SMEC
Member of the Surbana Jurong Group

HKT

Project Profile

Ultra Express Link

June 2017

Project/Deliverable No.	7076486| D01/01
Project Name:	Ultra Express Link
Report Name:	Project Profile
Report Date:	June 2017
Report for:	Hong Kong Telecommunications (HKT) Limited

PREPARATION, REVIEW AND AUTHORISATION

Revision#	Date	Prepared by	Reviewed by	Approved by
1.1 (Initial Draft)	April 2017	Samantha KONG	Vivian CHAN	Alexi BHANJA
1.2 (Revised Draft)	June 2017	Samantha KONG	Vivian CHAN	Alexi BHANJA
1.3 (Revised Draft)	June 2017	Samantha KONG	Vivian CHAN	Alexi BHANJA
1.4 (Final)	June 2017	Samantha KONG	Vivian CHAN	Alexi BHANJA

ISSUE REGISTER

Distribution List	Date Issued	Number of Copies
Hong Kong Telecommunications (HKT) Limited	June 2017	1 soft copy
Environmental Protection Department (EIAO Office)	June 2017	1 soft copy + 20 hard copies
SMEC Project File:		1 electronic

SMEC COMPANY DETAILS

SMEC Asia Limited
27/F Ford Glory Plaza, 37-39Wing Hong Street, Cheung Sha Wan, Kowloon, Hong Kong
T +852 3995 8100|**F** +852 3995 8101
smecasia@smec.com |www.smec.com

The information within this document is and shall remain the property of **SMEC Asia Limited**

CONTENTS

1 BASIC INFORMATION 1-1

1.1 Project Title 1-1
1.2 Purpose and Nature of the Project 1-1
1.3 Name of Project Proponent 1-1
1.4 Location and Scale of Project 1-2
1.5 Cable Route Selection Process 1-3
1.6 Project Details 1-5
1.7 Designated Projects to be Covered by the Project Profile 1-9
1.8 Name and Telephone Number of Contact Person 1-9

2 OUTLINE OF PLANNING AND IMPLEMENTATION PROGRAMME 2-1

2.1 Project Planning and Implementation 2-1
2.2 Project Programme 2-1
2.3 Interactions with Other Projects 2-1

3 MAJOR ELEMENTS OF THE SURROUNDING ENVIRONMENT 3-1

3.1 Marine Fairways and Traffic Separation Scheme 3-1
3.2 Cable, Pipelines, Outfalls and Intakes 3-1
3.3 Designated Areas 3-2
3.4 Coral Communities 3-2
3.5 Fish Culture Zones (FCZ) 3-3
3.6 Cultural Heritage Sites 3-3
3.7 Cumulative Impacts From Other Projects 3-3

4 POSSIBLE IMPACTS ON THE ENVIRONMENT 4-1

4.1 Summary of Potential Environmental Impacts 4-1
4.2 Water Quality Assessment 4-2
4.3 Waste Assessment 4-5
4.4 Marine Ecology Assessment 4-6
4.5 Fisheries Assessment 4-7
4.6 Noise Assessment 4-8
4.7 Cultural Heritage Assessment 4-9
4.8 Others 4-10

5 ENVIRONMENTAL PROTECTION MEASURES TO BE INCORPORATED INTO THE DESIGN AND ANY FURTHER IMPLICATIONS 5-1

5.1 Measures to Minimise Environmental Impacts 5-1
5.2 Possible Severity, Distribution and Duration of Environmental Effects 5-2
5.3 Further Implications 5-2
5.4 Environmental Monitoring and Auditing (EM&A) 5-2
6 USE OF PREVIOUSLY APPROVED EIA REPORTS 6-1
6.1 Submarine Cables Landing at TKOIE 6-1
6.2 Other Submarine Cables 6-1

ANNEXES

Annex A Water Quality Assessment
Annex B Drilling Fluid Management Plan
Annex C Marine Ecology Assessment
Annex D Fisheries Assessment
Annex E Construction Noise Assessment
Annex F Cultural Heritage Assessment

TABLES

Table 4-1 Potential Sources of Environmental Impacts

FIGURES

Figure 1-1 Ultra Express Link Alignment
Figure 1-2 Sensitive Receivers in the Area
Figure 1-3 Extent of HDD Works
Figure 1-4 SSW Shore Based Temporary Works Area
Figure 1-5 Vertical Profile of HDD Cable Duct
Figure 1-6 Examples of Cable Laying Vessels and Cable Burial Tools
Figure 1-7 Possible Cable Protection Measures at Crossing Locations
Figure 1-8 TKOIE Cable Landing Area with Existing Beach Manhole and Cable Duct

1 BASIC INFORMATION

1.1 Project Title

1.1.1 The title of the Project is “Ultra Express Link” and the project proponent is Hong Kong Telecommunications (HKT) Limited (“HKT”), a telecommunication service provider in Hong Kong.

1.2 Purpose and Nature of the Project

1.2.1 In order to meet the rising demand for high speed and high capacity connectivity requirements from data centre operators, HKT plans to construct a submarine cable linking Tseung Kwan O Industrial Estate ("TKOIE") and Siu Sai Wan at Chai Wan. This cable, called Ultra Express Link (“the Project”), not only provides robust, reliable, low latency, diversity and connectivity, but also fosters the development of TKOIE towards becoming Asia's data centre hub.

1.2.2 Tseung Kwan O is a strategically important telecommunications and media hub for Hong Kong. Within TKOIE there are several existing high-tier data centres, such as the Hong Kong Stock Exchange, HKColo, NTT, Digital Realty, China Mobile, HSBC, China Unicom, etc. There are also more data centres under development within TKOIE (including Global Switch data centre) and at designated sites nearby (such as the SUNeVision / i-Advantage data centre) that are presently under construction.

1.2.3 TKOIE has a purpose-designed landing point for cables built into the existing seawall that is currently being used by several local and international telecommunication cable systems, including the *East Asia Crossing (“EAC”) Cable System*, *Asia Submarine-cable Express (ASE) System*, *Asia Pacific Gateway (“APG”) System* and *Tseung Kwan O (“TKO”) Express – Cable System*.

1.2.4 The areas of Chai Wan and Siu Sai Wan (SSW) on Hong Kong Island are also a preferred location for high-tier data centres and large-scale data co-location facilities, such as HKColo and Mega-iAdvantage. The area is a growth location for ICT, following the government’s initiative to allow conversion of older industrial buildings into data centres. The Ultra Express Link will connect this area with the well-established facilities in TKOIE and ultimately connect into HKT’s terrestrial cable network system.

1.2.5 An assessment of the potential environmental impacts associated with the Project has been provided in this Project Profile. The construction and installation of the Ultra Express Link is virtually identical to other telecommunication cable systems that have been installed at TKOIE and within other areas of Hong Kong, and especially similar to *TKO Express – Cable System*, with a similar alignment connecting SSW and TKOIE.

1.3 Name of Project Proponent

Hong Kong Telecommunications (HKT) Limited
8/F, Lai Chi Kok Engineering Center II
4 Yuet Lun Street,
Lai Chi Kok, Hong Kong

1.4 Location and Scale of Project

Location of Project

1.4.1 The Project comprises of the installation of a high capacity network cable system between SSW on Hong Kong Island and TKOIE in Sai Kung. The Ultra Express Link will link TKOIE with existing and future data centres in Chai Wan.

1.4.2 The route alignment of Ultra Express Link between SSW and TKOIE is shown in ***Figure 1-1***. Between these two locations is the Tathong Channel Traffic Separation Scheme.

1.4.3 The marine area between TKOIE and SSW Promenade has been used over the years for fishing, material extraction and for public utilities. The seabed has been significantly disturbed from its previous use as a designated Marine Borrow Area. Based on geophysical survey data, the seabed shows signs of fishing vessel trawling scars and informal rock dumping activities. There are several utilities within the area, including marine water extraction, sewage discharge points and other subsea telecommunications cable systems.

Scale of Project

1.4.4 As shown in ***Figure 1-1***, Ultra Express Link will span some 2.76km between SSW and TKOIE and will include a multi-fibre, armoured high capacity submarine cable system of around 60mm in diameter.

1.4.5 Land based earthworks at SSW will be required for the project including construction of a new underground cable receiving pit below unused land near to the SSW Promenade. The cable pit will be located outside all leisure facilities managed by the Leisure and Cultural Services Department (LCSD) and the construction will involve only small-scale shallow excavation works for the manhole. The cable pit, upon completion, will be located fully below ground, with exception of pit covers at ground level. The area will be fully reinstated after cable installation.

1.4.6 At the cable pit location, a cable duct will be installed using Horizontal Directional Drilling (HDD) techniques (see ***Section 1.6*** for details). HDD techniques provide a steerable trenchless method of installing underground utilities with minimal impact on the surrounding surface areas. The cable duct will be drilled below the foundations of the existing seawall, emerging from the seabed at a point about 423m offshore. HDD has been selected as a method of construction to minimise environmental impacts and disturbance to LCSD's facilities in the SSW Promenade area and to ensure the existing Siu Sai Wan seawall and foundation are not disturbed during the cable installation.

1.4.7 From the point that the cable emerges from the seabed offshore from SSW, it will be installed by a cable-laying barge that will simultaneously lay and bury the cable along the short distance across the Tathong Channel to TKOIE, following a similar route to other cable systems in the area. This method has been used extensively for cable laying in Hong Kong and has been found to be environmentally acceptable. The intended burial depth for the offshore burial of the cable will be between 3m to 5m below seabed and no less than 5m within the marine fairway.

1.4.8 At TKOIE, the cable will emerge from the sea and enter an existing conduit within the seawall, which has an existing duct in place. This duct leads to an existing cable manhole and then to the existing cable duct network system. As the seawall conduit and manhole

are already in place, along with the connecting land based ducts, there will only be minor installation works associated with pulling the Ultra Express Link through the existing infrastructure with no new construction required. As such, no disturbance or impacts will result from the installation works at the land-side of TKOIE.

1.4.9 Submarine cables are vulnerable to damage by vessel anchors and dropped objects. In order to prevent damage of the submarine cable, protective measures including installation of articulated pipe at the section of cable with shallow burial and/or placement of concrete mattress on the seabed as additional cable protection will be employed. In case the cable installed under the seabed being damaged by dropped objects or anchoring activities, cable repair works shall be required.

1.4.10 No seabed dredging will be required for the HDD installation, cable laying or cable maintenance works.

1.5 Cable Route Selection Process

1.5.1 There are several existing sensitive receivers in the vicinity of the Ultra Express Link alignment that have defined the route selection and cable-laying process, as shown in ***Figure 1-2***.The final cable route follows a narrow corridor in order to either avoid or reduce impacts to these features as far as possible. The Ultra Express Link can allow the seabed considerations, landing site considerations, physical constraints, planning considerations and environmental considerations to be included.

Seabed Considerations

- **Marine Sediments.** Ultra Express Link needs to be installed within soft marine sediment of a sufficient depth above bedrock to provide protection to the cable and to achieve a burial depth of between 3m to 5m and a burial depth of 5m (at minimum) in the marine fairway. The alignment has been based on the geophysical survey, which has provided the best route to achieve this.
- **Foul Areas.** In order to achieve the target burial depth, areas of construction debris or areas where rock has been dumped on the seabed need to be avoided. During earlier surveys, areas of rock dumping were identified in the vicinity of the cable alignment, including the area between Drainage Services Department (DSD) outfall, the *TKO Express – Cable System* and *EAC Cable Project*. As such, Ultra Express Link has avoided these foul areas for cable installation.
- **Rock Outcrops and Shallow Bedrock.** Rock outcrops and shallow bedrock areas are present along the seawall of the SSW Promenade, in particular along the western-most portion of the SSW Promenade. HDD has been proposed for the Ultra Express Link installation through the rock area near the seawall at the SSW Promenade to safely install the cable in these areas.

Landing Site Considerations

- **Direct Path.** The most direct path that could be achieved has been selected, given the seabed conditions and physical constraints including utilities between SSW and TKOIE, thus allowing for efficiencies in construction works, material procurement, minimising environmental impacts and achieving operational targets.

- **Existing Facilities.** Ultra Express Link will utilise the existing available seawall duct space at TKOIE, rather than undertaking new duct construction, and existing facilities (manhole and cable duct network) will be used.
- **Manhole Locations.** Ultra Express Link is a public infrastructure project and suitable government land is required for the cable pit location at SSW. The Site that has been selected is an unoccupied land that is located on reclaimed land, outside LCSD's facilities, and is close to the existing road and cable networks.

Physical Constraints

- **DSD Sewage Pipeline.** The sewage pipeline is a reserve outfall (replaced by the Harbour Area Treatment Scheme (HATS)) that covers the majority of the area from TKO, across the Tathong Channel. Ultra Express Link will need to cross this pipeline (similar to the other cables entering TKOIE) and the crossing location has been selected to achieve the following:
  - The crossing is located outside the Marine Traffic Separation Zone (for cable safety and to reduce impacts to marine traffic during installation).
  - The crossing point is at an area where the DSD pipeline is buried sufficiently deep to allow the cable to be buried (for protection) above it, rather than crossing where the DSD pipeline is at a shallower depth requiring the cable to be surface laid (with less protection) above it.
  - The crossing point is situated at distance from the near shore area along the TKOIE for cable protection against existing marine traffic near TKOIE and from future works associated with the construction of the Cross Bay Link.
- **Island East Transfer Station (IETS).**The IETS marine basin and loading area, is located adjacent to the SSW Promenade near the cable pit. Ultra Express Link avoids the area close to the shore near the marine vessel area to avoid disturbance to operations during cable installation and also for cable protection.
- **Water Supplies Department (WSD) Seawater Intake.** The WSD intake is located along the western portion of the SSW Promenade. This area has been avoided and the closest point to the pumping station from Ultra Express Link is approximately 540m.
- **Pamela Youde Nethersole Eastern Hospital Seawater Intake.** The intake is located approximately 995m from the nearest point of the Ultra Express Link.
- **Existing Seawall.** The seawall at SSW Promenade is a block wall configuration with a sloping seawall toe and disturbance to the seawall and its foundation should be avoided. As such, the cable duct will be bored beneath the seawall foundation to avoid disturbance to this structure – the Civil Engineering and Development Department (CEDD) have been consulted on this matter and have no objections to the proposed cable installation works.
- **Other Telecommunication Cables.** It is preferred that the Ultra Express Link alignment minimises the number of cable crossings as far as practicable. The Ultra Express Link has no crossings with other telecommunication cables.

Planning Considerations

- **Marine Traffic.** The Project avoids the Eastern Fairway and crosses the Tathong Channel Traffic Separation Scheme perpendicularly to minimise marine traffic

impact. For the areas where the Ultra Express Link is required to cross other infrastructure, this has also been planned outside the Tathong Channel Traffic Separation Scheme.

- **Anchorage Areas.** There is a designated anchorage area about 2km west of the TKO landfall and the Ultra Express Link alignment has avoided this area.
- **Marine Sand Borrow Area.** The marine seabed area near SSW Promenade was used as a sand borrow area between 1990 to the end of 2003. As a result, the seabed in this area has variable topography and the marine survey has recommended the preferred route to avoid these areas.
- **Siu Sai Wan Promenade.** The SSW Promenade is a popular sports and recreation area managed by LCSD, and includes SSW Promenade, Fu Hong Street Pet Garden, Fu Hong Street Sitting-out Area and the SSW Sports Ground. Direct impacts have been avoided to all these facilities by constructing the cable duct using HDD techniques, which involve no physical encroachment onto any LCSD facilities. Measures have been incorporated into the project design to minimise impacts to public enjoyment of LCSD's facilities during construction of the Project.
- **Other Projects.** The following projects are planned for the area:
  - Asia-Africa-Europe-1 (AAE-1) Cable System.
  - Desalination Plant at Tseung Kwan O.
  - Tseung Kwan O – Lam Tin Tunnel and Associated Works.
  - Cross Bay Link.
  - Hong Kong Offshore Wind Farm in Southeastern Waters.

  The Ultra Express Link alignment has been planned taking these projects into consideration.

Environmental Considerations

- **Manhole Location.** The cable pit location has been selected at a non-environmentally sensitive location on a reclaimed, vacant, government land at SSW, adjacent to an existing roadway and near the cable-receiving site.
- **Environmentally Sensitive Areas.** The Project avoids sensitive areas, such as gazette-bathing beaches, marine parks, areas of known coastal ecology, corals and fish culture zones.
- **Low Impact Construction.** The Project will involve HDD for construction through the existing seawall at SSW to avoid opening up the seawall and thereby avoiding excavation and disturbance to LCSD's facilities along SSW Promenade. It will also use existing reserve facilities at TKOIE, rather than undertaking new construction.

1.5.2 Given the above, the route selected for Ultra Express Link has been based on engineering, planning, environmental and operational considerations.

1.6 Project Details

1.6.1 The Project will be constructed in the following stages:

- Shore Installation at SSW.
- Offshore Cable Installation with Protection over Crossing.
- Shore Installation at TKOIE.

1.6.2 During project operation stage, cable repair works could be required for accidentally damaged cable.

Shore Installation at SSW

1.6.3 The land-based cable installation activities will be located in a roadside amenity area near to, but outside of the Fu Hong Street Pet Garden and will comprise:

- Construction of a cable connection pit (manhole).
- Construction of a cable duct using HDD from the manhole at SSW, below LCSD's facilities (Fu Hong Street Pet Garden and Fu Hong Street Sitting-out Area), and traversing below the seawall foundation and emerging in the seabed at a point some 423m offshore.

1.6.4 The proposed SSW works area will temporarily occupy approximately 850m^2 in a roadside amenity area near to Fu Hong Street Pet Garden in which there are some trees and soft landscape under LCSD's maintenance. ***Figure 1-3*** shows the temporary layout of this works area, which includes both the permanent manhole and also the temporary plant and equipment needed for the HDD construction.

Construction of the Cable Connection Pit (Manhole)

1.6.5 The cable connection pit (manhole) at SSW will have external dimensions of around 4.8m(L) x 2.5m(W) and 3m(D). This will involve minor excavation and off-site disposal of approximately 46.7m^3 of material, mainly topsoil and reclamation fill. The location of the manhole is shown on ***Figure 1-3***.

1.6.6 The area of the pit and underground cabling will be fully reinstated after installation. As the proposed cable connection pit will be constructed below ground level and on reclaimed land, no natural terrestrial habitat or terrestrial habitat of conservation importance will be lost or affected. Only a small cable pit (manhole) cover will be visible after construction.

Construction of a Cable Duct Using HDD

1.6.7 Construction of the cable duct (an underground pipe to house the cable) will be achieved using HDD. The cable duct will be between 150-200mm in diameter. This method has been widely used in Hong Kong for other cable projects (both telecommunication and power cables) and pipeline projects and throughout the world in areas where trenchless technology is preferred to minimise surface impacts. As shown on ***Figure 1-4,*** the HDD duct will be around 550m in length, with around 127m running below existing reclamation (i.e. Fu Hong Street Pet Garden, Fu Hong Street Sitting Out Area and Siu Sau Wan Promenade) and 423m under the sea.

1.6.8 A borehole will be drilled using specialised HDD drilling equipment and a metal conduit will be installed. The cable will then be pulled through the conduit with a rope wire system from the marine end. The cable will then be buried using a cable burial tool that will simultaneously lay and bury the cable into the seabed. The HDD construction

equipment will include the HDD drill rig, along with a generator, fluidised material circulation system, collection system and water tanks.

1.6.9 As shown on ***Figure 1-3***, the plant and equipment required for the HDD construction works will be arranged within the roadside amenity area such that no trees will need to be felled. With the exception of the mobile crane, which will not be located near tree canopies, most of the plant and equipment is only a few metres tall and will not adversely affect trees in the area. Some existing small shrubs/grass will need to be relocated from within the works area and these plantings will be reinstated afterwards in coordination with LCSD.

1.6.10 During the drilling process, the drill head is used to cut through the topsoil and reclamation fill material to the former seabed. It will then travel below the foundation of the seawall (pellmell rubble) and through bedrock then up to an area of marine sediment approximately 423m offshore, along a pre-defined drill path. ***Figure 1-5*** shows the vertical alignment of the HDD duct beneath LCSD's facilities at SSW and beneath the seawall and foundations, which demonstrates that no impact will result to either.

1.6.11 Drilling fluids will be used during duct construction to maintain the duct shape and stability (to avoid collapse), to remove rock cuttings and to lubricate the rotating drill bit. This drilling fluid (or "drilling mud") consists of water-based products – generally bentonite clay, which is mixed with freshwater to create slurry. The fluid is pumped through the drill, acting as a lubricant for the drilling process, and brings the rock cuttings back to the surface.

1.6.12 At surface, the returning drilling fluid will enter a centrifuge, which removes the heavier rock cuttings from the fluid, which flows into tanks for reuse. This process has proven to be effective on other projects in Hong Kong and has been found to be environmentally acceptable. To avoid any potential leakage of the drilling fluid into the marine environment when the drill head breaks out of the bedrock and into the marine mud on the seabed, drilling will stop 5m before exiting the seabed and the drill hole will be purged and water will be the predominant drilling fluid used for the final 5m of drilling.

1.6.13 The shore end works are planned to be undertaken during daytime hours but should any work be required in restricted hours (evening, night time or on general holidays) a Construction Noise Permit (CNP) will be obtained in advance under the Noise Control Ordinance (NCO).

Offshore Cable Installation

1.6.14 The offshore work will include:

- Feeding the cable through the conduit to the on shore manhole at SSW.
- Burial of the cable using a cable laying vessel and a cable burial tool.
- Provision of cable protection in high-risk areas.

Feeding the Cable Through the Conduit to the On Shore Manhole at SSW

1.6.15 Once the cable duct is constructed, divers will retrieve a float rope wire and the cable will be connected to the wire system from the cable laying vessel and an on shore winch will pull the cable through the HDD drilled cable duct to the cable connection pit in SSW.

Burial of the Cable Using a Cable Laying Vessel and a Cable Burial Tool

1.6.16 The cable-laying vessel will then install the cable off shore using direct cable installation and burial techniques using a cable burial tool. The route is first checked by the tool to ensure that there is no obstruction with the cable alignment. The cable is then placed in the tool, and is carefully laid into the seabed and set to the desired depth.

1.6.17 Passive jetting will then be undertaken automatically by the burial tool to liquefy the sediments at the desired installation level and to aid with the burial at the target depth of 3m to 5m below the seabed (5m within the marine fairway) as the tool is pulled along the route alignment by the cable-laying vessel. This method is designed to simultaneously lay and bury the cable with minimal disturbance to the seabed and will result in only localised, temporary impacts to the marine water quality at the seabed. ***Figure 1-6*** shows the typical cable laying and burial equipment.

1.6.18 The width of the trench created by the tool is narrow (250mm or less) and the disturbed area of the seabed will be limited to the tool's width. A dive team will be on standby during installation to ensure proper functioning and positioning of the installation tool.

1.6.19 The cable laying vessel will travel approximately 1km per hour or less along the planned cable route. The marine cable installation using the cable laying vessel between SSW and TKOIE is expected to take one day to complete.

Provision of Cable Protection in Risk Areas

1.6.20 For the areas where Ultra Express Link will need to cross existing pipelines, the cable tool will be readjusted to about 50m from the target crossing location to a depth sufficient to allow a cushion of seabed material to be in place above the target to be crossed. Additional protection will be provided by Articulated Pipe (AP) and concrete mattress, if needed, and will be agreed with other cable owners in advance of installation. Once crossed, the burial tool will be adjusted to re-achieve the target burial depth.

1.6.21 At the DSD sewage outfall crossing, a shallower burial depth will be required and due to previous problems of anchors damaging cables at shallower depths, additional cable protection will be required. The additional protection may include either placement of reinforced precast interlinked concrete mattresses on top of the Ultra Express Link at the crossing location or installation of AP prior to cable burial, or a combination of the two.

1.6.22 Should concrete mattress protection be required at the DSD sewage outfall, the cable laying barge will install Ultra Express Link, starting 50m from the crossing, at a depth of 1.5m at the crossing location (to provide a buffer between Ultra Express Link and the DSD pipeline). The barge will then return after the cable is buried and place the mattresses (approximately 80m x 3.5m by 0.3m each) on top of the cable where it crosses the pipeline. It is expected that the concrete will settle by its mass to a depth of 1.5m below seabed. If this option is selected, the cable protection installation method will be agreed in full with DSD prior to the commencement of work.

1.6.23 ***Figure 1-7*** shows the crossings and potential cable protection measures.

Shore Installation at TKO Industrial Estate

1.6.24 At the shore end at TKOIE, the cable will be fed through the existing duct with a winch and the cable will be pulled through the duct and secured at the existing beach manhole.

It will then be pulled through the existing cable duct network within TKOIE. ***Figure 1-8*** shows the TKOIE cable landing area with existing beach manhole and cable duct. No excavation or construction is necessary for this section.

Cable Repair Works

1.6.25 In case the cable installed under the seabed is being damaged by dropped objects or anchoring activities, cable repair works shall be required. Cable repair work shall comprise of route clearance prior to repair works, exposing the damaged cable section by same diver jetting tool and/or cable burial tool used for marine works during construction stage, reconnecting the damaged cable, and reburial of the repaired cable section by diver jetting tool and/or cable burial tool. The seabed can be expected to naturally reinstate to before-work level and condition shortly after completion of the works.

1.7 Designated Projects to be Covered by the Project Profile

1.7.1 The project is classified as Designated Project (DP) under the Environmental Impact Assessment Ordinance (EIAO) as specified below:

- **Schedule 2 (Part I), C.12.** This refers to a dredging operation which (a) is less than 500m from the nearest boundary of an existing or planned (ii) Site of Cultural Heritage, including a Declared Monument – 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.

1.7.2 These sites are located on Fat Tau Chau (Junk Island), which is within 500m of the cable route on the TKO side. Temporary marine works will not be required at TKOIE or near the SSW shore.

1.8 Name and Telephone Number of Contact Person

1.8.1 The contact person for the Project Proponent is:

Mr K C LEUNG
Assistant Vice President
Hong Kong Telecommunications (HKT) Limited
Email kc.leung@pccw.com
Telephone +852 9036 9935

1.8.2 SMEC Asia Limited (SMEC) has been appointed by HKT to undertake the environmental permitting for this Project. All enquiries can be addressed to SMEC at:

Ms Vivian CHAN
Associate, Water & Environmental Group
SMEC Asia Limited
Email vivian.chan@smec.com
Telephone +852 3995 8100

Figure 1-1 Ultra Express Link Alignment

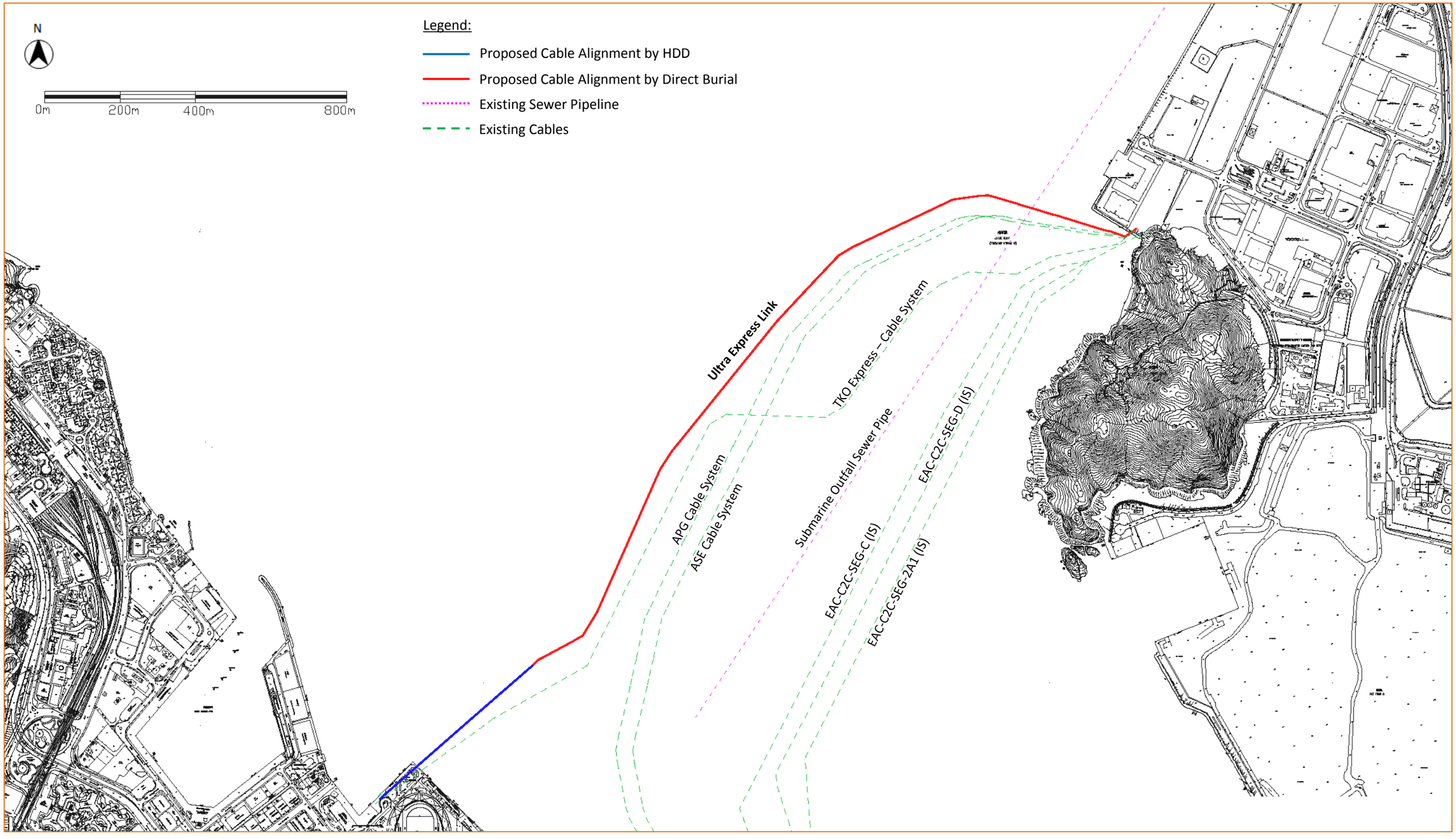
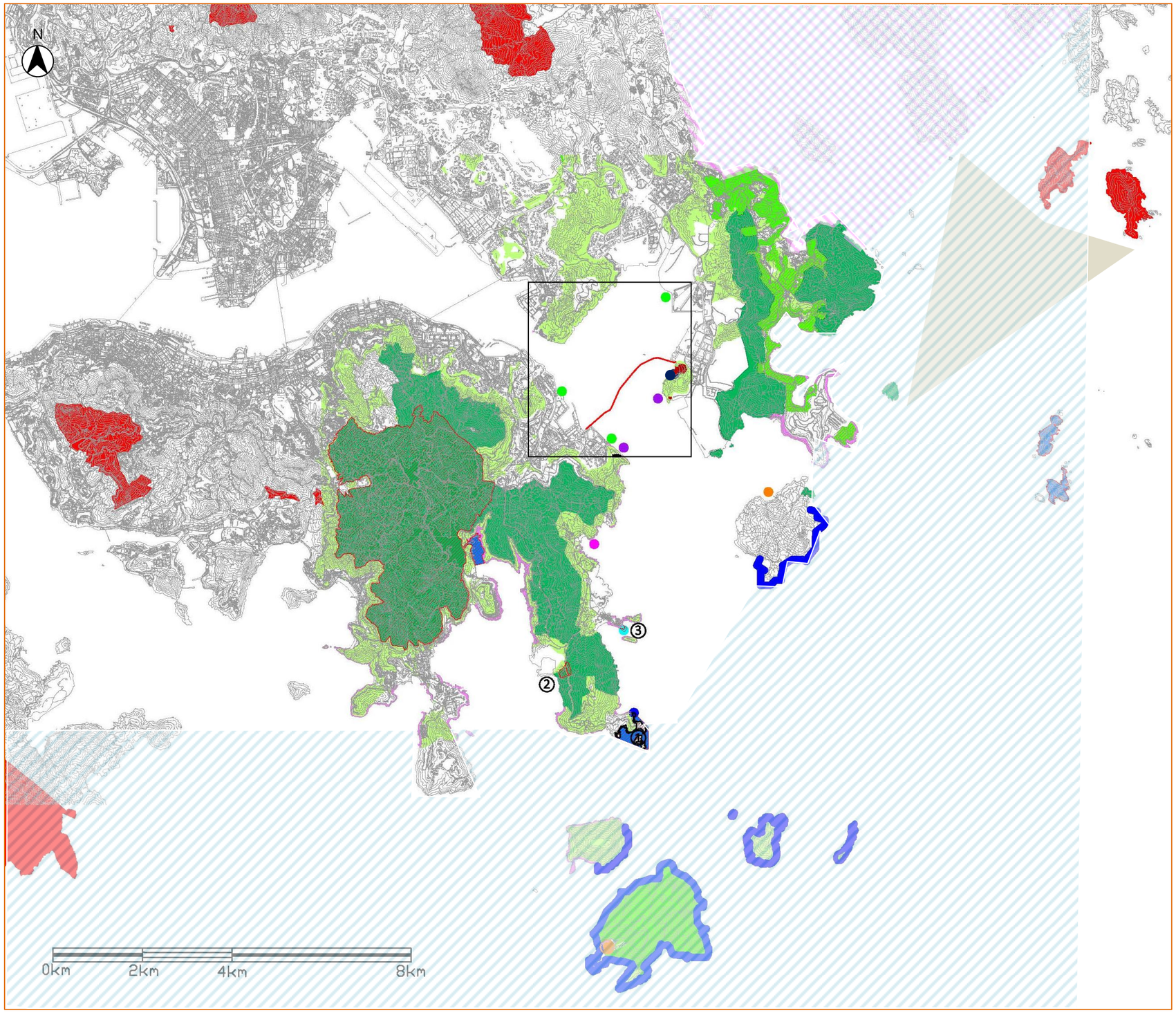
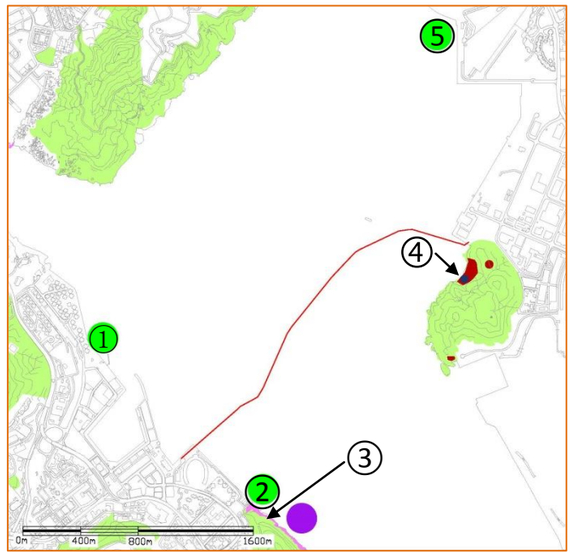


Figure 1-2 Sensitive Receivers in the Area





Key (Distance from Cable Alignment in Brackets):

① Pamela YoudeNethersole Eastern Hospital Salt Water Intake (995m)

② WSD Siu Sai Wan Salt Water Pumping Station (Salt Water Intake) (540m)

③ Closest Part of Coastal Protection Area (CPA) (555m)

④ Old Customs Station on Fat Tau Chau (Declared Monument) (237m)

⑤ WSD Tseung Kwan O Salt Water Intake (1,360m)

Legend:

- Cable Alignment
- Site of Scientific Interest
- ① Hok Tsui (Cape D'Aguilar)
- ② D'Aguilar Peninsula
- ③ Shek O Headland
- Marine Reserve
- Coastal Protection Area
- Country Park
- Green Belt
- Coral Communities of Ecological Concern
- Fish Culture Zone
- Site of Scientific Interest
- Seawater Intake
- Coral Communities of Ecological Concern
- Gazetted Bathing Beach
- Sites of Archaeological Interest
- Spawning Ground
- Nursery Ground
- Artificial Reef
- Declared Monument

Figure 1-3 SSW Shore Based Temporary Works Area

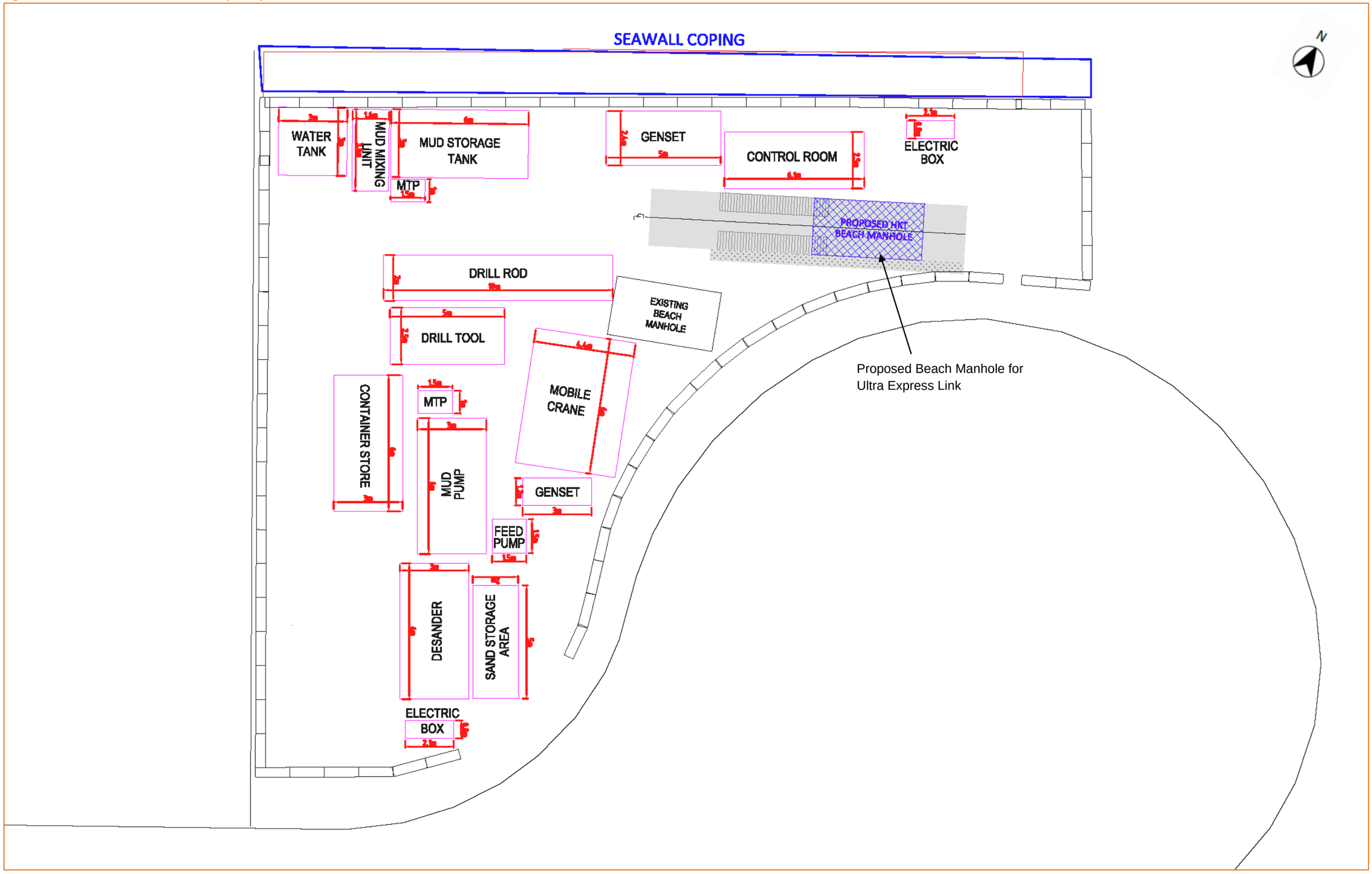


Figure 1-4 Extent of HDD Works

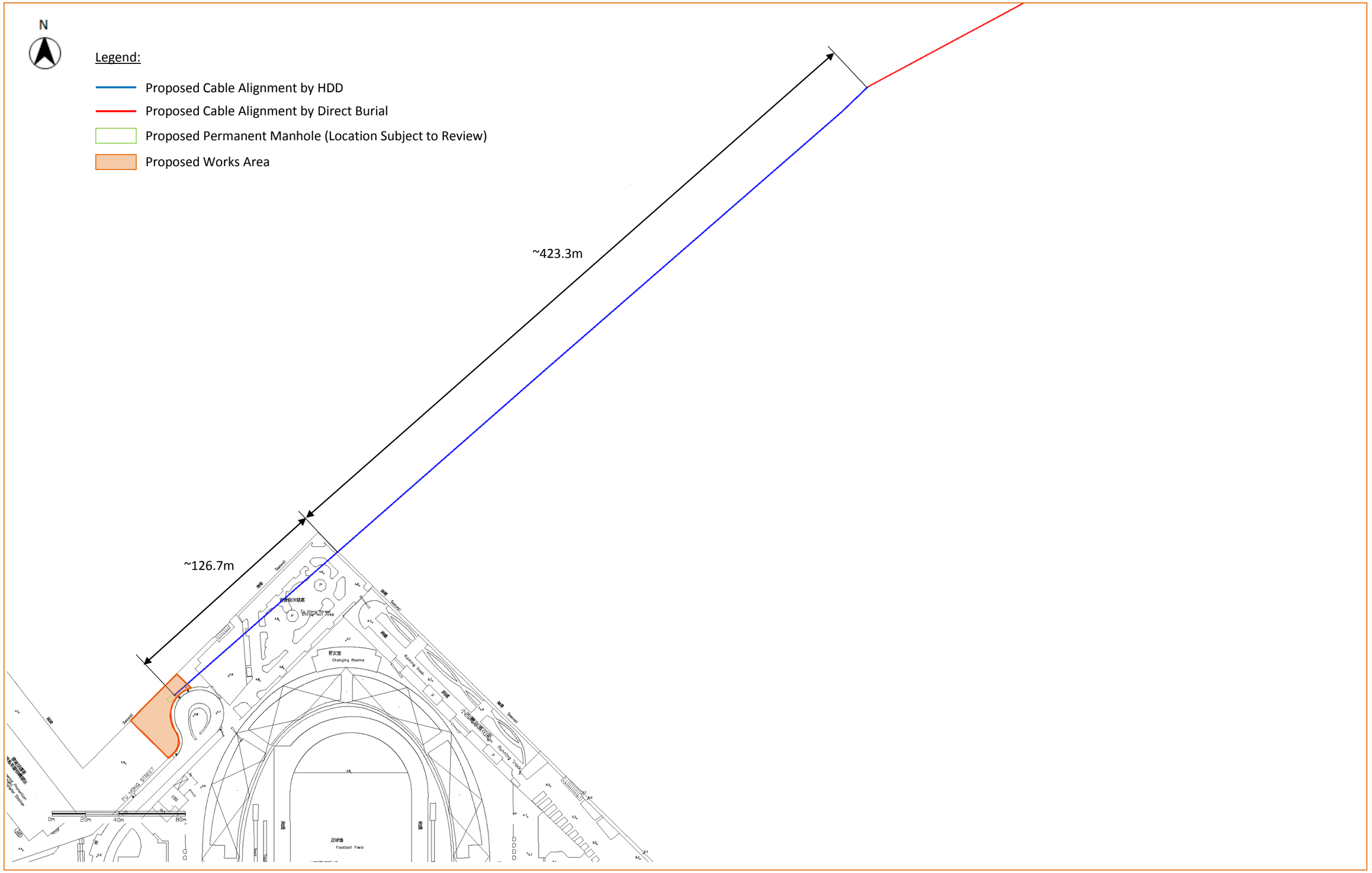
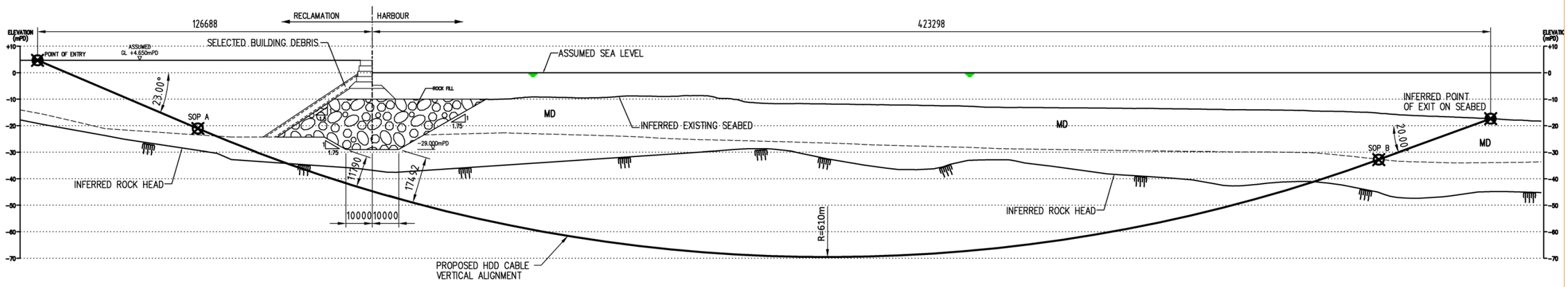


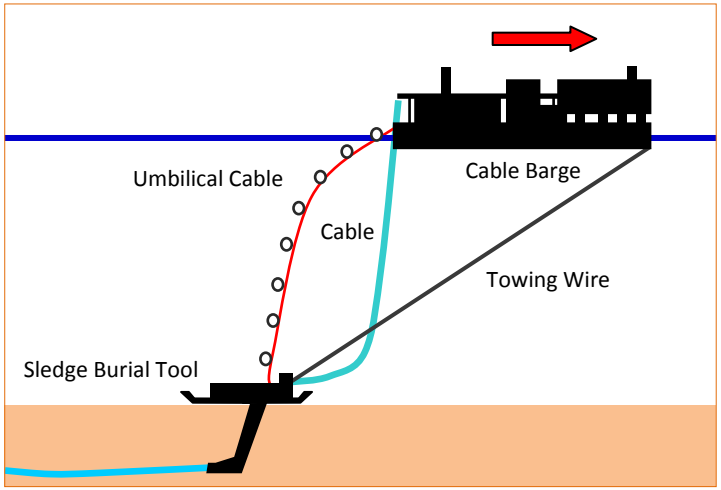
Figure 1-5 Vertical Profile of HDD Cable Duct



CONTROL POINT CHAINAGE (m)	0.000	60.652	100.000	200.000	300.000	400.000	500.000	507.631	549.986
CONTROL POINT LEVEL (mPD)	+4.65	-21.095						-32.800	-17.394
VERTICAL PROFILE	STRAIGHT = 60.652m DIP ANGLE = 23°		CURVE = 457.800m RADIUS = 610m					STRAIGHT = 42.355m DIP ANGLE = 20°	
HORIZONTAL PROFILE	STRAIGTH = 549.986m								
DRILLING METHOD	HORIZONTAL DIRECTIONAL DRILLING WITH STEEL CASING DRILLING METHOD INTERNAL DIAMETER OF STEEL CASING SHALL BE 152mm								

Figure 1-6 Examples of Cable Laying Vessels and Cable Burial Tools

Simultaneous Cable Laying and Burial Operation (Sledge Tool)

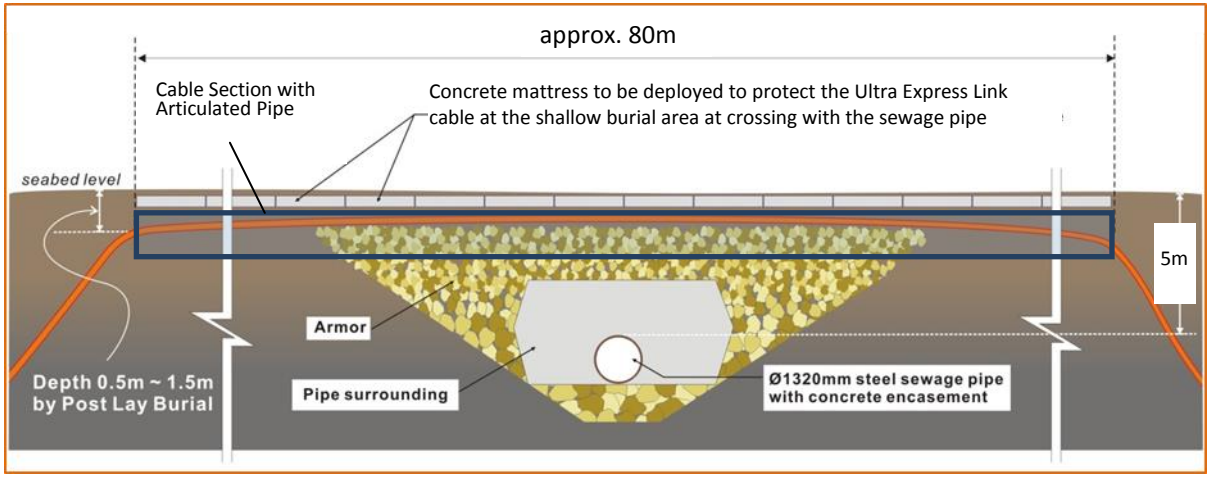


Typical Sledge Burial Tool

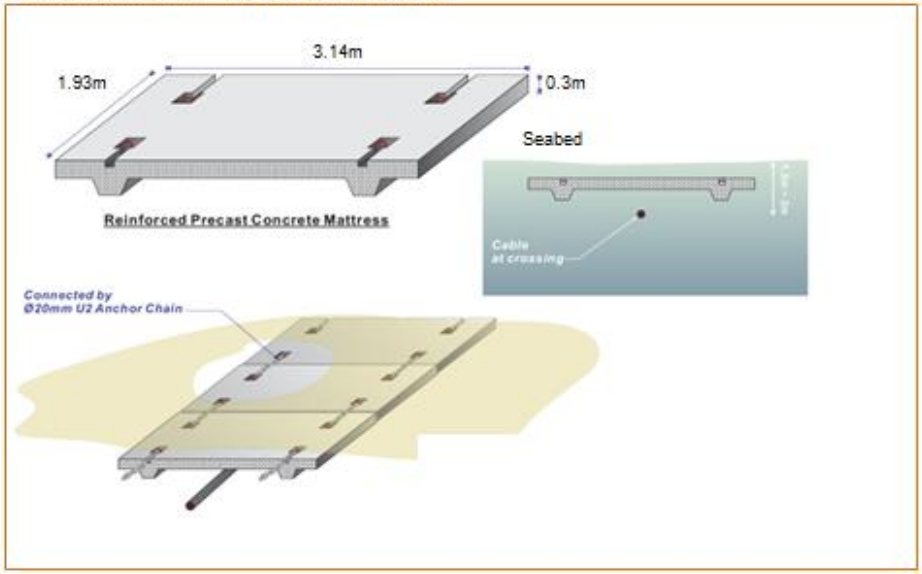
Typical Cable Installation Barge

Figure 1-7 Possible Cable Protection Measures at Crossing Locations

Cross Section of Articulated Pipe and Concrete Mattress Above DSD Pipeline



Concrete Mattress – Typical Specifications



Articulated Pipe – Typical Specifications

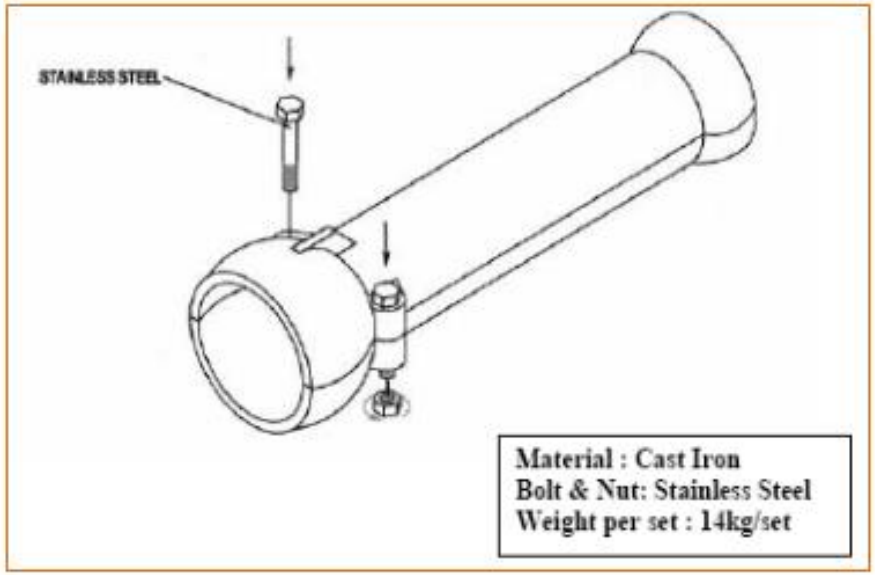
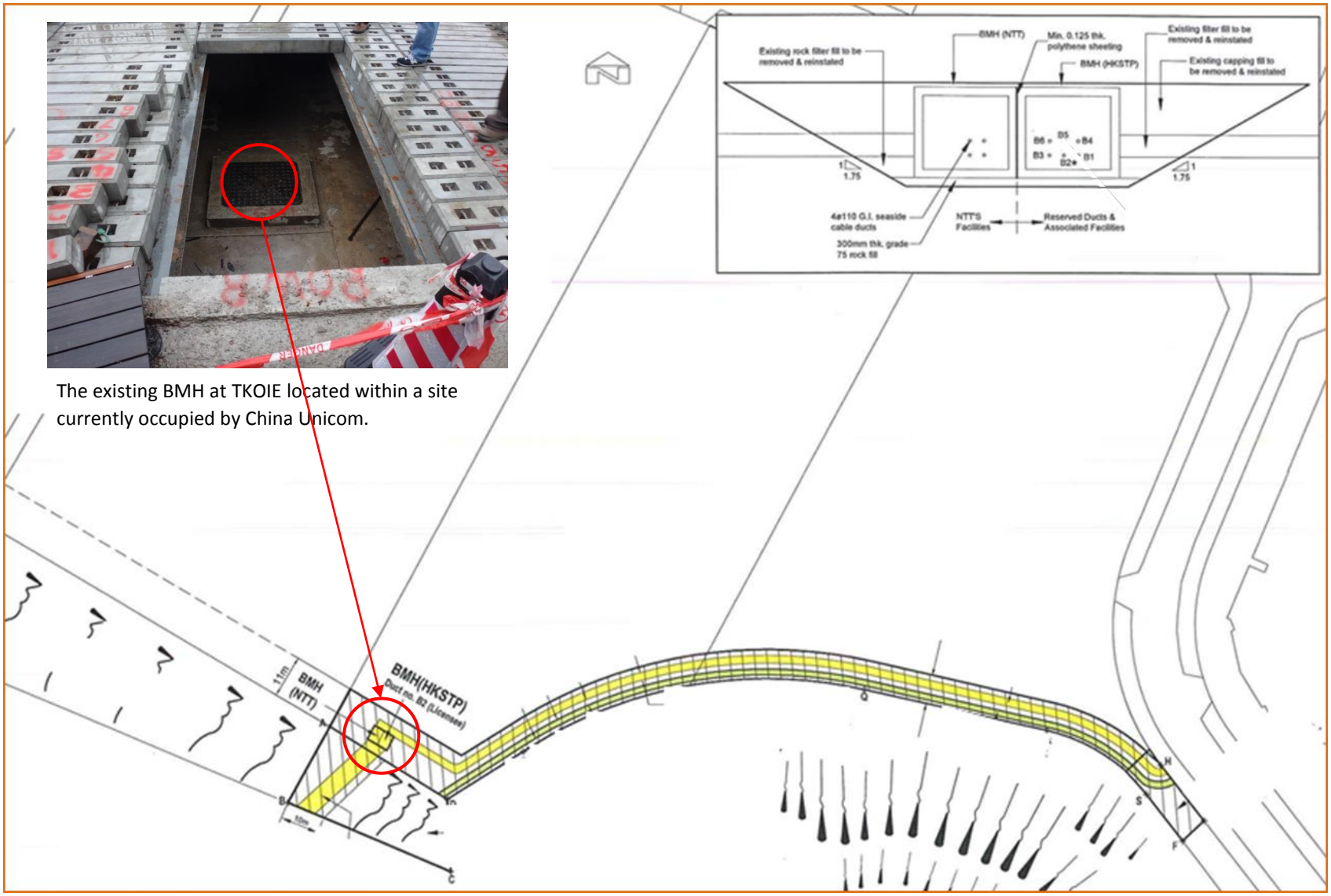


Figure 1-8 TKOIE Cable Landing Area with Existing Beach Manhole and Cable Duct



The existing BMH at TKOIE located within a site currently occupied by China Unicom.

2 OUTLINE OF PLANNING AND IMPLEMENTATION PROGRAMME

2.1 Project Planning and Implementation

2.1.1 The Project is to be led, planned and managed by the Project Proponent, Hong Kong Telecommunications (HKT) Limited. To assist in project planning and implementation, HKT has engaged:

- Consultants to:
  - Obtain gazettal under the Seabed and Foreshore (Reclamation) Ordinance (FSRO) and liaise with Lands Department (LandsD) and District Councils (DCs).
  - Address planning issues and liaise with Planning Department (PlanD).
  - Prepare geotechnical/civil/structural engineering design for the manhole and associated structures, and to liaise with CEDD and the works contractors.
  - Address marine traffic issues and liaise with Marine Department.
- Contractors to:
  - Carry out the HDD works.
  - Carry out the cable laying works.

2.2 Project Programme

2.2.1 The initial cable-laying operation is targeted to commence as early as possible upon completion of required permits, which are expected to be received by end-2017.

2.2.2 The time requirements for the various stages of installation and reinstatement are as follows:

- Cable pit and duct construction at SSW: 8 to 12 weeks
- Offshore cable installation: 1 day
- Cable protection work: 2 to 4 days
- Shore end works at TKOIE: 1 to 2 weeks

2.2.3 It is expected that the Project would take about three months to construct overall.

2.3 Interactions with Other Projects

2.3.1 The following projects are planned for the general area:

- **Asia-Africa-Europe-1 (AAE-1) Cable System.** According to a Lands Department Press Release, the project works for this project was scheduled to begin in November 2016 and is expected to be completed by August 2017. The installation works of AAE-1 will commence BEFORE the construction works for Ultra Express Link.

- **Desalination Plant at Tseung Kwan O.** This project is currently in the investigation review, design and tender preparation stage for the first stage of the proposed desalination plant. According to the Water Supplies Department, the only works proposed to commence in 2017 is the main laying works, whereas the associated marine works of submarine intake and outfall pipeline installation is expected to begin at a later stage. Therefore, the marine works for this project is not likely to begin until AFTER the expected completion of works for Ultra Express Link.
- **Tseung Kwan O – Lam Tin Tunnel and Associated Works.** Construction for this project commenced in mid-2016 and is expected to finish mid-2021. As such, marine works associated with the reclamation of approximately 3 hectares of Junk Bay will likely overlap the works program of the Ultra Express Link. Marine works for Ultra Express Link, including cable installation and cable protection works, will only take about 5 days to complete, cumulative water quality impact during construction phase shall be minimal.
- **Cross Bay Link.** According to CEDD, the detailed design stage of the project is still in progress with no expected completion date. Only the sectional model wind tunnel tests on steel arch rib and steel deck for the project is in tender stage currently, and is expected to be completed in mid-2017; whereas other construction packages have not been tendered. Therefore, it is unlikely that the construction works for this project will begin before the expected completion of works for Ultra Express Link.
- **Hong Kong Offshore Wind Farm in Southeastern Waters.** CLP has extended the feasibility study stage of the project by a few years and postponed the construction stage. Since further economic viability and technical design studies are needed, there is still no firm date for the commencement of the project. The construction works for cable section of this project is therefore not likely to be installed until AFTER the expected completion of works for Ultra Express Link.

3 MAJOR ELEMENTS OF THE SURROUNDING ENVIRONMENT

3.1 Marine Fairways and Traffic Separation Scheme

3.1.1 The Ultra Express Link alignment avoids the Eastern Fairway but will be laid across the Tathong Channel Traffic Separation Scheme. The route selected has taken the most direct path across the Tathong Channel to minimise the amount of time the cable-laying barge will be positioned in the Traffic Separation Scheme. Cable crossing with DSD pipeline has been planned to take place outside the Traffic Separation Scheme and burial of the Ultra Express Link within the Tathong Channel will be at 5m below seabed.

3.2 Cable, Pipelines, Outfalls and Intakes

3.2.1 There are a number of utilities located in the vicinity of the Ultra Express Link alignment and these include:

- **Communication Cables.** TKOIE is a prime location for landing of submarine cable systems. There are four existing in-service cables systems landed at TKOIE:
  - *TKO Express Cable System*. One in-service cable system just completed installation in early 2017 and landed within one of the existing ducts at TKOIE.
  - *EAC Cable Project*. Three in-service cables landing at TKOIE to the east of the Project.
  - *ASE Cable Project*. One in-service cable landing in one of the existing ducts at TKOIE.
  - *APG Cable Project*. One in-service cable landing in one of the existing ducts at TKOIE.
- **Electrical Cables.** There are no existing electrical cables located in the vicinity of the Ultra Express Link alignment; however, there may be a submarine electrical cable that is part of the proposed "*Hong Kong Offshore Wind Farm in Southeastern Waters*" (FEP-01/34/2009). This marine cable would take power from the offshore wind farms to the main grid near LOHAS Park, across from TKOIE. Based on discussions with CLP, the expected timing of the cable construction is expected to occur after the Ultra Express Link is installed.
- **Pipelines and Outfalls.** One sewer outfall is located in the vicinity of the Ultra Express Link alignment:
  - Junk Bay Sewage Outfall ("the DSD Outfall"). This sewage outfall is no longer in routine use since construction of the Harbour Area Treatment Scheme (HATS), but is still maintained by DSD for emergencies. The Ultra Express Link will need to cross the DSD Outfall and a location has been selected outside the Marine Fairway. The *ASE Cable Project* and *APG Cable Project* also cross this DSD sewage outfall. As such, this outfall will be affected by the project, as described in ***Section 1.6***.
- **Seawater Intakes.** The following seawater intakes are located in the area:
  - Water Services Department (WSD) Seawater Intake in the Inner Part of Junk Bay. The Ultra Express Link alignment is around 1.36km from the seawater

intake at the closest point and due to this distance the intake will not be affected by the Project.

- WSD Seawater Intake at Siu Sai Wan. The Ultra Express Link alignment is around 540m from the seawater intake at the closest point and due to this distance the intake will not be affected by the Project.
- Cooling Water Intake of Pamela Youde Nethersole Eastern Hospital. The Ultra Express Link alignment is around 995m from the cooling water intake at the closest point and due to this distance the intake will not be affected by the Project.

3.3 Designated Areas

3.3.1 There are a number of areas with special planning designation located in the vicinity of the Ultra Express Link alignment and these include:

- **Coastal Protection Area (CPA).** There is a CPA south of the Site, along the length of the coastline at Cape Collinson. The Ultra Express Link is approximately 555m from the CPA at the closest point and due to this distance, the CPA will not be affected by the Project.
- **Gazetted Bathing Beaches.** The closest Gazetted Bathing Beach is Big Wave Bay. The Ultra Express Link is approximately 2.6km from this Gazetted Bathing Beach and due to this distance, the Gazetted Bathing Beach will not be affected by the Project.
- **Marine Reserve.** The closest Marine Reserve is Cape D'Aguilar Marine Reserve. The Ultra Express Link is approximately 6.4kmfrom this Marine Reserve and due to this distance, the Marine Reserve will not be affected by the Project.
- **Site of Special Scientific Interest (SSSI).** The closest SSSI is Shek O Headland SSSI. The Ultra Express Link is approximately 4.6km from this SSSI and due to this distance, the SSSI will not be affected by the Project.

3.4 Coral Communities

3.4.1 Coral communities are only expected to be present in the hard stratum along the coastline – coral surveys have been undertaken for similar projects in the same area, in particular the *Tseung Kwan O Express – Cable System* and *APG Cable Project*, which both landed at TKOIE in an existing BMH similar to the Ultra Express Link. For this location, reference to previous surveys is considered to be appropriate.

3.4.2 Results showed that corals were present at the Cape Collinson area. However, by adoption of HDD will avoid the coastline at SSW and the duct will emerge from the seabed in marine mud around 423m offshore. A coral survey has been conducted by *TKO Express – Cable System*, which has a similar alignment to Ultra Express Link. The survey confirmed that no coral was identified at 250m offshore and onwards. With a breakout location of 423m offshore, no coral is anticipated and will be affected. Also confirmed by geophysical/dive survey conducted in January 2017, the seabed material at the HDD breakout location and along the cable alignment to be installed by direct burial is composed of soft mud and silt, which are not suitable for hard coral or octocoral growth. Details of the seabed features at SSW are described in ***Annex C.***

3.5 Fish Culture Zones (FCZ)

3.5.1 There are no AFCD gazetted Fish Culture Zone (FCZ) within 500m of the proposed cable alignment. The closest Fish Culture Zone (FCZ) is Tung Lung Chau FCZ. The shortest navigation distance between the Ultra Express Link alignment and the boundary of Tung Lung Chau FCZ is 3.6km. Due to this far distance, the FCZ will not be affected by the Project.

Spawning Grounds

3.5.2 The shortest navigation distances between the spawning grounds in Southeastern Waters from the cable is 2.1km. Due to this far distance, spawning grounds will not be affected by the Project.

Proposed Fisheries Protection Area

3.5.3 The shortest navigation distances between the proposed fisheries protection area in Outer Port Shelter from the cable is 4.7km. Due to this far distance, the proposed fisheries protection area will not be affected by the Project.

3.6 Cultural Heritage Sites

3.6.1 There is a Declared Monument, the Site of Chinese Customs Station on Fat Tau Chau, situated at approximately 237m from the TKOIE landing site of the Ultra Express Link.

3.6.2 According to the List of Sites of Archaeological Interest in Hong Kong, there are three sites of archaeological interest located near the Ultra Express Link alignment, namely Fat Tau Chau Site of Archaeological Interest (approximately 93m), Fat Tau Chau Qing Dynasty Gravestone (approximately 221m) and Fat Tau Chau House Ruin (approximately 778m). All of these on land “Declared Monument” and “Site of Archaeological Interest” are expected to be unaffected by the cable installation works.

3.6.3 Locations of these heritage sites are shown on ***Figure 1-2***. However, since all of these sites are located on land, and since no construction work will be required at the TKOIE landing site, they will not be affected by the marine works component of the Project.

3.6.4 Geophysical surveys of previous Marine Archaeological Investigations (MAI) revealed that seabed along the Ultra Express Link cable alignment 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 area of the Tathong Channel and Study Area, with the coarser sediments being less conducive to preserving organic archaeological material, such as wooden shipwrecks. The MAI for the Project established that no resources of marine archaeological value are located along the Ultra Express Link alignment and hence no impact to marine archaeological resources is expected.

3.7 Cumulative Impacts From Other Projects

3.7.1 The following projects are planned for the general area:

- **Asia-Africa-Europe-1 (AAE-1) Cable System.** According to a Lands Department Press Release, the project works for this project was scheduled to begin in

November 2016 and is expected to be completed by August 2017. The installation works of AAE-1 will commence BEFORE the construction works for the Ultra Express Link.

- **Desalination Plant at Tseung Kwan O.** This project is currently in the investigation review, design and tender preparation stage for the first stage of the proposed desalination plant. According to the Water Supplies Department, the only works proposed to commence in 2017 is the main laying works, whereas the associated marine works of submarine intake and outfall pipeline installation is expected to begin at a later stage. Therefore, the marine works for this project is not likely to begin until AFTER the expected completion of works for the Ultra Express Link.
- **Tseung Kwan O – Lam Tin Tunnel and Associated Works.** Construction for this project commenced in mid-2016 and is expected to finish mid-2021. As such, marine works associated with the reclamation of approximately 3 hectares of Junk Bay will likely overlap the works program of the Ultra Express Link Marine works for Ultra Express Link, including cable installation and protection, will only take about 5 days to complete, cumulative water quality impact during construction phase shall be minimal.
- **Cross Bay Link.** According to CEDD, the detailed design stage of the project is still in progress with no expected completion date. Only the sectional model wind tunnel tests on steel arch rib and steel deck for the project is in tender stage currently, and is expected to be completed in mid-2017; whereas other construction packages have not been tendered. Therefore, it is unlikely that the construction works for this project will begin before the expected completion of works for the Ultra Express Link.
- **Hong Kong Offshore Wind Farm in Southeastern Waters.** CLP has extended the feasibility study stage of the project by a few years and postponed the construction stage. Since further economic viability and technical design studies are needed, there is still no firm date for the commencement of the project. The construction works and cable section of this project is therefore not likely to be installed until AFTER the expected completion of works for the Ultra Express Link.

4 POSSIBLE IMPACTS ON THE ENVIRONMENT

4.1 Summary of Potential Environmental Impacts

4.1.1 The potential environmental impacts associated with the cable system are summarised in ***Table 4-1*** below and likely impacts are assessed in the following sub-sections.

Table 4-1 Potential Sources of Environmental Impacts

Potential Installation Impacts	Construction	Operation	Remarks
Gaseous Emissions	✗	✗	No significant emissions
Dust	✗	✗	Not anticipated from HDD with standard mitigation
Odour	✗	✗	Not anticipated
Noisy Operations	✓	✗	Potential noise generation during HDD works at SSW
Night-time Operations	✗	✗	Not anticipated
Traffic Generation	✗	✗	Not anticipated
Liquid Effluents, Discharges, or Contaminated Runoff	✓	✗	Possible chance of surface water run-off at SSW side and drilling fluid
Generation of Waste or By-products	✓	✗	Excavated materials from manhole and HDD works
Manufacturing, Storage, Use, Handling, Transport, or Disposal of Dangerous Goods, Hazardous Materials or Wastes	✗	✗	Not anticipated
Risk of Accidents Which Result in Pollution or Hazard	✗	✗	Not anticipated
Disposal of Spoil Material, Including Potentially Contaminated Material	✗	✗	Not anticipated
Disruption of Water Movement or Bottom Sediment	✓	✓	Will occur during cable burial and cable repair
Unsightly Visual Appearance	✗	✗	Not anticipated
Ecological Impacts:			
- Terrestrial	✗	✗	Not anticipated
- Marine	✓	✗	Potential impacts at the HDD break-out point on SSW side
- Fisheries	✓	✓	Potential impacts along the alignment during cable laying and cable repair
Cultural Heritage	✓	✗	Potential impacts on marine archaeological resources, if any

Key: ✓ = Potential to result in adverse impacts
✗ = Not expected to result in adverse impacts

4.1.2 No environmental impacts are expected to occur during normal operation of the submarine cable system. However, there may be a potential requirement for maintenance work (i.e. cable repair at particularly fault location due to unexpected damage) to be carried out. The following assessments relate only to the construction phase and potential cable repair works.

4.2 Water Quality Assessment

4.2.1 A water quality assessment is provided in ***Annex A***. A summary is provided below.

4.2.2 Cable installation will involve the following activities that have the potential to generate suspended solids in the Harbour:

- **Pit and Duct Construction at SSW Landing Site.** Run-off from shore based excavation and construction works at SSW for the cable pit and duct construction.
- **HDD Seabed Breakout Point**. HDD equipment recovery and cable installation at the exit point about 423m offshore from the SSW Promenade.
- **Marine Installation by Cable Burial Tool.** Cable burial by cable burial tool.
- **Diver-Assisted Burial.** Shallow burial by divers using hand-held equipment at crossing points and in waters adjacent to the TKOIE.

4.2.3 During project operation stage, cable repair works could be required for accidentally damaged cable which would have the potential to generate suspended solids.

Pit and Duct Construction at SSW Landing Site

4.2.4 The potential impacts to water quality during construction works on land primarily relate to surface water run-off and the discharge of pumped water. Construction of the cable pit will require small-scale excavation, soil stockpiling and drill hole boring.

4.2.5 Sediment run-offs can be controlled to acceptable environmental standards through the application of good site 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 pit 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).
- Best Management Practices (BMPs) will be applied to avoid and minimise contaminated runoff from work sites, marine plants and vessels.

4.2.6 There will be no discharge of HDD fluid muds associated with the project and during drilling, the drilling fluids will be recirculated through an on-site treatment system and will be tankered off-site upon completion of drilling.

4.2.7 No unacceptable impacts are predicted to occur during the pit and duct construction at SSW landing site provided that good site practices are incorporated during construction.

HDD Seabed Breakout Point

4.2.8 During construction of the marine duct breakout point, the drilling will stop 5m from the surface and the drill hole will be purged to ensure that the drilling cuttings and fluid do not break out into the marine environment. The drill hole will then use water as a primary drilling fluid; the remaining 5m will be slowly drilled through and will be monitored from the marine vessel until the drill cutter is near the surface. Divers will then be deployed with hand held jets to retrieve the drill wire and the cutter. A bell mouth and hauling wire will then be installed and cable will then be winched through the cable duct in a separate operation.

4.2.9 This installation process will be carefully controlled by divers in the water. Suspended solids generated during the diver-assisted installation are expected to be localised and of very short term in duration. A manned vessel will be stationed along the drill route during drilling operations to assist with the detection of any escape of fluid.

4.2.10 Only minimal disturbance to water quality is expected and since the HDD process will not result in adverse impacts to the marine environment, no specific mitigation measures are required.

Marine Installation by Cable Burial Tool

4.2.11 The majority of the cable will be installed using a cable burial tool to install the Ultra Express Link at a target burial depth of 3 to 5m below the seabed and 5m below seabed within the Tathong Channel. This installation method, which uses cable burial machine, has been used for previous cable installation projects in Hong Kong waters without adverse water quality impact.

4.2.12 Prior to cable installation, the seabed will be checked by the tool to ensure there are no obstructions to cable installation. This will include a pre-run of the cable route with the burial tool employed at shallow depth to ensure the seabed surface is clear. This is then followed by cable installation where the cable burial tool is lowered onto the seabed and is placed at the desired burial depth. During the cable laying process, the cable burial tool will fluidise the sediment at the burial depth level to assist with the laying process and the cable is simultaneously laid and buried. The installation tool is about 250mm in width and only minimal disturbance is anticipated to the seabed.

4.2.13 Calculations of sediment transport resulting from the use of the cable burial tool make appropriate reference to the *TKO Express – Cable System*, *APG Cable Project* and *ASE Cable Project*, which also employ this same method of cable installation at the same location as Ultra Express Link.

4.2.14 Calculations indicates that the sediments disturbed during cable laying works will settle onto the seabed within approximately 180m of the cable alignment and will settle within about three and half minutes.

4.2.15 All of the Water Sensitive Receivers (WSRs) are located more than 180m from the alignment and so it is not anticipated that the works will cause significant impacts to these WSRs. The closest WSR, WSD's SSW Seawater Intake, is 520m from the closest point of the alignment. Other WSRs, including coral communities, SSSIs and FCZs range from 540m to more than 4.6km distant, so will also not be affected.

4.2.16 Notwithstanding, the following good site practices will be followed:

- The crane barge used for the transport of any debris recovered from the seabed during route clearance shall be fitted with tight bottom seals in order to prevent leakage of materials during loading and transport to the disposal site.
- The crane barge shall be filled to a level that ensures material does not spill over during loading and transport and that adequate freeboard is maintained to ensure that the decks are not washed by wave action.
- The speed of the installation barge will be limited to a maximum of 1km/hour.

Diver-Assisted Burial

4.2.17 Diver-assisted burial will be required at the two cable crossings, the DSD sewage outfall crossing and approximately 20m from the seawall at TKOIE and at the HDD breakout point. The cable will be buried to a depth of approximately 2m using hand held jetting equipment.

4.2.18 It is anticipated that burying by divers will not cause significant water quality impacts as only a small area will be disturbed (short lengths of approximately 20 to 80m) and the burial depth will be shallower for these areas (around 2m).

4.2.19 The sediments disturbed during diver-assisted burial will be localised, similar to the cable burial machine, and are expected to settle onto the seabed within approximately 180m of the cable alignment and will settle within about three and half minutes. All of the WSRs are located more than 180m from the alignment and so it is not anticipated that the works will cause significant impacts to these WSRs.

Cable Repair Works

4.2.20 In case the cable installed under the seabed is being damaged by dropped objects or anchoring activities, cable repair works shall be required. Cable repair works shall comprises of route clearance prior to repair works, exposing the damaged cable section by diver jetting tool and/or cable burial tool used for marine works during construction stage, reconnecting the damaged cable, and reburial of the repaired cable section by diver jetting tool and/or cable burial tool. Considering the short-term and small-scale construction works involving the use of less powerful jetting tool, sediment release during cable repair shall be minimal as compared to the cable burial works being assessed above. The seabed can be expected to naturally reinstate to before-work level and condition shortly after completion of works. No significant water quality impacts are anticipated during cable repair.

Cumulative Impacts

4.2.21 While there are five planned projects near Ultra Express Link, as stated in ***Section 2.3***, four of them are not expected to be in construction at the same time as the installation of the Ultra Express Link, with the exception of Tseung Kwan O – Lam Tin Tunnel and Associated Works. Since marine works for Ultra Express Link, including cable installation and cable protection works, will only take about 5 days to complete, cumulative water quality impacts during construction phase shall be minimal.

Conclusion

4.2.22 With the following recommended good site 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 pit 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).
- Best Management Practices (BMPs) will be applied to avoid and minimise contaminated runoff from work sites, marine plants and vessels.

4.2.23 No adverse water quality impacts are anticipated from cable installation and cable repair works.

4.3 Waste Assessment

Waste from HDD Works at SSW

4.3.1 Waste will be generated from the HDD works in the form of rock (inert Construction and Demolition (C&D) Materials) that has been drilled out from the underground cable duct. The drilled rock will be brought to the surface in small pieces in the drilling fluid from which it will be separated and stored on Site prior to disposal upon completion of the HDD works. The rock will be generated over a period of about 1 to 2 weeks during the HDD construction works.

4.3.2 Based on a length of 550m and a diameter of 200mm, the quantity of rock is estimated to be 12.6m^3 *in situ*. To allow for *ex situ* bulking, approximately 29.4m^3 of rock fines will be generated, equivalent to approximately 47 tonnes.

4.3.3 It is unlikely that the drilled rock fines can be used for any purpose in the Project and so will need to be disposed of. The nearest disposal location is the Public Filling Area in Tseung Kwan O Area 137, which is around 20km from the Site in SSW.

Waste from Manhole Construction at SSW

4.3.4 Waste will be generated from the excavation of the manhole in the form of topsoil and reclamation fill (inert C&D Materials). This waste will be stored on Site until excavation is completed, which is expected to be within one week after the start of work.

4.3.5 Assuming external manhole dimensions of 4.8m(L) x 2.5m(W) and 3m(D), the volume of the excavation will be 36m^3 *in situ*. To allow for *ex situ* bulking, approximately 46.7m^3 of topsoil/reclamation fill will be generated, equivalent to approximately 84.1 tonnes.

4.3.6 It is unlikely that the excavated topsoil and reclamation fill can be used for any purpose in the Project, other than backfilling around the manhole, and so will need to be disposed of. The nearest disposal location is the Public Filling Area in Tseung Kwan O Area 137, which is around 20km from the Site in SSW.

Other Wastes

4.3.7 There will be no dredged/excavated sediment/mud generated during construction and operation stages of Ultra Express Link. There will be no other waste generated during construction other than small quantities of general refuse from workers – this will be collected on-site and removed by a licenced waste contractor for disposal at an EPD waste facility.

4.3.8 No waste of any kind will be generated during the operation of Ultra Express Link.

Conclusion

4.3.9 The 76.1m^3 or 131.1 tonnes of waste rock fines, topsoil and reclamation fill is not considered to be significant in quantity and no adverse environmental impacts are likely to result from its handling, transport or disposal at government operated disposal sites.

4.4 Marine Ecology Assessment

4.4.1 A marine ecological assessment is provided in ***Annex C***. A summary is provided below.

4.4.2 The review of the existing information on the marine ecological resources in the vicinity of the cable landing point at TKOIE and the cable alignment across the Tathong Channel 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 are considered to be of low ecological value and will be reinstated by similar communities within a short time and thus the impacts are considered acceptable.

4.4.3 The rocky shores in the vicinity of the cable landing point off Fat Tong Chau support low abundance and diversity of intertidal organisms. Most of these species are common and widespread on the similar shores in Hong Kong and as such, are considered to be of low ecological value. Impacts to these assemblages are, therefore, not regarded as significant. As confirmed by geophysical/dive survey conducted in January 2017, the seabed material at the HDD break out location, along the cable alignment to be installed by direct burial and the landing point at TKOIE is composed of soft mud and silt not suitable for hard coral or octocoral growth, as such no coral impact is expected to occur from the cable installation.

4.4.4 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. There will be no adverse, irreversible ecological impact as re-colonization of benthic organisms on benthic substrates is expected to occur promptly after the cable installation work and no habitat will be lost permanently.

4.4.5 Victoria Harbour is not considered to represent an important habitat for the Indo-pacific Humpbacked Dolphin or the Finless Porpoise and so disturbance to these marine mammal species is not expected.

4.4.6 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.

4.4.7 Good site practices that have been recommended to minimise impacts to water quality are also expected to control any impacts to marine ecological resources, particularly any coral colonies in the vicinity of the cable alignment. These good site practices include limiting the maximum speed of the cable laying machine, preventing leakage of HDD drilling fluid at the HDD breakout location, and implementing good housekeeping practices during land based activities at SSW.

4.5 Fisheries Assessment

4.5.1 A fisheries assessment is provided in ***Annex D***. A summary is provided below.

4.5.2 The Project traverses a Marine Traffic Separation Scheme. While fishing is not specifically prohibited in this area, is discouraged by Marine Department on safety grounds.

Cable Installation Impacts

4.5.3 The Ultra Express Link will be installed using a cable burial machine to a target depth of 5m within the seabed and the seabed will be reinstated naturally by resettlement of disturbed sediments immediately upon cable installation. Re-colonisation of the sediments by benthic infauna is expected to occur quickly, thereby providing food for bottom dwelling fisheries resources.

Capture Fisheries Resources

4.5.4 Fisheries production rates in the waters to be crossed by the Ultra Express Link are between 100 to 200 kg per hectare.

4.5.5 Minor interruptions to any fishing operations in Tathong Channel may occur during cable installation where the cable laying barge occupies space at the sea surface (approximately 125m x 200m) but the barge will only be in use for 1 to 2 days. During cable laying operation, the cable laying barge will have no more impact on fishing operations than any other vessel traversing the waters of Hong Kong. Temporary berthing of the cable laying barge will be required along the cable alignment at Tathong Channel if offshore cable installation cannot be completed within 1 day. The temporary loss of fishing grounds will follow from similar projects such as the *TKO Express – Cable System*, *APG Cable Project* and *ASE Cable Project*.

4.5.6 The marine works, including cable laying and placement of concrete mattress as protective measures, will have localised disturbance on seabed and zooplankton within sediment column. The seabed will be quickly reinstated, with almost immediate resettlement of disturbed sediments and subsequent re-colonisation by benthic infauna and zooplankton within sediment column. The disturbance will only last for a short duration at localised area, no unacceptable impact on fisheries resources and production are expected to result from installation of the cable.

Spawning and Nursery Areas

4.5.7 The Ultra Express Link alignment is located outside the recorded fish fry production area, and the area where the cable will be buried is not considered to be an important nursery area for commercial fish species.

4.5.8 The shortest navigation distances between the spawning grounds in Southeastern Waters from the cable is 2.1km; the shortest navigation distances between the proposed fisheries protection area in Outer Port Shelter from the cable is 4.7km; and shortest navigation distances between the nursery grounds are from the cable is 4.9km.

4.5.9 The cable laying works are of relatively short duration and given that sediment will disperse a maximum of 180m from the alignment, the installation of cable is not expected to result in unacceptable adverse impacts to nursery and spawning grounds.

Culture Fisheries

4.5.10 The nearest FCZ to Ultra Express Link is the Tung Lung Chau FCZ, located approximately 3.6km from the closest point of the cable alignment. Given this distance, no impact from cable installation works is expected at the Tung Lung Chau FCZ.

Cumulative Impacts

4.5.11 While there are five planned projects near Ultra Express Link, as stated in ***Section 2.3***, four of them are not expected to be in construction at the same time as the installation of the Ultra Express Link, with the exception of Tseung Kwan O – Lam Tin Tunnel and Associated Works. Since marine works for Ultra Express Link, including cable installation and cable protection works, will only take about 5 days to complete, cumulative fishery impact during construction phase shall be minimal.

Conclusion

4.5.12 The cable installation works at the SSW and TKOIE shore ends are not expected to result in unacceptable impacts to water quality. As such, on-shore works are not expected to result in any significant impacts to fisheries at these locations.

4.5.13 No long-term direct impacts to fisheries resources or fishing operations are expected to occur that would affect either fisheries resources or fishing operations. No specific good site practices are recommended other than those adopted for water quality.

4.6 Noise Assessment

On-shore Works at SSW

4.6.1 A noise assessment for the on-shore works at SSW is provided in ***Annex E***. A summary is provided below.

4.6.2 Within 300m of the SSW Site, there are two residential developments, namely Harmony Garden (Blocks 1-3) and Island Resort (Blocks 1, 2 and 9), both of which are considered to be Noise Sensitive Receivers (NSRs) under the EIAO.

4.6.3 The cable installation at SSW involves construction of a cable connection pit (manhole), construction of a cable duct using HDD and its associated works. All of which will employ Powered Mechanical Equipment (PME) that may generate noise impacts on the surrounding area. All works are expected to be undertaken during daytime hours and if any works during restricted hours are required, a Construction Noise Permit (CNP) will be will be obtained in advance.

4.6.4 The results of the assessment have demonstrated the predicted noise levels will not exceed the construction noise criteria as per Annex 5 of EIAO-TM at representative NSRs.

4.6.5 Nonetheless, the Contractor is advised to implement the recommended good site practices to further minimise potential noise impacts. These measures include using quiet PME, ensuring the plants are well maintained and in good condition, strategic placement of noisy PME away from the NSRs and installing noise-reducing barriers around the Site, as needed.

4.6.6 Given that the above measures are properly implemented, adverse noise impacts resulting from the construction activities at the SSW Site are unlikely to occur.

On-shore Works at TKOIE

4.6.7 Installation of the Ultra Express Link at TKOIE is not expected to generate significant noise impacts as the BMH is distant from noise sensitive receivers and no construction is required (the BMH is already constructed).

Cumulative Impacts

4.6.8 While there are five planned projects near Ultra Express Link, as stated in ***Section 2.3***, four of them are not expected to be in construction at the same time as the installation of Ultra Express Link, with the exception of Tseung Kwan O – Lam Tin Tunnel and Associated Works. Since construction site for Ultra Express Link is mainly located at SSW, which is at least 4.6km from the work site for Tseung Kwan O – Lam Tin Tunnel and Associated Works, therefore, there will be no cumulative impacts.

Conclusion

4.6.9 The cable installation work at the SSW is not expected to result in adverse noise impacts on NSRs in the vicinity. Nevertheless, good site practices, including the use of acoustic enclosures for PME, are recommended.

4.7 Cultural Heritage Assessment

4.7.1 A cultural heritage assessment is provided in ***Annex F***. A summary is provided below.

4.7.2 The land at SSW side on which the project is located was reclaimed in the mid-1980s as part of the *Siu Sai Wan Development Works Stage 1 – Construction of Seawall and Reclamation* by the then Engineering and Development Department. As such, there is no archaeological potential at the SSW side and there are no declared Monuments at SSW side.

4.7.3 At TKO, there is a declared Monument, the Site of Chinese Customs Station at Fat Tau Chau, located approximately 237m of the landing site at TKOIE; and three sites of archaeological interest (Fat Tau Chau Site of Archaeological Interest, Fat Tau Chau Qing Dynasty Gravestone and Fat Tau Chau House Ruin) that are located approximately 93m to 778m from the landing site at TKOIE.

4.7.4 The declared Monument and sites of archaeological interest are on land and so will not be affected by the marine-based cable installation works. As the cable ducts at TKOIE are already in existence, no land-based construction works will be required. There will only be minor land-based installation works associated with pulling the Ultra Express Link

through the existing cable duct. As such, there will be no impacts to the declared monument and sites of archaeological interest.

4.7.5 In terms of marine archaeological resources, the Ultra Express Link alignment is within the same assessment corridor as the *TKO Express – Cable System*, *APG Cable Project* and *ASE Cable Project*, all of which landed at TKOIE and all of which included Marine Archaeological Investigations (MAIs) in their Project Profiles. These MAIs did not identify any marine archaeological resources in the vicinity of Ultra Express Link.

4.7.6 The geophysical surveys carried out for the *APG Cable Project*, the *TKO Express – Cable System* and for this Project have revealed that seabed along the Ultra Express Link alignment has been heavily impacted from trawling and dumping of materials. The surveys also found that the nature of the sediments to be coarse sediments in the area of the Tathong Channel and MAI study area (which is the assessment corridor along the cable alignment with 100m width on both sides), with the coarser sediments being less conducive to preserving organic archaeological material, such as wooden shipwrecks.

4.7.7 Since Ultra Express Link will be laid by cable burial machine, which will only have a minimal impact on the seabed sediments and no potential impacts are anticipated.

4.7.8 The findings from the terrestrial archaeological assessment showed that no sites of archaeological interest or potential archaeological deposits will be impacted by the project.

4.7.9 The marine archaeological investigation established that no resources of marine archaeological value are located within the MAI study area and hence no marine archaeological impacts are expected.

4.7.10 As there are no unacceptable impacts expected to result from the project to cultural heritage, no specific good site practices are recommended.

4.8 Others

4.8.1 The following environmental impacts are not anticipated during installation of the Ultra Express Link for the reasons outlined:

- **Gaseous Emissions.** Exhaust emissions from construction plant will be insignificant due to the limited plant required for manhole excavation and HDD at the SSW side. As such, adverse impacts on air quality will not result from the construction activities.
- **Dust.** Only a small manhole of external dimensions 4.8m(L) x 2.5m(W) and 3m(D) will be required at SSW and its excavation is unlikely to result in significant generation of dust. The HDD drilling process is essentially a “wet” process and will not result in the generation of dust. No construction works are required at the TKO side as the BMH at TKOIE is already constructed. Relevant standard mitigations set out in the Air Pollution Control (Construction Dust) Regulation will be implemented to minimise dust emissions, where applicable, during construction phase.
- **Odour.** No odour impacts are expected to result from the construction activities.

- **Night-time Operations.** It is not anticipated that works will be undertaken during night-time. However, should night-time operations be necessary then a CNP will be obtained in advance.
- **Traffic Generation.** No significant construction traffic will be generated from the Project and no temporary traffic diversion will be required at SSW landing site.
- **Manufacture Storage, Use, Handling, Transport, or Disposal of Dangerous Goods, Hazardous Materials or Wastes.** Dangerous goods and hazardous materials are not anticipated to be used or generated during construction.
- **Risk of Accidents Resulting in Pollution or Hazard.** The laying of submarine cables is an established process in Hong Kong and the risk of accident is very low. As such, there is considered to be a minimal risk of accidents from cable laying activities that could result in pollution or hazard.
- **Disposal of Spoil Material, Including Potentially Contaminated Material.** No contaminated material is anticipated to be excavated or generated from the HDD. No dredging will be involved in the cable laying process and so there will be no sediment to be disposed of.
- **Unsightly Visual Appearance.** The manhole at SSW is to be located in an area of ornamental planting, which will be reinstated after completion of manhole construction and cable installation. The duration of construction is relatively short (three months). As such, only temporary visual or landscape impacts will result during construction. The site will be reinstated in full upon completion of the project.
- **Terrestrial Ecology.** The cable pit (at SSW) is located on reclaimed land that presently holds ornamental planting of low ecological value. At TKOIE the cable will land at an existing BMH and thereafter enter an existing cable duct. No civil construction works will be required at TKOIE. Overall, therefore, there will be no impacts to terrestrial ecology resulting from construction.

5 ENVIRONMENTAL PROTECTION MEASURES TO BE INCORPORATED INTO THE DESIGN AND ANY FURTHER IMPLICATIONS

5.1 Measures to Minimise Environmental Impacts

5.1.1 This environmental assessment has identified that the Project will result in a localised temporary elevation of suspended solids at seabed level during cable installation. The increased suspended solids will be generally limited to within the immediate area of the cable burial tool and would settle within about 3.5 minutes after cable installation. Previous assessments and monitoring results from similar projects in Hong Kong (referenced in ***Section 6***) support this.

5.1.2 The Project is not in proximity to any marine sensitive receivers. Sensitive receivers identified are more than 500m from the nearest portion of the cable and the Project has been designed to minimise the potential for land and marine impacts through the application of good site management and 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 pit 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).
- Relevant standard mitigations set out in the Air Pollution Control (Construction Dust) Regulation will be implemented to minimise dust emissions, where applicable, during project construction phase.

5.1.3 Best Management Practices (BMPs) will be applied to avoid and minimise contaminated runoff from work sites, marine plants and vessels. This environmental assessment has identified that noise will be generated at the SSW Site during the HDD works, primarily from PME that will be used. However, the results of the assessment have demonstrated the predicted noise levels will not exceed the construction noise criteria as per *Annex 5 of EIAO-TM* at representative NSRs. Nonetheless, good site practices have been recommended to further minimise potential noise impacts. These include using quiet PME, ensuring the plants are well maintained and in good condition, strategic placement of noisy PME away from the NSRs and installing noise-reducing barriers around the Site, as needed.

5.1.4 Other than the above, this environmental assessment has not identified any other environmental impacts during the construction stage that require environmental protection measures to be incorporated into the design, or require good site practices.

5.1.5 There will be no environmental impacts from the operation of Ultra Express Link.

5.2 Possible Severity, Distribution and Duration of Environmental Effects

5.2.1 Potential environmental impacts have been assessed in this Project Profile. Minor adverse environmental effects have been identified, although these are minimal, temporary in nature, and localised. There are no environmental impacts from the operation of the Project.

5.2.2 No secondary or induced effects have been identified. There are no cumulative effects as no other projects have been identified in the same area in the same timeframe as Ultra Express Link. The Project is located entirely within Hong Kong and so there are no transboundary concerns.

5.2.3 In terms of benefits, Ultra Express Link will help meeting the growing demand for high speed internet access services and greatly increase bandwidth capacity within Hong Kong. The Project will provide telecommunication infrastructure to support industries (such as financial, trading, logistics, media, and other data intensive industries) that have a far-reaching effect on the economy of Hong Kong. Without this Project, these benefits may not be realized. Without the cross-Harbour alignment proposed in this Project Profile, Ultra Express Link would need to follow a terrestrial route that would be much longer and would generate over much longer period significant disturbances to traffic; disrupt land-based activities; and would generate greater terrestrial environmental impacts.

5.3 Further Implications

5.3.1 TKOIE has been used by several other cable systems and no records of adverse impacts to the environment have been identified from the installation or operations of these systems – see ***Section 6.1*** for details of other similar projects.

5.3.2 Obtaining the Environmental Permit (EP) for Ultra Express Link is just one of the requirements. Support for the Project has already been obtained from the Office of the Communications Authority (OFCA). Approvals from other government departments, including Marine Department, Lands Department, Civil Engineering and Development Department, Planning Department and the Leisure and Cultural Services Department (and their works agents, the Architectural Services Department and Electrical and Mechanical Services Department) must also be obtained, and all of these departments have already been contacted.

5.4 Environmental Monitoring and Auditing (EM&A)

5.4.1 For the *APG Cable Project*, installed in 2016, which also lands at TKOIE, although no unacceptable environmental impacts were identified in the Project Profile, water quality monitoring was undertaken during cable installation. The results of the EM&A were:

- The *Post Project Water Quality Monitoring Report* issued in June 2016 covered the cable laying works in proximity to TKOIE and concluded "*… the overall water quality changes in DO, Turbidity and SS levels during the post project monitoring period are considered a reflection of natural background fluctuation*".

- The *Post Project Coral Survey Report* issued in July 2016 covered the cable laying works in proximity to TKOIE and concluded *"…overall, there did not appear to be any unacceptable impacts to corals as a result of the cable installation works.*"

5.4.2 For the *ASE Cable Project*, installed in 2013, which also lands at TKOIE, although no unacceptable environmental impacts were identified in the Project Profile, water quality monitoring was undertaken during cable installation. The results of the EM&A were:

- The *Post Project Water Quality Monitoring Report* (Zone A) issued in March 2014 covered the cable laying works in proximity to TKOIE and concluded that *"…no deterioration of water quality was observed and the impacts from the Project works on water quality are negligible*".
- Coral monitoring in the vicinity of TKOIE was not required as no significant coral communities were identified. The results of monitoring corals along the alignment as presumed in the *Post-project Coral Monitoring Survey Report* issued in February 2013 concluded that *"Overall, there did not appear to be any unacceptable impacts to corals as a result of the AES cable installation works"*.

5.4.3 For the *EAC Cable System* and *TKO Express – Cable System*, installed in 2000 and 2016 respectively, which also land at TKOIE, no EM&A was required. As such, no EM&A is proposed for this Project.

5.4.4 For *TKO Express – Cable System*, in the vicinity of the marine works there is a generally low abundance and density of marine organisms (e.g. corals), which are of low ecological value. No coral monitoring was required. Since the results of the previous coral dive survey and recent geophysical survey revealed that no hard coral or octocoral were present. As such, no coral monitoring is proposed for this Project.

5.4.5 Given that HDD will be carried out at the SSW side, a *Drilling Fluid Management Plan* has been prepared and provided in ***Annex B***, outlining the proper management of the drilling fluid on site.

6 USE OF PREVIOUSLY APPROVED EIA REPORTS

6.1 Submarine Cables Landing at TKOIE

6.1.1 TKOIE is a landing site for the following submarine cable systems, all of which obtained EPs via obtaining permission to apply directly under Section 5(1)(b) of the EIAO:

- **Tseung Kwan O (TKO) Express – Cable System (Superloop (Hong Kong) Limited).** The Project Profile was submitted on 16 December 2015 (PP-532/2015). The length of cable in Hong Kong waters was around 2.7km. The study concluded that there would be no adverse long-term or cumulative effects/impacts to the environment. The EP was granted on 20 May 2016 (EP-509/2016).
- **Asia Pacific Gateway (APG) – Tseung Kwan O (China Mobile International Ltd).** The Project Profile was submitted on 9 October 2013 (PP-496/2013). The length of cable in Hong Kong waters was around 35km. The study concluded that there would be no adverse long-term or cumulative effects/impacts to the environment. The EP was granted on 18 February 2014 (EP-485/2014).
- **Asia Submarine-cable Express (ASE) – Tseung Kwan O (NTT Com Asia Ltd).** The Project Profile was submitted on 7 October 2011 (PP-452/2011). The length of cable in Hong Kong waters was around 33.5 km. The study concluded that there would be no adverse long-term or cumulative effects/impacts to the environment. The EP was granted on 20 December 2011 (EP-433/2011).
- **East Asian Crossing (EAC) Cable System, Tseung Kwan O (Asia Global Crossing Ltd).** Two Project Profiles for this project were submitted, one on 30 June 2000 (PP-094/2000) and the other on 21 June 2000 (PP-101/2000). The length of each of the two cables in Hong Kong waters was around 25km. The studies concluded that there would be no adverse long-term or cumulative effects/impacts on the environment. The EPs were granted on 6 September 2000 (EP-79/2000) and on 4 October 2000 (EP-081/2000).

6.1.2 As indicated above, the environmental studies undertaken in Project Profiles for all these projects concluded that no unacceptable environmental impacts would result from cable installation or operation. The EM&A undertaken for the *ASE Cable Project* and *APG Cable Project* also showed no adverse environmental impacts during construction. There were no environmental monitoring and audits required for the *EAC Cable System* and *TKO Express – Cable System*.

6.1.3 Given that the same installation method undertaken for the above projects will be used for Ultra Express Link, no adverse environmental impacts are expected to result from this Project.

6.2 Other Submarine Cables

6.2.1 All other similar submarine cable systems – both telecommunication and electrical cables – in other areas of Hong Kong also obtained EPs via obtaining permission to apply directly under Section 5(1)(b) of the EIAO:

- **Replacement of the Existing 11KV Submarine Cable Circuit Connecting Liu Ko Ngam and Pak Sha Tau Tsui at Kat O (CLP Power Hong Kong Ltd).** The Project Profile was submitted on 30 May 2013 (PP-489/2013). The length of cable in Hong Kong waters was around 880m. The study concluded that there would be no adverse long-term or cumulative effects/impacts to the environment. The EP was granted on 27 August 2013 (EP-461/2013).
- **South-East Asia Japan Cable System (SJC) Hong Kong Segment (China Telecom (Hong Kong) International Ltd).** The Project Profile was submitted on 22 June 2011 (PP-444/2011). The length of cable in Hong Kong waters was around 37 km. The study concluded that there would be no adverse long-term or cumulative effects/ impacts to the environment. The EP was granted on 24 October 2011 (EP-423/2011).
- **Asia-America Gateway (AAG) Cable Network, South Lantau (Reach Networks Hong Kong Ltd).** The Project Profile was submitted on 5 October 2007 (PP-331/ 2007). The length of cable in Hong Kong waters was around 10 km. The study concluded that there would be no adverse long-term or cumulative effects/impacts to the environment. The EP was granted on 20 December 2007 (EP-298/2007).
- **VSNL Intra Asia Submarine Cable System – Deep Water Bay (Videsh Sanchar Nigam Ltd).** The Project Profile was submitted to EPD on 31 August 2007 (PP-324/2007). The length of cable in Hong Kong waters was around 40 km. The study concluded there would be no adverse long-term or cumulative effects/impacts to the environment. The EP was granted on 23 December 2007 (EP-294/2007).
- **Proposed 132kV Submarine Cable Route for Airport "A" to Castle Peak Power Station Cable Circuit (CLP Power Hong Kong Ltd).** The Project Profile was submitted on 18 July 2006 (PP-295/2006). The length of the cable in Hong Kong waters was around 6.2 km. The study concluded that there would be no adverse long-term or cumulative effects/impacts on the environment. The EP was granted on 29 August 2006 (EP-267/2007).
- **Proposed 132kV Submarine Cable Installation for Wong Chuk Hang-Chung Hom Kok 132kV Circuits (Hong Kong Electric Co Ltd).** The Project Profile was submitted on 21 January 2002 (PP-159/2002). The length of the cable in Hong Kong waters was around 2.9 km. The study concluded that there would be no adverse long-term or cumulative effects/impacts on the environment. The EP was granted on 4 March 2002 (EP-132/2002).
- **HGC Optical Fibre Submarine Cable System between Tuen Mun and Chek Lap Kok (Hutchison Global Crossing Ltd).** The Project Profile was submitted on 19 April 2001 (PP-127/2001). The length of the cable in Hong Kong waters was around 500 m. The study concluded that there would be no adverse long-term or cumulative effects/impacts on the environment. The EP was granted on 9 June 2001 (EP-106/2001).
- **FLAG North Asian Loop, Tong Fuk (FLAG Telecom Asia Ltd).** The Project Profile was on 28 March 2001 (PP-121/2001). The length of cable in Hong Kong waters was around 10 km. The study concluded that there would be no adverse long-term or cumulative effects/impacts on the environment. The EP was granted on 18 June 2001 (EP-099/2001).
- **C2C Cable Network – Hong Kong Section: Chung Hom Kok (GB21 (Hong Kong) Ltd).** The Project Profile for this Study was submitted to EPD on 5 December 2000 (PP-109/2000). The length of each cable in Hong Kong waters was around 30 km. The study concluded that there would be no adverse long-term or

cumulative effects/impacts on the environment. The EP was granted on 16 February 2001 (EP-087/2001).

- **New T&T Hong Kong Limited: Domestic Cable Route (New T&T Hong Kong Ltd).** The Project Profile was submitted on 5 December 2000 (PP-108/2000). The length of the Chung Hom Kok to Cheung Sha cable was around 37 km and the Chung Hom Kok to Sandy Bay cable was around 32 km in length. The study concluded that there would be no adverse long-term or cumulative effects/ impacts on the environment. The EP was granted on 16 February 2001 (EP-086/2001).
- **Asia Pacific Cable Network 2 (APCN 2) Fibre Optic Submarine Cable System, Tong Fuk (EGS (Asia) Ltd).** The Project Profile was submitted in May 2000 (PP-089/2000). The length of the two cables in Hong Kong waters were around 24.6 km and 25.4km. The study concluded that there would be no adverse long-term or cumulative effects/impacts on the environment. The EP was granted on 26 July 2000 (EP-069/2000).
- **North Asia Cable (NAC) Fibre Optic Submarine Cable System, Tong Fuk (Level 3 Communications Ltd).** The Project Profile was submitted in March 2000 (PP-79/2000). The length of cable in Hong Kong waters was approximately 10 km. The study concluded that there would be no adverse long-term or cumulative effects/impacts on the environment. The EP was granted on 5 June 2000 (EP-064/2000.
- **Cable Landing Work in Deep Water Bay for SEA-ME-WE 3 Fibre Optic Submarine Cable System (Hong Kong Telecom International).** The Project Profile was submitted on 26 May 1998 (PP-006/1998). The length of cable in Hong Kong waters was not mentioned but was probably more than 20km. The study concluded that there would be no adverse impacts on the environment. The EP was granted on 3 July 1998 (EP-001/2000). This project has the distinction of being the first Project Profile submitted for Direct Application (only 11 pages long) and also having the first EP issued under the EIAO.

6.2.2 Of particular note is the *FLAG North Asian Loop*, which also included HDD in the Project Profile and for which an EP was granted via approval to apply directly. This project used HDD to avoid surface impacts to a gazetted bathing beach.

ANNEX A

Water Quality Assessment

CONTENTS

A. WATER QUALITY ASSESSMENT A-1

A.1 Introduction A-1
A.2 Relevant Legislation and Assessment Criteria A-1
A.3 Description of the Environment A-3
A.4 Impact Assessment A-7
A.5 Good Site Practices During Cable Installation A-14
A.6 Conclusion A-16

TABLES

Table A-1 Summary of Water Quality Objectives for the Junk Bay and Eastern Buffer WCZs
Table A-2 WQOs for Seawater for Flushing Supply at Intake Point
Table A-3 Summary of EPD Routine Water Quality Monitoring Data between 2011 to 2015 (JM4, JM3, EM1 and EM2)
Table A-4 Summary of EPD Routine Sediment Quality Monitoring Data between 2011 to 2015 (ES1, ES4 and JS2)
Table A-5 Closest Distances of WSRs to the Cable Alignment
Table A-6 Summary of Past Water Quality Monitoring Data
Table A-7 Water Quality Impact at Sensitive Receivers During Cable Burial Machine Installation

FIGURES

Figure A-1 Water Control Zones in Hong Kong
Figure A-2 EPD's Marine Water Quality Monitoring Stations
Figure A-3 EPD's Marine Sediment Monitoring Stations
Figure A-4 WSRs and EPD Monitoring Stations in the Vicinity of the Alignment
Figure A-5 Water Quality Monitoring Stations for APG Cable Project in the Vicinity of the Ultra Express Link Alignment

A. WATER QUALITY ASSESSMENT

A.1 Introduction

A.1.1 This Annex provides an assessment of water quality impacts associated with the installation of Ultra Express Link. Installation will involve the following activities that have the potential to generate suspended solids in the marine water quality:

- **Pit and Duct Construction at SSW Landing Site.** Run-off from shore based excavation and construction works at SSW for the cable pit and duct construction.
- **HDD Seabed Breakout Point**. HDD equipment recovery and cable installation at the exit point about 423m offshore from the SSW Promenade.
- **Marine Installation by Cable Burial Tool.** Cable burial by cable burial tool.
- **Diver Assisted Burial.** Shallow burial by divers using hand-held equipment at crossing points and in waters adjacent to the TKOIE.

A.1.2 Each of the above activities has been assessed separately in ***Section A.4***.

A.1.3 Information on the general water quality in the area and the potential impacts that may result during the cable installation and good site practice that will be implemented during construction are detailed in the following sections.

A.2 Relevant Legislation and Assessment Criteria

A.2.1 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 Discharge into Drainage and Sewerage Systems, Inland and Costal Waters (TM-ICW).
- Professional Persons Environmental Consultative Committee Practice Notes, Construction Site Drainage (ProPECC PN1/94).

A.2.2 These regulations and guidelines are applicable in assessing water quality impacts associated with the installation of the submarine cable.

Water Pollution Control Ordinance (WPCO)

A.2.3 The WPCO is the primary legislation for the control of water pollution and water quality in Hong Kong. There are a total of ten Water Control Zones (WCZ) and four supplementary WCZs, each of which has its own set of statutory Water Quality Objectives (WQO).

A.2.4 The alignment of Ultra Express Link passes through Junk Bay and Eastern Buffer WCZs, as shown in ***Figure A-1***. A summary of the WQOs for these WCZs is presented in ***Table A-1***.

These WQOs are applicable as evaluation criteria for assessing the compliance of any discharge during the installation of the submarine cable system.

Table A-1 Summary of Water Quality Objectives for Junk Bay and Eastern Buffer WCZs

Parameter	Junk Bay and Eastern Buffer WCZ
Temperature	Change due to waste discharge not to exceed 2°C
Salinity	Change due to water discharge not to exceed 10% of natural ambient level
pH	To be in the range 6.5 to 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 • Depth-averaged	 Not less than 2mg/L for 90% samples Not less than 4mg/L for 90% samples
Nutrients (measured as total inorganic nitrogen)	Junk Bay WCZ: Not to exceed 0.3mg/L (annual mean depth-averaged) Eastern Buffer WCZ: Not to exceed 0.4mg/L (annual mean depth-averaged)
Unionised Ammonia	Not to exceed 0.021mg/L (annual mean)
Chlorophyll-a	No criteria established for Junk Bay and Eastern Buffer WCZs
Toxicants	Not to be present at levels producing significant toxic effect
E. coli	Annual geometric mean not to exceed 610cfu/100mL (fish culture subzones in Junk Bay and Eastern Buffer WCZs)

EIAO-TM

A.2.5 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 all WQOs at the point of discharge since there are areas that are subjected to greater impacts (which are termed "mixing zones" by EPD) 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.

TM-ICW

A.2.6 Under Section 21 of WPCO, all discharges during the installation of the submarine cable are required to comply with 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.

Seawater Intakes

A.2.7 Quality of seawater at seawater intake points should comply with the relevant WQO for seawater flushing issued by the Water Supply Department (WSD), as shown in ***Table A-2***.

Table A-2 WQOs for Seawater for Flushing Supply at Intake Point

Parameter	Target[Note 1]
Colour (HU)	<20
Turbidity (NTU)	<10
Threshold Odour No. (TON)	<100
Ammonical Nitrogen (mg/L)	<1
Suspended Solids (mg/L)	<10
Dissolved Oxygen (mg/L)	>2
Biochemical Oxygen Demand (mg/L)	<10
Synthetic Detergents (mg/L)	<5
E.coli (cfu per 100mL)	<20,000

Note: 1. Measured at intake point

ProPECC PN 1/94

A.2.8 Apart from the above statutory requirements, the *Practice Notes for Professional Persons, Construction Site Drainage* (ProPECC PN 1/94), issued by the Environmental Protection Department in 1994, also provides useful guidelines on water pollution associated with construction activities.

A.3 Description of the Environment

A.3.1 The water quality throughout Hong Kong is monitored routinely by EPD, including Junk Bay and Eastern Buffer WCZs. The closest water quality and sediment monitoring stations that EPD monitor, along with the water sensitive receivers in the area, are shown in ***Figure A-2***. The following sections describe the general marine water quality in the vicinity of the Project and the marine sensitive receivers.

General Marine Water Quality

A.3.2 Within the Project area, there are several sewage discharge outfalls that are no longer in regular use since commissioning of the Stonecutters Island Sewage Treatment Works (SCISTW) under the Harbour Area Treatment Scheme (HATS) Stage 1, at the end of 2001. EPD's publication *Marine Water Quality in Hong Kong in 2015* notes that water quality has improved significantly since implementation of HATS and about 75% of the sewage around Victoria Harbour now receives chemically enhanced primary treatment, resulting in a 70% reduction of the pollution load (in terms of organic pollutants). In particular, improvements in water quality have been found in the Eastern Buffer and Junk Bay WCZs.

Routine Water Quality Monitoring Results

A.3.3 The closest EPD routine water quality monitoring stations to the Ultra Express Link alignment are JM4, JM3, EM1 and EM2, as shown in ***Figure A-2***. The latest published water quality data for these stations are summarised in ***Table A-3***.

A.3.4 The average value for the depth-averaged dissolved oxygen over the last five years is generally high at all stations and generally in excess of the WQO. The suspended solids concentrations over the last five years is low at all four stations with a depth averaged value of around 3.3mg/L. Annual depth averaged values for nutrients (measured as total

inorganic nitrogen) are similar at each of the water quality monitoring stations and are well below the WQOs. Over the last five years, unionised ammonia at each of the monitoring stations has achieved the WQO of less than 0.021mg/L.

Routine Sediment Quality Monitoring Results

A.3.5 The closest sediment quality monitoring stations to the Ultra Express Link alignment are ES4, J2 and ES1, as shown in ***Figure A-3***. The latest published sediment quality data for these stations are summarised in ***Table A-4***.

A.3.6 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).

A.3.7 The above data (mean values) show that sediments at the sample locations have not exceeded the UCEL over the last five years. There were three marginal exceedances of the LCEL, one for copper at JS2; and two for silver at Stations ES4 and JS2. The results are consistent with other data presented from other submarine cables installed in the same area and indicate previous discharges to Junk Bay.

Water Quality Sensitive Receivers

A.3.8 Water Quality Sensitive Receivers (WSRs) in the vicinity of the cable alignment, shown on ***Figure A-4***, have been summarised in ***Table A-5***, which indicates the distance between the WSRs and the closest alignment of the Ultra Express Link. The WSRs in the area comprise:

- **Gazetted Bathing Beaches.** The closest gazetted bathing beach is Big Wave Bay Beach, about 2.6km from the cable alignment.
- **Marine Reserves.** The closest Marine Reserve is Cape d' Aguilar Marine Reserve, located over 6.4km from the cable alignment.
- **Fish Culture Zones (FCZ).** The closest FCZ is Tung Lung Chau FCZ, located over 4.0km from the cable alignment.
- **Seawater Intakes.** The Pamela Youde Nethersole Eastern Hospital is located around 995m from the cable route. The WSD Siu Sai Wan Flushing Water Intake is located around 540m from the cable alignment.
- **Other Sites of Ecological Importance.** Coral colonies have been identified in the area as described in ***Annex C*** of this report. The coral communities have been identified along Cape Collinson and at Fat Tong Chau (near TKOIE), which are within 1km of the cable alignment. More distant coral communities include those identified at South West Junk Bay over 1.8km from the cable alignment.

Table A-3 Summary of EPD Routine Water Quality Monitoring Data between 2011 to 2015 (JM4, JM3, EM1 and EM2)

Water Quality Parameter	Junk Bay			Junk Bay			Chai Wan			Tathong Channel		
	JM4			JM3			EM1			EM2		
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Temperature(^{o}C)	22.7	23.0	22.9	22.8	23.2	23.1	22.8	23.0	22.9	22.7	23.0	22.9
Salinity	31.7	32.9	32.4	31.5	32.7	32.2	31.7	32.8	32.3	31.8	32.9	32.4
pH	7.8	8.0	7.9	7.8	8.0	7.9	7.8	8.0	7.9	7.8	8.0	7.9
Dissolved Oxygen (mg/L)	5.9	6.9	6.3	6.0	6.9	6.5	5.9	6.7	6.2	6.1	7.0	6.4
5-day Biochemical Oxygen Demand (mg/L)	0.4	1.0	0.8	0.5	1.3	1.0	0.5	0.8	0.7	0.5	1.1	0.8
Suspended Solid (mg/L)	2.4	4.7	3.4	1.8	4.9	3.0	2.7	3.6	3.3	2.6	4.5	3.7
Total Inorganic Nitrogen (mg/L)	0.13	0.22	0.16	0.15	0.24	0.18	0.13	0.23	0.18	0.12	0.19	0.15
Unionised Ammonia (mg/L)	0.002	0.002	0.002	0.002	0.003	0.002	0.002	0.003	0.002	0.001	0.002	0.002
Chlorophyll-a (µg/L)	1.8	4.4	3.3	2.2	5.1	3.9	1.6	4.4	3.0	1.8	3.8	2.8
Escherichia coli (cfu/100mL)	27	100	58	34	92	62	24	93	55	10	29	19

Source: Compiled from Appendix B of *Marine Water Quality in Hong Kong in 2011to 2015*, EPD.

Notes:

1. Data presented is the depth-averaged value averaged over 5 years and the depth-averaged range within the 5 years, unless stated otherwise.
2. Total Inorganic Nitrogen and Unionised Ammonia are presented as the depth averaged annual mean over 5 years and the depth averaged annual range.
3. *E.coli* is presented as depth averaged annual geometric mean and the range within 5 years.
4. Where value is less than detection limit, results are taken as half of the reporting limit for average calculation.

Table A-4 Summary of EPD Routine Sediment Quality Monitoring between 2011 to 2015 (ES1, ES4 and JS2)

Sediment Quality Parameter	LCEL	UCEL	Chai Wan			Tathong Channel			Junk Bay		
			ES1			ES4			JS2		
			Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Chemical Oxygen Demand (mg/kg)	-	-	7,200	14,000	9,790	9,300	24,000	12,530	8,900	17,000	13,190
Total Kjeldahl Nitrogen (mg/kg)	-	-	220	460	400	290	560	470	430	660	570
Arsenic (mg/kg)	12	42	3.6	6.4	5.2	4.2	7.6	6.0	6.8	8.6	7.5
Cadmium (mg/kg)	1.5	4	<0.1	<0.1	<0.1	<0.1	0.4	0.1	0.1	0.2	0.1
Chromium (mg/kg)	80	160	14	30	21	24	40	32	29	47	41
Copper (mg/kg)	65	110	15	36	24	39	100	57	55	78	**69**
Lead (mg/kg)	75	110	15	35	26	25	61	35	31	55	46
Mercury (mg/kg)	0.5	1	0.08	0.21	0.11	0.09	0.50	0.21	0.18	0.25	0.22
Nickel (mg/kg)	40	40	9	18	13	13	21	16	15	23	20
Silver (mg/kg)	1	2	0.2	0.6	0.4	0.6	4.2	**1.4**	0.9	1.6	**1.2**
Zinc (mg/kg)	200	270	48	87	65	69	260	110	97	160	140
Total PCBs (µg/kg)	23	180	18			18	19	18	18		

Source: Compiled from Appendix E of *Marine Water Quality in Hong Kong in 2011 to 2015*, EPD.

Notes:

1. Data presented are arithmetic mean (except if specified differently)
2. Data is based on Government laboratory analysis of bulk samples collected twice per year.
3. LCEL – Lower Chemical Exceedance Level, UCEL – Upper Chemical Exceedance Level.
4. If concentrations are below the limit of detection, results are taken as half of the reporting limit for average calculation..
5. Annual average exceedances of the LCEL are **in bold**.

Table A-5 Closest Distances of WSRs to the Cable Alignment

Category	ID	Water Quality Sensitive Receivers	Closest Distance from Cable Alignment
Gazetted Bathing Beaches	B1	Big Wave Bay Beach	2.6km
Marine Reserve Area	M1	Cape D'Aguilar Marine Reserve	6.4km
Fish Culture Zone	F1	Tung Lung Chau FCZ	3.6km
Site of Scientific Interest	S1	Shek O Headland	4.6km
Seawater Intake	W1	The Pamela Youde Nethersole Eastern Hospital	995m
	W2	WSD Siu Sai Wan Seawater Intake	540m
Coral Communities of Ecological Concern	C1	Corals along Cape Collinson (not of high ecological value but have a higher coral diversity compared to adjacent areas)	875m
	C2	Coral Communities at Fat Tong Chau	800m
Coastal Protection Area	CP1	Coastal Protection Area	555m

A.4 Impact Assessment

A.4.1 The potential for any adverse direct and indirect impacts to water quality have been assessed below based on the installation of the submarine cable and cable repair works.

Pit and Duct Construction at SSW Landing Site

A.4.2 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. Construction of the cable pit will require small-scale excavation, soil stockpiling and drill hole boring.

A.4.3 Run-offs can be controlled to acceptable environmental standards through the application of standard good site practices (such as covering of excavated material). There will be no discharge of HDD fluid muds associated with the project and drilling fluids will be recirculated through an on-site treatment system and will be tankered off-site upon completion of drilling.

A.4.4 No unacceptable impacts predicted to occur during the pit and duct construction at SSW landing site provided that standard good site practices are adopted.

HDD Seabed Breakout Point

A.4.5 During construction of the marine duct breakout point, the drill hole will stop 5m from the surface and the drill hole will be purged to ensure that the drilling cuttings and fluid do not break out into the marine environment. The drill hole will then use water as a primary drilling fluid; the remaining 5m will be slowly drilled through and will be monitored from the marine vessel until the drill cutter is near the surface. Divers will then be deployed with hand held jets to retrieve the drill wire and the cutter. A bell mouth will then be installed and the cable will then be winched through the cable duct.

A.4.6 Divers in the water will carefully control this installation process. Suspended solids generated during the diver-assisted installation are expected to be localised and short term in duration. A person in a vessel will be stationed along the drill route during drilling operations to assist with the detection of any escape of fluid.

A.4.7 Only minimal disturbance to water quality is expected and so the HDD process will not significantly affect the marine environment. No specific mitigation measures are required.

Marine Installation by Cable Burial Tool

A.4.8 The majority of the cable will be installed using a cable burial machine at a target burial depth of 3m to 5m below the seabed and 5m below seabed within the Tathong Channel. This installation method, which uses cable burial machine techniques, has been used on most previous cable installation projects in Hong Kong waters without adverse water quality impact.

Similar Projects

A.4.9 There are several similar project that have used the same approach for calculating the transportation of sediment in suspension, including the following Project Profiles for which Environmental Permits have been issued:

- Tseung Kwan O (TKO) Express – Cable System (AEP-509/2016). Environmental Permit was granted on 20 May 2016 (EP-509/2016).
- Asia Pacific Gateway (APG) – Tseung Kwan O (AEP-485/2014). Environmental Permit was granted on 18 February 2014 (EP-485/2014).
- Asia Submarine-cable Express (ASE) – Tseung Kwan O (AEP-433/2011). Environmental Permit was granted on 20 December 2011 (EP-433/2011).
- South-East Asia Japan Cable System (SJC) Hong Kong Segment (AEP-423/2011). Environmental Permit was granted on 24 October 2011 (EP-423/2011).
- Asia-America Gateway (AAG) Cable Network, South Lantau (EP-298/2007). Environmental Permit was granted on 20 December 2007 (EP-298/2007).
- 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).
- 132 kV Submarine Cable Installation for Wong Chuk Hang – Chung Hom Kok 132 kV Circuits (AEP132/2002). Environmental Permit was granted on 16 April 2002 (EP-132/2002).
- Flag North Asian Loop (AEP099/2001). 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 Lot591SA 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.
- 11 kV Cable Circuits from Tai Mong Tsai to Kiu Tsui, CLP Power. Gazetted under Foreshore Seabed (Reclamation) Ordinance in 2004.

A.4.10 Figures and formulas from the above projects have been adapted for use of this Project. Calculations have been made for release rate, settling velocity and settling time and also the distance travelled for suspended sediment. Upper limits for the parameters have been used for a worst-case scenario assessment.

A.4.11 In particular, the quantitative water quality assessments for the *TKO Express Cable System* (AEP-509/2016), *Asia Pacific Gateway* – Tseung Kwan O (AEP-485/2014) ("*APG Cable Project*") and *Asia Submarine-cable Express* – Tseung Kwan O (AEP-433/2011) ("*ASE Cable Project*") have been referenced in this assessment as their landing site is at the same location and these cables follow a similar route as the Ultra Express Link. The cable installation methodology and equipment for Ultra Express Link is also the same as for these projects.

Methodology for Cable Installation

A.4.12 Prior to cable installation, the seabed will be checked to ensure there are no obstructions to cable installation. This will be achieved by a pre-run along the cable alignment with the burial tool employed at shallow depth to confirm the seabed surface is clear. Any debris will be brought on-board the cable installation vessel and disposed of at landfill.

A.4.13 The Ultra Express Link will then be installed by cable burial machine, using a cable burial tool that is lowered to the seabed. The weight of the cable burial tool allows the cable to be positioned to the desired depth below the seabed of 3m to 5m. The burial tool is then pulled through the water by a cable-laying vessel. The cable burial tool contains localised high-pressure jets directly around the cable to assist with installing the cable below the seabed. With this method, the cable is simultaneously laid and buried. The sediment along the cable area naturally slumps around the cable, burying it and leaving a small line in the seabed, which is then infilled by natural sedimentation. There is no material that will be dredged or disposed off-site.

A.4.14 The maximum width of the seabed fluidised by the burial tool is 0.5m and the cable is buried to a depth of 5m. During the cable laying process, the seabed sediments will be disturbed and a small percentage of sediment will be lost to suspension in the lower part of the water column in the immediate vicinity of the cable burial tool. The analysis of the potential transport of fine sediments suspended into the water column during the cable laying process has been undertaken recently within the same area as the Ultra Express Link, for the *TKO Express Cable System Project*, APG *Cable Project* and *ASE Cable Project*, and is presented in the following paragraphs with regard to Ultra Express Link.

Calculation of Sediment Transport

A.4.15 Calculation of sediment transport is based on the following approach with appropriate reference to the *TKO Express Cable System*, *APG Cable Project* and *ASE Cable Project*. The upper limits for the parameters have been used in these studies for calculating the release rate, settling velocity and settling time and distance travelled for suspended sediments to account for a worst case scenario.

Release Rate	= cross sectional area of disturbed sediment x speed of cable laying machine x sediment dry density x percentage loss
Depth of Disturbance	= 5m (burial depth of cable)
Width of Disturbance	= 0.5m (width of seabed disturbance as cable buried)
Max. Cross-sectional Area	= $2.5m^2$
Loss Rate	= 20% (majority of sediment not disturbed)
Speed of Machine	= $0.278ms^{-1}$ ($1km\ hour^{-1}$)
In-situ Dry Sediment Density	= $600kg\ m^{-3}$ (typical of Hong Kong sediment)
Release Rate	= **$83.4kg\ s^{-1}$**

Initial Concentration of Suspended Sediments

A.4.16 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. At high concentrations and within a localised area the suspended sediments will tend to form large aggregations of sediment particles (flocculation), which have a higher settling velocity than the individual particles.

A.4.17 It is expected that the suspended sediments will remain within 1m 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. The current velocity has been chosen based on estimated velocity values of similar projects entering TKOIE. For the purpose of the assessment a current velocity of $0.9m\ s^{-1}$ has been applied, which is an upper bound estimate of bottom current velocities in the vicinity of the cable area and a conservative estimate and based on recent data, would be an absolute worst-case scenario.

A.4.18 It is expected that the sediment will initially spread to a maximum of 6m along the centre line of the cable alignment, which represents the longitudinal dimension of the cable burial tool. Although the suspended solids are expected to form around the cable laying works, a conservative assumption has been used to allow for a cross-current to carry sediment towards the sensitive receivers.

A.4.19 Based on the above, and given the worst case scenario that the sediment initially mixes evenly over the lower 1m 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	= $83.4kg\ s^{-1}$

Current Velocity	= 0.9m s^{-1}	(The current velocity at Tathong Channel along the cable alignment range from 0.2 to 0.5m s^{-1} (depth averaged) as reported in Digital Tidal Atlas 2006 published by the Marine Department. To assess the worst case scenario, the value of 0.9m s^{-1} adopted in the approved Project Profiles for the *TKO Express Cable System Project, APG Cable Project* and the *ASE Cable Project* was used, all of which also land at TKOIE.)
Height of Sediment	= 1m	
Width of Sediment	= 6m	
Initial Concentration	**= 15.44kg m^{-3}**	

Settling Velocity and Settling Time

A.4.20 Typically the settling velocity of suspended solids is determined by examining the relationship between the initial suspended solids concentrations and the cohesive nature of the sediment being disturbed. It is generally accepted that an increase in sediment concentrations also increases the settling velocity, a result of flocculation leading to gain in mass and therefore the particles settle faster. However when initial concentrations exceed values such as 1kg m^{-3} (*Hydraulics Research, Estuarine Muds Manual*, 1998), this is no longer true. As the initial concentrations for this project are predicted to be greater than this value, a conservative settling velocity of 10mm s^{-1} has been adopted.

A.4.21 As the sediment progressively settles onto the seabed, 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 5.0mm s^{-1}. This is the same approach as was adopted for the *TKO Express Cable System Project*, *APG Cable Project* and *ASE Cable Project*.

A.4.22 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 = 1m/0.005m s^{-1} = 200s (3.5 minutes)

Distance Travelled

A.4.23 Combining this settling time with the speed of the tidal currents allows an estimate of how far the sediment will spread during the cable laying process. In this case, a worst-case tidal current of 0.9 m s^{-1} has been assumed.

Distance Travelled = Settling Time x Speed of Tidal Current

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

A.4.24 The above calculation indicates that the sediments disturbed during cable laying works will settle onto the seabed within approximately 180m of the cable alignment and will settle within about three and half minutes.

Past Water Quality Monitoring Data

A.4.25 *APG Cable Project* and *TKO-Express Cable System*, constructed in mid-2016 and earyl-2017 respectively, are the two most recently constructed submarine cable projects in the vicinity of the Ultra Express Link. Since water quality monitoring was not carried out during construction of *TKO-Express Cable System*, water quality monitoring data for *APG Cable Project* has been reviewed to assess the water quality impacts caused by the cable laying works.

A.4.26 Water quality monitoring was carried out in accordance with the requirements as detailed in the Project Profile for the *APG Cable Project*. As shown in ***Figure 1-1***, *APG Cable Project* has the same landing site at TKOIE as Ultra Express Link, and runs towards the southeast with similar alignment as Ultra Express Link across Tathong Channel. Water quality monitoring stations for *APG Cable Project* in the vicinity of the project is shown in ***Figure A-5***. The nearest and most representative water quality monitoring stations for the Ultra Express Link cable alignment are E9 and S2. The monitoring results on suspended solids and turbidity have been reviewed and findings are summarized in ***Table A-6***. Water quality monitoring results for *APG Cable Project* concluded that there was no deterioration of water quality at the water sensitive receivers in the vicinity and water quality impact caused by the cable installation works was negligible.

Table A-6 Summary of Past Water Quality Monitoring Data

Duration	Construction Works within Zone A	Exceedances	Conclusion
16 to 22 May 2016	Route Clearance	Exceedances of depth-averaged turbidity and SS Action Levels were recorded on 17 May and 18 May 2016 at E9 and S2. However the exceedances were not considered to be caused by the route clearance works but a reflection of the natural background fluctuation on each impact monitoring as explained in the First Weekly Impact Water Quality Monitoring Report for APG.	It is concluded that there was no deterioration of water quality during the reporting week and hence the effect of the Project route clearance works on water quality is considered to be negligible over this reporting week.
23 to 29 May 2016	Cable Installation Works	Exceedances of depth-averaged SS Action Levels were recorded on 27 May 2016 at S2. It is considered that these exceedances were not caused by the Project's cable installation works but reflected the natural background fluctuation of marine water quality as explained in the Second Weekly Impact Water Quality Monitoring Report for *APG Cable Project*.	It is concluded that there was no deterioration of water quality during the reporting week and hence the effect of the Project cable laying works on water quality is considered to be negligible over this reporting week.
30 May to 5 June 2016	No works within Zone A	N/A	N/A

Duration	Construction Works within Zone A	Exceedances	Conclusion
6 to 12 June 2016	No works within Zone A	N/A	N/A

Potential Impacts to Water Quality Sensitive Receivers

A.4.27 ***Table A-7*** shows all the WSRs are located beyond the above predicted distance. It is anticipated that the works will not cause impacts to the WSRs.

Table A-7 Water Quality Impact at Sensitive Receivers During Cable Burial Machine Installation

Category	ID	Sensitive Receivers	Closest Distance from Cable Alignment	Potential for Adverse Impact
Gazetted Bathing Beaches	B1	Big Wave Bay Beach	2.6km	None due to distance between WSR and expected sediment plume
Marine Reserve Area	M1	Cape D'Aguilar Marine Reserve	6.4km	None due to distance between WSR and expected sediment plume
Fish Culture Zone	F1	Tung Lung Chau FCZ	3.6km	None due to distance between WSR and expected sediment plume
Seawater Intake	W1	The Pamela Youde Nethersole Eastern Hospital	995m	None due to distance between WSR and expected sediment plume
	W2	WSD Siu Sai Wan Seawater Intake	540m	None due to distance between WSR and expected sediment plume
Coral Communities of Ecological Concern	C1	Corals along Cape Collinson	875m	None due to distance between WSR and expected sediment plume
	C2	Coral Communities at Fat Tong Chau	800m	None due to distance between WSR and expected sediment plume
Coastal Protection Area	CP1	Coastal Protection Area	555m	None due to distance between WSR and expected sediment plume

A.4.28 Sediments disturbed during use of the cable burial tool are predicted to settle back to the seabed within a maximum of 180m of the cable alignment within about three and half minutes. All of the WSRs are located more than 180m from the alignment and the works will not cause any adverse impacts to these WSRs.

Diver-Assisted Burial

A.4.29 Diver assisted burial will be required at the DSD sewage outfall crossing and approximately 20m from the seawall at TKOIE, near the existing conduit. The cable will be buried to a depth of approximately 2m using hand held jetting equipment.

A.4.30 The burying by divers of the shore end cable will not cause significant water quality impacts as only a small area will be disturbed (short lengths of approximately 20m to 80m) and since the burial depth will be shallower for these area (around 2m).

A.4.31 Using the same calculation for 2m burial depth, the initial concentration is predicted to be 2.3kg m^{-3} exceeding 1kg m^{-3} and hence 10mms^{-1} settling velocity was used. Therefore, the distance travelled by the disturbed sediments is expected to also be about 180m from the cable alignment, which will not affect WSRs in the area.

Cable Repair Works

A.4.32 In case the cable installed under the seabed being damaged by dropped objects or anchoring activities, cable repair works shall be required. Cable repair works shall comprise of route clearance prior to repair works, exposing the damaged cable section by diver jetting tool and/or cable burial tools used for marine works during construction stage, reconnecting the damaged cable, and reburial of the repaired cable section by diver jetting tool and/or cable burial tools. Diver jetting tools has a much smaller water jetting capacity and seabed fluidization ability (about 2m under seabed) as compared to the cable burial tool used for cable installation (about 5m under seabed). The cable repair work will only be conducted at a small section of the damaged cable. Considering the short-term and small-scale construction works involving use of less powerful jetting tool, sediment release during cable repair shall be minimal as compared to the cable burial works being assessed above. The seabed can be expected to naturally reinstate to before-work level and condition shortly after completion of the works. No significant water quality impact is anticipated during cable repair.

Cumulative Impacts

A.4.33 While there are five planned projects near Ultra Express Link, as stated in ***Section 2.3***, four of them are not expected to be in construction at the same time as the installation of the Ultra Express Link, with the exception of Tseung Kwan O – Lam Tin Tunnel and Associated Works. Since marine works for Ultra Express Link, including cable installation and cable protection works, will only take about 5 days to complete, cumulative water quality impact during construction phase shall be minimal.

A.5 Good Site Practices During Cable Installation

Pit and Duct Construction at SSW Landing Site

A.5.1 The following good site practices will be adopted during land-based cable installation:

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

Drilling Fluid Recycling at SSW

A.5.2 During the casing installation works by HDD at SSW landing site, drilling fluid will be produced by mixing bentonite to drive the downhole mud motor and lubricate the tricone roller. Drilling fluid will be recycled in a closed loop system, where all drill mud that is pumped downhole will return up and will be cleaned of cuttings before being used. This would allow monitoring of the amount of mud that has been mixed to identify the amount of drilling fluid leaving the system.

A.5.3 Precautionary measures will be implemented to avoid runoff of the collected drilling fluid from entering the storm water drainage system, extra care will be taken to monitor changes in drilling pressure to ensure enough pressure is being used to power the mud motor and advance the hole without risk of drilling fluid break out during drilling. Slurry pit of sufficient capacity will be provided to ensure no leakage of the collected drilling fluid and condition of the slurry pit will also be closely monitored. Visually inspection will be carried out throughout the drilling process to ensure no fluid being leaked into the drainage system and sea. Works will be stopped immediately in case any leakage of drilling fluid found.

HDD Seabed Breakout Point

A.5.4 During construction of the marine duct breakout point, the drill hole will stop 5m from the rock head and the drill hole will be purged to ensure that the drilling cuttings and fluid do not break out in the marine environment. To avoid any potential leakage of the drilling fluid into the marine environment when the drill head breaks out of the bedrock and into the marine mud on the seabed, drilling fluid will be predominantly water for the final 5m of drilling. The remaining 5m will be slowly drilled through and will be monitored from the marine vessel until the drill wire is near the surface.

A.5.5 The used drilling fluid for the final 5m drilling, i.e. predominantly water with the drilling cuttings, will also be returned to the SSW landing site for drilling cuttings removal before being reuse.

A.5.6 During this final 5m drilling, divers in the water will carefully control the installation works. The drilling process and pumping of drilling fluid will stop when the drilling assembly enters the marine deposits at approximately 20-30m below the surface of the seabed. The drill wire will then be pushed to punch-out through the marine deposits. Divers will then be deployed with hand held jets to retrieve the drill wire and the cutter. A bell mouth and hauling wire will then be installed. The cable will then be winched through the cable duct in a separate operation. This lack of drill fluid pumping in the marine deposits will prevent breakout of the drilling fluid and drill cuttings into the marine setting.

A.5.7 This installation process will be carefully controlled by divers in the water. Suspended solids generated during the diver-assisted installation are expected to be localised and of very short term in duration. A manned vessel will be stationed along the drill route during drilling operations to assist with the detection of any escape of fluid.

A.5.8 Suspended solids generated during the diver assisted installation will be limited to the drill wire and cutter retrieval process and are expected to be localised and short term in duration. As such, only minimal disturbance to water quality are expected to result, which will not significantly affect the marine environment. No impacts are found to result from this method of installation and mitigation measures are not required.

A.5.9 As a good practice measure, a *Drilling Fluid Management Plan* has been prepared and attached in ***Annex B***, outlining the proper management of the drilling fluid on site.

Marine Installation with Cable Burial Machine

A.5.10 No adverse impacts are expected to occur during marine installation of the cable with the cable burial tool, but the following measures will be followed:

- The crane barge used for the transport of any 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 to the disposal site.
- The crane barge shall be filled to a level that ensures that material does not spill over during loading and transport and that adequate freeboard is maintained to ensure that the decks are not washed by wave action.
- The speed of the installation barge will be limited to a maximum of 1km/h.

Diver Assisted Burial

A.5.11 No impacts are found to result from this method of installation and so mitigation measures are not required.

Cable Repair Works

A.5.12 No impacts are found to result from cable repair works and so mitigation measures are not required.

A.6 Conclusion

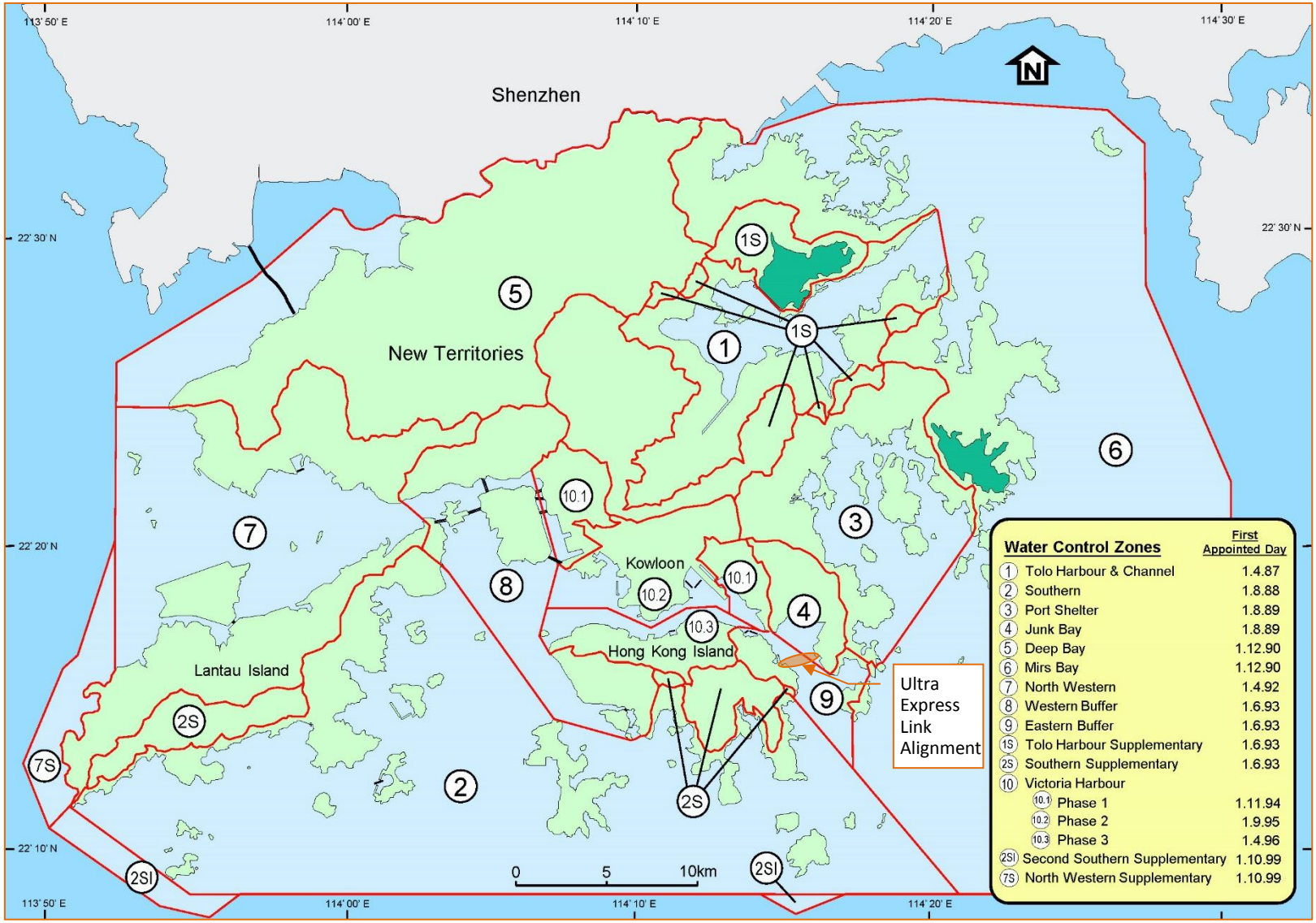
A.6.1 WSRs, including Big Wave Bay Beach, Cape D'Aguilar Marine Reserve, Tung Lung Chau Fish Culture Zone, Shek O Headland, The Pamela Youde Nethersole Eastern Hospital, WSD Siu Sai Wan Seawater Intake, Coral Communities along Cape Collinson and Fat Tong Chau are located far from the project works and will not be affected by the Project works.

A.6.2 An assessment of sediment dispersion impacts associated cable laying works along the proposed cable alignment has been undertaken. There is potential for small scale and localised water quality impacts to occur from runoff from the on shore cable pit at SSW and at the HDD breakout point off shore. This will be prevented through good site practices described in ***Section A.5*** and through good site working practices.

A.6.3 The calculation of sediment transport from the cable laying works indicates that sediments disturbed during use of the cable burial tool will settle back to the seabed within a maximum of 180m of the cable alignment within about three and half minutes. All of the WSRs are located more than 180m from the alignment and impacts to these WSRs will not result from the Project works. Good site practices have also been recommended during the marine installation; for example, the speed of the installation barge will be set to a maximum of 1km/hr.

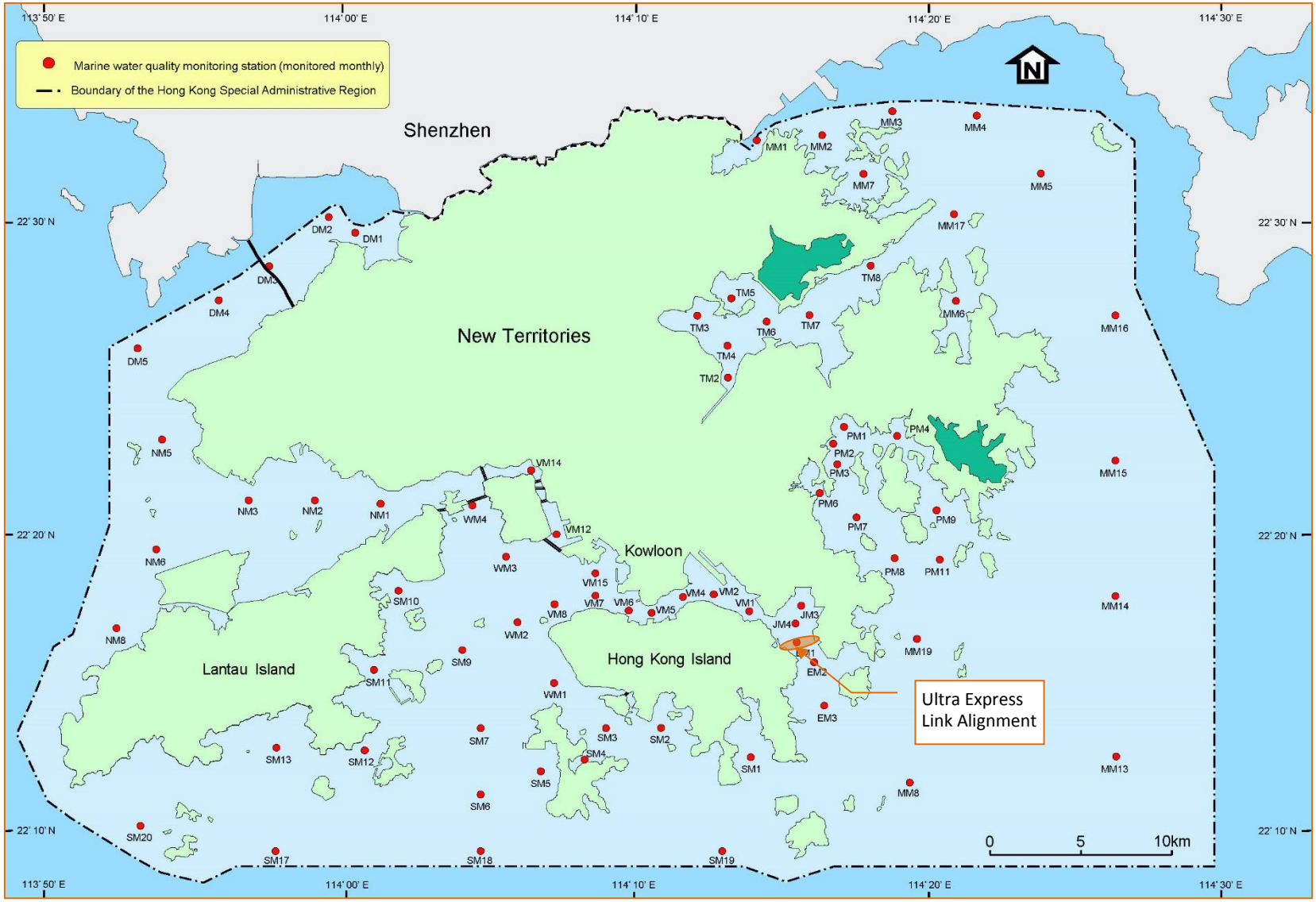
A.6.4 Overall, with the recommended good site practices in place, no adverse water quality impacts are anticipated from the cable installation works.

Figure A-1 Water Control Zones in Hong Kong



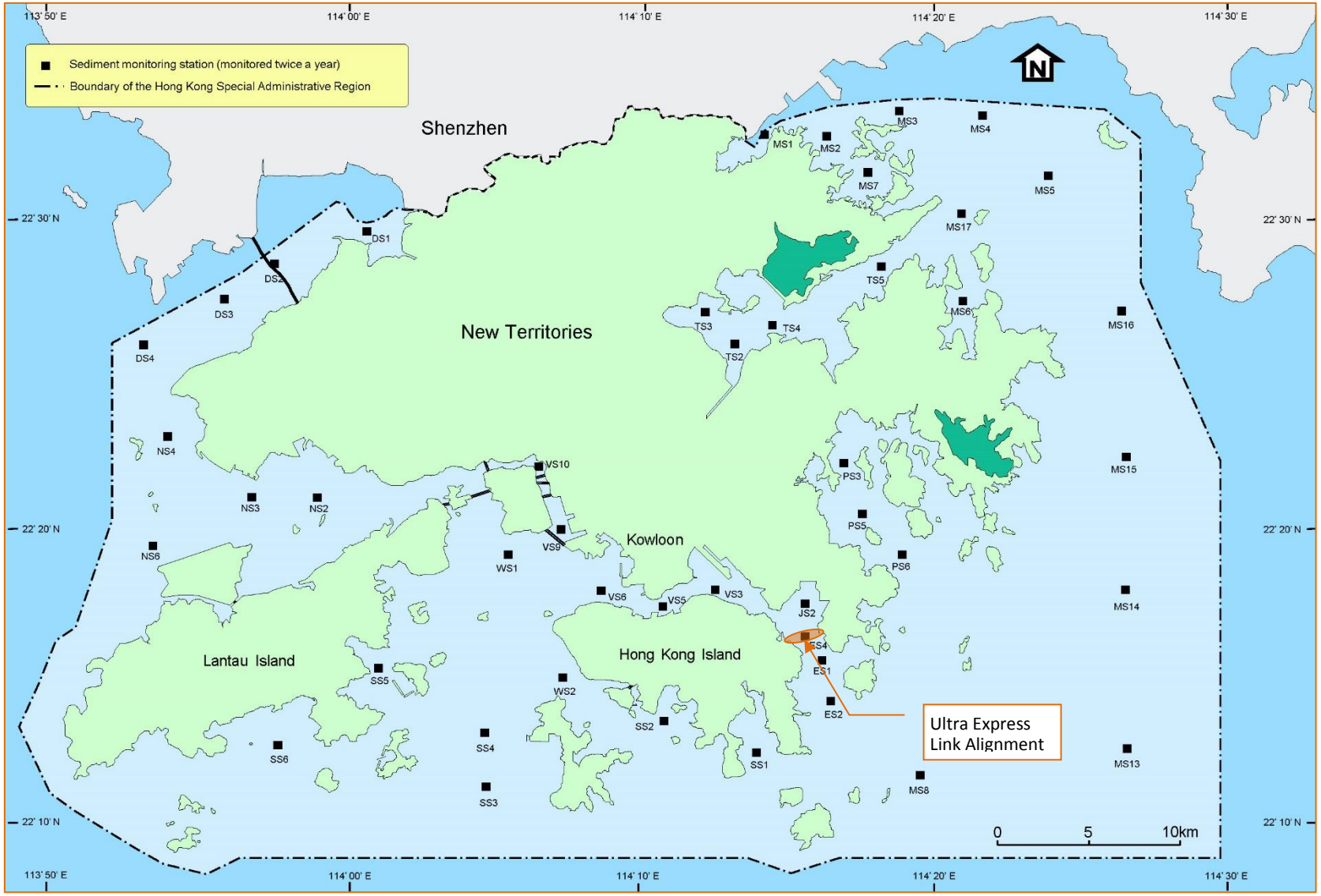
Source: Environment Bureau – Plan No. WP/WP4/75, Oct 1999 in *Marine Water Quality in Hong Kong in 2015*, EPD

Figure A-2 EPD's Marine Water Quality Monitoring Stations



Source: *Marine Water Quality in Hong Kong in 2015*, EPD

Figure A-3 EPD's Marine Sediment Monitoring Stations



Source: *Marine Water Quality in Hong Kong in 2015*, EPD

Figure A-4 WSRs and EPD Monitoring Stations in the Vicinity of the Alignment

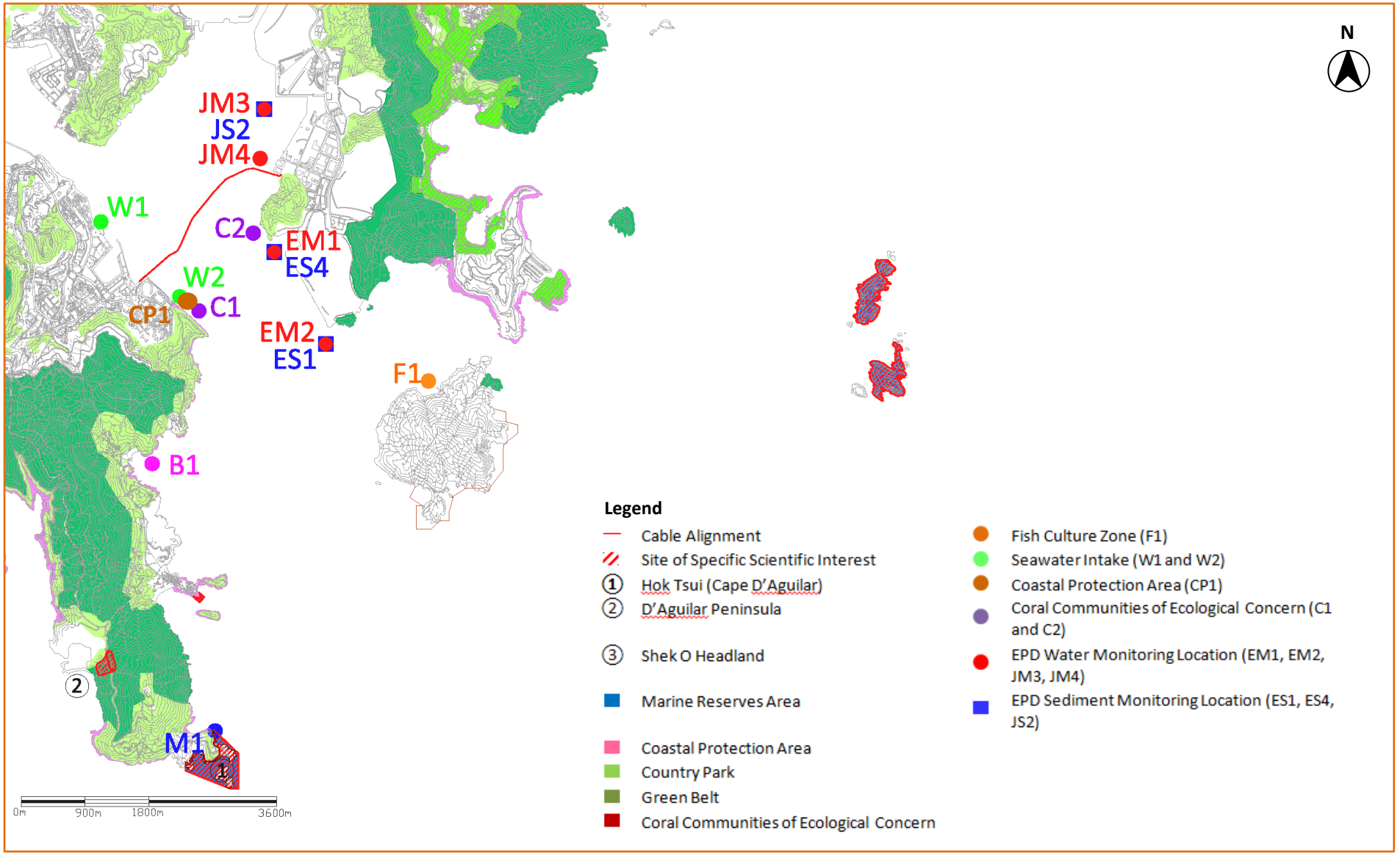
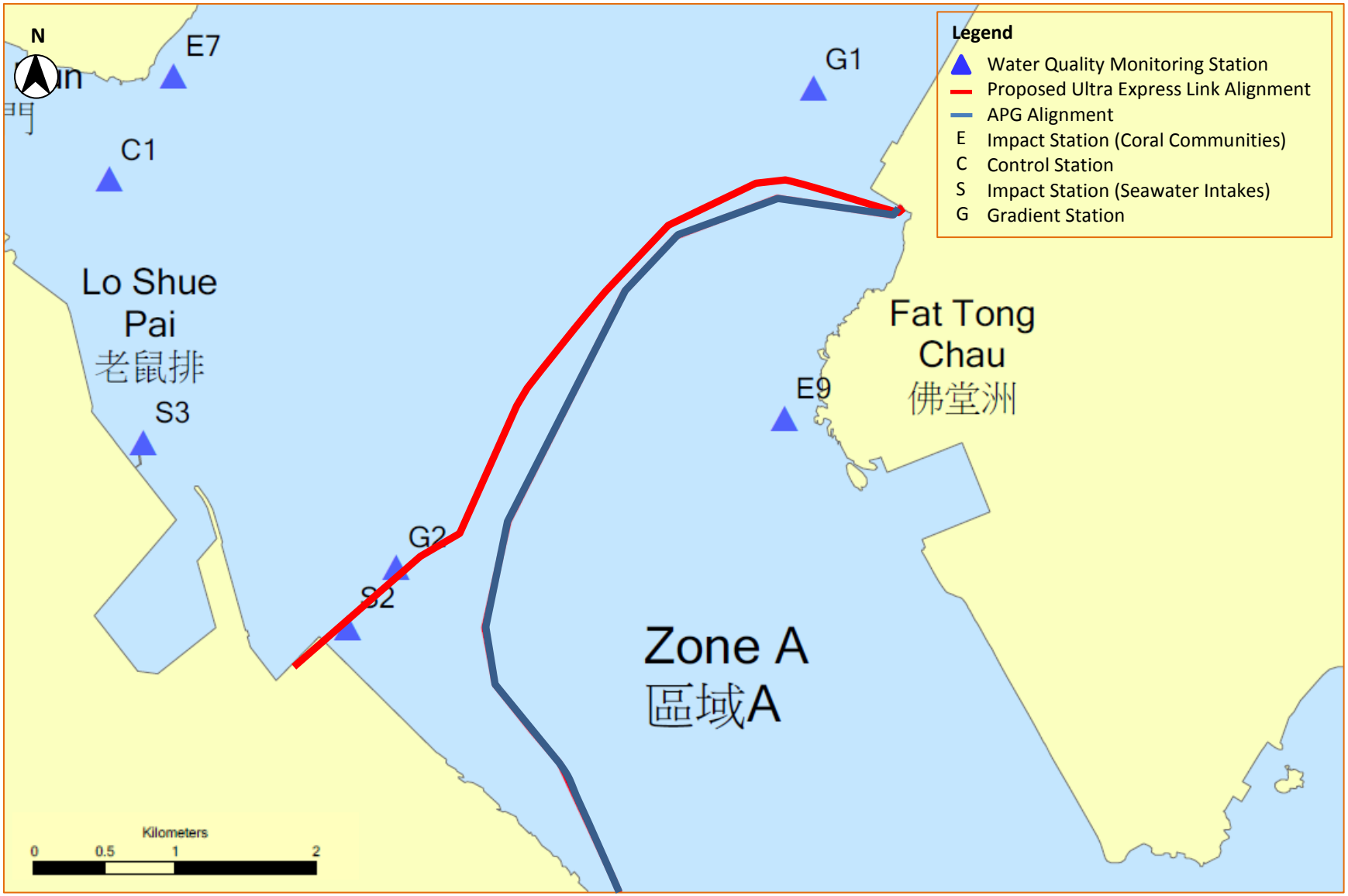


Figure A-5 Water Quality Monitoring Stations for APG Cable Project in the Vicinity of the Ultra Express Link Alignment



Reference: Project Profile for Asia Pacific Gateway (APG) – Tseung Kwan O

ANNEX B

Drilling Fluid Management Plan

CONTENTS

B. DRILLING FLUID MANAGEMENT B-1

B.1 Drilling Fluid B-1
B.2 Recycling and Closed Loop System B-1
B.3 Breakout Prevention B-1
B.4 Response Action B-2
B.5 Disposal B-2

FIGURES

Figure B-1 Bentonil Thr Datasheet
Figure B-2 Flow Diagram of Closed Loop Drilling Fluid System

B. Drilling Fluid Management

B.1 Drilling Fluid

Purpose

B.1.1 During casing installation works by HDD Contractor, a drilling fluid primarily comprised of bentonite mud will be employed. The purpose of this drilling fluid is to:

- Drive the downhole mud motor to advance the hole
- Lubricate the tricone roller bit
- Support the open hole
- Clear cuttings from the hole

Composition and Monitoring

B.1.2 Drilling fluid will be produced by mixing bentonite with fresh water. Technical datasheet for a sample bentonite available from the market, Bentonil THR, is contained in ***Figure B-1*** for reference. The mixing proportions will be as per manufacturer's recommendations; however changes may be made to the mixing proportions to accommodate different geology or if water affects the physical properties.

B.1.3 Physical properties of the drilling fluid will be monitored by a dedicated mud mixer during drilling. The following measurements will be taken and recorded at least 3 times per shift and whenever any mud is mixed:

- Flow cone/marsh funnel
- Sand content
- Mud balance

B.1.4 Amount of drilling fluid mixed as well as how much mud is contained within the system will also be measured and recorded at least 3 times a shift.

B.2 Recycling and Closed Loop System

B.2.1 Drilling fluid will be recycled and reused in a closed loop system. This means that all drill mud that is pumped downhole will return up the annular space and will be cleaned of cuttings before being reused. Monitoring the amount of mud that has been mixed and how much drilling fluid is currently contained within the system is essential for this closed loop system. This allows quick identification if drilling fluid is leaving the system.

B.2.2 A flow diagram showing details of the closed loop system is presented in ***Figure B-2***.

B.3 Breakout Prevention

B.3.1 During drilling process, care will be taken to monitor changes in drilling pressure to ensure enough pressure is being used to power the mud motor and advance the hole without risk of drilling fluid break out.

B.3.2 Careful monitoring of the physical properties of the drilling fluid will also help to ensure that the fluid will create an effective mud cake on hole walls. This mud cake will prevent drilling fluid leaving the system through the walls of the drilled hole.

B.3.3 Before completion of the drilling, the drilling assembly will enter the marine deposits. At this point the pumping of drilling fluid will be stopped. The drill wire will then be pushed to punch-out through the marine deposits.

B.3.4 This lack of drill fluid pumping in the marine deposits will prevent breakout of the drilling fluid into the marine setting.

B.4 Response Action

B.4.1 The quantity of drilling fluid within the closed loop system is regularly monitored by visual inspection of the level of drilling fluid in the mud tank and calculation of the volume of drilling fluid in the drilled hole – this is the total quantity of drilling fluid. If the decrease in the amount of drilling fluid in the mud tank exceeded the expected increase of drilling fluid in the drilled hole, indicates that drilling fluid is being lost from the system.

B.4.2 At any time during the drilling process, if large quantities of drilling fluid are discovered to have left the closed system (by monitoring drilling fluid levels on site and by visually inspecting the seawater above the alignment of the hole) then drilling will be paused.

B.4.3 In the event no fluid was observed to have leaked into the sea, an attempt will be made to top up the system with drilling fluid. If the level of fluid then remains constant, drilling shall be resumed. If the level of drilling fluid drops once again then the hole will be back filled with bentonite cement until the loss of drilling fluid is stopped. The cement will be let to set and then the drilling restarted following the normal procedure.

B.4.4 However, if there is evidence that the drilling fluid has leaked to the sea, i.e. visible pool of fluid in the sea water, then the above method of topping up the system with drilling fluid shall not be used. Instead, the drilling shall be stopped immediately and the hole will be back filled with bentonite cement until the loss of drilling fluid is stopped. The cement will be let to set and then the drilling can restart, following the normal procedure.

B.4.5 Towards the end of the drilling process, divers will be employed to carry out full time visually inspection around the punch-out point to ensure no leakage of the drilling fluid from the punch-out point.

B.4.6 When the drilling assembly enters the marine deposits at approximately 20-30m below the surface of the seabed, the drilling process and pumping of drilling fluid will stop. There shall be no leakage of drilling fluid into the sea at completion of the drilling process, no response action is needed.

B.5 Disposal

B.5.1 Once the drilling works are completed, all drilling fluids shall be returned to the SSW works area where they shall be cleaned of cutting and stored in the mud tanks prior to being removed from site for disposal. All cuttings and drilling fluids will be pumped into collection trucks and disposed of at an authorized disposal site. The spoil disposal will be monitored by a trip ticket system managed by the public dumps.

Figure B-1 Bentonil Thr Datasheet

CLARIANT

Technical Data Sheet

BENTONIL® THR

Description

BENTONIL® THR is a very high yielding, sodium bentonite with well-balanced rheological profile, designed to meet the requirements of horizontal and vertical drilling applications.

PT. SUD-CHEMIE INDONESIA
BU FUNCTIONAL MINERALS
BL ADSORBENTS
BUSINESS GROUP CIVIL ENGINEERING

Jl. Raya Narogong Km.
14 Pangkalan 1D, Desa Limusnunggal
Cileungsi 16820
West Java/ Indonesia
www.clariant.com

COPYRIGHT ©
CLARIANT INTERNATIONAL LTD 2013

EDITION
October 2013

Main Applications

- Horizontal Directional Drilling
- Pipe Jacking
- Vertical Drilling

Mud and product specification (*)

Yield Point (YP):	≥ 25 lb/100ft2
Fann-Value at 6 rpm	≥ 14
Filtrate (30 min)	≤ 25 [ml]
Plastic Viscosity	5-15 mPa
Wet screen analysis (75 µm)	< 2,5 %
Water content	11 ± 3%

* Obtained with 45 g/l tap water, mixed at 11000 rpm during 10 min, and after 1 h ageing at 20 °C.

Indicative rheological performance after 1h ageing (**)

BENTONIL® THR	Marsh Viscosity (API)	Filtrate (ISO 13500)
35 kg/m³	40 – 45 s	< 25 ml
45 kg/m³	>50 s	< 22 ml

** No guaranteed values because the properties are strongly dependent on water quality and mixing procedures.

1

CLARIANT

Instruction for use

The recommended dosage range varies from 35 – 55 kg/m³ and should be adjusted according to the local ground and water conditions applicable. Standard dosage is 45 kg/m³ of water. Water should satisfy minimum standards of quality. It is necessary to apply enough shear during mixing to ensure the correct hydration of the bentonite. To reach good rheological values we recommend a minimum swelling time of 4-6 hours. BENTONIL® THR could be modified by our SC-additives. Contact your CLARIANT technical representative for any further technical information.

Packaging

packed in 25 kg paper bags, 1000 kg big-bags.

Storage and stability

Keep the product in its original packaging at ambient temperature and protect it from humidity. A loss of rheological and filtrate properties may result from inadequate storage

Related document:

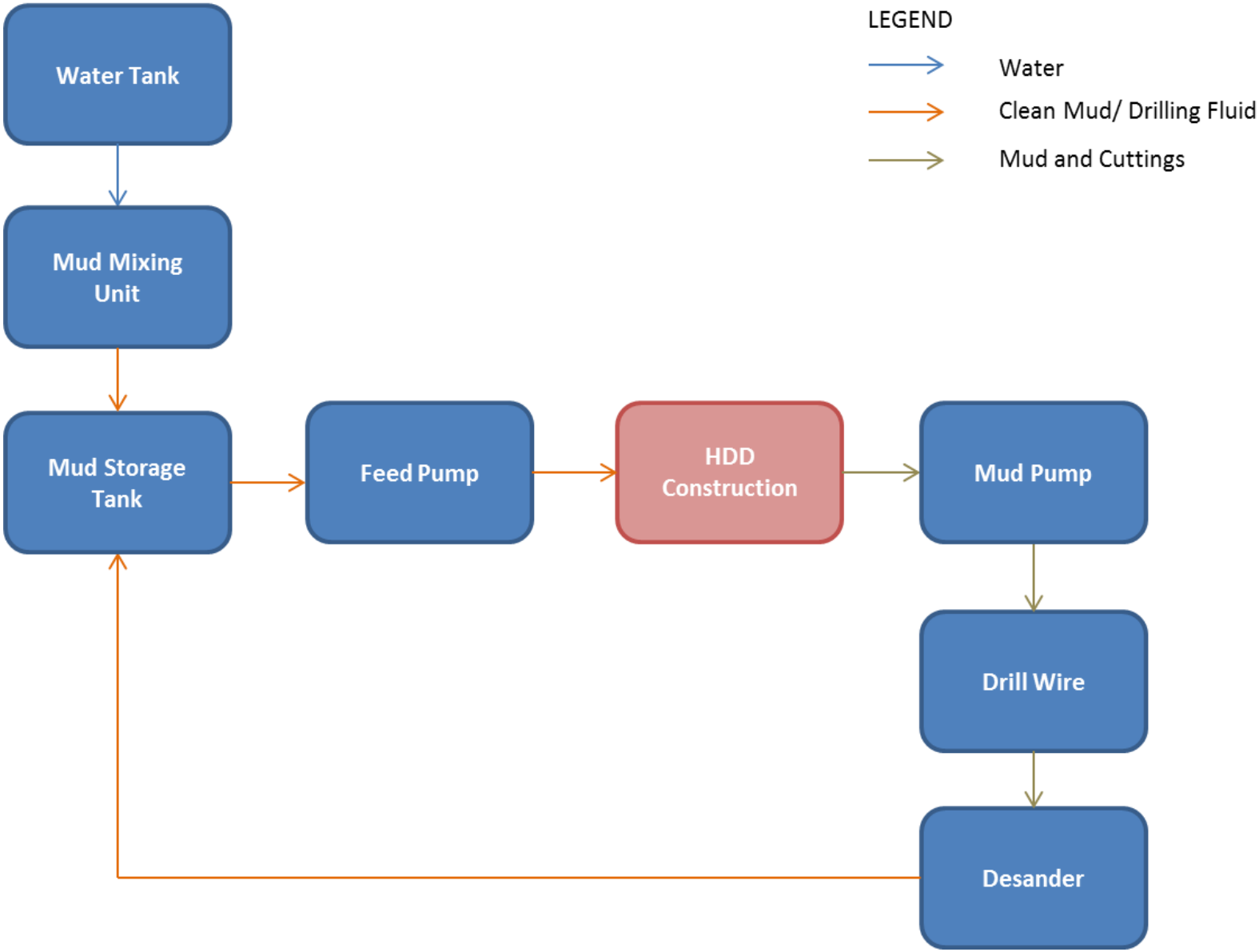
MSDS and application sheet on demand.

This information corresponds to the present state of our knowledge and is intended as a general description of our products and their possible applications. Clariant makes no warranties, express or implied, as to the information's accuracy, adequacy, sufficiency or freedom from defect and assumes no liability in connection with any use of this information. Any user of this product is responsible for determining the suitability of Clariant's products for its particular application.* Nothing included in this information waives any of Clariant's General Terms and Conditions of Sale, which control unless it agrees otherwise in writing. Any existing intellectual/industrial property rights must be observed. Due to possible changes in our products and applicable national and international regulations and laws, the status of our products could change. Material Safety Data Sheets providing safety precautions, that should be observed when handling or storing Clariant products, are available upon request and are provided in compliance with applicable law. You should obtain and review the applicable Material Safety Data Sheet information before handling any of these products. For additional information, please contact Clariant.

® Trademark registered in many countries and owned by Clariant
© 2012 Clariant International Ltd, Rothausstrasse 61, 4132 Muttenz, Switzerland

2

Figure B-2 Flow Diagram of a Closed Loop Drilling Fluid System



ANNEX C

Marine Ecology Assessment

CONTENTS

C. MARINE ECOLOGY ASSESSMENT C-1

C.1 Introduction C-1
C.2 Relevant Legislation and Assessment Criteria C-1
C.3 Description of the Marine Environment C-1
C.4 Impact Assessment C-1
C.5 Good Site Practices During Cable Installation C-5
C.6 Conclusion C-6

FIGURES

Figure C-1 Seabed Feature of Ultra Express Link

C. MARINE ECOLOGY ASSESSMENT

C.1 Introduction

C.1.1 This Annex provides an assessment of marine ecology impacts associated with the installation of the Ultra Express Link, and should be read in conjunction with the water quality assessment in ***Annex A***.

C.2 Relevant Legislation and Assessment Criteria

C.2.1 The criteria for evaluating marine ecological impact are laid out in the *Technical Memorandum of the Environmental Impact Assessment Ordinance* (EIAO-TM):

- Annex 8 sets out the criteria for evaluating such potential ecological impacts.
- 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.

C.3 Description of the Marine Environment

C.3.1 As described in ***Section 3.3***, there are a number of ecologically sensitive areas with special planning designation located in the vicinity of the Ultra Express Link alignment:

- **Coastal Protection Area (CPA).** There is a CPA south of the Site, along the length of the coastline at Cape Collinson. The Ultra Express Link is approximately 555m from the CPA at the closest point and due to this distance the CPA will not be affected by the Project.
- **Marine Reserve.** The closest Marine Reserve is Cape D'Aguilar Marine Reserve. The Ultra Express Link alignment is approximately 6.4km from this Marine Reserve and due to this distance the Marine Reserve will not be affected by the Project.
- **Site of Special Scientific Interest (SSSI).** The closest SSSI is Shek O Headland SSSI. The Ultra Express Link alignment is approximately 4.6km from this SSSI and due to this distance the SSSI will not be affected by the Project.

C.3.2 In addition to the above, coral communities are expected to be present only in the hard stratum along the coastline – coral surveys undertaken for both the Asia Pacific Gateway ("APG Cable System") in 2013 and Tseung Kwan O Express – Cable System ("TKO Express Cable System) in 2015 showed corals were present at Cape Collinson area. However, HDD will avoid the coastline at SSW and the duct will emerge from the seabed in marine mud around 423m offshore.

C.4 Impact Assessment

C.4.1 The following impact assessment is based on a review of previous marine ecological assessments carried out for similar projects in the same area, in particular the *Tseung Kwan O Express – Cable System* and *APG Cable System*, which both land at TKOIE in the same BMH at the Ultra Express Link. For this location, reference to previous surveys is considered to be appropriate.

Intertidal Soft Bottom Assemblages

C.4.2 Based on the previous surveys conducted, a small area of sandy shore is located to the south of the BMH at TKO Industrial Estate; however, information regarding the ecology of this sandy shore 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 Hong Kong may appear devoid of intertidal life[Ref #1].

C.4.3 As concluded in the water quality assessment in ***Annex A***, with the recommended good site practices in place, no adverse water quality impacts are anticipated from the cable installation works. On this basis, no adverse impact to intertidal soft bottom assemblages from the installation of the Ultra Express Link is expected.

Intertidal Hard Bottom Assemblages

C.4.4 The Project Profile for *APG Cable System* references two intertidal surveys that have previously been conducted at the artificial seawall of the proposed landing site at TKOIE, as well as at the natural rocky shore of Fat Tong Chau near the landing site.

C.4.5 Findings from this intertidal survey undertaken in the wet season of 2008 indicated that the assemblage structure on the natural rocky shore at Fat Tong Chau and on the artificial seawall at TKOIE was considered to be typical of sheltered to semi-exposed rocky shores and artificial seawall in Hong Kong. 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 topshell *Monodonta labio*. These are all common species on natural rocky shores in Hong Kong.

C.4.6 In 2011, intertidal surveys were undertaken along the seawall of TKOIE for the *APG Cable System* using qualitative spot checks and the 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 within 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 in Hong Kong.

C.4.7 Overall, results from previous intertidal surveys have shown that the intertidal rocky shores and artificial seawall along the cable alignment, including the proposed cable landing point at TKOIE 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.

C.4.8 As concluded in the water quality assessment in ***Annex A***, with the recommended good site practices in place, no adverse water quality impacts are anticipated from the cable installation works. On this basis, no significant adverse impacts to intertidal hard bottom assemblages from the installation of Ultra Express Link are expected.

Subtidal Soft Bottom Assemblages

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

C.4.9 Information on the subtidal soft bottom assemblages in the vicinity of the Ultra Express Link alignment is available from the *Consultancy Study on Marine Benthic Communities in Hong Kong*[Ref #2]. A number of sampling stations used in that study are in the vicinity of the Ultra Express Link alignment and data extracted from them can be considered to be representative for this Project.

C.4.10 According to their findings, the substratum of the sampling stations is covered by medium/fine/very fine sand. Their benthic assemblages are typical of Hong Kong waters and similar to benthic assemblages in majority of other subtidal habitats in Hong Kong. Surveys carried out in both the summer and winter did not identify any species of conservation concern.

C.4.11 As concluded in the water quality assessment in ***Annex A***, with the recommended good site practices in place, no adverse water quality impacts are anticipated from the cable installation works. On this basis, no adverse impact to sub-tidal soft bottom assemblages from the installation of the Ultra Express Link is expected.

Subtidal Hard Bottom Assemblages

C.4.12 Several studies undertaken in the period of 2007 to 2013 provide relevant information on subtidal hard bottom habitats within the Study Area and were referenced in the Project Profile for the *APG Cable System*. The surveyed subtidal hard bottom habitats included those located at Fat Tong Chau and near to the TKOIE in the vicinity of the cable landing site. Overall, results of these surveys showed that generally very sparse colonies of locally common, widespread hard coral species are present in the vicinity of the TKOIE, and their abundance and diversity were considered to be very low in the context of subtidal coral assemblages in Hong Kong.

C.4.13 Supplementary dive surveys conducted in September and October 2012 and in February 2013 for the *APG Cable System* comprised qualitative spot dive surveys and semi-quantitative Rapid Ecological Assessment (REA) surveys at TKOIE and Fat Tong Chau (i.e. near the proposed cable landing point).

C.4.14 Results of these surveys showed that both hard coral and octocoral covers were below 5% with five hermatypic hard coral species, one ahermatypic hard coral species and two octocoral species being recorded. All hard coral colonies recorded were less than 10cm in diameter and octocoral colonies were about 10cm in height. All coral species recorded were considered as common and widespread in Hong Kong nearshore waters.

C.4.15 Overall, results of the supplementary dive surveys carried out previously showed that sparse hard coral colonies of locally common, widely distributed species were recorded in the vicinity of the Ultra Express Link landing point. The abundance and diversity of hard corals were considered to be very low in the context of subtidal hard bottom habitats in Hong Kong. Octocoral coverage and diversity were generally considered to be low.

C.4.16 An ecological survey has been carried out in 2015 at the subtidal area at SSW and survey findings were presented in the Project Profile for the *TKO Express Cable System.* Coral dive survey was conducted at seven sub tidal transects along the *TKO Express Cable System* alignment to record the physical (substrate types) and ecological (marine benthic organisms and corals) benthic components.

2. CityU Professional Services Limited (2002). *Consultancy Study on Marine Benthic Communities in Hong Kong*. Final Report for AFCD.

C.4.17 Substrate type along the transect was recorded at 1m intervals. The benthic cover, taxon abundance, and ecological attributes along the transect were recorded in a swathe of 2m wide, 1m either side of the transect. Locations of corals and associated substrates were recorded, size and health status (including percentage cover of bleaching, mortality and sedimentation) recorded.

C.4.18 All hard substrate including bedrock, boulders and rubbles were observed at shallow water (<8.0m depth). Sea bottom at greater depth was dominated by fine sand or mud, with sparse distribution of rubble and boulders.

C.4.19 Results of the survey found that there were a total of 123 octocoral colonies found along three of the seven transects, ranging in size from 2 to 45 cm in height. All octocoral colonies were generally healthy, with low percentage of sedimentation, bleaching or partial mortality. The species diversity of coral community was low (with only two species recorded), colonies were small to medium in size, and patchily distributed on rubble, boulders and sandy bottom. Only two species were observed, including *Echinomuricea* sp. (Family: Plexauridae) and *Dendronephthya* sp. (Family: Nephtheidae). No other sessile taxon of high conservation interest was recorded in the Study Area.

C.4.20 The HDD breakout location is located at 423m offshore with water depth of about 20m. With the similar alignment to the TKO Express – Cable System, the coral dive survey results undertaken for TKO Express in October 2015 has been referenced. Coral dive survey was conducted at seven transects (T1 to T7) of 50m long parallel to the coastline at TKO Express as shown in ***Figure C-1***. Patches of octocorals were observed from T1 to T4, of which the seabed was mainly composed of course sand and mud with boulders. However, from T5 onwards, these sites were all composed of mud and silt, no hard coral or octocorals were recorded at any of these transects at more than 250m offshore.

C.4.21 As confirmed by geophysical/dive survey conducted in January 2017, the HDD break out location lies in an area with dumped material composed of soft marine mud that was being dredged previously, which is considered to be very soft materials and not suitable for coral or octocoral growth. Our dive survey also confirmed that no coral was identified at the HDD break out location and along the cable alignment to be installed by direct burial. ***Figure C-1*** also shows the predicted boundary of the sediment plume of about 180m during cable laying process, where transects T5 to T7 lies with no coral identified.

C.4.22 Since the results of the previous coral dive survey and recent geophysical survey revealed that the seabed at the HDD breakout location and along the cable alignment are composed of mud and silt, no hard coral or octocoral were present, as such no coral impact is expected to occur from the Ultra Express Link installation.

C.4.23 As concluded in the water quality assessment in ***Annex A***, with the recommended good site practices in place, no adverse water quality impacts are anticipated from the cable installation works. On this basis, no adverse impact to sub-tidal hard bottom assemblages from the installation of Ultra Express Link is expected, either in the vicinity of the HDD breakout location or at the TKOIE landing point.

Marine Mammals

C.4.24 Literature reviews indicated that the Indo-Pacific Hump-backed Dolphin (*Sousa chinensis*) and the Finless Porpoise (*Neophocaena phocaenoides*) are the two species of marine mammals regularly sighted in Hong Kong waters.

C.4.25 The population of Indo-pacific Humpbacked Dolphins 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[Ref #3]. Southeast Lantau is considered to be the marginal habitat for the Indo-pacific Humpbacked Dolphins[Ref #4]. Victoria Harbour is not considered to represent an important habitat for the Indo-pacific Humpbacked Dolphin.

C.4.26 The Finless Porpoise is the most common and important species of cetacean in the southern waters of Hong Kong. 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[Ref #5]. 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. Victoria Harbour is not considered to represent an important habitat for Finless Porpoise.

C.4.27 Overall, Victoria Harbour is not considered to represent an important habitat for the Indo-pacific Humpbacked Dolphin or the Finless Porpoise and disturbance to these marine mammal species is not expected.

C.5 Good Site Practices During Cable Installation

C.5.1 In accordance with the guidelines in the EIAO-TM on marine ecology impact assessment, the general policy for mitigating impacts to marine ecological resources, in order of priority, are:

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

C.5.2 Based on the above, good site practices are discussed below.

Avoidance of Impacts

C.5.3 Impacts to marine ecological resources have 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 existing cables and the Marine Vessel Traffic Separation Zone in Tathong Channel amongst

3. Hung SK (2013) *Monitoring of Marine Mammals in Hong Kong Waters: Final Report (2012-13)*. An unpublished report submitted to AFCD (cited in the Project Profile for the APG Cable System).
4. Jefferson TA (1998). *Population Biology of the Indo-Pacific Hump-backed Dolphin (Sousa chinensis, Osbeck 1765) in Hong Kong Waters*. Final Report. For AFCD (cited in the Project Profile for the APG Cable System).
5. 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 (cited in the Project Profile for the APG Cable System).

other constraints, the Ultra Express Link alignment has been carefully considered (see ***Section 1.5***). The proposed cable alignment is located at the furthest distance from the known coral communities as practicable, i.e. shore of SSW and south of Cape Collinson.

Minimisation of Impacts

C.5.4 Good site practices have been recommended to minimise impacts to water quality are also expected to control impacts to marine ecological resources. These are as stated in ***Section A.5 of Annex A***:

- The crane barge used for the transport of any 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 to the disposal site.
- The crane barge shall be filled to a level which ensures that material does not spill over during loading and transport and that adequate freeboard is maintained to ensure that the decks are not washed by wave action.
- The speed of the installation barge will be limited to a maximum of 1km hour^{-1}.

Compensation

C.5.5 Based on the above good site practices, no compensation will be required as no unacceptable residual impacts to marine ecological resources are predicted to occur.

C.6 Conclusion

C.6.1 The review of the existing information on the marine ecological resources in the vicinity of the cable landing point at TKOIE and the cable alignment across Victoria Harbour have identified the area to be of generally low ecological value.

C.6.2 Although soft bottom assemblages will be disturbed during the cable laying works, the habitat will be reinstated by similar communities within a short period of time and thus the impacts are considered acceptable.

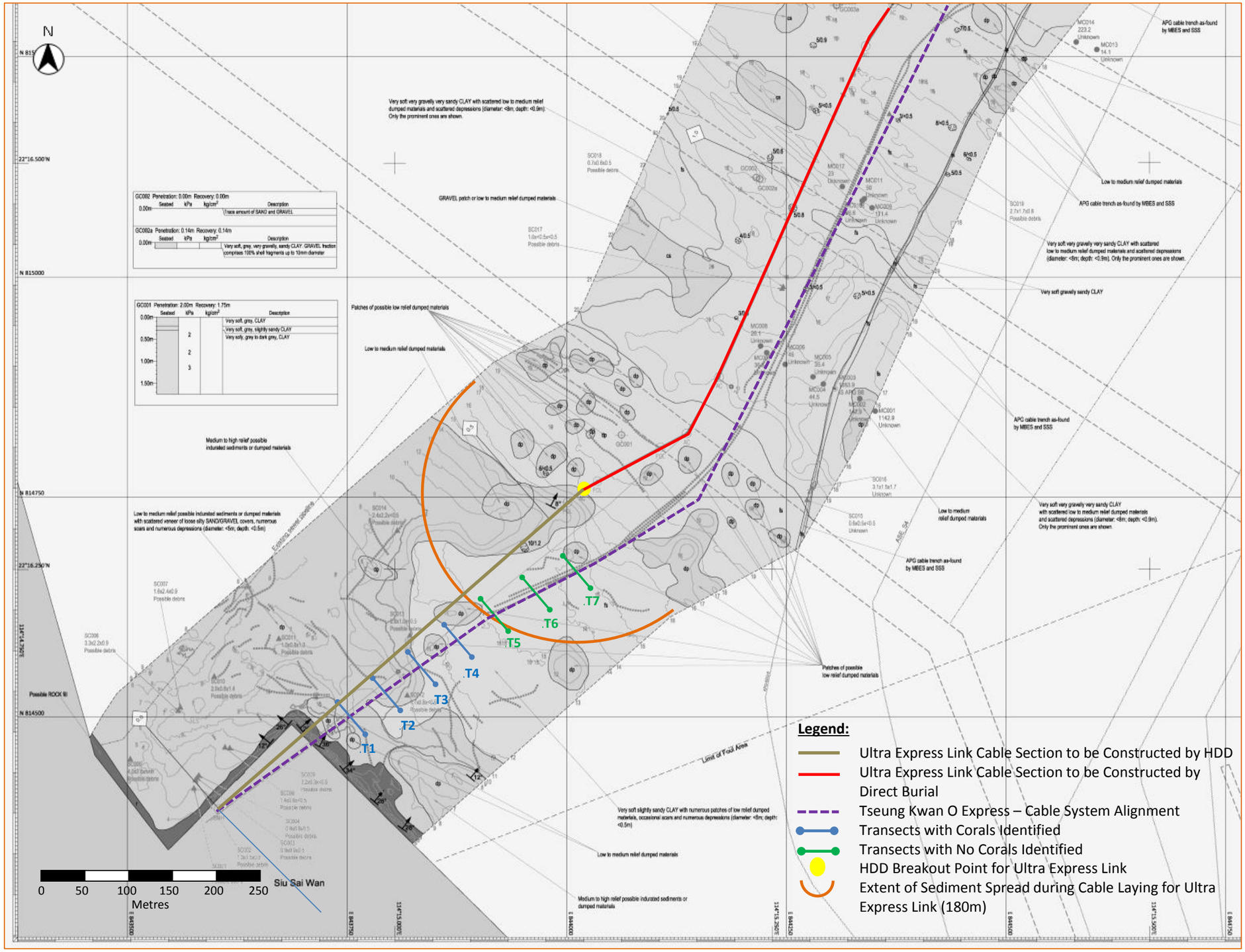
C.6.3 The rocky shores in the vicinity of the cable landing point off Fat Tong Chau support low abundance and diversity of intertidal organisms. Most of these species are common and widespread on the similar shores in Hong Kong and as such, are considered to be of low ecological value. Impacts to these assemblages are, therefore, not regarded as significant.

C.6.4 Victoria Harbour is not considered to represent an important habitat for the Indo-pacific Humpbacked Dolphin or the Finless Porpoise and so disturbance to these marine mammal species is not expected.

C.6.5 Impacts to marine ecological resources have largely been avoided during cable laying through the selection of a landing site, undertaking HDD at SSW for the cable duct installation, selecting a 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. Due to the small scale of the works, the short duration of impacts and the limited dispersion of sediment plume, adverse impacts to marine ecology are not expected to be significant and will be minimised during the cable installation.

C.6.6 Good site practices that have been recommended to minimise impacts to water quality are also expected to control any impacts to marine ecological resources.

Figure C-1 Seabed Feature of Ultra Express Link



ANNEX D

Fisheries Assessment

CONTENTS

D FISHERIES ASSESSMENT D-1

D.1 Introduction D-1
D.2 Relevant Legislation D-1
D.3 Existing Situation D-2
D.4 Impact Assessment D-3
D.5 Cumulative Impact D-5
D.6 Mitigation Measures D-5
D.7 Residual Impact D-5
D.8 Conclusion D-5

FIGURES

Figure D-1 Distribution of Fishing Operations in Hong Kong Waters
Figure D-2 Distribution of Fishing Operations (Vessel not Exceeding 15m in length)
Figure D-3 Distribution of Fisheries Production (Adult Fish)
Figure D-4 Distribution of Fisheries Production (Fish Fry)
Figure D-5 Fisheries Sensitive Receivers

D FISHERIES ASSESSMENT

D.1 Introduction

D.1.1 This Annex provides an assessment of impacts to the existing fisheries resources and fishing operations within and adjacent to the proposed Ultra Express Link and evaluates the potential impacts to these resources.

D.1.2 The cable will traverse the marine vessel traffic separation scheme, where fishing is generally discouraged and fishing activities either side of the cable are limited to recreational shore-based line fishing. Trawling (including pair, stern, shrimp and hang trawling) is banned in Hong Kong waters. There is no actual dredging required for the installation of Ultra Express Link and no temporary marine works will be required at TKOIE nor near the SSW shore. Temporary berthing of the cable laying barge will be required along the cable alignment if offshore cable installation cannot be completed within 1 day.

D.1.3 In Hong Kong, the marine fishing industry refers to “Capture Fisheries”. Information and data can be obtained from the Agriculture, Fisheries and Conservation Department (AFCD) to assess the potential impacts on fishing grounds that occur along proposed cable alignment.

D.1.4 Baseline information has been obtained from the AFCD website and from recent and relevant studies in the vicinity of Ultra Express Link to determine whether the waters surrounding Ultra Express Link are important spawning grounds or nursery areas for commercial fisheries. Mariculture information was obtained from the latest *AFCD Report 2015-2016*.

D.1.5 There are no gazetted Fish Culture Zones (FCZs) within 500m of the cable alignment – the nearest is Tung Long Chau FCZ, located more than 3.6km from the cable and this FCZ is too far away to be affected by cable installation works. The alignment does not pass through any nursery grounds or spawning grounds.

D.1.6 The northern part of the Ultra Express Link lies within the Junk Bay Water Control Zone (WCZ) and the southern part lies within Eastern Buffer WCZ. Special attention has been given to the fishing activities along the alignment.

D.2 Relevant Legislation

D.2.1 The *Technical Memorandum of the Environmental Impact Assessment Ordinance* (EIAO-TM) of Annex 17 and Annex 9 highlight the relevant guideline and evaluate impacts to fisheries. Other regulations also apply to fisheries resources, namely:

- Fisheries Protection Ordinance (Cap 171).
- Marine Fish Culture Ordinance (Cap 353).
- Water Pollution Control Ordinance (Cap 358).
- Marine Parks Ordinance (Cap 476).
- Environmental Impact Assessment Ordinance (Cap 499).

D.2.2 These regulations and guidelines are applicable in assessing fish impacts and regulate fishing practices.

D.3 Existing Situation

Fishing Background

D.3.1 Commercial fishing provides an important contribution to Hong Kong in maintaining a steady supply of fresh marine fish to local consumers. In 2015, Hong Kong fishermen provided an estimated 145,193 tonnes of fisheries produce valued at about HKD 2,338M. According to the AFCD website, the industry now consists of some 5,050 fishing vessels and some 10,500 local fishermen working aboard and provides employment in ancillary sectors servicing the fishing industry.

D.3.2 The combined production of capture fisheries and culture fisheries accounted for about 28% of all seafood consumed in Hong Kong (*AFCD Report 2015-2016*).

D.3.3 The latest comprehensive survey of fisheries was undertaken as part of the Port Survey 2006, which provided a grid analysis of fishing operations covering Hong Kong waters, with each grid cell representing 720ha. The study compiled information on fisheries production and fishing operations in Hong Kong and has been useful in setting out fisheries management strategies and assessing potential environmental impacts of marine development projects on fisheries.

D.3.4 The following assessment has been based on the Port Survey 2006, other relevant and more recent studies, and from a review of information from AFCD's Annual Reports.

Capture Fisheries

D.3.5 Capture fishing activities for Hong Kong are mainly conducted in the waters adjacent to the continental shelf in the South China Sea. The majority of fishing vessels are family-operated businesses with the main fishing methods being trawling, long-lining, gill-netting and purse-seining, with the majority of the total catch obtained through trawling.

D.3.6 Around 100 to 400 fishing vessels, mostly sampans, operate in waters within the Ultra Express Link, as shown in ***Figure D-1***. The distribution of Fishing Operations (vessel not exceeding 15m in length) in Hong Kong Waters is shown in ***Figure D-2***.

D.3.7 Fisheries production rates in the waters to be crossed by the Ultra Express Link are between 100 to 200 kg/ha, as shown in ***Figure D-3***.

D.3.8 Similar figures to the above were adopted in fisheries resource studies in the same area carried out in the Project Profile for the *TKO Express Cable System*, prepared in December 2015, which is the most recent study available.

Spawning and Nursery Areas

D.3.9 The Ultra Express Link is located outside the AFCD recorded fish fry production area, as shown in ***Figure D-4***, and the area where the Cable will be buried is not considered to be an important nursery area for commercial fish species.

D.3.10 The shortest navigation distances between the spawning grounds in Southeastern Waters from the cable is 2.1km; the shortest navigation distances between the proposed fisheries

protection area in Outer Port Shelter from the cable is 4.7km; and shortest navigation distances between the nursery grounds are from the cable is 4.9km. Due to these long distances, these fisheries sensitive receivers will not be affected by the Project.

Culture Fisheries

D.3.11 Mariculture involves rearing marine fish in cages suspended from floating rafts in sheltered coastal areas. According to AFCD's Annual Report 2015-2016 [Ref #1], there were 969 licensed operators in the 26 FCZs designated under the Marine Fish Culture Ordinance. These occupied a sea area of 209ha with an estimated production in 2015 of 1,219 tonnes, or about 5% of all locally consumed live marine fish.

D.3.12 The shortest navigation distance between the closest FCZ at Tung Lung Chau from the cable alignment is more than 3.6km (shown in ***Figure D-5***). Given this distance, no impact from cable installation works is expected at the Tung Lung Chau FCZ.

D.4 Impact Assessment

Cable Installation Impacts

D.4.1 The Ultra Express Link will be installed by a cable burial machine using simultaneous cable installation and burial technique to a maximum depth of 5m within the seabed and the seabed will be reinstated naturally by resettlement of disturbed sediments immediately upon cable installation. Re-colonisation of the sediments by benthic infauna and zooplankton within sediment column is expected to occur quickly, thereby providing food for bottom dwelling fisheries resources.

D.4.2 Minor interruptions to any fishing operations in Tathong Channel may occur during cable installation where the cable laying barge occupies space at the sea surface (approximately 125m x 200m) but the barge will only be in use for 1 to 2 days. During cable laying operation, the cable laying barge will have no more impact on fishing operations than any other vessel traversing the waters of Hong Kong. Temporary berthing of the cable laying barge will be required along the cable alignment at Tathong Channel if offshore cable installation cannot be completed within 1 day. The temporary loss of fishing grounds will follow from similar projects such as the *TKO Express Cable System*, *APG* and *ASE* Project Profiles for submarine cable systems.

D.4.3 These disruptions would be minimal as the time required for cable laying is relatively short as only 2.21km of cable needs to be buried through this method:

- Offshore cable installation: 1 to 2 days
- Cable protection work: 2 to 4 days
- Shore end works at TKOIE: 1 to 2 weeks
- HDD Exit at Seabed 1 to 2 days

D.4.4 No long-term direct impacts to fisheries resources or fishing operations are expected to occur that would affect either fisheries resources or fishing operations.

1. AFCD Annual Report 2015-2016: http://www.afcd.gov.hk/misc/download/annualreport2016/en/fisheries.html

D.4.5 Indirect impacts may occur through elevation in suspended solids and disturbance of zooplankton within sediment column resulting from the localised disturbance of the seabed through the burial of the cable and placement of concrete mattress as protective measures. However, these disturbances will be localised and of short duration. As determined in ***Annex A***, the maximum predicted extent of suspended solids is expected to be 180m from the cable alignment and would settle back onto the seabed within 3.5 minutes based on worst case assumptions.

D.4.6 The cable installation work at SSW and TKOIE shore ends are not expected to result in unacceptable impacts to water quality. As such, the shore-end works are not expected to result in any significant impacts to fisheries at these locations.

Fisheries Impact Evaluation

D.4.7 An evaluation of the impact to fisheries is presented in ***Table D-1*** in accordance with EIAO-TM Annex 9.

Table D-1 Evaluation of Fisheries Impact

Aspect	Evaluation of Impact
Nature of Impact	The Cable will be installed over a 2.76km distance from SSW to TKOIE across the Tathong Channel, of which about 2.21km will be directly laid and buried below the seabed using a cable burial machine, and only localized disturbances to the seabed will result. As a result of the small scale and relatively localised disturbances to the seabed, no adverse impacts to fisheries resources and subsequent fishing operations are predicted to occur during the cable laying process.
Size of Affected Area	The total length of the cable in Hong Kong waters is approximately 2.76km. In view of the small area occupied by the cable laying barge and the short duration required for cable installation, potential impacts on vessel transit and fishing activities along the cable alignment are not anticipated.
Loss of Fisheries Resources and Production	Fisheries production in the affected area is 100 to 200kg/ha in terms of catch weight of adult fish. Within this affected area, only about 2.21km of cable will be buried. Due to the small area occupied by the cable laying barge and short duration required for the cable installation, no adverse impacts on fishing vessel transit and fishing activities along the cable alignment will be anticipated not.
Destruction and Disturbance of Spawning and Nursery Grounds	The cable does not pass through any Spawning Grounds or Nursery Grounds.
Impact on Fishing Activities	The proposed cable alignment passes through fisheries operation areas, which have been recorded as having mostly moderate numbers of fishing vessels (100 to 400 vessels/ha) and are mostly fished by vessels less than 15m in length. The cable laying works are of short duration, the disturbance on seabed is localised and the seabed is expected to quickly recover, immediately upon installation. As such, impacts to fishing activities are not expected to occur.
Impact on Aquaculture Activity	The shortest navigation distance between the closest FCZ at Tung Lung Chau from the cable alignment is more than 3.6km, and at this distance, will not be affected by the cable burial works.

D.5 Cumulative Impact

D.5.1 While there are five planned projects near Ultra Express Link, as stated in ***Section 2.3***, four of them are not expected to be in construction at the same time as the installation of the Ultra Express Link, with the exception of Tseung Kwan O – Lam Tin Tunnel and Associated Works. Since marine works for Ultra Express Link, including cable installation and cable protection works, will only take about 5 days to complete, cumulative fishery impact during construction phase shall be minimal.

D.6 Mitigation Measures

D.6.1 As no adverse impacts to fisheries resources are expected to occur, no mitigation measures specific to fisheries are required.

D.7 Residual Impact

D.7.1 The residual impacts to fisheries resources, habitats and fishing operations during construction phase are considered to be within acceptable level and no specific fisheries monitoring programme is found to be necessary.

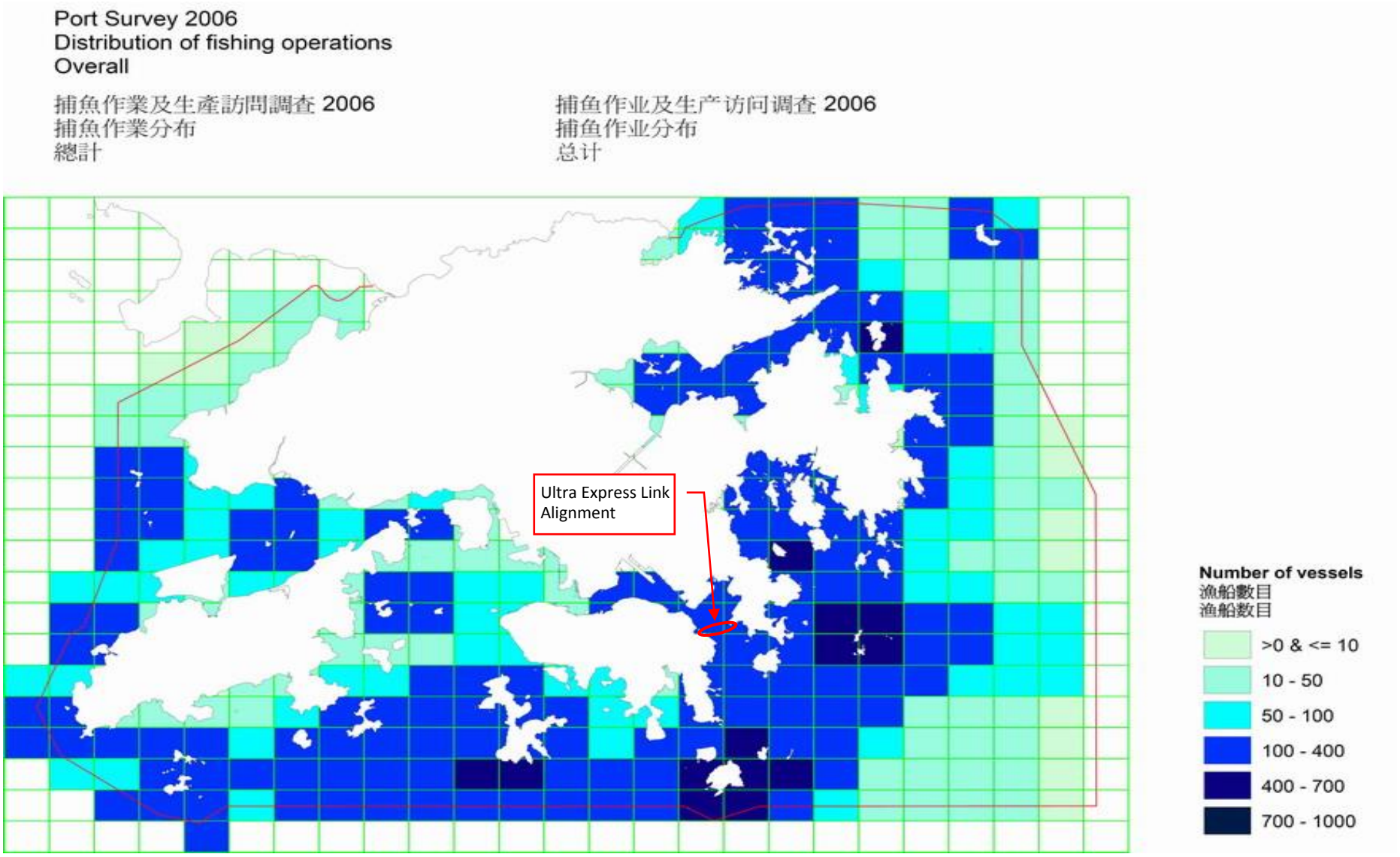
D.8 Conclusion

D.8.1 A review of existing information on the fisheries resources and fishing operations along the alignment of the Ultra Express Link has found the majority of the area supports fisheries resources with a low to medium ranking in terms of fisheries production. There are no identified nursery or spawning grounds located along the cable alignment and the shortest navigation distance between the closest FCZ at Tung Lung Chau from the cable alignment is more than 3.6km.

D.8.2 Given the status of the area in terms of fisheries production, the distance from mariculture activities, the relatively short duration of marine works and small sediment plume (within 180m from the cable alignment, settling with 3.5 minutes) adverse impacts are not expected to arise from the cable laying works. Overall, no unacceptable impacts are predicted to occur to fisheries resources or fishing operations as a result of this Project.

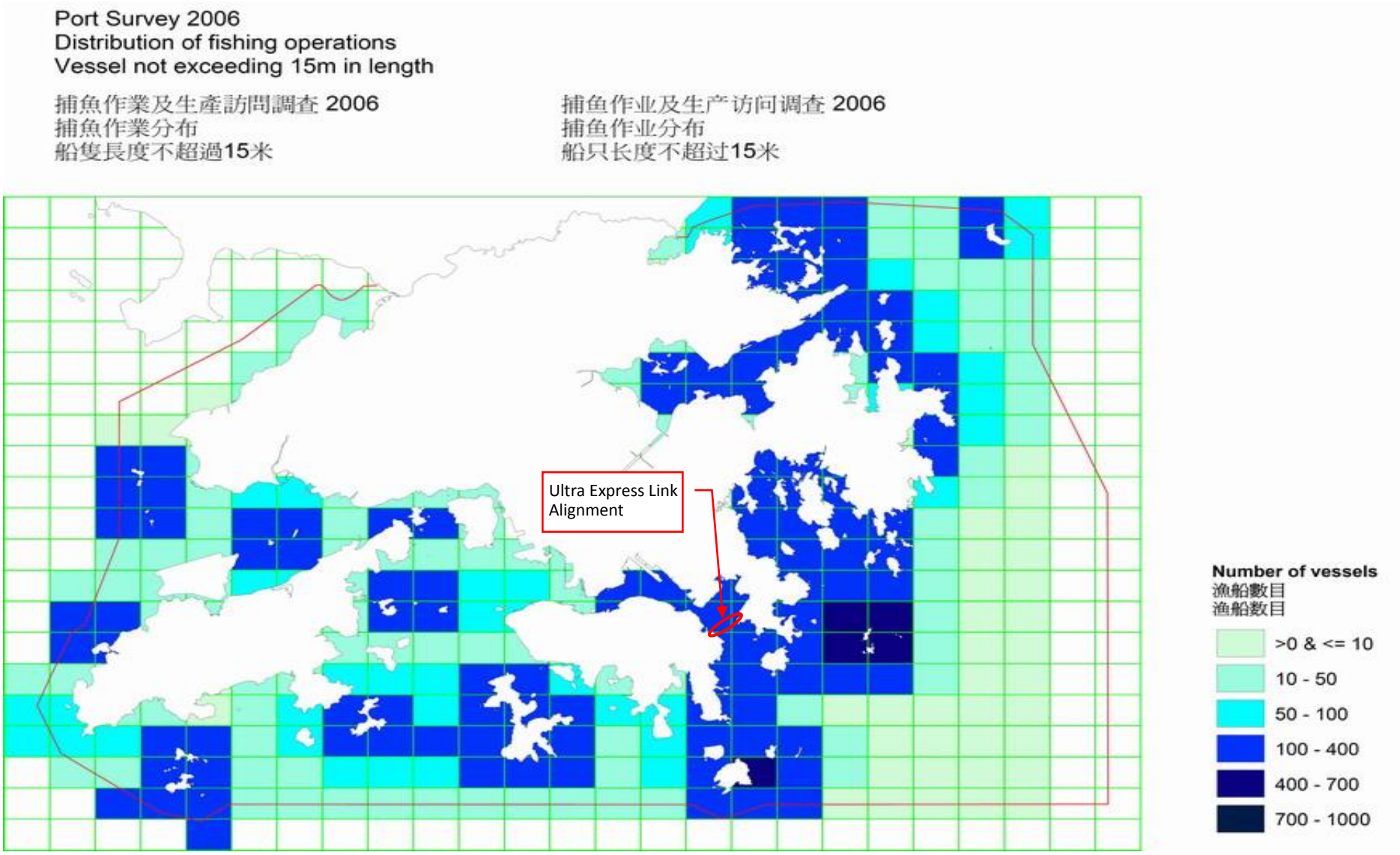
D.8.3 Overall, it is concluded that the installation of the Ultra Express Link will comply fully with Annex 9 of the EIAO-TM.

Figure D-1 Distribution of Fishing Operations in Hong Kong Waters



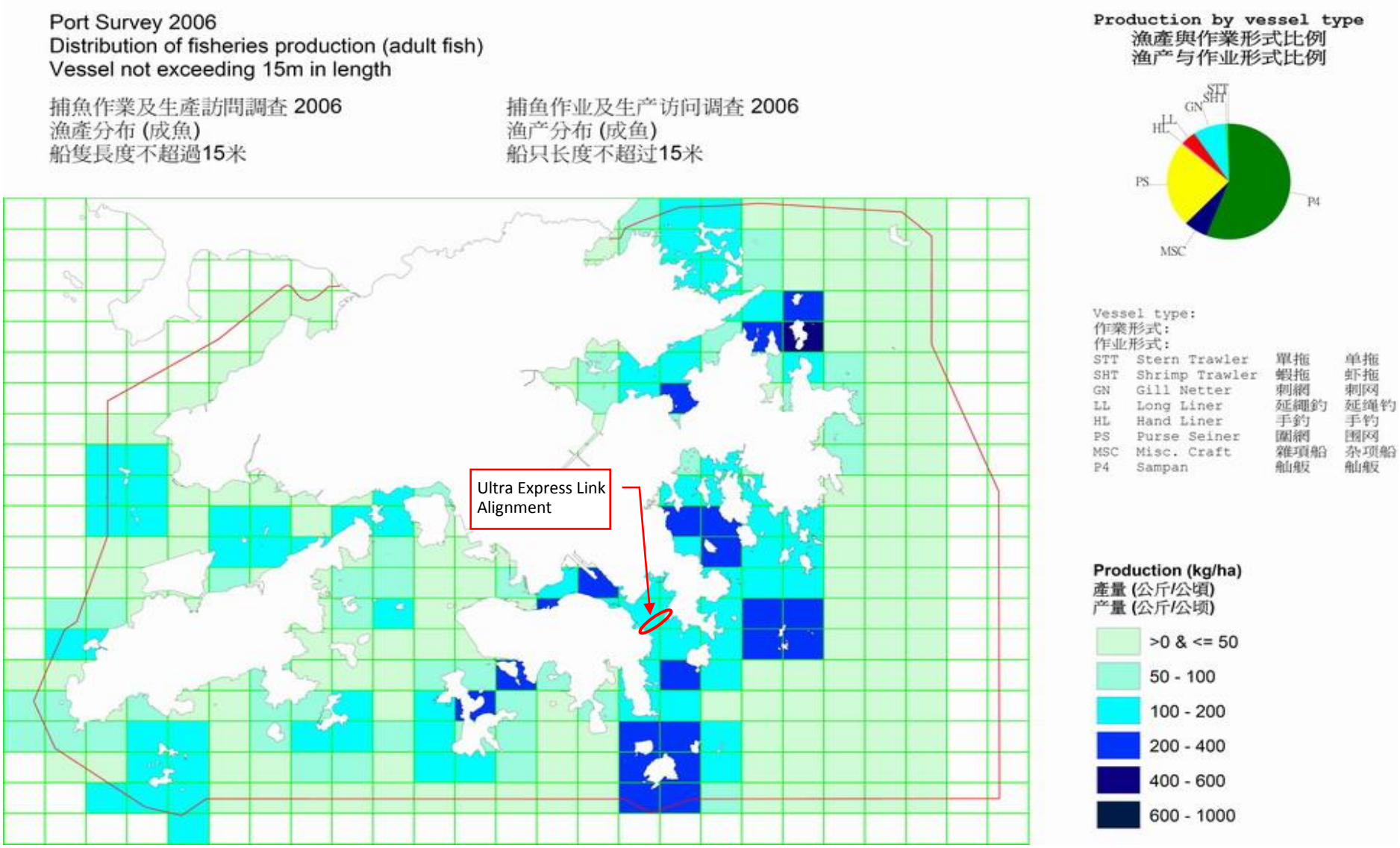
Source: Port Survey 2006, AFCD.

Figure D-2 Distribution of Fishing Operations (Vessel not Exceeding 15m in length)



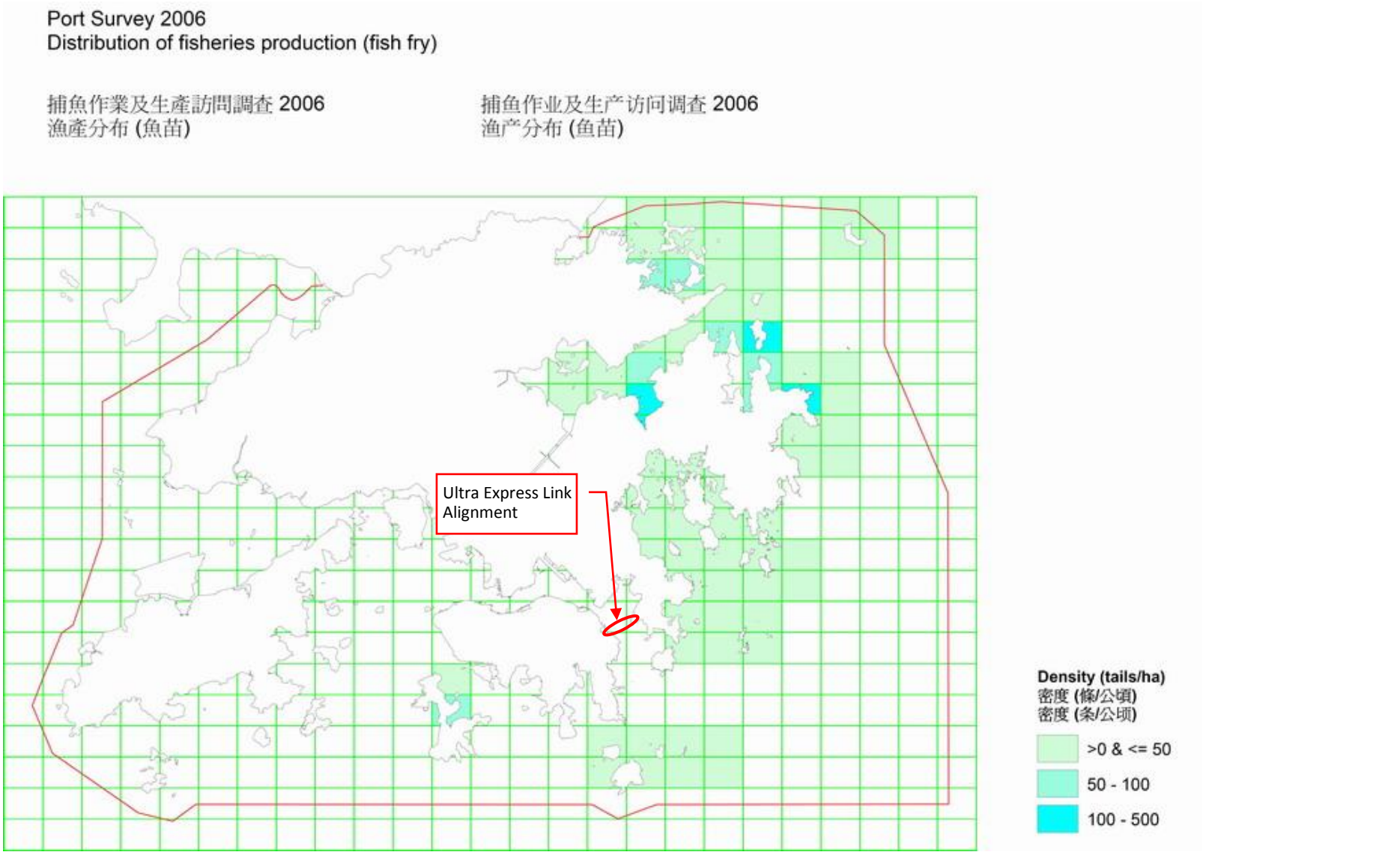
Source: Port Survey 2006, AFCD.

Figure D-3 Distribution of Fisheries Production (Adult Fish)



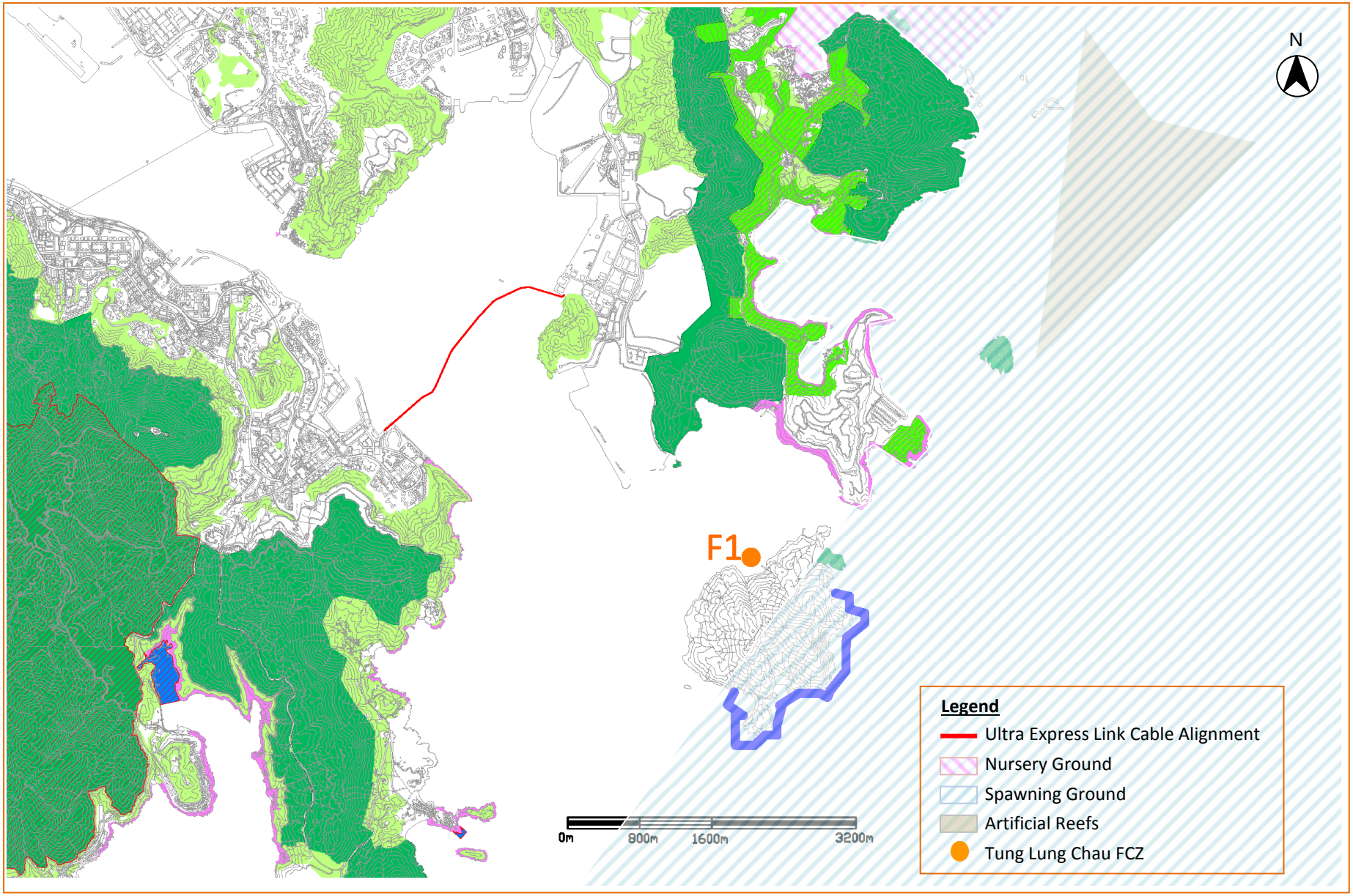
Source: Port Survey 2006, AFCD.

Figure D-4 Distribution of Fisheries Production (Fish Fry)



Source: Port Survey 2006, AFCD.

Figure D-5 Fisheries Sensitive Receivers



ANNEX E

Noise Assessment

CONTENTS

E NOISE ASSESSMENT E-1

E.1 Introduction E-1
E.2 Relevant Legislation E-1
E.3 Description of the Environment E-2
E.4 Impact Assessment E-2
E.5 Evaluation of Impact E-3
E.6 Good Site Practices E-4
E.7 Conclusion E-4

TABLES

Table E-1 Noise Standards for Daytime Construction Activities (EIAO-TM)
Table E-2 Tentative Construction Stages with Estimation Duration
Table E-3 Locations of NSRs
Table E-4 Summary of Predicted Noise Level at NSR N5
Table E-5 Detailed Construction Noise Impact Assessment at NSR N5

FIGURES

Figure E-1 Location of SSW Site and NSRs

E NOISE ASSESSMENT

E.1 Introduction

E.1.1 The following provides an assessment of potential noise impacts associated with the installation of Ultra Express Link.

E.1.2 The cable installation will involve shore installation at SSW, which involves construction of a cable connection pit (manhole), construction of a cable duct using HDD and its associated works. All of which will employ Powered Mechanical Equipment (PME) that may generate noise impacts on the surrounding area.

E.1.3 Offshore cable installation and shore installation at TKOIE are not expected to generate significant noise impacts as the sites are distant from Noise Sensitive Receivers (NSRs) and no construction is required at TKOIE (the Beach Manhole is already constructed).

E.1.4 This assessment therefore focuses on the SSW Site, where a manhole will be constructed and from where the HDD will be launched. Information on the required PME during the construction phase, the potential noise impacts and recommended good site practices will be detailed in the following sections.

E.2 Relevant Legislation

E.2.1 The *Noise Control Ordinance* (NCO) is the main legislation controlling noise. Because this Project is classified as a Designated Project (DP), the *Environmental Impact Assessment Ordinance* (EIAO) is also applicable to activities of the Project generating noise.

E.2.2 Noise impact arising from construction works excluding percussive piling during non-restricted hours (i.e. 07:00 to 19:00 on any day not being a Sunday or a general holiday) is not governed under the NCO. However, as this Project is classified as a DP, the *Technical Memorandum of the EIAO* (EIAO-TM) Annex 5 and Annex 13 is therefore referred.

E.2.3 Percussive piling will not be required and so a Construction Noise Permit (CNP) for percussive piling to be issued under NCO is not required. There is no expectation that construction activities will need to be carried out during restricted hours (i.e. 19:00 to 07:00 on any day, or any time on a Sunday or public holiday). However, should this be needed, then a CNP will have to be applied for in accordance with the following:

- Technical Memorandum on Noise from Construction Work other than Percussive Piling (GW-TM).
- Technical Memorandum on Noise from Construction Work in Designated Areas (DA-TM) – the Site is wholly within the Designated Areas shown on Plan No. EPD/AN/HKI-01 issued under the Noise Control (Construction Work Designated Areas) (Amendment) Notice 2008.

E.2.4 For assessing the noise arising from the construction activities during non-restricted hours, the following technical memoranda describe the methodology for noise impact assessment:

- EIAO-TM Annex 5 and Annex 13.
- GW-TM.

E.2.5 The applicable noise standard for daytime construction activities is found in Table 1B, Annex 5 of the EIAO-TM, which indicates the maximum permissible noise level assessed at one (1) metre from the external façade, as shown in ***Table E-1***.

Table E-1 Noise Standards for Daytime Construction Activities (EIAO-TM)

Uses	Noise Standards (Leq (30 mins)) (db(A))	Remarks
Domestic Uses (including hotels and hostels)	75	0700-1900 hours on any day not being a Sunday or general holiday
Education Institutions (general/exam)	70/65	

E.3 Description of the Environment

E.3.1 The existing noise climate surrounding the SSW Site is predominantly urban, with traffic noise from vehicles traversing through the industrial buildings, godowns and the Island East Refuse Transfer Station to the west of the Site, and public buses serving residential developments to the east.

E.3.2 There are two residential developments within 300m radius of the Site, namely Harmony Garden (Blocks 1-3) and Island Resort (Blocks 1, 2 and 9), both of which are considered to be NSRs under the EIAO-TM.

E.3.3 The locations of NSRs are shown in ***Figure E-1***.

E.4 Impact Assessment

Potential Sources of Impact

E.4.1 The major sources of noise associated with the cable installation works are expected to occur during site set up (including excavation of the manhole), during HDD and manhole construction (including drilling and recirculation/treatment of drilling fluid), and during demobilisation. During these construction stages, PME such as excavators, breakers, mobile cranes, trucks, mixing plants will be in operation concurrently. ***Table E-2*** is a summary of the draft construction programme, with estimated duration for each activity at SSW.

Table E-2 Tentative Construction Stages with Estimated Duration

Construction Activity	Estimated Duration
Site Formation	2 weeks
HDD, Manhole Construction, Cable Laying	5 weeks
Site Demobilization and Reinstatement	2 weeks

Assessment Methodology

E.4.2 The assessment of noise arising from cable installation activities – predominantly HDD – has been carried out according to the methodology outlined in *GW-TM*, as follows:

- Locate the NSRs that may be affected by the Project.

- Locate and list the PME to be used for the Project and identify the Notional Source Positions (NSP) for the Site.
- Aggregate the sound power levels of PME based on *GW-TM* or other PME lists.
- Calculate the correction factor based on the distance between the NSP and the NSR, apply corrections for façade reflection and acoustic barriers.
- Predict construction noise level at the NSRs and compare against the daytime noise criterion for construction activities according to the *EIAO-TM Annex 5*.

Noise Sensitive Receivers (NSRs)

E.4.3 There are six residential apartments within 300m of the Site that are considered as NSRs under the *EIAO-TM*.

E.4.4 Openable windows for ventilation at the residential apartments shall be identified as NSRs. The NSRs identified within 300m of the SSW Site are listed below in ***Table E-3*** and locations are shown on ***Figure E-1***.

Table E-3 Locations of NSRs

NSR ID	Description	Distance from NSP (m)
N1	Island Resort Block 9	298
N2	Island Resort Block 1	265
N3	Island Resort Block 2	261
N4	Harmony Garden Block 3	271
N5	Harmony Garden Block 2	238
N6	Harmony Garden Block 1	250

E.4.5 To facilitate the assessment, NSR N5 is selected as the Representative NSR as it is the closest NSR to the NSP.

E.5 Evaluation of Impact

E.5.1 For the detailed noise assessment provided in ***Table E-5***, the plant inventory and on time has been provided and confirmed by the Project Engineer to be reasonable and practicable. Justifications for the sound power levels adopted for equipment not listed in GW-TM is provided in the notes under each table.

Representative NSRs Under EIAO-TM

E.5.2 The predicted noise levels at N5 are summarized in ***Table E-4***. The noise levels from concurrently operating PME is summed for each construction stage, taking into account of distance, plant uptime, potential screening effects and façade correction. A detailed assessment is shown in ***Table E-5***.

Table E-4 Summary of Predicted Noise Level at Representative NSR N5

Construction Activity	Assessment Criteria, dB(A)	PNL, dB(A)
Site Preparation	75	64
HDD & Manhole Construction	75	69

Construction Activity	Assessment Criteria, dB(A)	PNL, dB(A)
Site Demobilisation	75	66

E.5.3 The noise levels predicted at this NSR during each construction stage are well within the limits as stipulated in the *EIAO-TM Annex 5*.

E.5.4 Overall, potential noise impacts at the NSRs are in compliance with the noise assessment criteria specified in Annex 13 of the EIAO-TM and therefore adverse noise impacts resulting from the construction activities at the SSW Site are unlikely to occur.

E.6 Good Site Practices

E.6.1 In order to reduce noise levels during construction stages, the following good site practices are recommended and should be implemented as far as practicable:

- The HDD drilling rig should be provided with sound blankets and/or acoustic enclosures during the HDD works and properly maintained throughout.
- Quiet PME should be employed in lieu of standard PME.
- Employ only well-maintained plant equipment on-site and ensure regular upkeep and service over the course of the construction period.
- Plant with a directional noise emission profiled should be orientated such that noise emits away from NSRs.
- Machines and trucks with intermittent uptime should be shut down when idling.
- Movable acoustic barriers should be employed as required and positioned within a few meters away from the PMEs.

E.6.2 Since there will be potentially noisy works carried out at the SSW site, the Project Proponent proposes to engage an independent Environmental Team (ET) to carry out regular weekly noise monitoring during the Project works at SSW.

E.6.3 A programme for noise monitoring shall be submitted to EPD for their review and approval prior to construction and *Impact Noise Monitoring Reports* shall be submitted to EPD each month for their review and approval.

E.7 Conclusion

E.7.1 A construction noise assessment has carried out to evaluate the potential noise impacts arising from the construction works at the SSW Site on nearby NSRs.

E.7.2 The results of the assessment have demonstrated the predicted noise levels will not exceed the construction noise criteria as per *Annex 5 of EIAO-TM* at representative NSRs.

E.7.3 Nonetheless, the Contractor is advised to implement recommended good site practices to further minimise potential noise impacts. These measures include using quiet PME, ensuring the plant are well maintained and in good condition, strategic placement of noisy PME away from NSRs and installing noise-reducing barriers around the Site.

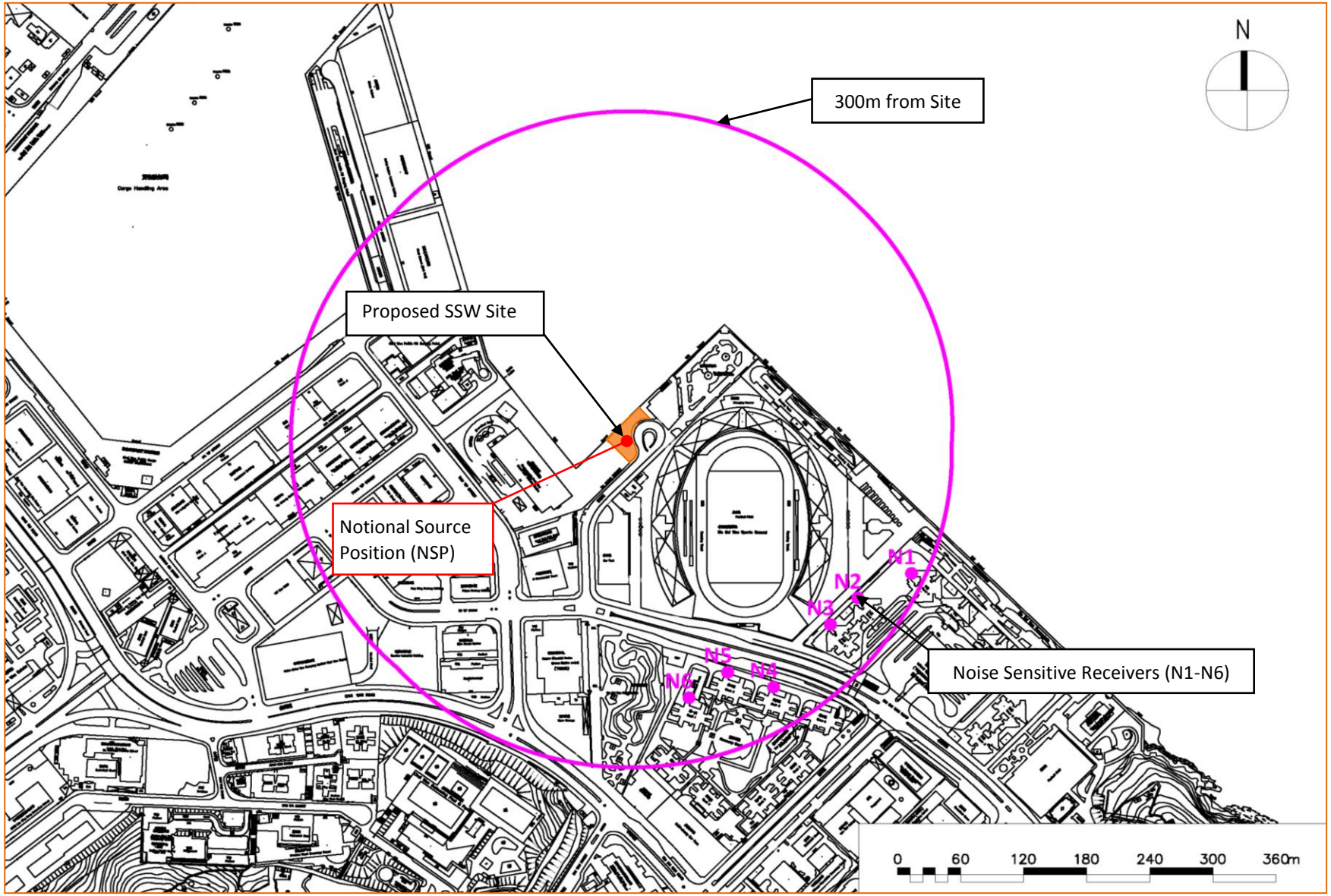
E.7.4 Given that the above measures are properly implemented, adverse noise impacts resulting from the construction activities at the SSW Site are unlikely to occur.

Table E-5 Detailed Construction Noise Impact Assessment at NSR N5

Construction Noise Impact Assessment at Residential Building N5 (NSR)												
PME	ID code	SWL, dB(A)	No. of PME	Total SWL, dB(A)	Hor. dist, m	Operation time in any 30 min, min	% of time	Dist correction, dB(A)	% on time correction, dB(A)	Screening, dB(A)	Façade correction, dB(A)	PNL, dB(A)
Stage 1 - Site Set Up												
Excavator	CNP 081	112	2	115	238.0	30.0	100.0%	-55.5	0.0	0.0	3.0	62.5
Dump truck , 5.5 tonne < gross vehicle weight ≦ 38 tonne	Other PME	105	2	108	238.0	15.0	50.0%	-55.5	-3.0	0.0	3.0	52.5
Generator, silenced, 75 dB(A) at 7 m	CNP 102	100	2	103	238.0	30.0	100.0%	-55.5	0.0	0.0	3.0	50.5
Lorry, with crane/grab, 5.5 t < gross vehicle weight ≦ 38 t	Other PME	105	2	108	238.0	15.0	50.0%	-55.5	-3.0	0.0	3.0	52.5
Air compressor, air flow > 10m3/min and <= 30m3/min	CNP 002	102	2	105	238.0	30.0	100.0%	-55.5	0.0	0.0	3.0	52.5
											Total	**63.9**
Stage 2 - HDD & Manhole Construction												
HDD (Note1)	CNP 167	114	1	114	238.0	30.0	100.0%	-55.5	0.0	0.0	3.0	61.5
Mud pump (Note2)	Other PME	105	4	111	238.0	30.0	100.0%	-55.5	0.0	0.0	3.0	58.5
Mud mixer (Note3)	Other PME	90	1	90	238.0	30.0	100.0%	-55.5	0.0	0.0	3.0	37.5
Water pump (electric)	CNP 281	88	10	98	238.0	30.0	100.0%	-55.5	0.0	0.0	3.0	45.5
Bentonite filtering plant	CNP 162	105	1	105	238.0	30.0	100.0%	-55.5	0.0	0.0	3.0	52.5
Generator, silenced, 75 dB(A) at 7 m	CNP 102	100	2	103	238.0	30.0	100.0%	-55.5	0.0	0.0	3.0	50.5
Lorry, with crane/grab, 5.5 t < gross vehicle weight ≦ 38 t	Other PME	105	1	105	238.0	15.0	50.0%	-55.5	-3.0	0.0	3.0	49.5
Crane, mobile / barge mounted (diesel)	CNP 048	112	1	112	238.0	30.0	100.0%	-55.5	0.0	0.0	3.0	59.5
Bar bender and cutter (electric)	CNP 021	90	2	93	238.0	30.0	100.0%	-55.5	0.0	0.0	3.0	40.5
Saw, circular, wood	CNP 201	108	2	111	238.0	30.0	100.0%	-55.5	0.0	0.0	3.0	58.5
Concrete pump	Other PME	109	2	112	238.0	30.0	100.0%	-55.5	0.0	0.0	3.0	59.5
Concrete mixer	CNP 046	96	1	96	238.0	30.0	50.0%	-55.5	-3.0	0.0	3.0	40.5
Poker, vibratory, hand-held	CNP 170	113	2	116	238.0	30.0	100.0%	-55.5	0.0	0.0	3.0	63.5
											Total	**68.6**
Stage 3 - Site Demobilization												
Excavator	CNP 081	112	1	112	238.0	30.0	100.0%	-55.5	0.0	0.0	3.0	59.5
Dump truck , 5.5 tonne < gross vehicle weight ≦ 38 tonne	Other PME	105	1	105	238.0	15.0	50.0%	-55.5	-3.0	0.0	3.0	49.5
Generator, silenced, 75 dB(A) at 7 m	CNP 102	100	1	100	238.0	30.0	100.0%	-55.5	0.0	0.0	3.0	47.5
Lorry, with crane/grab, 5.5 t < gross vehicle weight ≦ 38 t	Other PME	105	2	108	238.0	15.0	50.0%	-55.5	-3.0	0.0	3.0	52.5
Crane, mobile / barge mounted (diesel)	CNP 048	112	3	117	238.0	30.0	100.0%	-55.5	0.0	0.0	3.0	64.3
Compactor, vibratory	CNP 050	105	1	105	238.0	30.0	100.0%	-55.5	0.0	0.0	3.0	52.5
											Total	**66.1**

Notes:
1. The SWL of the PME was referred to the Piling, earth auger, auger of the Technical Memorandum on Noise from Construction Work Other Than Percussive Piling.
2. The SWL of the PME was referred to the grout pump from the list of other commonly used PME.
3. The SWL of the PME was referred to the grout mixer from the list of other commonly used PME.

Figure E-1 Location of SSW Site and NSRs



ANNEX F

Cultural Heritage Assessment

CONTENTS

F CULTURAL HERITAGE ASSESSMENT F-1

F.1 Introduction F-1
F.2 Relevant Legislation and Guidelines F-1
F.3 Baseline Study F-2
F.4 Baseline Review F-3
F.5 Marine Archaeological Investigation F-6
F.6 Summary and Conclusion F-8
F.7 References F-8

TABLES

Table F-1 Sonar Contacts
Table F-2 Magnetic Contacts
Table F-3 Wrecks Record from United Kingdom's Hydrographic Office

FIGURES

Figure F-1 Extent of Reclamation at SSW Side
Figure F-2 Location of Declared Monument and Sites of Archaeological Interest at TKO Side
Figure F-3 Locations of Potential Marine Archaeological Resources
Figure F-4 United Kingdom Hydrographic Office Wreck database for Wreck No. 46674
Figure F-5 United Kingdom Hydrographic Office Wreck database for Wreck No. 57736
Figure F-6 United Kingdom Hydrographic Office Wreck database for Wreck No. 65704
Figure F-7 United Kingdom Hydrographic Office Wreck database for Wreck No. 65706
Figure F-8 United Kingdom Hydrographic Office Wreck database for Wreck No. 65708
Figure F-9 Extent of Geophysical Survey for the Ultra Express Link

F CULTURAL HERITAGE ASSESSMENT

F.1 Introduction

F.1.1 This Annex contains an assessment of cultural heritage associated with the proposed project.

F.2 Relevant Legislation and Guidelines

F.2.1 The following legislation and guidelines are applicable to the assessment of cultural heritage impact in Hong Kong:

- Environmental Impact Assessment Ordinance (Cap 499) and the associated Technical Memorandum on the EIAO Process (EIAO-TM), Annexes 10 and 19.
- Antiquities and Monuments Ordinance (Cap. 53).
- Hong Kong Planning Standards and Guidelines (HKPSG).
- Guidelines for Marine Archaeological Investigation (MAI) prepared by the Antiquities and Monuments Office (AMO).

EIAO-TM Annex 10 and 19

F.2.2 The EIAO-TM outlines the approach and criteria for assessment of impact on sites of cultural heritage.

F.2.3 Annex 10 provides the criteria for evaluating impact on sites of cultural heritage and also notes the general presumption in favour of the protection and conservation of sites of cultural heritage and that adverse impacts on sites of cultural heritage shall be kept to the absolute minimum.

F.2.4 Annex 19 notes that preservation is the preferred solution and if full preservation is not feasible, due to site constraints and other factors, this must be fully justified with alternative proposals or layout designs, which confirm the impracticability of total preservation.

Antiquities and Monuments Ordinance, Cap 53

F.2.5 The Antiquities and Monuments Ordinance (Cap. 53) provides statutory protection against the threat of development on declared and proposed Monuments, to enable their preservation for posterity. The Ordinance also establishes statutory procedures to be followed in making such a declaration.

Hong Kong Planning Standards and Guidelines

F.2.6 The Chapter 10, Conservation, of the HKPSG provides general guidelines and measures for the conservation of historic buildings, sites of archaeological interest and other antiquities.

MAI Guidelines

F.2.7 The objectives of the MAI are to include a phased review/investigation of a Study Area in accordance with the MAI Guidelines for Marine Archaeological Investigation. The Study Area refers to the assessment corridor along the cable alignment with 100m width on both sides as shown in ***Figure F-9***. The MAI shall include a Phase I Assessment, which shall determine if a Phase II Assessment be required.

F.2.8 During a Phase I Assessment, the following shall be undertaken:

- Desktop review of the Study Area
- Review of Geophysical Survey data
- Establish marine archaeological potential
- Conduct marine archaeological impact assessment

F.2.9 Based on the results of the first stage MAI, further investigation may or may not be required.

F.2.10 Should a Phase II Assessment be required, the following shall be undertaken:

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

F.3 Baseline Study

F.3.1 The Ultra Express Link cable alignment and landing site at TKOIE is within the same assessment corridor as the previous MAIs of several other submarine cables systems. These include the *TKO Express – Cable System*, *APG Cable System* and the *ASE Cable System*. As such, information from recent MAIs has been extracted to describe the existing conditions and findings within the Study Area.

Inventory of Heritage within Study Area

F.3.2 The land at the SSW side on which the project is located was reclaimed in the mid-1980s as part of the *Siu Sai Wan Development Works Stage 1 – Construction of Seawall and Reclamation* by the Civil Engineering and Development Department. The extent of this reclamation with reference to the SSW Site is shown in ***Figure F-1***. As such, there is no archaeological potential at the SSW side and there are no declared Monuments at SSW side.

F.3.3 At TKO, there is a declared Monument, the Site of Chinese Customs Station at Fat Tau Chau, located approximately 237m of the landing site at TKOIE; and there are three sites of archaeological interest located near the Ultra Express Link alignment, namely Fat Tau Chau Site of Archaeological Interest (approximately 93m), Fat Tau Chau Qing Dynasty Gravestone (approximately 221m) and Fat Tau Chau House Ruin (approximately 778m). ***Figure F-2*** shows the location of the declared Monument and the sites of archaeological interest.

F.3.4 In terms of marine archaeological resources, Ultra Express Link is in the vicinity of several other submarine cable systems that have landed at TKOIE and have been subject

to previous Marine Archaeological Investigations (MAIs), as shown in ***Figure 1-1***. These MAIs did not identify any actual marine archaeological resources, which confirmed that no objects fall within the Study Area of the MAI for this project. The closest object, UKHO 65706 is located about 102m from the Ultra Express Link, which lies outside the Study Area, as shown in ***Figure F-3***.

Possible Threats to Terrestrial Heritage

F.3.5 At the TKO side, there will only be minor land based installation works associated with pulling the cable through the existing conduit/duct with no new construction required.

F.3.6 There are no possible threats to the Declared Monument or the three sites of archaeological interest from the submarine installation works or the cable pulling works. There will be no land based work or destruction in whole or in part of the Declared Monument or the three sites of archaeological interest.

Possible Threats to Marine Heritage

F.3.7 The distances between the proposed cable alignment and the identified potential objects in the previous MAIs are shown in ***Figure F-3***. To ascertain whether any of these objects are marine archaeological resources, a brief MAI has been carried out for the Ultra Express Link, as described in ***Section F.5***.

F.4 Baseline Review

Geotechnical Data

F.4.1 Thick marine sediments have been deposited along the South China coast during quaternary fluctuations in sea level. Mean sea level has risen some 120m since the end of the last ice age when the shoreline was far off the present coastline and close to the edge of the continental shelf. This rise in sea level has formed drowned coastline topography. The deposits that now occupy this topography throughout Hong Kong waters (and PRC waters south of Hong Kong) are characterised by two main sedimentary facies; marine sediments of the Hang Hau Formation overlying older sediments of the Sham Wat and Chek Lap Kok formations [Ref #1].

F.4.2 The upper-most geological unit is the “Marine Deposits” of the Holocene Hang Hau Formation. This comprises very soft to soft homogenous sediments deposited shortly after the rise in sea level at the end of the last ice age, 10,000 to 6,000 years ago. It typically consists of greenish grey silty clay that has a variable thickness up to 30m. Undrained shear strengths vary from <3kPa to 20kPa. The sediment generally becomes coarser to the base of the formation [Ref #1].

F.4.3 Underlying the Hang Hau Formation is the laterally impersistent late Pleistocene marginal marine to estuarine Sham Wat Formation and the Chek Lap Kok Formation. The Sham Wat Formation consists of similar source material to the Holocene sediment, but is firmer as it has been exposed to subaerial weathering when sea levels have been lowered during previous glacial/inter-glacial cycles. The Sham Wat Formation generally comprises firm (40-60kPa) grey silty clay with occasional leached soft shell fragments. The Chek Lap Kok Formation comprises a heterogeneous, poorly sorted mix of sediments ranging in size from boulders to clay. The clay tends to be firmer than the

1. EGS, 2016. Ultra Express Link from Hong Kong to New Territories Cable Route Study. Earth Sciences and Surveying

overlying formations with an unconfined compressive strength of between 30 to 90kPa. The thickness of these combined formations is up to 30m [Ref #1].

F.4.4 Close to the coast, where wave action has removed the fines, the Chek Lap Kok Formation includes colluvial sand, gravel and boulders. Away from the coastline, the formation tends to a poorly sorted soil, mostly sand and silt but with clay and gravel in places [Ref #1].

F.4.5 Below the Chek Lap Kok formation is the solid rock geology of Hong Kong, mostly tuff and granite, often with a thick highly weathered horizon above the unweathered rock, with some sedimentary rocks [Ref #1].

Review of Historical Documents

F.4.6 The following has been extracted from previous archaeological studies (APG Cable System) and Heritage Impact Assessments (Chai Wan Factory Estate at No. 2 Kut Shing Street, Chai Wan, Hong Kong April 2013, Hong Kong Housing Authority) within the Study Area.

TKOIE Landing Point

F.4.7 Archaeological evidence indicates that seafarers have used the waters of Hong Kong for around 6,000 years [Ref #2] and it is reported [Ref #3] 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 6,000 years ago, the Neolithic peoples had already settled in the coastal area of South China.

F.4.8 The TKO landing site is located in what is now called Junk Bay (formerly known as Fat Tong Mun) due to the many junks that previously took shelter within in the bay, as reported by Aijmer [Ref #4]. Junk Bay and Tathong Channel (which the Ultra Express Link will cross) were used from the Song Dynasty during trading activities that connected Guangzhou and northern China. This waterway forms the eastern entrance to Victoria Harbour and has continued to the present day to be an important waterway for many vessels of all sizes.

F.4.9 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 northeastern coastline of Junk Bay is one of the oldest settlements in the region, dating back to the early Ming Dynasty.

Siu Sai Wan Landing Site

F.4.10 In many archaic maps, Chai Wan was called Sai Wan. It is said that because many local villagers used to collect firewood in the seaward area in Sai Wan, it was subsequently renamed “Chai” Wan [Ref #5].

F.4.11 The flat inland bay and sheltering hills, coupled with a stable source of fresh water made the area favourable for agricultural activities. Fishing and agricultural was carried out in

2. Bard, S. 1988. *In Search of the Past: A Guide to the Antiquities of Hong Kong*. Hong Kong Urban Council
3. Chau, Hing-wah, (ed) 1993. *Collected essays on the culture o f the Ancient Yue People in South China*. Hong Kong Museum of History
4. Aijmer, 1984, cited in 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.
5. Rosanna Eng Pui Yan., 1999. *Siu Sai Wan: life on and by water.* HKU Theses Online (HKUTO).

Chai Wan since the Ming Dynasty (1368-1644). Fishing boats would also take shelter and refill stocks at the inland bay of Chai Wan. Newcomers started to populate the Chai Wan area as the Qing Government began to reverse the Evacuation Order in the 8th year of Kangxi era (1669). New settlers in the area included the Laws from Pak Heung, Yuen Long; Shings from Man Gong Uk, Sai Kung; Luks from Tam Shui, Wai Yeung; and later on, the Nams and Yaus. They built the Law Uk, Shing Uk, Luk Uk, and Nam Uk in the area, each of these small villages were named by the clan's family name [Ref #6].

F.4.12 Apart from agriculture and farming, these villagers made a living in ceramics. Proximity to the sea allowed villagers to obtain shells and corals as raw materials for making ceramics, with firewood logged from surrounding hills providing the fuel for the kilns. The area was believed to be heavily forested at that time and was therefore given the name Chai Wan [Ref #7].

F.4.13 More recently, Siu Sai Wan was an intelligence gathering centre for UK. In 1947, The British Armed Forces then set up an intelligence gathering centre in Siu Sai Wan, one of the largest in the Far East, to monitor wireless communications from the then Republic of China (ROC), present day People's Republic of China (PRC). In 1985, as the handover of Hong Kong to the PRC became inevitable, the centre was decommissioned [Ref #8].

F.4.14 Early reclamation work between 1950s and 1970s in Chai Wan provided a total of around 42ha of land. The reclamation work closed off the deep inner bay, and moved the typhoon shelter outwards. The area eventually became the site for the mass transit railway, industrial buildings and housing estates [Ref #8].

F.4.15 The land at the SSW side on which the project is located was reclaimed in the mid-1980s as part of the *Siu Sai Wan Development Works Stage 1 – Construction of Seawall and Reclamation* by the then Engineering and Development Department [Ref #9].

United Kingdom's Hydrographic Office

F.4.16 The UK Hydrographic Office (UKHO) in Taunton maintains a database of known shipwrecks and other underwater obstructions in the HKSAR.

F.4.17 As the Ultra Express Link follows the same alignment as the *TKO Express Cable System* and *APG Cable System*, information has been obtained from the APG Cable System with regard to the assessment of marine archaeological resources. ***Figures F-4*** to ***Figure F-8*** provides a list of the sites within the Ultra Express Link cable alignment, which are summarised along with the other sonar and magnetic contacts.

Geophysical Surveys

F.4.18 The following MAIs were undertaken in Project Profiles for previous cables in the vicinity of the Ultra Express Link:

- MAI in the Project Profile for the *Tseung Kwan O Express – Cable System project*, for Superloop, dated 16 December 2015. The geophysical survey was carried out

6. Kwok Siu Tong, 2003. *A Guide to The Antiquities of Hong Kong Eastern District: Collective Memory in the Community*, p. 8. Eastern District Council
7. Iu Kow-choy, 2011. *Place Names and local history of Hong Kong*, p.135. Hong Kong Cosmos Books
8. Ho Puay-peng, 2013. *Heritage Impact Assessment on Chai Wan Factory Estate at No. 2 Kut Shing Street, Chai Wan, Hong Kong*. Hong Kong Housing Authority.
9. Urban Area Development Office, 1988. *Urban Area Development Programme, Eastern District Works Programme.* Territory Development Department Hong Kong

between 16 to 30 November 2015 and covered a 500m wide corridor, which included the Study Area for the Ultra Express Link.

- MAI in the Project Profile for the *ASE Cable project*, for NTT, dated 7 October 2011. The survey covered a 1,000m wide corridor, including the Study Area for the Ultra Express Link. The survey period was between 14 March to 4 May 2011.
- MAI in the Project Profile for the *APG Project*, dated 8 October 2013, for China Mobile using the same type of survey for the ASE project. The geophysical survey was carried out between 11 and 24 October 2012 and covered a 650m corridor, which included the Study Area for the Ultra Express Link.

F.4.19 A geophysical survey for Ultra Express Link was also undertaken in early 2017. The extent of this survey is shown in ***Figure F-9***.

F.4.20 Geophysical surveys were undertaken that encompassed an assessment of the depth and nature of the seabed sediments and any seabed and sub bottom anomalies. Information was extracted from earlier surveys for the Ultra Express Link as it has a similar alignment as other submarine cable projects.

F.4.21 The following equipment was employed during the earlier geophysical surveys:

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

F.4.22 Dumped materials were found by the side scan sonar survey along the length of Ultra Express Link cable route. The seabed in the Study Area comprises more than 5m 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, near TKOIE.

F.5 Marine Archaeological Investigation

F.5.1 Geophysical survey data was obtained by local marine surveying company EGS (Asia) Ltd (EGS) for other cable projects along the cable route alignment, namely the ASE Cable project (survey from 14 March to 4 May 2011), APG Cable project (survey from 11 to 14 October 2012). This data was processed by in house geophysicists and reviewed by a qualified marine archaeologist. In addition to this, EGS has also carried out a geophysical survey for this Project, from 26 January to 23 May 2017.

F.5.2 The survey findings for the ASE Cable project did not identify any items of potential archaeological interest within the vicinity of the Ultra Express Link. The survey found that the seabed comprised coarse sediment for most of the Study Area with a number of areas of rock/boulders and low relief dumped materials. The survey found that the area was heavily impacted from historical trawling and dumping of material.

F.5.3 The survey findings for the APG Cable project were the same as those identified in the ASE Project Profile: No items of potential archaeological interest were found within the vicinity of the Ultra Express Link.

F.5.4 The geophysical survey for the Ultra Express Link project had the same findings as those for the ASE Cable project and the APG Cable project.

F.5.5 A list of sonar contacts from the survey, within the vicinity of the Ultra Express Link is provided below in ***Table F-1*** and shown on ***Figure F-3***.

F.5.6 There were no sonar contact points located within 100m of the Ultra Express Link cable alignment.

Table F-1 Sonar Contacts

Ref	Survey Reference	Latitude Longitude	Size (m)	Description
SC001	APG Cable System	22°17.017' N 114°15.994' E	62xnmwxnmh	Unknown Linear
SC002	APG Cable System	22° 17.001' N 114° 15.977' E	20xnmwxnmh	Unknown Linear
SC003	APG Cable System	22°17.017' N 114°15.978' E	20xnmwxnmh	Unknown Linear
(APG)	ASE Cable System	22°16.112' N 114°15.288' E	87m W 12x2.5nmh	Debris
SC032 (E18)	ASE Cable System	22°16.063' N 114° 15.386' E	56m E 3x1.5x1	Boulder/Debris
SC038 (E19)	ASE Cable System	22°15.982' N 114°15.326' E	91m SW 3.5x1.5x<1	Debris

F.5.7 Magnetic surveys were carried out to locate existing cables and pipelines. A list of magnetic contacts, in the vicinity of the Ultra Express Link is shown in ***Table F-2***.

Table F-2 Magnetic Contacts

Ref	Survey Reference	Latitude Longitude	Size (m)	Description
MC041	APG Cable System	22°15.56.099” N 114°15.17.177” E	185.3	Unknown
MC042	APG Cable System	22° 15.55.933” N 114° 15.16.809” E	84.9	Unknown
MC046	APG Cable System	22° 15.54.968”N 114° 15.18.750” E	74.9	Unknown

F.5.8 There were no magnetic contacts located within 100m of the Ultra Express Link. Other magnetic contacts and sub-bottom anomalies that were found during the geophysical surveys have been identified as related to the ASE and APG cables, DSD’s sewage pipeline, and dumped materials/debris given their association with these types of seabed features.

F.5.9 A review of the UK Hydrographic Office wrecks database found the following shown in *Table F-3* to be located within the Study Area.

Table F-3 Wrecks Record from United Kingdom's Hydrographic Office

Wreck No.	Latitude Longitude	Classification	Description
46674	22° 16'.910 N 114° 16'.150 E	Unclassified	Recent (26/08/1993). Caught fire while proceeding on a "Gambling Excursion". Abandoned by passengers.
57736	22° 16'.910 N 114° 16'.150 E	Dead	Undefined
65704	22° 17'.000 N 114° 16'.500E	Dead	Recent (19/09/1976). Vessel was moored in Junk Bay and broke free in Typhoon Iris.
65706	22° 16'.350 N 114° 15'.267E	Dead	Undefined
65708	22° 16'.083 N 114° 15'.433 E	Undefined Origin	Dangerous Wreck - Marked by buoy

F.6 Summary and Conclusion

F.6.1 The geophysical surveys of previous MAIs revealed that seabed along the Ultra Express Link cable alignment 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 area of the Tathong Channel and Study Area, with the coarser sediments being less conducive to preserving organic archaeological material, such as wooden shipwrecks.

F.6.2 The Ultra Express Link will be laid by cable burial machine that will only have a minimal impact on the seabed sediments with a width of disturbance of at most 0.5m.

F.6.3 The findings from the terrestrial archaeological assessment showed that no sites of archaeological interest or potential archaeological deposits will be impacted by the project. Hence no mitigation measures need to be put in place.

F.6.4 The MAI established that no resources of marine archaeological value are located within the Study Area and hence no marine archaeological impacts are expected. No mitigation measures shall be required.

F.7 References

Aijmer, 1984, cited in 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.

Bard, S. 1988. *In Search of the Past: A Guide to the Antiquities of Hong Kong*. Hong Kong Urban Council

Chau, Hing-wah, (ed) 1993. Collected essays on the culture of the Ancient Yue People in South China. Hong Kong Museum of History

EGS, 2016. *Ultra Express Link from Hong Kong to New Territories Cable Route Study.* Earth Sciences and Surveying

Ho Puay-peng, 2013. *Heritage Impact Assessment on Chai Wan Factory Estate at No. 2 Kut Shing Street, Chai Wan, Hong Kong*. Hong Kong Housing Authority.

Iu Kow-choy, 2011. *Place Names and local history of Hong Kong*, p.135. Hong Kong Cosmos Books

Kwok Siu Tong, 2003. *A Guide to The Antiquities of Hong Kong Eastern District: Collective Memory in the Community*, p. 8. Eastern District Council

Project Profile for Asia Pacific Gateway, 9 October 2013 (PP-496/2013)

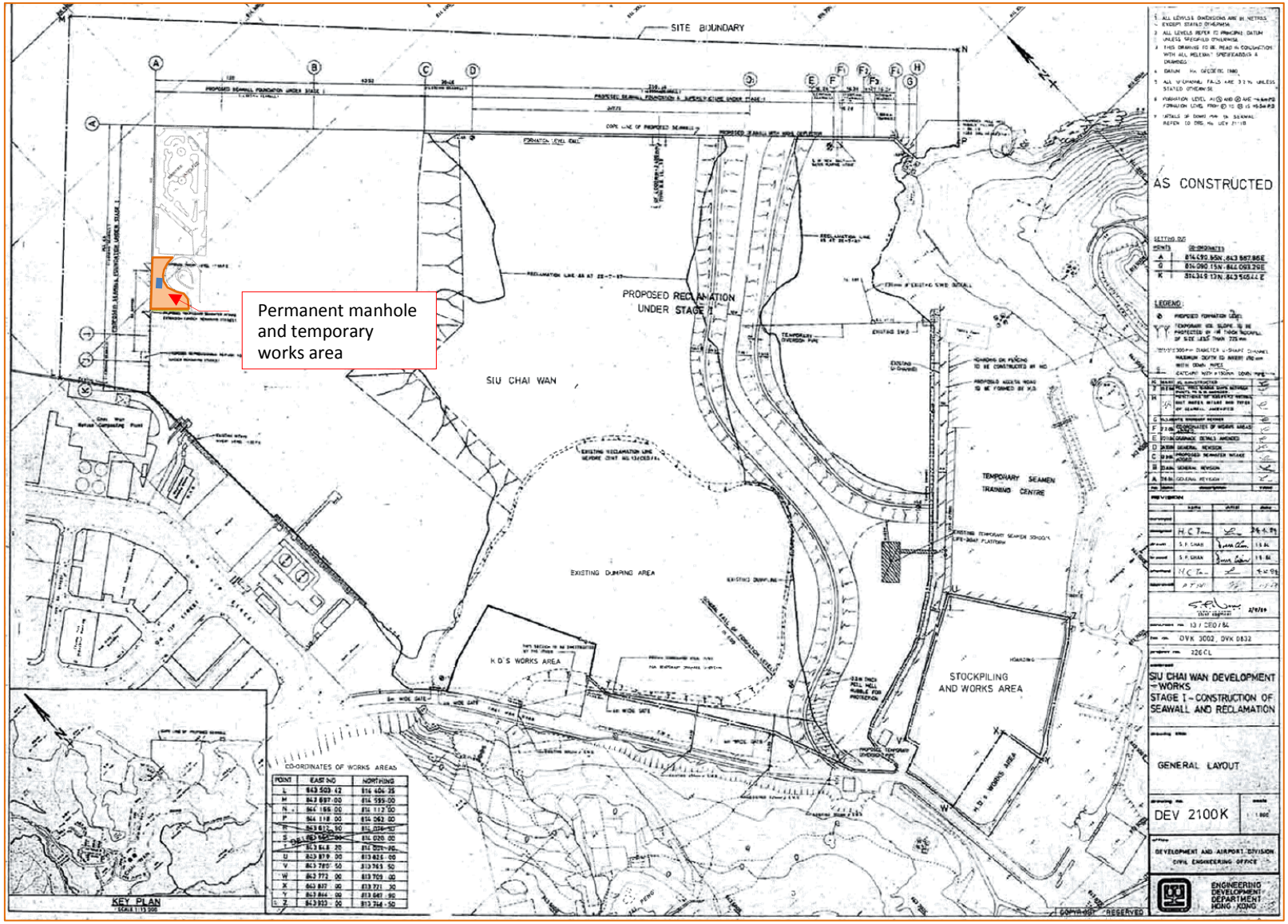
Project Profile for Asia Submarine-cable Express, 7 October 2011 (PP-452/2011)

Project Profile for Tseung Kwan O Express – Cable System, 16 December 2015 (PP-532/2015)

Rosanna Eng Pui Yan, 1999. Siu Sai Wan: life on and by water. HKU Theses Online (HKUTO).

Urban Area Development Office, 1988. *Urban Area Development Programme, Eastern District Works Programme.* Territory Development Department Hong Kong

Figure F-1 Extent of Reclamation at SSW Side



Source: CEDD – As-built drawing from *Siu Sai Wan Development Works Stage 1 – Construction of Seawall and Reclamation*, circa 1984.

Figure F-2 Location of Declared Monument and Sites of Archaeological Interest at TKO Side

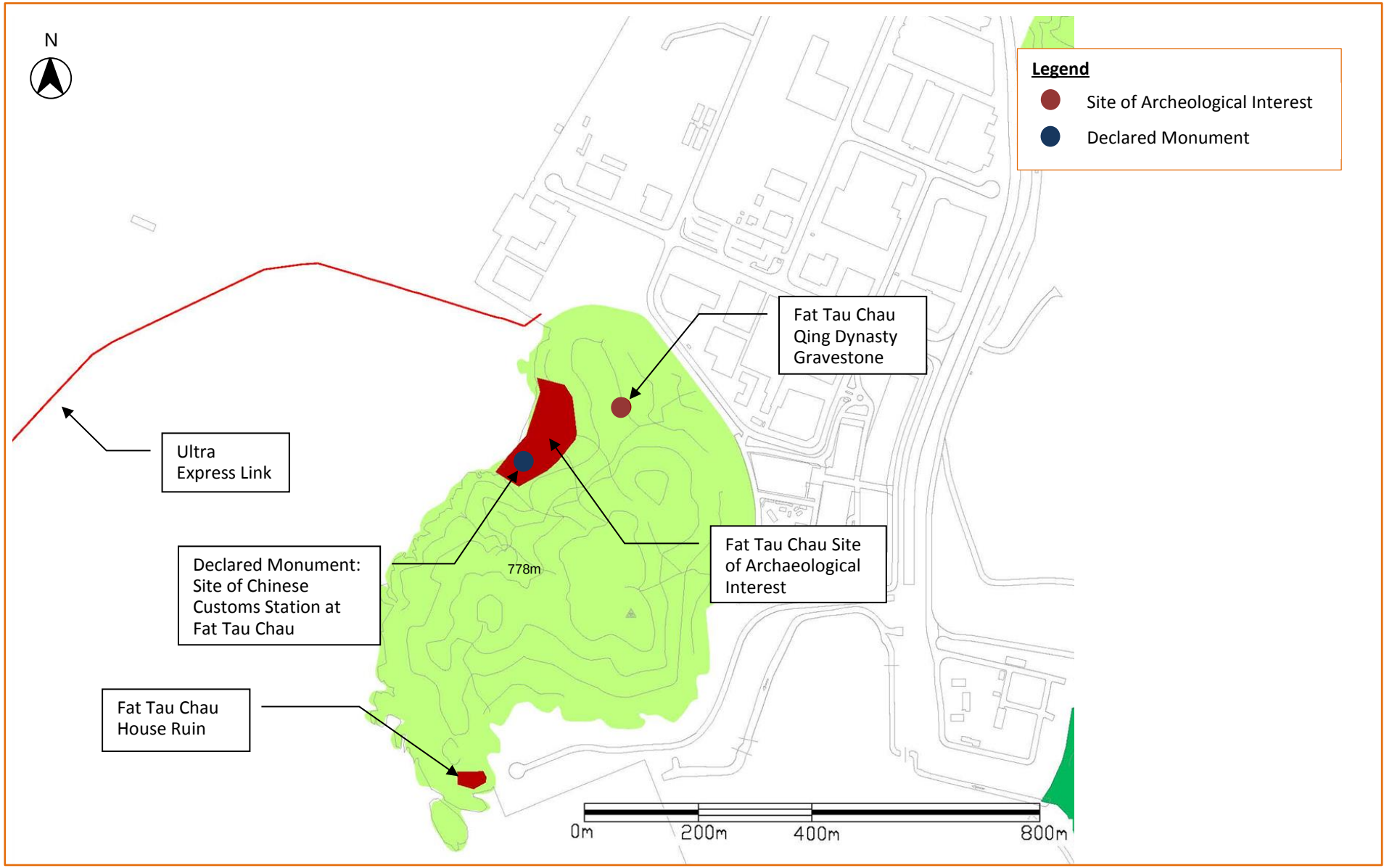
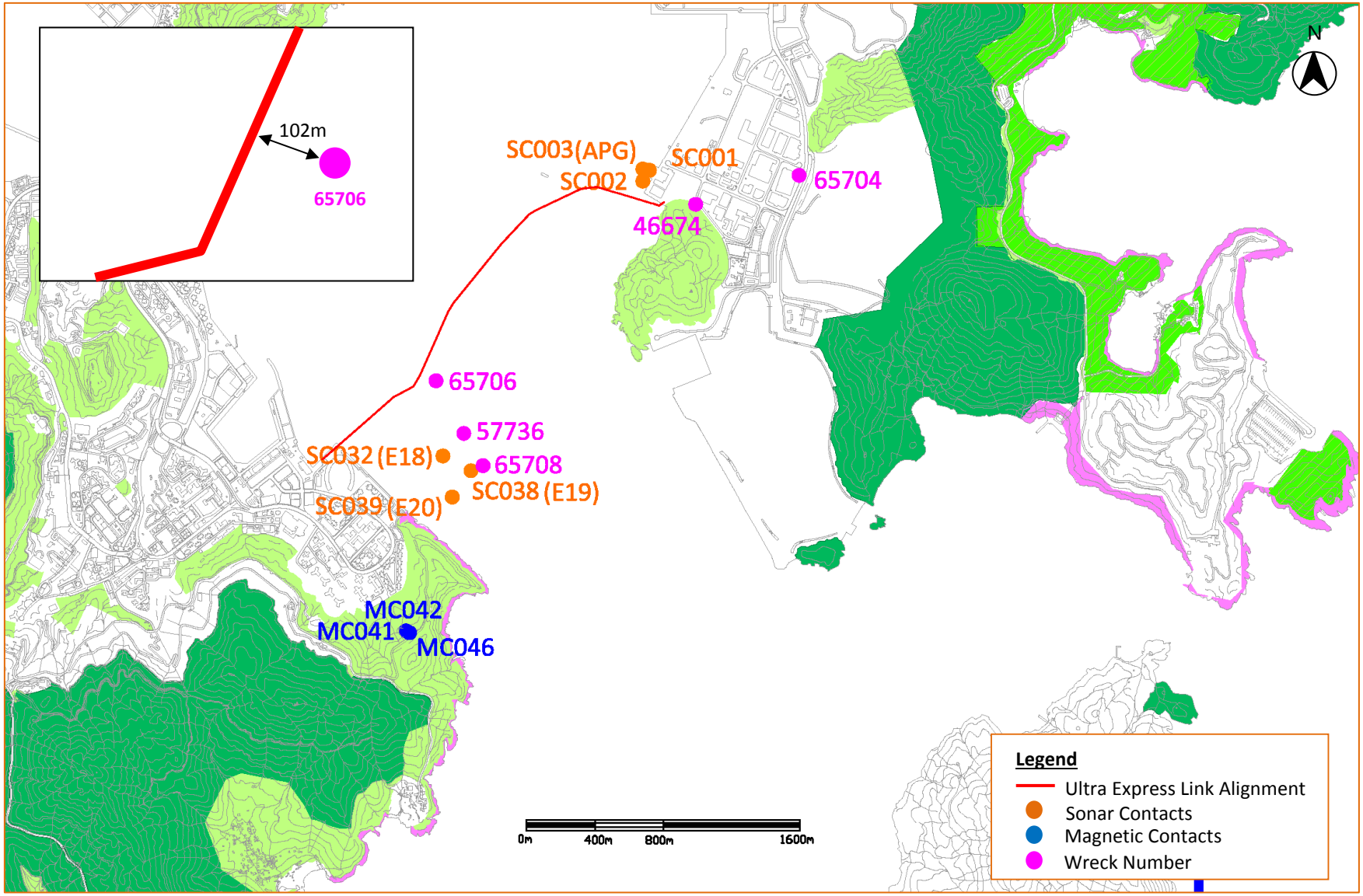


Figure F-3 Locations of Potential Marine Archaeological Resources



Source: Geophysical Surveys for ASE Cable project, APG Cable Project and this Project

Figure F-4 United Kingdom Hydrographic Office Wreck Database for Wreck No. 46674

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.

Figure F-5 United Kingdom Hydrographic Office Wreck Database for Wreck No. 57736

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.

Figure F-6 United Kingdom Hydrographic Office Wreck Database for Wreck No. 65704

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.

Figure F-7 United Kingdom Hydrographic Office Wreck Database for Wreck No. 65706

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.

Figure F-8 United Kingdom Hydrographic Office Wreck Database for Wreck No. 65708

Latitude = 22 16'.083 N **Longitude** = 114 15'.433 E [UND] **Square Number** = 1113
State = DEAD

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.

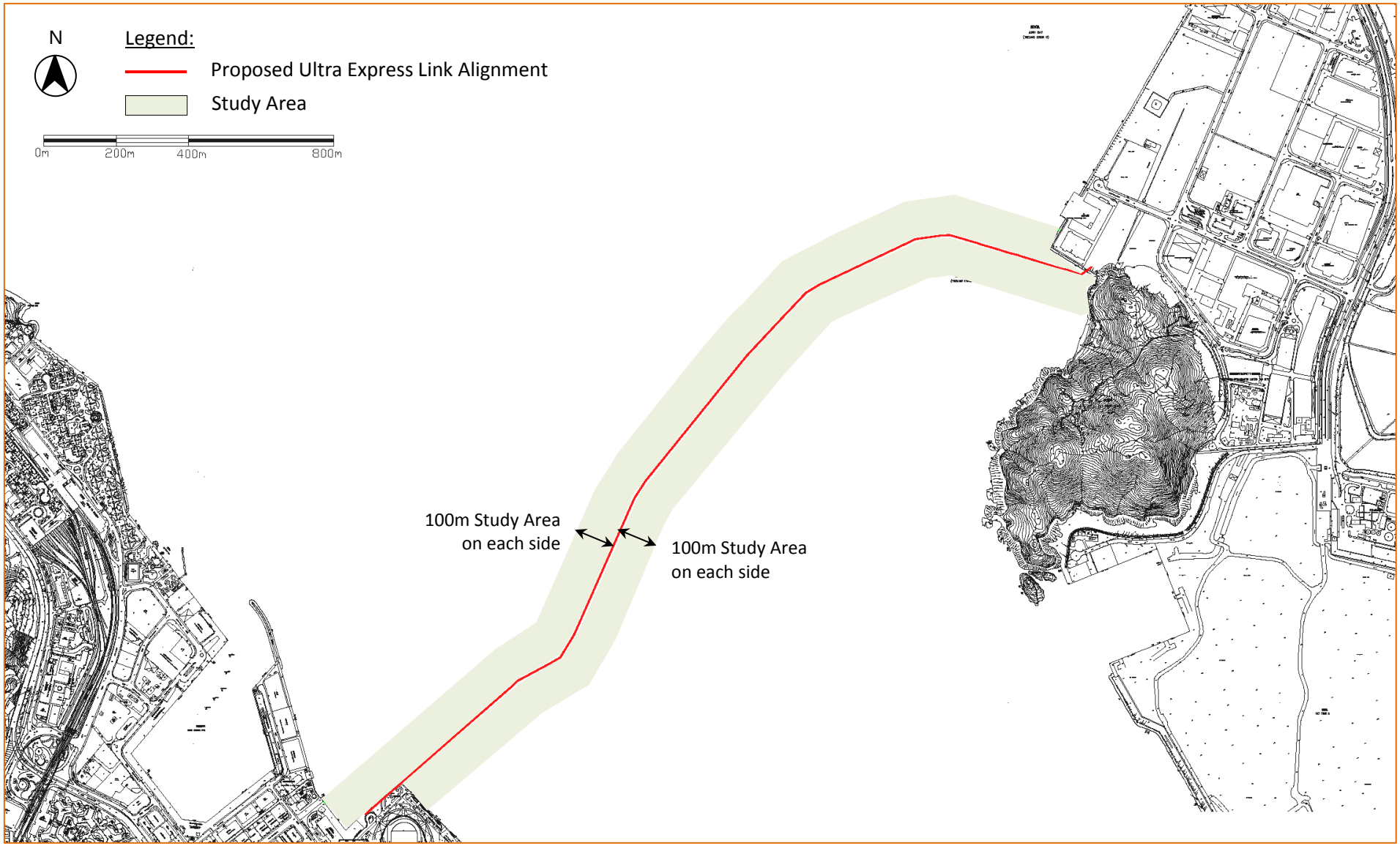



Figure F-9 Extent of Geophysical Survey for the Ultra Express Link