N, 1141530E FOR FILING ONLY.

POSITIONS BELOW THIS POINT ARE IN DEGREES, MINUTES AND DECIMALS OF A MINUTE
**9.4.05 NOT SHOWN ON HONG KONG SURVEYS OF 2003-04. AMENDED TO DEAD.

Latitude = 22 16'.350 N **Longitude =** 114 15'.267 E [UND] **Square Number =** 1113
State = DEAD

Wreck Number 65706 **Classification =** Unclassified
Symbol OB 11.9 **Largest Scale Chart =** 4117
Charting Comments
Old Number
Category Undefined

WGS84 Position **Latitude =** 22 16'.350 N **Longitude =** 114 15'.267 E
WGS84 Origin Undefined
Horizontal Datum UND UNDETERMINED

Position Method
Position Quality
Position Accuracy
Area at Largest Scale No

Depth 11.9 metres
Drying Height
Height
General Depth 15 metres
Vertical Datum Approximate lowest astronomical tide
Depth Method
Depth Quality Depth known
Depth Accuracy
Conspic Visual NO **Conspic Radar** NO
Historic NO **Military** NO **Existence Doubtful** NO
Non Sub Contact NO

Last Amended 09/04/2005
Position Last Amended
Position Last **Latitude =** **Longitude =**

Name
Type OBSTRUCTION
Flag
Dimensions **Length =** **Beam =** **Draught =**
Tonnage
Cargo
Date Sunk

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

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

Markers
General Comments

Circumstances of Loss

Surveying Details
**7.5.53 OB 6FMS 3FT IN 221621N, 1141516E. (HYDRO) NE 3279.
**H1162/64 12.5.64 DELETE. (HMS DAMPIER, 1963) AMENDED TO DEAD. DELETE. BR STD.

Wreck Number 65708 **Classification** = Unclassified
Symbol WK 11.9 **Largest Scale Chart** = 4117
Charting Comments
Old Number
Category Dangerous wreck

WGS84 Position **Latitude** = 22 16'.083 N **Longitude** = 114 15'.433 E
WGS84 Origin Undefined
Horizontal Datum UND UNDETERMINED

Position Method
Position Quality
Position Accuracy
Area at Largest Scale No

Depth 11.9 metres
Drying Height
Height
General Depth 20 metres
Vertical Datum Approximate lowest astronomical tide
Depth Method
Depth Quality Depth known
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
Type
Flag
Dimensions **Length** = **Beam** = **Draught** =
Tonnage

Cargo
Date Sunk

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

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

Markers G CAN LT BUOY, GPFL(2)10S.
General Comments
Circumstances of Loss

Surveying Details
**H4197/62 28.7.69 WK 6FMS 3FT IN 221605N, 1141526E, MARKED BY G CAN LT BUOY, GPFL(2)10S. (HONG KONG TNM 17/69) NCA.
**3.10.83 NOT CHARTED. (AUTHORITY NOT STATED) AMENDED TO DEAD. NC 3279.

Latitude = 22 16'.167 N **Longitude** = 114 28'.833 E [UND] **Square Number** = 1113
State = DEAD

Wreck Number 67382 **Classification** = Unclassified
Symbol OB **Largest Scale Chart** = 4126
Charting Comments
Old Number
Category Undefined

WGS84 Position **Latitude** = 22 16'.167 N **Longitude** = 114 28'.833 E
WGS84 Origin Undefined
Horizontal Datum UND UNDETERMINED

Position Method
Position Quality Precisely known
Position Accuracy
Area at Largest Scale No

Depth
Drying Height
Height
General Depth 26 metres
Vertical Datum 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 20/01/2006
Position Last Amended
Position Last **Latitude =** **Longitude =**

Name
Type
Flag
Dimensions **Length =** **Beam =** **Draught =**
Tonnage
Cargo
Date Sunk

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

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

Markers
General Comments

Circumstances of Loss

Surveying Details
**HH1274/74 3.2.76 OBSTN SHOWN IN 2216.167N, 11428.833E [UND] ON CHINESE 0013. NE 937.
**14.9.89 NOT SHOWN ON NC 937.
**1.10.92 NO LONGER SHOWN ON CHINESE CHARTS. NOTED THAT AN EXPLOSIVES DUMPING GROUND EXISTS IN 2216.00N, 11428.00E, RADIUS 0.5 MILES, ON BA 937. AMENDED TO DEAD.

Latitude = 22 14'.317 N **Longitude =** 114 16'.100 E [UND] **Square Number =** 1113
State = DEAD

Wreck Number 72503 **Classification =** Unclassified
Symbol WK 10.0 **Largest Scale Chart =** 4127
Charting Comments
Old Number
Category Dangerous wreck

WGS84 Position **Latitude =** 22 14'.317 N **Longitude =** 114 16'.100 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 10.0 metres
Drying Height
Height
General Depth 22 metres
Vertical Datum Approximate lowest astronomical tide
Depth Method
Depth Quality Depth known
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 WING LIEN
Type CARGO VESSEL
Flag
Dimensions **Length =** **Beam =** **Draught =**
Tonnage
Cargo FOODSTUFFS & GENERAL
Date Sunk 05/04/1968

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

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

Markers G CAN LT BUOY, GPFL(2)10S CLOSE NE
General Comments
Circumstances of Loss

Surveying Details
**H809/53 22.5.68 DW IN 221420N, 1141602E, OR 043.5DEGS, 1720FT FROM TAI LONG PAI LT, MARKED BY G CAN LT BUOY, GPFL(2)10S, 049DEGS, 2400FT FROM TAI LONG PAI LT. (WP 984, 985 & HONG KONG TNM'S 18 & 20/68) - NM ACTION.
**H809/53 6.6.68 NOW WK 5FMS 3FT [10MTRS] IN 221419N, 1141606E, OR 054DEGS, 1950FT FROM TAI LONG PAI LT, WITH BUOY 061DEGS, 2650FT FROM LT. (HONG KONG, SIGNAL 6.6.68) - NM 909/68.
**H809/53 19.2.69 DELETE WK & BUOY. (HONG KONG NM 10/69) AMENDED TO DEAD. DELETE. - NM 439/69.

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 =**

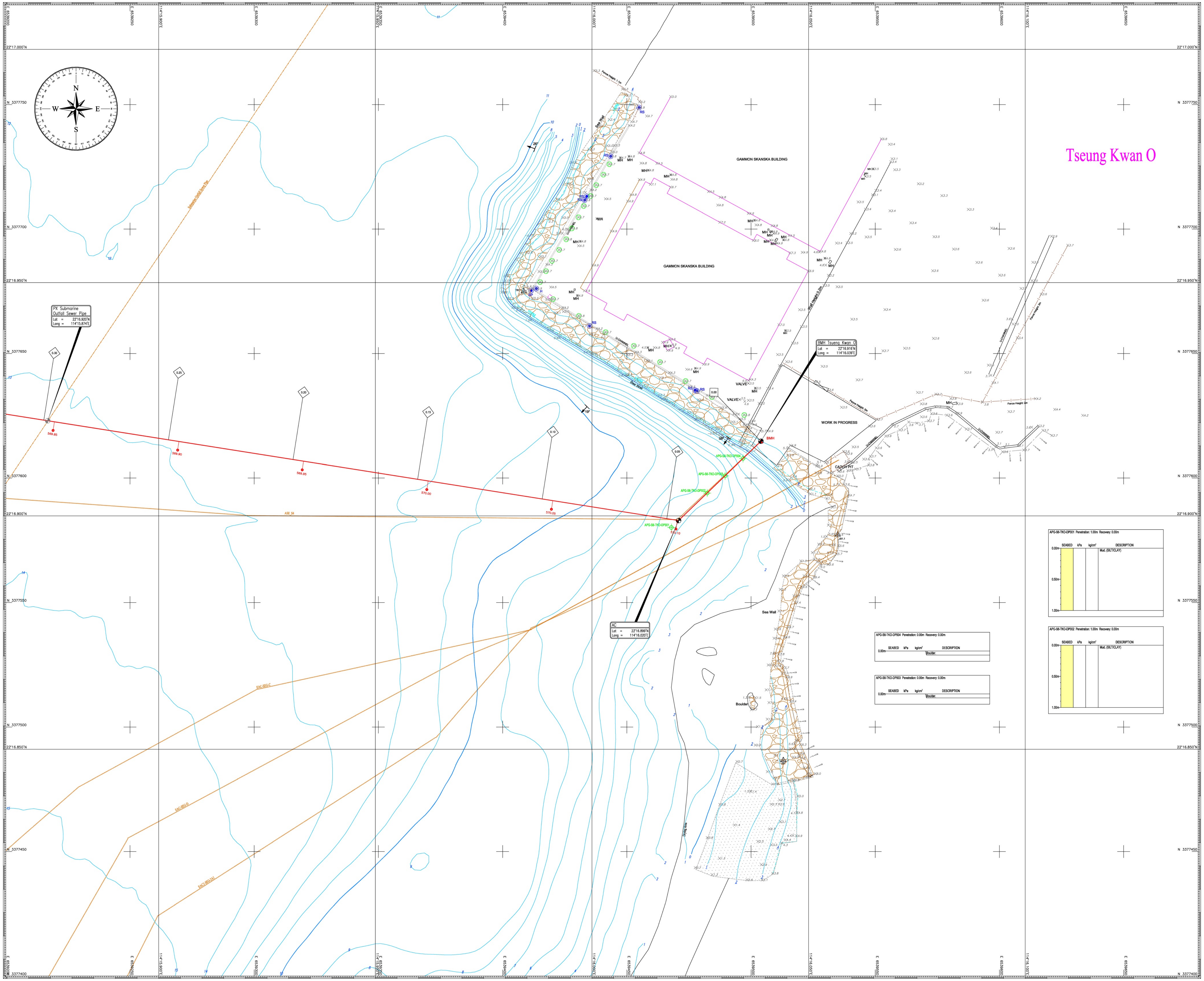
Markers
General Comments

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 附件 D3

Figures 圖



CARTOGRAPHIC SYMBOLS 製圖符號

TOPOGRAPHIC FEATURES 地形特質

CHART COMMENT: 圖表註解:

Cable and Pipelines 電纜及管道

Database in-service ASE Segment 4 shares the same route from the BHM to 22° 16.899' N, 114° 16.020' E (KP0.05).
As-found Submarine Outfall Sewer Pipe crosses at 22° 16.920' N, 114° 15.877' E (KP0.3) at an angle of 65° in 13m WD by magnetometer and sub-bottom profiler.

現有亞洲快線海底光纜系統(ASE)第4段以相同路線由沙灘沙井延伸至22° 16.899' N, 114°16.020 'E (KP0.05)
以磁力儀及海底分析器確認位置之海底污水排放管以角度65°橫跨22° 16.920' N, 114°15.877 'E (KP 0.3) 。

Hazards and Obstructions 危險及阻礙

The proposed BMH is located at 22°16.916'N, 114° 16.039'E at an elevation of 5.15m above LAT sharing the same BMH with the ASE Segment 4. The BMH is placed about 8m southeast from the wall of construction site on a rubber-mounted seawall. The ASE Segment 4 BMH is under construction during the survey period. The excavated trench over the rubble-mounted seawall was observed backfilled at the end of the landfall survey.
The proposed route leaves the BMH to the southwest and descends along the very steep (locally up to 18°) seawall entering sea. The proposed route turns to west at 22° 16.899' N, 114° 16.020' E (KP0.05) to better cross the Submarine Outfall Sewer Pipe. From the database information, the burial depth of the pipe is about <3m below seabed.
The proposed route runs in Hong Kong Water.

建議興建之沙灘沙井將位於22° 16.916' N, 114°16.039 'E 並高於最低天文潮面5.15米，亦將與亞洲快線海底光纜系統(ASE)第4段的沙灘沙井共同使用。該沙井大概位置將建築地盤邊界之東南方約8米,並將建築於毛石海堤之上。亞洲快線海底光纜系統(ASE)第4段的沙灘沙井於調查期間正在進行施工工作。在靠岸陸地調查完結時，已完成挖掘的海堤壕溝被回填了。
擬建路線位於香港水域於沙灘沙井的西南方向下發展(18°), 並沿著一個陡峭的海堤進入大海。擬建路線位於香港水域於22° 16.899' N, 114°16.020 'E (KP0.05)轉向西方發展以更有效地橫跨海底污水排放管。根據數據庫的資料，該管道的埋藏深度大概位於海床以下少於3米的位置。
擬建路線位於香港水域位於香港水域之內。

GENERAL NOTES: 一般注意事項:

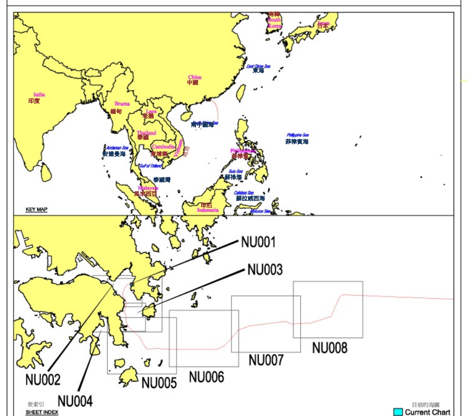
OFFSHORE SURVEY VESSEL 海洋調查船	--
Surface positioning system 表面定位系統	--
Underwater positioning system 水下定位系統	--
Bathymetry 水深	--
Morphology and stratigraphy 形態及地層	--
Magnetometer survey 磁力儀調查	--
INSHORE SURVEY VESSEL 近岸調查船	*MV Wing Hung 2 / MV Wing Hung 8*
Surface positioning system 表面定位系統	C-Nav GcGPS System
Underwater positioning system 水下定位系統	--
Bathymetry 水深	R2Sonic 2024 Multi-beam System, Knudsen 320M Echo Sounder
Morphology and stratigraphy 形態及地層	C-Boom Seismic Profiler, EdgeTech 272 Side Scan Sonar System
Magnetometer survey 磁力儀調查	SeaSPY Marine Magnetometer System

Descriptive Terms and Definitions: 描述性的條款及定義
The criteria used for interpretations and descriptions are presented in the survey results 解釋及描述的標準可見於調查結果
Multibeam Processing Parameters: Depths in metres, reduced to Lowest Astronomical Tide (LAT) 多波束處理參數: 深度以米為單位，並以最低天文潮面以下計算。
Predictions used from tide stations : Tide Gauge at Tung Lung Chau 潮汐測量站提供的預測應用

GEODETIC PARAMETERS:

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

Projection Parameters 投影參數
Projection : Mercator 投影
Longitude of Origin : 90°E 原點經度
Standard Parallel : 20°N 標準平行
Scale Factor : 1 比例因子
False Easting (m) : 4 000 000 橫座標偏移距離(米)
False Northing (m) : 1 000 000 縱座標偏移距離(米)



測量日期 Survey Date: Oct - Nov 2012

Scale : 比例尺: Scale 1:500

TRUE SCALE 1 : 492.40 (At Mid-Latitude of Chart) 真實比例尺 於海圖的中緯度

Contractor : 承辦商: NEC Corporation

Surveyor : 測量師: EGS (ASIA) LIMITED

EGS JOB NO.: HK228412

Project Name: 項目名稱:
APG Submarine Cable Systems
Hong Kong Landfall
APG 海底電纜系統 - 香港

Document Title: 文件標題:
NORTH UP CHART
SEGMENT 6
CHART NO. 001 OF 008
(KP 0.00 - KP 0.31)

Rev	Date	Prepared by	Checked by	Approved by
0	Jan 2013	K. F. Lai	C. T. Lau	S. P. Lau

Figure D3-1
圖D3-1

ROUTE BASED UPON: APG_RPL_S6(Issue-1.4)_17DEC12.xls 路線根據:
File Name: APG_S6_NU001 文件名稱:

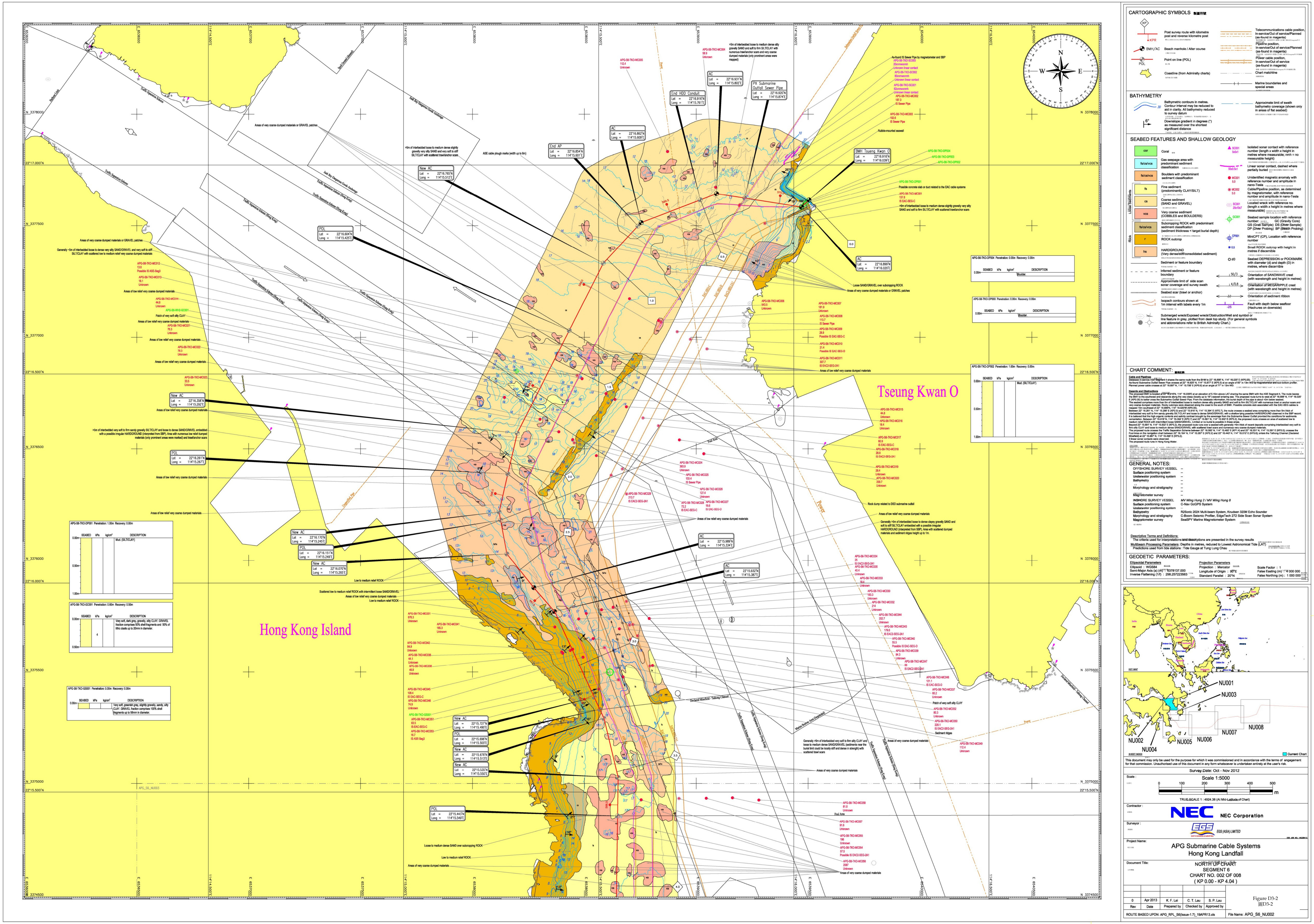
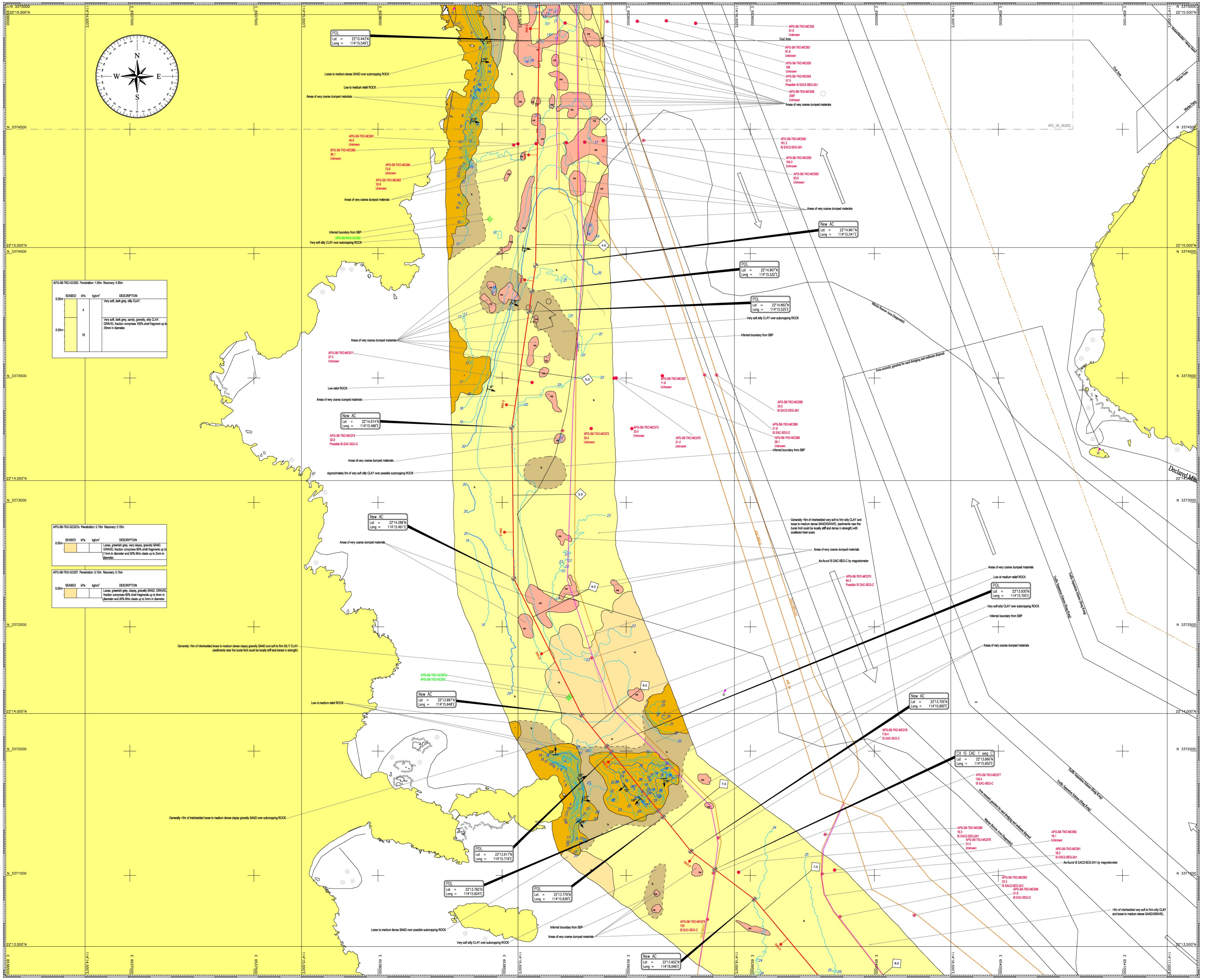


Figure D3-2
圖D3-2



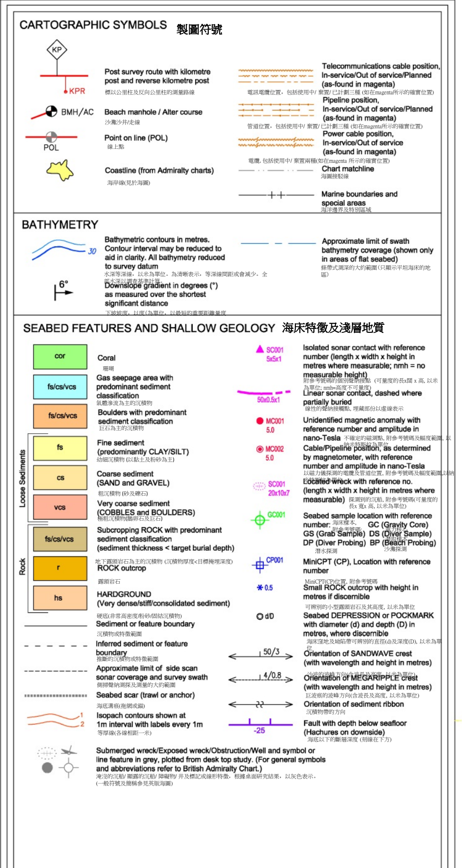


CHART COMMENT: 圖表註解:

Cable and Pipelines 電纜及管道

As-found in-service EAC-SEG-C crosses at 22° 13.658' N, 114° 15.954' E (KP7.2) at an angle of 59° in 24m WD by magnetometer. 位置確定的電纜於22° 13.653' N, 114°15.954 'E以角度 59°(在 24m WD)橫跨EAC seg.C。

Hazards and Obstructions 危險及阻礙

The proposed route runs over a seabed with generally >5m thick of recent deposits comprising interbedded very soft to firm silty CLAY and loose to medium dense SAND/GRAVEL with scattered trawl scars and numerous very coarse dumped materials. Wherever the thickness of the recent deposits is insufficient of 5m, the older Pleistocene stiffer and denser sediments would be encountered.

Two areas of subcropping ROCK, as observed from sub-bottom profiler, are inferred crossing the route from 22° 14.911' N, 114° 15.527' E (KP4.6) to 22° 14.860' N, 114° 15.529' E (KP4.7); and from 22° 14.548' N, 114° 15.537' E (KP5.3) to 22° 14.487' N, 114° 15.539' E (KP5.4). The proposed route continues running south across an area of low to medium relief ROCK from 22° 13.930' N, 114° 15.702' E (KP6.5) to 22° 13.773' N, 114° 15.796' E (KP6.8) off the Shek O headland. Very steep gradients were observed up to 16°. Appropriate slacking value and cable armor type should be adopted for the cable to be surface laid in this section. Caution should also be taken during installation in this area as leisure activities including canoeing and sailing are very common off Shek O.

The proposed route exits the Foul Area at 22° 15.443' N, 114° 15.512' E (KP3.6) and crosses a suspended Marine Borrow Area between 22° 14.473' N, 114° 15.539' E (KP5.4) and 22° 14.264' N, 114° 15.559' E (KP5.8).

The proposed route runs in Hong Kong Water.

建議路線所經過的海床大致上都是超過5米厚的新近沉澱物，其成份是由極鬆軟至結實的粉質黏土，以及由鬆散至中等密度的砂／礫所組成的夾層；當中有零星的拖網痕跡，以及大量十分粗糙的傾倒材料。在那些厚度少於5米的近期沉積物中，會有屬於早期更新世的較結實和密度較高的沉積物。

從淺層地底剖面儀所見，估計有兩處地下露頭的岩石，分別從 22° 14.9118' N, 114° 15.527' E (KP4.6) 至22° 14.860' N, 114° 15.529' E (KP4.7)；以及從22° 14.548' N, 114° 15.537' E (KP5.3) 至22° 14.487' N, 114° 15.539' E (KP5.4) 橫過建議的電纜鋪設路線。擬議路線繼續向南延伸，並在石澳岬角經過位於22° 13.930'N, 114° 15.702'E (KP6.5) 至22° 13.773'N, 114° 15.796'E (KP6.8)的地區，當中主要是高度介乎低至中的岩石。該區較為陡峭，坡度可達16°。在這區進行表面鋪設的電纜應該採用適當的鬆弛值和電纜保護層。鋪設電纜時應該小心，因為石澳附近經常有休閒活動，包括划艇及風帆等。

擬議電纜鋪設路線在22° 15.443' N, 114° 15.512' E (KP3.6) 的位置離開"禁止錨碇區"，並橫過位於22° 14.473' N, 114° 15.539' E (KP5.4) 至22° 14.264' N, 114° 15.559' E (KP5.8) 已暫停使用的海洋取土區。

這條擬議路線位於香港水域內。

GENERAL NOTES: 一般注意事項:

OFFSHORE SURVEY VESSEL 海洋調查船	--
Surface positioning system 表面定位系統	--
Underwater positioning system 水下定位系統	--
Bathymetry 水深	--
Morphology and stratigraphy 形態及地層	--
Magnetometer survey 磁力儀調查	--
INSHORE SURVEY VESSEL 近岸調查船	MV Wing Hung 2 / MV Wing Hung 8
Surface positioning system 表面定位系統	C-Nav GcGPS System
Underwater positioning system 水下定位系統	--
Bathymetry 水深	R2Sonic 2024 Multi-beam System, Knudsen 320M Echo Sounder
Morphology and stratigraphy 形態及地層	C-Boom Seismic Profiler, EdgeTech 272 Side Scan Sonar System
Magnetometer survey 磁力儀調查	SeaSPY Marine Magnetometer System

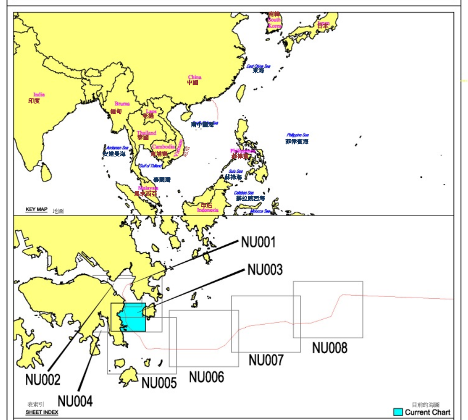
Descriptive Terms and Definitions: 描述性的條款及定義
The criteria used for interpretations and descriptions are presented in the survey results 解釋及描述的標準可見於調查結果

Multibeam Processing Parameters: Depths in metres, reduced to Lowest Astronomical Tide (LAT) 多波束處理參數: 深度以米為單位，並以最低天文潮面以下計算。
Predictions used from tide stations : Tide Gauge at Tung Lung Chau 潮汐測量站提供的預測應用

GEODETIC PARAMETERS:

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

Projection Parameters 投影參數
Projection : Mercator 投影
Longitude of Origin : 90°E 原點經度
Standard Parallel : 20°N 標準平行
Scale Factor : 1 比例因子
False Easting (m) : 4 000 000 橫座標偏移距離(米)
False Northing (m) : 1 000 000 縱座標偏移距離(米)



測量日期 Survey Date: Oct - Nov 2012

Scale : 比例尺: Scale 1:5000

0 100 200 300 400 500 m

TRUE SCALE 1 : 4925.44 (At Mid-Latitude of Chart) 真實比例尺 於海圖的中緯度

Contractor : 承辦商: NEC Corporation

Surveyor : 測量師: EGS (ASIA) LIMITED

EGS JOB NO.: HK228412

Project Name: 項目名稱:

APG Submarine Cable Systems Hong Kong Landfall

APG 海底電纜系統 - 香港

Document Title: 文件標題:

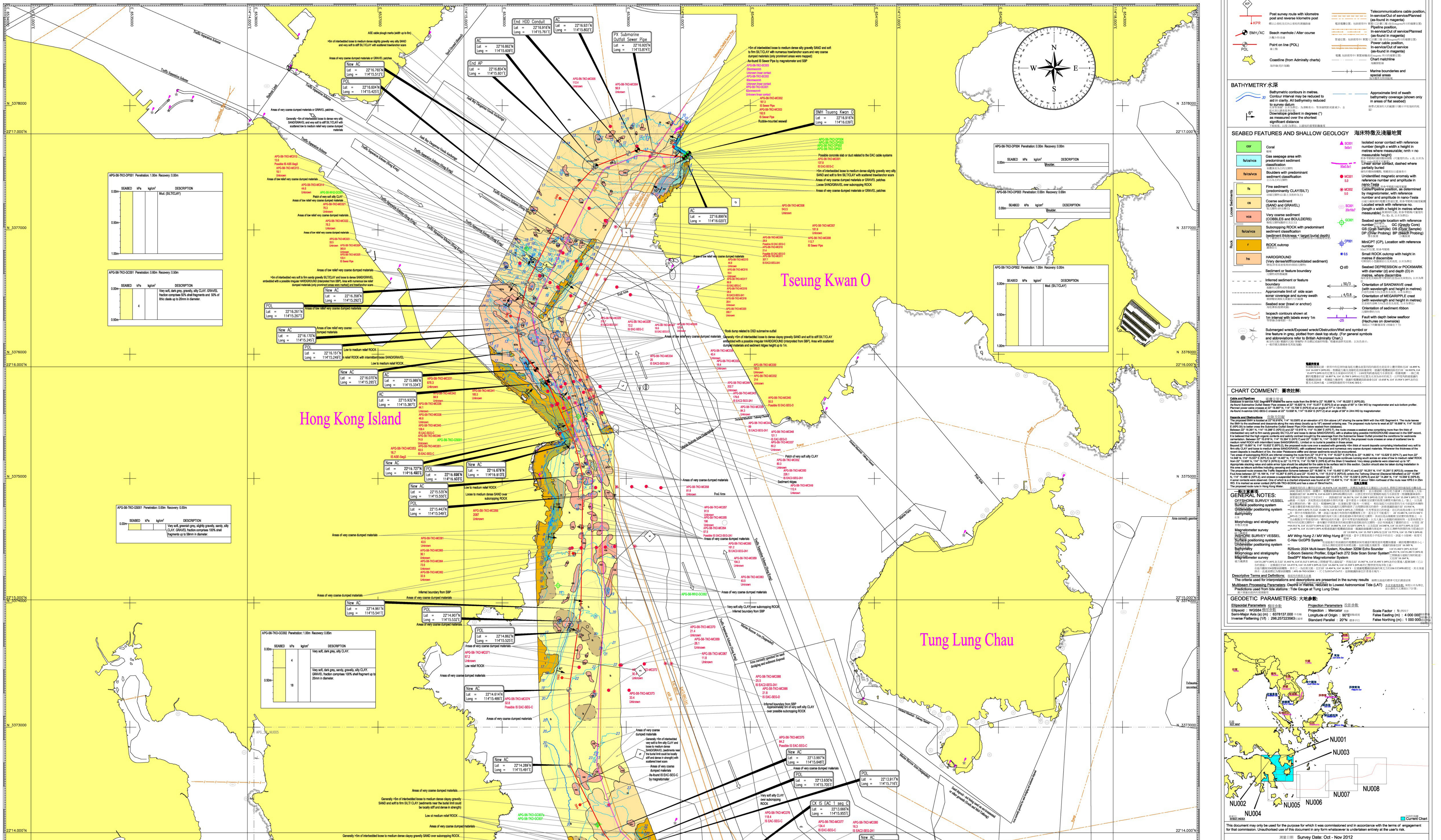
NORTH UP CHART SEGMENT 6 CHART NO. 003 OF 008 (KP 3.56 - KP 7.83)

Rev	Date	Prepared by	Checked by	Approved by
0	Apr 2013	K. F. Lai	C. T. Lau	S. P. Lau

Figure D3-3
圖D3-3

ROUTE BASED UPON: APG_RPL_S6(Issue-1.7)_19APR13.xls 路線根據:

File Name: APG_S6_NU003 文件名稱:



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測量日期 Survey Date: Oct - Nov 2012

Scale: 比例尺: 比例尺 Scale 1:10,000

TRUE SCALE 1 : 9849.72 (At Mid-Latitude of Chart)

Contractor: 承辦商: NEC Corporation

Surveyor: 測量師: EGS (ASIA) LIMITED

Project Name: 項目名稱: APG Submarine Cable Systems Hong Kong Landfall

APG 海底電纜系統 - 香港

Document Title: 文件標題: NORTH UP CHART SEGMENT 6 CHART NO. 004 OF 008 (KP 0.00 - KP 7.96)

Rev	Date	Prepared by	Checked by	Approved by
0	Apr 2013	K. F. Lai	C. T. Lau	S. P. Lau

路線根據: ROUTE BASED UPON: APG_RPL_S6(Issue-1.7)_19APR13.xls

文件名稱: File Name: APG_S6_NU004

Figure D3-4
圖D3-4

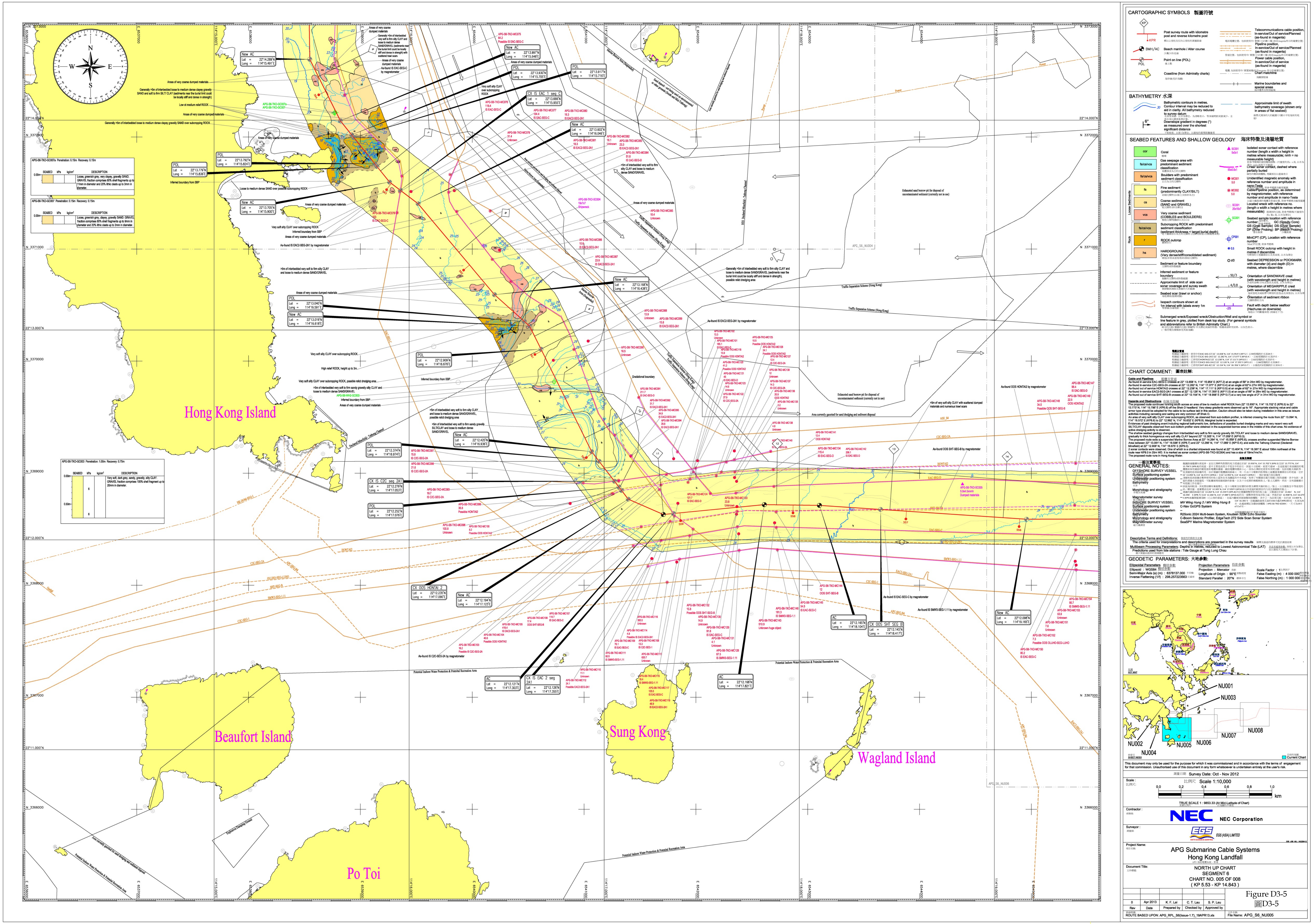
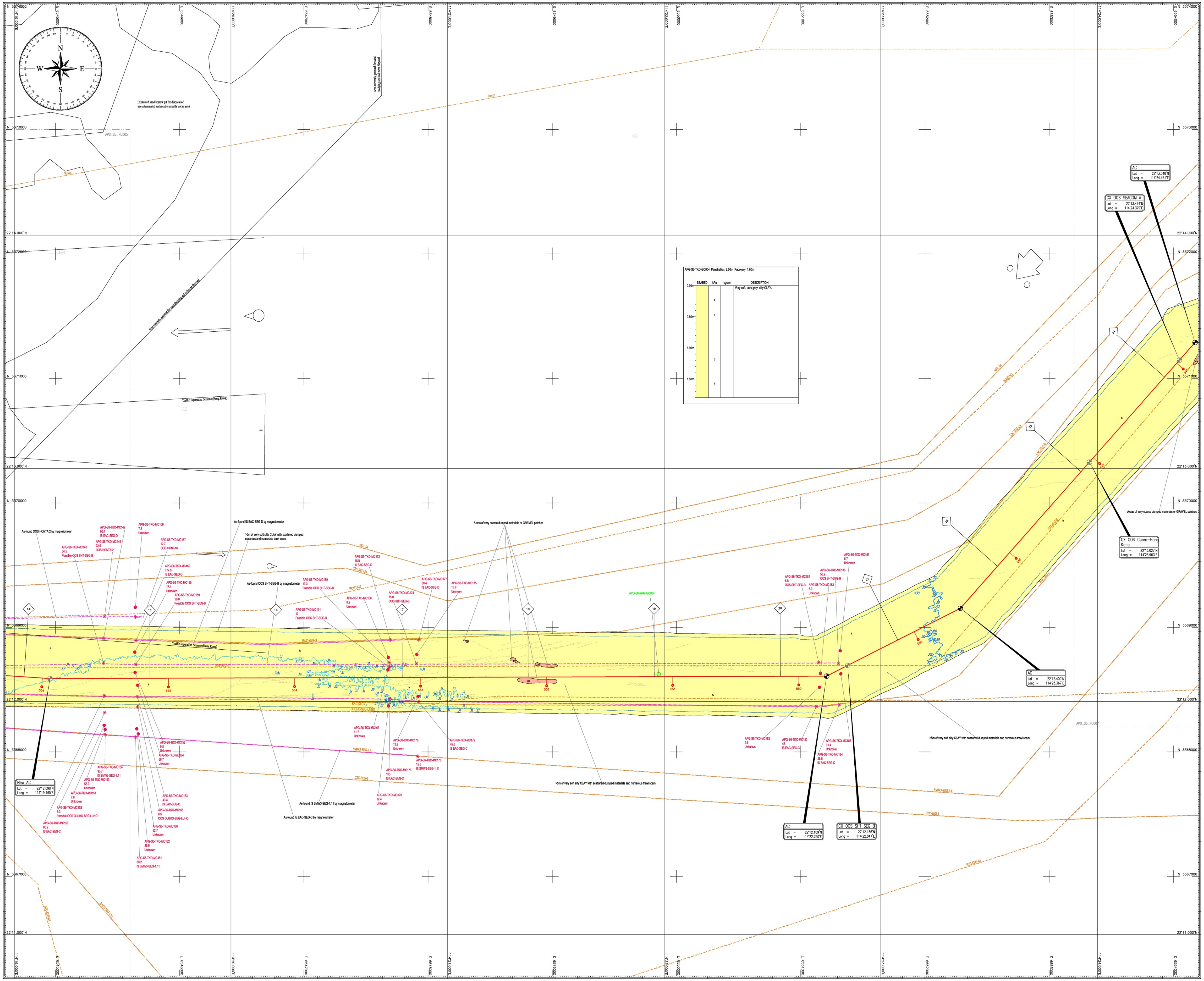


Figure D3-5
圖D3-5



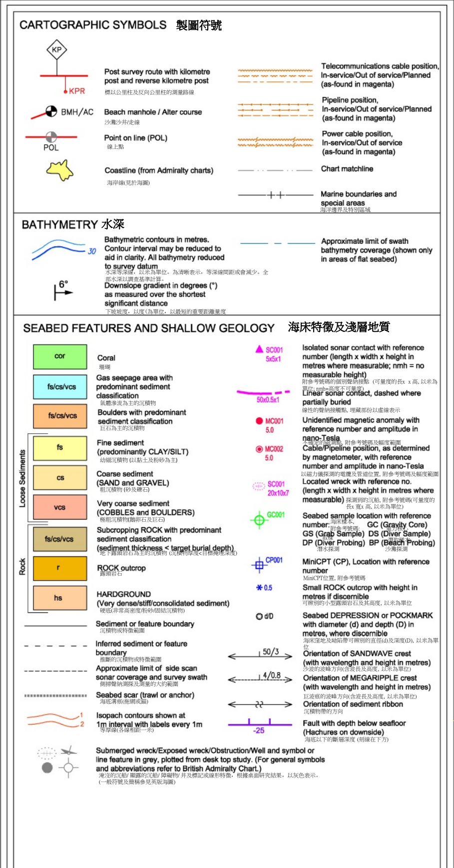


CHART COMMENT: 圖表註解:

Cable and Pipelines 電纜及管道

Database out of service SHT-SEG-B crosses twice at:

- 22° 12.146' N, 114° 19.647' E (KP14.9) at a very low angle of 1° in 31m WD;
- 22° 12.154' N, 114° 22.847' E (KP20.4) at an angle of 27° in 30m WD.

根據數據庫：已停止使用的SHT-SEG-B在兩個位置橫過擬議電纜鋪設路線：
- 於22° 12.146' N, 114° 19.647'E (KP14.9) 的位置，在水深為31米的地方，以十分低的1° 的角度橫過；
- 於22° 12.154' N, 114° 22.847' E (KP20.4) 的位置，在水深為30米的地方，以27° 的角度橫過。

Hazards and Obstructions 危險及阻礙

The route then rides along the out of service SHT-SEG-B cable and makes several crossings with it between KP11 and KP20. The route then turns to northeast running at 22° 12.109' N, 114° 22.750' E (KP20.2).
The shallow seabed geology comprises very thick (>5m) homogenous very soft silty CLAY with scattered dump materials and numerous trawl scars throughout this area. The seabed is generally flat with low variation.
Target burial is achievable.
The proposed route runs in Hong Kong Water.

然後，擬議鋪設路線與已停用的SHT-SEG-B電纜並排，且於KP11及KP20之間多次橫跨該電纜。其後，該條路線在22° 12.109' N, 114° 22.750' E (KP20.2) 的位置轉向東北面伸延。
該區的海床較淺，其地質結構是極厚 (>5m) 的同質且非常柔軟的粉質粘土、零星的傾倒物料及大量拖網痕跡。該區的海床比較平坦，地形變化很少。
掩埋目標是可行的。
這條擬議路線位於香港水域內。

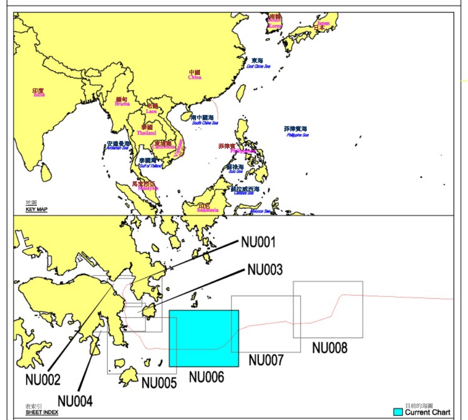
GENERAL NOTES: 一般注意事項:

OFFSHORE SURVEY VESSEL 海洋調查船	--
Surface positioning system 表面定位系統	--
Underwater positioning system 水下定位系統	--
Bathymetry 水深	--
	--
Morphology and stratigraphy 形態及地層	--
	--
Magnetometer survey 磁力儀調查	--
INSHORE SURVEY VESSEL 近岸調查船	*MV Wing Hung 2 / MV Wing Hung 8*
Surface positioning system 表面定位系統	C-Nav GcGPS System
Underwater positioning system 水下定位系統	--
Bathymetry 水深	R2Sonic 2024 Multi-beam System, Knudsen 320M Echo Sounder
Morphology and stratigraphy 形態及地層	C-Boom Seismic Profiler, EdgeTech 272 Side Scan Sonar System
Magnetometer survey 磁力儀調查	SeaSPY Marine Magnetometer System

Descriptive Terms and Definitions: 描述性的條款及定義
The criteria used for interpretations and descriptions are presented in the survey results 解釋及描述的標準可見於調查結果
Multibeam Processing Parameters: Depths in metres, reduced to Lowest Astronomical Tide (LAT) 多波束處理參數: 深度以米為單位，並以最低天文潮面以下計算。
Predictions used from tide stations : Tide Gauge at Tung Lung Chau 潮汐測量站提供的預測應用

GEODETIC PARAMETERS: 大地參數:

Ellipsoidal Parameters 橢球參數	Projection Parameters 投影參數	
Ellipsoid : WGS84 橢球參數	Projection : Mercator 投影	Scale Factor : 1 比例因子
Semi-Major Axis (a) (m) : 6378137.000 半長軸	Longitude of Origin : 90°E 原點經度	False Easting (m) : 4 000 000 橫座標偏移距離(米)
Inverse Flattening (1/f) : 298.257223563 反扁率	Standard Parallel : 20°N 標準平行	False Northing (m) : 1 000 000



測量日期 Survey Date: Oct - Nov 2012

Scale : 比例尺: 比例尺 Scale 1:10,000

0.0 0.2 0.4 0.6 0.8 1.0 km

TRUE SCALE 1 : 9852.71 (At Mid-Latitude of Chart) 真實比例尺 於海圖的中緯度

Contractor : 承辦商: NEC Corporation

Surveyor : 測量師: EGS (ASIA) LIMITED

EGS JOB NO.: HK228412

Project Name: 項目名稱:

APG Submarine Cable Systems
Hong Kong Landfall
APG 海底電纜系統 - 香港

Document Title: 文件標題:

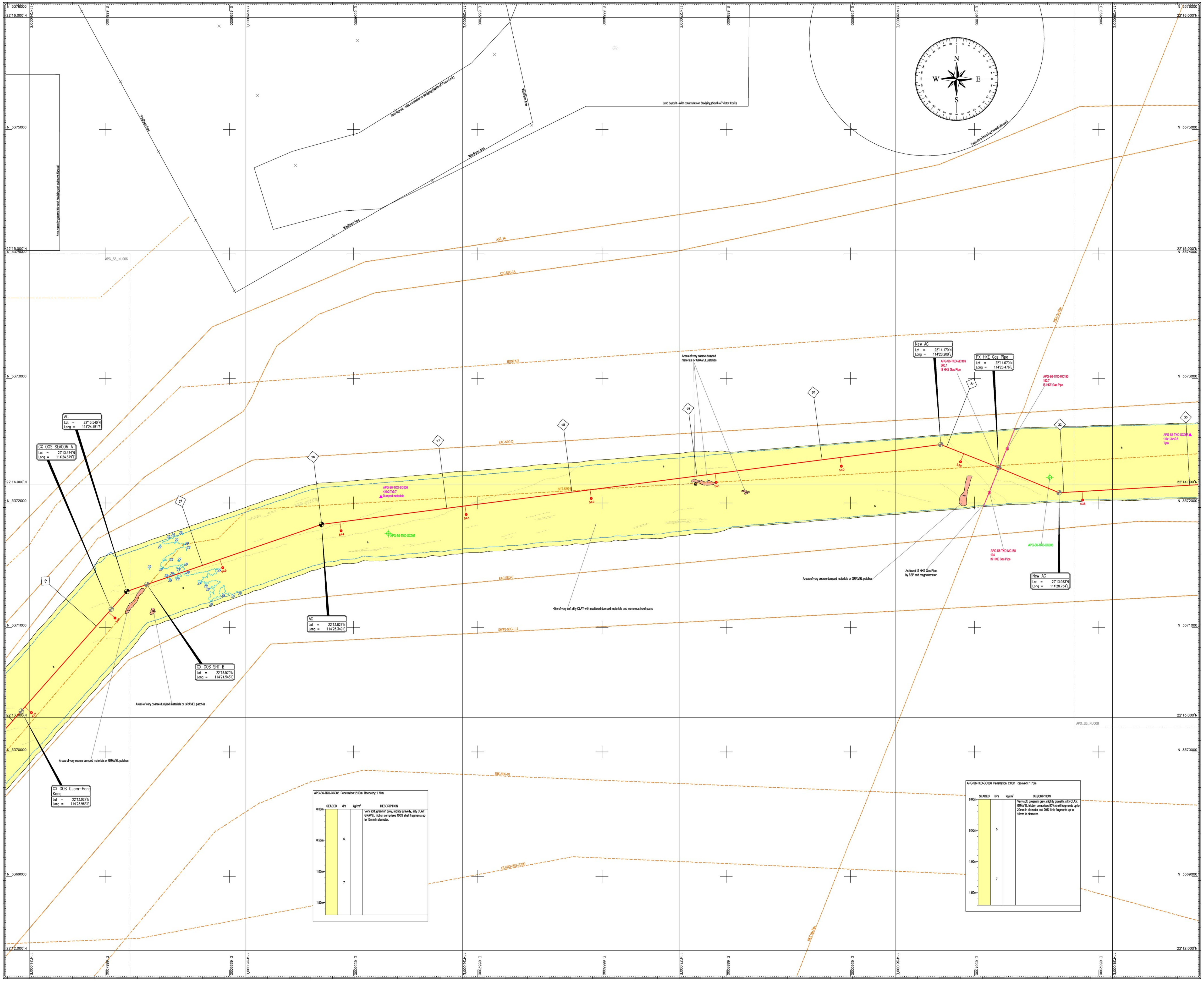
NORTH UP CHART
SEGMENT 6
CHART NO. 006 OF 008
(KP 13.86 - KP 24.39)

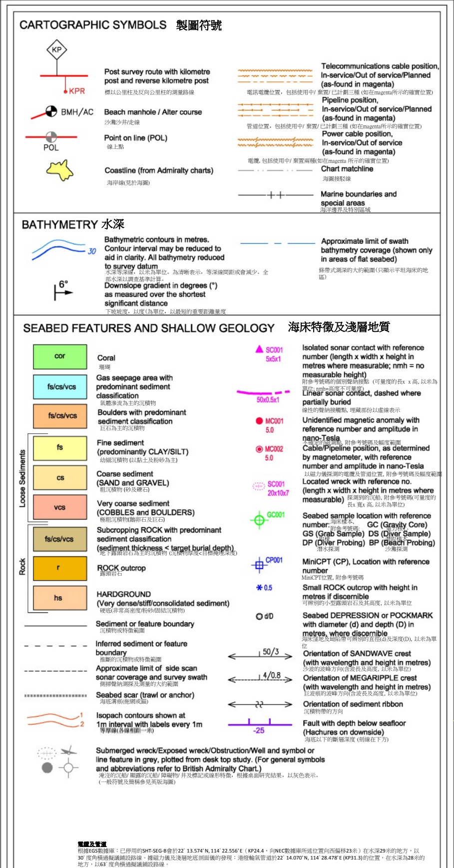
Rev	Date	Prepared by	Checked by	Approved by
0	Apr 2013	K. F. Lai	C. T. Lau	S. P. Lau

Figure D3-6
圖D3-6

路線根據: ROUTE BASED UPON: APG_RPL_S6(Issue-1.7)_19APR13.xls

文件名稱: File Name: APG_S6_NU006





電纜及管道
根據EGS數據庫：已停用的SHT-SEG-B會於22° 13.574' N, 114° 22.556' E（KP24.4，向NEC數據庫所述位置向西偏移23米）在水深29米的地方，以30° 度角橫過擬議鋪設路線。據磁力儀及淺層地底剖面儀的發現：港燈輸氣管道於22° 14.070' N, 114° 28.478' E (KP31.3)的位置，在水深為28米的地方，以63° 度角橫過擬議鋪設路線。

CHART COMMENT: 圖表註解:

Cable and Pipelines 電纜及管道

EGS database out of service SHT-SEG-B crosses at 22° 13.574' N, 114° 24.556' E (KP24.4, offset 23m to the west of the NEC database position) at an angle of 30° in 29m WD.
As-found HKE Gas Pipe crosses at 22° 14.070' N, 114° 28.478' E (KP31.3) at an angle 63° in 28m WD by magnetometer and sub-bottom profiler.

Hazards and Obstructions 危險及阻礙

The route then turns to east northeast running at 22° 13.827' N, 114° 25.349' E (KP25.9) and crosses the HKE Gas pipe. The exact burial depth of at the crossing location is difficult to be resolved in the boomer record. An estimation of 2-4m burial depth of the pipe was made.
The shallow seabed geology comprises very thick (>5m) homogenous very soft silty CLAY with scattered dump materials and numerous trawl scars throughout this area. The seabed is generally flat with low variation.
2 sonar contacts were observed.
Target burial is achievable.
The proposed route runs in Hong Kong Water.

建議之路線於22° 13.827' N, 114° 25.349' E (KP25.9) 轉向東北偏東伸延，並橫跨港燈輸氣管道。該管道在該位置的精確掩埋深度難以透過地震剖面儀的記錄確定，估計約為2-4米。
該區海床較淺，其地質結構是極厚的 (>5m) 同質且非常柔軟的粉質粘土，以及遍佈全區的零星傾倒物料和大量拖網痕跡。海床比較平坦，地形變化較少。
區內有2個聲納接觸點。
掩埋目標是可行的。
這條擬議路線位於香港水域內。

GENERAL NOTES: 一般注意事項:

OFFSHORE SURVEY VESSEL 海洋調查船	--
Surface positioning system 表面定位系統	--
Underwater positioning system 水下定位系統	--
Bathymetry 水深	--
Morphology and stratigraphy 形態及地層	--
Magnetometer survey 磁力儀調查	--
INSHORE SURVEY VESSEL 近岸調查船	*MV Wing Hung 2 / MV Wing Hung 8*
Surface positioning system 表面定位系統	C-Nav GcGPS System
Underwater positioning system 水下定位系統	--
Bathymetry 水深	R2Sonic 2024 Multi-beam System, Knudsen 320M Echo Sounder
Morphology and stratigraphy 形態及地層	C-Boom Seismic Profiler, EdgeTech 272 Side Scan Sonar System
Magnetometer survey 磁力儀調查	SeaSPY Marine Magnetometer System

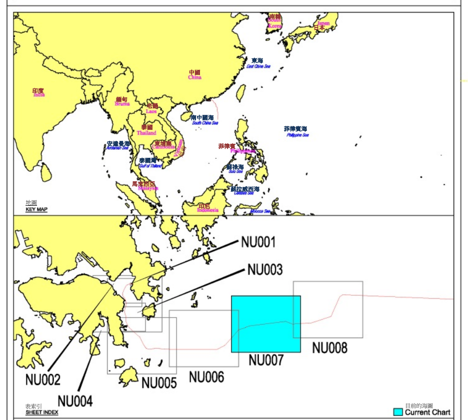
Descriptive Terms and Definitions: 描述性的條款及定義
The criteria used for interpretations and descriptions are presented in the survey results 解釋及描述的標準可見於調查結果
Multibeam Processing Parameters: Depths in metres, reduced to Lowest Astronomical Tide (LAT) 多波束處理參數: 深度以米為單位，並以最低天文潮面以下計算。
Predictions used from tide stations : Tide Gauge at Tung Lung Chau 潮汐測量站提供的預測應用

GEODETIC PARAMETERS: 大地參數:

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

Projection Parameters 投影參數
Projection : Mercator 投影
Longitude of Origin : 90°E 原點經度
Standard Parallel : 20°N 標準平行

Scale Factor : 1 比例因子
False Easting (m) : 4 000 000 橫座標偏移距離(米)
False Northing (m) : 1 000 000 縱座標偏移距離(米)



測量日期 Survey Date: Oct - Nov 2012

Scale : 比例尺: 比例尺 Scale 1:10,000

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TRUE SCALE 1 : 9851.46 (At Mid-Latitude of Chart) 真實比例尺 於海圖的中緯度

Contractor : 承辦商: NEC Corporation

Surveyor : 測量師: EGS (ASIA) LIMITED

EGS JOB NO.: HK228412

Project Name: 項目名稱:
APG Submarine Cable Systems
Hong Kong Landfall
APG 海底電纜系統 - 香港

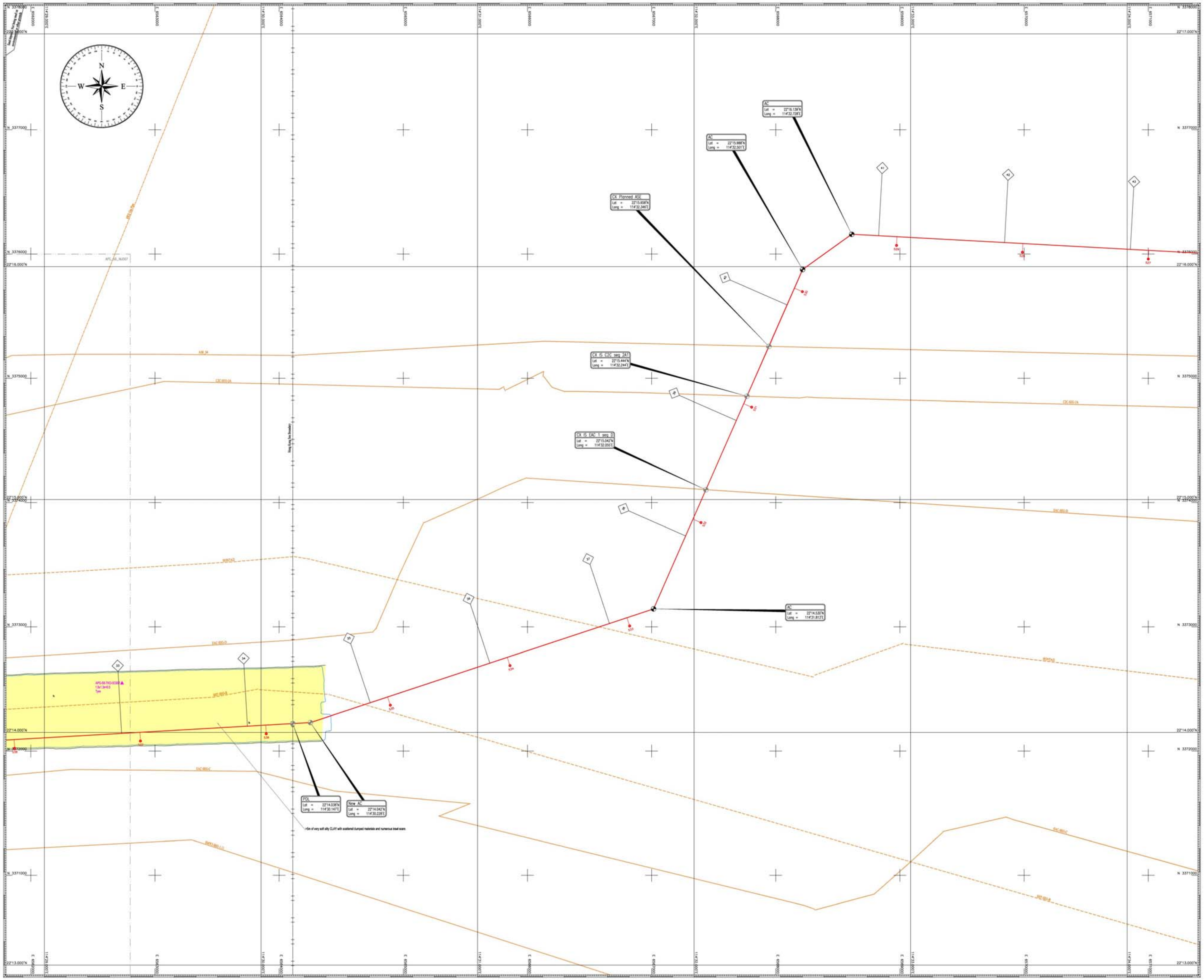
Document Title: 文件標題:
NORTH UP CHART
SEGMENT 6
CHART NO. 007 OF 008
(KP 22.92 - KP 33.06)

Rev	Date	Prepared by	Checked by	Approved by
0	Apr 2013	K. F. Lai	C. T. Lau	S. P. Lau

Figure D3-7
圖D3-7

路線根據: ROUTE BASED UPON: APG_RPL_S6(Issue-1.7)_19APR13.xls

文件名稱: File Name: APG_S6_NU007



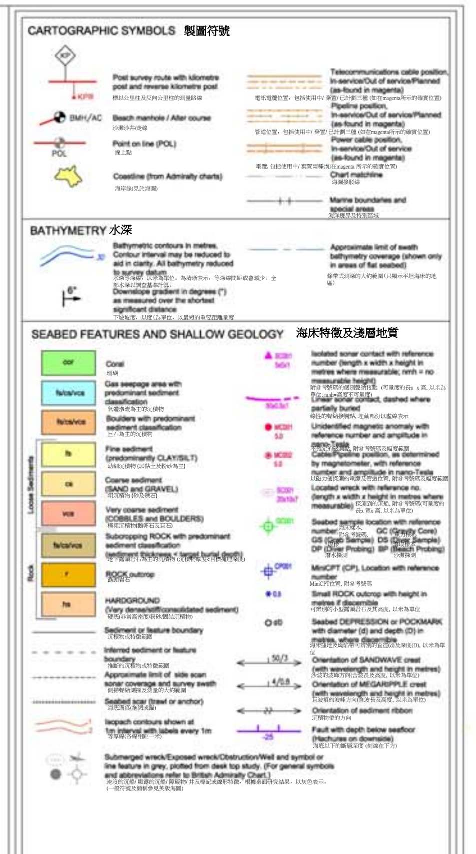


CHART COMMENT: 圖表註解:

Cable and Pipelines 電纜及管道
Nil.
無。

Hazards and Obstructions 危險及阻礙
The shallow seabed geology comprises very thick (>5m) homogenous very soft silty CLAY with scattered dump materials and numerous trawl scars throughout this area. The seabed is generally flat with low variation.
1 sonar contact was observed.
Target burial is achievable.
The route exit Hong Kong SAR Sea Boundary at 22 °14.120 ' N, 114 °30.147' E (KP34.1).
該區域淺層海床地質具有極厚的(>5m)同質且非常柔軟的粉質粘土、零落的傾倒物料及大量拖網痕跡。海床比較平坦，坡度均勻。
觀察到1個聲納接觸器。
掩埋目標是可行的。
路線於22°14.120'N, 114°30.147'E (KP34.1)離開香港水域。

GENERAL NOTES: 一般注意事項:

OFFSHORE SURVEY VESSEL 海洋調查船	–
Surface positioning system 表面定位系統	–
Underwater positioning system 水下定位系統	–
Bathymetry 水深	–
Morphology and stratigraphy 形態及地層	–
Magnetometer survey 磁力儀調查	–
INSHORE SURVEY VESSEL 近岸調查船	MV Wing Hung 2 / MV Wing Hung 8
Surface positioning system 表面定位系統	C-Nav GcGPS System
Underwater positioning system 水下定位系統	–
Bathymetry 水深	R2Sonic 2024 Multi-beam System, Knudsen 320M Echo Sounder
Morphology and stratigraphy 形態及地層	C-Boom Seismic Profiler, EdgeTech 272 Side Scan Sonar System
Magnetometer survey 磁力儀調查	SeaSPY Marine Magnetometer System

Descriptive Terms and Definitions: 描述性的條款及定義
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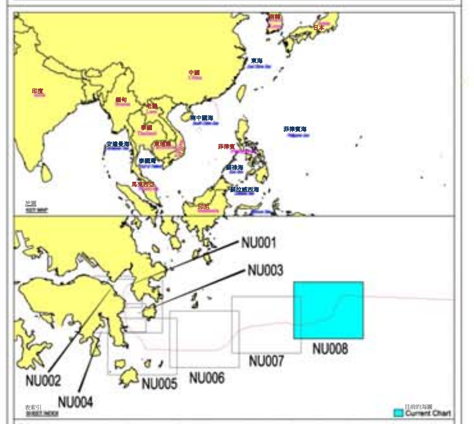

測量日期 Survey Date: Oct - Nov 2012

Scale: 比例尺: 比例尺 Scale 1:10,000
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TRUE SCALE 1 : 9850.22 (At Mid-Latitude of Chart)
真實比例尺 於海圖的中緯度

Contractor: 承辦商: NEC Corporation

Surveyor: 測量師: EGS (ASIA) LIMITED

Project Name: 項目名稱:
APG Submarine Cable Systems
Hong Kong Landfall
APG 海底電纜系統 - 香港

Document Title: 文件標題:
NORTH UP CHART
SEGMENT 6
CHART NO. 008 OF 008
(KP 32.09 - KP 43.53)

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0	Apr 2013	K. F. Lai	C. T. Lau	S. P. Lau

Figure D3-8
圖D3-8

路線根據: ROUTE BASED UPON: APG_RPL_S6(Issue-1.7)_19APR13.xls
文件名稱: File Name: APG_S6_NU008

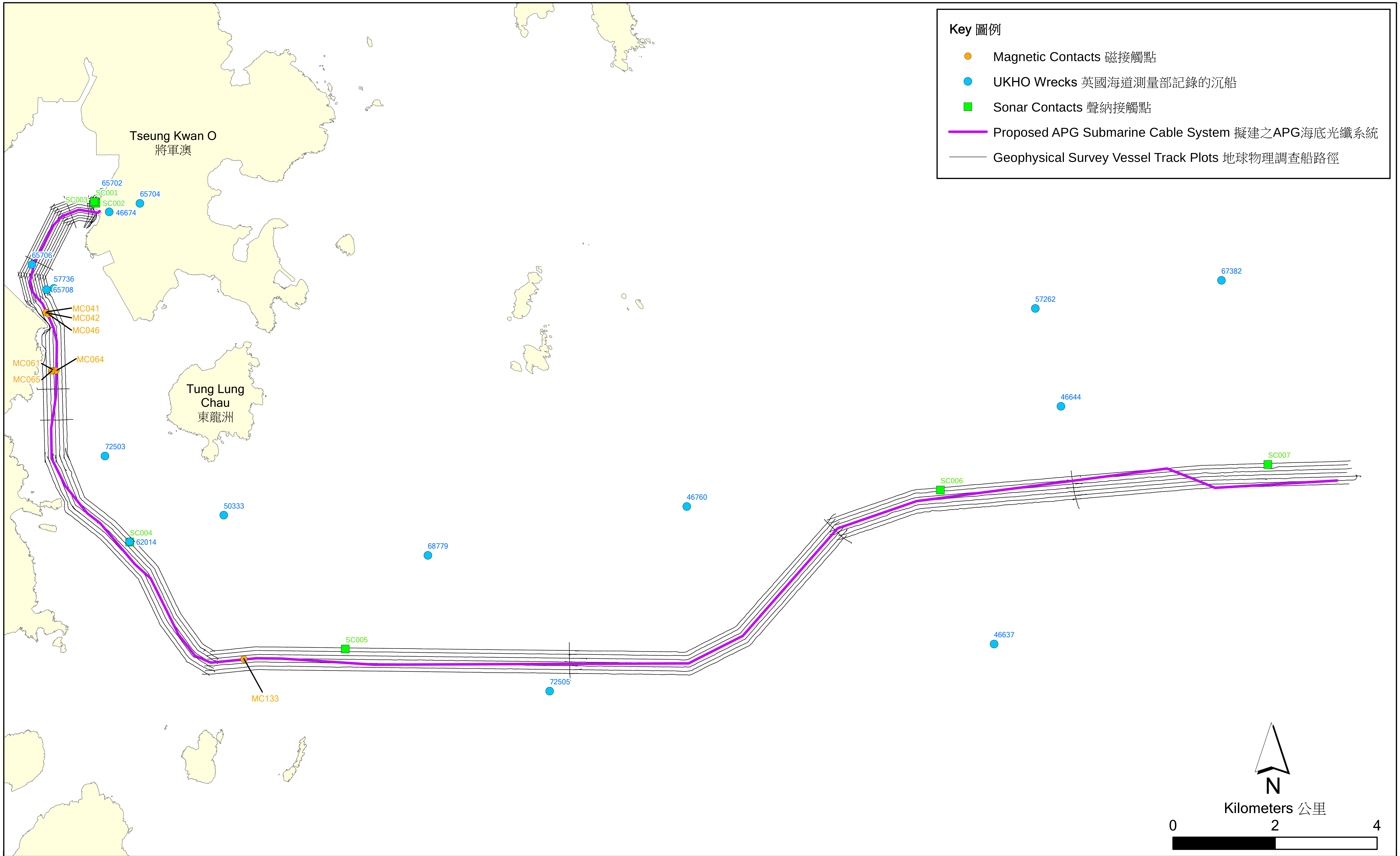

Figure D4.1
圖 D4.1

The Asia Pacific Gateway Cable System with Geophysical Survey Tracks and Contacts
APG 光纖系統及地球物理調查路徑和調查接觸異常點

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Date: 28/8/2013

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Annex E

Environmental Monitoring & Audit

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E1 EM&A MEASURES

This Environmental Monitoring and Audit *Annex E* has been prepared to:

- verify whether the monitoring results are in line with the predicted impact;
- monitor the effectiveness of the control measures employed during the cable laying works;
- verify that the project works are not resulting in any impacts to water quality, especially at water sensitive receivers;
- ensure that any adverse impacts are detected during the cable laying process 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 installation works; and,
- carry out coral monitoring works at Impact stations (Cape Collinson and Tai Long Pai) which are in the vicinity of the cable alignment and at a Control station (Tung Lung Chau) to ensure corals (ie hard corals, octocorals and black corals) will not be affected by the cable laying works as well as confirming the effectiveness of the precautionary measure (provision of silt curtain).

E2 WATER QUALITY MONITORING

Potential impacts on water quality associated with the construction of the Project have been identified and mitigation measures recommended to include 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.

E2.1 SAMPLING AND TESTING METHODOLOGY

E2.1.1 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 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.

E2.1.2 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.

E2.1.3 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.

E2.1.4 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 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 two (2) days of the sampling event (48 hours). 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.

E2.2 MONITORING LOCATIONS

The monitoring station locations have been established to identify potential impacts to water and ecological sensitive receivers.

Prior to, during, and after the installation of the cable, water quality sampling will be undertaken at stations situated around the cable laying works at Junk Bay and near Tung Lung Chau and Tai Long Pai. The monitoring at those stations is to ensure the construction works of the Project do not affect the sensitive area nearby (shown in *Figure E1*).

- B1 is an Impact Station to monitor the impacts of cable installation works on the Big Wave Bay Beach;
- B2 is an Impact Station to monitor the impacts of cable installation works on the Rocky Bay Beach;
- B3 is an Impact Station to monitor the impacts of cable installation works on the Shek O Beach;

- E1 is an Impact Station to monitor impacts of cable installation works on Cape d'Aguilar Marine Reserve;
- E2 is an Impact Station to monitor the impacts of cable installation works on the coral communities at Tung Lung Chau;
- (There is no Impact Station E3 as E3 represents coral communities along the coast of Ninepins, over 5 km from the cable installation works, and will not be affected by the Project due to the distance)
- E4 is the Impact Station to monitor the impacts of cable installation works on the coral communities at the coast of Sung Kong;
- E5 is the Impact Station to monitor the impacts of cable installation works on the coral communities at the coast of Waglan Island;
- E6 is an Impact Station to monitor the impacts of cable installation works on the coral communities at Tai Long Pai (the Gradient Station is not set due to the insufficient distance between this Impact Station and the nearby proposed cable works which may affect the cable laying works);
- E7 is an Impact Station to monitor the impacts of cable installation works on the coral communities along Junk Bay – South West;
- E8 is an Impact Station to monitor the impacts of cable installation works on the coral communities at Cape Collinson (the Gradient Station is not set due to the insufficient distance between this Impact Station to nearby proposed cable works which may affect the cable laying works);
- E9 is an Impact Station to monitor the impacts of cable installation works on the coral communities at Fat Tong Chau (the Gradient Station is not set due to the insufficient distance between this Impact Station to nearby proposed cable works which may affect the cable laying works);
- F1 is an Impact Station to monitor the impacts of cable installation works on the Tung Lung Chau Fish Culture Zone;
- I1 is an Impact Station to monitor the impacts of cable installation works on the Shek O Headland SSSI;
- S1 is an Impact Station situated at the WSD Seawater Intake Point in Junk Bay. It is located within 500 m north of the cable alignment at Junk Bay and set up to monitor the effect of cable laying works in the area;
- S2 is an Impact Station to monitor the impacts of cable installation works on the WSD Seawater Intake at Siu Sai Wan;
- S3 is an Impact Station to monitor the impacts of cable installation works on the Pamela Youde Nethersole Eastern Hospital Cooling Water Intake at Heng Fa Chuen;

Figure E1
圖 E1

Proposed Water Quality Monitoring Station
擬 建 水 質 監 測 點

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- G1 is a Gradient Station between S1 and the cable alignment;
- G2 is a Gradient Station between S2 and the cable alignment;
- G3 is a Gradient Station between F1 and the cable alignment;
- G4 is a Gradient Station between E2 and the cable alignment;
- G5 is the Gradient Station between E4 and the alignment;
- G6 is the Gradient Station between E5 and the alignment;
- G7 is a Gradient Station between E1 and the cable alignment;
- C1 is a Control Station (approximately 3 km from the proposed cable alignment) for Zone A. It is not supposed to be influenced by the cable laying works due to its remoteness to the construction works;
- C2 is a Control Station (approximately 4 km from the proposed cable alignment) for Zone B. It is not supposed to be influenced by the cable laying works due to its remoteness to the construction works; AND
- C3 is a Control Station (approximately 3 km from the proposed cable alignment) for Zone C. It is not supposed to be influenced by the cable laying works due to its remoteness to the construction works.

The monitoring works will be carried out at C1, E7, E8, E9, F1, G1, G2, G3, S1, S2, and S3 (ie ten (10) stations) when the cable laying vessel moves inside Zone A (*Figure E2*). Similarly, the monitoring works will be carried out at B1, B2, B3, C2, E1, E2, E6, E8, F1, G3, G4, G7 and I1 (ie thirteen (13) stations) when the vessel moves inside Zone B (*Figure E3*). Monitoring works will start at C3, E4, E5, G5 and G6 (ie five (5) stations), when the vessel enters Zone C (*Figure E4*).

The suggested co-ordinates of these monitoring stations are listed in *Table E1* and the exact co-ordinates should be confirmed before commencement of Baseline Monitoring (prior to cable laying).

The above monitoring stations shall be sampled during Baseline Monitoring (prior to cable laying), Impact Monitoring (during any works related to the cable installation) and Post Project Monitoring (after completion of the cable installation).

Table E1 Co-ordinates of Sampling Stations (HK Grid)

Station	Nature	Easting	Northing
B1	Impact Station (Beach)	843556.84	811853.46
B2	Impact Station (Beach)	844062.02	810369.19
B3	Impact Station (Beach)	843988.33	809902.13
E1	Impact Station (Marine Reserve)	842021.64	816547.02
E2	Impact Station (Coral Communities)	847527.33	811059.83
E4	Impact Station (Coral Communities)	848471.60	804135.73

Station	Nature	Easting	Northing
E5	Impact Station (Coral Communities)	845056.10	807712.89
E6	Impact Station (Coral Communities)	848503.03	811247.01
E7	Impact Station (Coral Communities)	849586.94	805696.09
E8	Impact Station (Coral Communities)	844547.04	813522.78
E9	Impact Station (Coral Communities)	845202.76	815205.38
F1	Impact Station (Fish Culture Zone)	846948.57	813085.03
I1	Impact Station (Site of Special Scientific Interest)	844698.75	809894.80
S1	Impact Station (Seawater Intakes)	845297.24	816281.54
S2	Impact Station (Seawater Intakes)	844070.53	814783.54
S3	Impact Station (Seawater Intakes)	846099.31	812825.53
G1	Gradient Station	847365.06	810245.78
G2	Gradient Station	843936.91	814720.04
G3	Gradient Station	849692.91	806360.59
G4	Gradient Station	846748.01	810394.92
G5	Gradient Station	845320.83	816717.97
G6	Gradient Station	843779.38	814520.41
G7	Gradient Station	843110.53	815125.70
C1	Control Station	842999.91	815984.25
C2	Control Station	845297.24	816281.54
C3	Control Station	844070.53	814783.54

E2.3 *SAMPLING PROCEDURES*

E2.3.1 *Monitoring Frequency*

Baseline Monitoring

Baseline Monitoring will comprise sampling on three occasions (days) prior to, but no more than six weeks before, cable laying work. The interval between two sets of monitoring shall not be less than 36 hours. The monitoring will be undertaken at all (ie twenty-five (25) monitoring stations, as shown in *Figure E1* (and zoom in *Figures E2* to *E4*) and in *Table E1*. Samples will be taken during mid-flood and mid-ebb tidal state on each sampling occasion.

Impact Monitoring

Impact Monitoring at C1, E7, E8, E9, F1, G1, G2, G3, S1, S2, and S3 (ie ten (10) stations) will commence when the cable installation barge works are within Zone A. The sampling works will cease once the cable barge is outside Zone A or no cable laying works are being undertaken.

Similarly, Impact Monitoring at B1, B2, B3, C2, E1, E2, E6, E8, F1, G3, G4, G7, and I1 (ie thirteen (13) stations) will commence when cable installation barge works move to within Zone B.

The monitoring works will start at E4, E5, G5, G6 and C3 when the vessel goes into Zone C.

The water quality sampling works will cease once the cable laying works are outside Zones A, B and C or when no cable laying works are being undertaken for the Project.

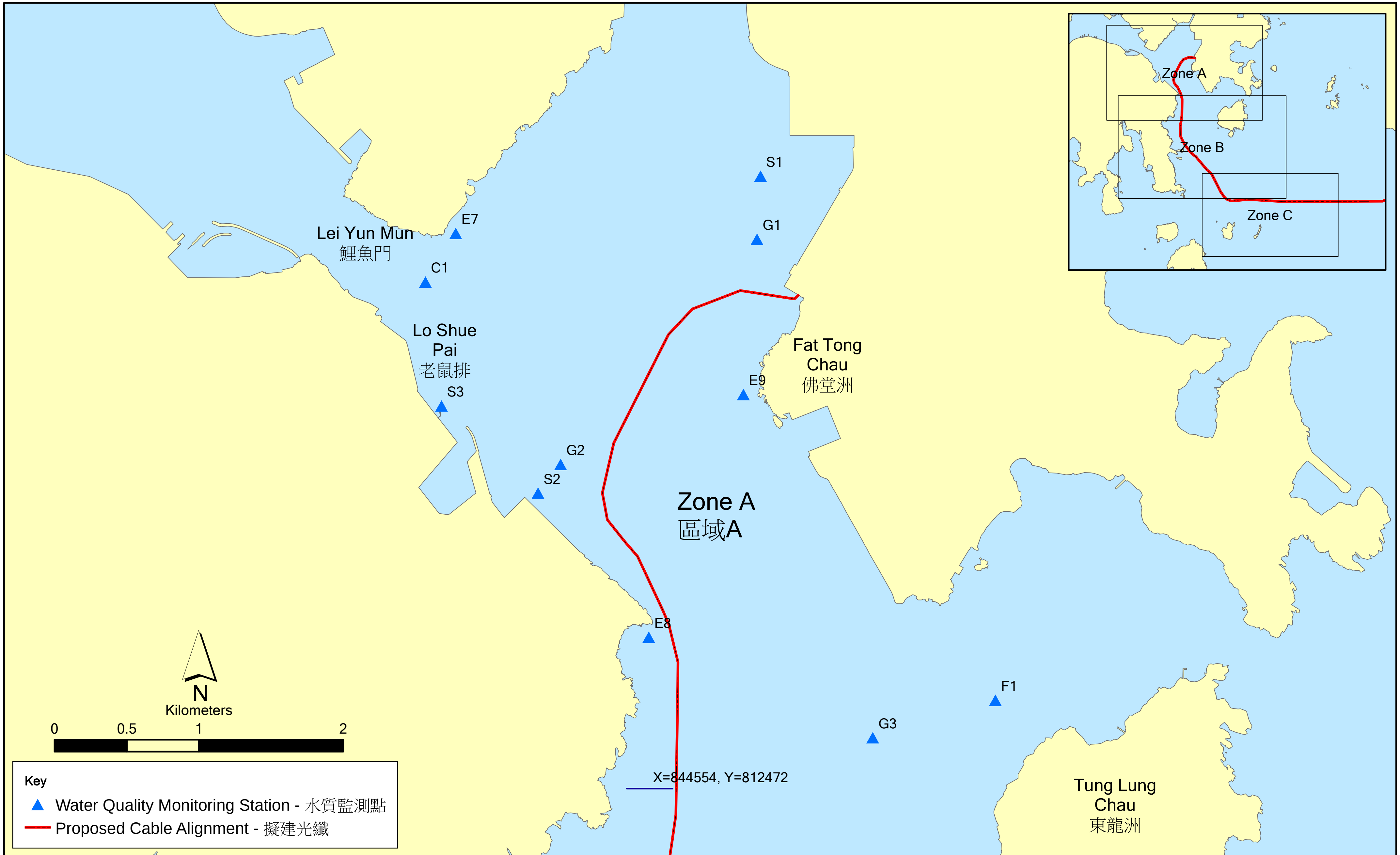

Figure E2
圖 E2

Proposed Water Quality Monitoring Station (Zone A)
擬 建 區 域 A 內 的 水 質 監 測 點

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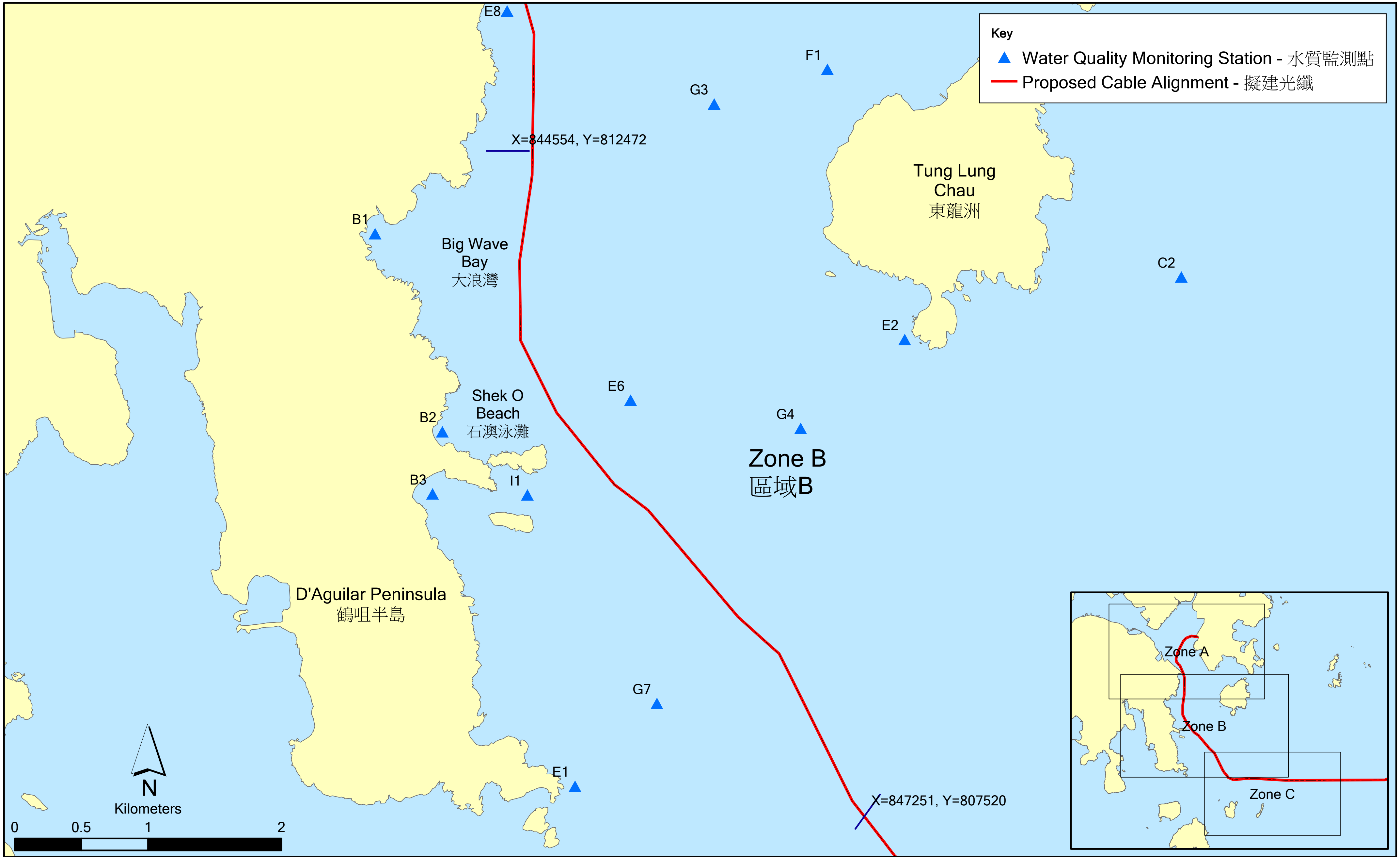

Figure E3
圖 E3

Proposed Water Quality Monitoring Station (Zone B)
擬 建 區 域 B 內 的 水 質 監 測 點

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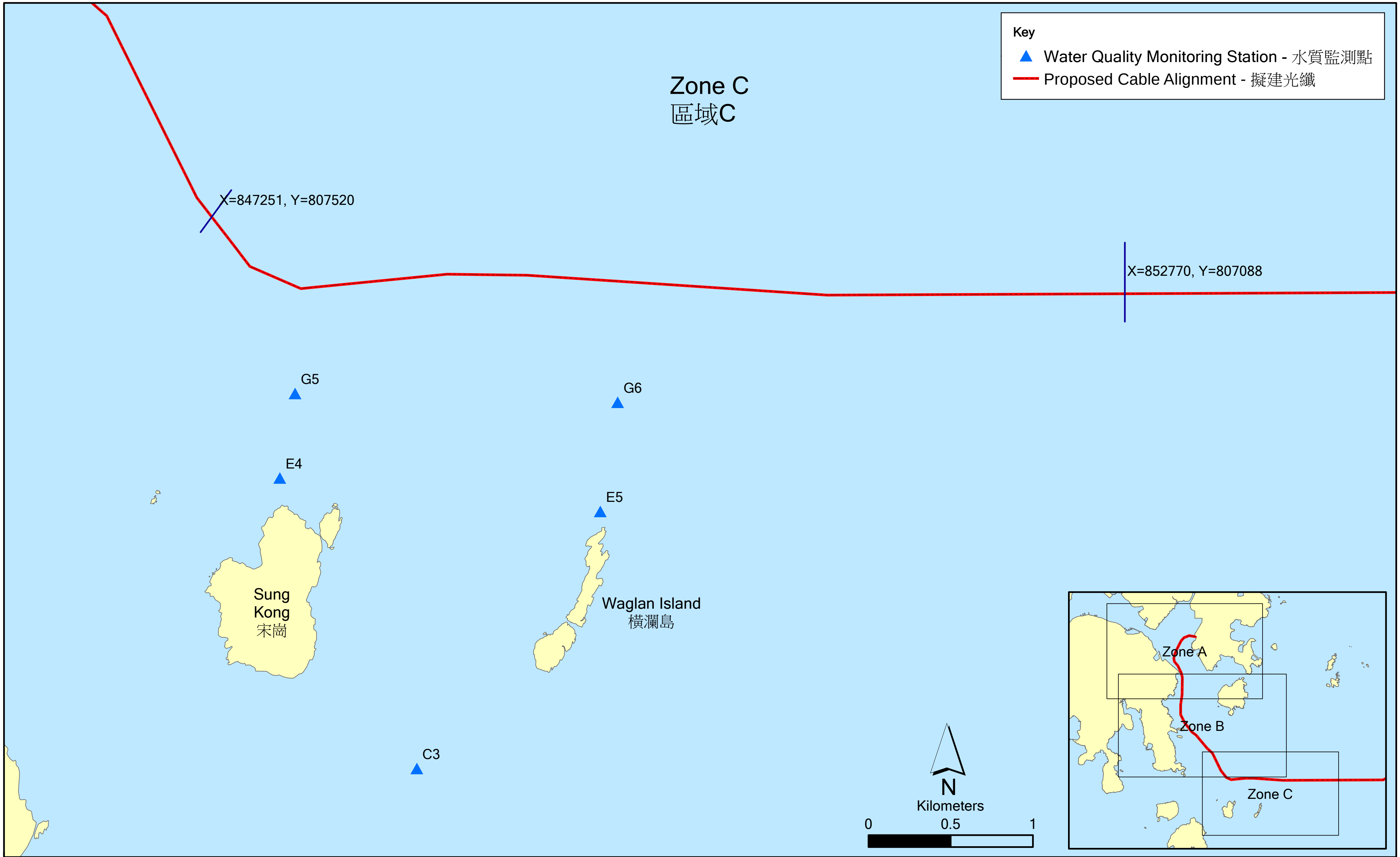

Figure E4
圖 E4

Proposed Water Quality Monitoring Station (Zone C)
擬 建 區 域 C 內 的 水 質 監 測 點

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In-situ data and SS data will be collected at monitoring stations (actual time interval subject to the sampling vessel travelling time among stations) during the cable installation works for each zone.

Post Project Monitoring

Post Project Monitoring will comprise sampling on three occasions (days) within three weeks after completion of the cable installation works at the same stations as Baseline Monitoring, during mid-flood and mid-ebb tides. The interval between two sets of monitoring shall not be less than 36 hours.

E2.3.2 Timing

For Baseline and Post Project Monitoring, water quality sampling will be undertaken within a 4 hour window of 2 hours before and 2 hours after mid flood and mid-ebb tides.

For Impact Monitoring, *in-situ* data and SS data will be collected at 2-hour intervals (actual time interval subject to the sampling vessel travelling time among stations) during the cable installation works for each zone.

The environmental contractor will be responsible for liaison with the engineering contractor to ensure installation works are being undertaken during the water quality sampling. Tidal range for flood and ebb tides should not be less than 0.5 m for capturing representative tides.

E2.3.3 Depths

Each station will be sampled and measurements will be taken at three depths, 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.

E2.4 COMPLIANCE / ACTION EVENT PLAN

Water quality monitoring results will be evaluated against Action and Limit levels shown in *Table E2*.

Table E2 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	99%-ile of baseline data, and 30% exceedance of value at any impact station compared with corresponding data from control station

Parameter	Action Level	Limit Level
DO in mgL^{-1}	Surface and Middle 5%-ile of baseline data for surface and middle layer Bottom 5%-ile of baseline data for bottom layers	Surface and Middle 5mg/L or 1%-ile of baseline for surface and middle layer Bottom 2mg/L or 1%-ile of baseline data for bottom layer
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	99%-ile of baseline data, and 30% exceedance of value at any impact station compared with corresponding data from control station

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 Junk Bay, 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 E3*.

Table E3 Event Action Plan for Water Quality

Event	Contractor
Action Level Exceedance	**Step 1** - repeat sampling event. **Step 2** – Inform EPD and AFCD and confirm notification of the non-compliance in writing; **Step 3** - discuss with cable installation contractor the most appropriate method of reducing suspended solids during cable installation (e.g. reduce cable laying speed/volume of water used during installation. **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 3. If non-compliance occurs a third time, suspend cable laying operations.
Limit Level Exceedance	Undertake **Steps 1-4** immediately, if further non-compliance continues at the Limit Level, suspend cable laying operations until an effective solution is identified.

E2.5 *REPORTING*

Schedule for baseline and impact monitoring should be submitted to the Environmental Protection Department (EPD) at least 2 weeks before commencement of the monitoring works for agreement.

The reports to be provided shall include:

- Baseline Monitoring Report;

- Weekly Impact Monitoring Reports; and
- Post Project Monitoring Report.

The Baseline Monitoring Report shall be provided no later than two weeks before the cable laying work and the report should be submitted to EPD for agreement on the Action/Limit Levels. The Impact Monitoring Report will be provided weekly within three days after the relevant monitoring data are collected or become available during the cable laying work. The Post Project Monitoring Report to review the environmental status after the cable installation and compare with the results as presented in the Baseline Monitoring Report 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 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 (AL 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 limited to, the following details:

- Basic Project Information - construction programme with fine tuning of construction activities showing the inter-relationship with environmental protection/mitigation measures for the week and works undertaken during the week;
- Operating practices of the cable burial machine during sampling (including: position, speed, cable burial depth) 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 baseline monitoring stations;
- full construction 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. The monitoring results should show the relationship between the Control and the Impact monitoring stations and compliance or non-compliance with respect to the Action/Limit Levels
- review the environmental status after the cable installation and compare with the results as presented in the Baseline Monitoring Report;
- comments and conclusions.

E3 CORAL MONITORING

Coral communities at Cape Collinson and Tai Long Pai which are in the vicinity of the cable alignment may have the potential to be indirectly disturbed through impact on water quality during cable-laying works. However, no unacceptable adverse indirect impacts on coral communities are expected to occur due to the following reasons.

- Firstly, both coral communities at Cape Collinson and Tai Long Pai are beyond the maximum distance of transport for the suspended sediments. The sediment plume calculation indicated that the disturbed sediments would have settled onto the seabed in less than 4 minutes before they can travel to the coral communities at Cape Collinson and Tai Long Pai.
- Secondly, the cable installation works will be of small-scale, short-term and temporary (approximately 15 working days for the whole cable installation while only several workings hours for the sections near Cape Collinson and Tai Long Pai).
- Thirdly, precautionary measure –silt curtain of multi-layers will be installed at the south of Cape Collinson during cable laying operation near Cape Collinson to ensure no disturbance from the water quality impact.

Nevertheless, coral monitoring is recommended to verify that the cable installation works are not resulting in any unacceptable adverse impacts to the coral communities at Cape Collinson and Tai Long Pai. Coral monitoring is not recommended to be undertaken at TKO Industrial Estate and Fat Tong Chau which are in close vicinity to the proposed cable landing site, and Shek O Headland which is near to the proposed cable alignment, given that low abundance and diversity of corals were recorded at the subtidal hard bottom habitat of these areas.

The following Section provides details of the coral monitoring programme for the installation of the submarine cable.

E3.1 OBJECTIVES AND APPROACH

The objective of the coral monitoring programme is to verify whether any adverse impacts to coral communities at Cape Collinson and Tai Long Pai occur as a result of the cable installation works.

The coral monitoring programme comprises the following two surveys:

1. Baseline Survey will be conducted within one month before jetting works for the cable installation commenced. The objective of the Baseline Survey is to identify suitable coral monitoring locations and to collect

baseline monitoring data of corals at those locations for comparison with data collected during the Post Project Survey.

2. Post Project Survey will be conducted within one month after completion of the cable installation works of the Project. During the Post Project Survey, data will be collected at the same locations and using the same methodology as the Baseline Survey. The Post Project Survey data will be used to compare with the baseline data in order to determine any detectable changes in coral conditions after cable installation works.

Coral monitoring will not be undertaken during jetting works as the works near Cape Collinson and Tai Long Pai will only last for several hours which will not allow adequate time for completion of the coral monitoring surveys at the monitoring locations.

Coral monitoring data will be reviewed in conjunction with the water quality monitoring data which will measure the levels of suspended solids generated during jetting works.

E3.2 MONITORING LOCATIONS

Coral monitoring will be undertaken at Cape Collinson and Tai Long Pai (Monitoring Station), and a Control Station at Tung Lung Chau which is located more than 2 km from the cable alignment and thus unlikely to be impacted by the works. The monitoring locations are shown in *Figure E5* and detailed below:

Monitoring Stations:

- Zone A: Cape Collinson; and
- Zone B: Tai Long Pai.

Control Station:

- Zone C: Tung Lung Chau.

At each monitoring station, coral monitoring will be undertaken in two depth zones (ie shallow water: -2 to -5 mCD and deep water: -5 to -15 mCD). The depth ranges may be revised based on observations of coral distribution during the Baseline Survey.

E3.3 MONITORING METHODOLOGY

E3.3.1 *Monitoring Personnel*

The coral monitoring works should be undertaken by a qualified coral specialist hired by the ET. The qualified coral specialist should be a degree holder in marine sciences with at least three years of post-graduate experience in the field of marine ecology and undertaking coral surveys. The same coral specialists should be used for each dive survey to maintain consistency in the documentation of the coral condition and should be approved by AFCD in advance of undertaking the monitoring work.

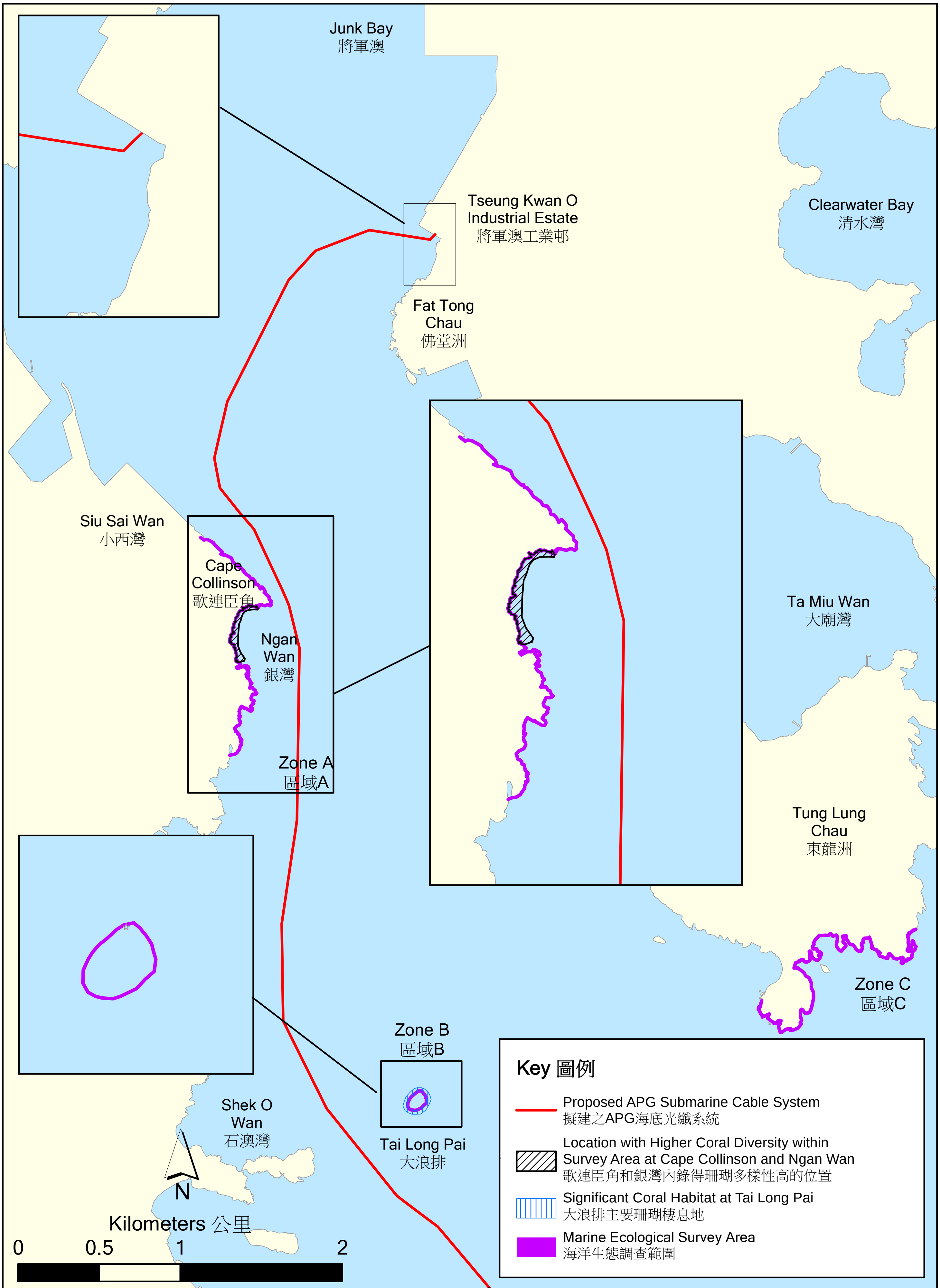

Figure E5
圖 E5

Locations of Coral Monitoring
珊瑚群落監測點

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Date: 30/8/2013

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Environmental Resources Management
ERM

E3.3.2 *Survey Methodology*

The Baseline Survey comprises the following three components:

- Qualitative spot dive survey;
- Semi-quantitative Rapid Ecological Assessment (REA) survey; and
- Coral Colony Monitoring.

The Post Project Survey comprises the same components as the Baseline Survey, except that the qualitative spot dive survey will not be undertaken. Survey methodology of the three components is described below.

Qualitative Spot Dive Survey

The qualitative spot dive survey will be undertaken as part of the Baseline Survey only to identify suitable coral monitoring locations at Cape Collinson, Tai Long Pai and Tung Lung Chau. During the survey, spot dive reconnaissance checks will be conducted within the designated Monitoring and Control Stations by SCUBA to collect qualitative information including coral composition, abundance and distribution. Based on the information collected, locations with relatively higher coral abundance and number of species/genus will be selected for each station for the subsequent Rapid Ecological Assessment (REA) survey and coral colony monitoring during the Baseline and Post Project Surveys. The depth range (shallow and deep) to be monitored will also be finalised based on observed coral distribution.

Rapid Ecological Assessment (REA) Survey Method

A standardised semi-quantitative REA survey technique will be used to investigate the general conditions of the coral communities (hard, soft and black corals) associated with subtidal hard bottom habitats at the Monitoring and Control Stations. The collection of REA data during the Baseline and Post-Project Surveys would allow for a comparison of coral conditions before and after cable installation works in order to determine any changes in conditions due to the works.

The REA technique allows semi-quantitative information on the ecological attributes of the subtidal habitat to be obtained in a relatively simple way without compromising scientific rigour. This technique is the standard practices for EIA marine baseline surveys in Hong Kong and has been modified from the standardised REA survey technique established for the assessment of coral communities on the Great Barrier Reef (1) for marine environment of Hong Kong (2).

(1) DeVantier, L.M., G.De'Ath, T.J. Done and E. Turak (1998). *Ecological assessment of a complaex natural system: A case study from the Great Barrier Reef.* Ecological Applications 8: 480-496.

(2) Fabricius, K.E. and D. McCorry. (2006). *Changes in octocoral communities and benthic cover along a water quality gradient in reefs of Hong Kong.* Marine Pollution Bulletin 52: 22-23.

A series of REA surveys will be conducted by qualified coral ecologists by SCUBA at the Monitoring stations (Cape Collinson and Tai Long Pai; *Figure E5*) and Control Station (Tung Lung Chau; *Figure E5*) with the aim to record the condition of substratum, estimate the diversity and relative abundance of coral assemblages (ie hard corals, octocorals and black corals) and with all hard coral colonies identified to species level while octocorals and black corals recorded to genus level. The survey will be undertaken on REA transects laid onto the seabed, each of which measure 100 m in length, at the following two depth zones of each station:

- Shallow depth region: -2 to -5 m CD (typically the depth range of hard coral colonies associated with subtidal hard bottom habitat); and

- Deep depth region: -5 to -15 m CD.

The location of the REA transects as well as the depth ranges of the monitored depth zones will be determined based on findings from the qualitative spot dive survey. A total of three (3) REA transects will be monitored at each depth region of Cape Collinson and Tung Lung Chau, while two (2) transects will be monitored at each depth region of Tai Long Pai due to limited survey area at this Monitoring Station.

Following the laying of the transect line, the coral specialist will swim along the transect slowly and conduct the REA survey. The REA methodology will encompass an assessment of the benthic cover (Tier I) and taxon abundance (Tier II) undertaken in a swathe ~ 4 m wide, 2 m either side of each transect. The belt transect width was dependent on underwater visibility and might be adjusted to a swathe ~ 2 m wide, 1 m either side of each transect in case of reduced visibility. An explanation of the two assessment categories (Tiers) used in the survey is presented below.

Tier I – Categorisation of Benthic Cover

Upon the completion of each survey transect, five ecological and seven substratum attributes will be assigned to one of seven standard ranked (ordinal) categories (Table *E4* and *E5*).

Table E4 Categories used in the REA Surveys – Benthic Attributes

Ecological	**Substratum**
Hard coral	Hard Substratum
Dead standing coral	Continuous pavement
Soft coral	Bedrock
Black coral	Rubble
Macroalgae	Sand
Turf Algae	Silt
	Large boulders (>50 cm)
	Small boulders (<50 cm)
	Rocks (<26 cm)

Table E5 Categories used in the REA Surveys – Ordinal Ranks of Percentage Cover

Rank	Percentage Cover (%)
0	None recorded
1	1-5
2	6-10
3	11-30
4	31-50
5	51-75
6	76-100

Tier II – Taxonomic Inventories to Define Types of Benthic Communities

An inventory of benthic taxa will be compiled for each transect. Taxa will be identified *in situ* to the following levels:

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

Following the completion of each transect survey, each taxon in the inventory will be ranked in terms of abundance in the community (*Table E6*). 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.

Table E6 Ordinal Ranks of Taxon Abundance

Rank	Abundance
0	Absent
1	Rare [(a)]
2	Uncommon
3	Common
4	Abundant
5	Dominant

Note:
(a) The classification of "rare" abundance refers to low abundance (small quantity) on the transect, rather than in terms of distribution in Hong Kong waters.

A set of environmental site descriptors will be recorded for each REA transect as follows:

(A) The degree of exposure to prevailing wave energy is ranked from 1 – 4, where:
1 = sheltered (highly protected by topographic features from prevailing waves);

2 = semi-sheltered (moderately protected);

3 = semi-exposed (only partly protected); and

4 = exposed (experiences the full force of prevailing wave energy).

(B) Sediment deposition on the reef substratum (particle sizes ranging from very fine to moderately coarse) rated on a four point scale, from 0 -3, where:

0 = no sediment;

1 = minor (thin layer) sediment deposition;

2 = moderate sediment deposition (thick layer), but substrate can be cleaned by fanning off the sediment; and

3 = major sediment deposition (thick, deep layer), and substrate cannot be cleaned by fanning.

A suite of representative photographs will be taken for each REA transect. All field data will be checked upon completion of each REA transect and a dive survey proforma sheet will be completed at the end of the fieldwork day. Photographs will be compiled for each REA transect which will then be reviewed and REA data be verified. Verified REA data will be presented in terms of:

- Site (transect) information (Tier I and II data), depth and environmental descriptors; and
- Species abundance data for each transect.
- Species lists, species richness and mean values for ecological and substratum types will be compiled. The rank abundance values will be converted to a mid-value percentage cover.

Coral Colony Monitoring

Coral colony monitoring will be undertaken during the Baseline and Post Project Surveys to identify any evidence of sediment stress to corals before and after cable installation works. At each coral monitoring station, a total of fifteen (15) hard coral colonies and fifteen (15) octocoral/black coral colonies will be selected for monitoring. Priority will be given to selecting colonies of horizontal plate-like and massive growth forms which present large stable surfaces for the interception and retention of settling solids. Each of the selected corals will be identified to species or genus levels and photographed. The following data will be collected:

- Maximum diameter of the identified hard coral and soft coral colonies;
- Maximum height and width of the identified gorgonians and black corals;

- Percentage of sediment cover on the identified colonies and the colouration, texture and approximate thickness of sediment on the coral colonies and adjacent substrate. Any contiguous patches of sediment cover >10 % were recorded;

- Percentage of bleached area on the identified colonies of which two categories were recorded: a. blanched (ie pale) and b. bleached (ie whitened);

- Percentage of colony area showing partiality mortality; and

- Physical damage to colonies, tissue distension, mucous production and any other factors relevant will be noted in the field.

Other information such as the survey date, time, weather, sea and tidal conditions should also be recorded. The coral colony monitoring exercise will be undertaken to ensure colonies of similar growth forms and size will be selected for the Baseline and Post Project Monitoring. Although coral tagging is a common practice for repeated monitoring of individual colony, this technique will not be employed in this monitoring programme due to difficulties in locating the tagged corals given the generally low visibility in the area and low light conditions in deep water.

E3.4 REPORTING

Schedule for Baseline and Post Project Survey should be submitted to the Environmental Protection Department (EPD) at least one week before commencement of the monitoring works for agreement.

The reports to be provided should include the Baseline Monitoring Report and Post Project Monitoring Report.

The Baseline Monitoring Survey Report should be submitted within two weeks after the completion of the baseline monitoring and the report should include the following details:

- Brief project background information;

- Monitoring results together with the information including monitoring methodology, parameters monitored, monitoring locations (and depth), monitoring date, time, frequency and duration; and

- Comments and conclusions.

Post Project Survey Report should be submitted within one month after the completion of the post monitoring and the report should include, but not limited to, the following details:

- Basic project information;

- Review of the coral conditions at the monitoring stations and the health status of the corals after the cable installation and compare with the results as presented in Baseline Monitoring Report; and

- Discussion of any detected adverse impacts to coral communities as a result of the cable installation works.

Cable installation works may result in a minor and short term increase in underwater sound from marine vessels. Given that Finless Porpoises and Indo-pacific Humpbacked Dolphins use high frequency ultrasonic clicks for foraging and communication, the low frequency underwater sound associated with vessels, jetting and cable laying would not be expected to interfere significantly with these two species of cetaceans. No unacceptable adverse impacts to Finless Porpoises and Indo-pacific Humpbacked Dolphins from underwater sounds are expected to occur. The cable installation works will be short-term and temporary, and be carried by one cable installation barge within a total of approximately 15 working days in HKSAR waters. The Finless Porpoises and Indo-pacific Humpbacked Dolphins are hence not expected to be disturbed by the cable laying vessel.

However, additional precautionary measure will be implemented for marine mammals during the cable installation works.

A marine mammal exclusion zone within a radius of 250 m from the cable installation barge will be implemented during the cable installation works taking place in daylight hours. This will be implemented along the section outside Zones A to C (shown in *Figure E1*) to avoid the major marine vessel fairway that is near/in Zones A to C. 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 barge. The viewpoint will be proposed by the Independent Checker.

Qualified observer(s) will stand on the open upper decks of the barge, allowing for observer eye heights of 4 to 5 m above water level and relatively unobstructed forward visibility between 270° and 90°. Vessel-based observation by the observer(s) shall be conducted by searching the 180° swath in front of the barge (270° to 90°) 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. If cetaceans are observed in the exclusion zone, cable installation works will be delayed until they have left the area. This measure will confirm that the area in the vicinity of the cable installation 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 barge, it is considered that cetaceans will have

(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.

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. Daily monitoring will be conducted till the completion of cable installation works.

(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

附件E

環境監測與審核

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E1 環境監測與審核措施

這份有關環境監測與審核的*附件E*旨在：

- 核實監測到的影響是否與預測影響一致；
- 監察光纜鋪設工程所採用的控制措施是否有效；
- 核實本項目的工程不會對水質造成任何影響，特別是位於水質敏感受體區域的水質；
- 確保在鋪設光纜時能夠偵測到任何不良影響，並在發現敏感受體會受到光纜安裝工程影響時，採取適當行動。
- 在位於光纜系統附近的影響監測站（歌連臣角和大浪排）和對照監測站（東龍洲）實行珊瑚監測，以確保珊瑚（例如，硬珊瑚、八放珊瑚和黑珊瑚）不受光纜鋪設工程的影響。以及確認預防措施(設置隔泥幕)的效能。

E2 水質監測

對於有關在鋪設海底光纜時對水質構成的潛在影響，建議了的緩減措施包括限制電纜安裝駁船的速度及進行水質監測計劃。下文將會詳述在鋪設海底光纜時的水質監測措施。

E2.1 樣本收集和化驗方法

E2.1.1 需要量度的參數

需要在實地測量的參數包括：

- 溶解氧（飽和百分比%及每公升毫克數 mgL^{-1}）
- 溫度（攝氏°C）
- 混濁度（NTU）
- 鹽度（‰或 ppt）

唯一需要在實驗室量度的參數是：

- 懸浮固體（每公升毫克數 mgL^{-1}）

除了水質參數之外，其他須測量及記錄於現場記錄冊中的相關數據包括：在收集樣本時，樣本收集站的位置和光纜掩埋機的位置、水深、時間、天氣情況、海面情況、潮汐狀態、水流方向和速度、在監測區和工程區可能影響監測結果的特別現象和工程活動。

E2.1.2 設備

在進行水質監測時，環保工作承辦商必須供應和使用下列設備。

- ***溶解氧和溫度量度設備–***這項儀器必須是一個可攜帶、防風雨的溶解氧量度儀器，並配備完整的電纜、感應器、全面的操作手冊，而且必須可以用直流電運作。它必須能夠量度：介乎每公升 0 – 20 毫克和 0-200%飽和度的溶解氧水平；以及 0-45 度攝氏的溫度。

  它必須有一個薄膜電極，並設有自動溫度調整，以及一條不短於35米的電纜。必須備有足夠的備用電極和電線庫存（例如：YSI 59型儀錶、YSI 5739型探測器、YSI 5795A型水底攪拌器，連同卷軸和電纜或獲認可的相同儀器）以便有需要時更換零件。

- ***混濁度量度設備–***量度混濁度應該與量度懸浮固體分用同一個水樣本。應該使用適當的混濁度測試套件來量度混濁程度。

- ***鹽度量度儀器–***應該在每個監測地點提供一個可以量度介乎 0-40 ppt 鹽度的可攜式鹽量計。

- ***水深計–***沒有為量度水深建議任何特定的儀器。然而，裝設於水質監測船底的水深計較為可取。環保工作承辦商在購置他們所建議的設備之前，必須先獲客戶批准。

- ***水流速度和方向–***沒有為量度水流速度和方向建議特定設備。然而，環保工作承辦商在購置他們所建議的設備之前，必須先獲客戶批准。

- ***定位設備–***在進行監測時，必須使用全球定位系統來準確地記錄監測船的位置，然後才進行量度。應該優先使用差分全球定位系統作為定位設備，但應先在適當的檢測點（例如鰂魚涌測量釘）進行準確度校對。

- ***水樣本收集設備–***必須使用水樣本收集器，其組成部份包括一個透明的聚氯乙烯或玻璃瓶，容量不少於兩公升，而且兩端都可以用瓶蓋有效密封（Kahlsico 水樣本收集器 13SWB203 型或獲批准的相似儀器）。水樣本收集器必須設有正面鎖定系統，令它能夠保持開啟，並防止過早閉上，直至收集器到達選定水深時，才由一個信號傳遞設備予以釋放。

E2.1.3 樣本收集／化驗程序

所有在實地使用的監測儀器，在使用前都必須由一家經"香港實驗所認可計劃"或其他國際認可計劃認可的實驗所進行檢查、校準和認證，並需在整個水質監測過程的所有階段都每月重新校準一次。所有感應器和電極在每次使用前，都必須以獲認證的標準溶液檢查其反應。

至於在現場校準野外設備的方法，必須依照英國標準1427：1993號《水域分析的野外及現場化驗方法指南》。在有需要時，必須儲存足夠的備用零件作替換之用。此外，亦必須配有後備監測儀器，務求在儀器進行維修、校準等程序時，監測工作仍能持續不斷地進行。

用作量度懸浮固體的水樣本必須以高密度的聚乙烯瓶收集，然後以冰藏起（冷卻至4° C但不凝結），並盡快送往一家香港實驗所認可計劃內的實驗室。

對每個監測事項都應該收集最少2個重複樣本，以便進行實地量度和實驗室分析。

E2.1.4 實驗室分析

所有化驗工作都必須由已獲"香港實驗所認可計劃"認證的實驗所進行。每個監測站和對照站都必須收集約1,000毫升的水樣本，以便進行各種實驗室測定工作。測定工作必須在收集水樣本後的下一個工作天展開。懸

浮固體的實驗室量度結果必須在收集樣本後2天（48小時）內提交予客戶。除非在（APHA 2540D for SS）另有說明，否則各項分析都必須依照美國公共衛生協會的*《水及廢水檢查標準方法（第19版）》*內所闡述的標準方法進行。

向客戶提交的資料應該包括：預先處理程序、所用儀器、質量保證／質量控制（質保／質控）詳情（例如空白樣本、加樣回收、每批樣本的複本數目等）、偵測極限和準確性。質保／質控的細節必須符合"香港實驗所認可計劃"或其他國際認可計劃的要求。

E2.2 監測位置

目前所選定的監測站位置，能夠識別出本項目對水質敏感受體和生態敏感受體的潛在影響。

在鋪設光纜之前、期間和之後，都會在監測站收集水質樣本。這些監測站均設於將軍澳、東龍洲和大浪排等地區的光纜鋪設工程四周。在這些監測站所進行的監測工作，是要確保本項目的建築工程不會影響附近的敏感受體（於*圖E1*顯示）。

- B1 是一個影響監測站，用作監測光纜鋪設工程對大浪灣沙灘的影響；
- B2 是一個影響監測站，用作監測光纜鋪設工程對石澳後灘的影響；
- B3 是一個影響監測站，用作監測光纜鋪設工程對石澳沙灘的影響；
- E1 是一個影響監測站，用作監測光纜鋪設工程對鶴咀海岸保護區的影響；
- E2 是一個影響監測站，用作監測光纜鋪設工程對東龍洲珊瑚群落的影響；
- 將不會設置影響監測站 E3，由於 E3 所代表的珊瑚群落位於距離光纜鋪設工程超過 5 公里的果洲群島沿岸，預計因遠離工程範圍而不受影響;
- E4 是一個影響監測站，用作監測光纜鋪設工程對宋崗珊瑚群落的影響；
- E5 是一個影響監測站，用作監測光纜鋪設工程對橫瀾島珊瑚群落的影響；

- E6 是一個影響監測站，用作監測光纜鋪設工程對大浪排珊瑚群落的影響（這裏沒有設置變化監測站，因為這個影響監測站與附近擬議光纜工程沒有足夠距離。設立變化監測站可能影響光纜鋪設工程）；

- E7 是一個影響監測站，用作監測光纜鋪設工程對沿將軍澳西南面生長的珊瑚群落所造成的影響；

- E8 是一個影響監測站，用作監測光纜鋪設工程對歌連臣角的珊瑚群落的影響（這裏沒有設置變化監測站，因為這個影響監測站與附近擬議光纜工程沒有足夠距離。設立變化監測站可能影響光纜鋪設工程）；

- E9 是一個影響監測站，用作監測光纜鋪設工程對佛堂洲的珊瑚群落的影響（這裏沒有設置變化監測站，因為這個影響監測站與附近擬議光纜工程沒有足夠距離。設立變化監測站可能影響光纜鋪設工程）

- F1 是個影響監測站，用作監測光纜鋪設工程對東龍洲魚類養殖區的影響；

- I1 是個影響監測站，用作監測光纜鋪設工程對石澳海角具特殊科學價值地點的影響；

- S1 是設於將軍澳水務署海水進水口的影響監測站。它位於將軍澳的光纜走線以北 500 米範圍內，旨在監測該區光纜鋪設工程的影響。當光纜鋪設躉船駛進 A 區，監測工作便會展開；

- S2 是一個影響監測站，用作監測光纜鋪設工程對小西灣的水務署海水進水口的影響；

- S3 是一個影響監測站，用作監測光纜鋪設工程對杏花村的東區尤德夫人那打素醫院冷卻水進水口的影響；

- G1 是設於 S1 和光纜之間的變化監測站；

- G2 是設於 S2 和光纜之間的變化監測站；

- G3 是設於 F1 和光纜之間的變化監測站；

- G4 是設於 E2 和光纜之間的變化監測站；

- G5 是設於 E4 和光纜之間的變化監測站；

- G6 是設於 E5 和光纜之間的變化監測站；

- G7 是設於 E1 和光纜之間的變化監測站；

Figure E1
圖 E1

Proposed Water Quality Monitoring Station
擬 建 水 質 監 測 點

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- C1 是為區域 A 內的一個對照站（距離擬議光纜約 3 公里）。它的位置遠離建築工程，因此不會受到光纜鋪設工程影響；

- C2 是為區域 B 內的一個對照站（距離擬議光纜約 4 公里）。它的位置遠離建築工程，因此不會受到光纜鋪設工程影響；及

- C3 是為區域 C 內的一個對照站（距離擬議光纜約 3 公里）。它的位置遠離建築工程，因此不會受到光纜鋪設工程影響。

當光纜鋪設躉船駛進 A 區，監測工作便會在 C1、S1、G1、E7、S2、S3、G2、E8、E9、F1 和 G3 (即十個監測站) 展開（*圖 E2*）。同樣，光纜鋪設躉船駛進 B 區，監測工作便會在 C2、F1、I1、G3、B1、B2、B3、E2、G4、E6、G7、E1 和 E8 (即十三個監測站) 展開（*圖 E3*）。當光纜鋪設躉船駛進 C 區，監測工作便會在 C3、G5、G6、E4 和 E5 (即五個監測站) 展開（*圖 E4*）。

這些監測站的座標均羅列於*表E1*，但在展開基線監測之前(鋪設光纜之前)，應該先確定準確的座標。

在進行基線監測（鋪設光纜前）、影響監測（在進行與光纜安裝有關的工程時）及項目後監測（在光纜安裝工程完成後）時，必須在上述監測站收集樣本。

表E1 *樣本收集站座標（香港網格）*

收集站	性質	東向	北向
B1	影響監測站（沙灘）	843556.84	811853.46
B2	影響監測站（沙灘）	844062.02	810369.19
B3	影響監測站（沙灘）	843988.33	809902.13
E1	影響監測站（海岸保護區）	842021.64	816547.02
E2	影響監測站（珊瑚群落）	849602.50	811528.05
E4	影響監測站（珊瑚群落）	848471.60	804135.73
E5	影響監測站（珊瑚群落）	845056.10	807712.89
E6	影響監測站（珊瑚群落）	848503.03	811247.01
E7	影響監測站（珊瑚群落）	849586.94	805696.09
E8	影響監測站（珊瑚群落）	844547.04	813522.78
E9	影響監測站（珊瑚群落）	845202.76	815205.38
F1	影響監測站（魚類養殖區）	846948.57	813085.03
I1	影響監測站（具特殊科學價值地點）	844698.75	809894.80
S1	影響監測站（海水進水口）	845297.24	816281.54
S2	影響監測站（海水進水口）	844070.53	814783.54
S3	影響監測站（海水進水口）	846099.31	812825.53
G1	變化監測站	847365.06	810245.78
G2	變化監測站	843936.91	814720.04
G3	變化監測站	849692.91	806360.59
G4	變化監測站	845670.92	808333.35
G5	變化監測站	845320.83	816717.97

收集站	性質	東向	北向
G6	變化監測站	843779.38	814520.41
G7	變化監測站	843110.53	815125.70
C1	對照站	842999.91	815984.25
C2	對照站	845297.24	816281.54
C3	對照站	844070.53	814783.54

E2.3 樣本收集程序

E2.3.1 監測頻率

基線監測

基線監測會在光纜鋪設工程進行前收集樣本三次（天），但不能早於動工前六個星期。每兩組監測工作之間的間距不可少於36小時。全部監測站(即二十五個監測站)都會進行監測工作，如*圖E1*(及放大於*圖E2至圖E4*)和*表E1*所示。每次樣本收集都是在漲潮中段和退潮中段進行。

影響監測

當光纜鋪設躉船進入A區時，監測站C1、S1、G1、E7、S2、S3、G2、E8、E9、F1和G3(即十個監測站)便會展開影響監測。當鋪纜船不在A區或沒有進行光纜鋪設工程時，樣本收集工作便會停止。

同樣，當光纜鋪設躉船進入B區時，監測站C2、F1、I1、G3、B1、B2、B3、E2、G4、E6、G7、E1和E8(即十三個監測站)便會展開影響監測。

當光纜鋪設躉船駛進C區時，監測工作便會於C3、G5、G6、E4和E5展開。

當光纜鋪設躉船不在B和C區，或沒有進行光纜鋪設工程時，樣本收集工作便會停止。

在進行光纜安裝工程時，每一區都會每隔一段時間收集實地數據和懸浮固體數據一次（實際間隔時間取決於樣本收集船在監測站之間的行使時間）。

項目後監測

項目後監測會在光纜鋪設工程完成後三星期內，進行三次（天）樣本收集，都是在漲潮中段和退潮中段，在基線監測的同一批監測站進行。每兩組監測工作之間的間距不可少於36小時。

E2.3.2 時間安排

在進行基線監測和項目後監測時，會分別在漲潮中段和退潮中段之前的2小時和之後的2小時內收集水質樣本。

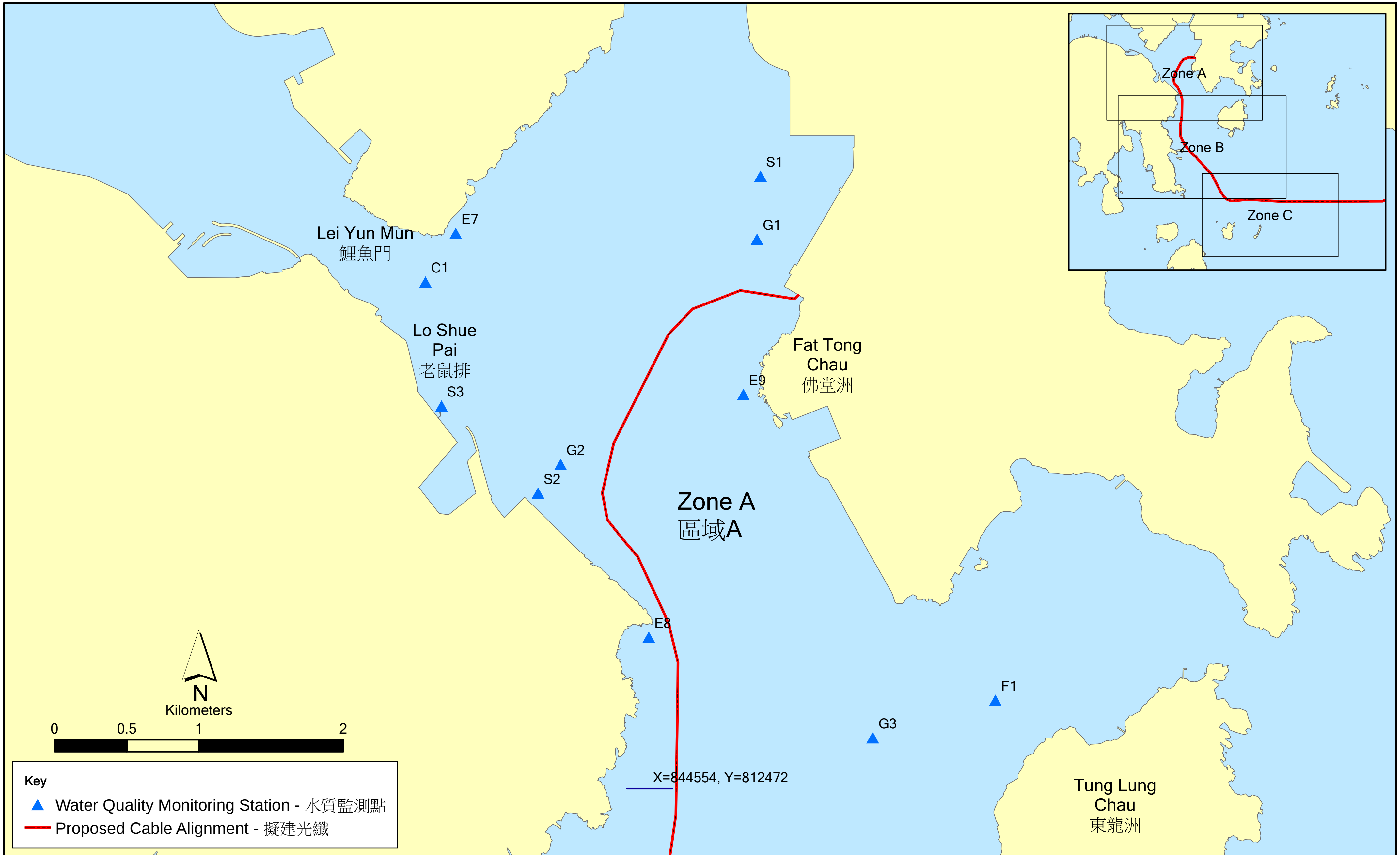

Figure E2
圖 E2

Proposed Water Quality Monitoring Station (Zone A)
擬 建 區 域 A 內 的 水 質 監 測 點

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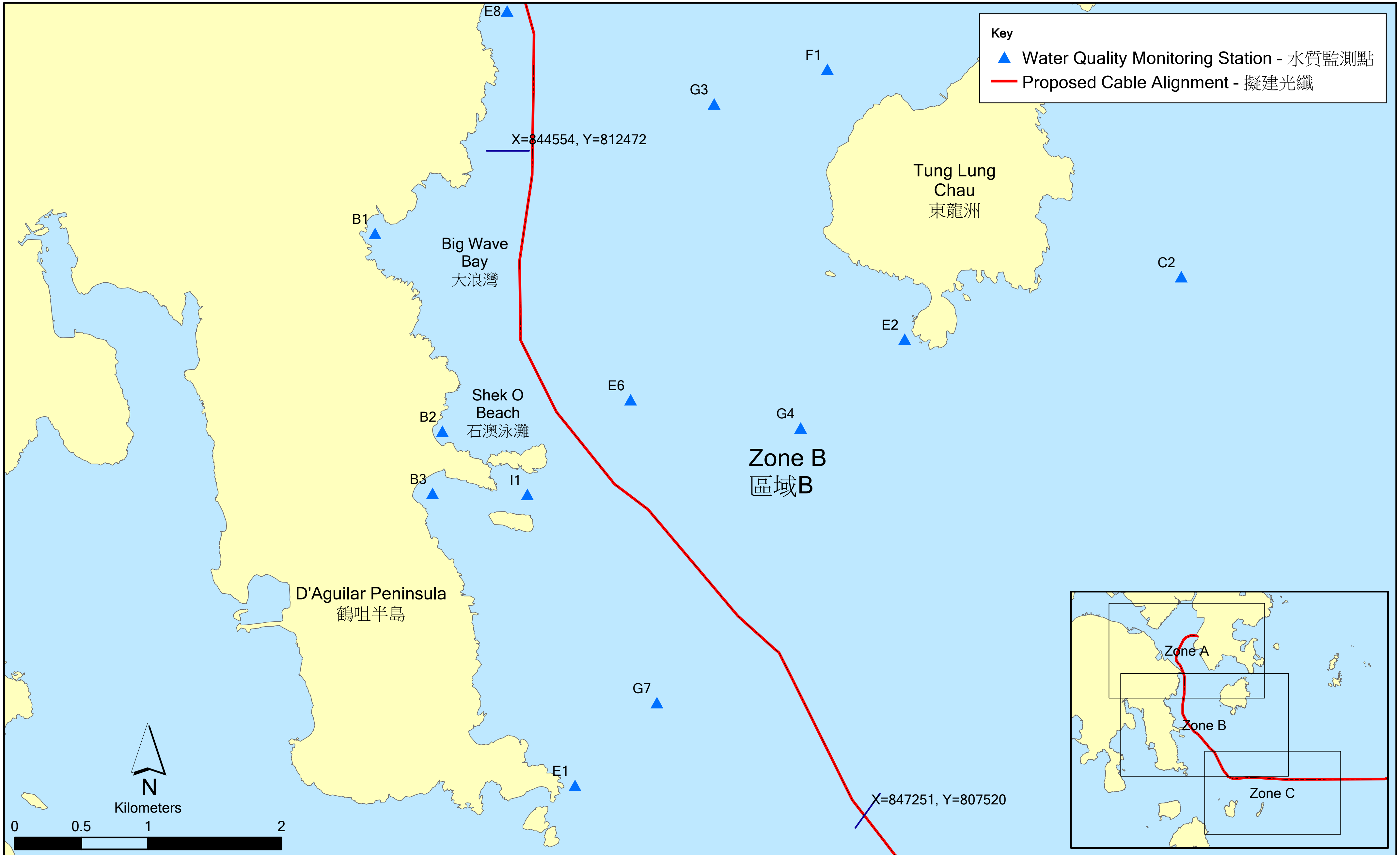

Figure E3
圖 E3

Proposed Water Quality Monitoring Station (Zone B)
擬 建 區 域 B 內 的 水 質 監 測 點

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Date: 28/08/2013

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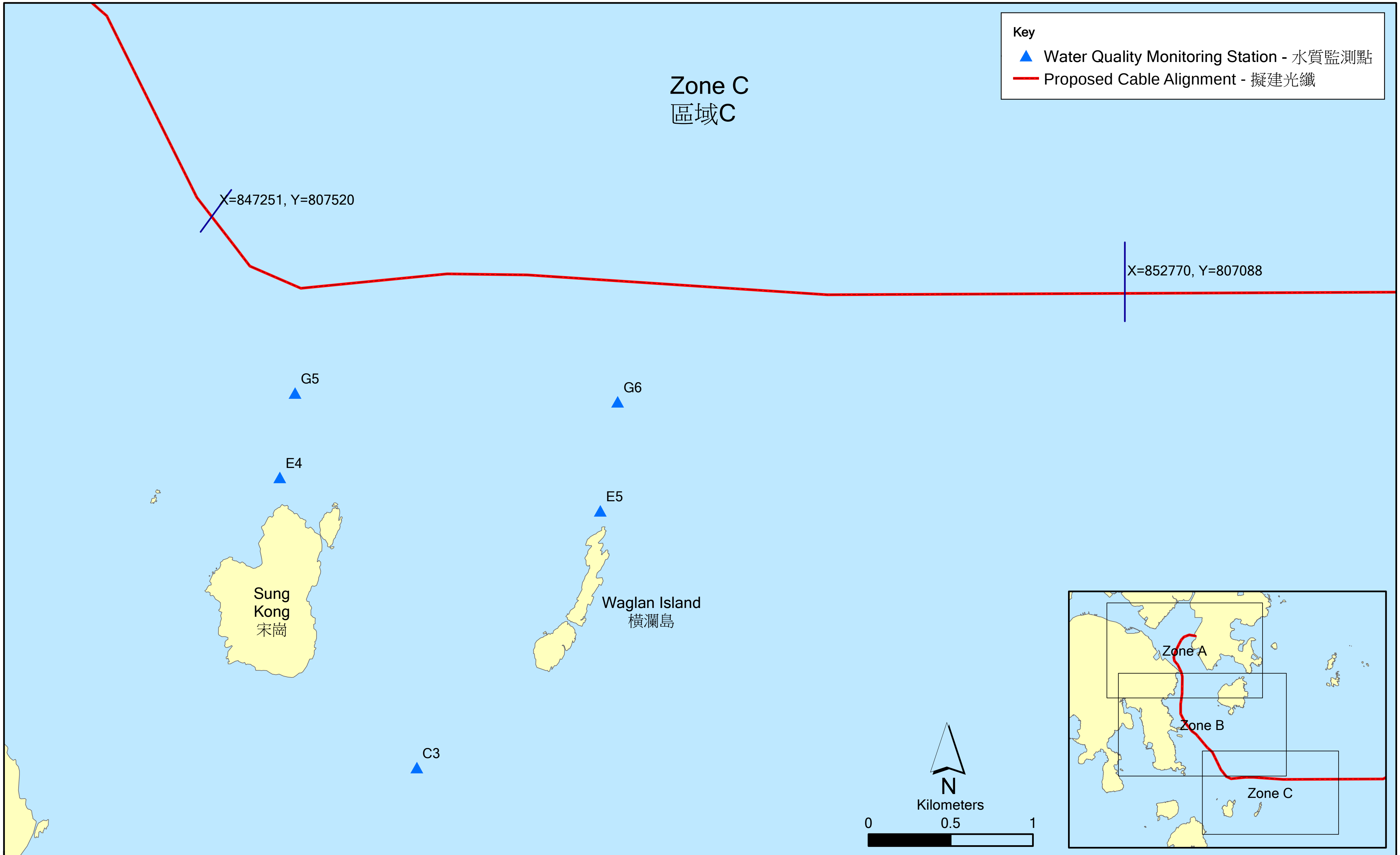

Figure E4
圖 E4

Proposed Water Quality Monitoring Station (Zone C)
擬 建 區 域 C 內 的 水 質 監 測 點

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至於影響監測，則會在每一區進行光纜安裝工程時，每隔2小時收集實地數據和懸浮固體數據一次（實際間隔時間取決於樣本收集船在監測站之間的行使時間）。

環保工作承辦商需負責與工程承建商聯絡，以確保光纜安裝工程會在收集水質樣本時進行。為了能夠反映具代表性的潮汐情況，漲潮和退潮的相差幅度不可小於0.5米。

E2.3.3 *深度*

每個站都會在三個深度收集樣本和進行水質量度，即：在海面下1米、中間深度和在海床上1米。若監測站的水深不足3米，便只收集中等深度的樣本。若監測站的水深不足6米，便只收集海面和海床的樣本。

E2.4 *符合要求／採取行動計劃*

水質監測的結果會與行動水平和限制水平限制水平比較。這兩種水平均展示於*表E2*。

表E2 *有關水質的行動水平和限制水平（根據基線情況報告的結果）*

參數	行動水平	限制水平
懸浮固體（每升毫克數）（深度平均）	基線數據的95%-分位數，或 任何影響監測站的數據比相應的參考站數據高出20%	基線數據的99%-分位數，及 任何影響監測站的數據比相應的參考站數據高出30%
溶解氧（每升毫克數）	<u>海面和中間</u> 海面和中間水層的基線數據的5%-分位數 <u>海底</u> 底層的基線數據的5%-分位數	<u>海面和中間</u> 表面和中間水層的基線數據的1%-分位數,即每公升5毫克 <u>海底</u> 底層的基線數據的1%-分位數，即每公升2毫克
混濁度（NTU）（深度平均）	基線數據的95%-分位數，或 任何影響監測站的數據比相應的參考站數據高出20%	基線數據的99%-分位數，及 任何影響監測站的數據比相應的參考站數據高出30%

註：

a. 在溶解氧方面，當監測結果低於限制水平便是不符合水質限制。

b. “深度平均”是把所有取樣深度的讀數計算其算術平均值。

c. 在懸浮固體和混濁度方面，當監測結果高於限制水平便是不符合水質限制。

d. 在完成基線監測後，其中一個或兩個會選作“行動水平”和“限制水平”。

e. 溶解氧的“限制水平”是參考將軍澳、東部緩衝區和大鵬灣等水質管制區的水質指標（分別根據《水污染管制條例》第358L、358Y和358I章而釐訂）。

當監測結果超出“行動水平”或“限制水平”時所應採取的措施於*表E3*列出。

表E3　　有關水質的行動計劃

事件	承辦商
超出"行動水平"	**第1步**–重複樣本收集 **第2步**–知會環保署和漁護署，並以書面確認不符合要求的情況； **第3步**–與鋪設光纜的承建商商討減少懸浮固體的最適當方法（例如降低光纜鋪設速度，或減少安裝時的用水體積）。 **第4步**–在實施緩解措施後再次量度有關參數，以確定水質是否符合要求。 **第5步**–倘若不符合要求的情況持續，便需在第3步增加緩解措施，並重複第4步的參數量度。倘若第三次不符合要求，便須停止光纜鋪設工程。
超出"限制水平"	立即進行**第1-4步**，倘若繼續出現不符合"限制水平"的情況，便需暫停光纜鋪設工作，直至找到有效的解決方法為止。

E2.5　　報告

在展開監測工作前最少2星期，需向環境保護署（環保署）提交基線監測和影響監測的時間表，以取得同意。

提交的報告必須包括：

- 《基線監測報告》；
- 《影響監測每週報告》；及
- 《項目後監測報告》。

《基線監測報告》必須在光纜鋪設工程進行前2個星期提交予環保署，以便取得該署對各項行動水平和限制水平的同意。《影響監測報告》會在每週取得所有影響監測數據後的3天內提交。《項目後監測報告》須於《項目後調查》完成後的一個月內提交，內容包括：檢討光纜安裝後的環境狀況，並與《基線監測報告》所述的結果比較。

《基線監測報告》必須包括下列詳情：

- 項目背景資料簡介；
- 各個基線監測站的位置圖；

- 最新的施工計劃，並須註明重要的環境保護事項和緩解活動；

- 監測結果及相關資料，包括監測方法、監測參數、監測位置（及深度）、監測日期、時間、頻率和持續時間；

- 各項影響因素的詳情，包括：該段時間在項目地點進行的主要活動（若有）、該段時間的天氣情況，以及可能影響監測結果的其他因素；

- 為每個監測參數決定"行動水平"和"限制水平"，以及對基線數據需要進行的統計分析。該等分析必須指出參考站和影響監測站在受監測的參數上，是否有顯著分別；及

- 意見和結論。

《影響監測報告》必須包括，但不限於下列詳情：

- 項目基本資料－施工計劃，連同各項施工活動的細節，要標明與該星期的環境保護活動/緩解措施之間的關係，以及該星期進行的工程；

- 在收集樣本時光纜掩埋機器的操作方式（包括：位置、速度、光纜掩埋深度），以及對監測結果的詮釋；及

- 應該以圖表方式表達監測數據，並顯示參考站和影響監測站之間的關係，以及是否符合"行動水平"和"限制水平"。

《項目後檢測報告》必須包括，但不限於下列詳情：

- 項目背景資料簡介；

- 各個基線監測站的位置圖；

- 完整的施工計劃，並須註明重要的環境保護事項和緩解活動

- 監測結果及相關資料，包括監測方法、監測參數、監測位置（及深度）、監測日期、時間、頻率和持續時間。監測結果應該顯示參考站和影響監測站之間的關係，以及是否符合"行動水平"和"限制水平"；

- 審查光纜鋪設完成後的環境狀態，並與基綫監測結果比較；及

- 評價與結論。

E3 珊瑚監察計劃

在光纜鋪設過程中，歌連臣角和大浪排附近的珊瑚群落可能因水質影響而間接受干擾。然而，珊瑚群落預期不會間接受到不良影響，原因如下:

- 首先，歌連臣角和大浪排附近的珊瑚群落皆位於懸浮沉積物最大的擴散距離範圍外，沉積物捲流計算表示，沉積物會在不到 4 分鐘內沉回海底，因此不會擴散到歌連臣角和大浪排的珊瑚群落。

- 其次，光纜鋪設工程的規模小、時間性短和工程屬臨時性質（鋪設整條光纜約需 15 個工作日，而歌連臣角附近和大浪排的光纜路段只需幾個小時）;

- 第三，預防措施-當在歌連臣角附近的光纜鋪設工程進行時，多層隔泥幕將被安裝在歌連臣角以南，以確保沒有因水質影響而帶來干擾。

然而，為確保光纜鋪設工程不會對在歌連臣角和大浪排的珊瑚群落造成任何不可接受的負面影響，因此仍建議對該區珊瑚作監察。另外，由於擬議光纜登岸點附近的將軍澳工業邨和佛堂洲以及擬議光纜沿線附近的石澳海角的珊瑚數量和多樣性都較低，所以不建議在以上的範圍進行珊瑚監察。

下文將會詳述在鋪設海底光纜時的珊瑚監察計劃。

E3.1 目的及方法

珊瑚監察計劃的目的是為了驗證海底光纜鋪設工程會否對在歌連臣角和大浪排的珊瑚造成任何不良的影響。

珊瑚監察計劃包括以下兩項調查：

(一) 基線調查將會在鋪設光纜的噴射工序前一個月內進行。基線調查的目的是要找出合適的珊瑚監察地點，並收集基線數據，與工程後數據作出比較。

(二) 工程後珊瑚監察將會在完成光纜鋪設工程後一個月內進行，並沿用基線珊瑚監察的方法，於相同的監察地點進行。工程後珊瑚監察的調查結果將用來與基線數據進行比較，以確定光纜鋪設工程對珊瑚群落造成的任何可檢出的變化。

由於在歌連臣角和大浪排附近的海底噴射過程只會持續幾個小時，因此沒有足夠時間在噴射過程中進行珊瑚監察調查。珊瑚監測數據將結合水質監測於噴射過程中量度的固體懸浮物水平進行審查。

E3.2 珊瑚監察位置

珊瑚監察計劃將在歌連臣角和大浪排（受影響監測站）和在位於海底光纜兩公里以外的東龍洲(參考站) 進行。監察地點顯示在*圖E5*，詳述如下：

監察站:

- A 區: 歌連臣角；和
- B 區: 大浪排

参考站:

- 東龍洲

珊瑚基線調查將在兩個深度區展開（即淺水：海圖深度基準面-3米至-5米和深層水：-海圖深度基準面-5米至-15米），監測深度可就實際珊瑚分佈進行修改。

E3.3 監察方法

E3.3.1 監察人員

珊瑚監測工作應由環境工作小組聘請一個合資格的珊瑚專家。合格的珊瑚專家應該是一個擁有海洋科學學士學位和其後進行至少三年或以上有關海洋生態和珊瑚調查的研究。每次潛水進行珊瑚調查時，應由相同的珊瑚專家負責並使用相同調查方法以維持調查的一致性，而該方法應在開展監測工作前由漁護署批准。

E3.3.2 調查方法

基線調查方法包括以下三個部份:

- 定性定點下潛；
- 半定量快速生態評估調查方法；和
- 珊瑚群落監察。

除了不用進行質性定點下潛，工程後珊瑚調查的方法與基線調查的方法相同。下文將會描寫上述三個調查方法。

定性定點下潛

定性定點下潛只會在歌連臣角、大浪排和東龍洲的基線珊瑚調查中進行，旨在物色合適的珊瑚監察位置。在調查過程中，定點偵察將以水肺

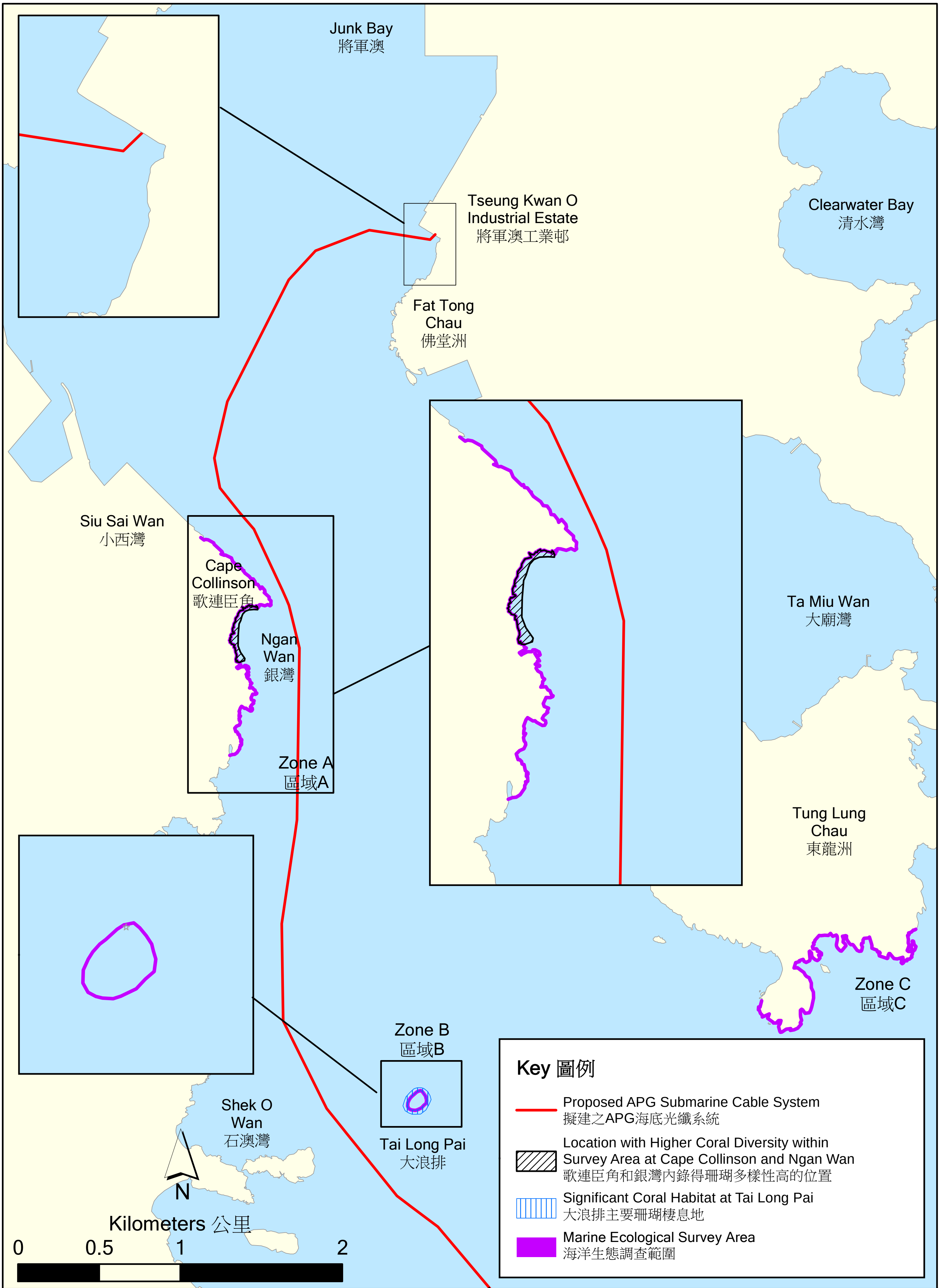

Figure E5
圖 E5

Locations of Coral Monitoring
珊瑚群落監測點

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Date: 30/8/2013

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式潛水在指定的監察站和參考站進行，收集資料包括珊瑚組成、數量和分佈。根據定性定點下潛收集到的數據，珊瑚物種和數量較高的位置會被選取為基線和工程後的快速生態評估和珊瑚群落監察的監察地點。珊瑚調查的水深範圍會根據實際觀察到的珊瑚分佈作修定。

快速生態評估調查方法

一個標準化的半定量快速生態評估調查方法會被用作調查位於監察站和參考站潮下硬底棲息地的珊瑚群落(硬珊瑚、軟珊瑚和黑珊瑚)狀況。基線和工程後的珊瑚調查結果會被用作比較，以評估海底光纜鋪設工程對珊瑚的影響。半定量快速生態評估調查方法是一個相對簡單而又不影響科學嚴謹性的方法，用以調查潮下帶生境的生態屬性。這種調查方法是從澳洲大堡礁[(1)]標準化的快速生態評估調查方法為香港的海洋環境修定過來[(2)]。

合資格的珊瑚生態學家會以潛水方式在受影響監察站（歌連臣角和大浪排；*圖E5*）和參考站（東龍洲；*圖E5*）進行一連串半定量快速生態評估調查，目的是記錄底棲狀況、估計珊瑚群落的多樣性和相對數量（即硬珊瑚、八放珊瑚和黑珊瑚）。所有的硬珊瑚群落將被鑑定到品種級，而八放珊瑚和黑珊瑚記錄到屬級。此調查將在各監察站以下兩個深度的海底鋪設100米長的樣帶進行:

- 淺水區: 海圖深度基準面-3 米至-5 米 (於潮下硬底棲息地生長的硬珊瑚群落的典型深度範圍); 和
- 深水區: 海圖深度基準面-5 米至-15 米。

快速生態評估調查的位置以及樣線的深度範圍將根據定性定點下潛調查的結果來作確定。在歌連臣角和東龍洲的每個深度會設三條樣線；由於大浪排調查區域有限，因為只會在每個深度設兩條樣線。珊瑚專家將沿樣線緩慢地前進並展開快速生態評估調查。快速生態評估調查將在樣線兩側兩米(共闊四米)對底棲層（第一層）和類群數量（第二層）進行評估。 樣帶的闊度能就水底能見度進行調整，調低至樣線兩側，每側一米的闊度(共闊兩米)。在調查中使用的兩個評估類別的解釋如下。

第一層 - 底棲層分類

每個調查樣帶完成後，五個生態和七個底層屬性將被分配到七個標準排名（序）類別的其中一個（表E4和E5）。

(1) DeVantier, L.M., G.De'Ath, T.J. Done and E. Turak (1998). *Ecological assessment of a complaex natural system: A case study from the Great Barrier Reef*. Ecological Applications 8: 480-496.

(2) Fabricius, K.E. and D. McCorry. (2006). *Changes in octocoral communities and benthic cover along a water quality gradient in reefs of Hong Kong*. Marine Pollution Bulletin 52: 22-23.

表E4　　用於半定量快速生態評估調查方法的分類 - 底棲屬性

生態	底棲
硬珊瑚	硬底棲
已死珊瑚	連續鋪面
軟珊瑚	基岩
黑珊瑚	碎石
大型海藻	沙
草皮藻類	淤泥
	大石頭(> 50厘米)
	小石(<50厘米)
	石塊(<26厘米)

表E5　　用於半定量快速生態評估調查方法的分類 - 有序排名覆蓋百分比

等級	覆蓋百分比
0	沒有記錄
1	1-5
2	6-10
3	11-30
4	31-50
5	51-75
6	76-100

第二層 - 底棲生物群落類型定義的分類

每條樣線的底棲生物類群將被列成清單，並即場將生物類群歸類至以下級別：

- 造礁石珊瑚（硬）盡可能將其分類至品種級
- 根據形態特徵盡可能把軟珊瑚、柳珊瑚、黑珊瑚、海葵和顯眼的大型海藻作記錄並盡可能將其分類至屬級；
- 盡可能把其他底棲動物（包括海綿、紐扣珊瑚、海鞘和苔蘚蟲）記錄至屬級，但通常記錄至門級及其生長形態。

完成樣線調查之後，記錄到的生物類群會根據其數量進行排序(表E6)。這些大至上的排序只根據其個體的相對數量而定，而不是基於類群於每條樣線所佔底棲層比例來排列。排列是根據主觀評估，而不是每個物種的定量計算。

表 3.1　類群數量排行序列

等級	數量
0	不存在
1	稀有(a)
2	罕少
3	常見
4	大量
5	佔優

(a)“稀有”的定義是指對在樣線上相對的低數量，而不是相對於整個香港水域分佈。

快速生態評估調查將記錄以下的現場環境描述：

(A)排列 1 - 4，受波浪衝擊的程度：

1= 被遮蔽（受高地保護）;

2=半遮蔽（適度保護）;

3=半外露（僅部分地區受保護）;

4=外露（受到風浪的全面衝擊）。

(B) 泥沙淤積在礁石基質的級別被評為四級（從極細微到中等大小的顆粒），從 0 -3：

0=無淤積;

1=少量（薄層）泥沙淤積;

2=中度泥沙淤積（厚層）;

3=主要泥沙淤積（厚、深層）。

每條快速生態評估調查樣線會有一輯具代表性的照片。 所有現場數據將會於每條樣線調查完結時被進一步檢查，潛水調查備考表亦會於一天的調查工作結束時完成。經驗證的數據將被歸納為以下幾點:

- 監察站的資料（一和二層數據）、深度和環境的描述;
- 每條樣線的物種豐富度; 和
- 物種清單、物種豐富度、生態平均值和底層類型的平均值將被編輯。豐富值將被轉換為一個覆蓋率百分比的中間值。

珊瑚群落監察

基線和工程後的珊瑚群落監察的數據可用以識別出沉積物對珊瑚造成任何壓力的證據。 在每個珊瑚監察站，一共有十五個（15）硬珊瑚

群落和十五個（15）八放珊瑚/黑珊瑚群落會被選作監察。橫板狀和巨大生長形態的珊瑚群落會優先考慮，因其大而穩定的表面容讓泥沙淤積。每個被選取的珊瑚會被拍照，並鑑定到種或屬的級別。

- 所確定的硬珊瑚和軟珊瑚群落最大直徑;
- 所確定的柳珊瑚和黑珊瑚的最大高度和闊度;
- 所確定珊瑚群落的沉積物覆蓋百分比、沉積物的顏色、質地和大約厚度和相鄰的基質。任何連續沉積物覆蓋大於百分之十都會被紀錄;
- 白化珊瑚面積的百分比，並分為兩類：(一) 淡白 和 (二) 白化;
- 珊瑚群落內的部份死亡率;
- 珊瑚群落的物理性損傷，例如: 組織膨脹、粘液增多及任何其他相關因素都會被紀錄。

其他相關資料，如調查日期、時間、天氣、海洋和潮汐條件也應被記錄下來。基線及工程後的珊瑚監察應選類似的生長形態和大小的珊瑚群落以作比較。雖然珊瑚標記監察是一種普遍的做法，但由於定位標籤的珊瑚在深水區和低光照條件下的能見度下較難被尋回，因此這種方法不會被用在這個監察程序。

E3.4 報告

基線和工程後的珊瑚調查時間表應在展開監測工作至少一個星期前取得環境保護署（環保署）同議。

須提供的珊瑚報告應包括基線監察報告及工程後監察報告。

基線監察報告應在完成基線監察調查兩週內提交，報告應包括以下內容：

- 項目背景資料簡介；
- 監察結果及相關資料，包括監察方法、監察參數、監察位置（及深度）、監察日期、時間、頻率和持續時間；
- 評論和結論。

工程後監察報告應在完成工程後監察調查一個月內提交，報告應包括但不限於以下內容：

- 項目背景資料簡介；
- 鋪設光纜前後的基線和工程後的珊瑚健康狀況作出比較；
- 就鋪設光纜工程造成任何不良珊瑚群落生長的影響作出討論。

海底光纜鋪設工程所使用的船隻可能會令水底的聲音輕微地增加一段短時間。由於江豚覓食和溝通所用的，是高頻超聲波的“咔嚓聲”，而船隻、沖噴法和光纜鋪設工作等所發出的，是低頻水底聲音，因此，預料江豚不會受到顯著干擾。所以，預計江豚和中華白海豚不會因為水底的聲音而受到不可接受的不良影響。光纜安裝工程會是短期和暫時的事件，而且會由一艘光纜鋪設躉船在約15個工作天內，於香港海域進行。故此，預計江豚不會受到光纜鋪設船隻的滋擾。

然而，在光纜鋪設工程進行期間，會為海洋哺乳類動物實施額外的預防措施。

當光纜安裝工程在日間沿著A至C區 (圖E1) 之外的纜段進行時（避開主要的海運航道），會在光纜鋪設躉船四周，以250米為半徑，實施一個海洋哺乳類動物觀察區。這個觀察區會由合資格的觀察員(1) 負責監察，並需保持一個居高臨下，及對該區一覽遺的無障礙視野。這個視野需以光纜鋪設躉船為原點。至於具體的視點會由獨立調查員建議。

合資格的觀察員會站在躉船上層的露天甲板上，並設法把眼睛保持在水面之上4至5米的高度，並在前方270°和90°之間保持相對無障礙的視野。觀察員在船上進行觀察時，必須以適當的海事雙筒望遠鏡搜索躉船正前方180°的範圍（從270°至90°），即以肉眼掃視該範圍，並間中以雙筒望遠鏡檢查。

合資格的觀察員會在開始安裝光纜前最少30分鐘，掃視半徑為250米的觀察區。如果在觀察區內發現鯨目動物，光纜鋪設工程便會推遲，直至牠們離開該區為止。這項措施可以在展開光纜鋪設工程前，確定工程附近都沒有海洋哺乳類動物，從而減少對牠們的滋擾。按照香港過去的做法，倘若在光纜鋪設工程進行期間有鯨目動物闖入工程區，便可以假定牠們已經適應這項工程，因此無需暫停鋪設光纜工作(2)。

在進行光纜鋪設工程進行期間，需要對海洋哺乳類動物觀察區進行監察。而且，在鋪設工程完工前，會每天進行監察。

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(1) 合資格觀察員的資格和經驗都必須達到漁農自然護理署署長（漁護署署長）滿意的程度。進行海洋哺乳類動物監察的觀察員必須接受適當的訓練，務求能夠進行視覺監察工程。合資格觀察員必須在開始進行監察調查前，把履歷表提交予漁護署署長。

(2) 這項措施與“香港國際機場永久航空燃油設施”項目的環境許可證中，有關沙洲和龍鼓洲海岸公園內運用抓斗進行挖泥工程所規定的條件相符。

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