Contents

Figures

1 INTRODUCTION

1.1 Background

1.1.1 As the Hong Kong-Zhuhai-Macao Bridge (HZMB) Hong Kong Link Road (HKLR) and Hong Kong Boundary Crossing Facilities (HKBCF) are closely inter-related, they are presented together under the EIA Report of each. Hence, this EIA Report for HKBCF will present descriptions and assessments not only on HKBCF but also relevant aspects on HKLR.

1.1.2 An application (No ESB-183/2008) for an Environmental Impact Assessment (EIA) Study Brief under Section 5(1) of the Environmental Impact Assessment Ordinance (EIAO) was submitted by Highways Department (the Project Proponent) on 12 March 2008 with a Project Profile (No. PP-346/2008) for the Hong Kong-Zhuhai-Macao Bridge Hong Kong Boundary Crossing Facilities (the Project). EPD issued an EIA Study Brief (No: ESB-183/2008) on April 2008 to the Project Proponent to carry out an EIA study.

1.1.3 Ove Arup & Partners Hong Kong Limited (Arup) has been commissioned by the Highways Department to carry out the investigation and preliminary design study for the Project as well as an EIA according to the EIAO for identification and evaluation of the environmental impacts and the mitigation measures required.

1.1.4 Amongst the Works to be carried out under the Project (HKBCF), the reclamation works, dredging operation, extension of Automated People Mover, and road bridges are designated projects under Schedule 2 of the EIA Ordinance (Cap. 499). Hence Environment Permits (EPs) are required for their construction and operation.

1.1.5 **Figure 1.1** illustrates the proposed location and extent of the HKBCF.

1.2 EIA Study Objective

1.2.1 The HKBCF Project is a designated project under:

(i) Item A.2, Part I, Schedule 2 of EIAO : “A railway and its associated stations”;

(ii) Item A.7, Part I, Schedule 2 of the EIAO: “A railway tunnel more than 800m in length between portals”;

(iii) Item A.8, Part I, Schedule 2 of the EIAO: “A road bridge more than 100m in length between abutments”; and

(iv) Item C.1, Part 1, Schedule 2 of the EIAO: “Reclamation works (including associated dredging works) more than 5 ha in size”; and

(v) Item C.12, Part 1, Schedule 2 of the EIAO: “A dredging operation exceeding 500,000m^3”.

1.2.2 The main objective of this EIA study is to provide a detailed assessment on the nature and extent of potential environmental impacts arising from the construction and operation of the Project and related activities taking place concurrently.

1.3 Need for the Project

1.3.1 The proposed HZMB will straddle the waters of Lingdingyang of the Pearl River Estuary. It is not only a large sea-crossing linking the Hong Kong Special Administrative Region, Zhuhai City of Guangdong Province and the Macao Special Administrative Region, but also an essential transport construction project included in “National High Speed Road Network Planning” (國家高速公路網規劃). Its scope includes the HZMB Main Bridge, Hong Kong BCF, Zhuhai BCF, Macao BCF, and the link roads connection between the HZMB Main Bridge and the

respective BCFs, in accordance with the agreement made by the three governments on the concept of "separate locations of BCF mode".

1.3.2 In connection with the above, the HKSAR Government is required to set up the Hong Kong boundary crossing facilities (HKBCF) within the Hong Kong territory, which is proposed to be located at the northeast waters off the Airport Island.

1.3.3 Besides, a link road (HKLR) is required so as to provide the necessary linkage between the HZMB Main Bridge and the HKBCF for the completion of the HZMB project.

1.4 Implementation Programme

1.4.1 The HZMB is targeted to be commissioned by 2015. To meet this target:

(a) Construction of the HKLR will start in 2011, for completion in 2015, with a construction period of 4 years;

(b) Construction of the HKBCF will start in the 3rd quarter of 2010, for first phase completion by End 2015, and second (final) phase completion by End 2016. The attached **Figure 1.2** shows the phasing extent of HKBCF, as well as the interim layout for the first phase and the overall layout for the second phase (ie. the final phase). The first phase will be designed to satisfy the requirements for the initial years of operation of HZMB.

2 ALTERNATIVE OPTIONS

2.1 General

2.1.1 A number of site options were long-listed at the Site Selection for HKBCF in Mid 2007. These are summarised on **Figure 2.1**.

2.1.2 As the Site Selection Study and then the Investigation Consultancy proceed, relevant factors or assessment results were revealed which rendered most of the site options not feasible. Eventually, only one site option (Option NECLK as shown on **Figure 2.1**) locating the HKBCF in the water adjacent to the north-eastern side of the Airport Island was confirmed as viable.

2.1.3 With NECLK determined as the site option for HKBCF, three alignment options were considered for HKLR, as shown on **Figure 2.2**.

2.1.4 Amongst the three HKLR alignment options, two of them were evaluated as not feasible. The only feasible option is an alignment in the form of a viaduct routed through the Airport Channel, referred to as Alignment Option (A) on **Figure 2.2**.

2.1.5 It should also be noted that two local alternatives are shown on **Figure 2.3** for that portion of Option (A) nearer to Tung Chung. This is because, at the earlier stages, this portion of HKLR was proposed as an elevated viaduct through the waters off the south-eastern side of the Airport Island, but has been revised to a tunnel cum at-grade road in response to public concerns on the elevated viaduct.

2.1.6 **Figure 1.1** shows the overall layout of HKBCF-cum-HKLR, based on the only feasible site option for HKBCF and the only feasible alignment for HKLR.

2.2 HKBCF Site Options Considered

2.2.1 Option WCLK (see Figure 2.4)

2.2.1.1 This option locates HKBCF on a piece of reclamation/artificial island of approx. 130 ha to the west of the Airport Island. The exact location of this option may vary between the HKSAR boundary and the Airport Island.

2.2.1.2 This option is considered not feasible mainly because of the following:

(a) Main tidal flow of PRD Region – The HZMB is located within a major tidal flowpath of the PRD. As such, extreme caution must be exercised in the planning of HZMB so as to avoid an unacceptable degree of impedance to the tidal flow, otherwise the flood discharge capacity of the Pearl River Estuary area may be jeopardized. Assessments were carried out during the HZMB feasibility study; the Ministry of Water Resources and other related experts unanimously considered that the water resistance ratio (阻水比) due to the HZMB marine substructures and reclamation/artificial-islands should be controlled within 10%, in order to alleviate the impacts on the flood discharging function of the Pearl River Estuary to an acceptable level. Should the HKBCF be located in the waters west of the Airport Island, the flow blockage area will be increased and the 10% target for 阻水比 cannot be met, thus affecting the tidal flow and flood discharge ability of the Pearl River Estuary. *[Note: The water resistance ratio is the ratio of the area of water-flow blocked by the HZMB marine-substructures and reclamation/artificial-islands, to the water-flow cross-sectional area.]*

(b) Conservation of Marine Ecology – The waters in the western side of the Airport is an important dolphin movement corridor in-between Sha Chau/ Lung Kwu Chau and the west of Lantau Island, which are the mostly densely populated waters for Chinese White Dolphins. It is also an important nursing ground for the dolphins. An artificial island constructed in this location will seriously affect the marine ecology.

(c) This option and other options except Option NECLK will preclude the opportunity of combining reclamation of the TMCLKL with the HKBCF. This option will require reclamation not only on the western side (or the HKBCF location for other options), but also on the eastern side to provide a landfall for the TMCLKL, which is not conducive to the sustainability development objective that reclamation should be minimized.

(d) In comparison with Option NECLK, this option will cause a 2km detouring, resulting in an additional social cost (including time and fuel consumption) and traffic emission.

(e) Should the HKBCF artificial island be located near the HKSAR boundary, the navigation channel thereat will have to be distorted so as to bypass the artificial island. That may have impact to the marine navigation safety.

2.2.2 Option SSW (see Figure 2.5)

2.2.2.1 This option involves partial-reclamation (of approx. 90 ha) cum partial-cutting of slope at the headland at San Shek Wan (SSW).

2.2.2.2 There are several reasons for adopting a partial-reclamation cum partial-excavation form for this option:

(a) Locating the HKBCF on an artificial island or fully on reclamation will cause blockage to the water flow of the Airport Channel.

(b) Resumption of village houses and private lots should be avoided as far as possible. As such, a full excavation option is not acceptable.

(c) There are 3 terrestrial archaeological sites in the vicinity, namely Sha Lo Wan Archaeological Site, Sha Lo Wan (West) Archaeological Site and San Shek Wan Archaeological Site. A full excavation option will encroach upon one or more of these archaeological sites, which however should be avoided as far as practicable. Otherwise a very large-scale of rescue excavation is required, which will result in serious delay to the project.

2.2.2.3 This partial-reclamation cum partial-cutting option at SSW is considered not feasible either, mainly because of the following:

(a) The HKBCF will be extremely close to the nearby villages, with the shortest distance being 20m. It is envisaged that it would result in non-compliance with air-quality and noise requirements as stipulated under the Environmental Impact Assessment Ordinance (EIAO).

(b) Option SSW involves large-scale of hillside cutting (about 15Mm^3), as well as substantial excavation to natural woodland (about 35 hectares) and damage to about 2km of natural shoreline, resulting in significant damage to the natural environment in San Shek Wan.

(c) This option will involve reclamation not only at San Shek Wan for the HKBCF, but also on the eastern side of the Airport Island to serve as the landfall for the TMCLKL, which is not conducive to the sustainability development objective that reclamation should be minimized.

2.2.3 Option SWCLK (see Figure 2.6)

2.2.3.1 This option involves locating HKBCF on the existing land on the Airport Island.

2.2.3.2 This option is considered not feasible mainly because of the following:

(a) The vast majority of the areas on Airport Island are already occupied by airport-related facilities. Locating HKBCF on the existing Airport Island will critically conflict with the operation of the Airport.

(b) Other remaining areas have already been planned for further airport developments. Locating HKBCF on the existing Airport Island will detrimentally affect and hinder the development of the Airport.

2.2.4 Option TCB (see Figure 2.7)

2.2.4.1 This option involves reclamation (approx. 50 ha) at the Tung Chung Bay for the HKBCF.

2.2.4.2 This option is considered not feasible mainly because of the following:

(a) Serious environmental impacts will be resulted to residents in Ma Wan Chung village and Yat Tung Estate in view of their close proximity.

(b) It will conflict with the Future Tung Chung West Development.

(c) The space here is not sufficient for the entire HKBCF, hence it would be necessary to split the HKBCF into parts, resulting in the need to identify other site(s) to locate the remaining part(s) of HKBCF.

2.2.5 Option TH (see Figure 2.8)

2.2.5.1 This option involves reclamation (approx. 130 ha) at Tai Ho for the HKBCF, at the west of the proposed LLP development site.

2.2.5.2 This option is considered not feasible mainly because of the following:

(a) This option will lead to significant detour for those HZMB travellers heading to the Chek Lap Kok Airport or to Northwest New Territories via Tuen Mun Chek Lap Kok Link.

(b) High-potential risk will be posed to the valuable ecology within the Tai Ho Wan which is well-known as ecologically valuable, as the reclamation of Option TH is only about 100m away from the Tai Ho Bay sole outlet.

2.2.6 Option NECLK (see Figure 2.9)

2.2.6.1 This option involves reclamation (approx. 130 ha) at the northeast waters off the Airport Island, about 2km away from the Tung Chung New Town.

2.2.6.2 Together with the HZMB Main Section and HKLR as well as the Tuen Mun Western Bypass (TMWB) and TMCLKL, this proposed HKBCF site enables the formation of a strategic road network linking Hong Kong, Zhuhai, Macao and Shenzhen, thereby further enhancing the transportation and aviation hub status of Hong Kong. The synergy effect will be considerable. With its proximity to the Hong Kong International Airport, the HKBCF will serve as a strategic multi-modal transportation hub. It is currently planned that the HZMB related projects, including the HKBCF and the HKLR, should be completed at the same time as that of TMWB and the TMCLKL.

2.2.6.3 The preferred site would have comparatively less impacts on hydraulics and environment, in particular on marine ecology and water quality. For instance, the preferred site location will cause less overall water resistance to the main flow path and less impact on flood discharge capacity of the Pearl River; less disturbance to the movement corridor of Chinese White Dolphins between Sha Chau and west of Lantau Island; less effect on navigation safety; and less damage to the natural hillside or shoreline, etc.

2.2.7 Taking account of the foregoing points, Option NECLK is recognised as the only feasible site option for HKBCF.

2.3 HKLR Alignment Options Considered

2.3.1 Alignment Option (A) – See Figure 2.10

2.3.1.1 Under this option, the alignment of the HKLR from HKSAR boundary to Scenic Hill is in the form of a marine viaduct running through the Airport Channel. In view of residents' concerns over the marine viaduct from Scenic Hill to the HKBCF, the viaduct option has been changed to a tunnel-cum-at grade road

scheme as described in Section 2.1.5 above.

2.3.1.2 The key merits of this alignment are:

(a) Major facilities in the HKIA will not be affected; and

(b) The Lantau hillside and associated ecological features (including the Lantau Country Park and the Tung O Ancient Trail) are kept intact.

2.3.1.3 In view of the visual concern by Sha Lo Wan residents on this alignment, larger span lengths will be adopted for the portion of viaduct near Sha Lo Wan.

2.3.2 Alignment Option (B) – See Figure 2.11

2.3.2.1 This alignment option features a tunnel on a strip of reclamation along the northern side of the Airport Island, together with viaducts connecting the western portal of the tunnel to HKSAR boundary across the western waters of the Airport as well as connecting the eastern portal of the tunnel to HKBCF. The tunnel will be about 7km long, whereas the viaducts will have a length of 8km totally.

2.3.2.2 This option is considered not feasible mainly because of the following:

(a) The tunnel will pose an undesirable constraint to the future developments of the HKIA; the area at the north of the Airport Island is planned for Airport expansion. Constructing a tunnel underneath the expansion will result in substantial risk in the event of fire or explosion inside the tunnel, thus affecting the operation and safety of the airport.

(b) The tunnel of this alignment option along the northern side of Airport Island will be close to the existing contaminated mud pits and hence there is potential of release of contaminated mud during dredging operation for the reclamation and the tunnel construction.

(c) When compared to the Alignment Option (A) through Airport Channel, this option [Option (B)] will cause about 3km detour, hence increasing social cost (e.g. time and fuel consumption) and exhausted gas emission (additional of about 90 tonnes of NOx emission per annum).

(d) It is much more costly than the Airport-Channel alignment described above (estimated net increase in construction cost of the order of HK$13 billion).

(e) Lighting and ventilation facilities will need to be operated 24-hours daily inside the proposed 7km long tunnel. A substantial increase in energy consumption annually is envisaged.

2.3.3 Alignment Option (C) – See Figure 2.12

2.3.3.1 This alignment option is mostly similar to Alignment Option (A), except that it involves a tunnel through the Lantau hillside in lieu of a viaduct near San Shek Wan headland.

2.3.3.2 This option is considered not feasible mainly because of the following:

(a) The eastern tunnel portal will encroach upon the Country Park.

(b) The western tunnel portal will destroy the natural shoreline and hillside of the Lantau Island.

(c) The tunnel will also need ventilation shafts in-between the eastern and western portals. These ventilation shafts will inevitably encroach upon the Country Park too.

(d) The eastern portal and the approach viaduct will affect the Tung O trail which has significant heritage value.

2.3.4 Taking account of the foregoing points, Alignment Option (A) is recognised as the only feasible alignment option for HKLR.

3 SUMMARY OF KEY FINDINGS IN EIA STUDY

3.1 Air Quality Impact Assessment

3.1.1 Fugitive dust assessment for the construction phase has concluded that 8 times/day watering in all works areas would be required to control fugitive dust impact.

3.1.2 A quantitative air quality assessment has been conducted to assess the cumulative impacts from all neighbouring pollution sources. The PATH model has been adopted to simulate the regional air quality effects, which has included various pollution sources in the PRDEZ. For the emission inventory in Hong Kong, various sources have also been included in the PATH model, including the power stations, Chek Lap Kok International Airport, marine emission, roads.

3.1.3 For the roads in North Lantau and the airport island, the vehicular emission has been estimated by using a finer model EmFAC, whilst CALINE4 and ISCST3 models have been used to simulate the local dispersion. The output of PATH, CALINE and ISCST have been combined and compared against the Hong Kong Air Quality Objectives (HKAQO). The combined results indicate that the cumulative air quality impacts at the identified receivers would comply with the HKAQO and hence there would not be any residual impacts.

3.2 Noise Impact Assessment

3.2.1 Construction noise assessment has been conducted. Results indicate that the noise impacts after the implementation of good site practices, quiet plant and some mitigation measures (eg temporary noise barriers etc) would comply with the stipulated noise criteria. Residual construction noise impacts are not anticipated.

3.2.2 The road traffic noise caused by the project has been simulated using the latest traffic forecast. Results indicate that the cumulative traffic noise impacts on all the noise sensitive receivers would comply with the relevant criterion. Hence, mitigation measures are not required and there are no residual operational traffic noise impacts.

3.2.3 Fixed noise sources during the operation phase include sewerage treatment plant, electric power substations etc. All these facilities are located at more than 1km from all existing noise sensitive receivers and hence cumulative noise impacts are not anticipated.

3.3 Sediment Quality

3.3.1 A marine GI with sediment sampling and laboratory testing has been undertaken and analysed in accordance with the requirements in ETWB 34/2002. The quantity of sediment that needs to be disposed of (in open sea or in dedicated disposal sites) has also been estimated.

3.4 Waste Management Implications

3.4.1 The quantity and timing for the generation of waste during the construction phase have been estimated. Measures including reusing excavated materials for reclamation, recycling excavated bituminous material etc, are devised in the construction methodology to minimise the surplus materials to be disposed off-site. The annual disposal quantities for construction & demolition materials and their disposal methods have also been assessed. Measures have also been

recommended for the Contractor to implement during the construction period to minimise waste generation and any off-site disposal.

3.4.2 The types and quantities of waste that would be generated during the operation phase have been assessed. Recommendations have been made to ensure proper treatment and proper disposal of these wastes.

3.5 Water Quality Impact Assessment

3.5.1 A quantitative water quality model has been set up to assess the potential impacts that dredging may cause on the neighbouring water quality sensitive receivers. Results indicate that, with the implementation of good implementation sequence and mitigation measures, the suspended solids would comply with the requirements specified in the Water Quality Objectives. There would not be residual water quality impacts during the construction phase.

3.5.2 The HKBCF Contractor will also be required to implement good site practices as stipulated in ProPECC Note 5/93 “Drainage Plan subject to Comment by the Environmental Protection Department”, ProPECC Note 1/94 “Construction Site Drainage'” and “Recommended Pollution Control Clauses for Construction Contracts” in order to control the construction site discharges.

3.5.3 During the operation phase, hydrodynamic study also confirms that there would be insignificant impacts on Tai Ho Bay and other aquatic ecological sensitive receivers.

3.6 Ecological Impact Assessment

3.6.1 The Project has avoided direct impacts on recognised sites of conservation importance (e.g. SSSIs, Country Parks and Marine Parks), and other ecological sensitive areas (e.g. mudflats, mangroves mangroves, nursery sites of horseshoe crabs and woodland with Romer’s Frog record on Scenic Hill).

3.6.2 The majority of the HKLR and the entire HKBCF would be on newly reclaimed area or piers in sea areas. Less than 1 ha of grassland / shrubland in Scenic Hill will be affected by the tunnel portal of HKLR. As the grassland / shrubland are of low ecological value and the affected area size is very small, the impacts on the habitat area considered insignificant and no mitigation is required. Apart from Scenic Hill, no other identified terrestrial ecological sensitive area is in the vicinity of the Projects.

3.6.3 The waters to the west of the Airport feature two areas of dolphin-conservation importance, viz the Sha Chau/Lung Kwu Chau Marine Park, and the waters near Tai O Peninsula to Fan Lau. The HKLR alignment passes between these two high dolphin-density areas. Impacts to Chinese White Dolphins (CWD) along this alignment can be expected to be less significant than if the alignment is to pass directly through either of the high dolphin-density areas.

3.6.4 The construction and operation of the HKLR would cause marine habitat loss and potential water quality impacts, but the reclaimed area is not highly used by dolphins and is of very low coverage of common gorgonians. A well-planned program of mitigation activities should be able to avoid most of the potential impacts to the CWD. Dolphins monitoring during construction will be thoroughly implemented. As a precautionary measure, a pre-construction dive survey would be conducted to identify any coral colonies suitable for translocation.

3.6.5 The construction and operation of the HKBCF would cause marine habitat loss and potential water quality impacts. The permanent loss of CWD habitat is a moderate impact requiring mitigation. To enhance the CWD habitat, the Administration has made a firm commitment to seek to designate the Brothers Islands as a marine park in accordance with the statutory process stipulated in the

Marine Parks Ordinance. The designation of the proposed marine park would proceed after the completion of these projects. The Administration's commitment to the marine park and subjecting it to control and management in accordance with the Marine Parks Ordinance as well as the Marine Parks and Marine Reserves Regulations would significantly help conserve the CWD, and hence serves as an effective mitigation measure for the loss of CWD habitat arising from these projects. With this committed measure, the residual impact (and cumulative impact) to CWD, in terms of permanent habitat loss, would therefore be acceptable.

3.6.6 It is proposed that new Artificial Reefs (ARs) will be installed, not only to replace the existing ARs inside Marine Exclusion Area, but also to serve as an enhancement measure. The volume of ARs to be installed will therefore be greater than that of the existing ARs.

3.7 Fisheries Impact Assessment

3.7.1 The construction and operation of HKLR and HKBCF would cause temporary and permanent fishing ground losses, but the loss area is not significant compared with the available fishing ground in Hong Kong waters. For the cumulative fishing ground loss, temporary loss of fishing ground during construction is small as the different potentially concurrent projects would not be constructed/operated at the same time. The cumulative permanent loss of sea area from these projects and other concurrent projects is also insignificant compared with the available fishing ground in Hong Kong waters.

3.7.2 Further, the areas to be reclaimed are not of high fisheries production rate, whilst the water quality impacts during construction could be mitigated. Except the Artificial Reefs (ARs) inside Marine Exclusion Zone, impacts on other fisheries sensitive receivers, such as the nearby fish and shrimp spawning ground, have been assessed and considered as acceptable.

3.7.3 Based on the water quality impact assessment, with the implementation of mitigation measures, there would not be significant residual water quality impacts from HKLR, HKBCF and other concurrent projects during the construction phase. During the operation phase, taking into account of concurrent projects, there would be minor changes in water quality, all of which comply with Water Quality Objectives. Other than the ARs inside Marine Exclusion Zone, impacts on the fish and shrimp spawning ground in North Lantau waters and Tung Chung Bay (i.e. the next nearest sites of fisheries sensitive receivers) are assessed and considered as not significant. Impacts on other more distant sites (eg. Ma Wan FCZ) would be even less.

3.7.4 Reprovision of ARs will be implemented as a mitigation measure for the existing ARs inside Marine Exclusion Zone. Additional volume of ARs will also be deployed as an additional enhancement measure for fisheries resources. A well-planned program of water quality protection activities should enable avoidance of most of these potential impacts to fisheries and mariculture. Besides water quality monitoring, no specific fisheries monitoring programme would be required.

3.7.5 In addition, to enhance the Chinese White Dolphins (CWD) habitat, the Administration has made a firm commitment to seek to designate the Brothers Islands as a marine park in accordance with the statutory process stipulated in the Marine Parks Ordinance The designation of the proposed marine park would proceed after the completion of these projects. With the establishment of the new marine park and implementation of management measures, the fisheries resource of the area will be better managed and together with the other ecological enhancement measures, will enhance the long-term sustainability of the fisheries industry in the area.

3.8 Cultural Heritage Impact Assessment

Terrestrial Archaeology

3.8.1 The HKBCF is located in the waters to be north-east of the Airport. It would not have any impacts on known archaeological site. Mitigation measures are therefore not required and there are no residual impacts on terrestrial archaeology.

Built Heritage

3.8.2 The project would not affect any built heritage in the vicinity. Mitigation measures are therefore not required and there are no residual impacts on built heritage.

Marine Archaeology

3.8.3 A literature review has concluded that there are no known marine archaeological sites within the project area which is located along an artificial shoreline. Geophysical survey and subsequent diver survey (conducted by a marine archaeologist) have also confirmed that the proposed reclamation is unlikely to have adverse impacts on marine archaeology.

3.9 Landscape & Visual Impact Assessment

3.9.1 The residual landscape impacts are mainly due to the proposed reclamation works for formation of HKBCF and at-grade HKLR along the southeast coast of Airport Island. The impact would result in direct loss of landscape resources of coastal water and inshore and offshore water landscape characters at the southwest, south and east of Hong Kong International Airport. However, the quantity of loss of the seawater resources and characters is relatively small in comparison to the large extent of adjacent seawater landscape resource / character within inshore and offshore of Airport Island.

3.9.2 Regarding the potential residual visual impacts by HKBCF, they are slight and negligible during construction and operation phases due to the integration of HKBCF and the Airport in view of their similarity in appearance. The amenity value of alternative views from the VSRs is high after the erection of HKBCF and HKLR. Proper mitigation measures (e.g. aesthetic engineering and architectural design for enhancing the aesthetics of HKBCF and HKLR during the detailed design stage) would further minimise any potential visual impacts.

3.9.3 In conclusion, the potential impacts can be effectively reduced by implementing the proposed mitigation measures during construction and operation phases. The overall residual impacts would be treated as “acceptable with mitigation measures” after implementing the mitigation measures.

3.10 Environmental Monitoring & Audit (EM&A)

3.10.1 It is recommended to implement an Environmental Monitoring and Audit (EM&A) programme throughout the entire construction period to monitor the environmental impacts on the neighbouring sensitive receivers regularly.

3.10.2 An EM&A Manual has been prepared as a standalone document to specify the monitoring requirements, timeframe and responsibilities for the implementation of the environmental mitigation measures identified in the EIA process

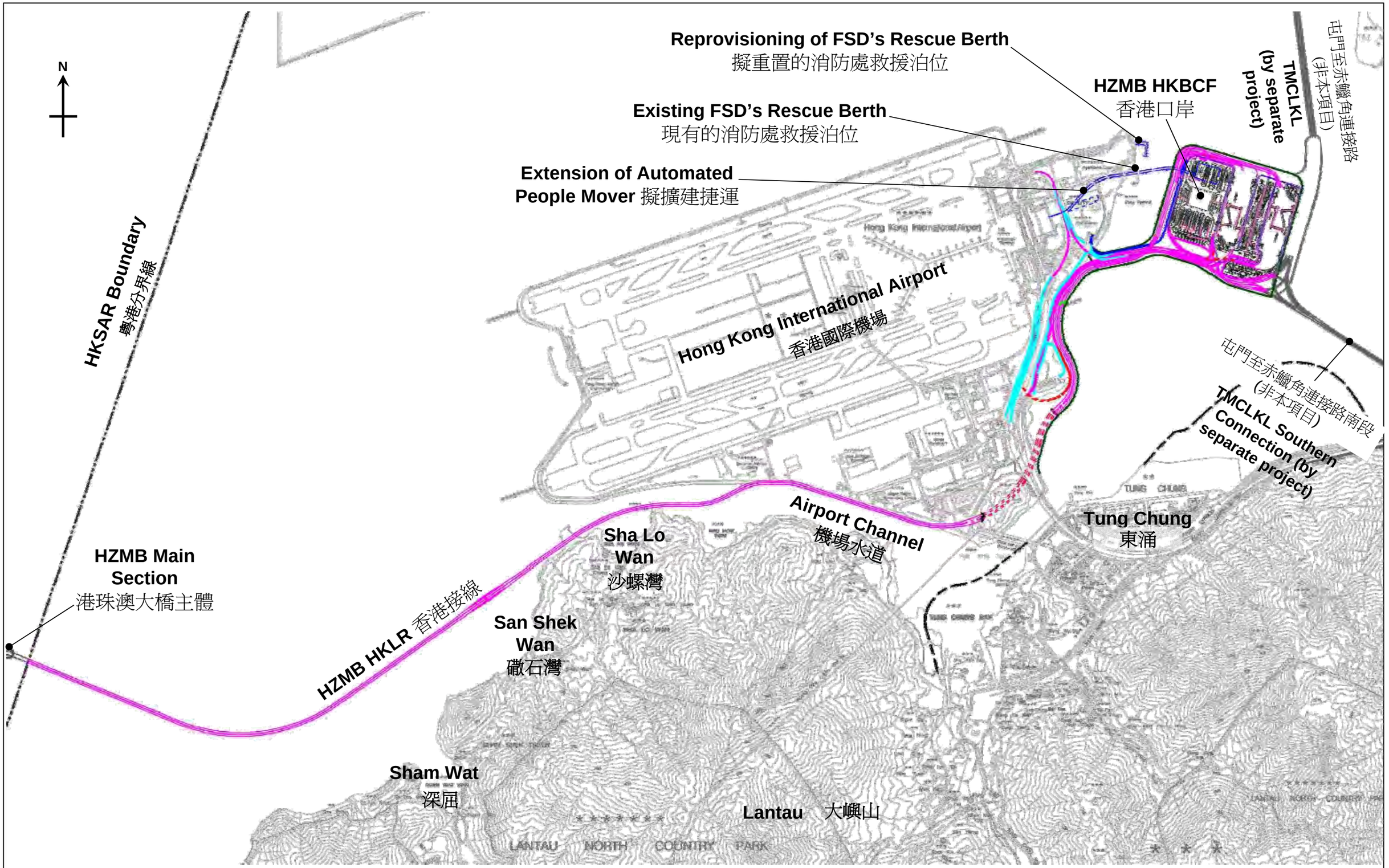
4 OVERALL CONCLUSION

4.1.1 An EIA Report has been carried out to assess the environmental impacts of the HZMB HKBCF in accordance with the requirements as specified in the EIA Study Brief No ESB-183/2008 and the TM-EIAO. All the latest design information has been incorporated into the EIA process. The key aspects that have been considered in this EIA Report include:

- Alternative options;
- Air quality impact;
- Noise impact;
- Sediment quality;
- Waste management;
- Water quality impact;
- Ecological impact;
- Fisheries impact;
- Cultural heritage impact;
- Landscape and visual impact;
- EM&A requirements.

4.1.2 Overall, the EIA Report has predicted that the Project would be environmentally acceptable with the implementation of the proposed mitigation measures for construction and operation phases. An environmental monitoring and audit programme has been recommended to ensure the effectiveness of recommended mitigation measures.

FIGURES



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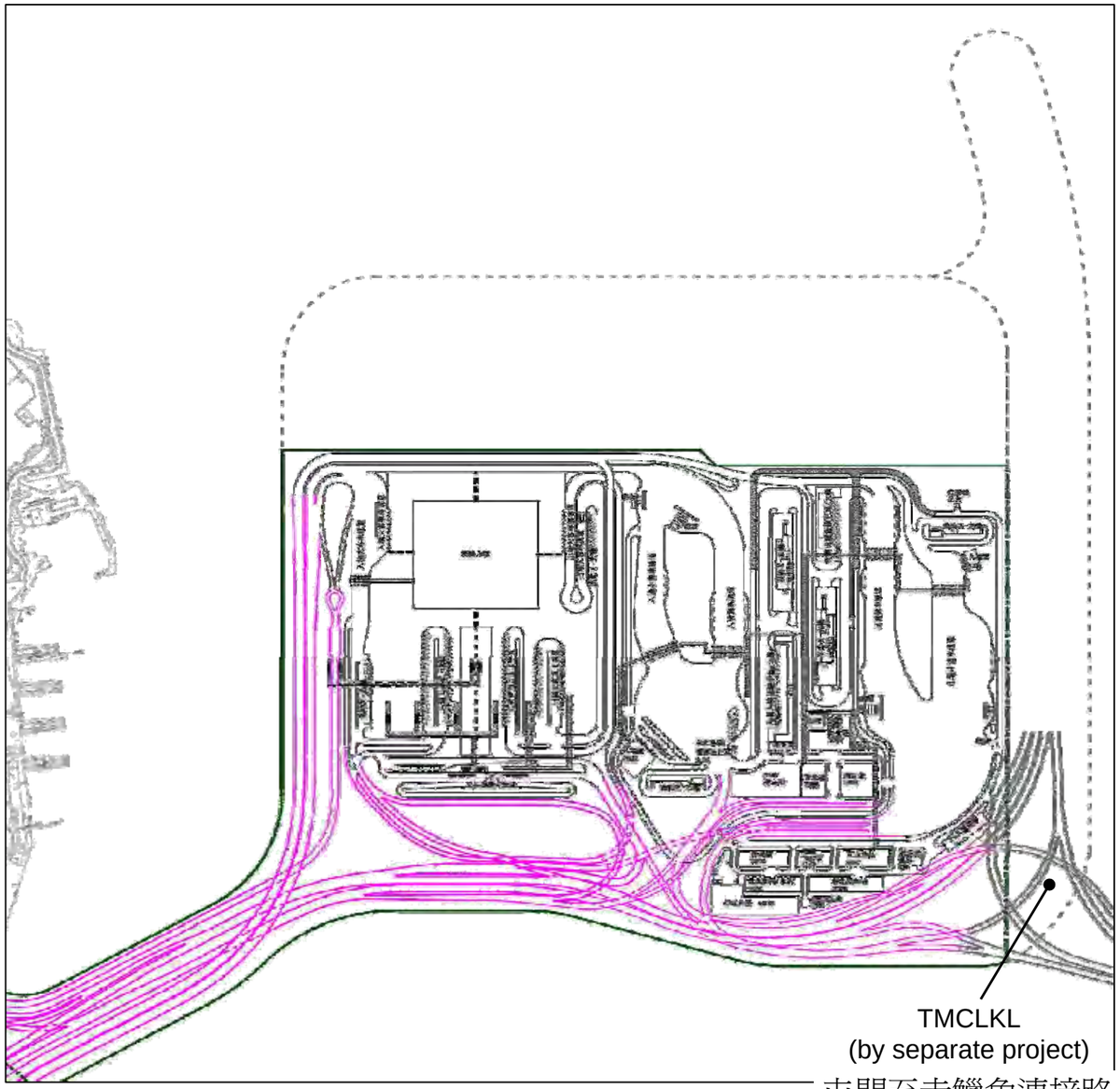
ARUP 奧雅納工程顧問 Ove Arup & Partners Hong Kong Limited

Drawing Title:

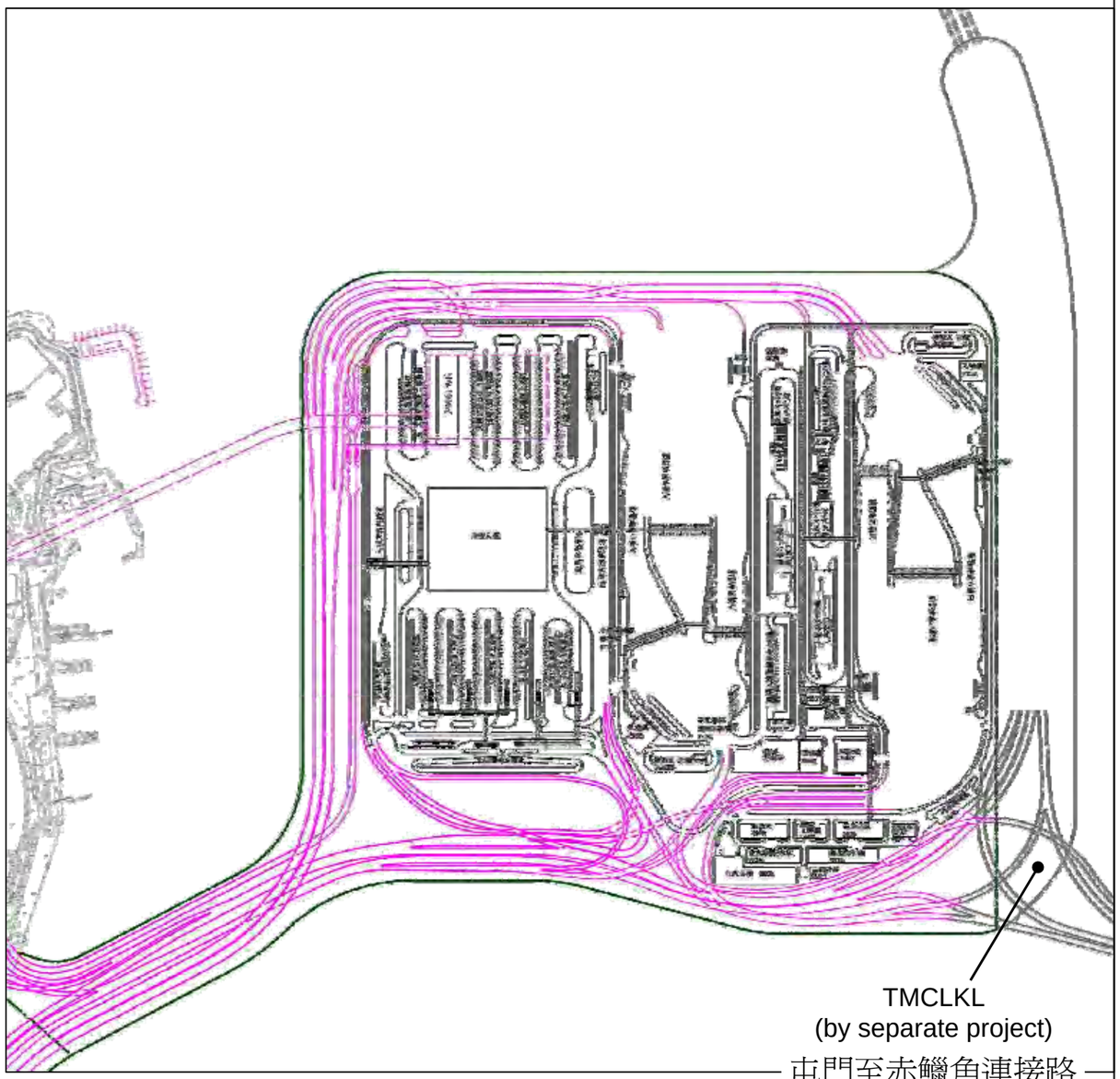
Overall Layout of HKLR and HKBCF 香港接線和香港口岸整體方案

Drawing No.:

Figure 1.1
圖 1.1



First Phase of HKBCF
香港口岸第一階段



Full Phase of HKBCF
香港口岸完成階段

路政署 HIGHWAYS DEPARTMENT
港珠澳大橋香港工程管理處 Hong Kong - Zhuhai - Macao Bridge Hong Kong Project Management Office

ARUP 奧雅納工程顧問 Ove Arup & Partners Hong Kong Limited

Drawing Title:

Implementation Phases of HKBCF 香港口岸實施階段

Drawing No.:

Figure 1.2
圖 1.2

N

粵港分界線
HKSAR Boundary

HZMB Main Section
港珠澳大橋主體

WCLK
西面海域方案

香港國際機場
HKIA

NECLK
機場島東北水域方案

SWCLK
機場島內方案

SSW
磡石灣方案

San Shek Wan
磡石灣

TCB
東涌灣方案

Tung Chung
東涌

TH
大蠔方案

大嶼山物流園
Lantau Logistics Park

Tai Ho Wan
大蠔灣

Future Tung Chung East and West Developments
東涌未來發展區

Lantau
大嶼山

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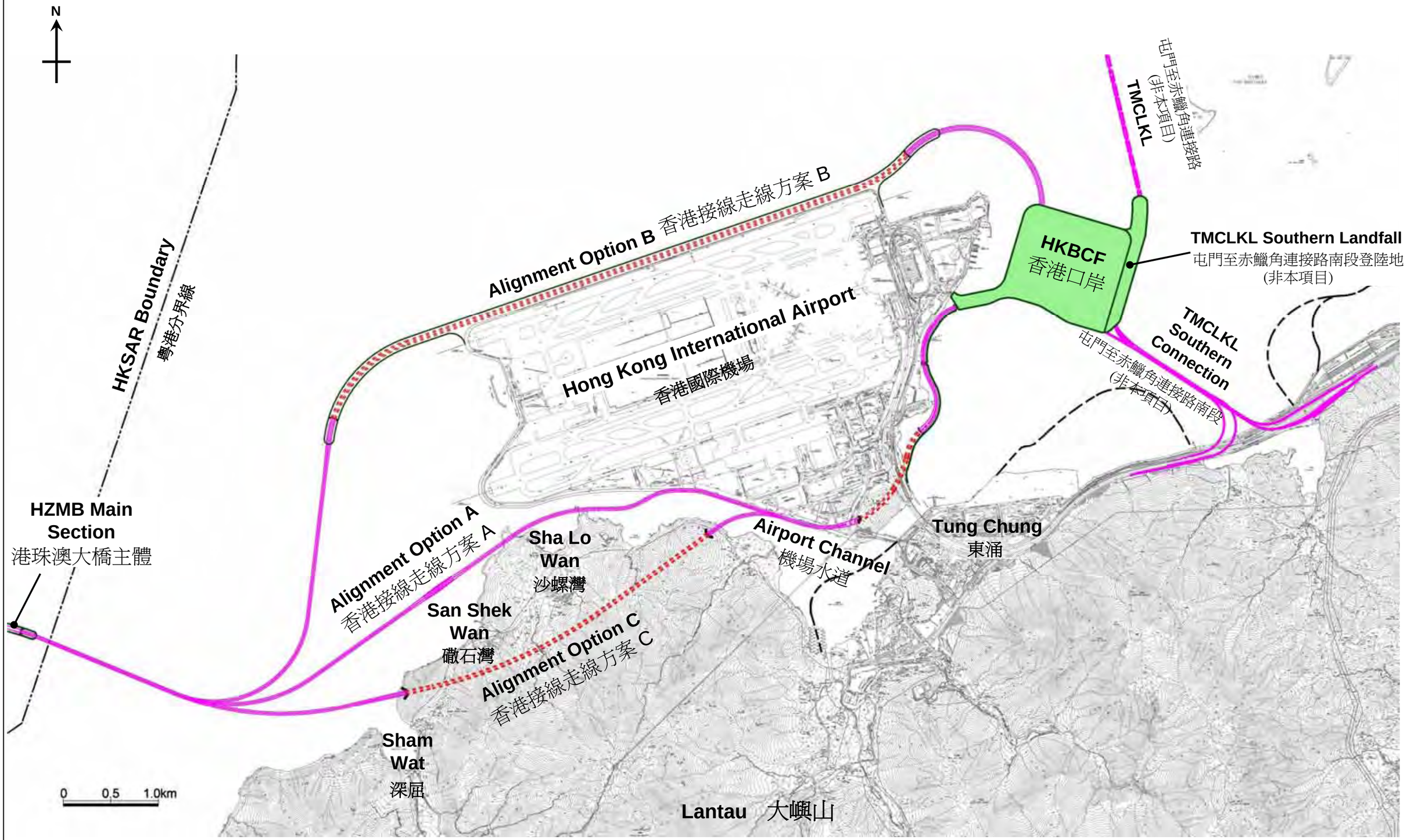

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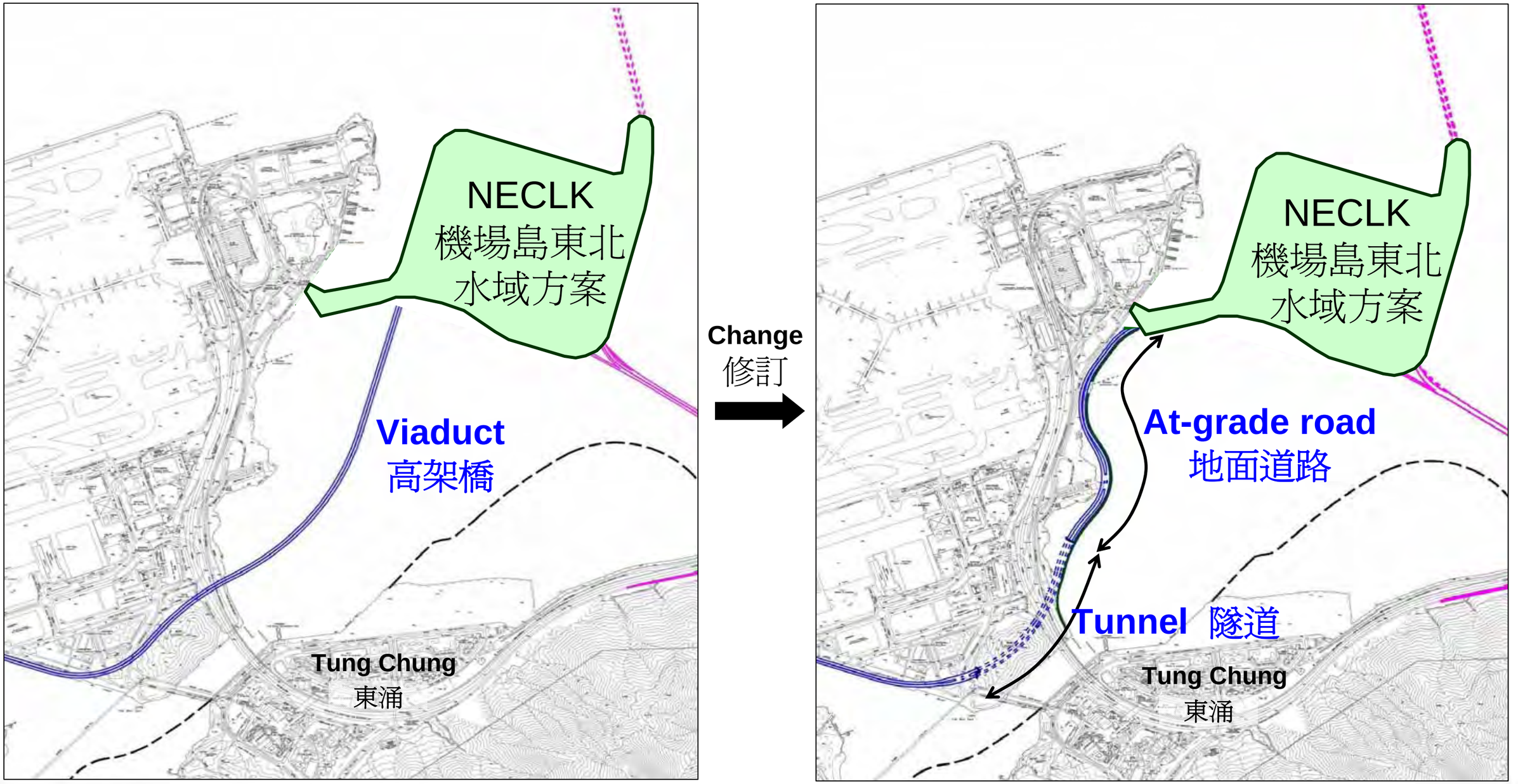
Tunnel cum At-grade Road Scheme for HKLR 香港接線隧道暨地面道路方案

- A section of viaduct of the HKLR near Tung Chung has been changed to a combination of tunnel and at-grade road.香港接線近東涌段的高架橋已修訂爲隧道及地面道路



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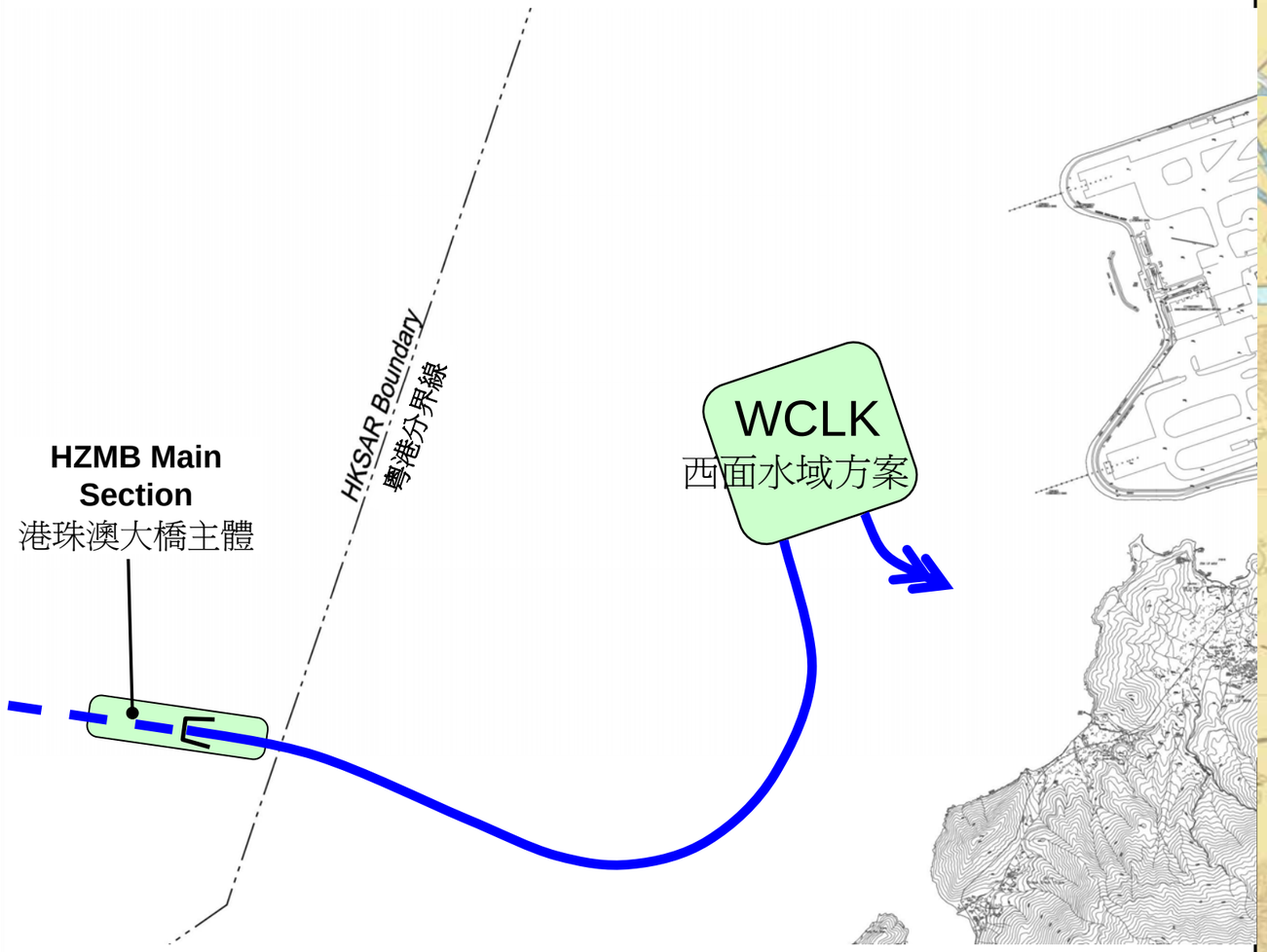

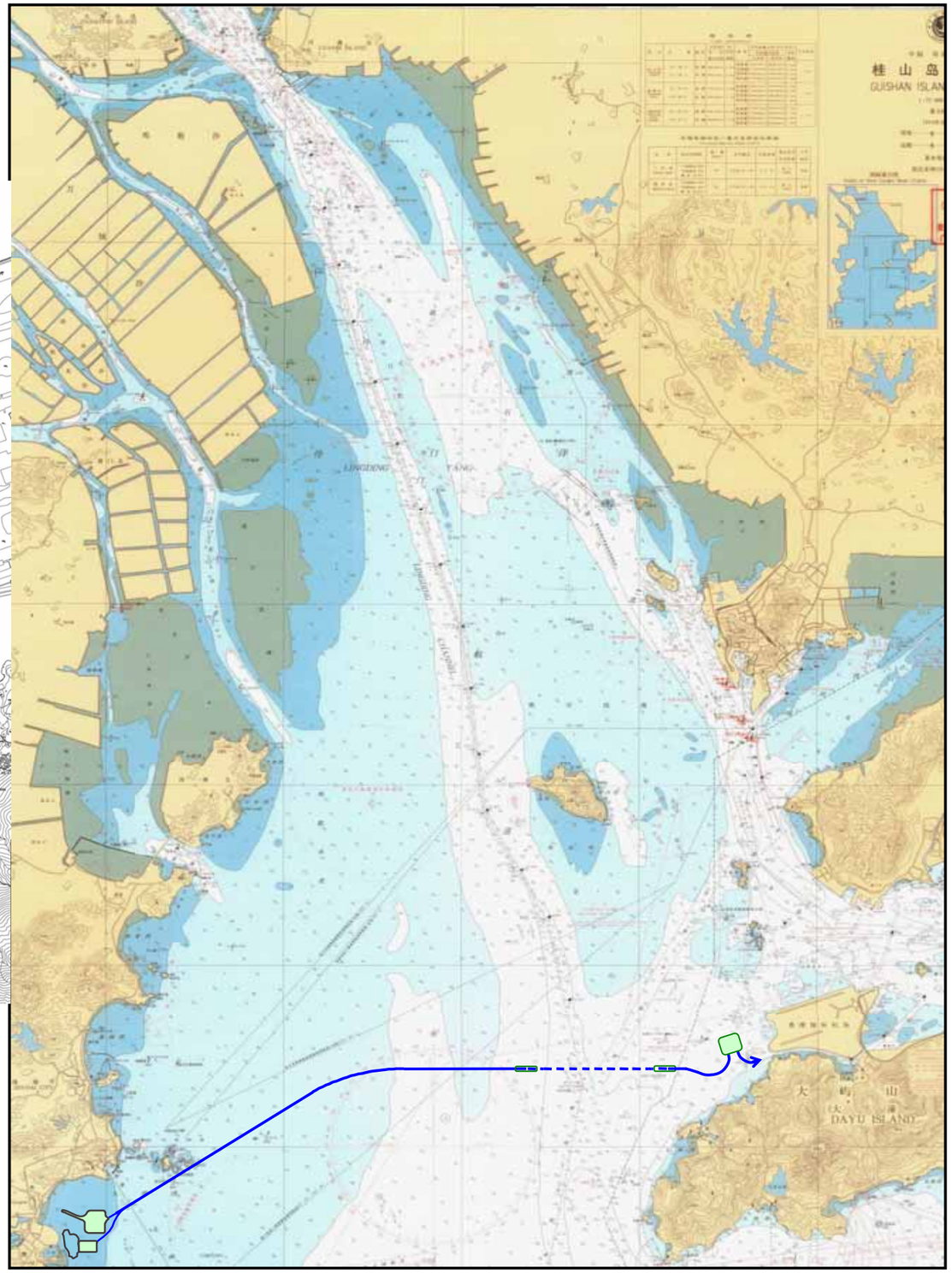

- **Serious impact on the flow and flood discharging ability at the upstream of Pearl River Estuary.**
- 影響珠江口的洩洪能力

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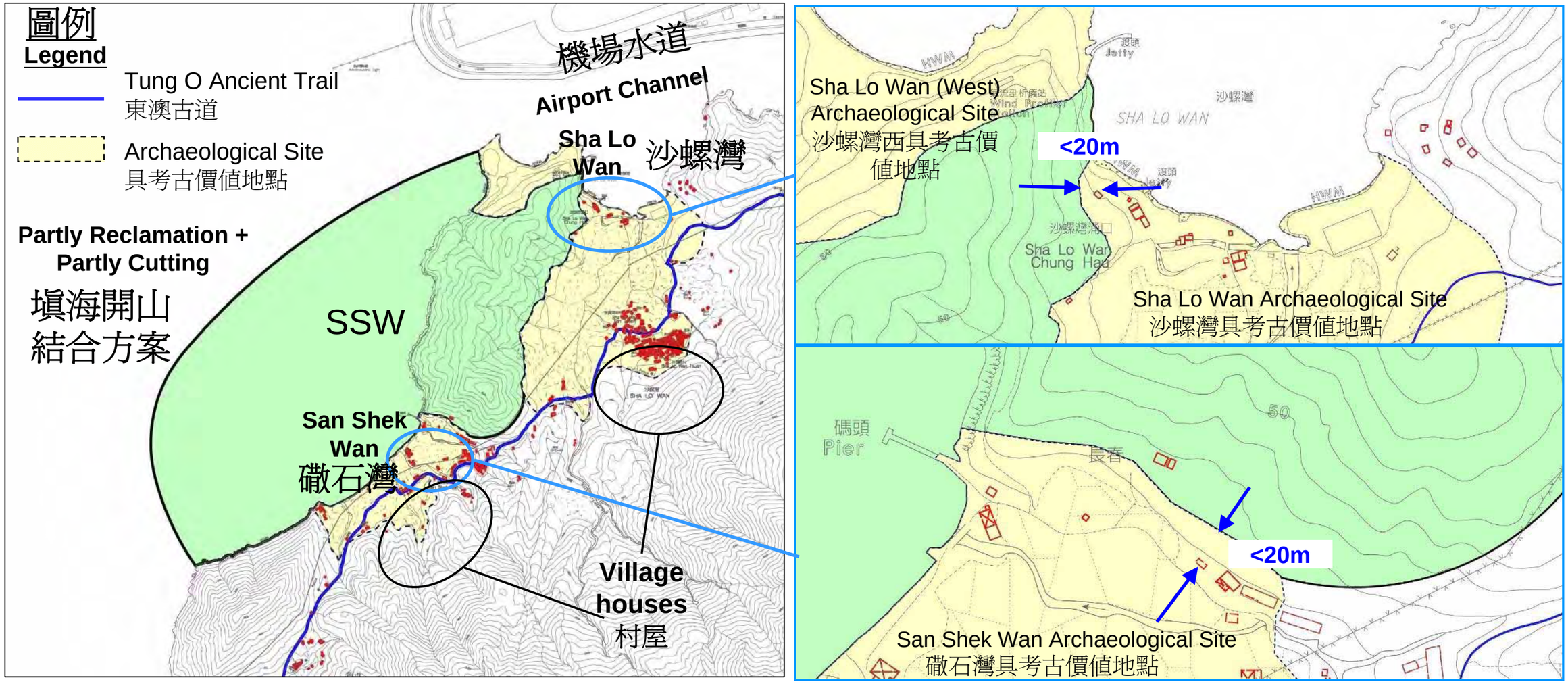

- Extremely close to village houses at San Shek Wan and Sha Lo Wan ➔ non-compliance with air-quality and noise criteria
- Substantial hillside cutting (~15 Million m^3), and damage to natural woodland (~35 hectares)➔ Serious impact on the natural setting of North Lantau
- Loss of natural shoreline (~2km)

- 非常接近沙螺灣的村屋 ➔ 嚴重影響環境
- 大量削坡 (~150萬平方米)和破壞天然林木 (~35公頃) ➔ 嚴重影響大嶼山生態環境
- 破壞天然海岸線(~2公里)

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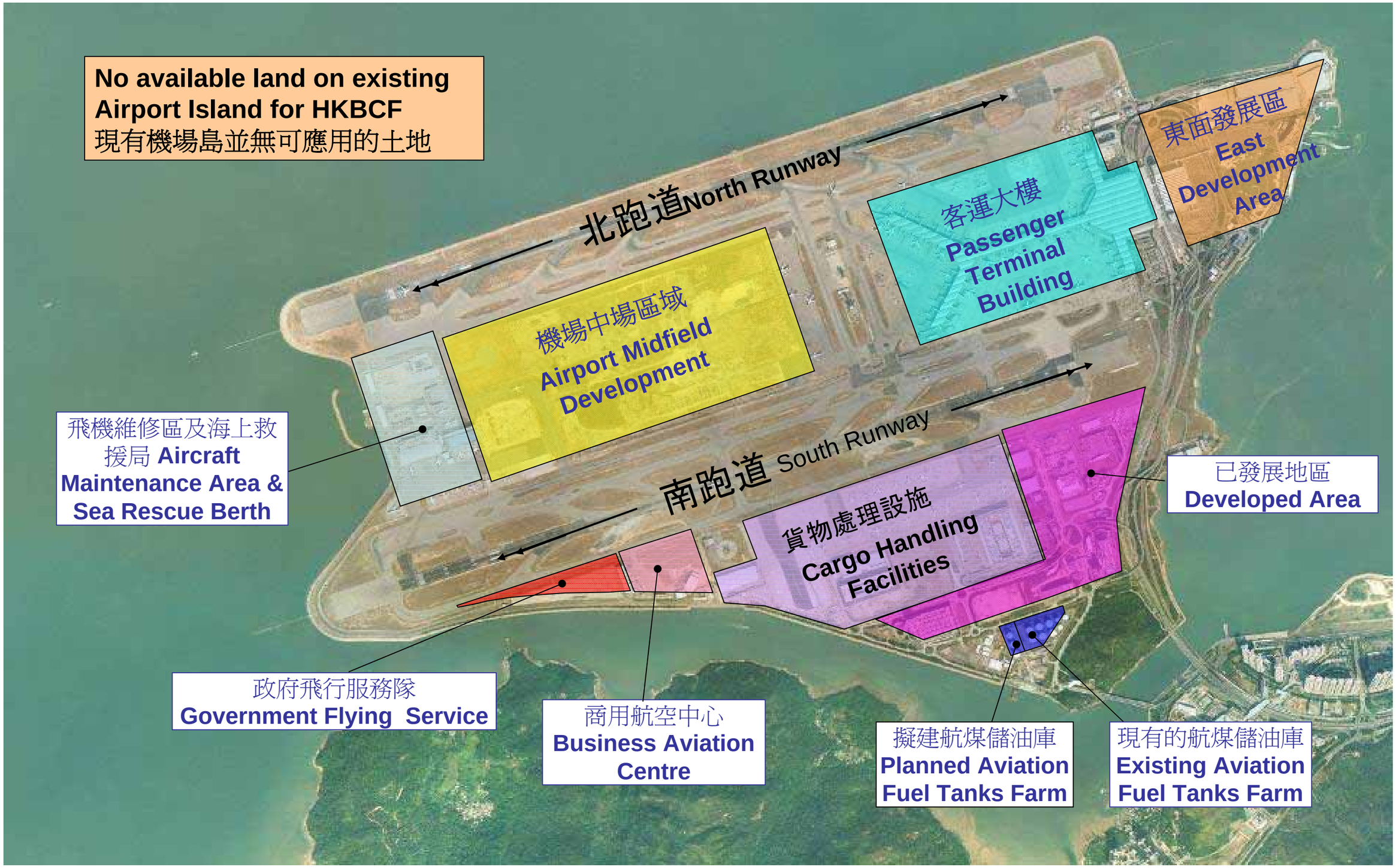

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Drawing Title:

HKBCF – Option SWCLK 香港口岸 – 機場島內方案

Drawing No.:

Figure 2.6
圖 2.6

- **Too close to residents** 非常接近民居
- **Conflict with future planning** 影響東涌未來發展規劃
- **Only ~50ha, not sufficient for entire HKBCF** 面積不足以容納整個香港口岸 **(see Inset 見插頁 P)**

HKIA
香港國際機場

Ha Law Wan
Archaeological Site
蝦螺灣考古地點

San Tau
Archaeological Site
磡頭考古地點

San Tau SSSI
磡頭具特殊科學價值地點

Cable Car 纜車

Tung Chung Crescent
東堤灣畔

Ma Wan Chung Archaeological Site
馬灣涌考古地點

TCB
東涌灣方案

Ma Wan Chung village
馬灣涌村

~100m

Yat Tung Estate
逸東邨

Cable Tower
纜車支塔

Tung O Ancient Trail
東澳古道

Country Park
郊野公園

Sha Tsui Tau
Archaeological Site
沙咀頭考古地點

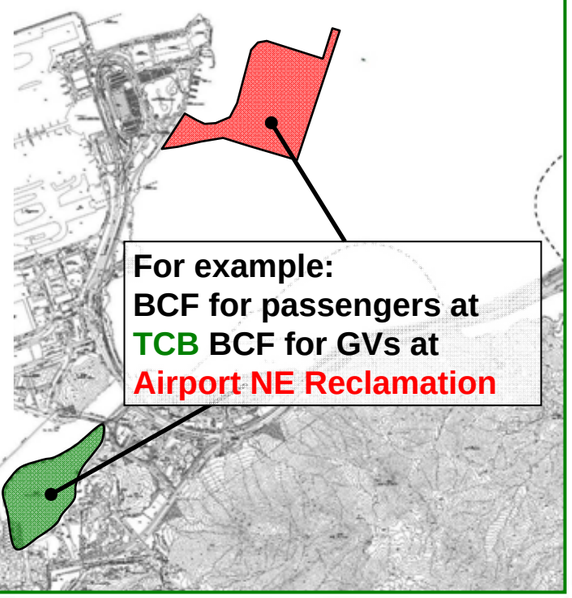
Inset 插頁 P

TCB Not sufficient for entire HKBCF thus require HKBCF splitting into parts

⇒ Need to identify other site(s) for remaining part(s) of HKBCF

基於東涌灣面積所限，香港口岸必需要分開兩部分

⇒ 需要爲香港口岸餘下部分另覓選址



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HKBCF – Option TCB 香港口岸 –東涌灣方案

Figure 2.7
圖 2.7

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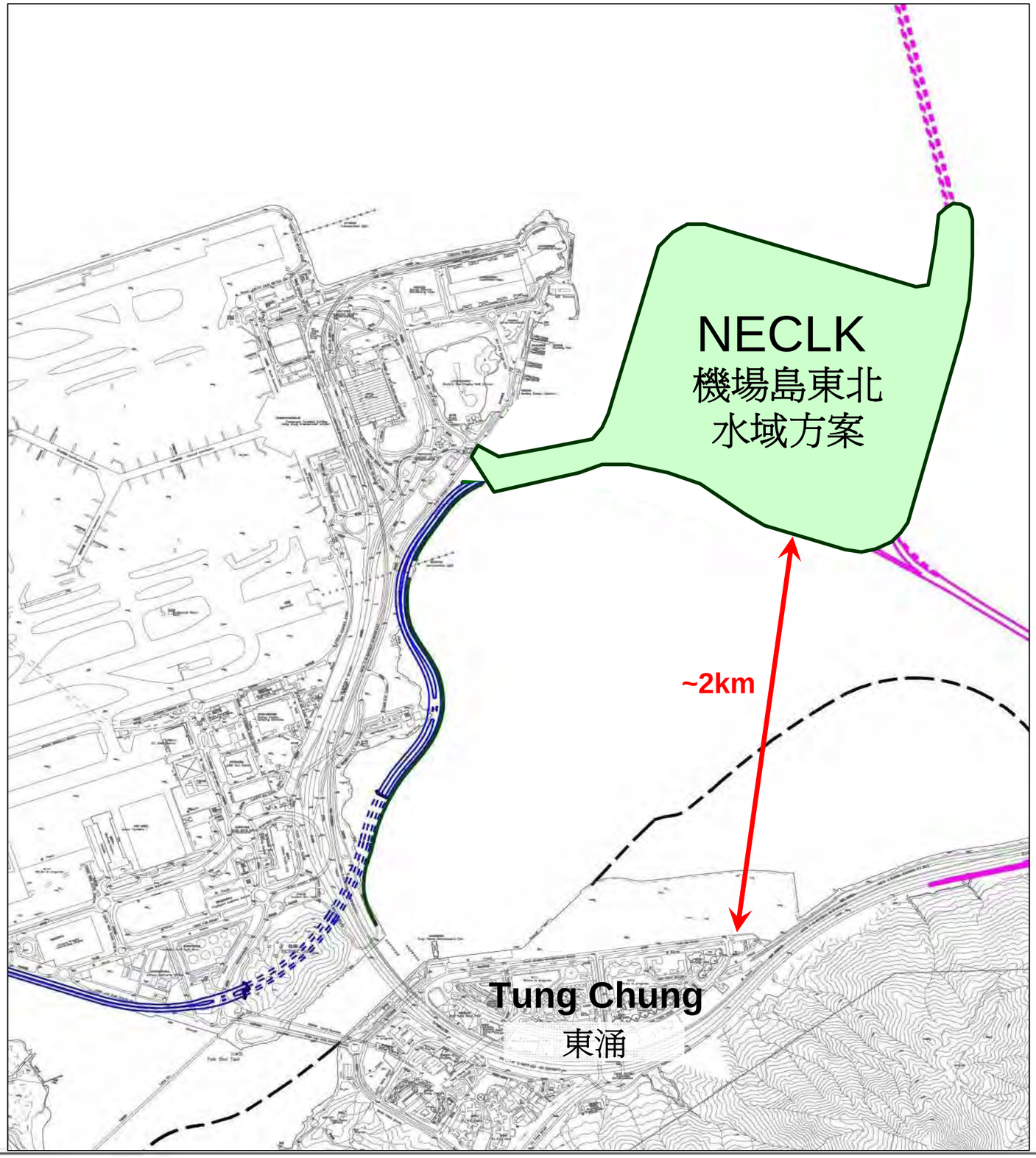
Drawing Title:

HKBCF – Option TH 香港口岸 – 大蠔方案

Drawing No.:

Figure 2.8
圖 2.8



路政署
HIGHWAYS DEPARTMENT
港珠澳大橋香港工程管理處
Hong Kong - Zhuhai - Macao Bridge
Hong Kong Project Management Office

ARUP
奧雅納工程顧問
Ove Arup & Partners
Hong Kong Limited

Drawing Title:

HKBCF – Option NECLK

香港口岸 – 機場島東北水域方案

Drawing No.:

Figure 2.9
圖 2.9

N

HKSAR Boundary
粵港分界線

HZMB Main Section
港珠澳大橋主體

Viaduct
高架橋

Western Navigation Channel

Alignment Option A
走線方案A

Hong Kong International Airport
香港國際機場

Government Flying Service Headquarters
政府飛行服務隊

Touch down zone
著陸點

Southern Runway 南跑道

Airport Road

AEL

HKBCF
香港口岸

At-grade road
地面道路

Tunnel
隧道

Viaduct
高架橋

Reclamation
填海

Scenic Hill
觀景山

Airport Channel
機場水道

Sha Lo Wan
沙螺灣

Hau Hok Wan
鑿殼灣

Viaduct span over
高架橋跨越陸地

Tung Chung
東涌

Cable Car Angle Station
纜車支塔

San Shek Wan
礫石灣

Sham Wat
深屈

Lantau 大嶼山

0 0.5 1.0km

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N

HKSAR Boundary
粵港分界線

HZMB Main Section 擬建之港珠澳大橋主體

Western Navigation Channel

Viaduct
高架橋

Cut and Cover Tunnel on Reclamation 以挖填方式興建的隧道

Alignment Option B 走線方案B

Existing and Proposed Submarine Power Cables
現有海底電纜

Existing Contaminated Mud Pits 現有污染泥料卸置坑

Viaduct
高架橋

HKBCF
香港口岸

Northern Runway北跑道

Hong Kong International Airport
香港國際機場

Airport Channel
機場水道

Tung Chung
東涌

San Shek Wan
磡石灣

Lantau 大嶼山

0 0.5 1.0km

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Drawing Title:

HKLR – Alignment Option B 香港接線 – 走線方案B

Drawing No.:

Figure 2.11
圖 2.11

N

HKSAR Boundary
粵港分界線

HZMB Main Section 擬建之港珠澳大橋主體

Western Navigation Channel

Viaduct
高架橋

0 0.5 1.0km

Hong Kong International Airport
香港國際機場

HKBCF
香港口岸

At-grade road 地面道路

Tunnel
隧道

Viaduct
高架橋

Reclamation
填海

Airport Channel
機場水道

Scenic Hill
觀景山

Tung Chung
東涌

村屋
Village houses

Tunnel隧道

San Tau SSSI
磡頭具特殊科學價值地點

Cable Car Angle Station
纜車支塔

磡石灣
San Shek Wan

Alignment Option C 走線方案C

Archaeological Site具考古價值地點

Rare Species of Seagrasses
稀有海草

Sham Wat
深屈

北大嶼郊野公園
Lantau North Country Park
Lantau North Country Park

Lantau
大嶼山

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港珠澳大橋香港工程管理處
Hong Kong - Zhuhai - Macao Bridge Hong Kong Project Management Office

ARUP 奧雅納工程顧問 Ove Arup & Partners Hong Kong Limited

Drawing Title:

HKLR – Alignment Option C 香港接線 – 走線方案 C

Drawing No.:

Figure 2.12
圖 2.12