# Agreement No. CE 52/2007 (HY)
# Tuen Mun – Chek Lap Kok Link – Investigation

## EIA Report
## Executive Summary

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## FIGURE

# 1. INTRODUCTION

1.1 AECOM Asia Company Ltd. (formerly known as Maunsell Consultants Asia Ltd.) were appointed on 19 May 2008 by Highways Department of the Government of the Hong Kong Special Administrative Region (HyD) to carry out the Assignment on Tuen Mun – Chek Lap Kok Link - Investigation under Agreement No. CE 52/2007 (HY) (the Project).

1.2 According to the findings of the Northwest New Territories (NWNT) Traffic and Infrastructure Review conducted by the Transport Department, Tuen Mun Road, Ting Kau Bridge, Lantau Link and North Lantau Highway (NLH) will be operating beyond capacity after 2016 due to the increase in cross boundary traffic, developments in the NWNT, and possible developments in North Lantau, including the Airport developments, the Lantau Logistics Park (LLP) and the Hong Kong – Zhuhai – Macao Bridge (HZMB). In order to cope with the anticipated traffic demand, two new road sections between NWNT and North Lantau – Tuen Mun – Chek Lap Kok Link (TM-CLKL) and Tuen Mun Western Bypass (TMWB) are proposed.

1.3 The proposed TM-CLKL if combined with the TMWB will provide a direct route linking NWNT and North Lantau, from north to south, the Kong Sham Western Highway (KSWH), port back-up areas in NWNT, Tuen Mun River Trade Terminal, the existing EcoPark in Tuen Mun Area 38, the Airport, the proposed Lantau Logistics Park, HZMB and North Lantau developments. The new connection will significantly reduce the travelling time between the KSWH and the NWNT region at its northern side, and North Lantau at its southern side.

# 2. ALIGNMENT DESCRIPTION

2.1 The previous Feasibility Study initially proposed an alignment of the TM-CLKL comprising a toll plaza island at Tai Mo To and this alignment formed the basis of the EIA Study Brief (ESB 175/2007). However, subsequent to these documents being prepared and based upon the proposed schemes for the Hong Kong-Zhuhai-Macao Bridge (HZMB) and Hong Kong Boundary Crossing Facilities (HKBCF), it was decided to integrate the TM-CLKL southern landfall reclamation with the HKBCF reclamation. It was considered that this arrangement would provide a cost-effective solution to both projects.

2.2 This preferred alignment of TM-CLKL is shown in Figure 1 and will comprise the following parts:

- a reclamation near the Tuen Mun River Trade Terminal forming the landfall for the northern tunnel portal of TM-CLKL;
- a toll plaza, about 0.5km elevated viaduct from the toll plaza formation to the northern tunnel portal on the new reclamation, associated slip roads to connect with Lung Mun Road and Lung Fu Road at Tuen Mun south ;
- about 5km tunnel across the Urmston Road sea channel connecting Tuen Mun with the TM-CLKL/HKBCF reclamation on north-eastern side of Airport Island;
- a reclamation on the north-eastern side of Airport Island (now integrated with the proposed HKBCF) forming the landfall for the southern tunnel portal; and
- a marine viaduct from the southern landfall reclamation/HKBCF to connect to North Lantau Highway at Tai Ho, and associated slip roads to connect with HKBCF.

# 3. ALIGNMENT OPTION SELECTION

AND REFINEMENT

3.1 The TM-CLKL project will be located largely in the north-western waters, an area already subject to large scale development and disturbance. The proposed alignment will also make landing in developed areas, namely the Pillar Point area in Tuen Mun, next to the River Trade Terminal and other industrial and commercial land uses, and in the North Lantau Highway at Tai Ho Wan. Overall, the proposed alignment is some distance from residential developments.

3.2 Notwithstanding, in respect of the ecology of the area, pockets of habitats on the land have ecology value, particularly at Tai Ho, although these would not be directly affected. From a marine ecology perspective, the proposed project will be constructed in waters, which are known to be a habitat for the important Chinese White Dolphins, fisheries and also contains other key species including corals, horseshoe crabs, mangroves and seagrasses. This is an area already subject to considerable disturbance because of other development projects and existing uses. The area is not known to give rise to notable benthos of significant abundance and diversity.

3.3 Maintaining these existing environmental conditions, as far as practicable, has been a major objective during the selection of a preferred route and design of the selected alignment. A detailed option assessment of various alignments has been undertaken and the ultimate alignment selected on the basis that it was preferred on environmental grounds, as well as meeting all the necessary engineering and operation constraints and requirements. The current preferred route has been designed in order to reach an alignment which can be stated as representing the optimum route after balancing all relevant requirements and constraints.

3.4 The main characteristics of the alignment which have been selected and designed to minimise the environmental effects of the Project include:

- combining the TM-CLKL southern landfall reclamation with the HKBCF to minimize reclamation area and habitat loss;
- combining the TM-CLKL southern landfall reclamation with the HKBCF to avoid the coral and horseshoe crab habitats at Tai Mo To inter-tidal and sub-tidal areas;
- as Tunnel Boring Machine (TBM) is not possible for the southern connection from the southern landfall towards North Lantau, a viaduct, as opposed to the Immersed Tube Tunnel (IMT), has been selected to, also, minimise seabed disturbance and loss;
- avoiding large areas of dredging works and reducing impacts on the seabed and benthic community by using TBM method instead of an IMT for the section of tunnel between the northern and southern landfalls;
- adopting a viaduct to connect the southern landfall / HKBCF to the existing North Lantau Highway to minimise seabed disturbance and loss arising from extra reclamations required for tunnel option;
- use of non-dredge reclamation techniques where possible to avoid sediment dredging and removal, thus minimising impacts to water quality and ecological sensitive receivers;
- relocating the toll plaza from reclaimed land to Tuen Mun Area 46, thereby reducing the extent of the southern landfall reclamation;
- for land based works, proposing to use land which is already disturbed and/or developed as far as possible, thus, minimising effects on natural terrestrial habitats;

- works areas for site office and storage will be located on sites already used as works areas or are on disturbed and developed land;
- optimisation of the tunnel level and profile to minimise the generation of C&D materials and C&D waste;
- maximisation of cut slope angles in order to reduce the amount of spoil generated and to minimise the footprint of the works;
- selection of bored piling methods for the marine viaduct, thereby avoiding high-intensity noise impacts from percussive piling which is capable of inducing physical injury to Chinese White Dolphins;
- no 'rainbowing' with use of trailer barges; and
- construction of seawalls to be advanced by at least 200m prior to reclamation dredging and filling activities to minimise dispersion of suspended solids.

## 4. CONCURRENT PROJECTS

4.1 The southern landfall reclamation of the TM-CLKL forms an integrated part of the HKBCF reclamation, and interfaces with the latter along its eastern edge. Reclamation works sequencing and programme have been planned to match those of the HKBCF in order to achieve an assumed Phase 1 commissioning date target in 2015. The HKLR is also scheduled to open in 2015 in matching the Phase 1 commissioning date of the HKBCF. This construction programme comprising the use of non-dredge methods for reclamation together with more extensive preloading surcharge would result in less water quality impacts, and can still meet the vital programming target for HKBCF. It should be noted that an alternative construction programme, adopting a series of temporary seawalls (including one at the project interface) and full-dredging around local programme critical areas, will enable Phase 1 to be completed by 2014. This 2014 programme will provide margin to enable the project to gain back delays. With respect to potential environmental impacts, these two programmes would have different levels of construction phase water quality impacts, and both have been modelled and assessed. Detailed coordination of the interfacing construction activities will be required, including construction access, layout of mitigation measures to control water quality during the construction stage, joint water quality monitoring system, and engineering and construction details at the interface.

4.2 Notwithstanding the fact that the TM-CLKL+HKBCF+HKLR would be constructed and implemented together, it has also been necessary to take into account other projects that may be constructed or be in place during the operation phase of the three projects and which could result in cumulative impacts. As such, all probable concurrent projects which could result in cumulative impacts during the construction and operation of the combined projects have been included in the assessment. These include the following:

- Tuen Mun Western By-pass;
- Proposed Lantau Logistics Park (LLP) and possible LLP extension or other compatible uses;
- Further Tung Chung East and West Developments;
- Existing and Proposed Contaminated Mud Disposal Facility at East of Sha Chau and South of Brothers;
- Mud Disposal Facility at North Brothers;
- Road P1 (Eastern Section);
- Kwai Tsing Basin; and

- Tonggu Channel maintenance dredging.

## 5. ENVIRONMENTAL IMPACT ASSESSMENT

5.1 The Project is a designated project under Section A.1 of Schedule 2 of the Environmental Impact Assessment Ordinance (EIAO). As such, the statutory procedures under the EIAO need to be followed and an environmental permit (EP) will be required prior to the commencement of construction. Thus, as part of this assignment, an Environmental Impact Assessment (EIA) is required to assess the potential impacts of the construction and operation of the Project.

5.2 The assessment of construction related impacts have included: air quality, noise, water quality, construction waste and contaminated land, ecology and fisheries, cultural heritage, landscape and visual and landfill gas hazards. The assessment of impacts during the operation of the Project has included: air quality, noise, water quality, ecology and fisheries, landscape and visual, landfill gas hazards and heritage impacts.

## 6. KEY FINDINGS OF THE EIA

6.1 In total, eleven different environmental parameters have been evaluated as part of the EIA and the impacts associated with each, as a result of the implementation of the Project, predicted. Where necessary, mitigation measures have been recommended to ameliorate any impacts. The eleven environmental parameters covered by the assessment are:

- air quality;
- noise;
- water quality;
- marine ecology and fisheries;
- terrestrial ecology;
- waste management;
- contaminated land;
- landscape and visual;
- cultural heritage; and
- landfill gas hazards.

6.2 A summary of the results and mitigation are provided below.

*Air Quality*

6.3 Construction phase dust impacts can be generally reduced to acceptable levels with the implementation of suitable measures comprising watering of exposed reclamation areas, haul roads and soil stockpiles on a frequent basis. Annual dust results will result in some exceedances at some non-residential sensitive receivers in Pillar Point. However, the contribution from the Project is limited and the exceedances are largely as a result of the background levels.

6.4 In respect of operation air quality, comprehensive modelling has been undertaken. The air quality background level for the future year of 2031 has been predicted using the PATH model and has taken into account key pollution sources such as power stations, the airport, marine traffic, industrial chimneys as well as emissions within Pearl River Delta Economic Zone.

6.5 Modelling for emission from traffic on open roads, tunnel portals, ventilation shafts, idling traffic for both the TM-CLKL and other concurrent projects as noted above, was undertaken and the results combined with the background levels. With the background data the results of the modelling show that the cumulative air quality levels will overall comply with the Air Quality Objectives for nitrogen dioxide ($NO_2$) and respirable suspended particulates (RSP) and no mitigation measures are required.

*Noise*

6.6 There are no noise sensitive receivers (NSR) at the northern end of the alignment and as such the noise assessment has focussed on the Project implementation in north Lantau at Tai Ho Wan.

6.7 Based upon the distance between the proposed works and the closest NSR at Pak Mong near Tai Ho Wan, no exceedances of the construction noise levels are predicted from the proposed pier and viaduct construction in the area and, therefore, no mitigation measures are required.

6.8 Without mitigation, the operation phase noise modelling has concluded that the existing roads are the main noise sources in the area, with the contribution from the TM-CLKL negligible and not exceeding 1 dB(A).

*Water Quality*

6.9 It is proposed that the TM-CLKL, HKBCF and HKLR will be constructed concurrently and the completed reclamations and road connections associated with each development could impact on local and large scale tidal flows with adverse impacts on the marine water quality and the marine environment. With respect to construction impacts on the marine environment, all three projects could result in the loss of fine sediment to suspension during the reclamation and related construction works.

6.10 Therefore, the assessment of impacts to the marine environment of any one of these projects individually would not reflect the potential impacts that could occur from their concurrent construction and implementation. As such, in order to fully assess the impacts from the three projects, the water quality assessment comprises a tidal hydraulic and marine water quality study during both the construction and operation phases of all three projects combined (TM-CLKL+HKBCF+HKLR).

6.11 There are a number of important water sensitive receivers (WSRs) within the study area, including areas of ecological sensitivity and conservation importance, commercial fishing resources, areas of direct human contact, e.g. bathing beaches, and various points where seawater is abstracted for domestic, commercial or industrial purposes. The Chinese White Dolphin (*Sousa chinensis*) is frequently observed within the study area. Other features of conservation concern in the wider study area include the mangrove stands and seagrasses at Tai Ho and along the Airport Channel, Sha Lo Wan and San Tau.

6.12 Tuen Mun is the home to a large offshore fishing fleet and the North-western waters support an important spawning ground and commercial fishery industry for a variety of fish species and shrimps. As such, there is a need to protect against any deterioration of water quality itself and any associated secondary impacts on ecological receivers from the construction and operation of the Project.

6.13 During the operation phase, potential impacts are associated with any effects the proposed reclamations will have on the larger scale flows in the area and any consequent deterioration in water quality. However, the 3D water quality modelling has shown that proposed developments will not result in any significant change to the residual flow patterns and only marginal increases/decreases in the water quality parameters will occur. All parameters, however, are expected to stay within the relevant criteria and significant water quality impacts as a result of the projects are not predicted.

6.14 However, the principal water quality concern relates to disturbance to the seabed during the construction period.

There will be a need for extensive dredging and filling for both the seawalls and the reclamations for all three projects. These operations will inevitably result in the loss of sediments and backfilling materials into the water column where they will add to the suspended sediment load. In order to keep the losses to a minimum, a series of integrated measures have been included into the construction methodology. Apart from those detailed in Section 3 above, some measures also include:

- the bored piling for the marine viaducts will be undertaken within a metal casing to limit any dispersal of the sediment in the short time when sediment is removed from the top;
- where public fill is proposed for filling below +2.5mPD, the fine content in the public fill will be controlled to 25% which is in line with the CEDD's General Specification; and
- while controlled, the fine contents of the public fill would normally be higher than sand and rock fills and potentially causing more severe water quality impacts. Thus, the use of public fill for filling below +2.5mPD is controlled to minimise the generation of suspended solids associated will filling activities.

6.15 Three worst case time periods in 2011, 2012 and 2013 have been selected to assess the construction phase water quality impacts throughout the construction period. An alternative construction sequence that could further minimise the potential water quality impacts has also been modelled and assessed.

6.16 As the majority of the projects are located in the relatively sheltered East Tung Chung Bay area, the modelling has shown that sediment plumes are largely retained within the vicinity of the site and do not spread significant distances. Sediment deposition is also the highest in the project area. However, as the predicted maximum suspended solid elevations could exceed the Water Quality Objectives (WQOs) at some sensitive receivers around the project site, mitigation measures have been recommended.

6.17 In addition to the integrated measures above, the mitigation for the marine works will comprise:

- standard good dredging practice measures;
- silt curtains (cage type) to be applied round all grab dredgers;
- single layer silt curtains will be applied around all works as defined in the EIA Report;
- silt curtain to be deployed to protect the Airport north-eastern water intake;
- one side of the seawall for Portion D of the HKBCF should be constructed first and prior to the other works;
- a sheet piled wall shall be constructed north of the HKBCF in order to allow the use of silt curtains during Phase 2 works; and
- silt curtain shall be fully maintained throughout the works.

6.18 The artificial reef at the north-east of the Airport Island will be affected even with the above mitigation applied and, therefore, in order to compensate for these impacts, a replacement artificial reef of the equivalent size will be provided as mitigation. Further, as an additional enhancement measure, a further artificial reef of twice the size of the one affected will also be deployed.

6.19 Construction run-off from land based works can be controlled through a series of good house keeping measures and significant impacts are not predicted.

6.20 The recommended mitigation measures are predicted to be sufficient to control

water quality impacts to acceptable levels during both the construction and operation phases. Thus, no adverse residual water quality impacts are predicted.

*Terrestrial Ecology*

6.21 Operation impacts to terrestrial ecology are not predicted as the Project is located within areas in north Lantau and Pillar Point which are already subject to disturbance.

6.22 However, during the construction phase, the study area contains many key ecological resources which may be affected. However, the Project has avoided and minimised key terrestrial habitats as far as possible by proposing to use land which is, overall, already disturbed and/or developed. In Tuen Mun, the landfall and toll plaza area is commercial and industrial in nature and only the fringes of natural habitats would be affected. In north Lantau, while the TM-CLKL makes landfall at the ecological sensitive Tai Ho Wan, the alignment would be some distance from the San Tau Beach (about 4.2km) and Tai Ho Stream SSSIs (about 600m) and not directly affect these areas, interfacing instead with the North Lantau Highway which is formed on reclaimed land and already disturbed.

6.23 However, some impacts will occur and some of the key habitats and species of concern, which may be affected to varying degrees if mitigation and enhancement measures are not applied, include:

- Loss of about 10ha of plantation woodland and tall shrubland in Area 46, Tuen Mun;
- pitcher plant colony in tall shrubland in Tuen Mun; and
- stream in north Lantau during slope works.

6.24 As such, the following mitigation and enhancement measures are proposed:

- restoration of disturbed areas in accordance with the landscape proposal;
- cut slopes for the new road should be landscaped using environmentally-sensitive bio-engineering measures as described in GEO (2000) such as incorporating a 'stepped' design with soil in the resultant terraces to facilitate establishment of vegetation.
- planting of 33ha within the site boundary as an enhancement measure for vegetation loss;
- installation of site hoarding to protect the Pitcher Plants; and
- undertake works near north Lantau stream in the dry season.

6.25 Further minimisation of construction impacts can also be achieved through good construction practice measures which should be implemented and should include:

- avoid damage and disturbance to the remaining and surrounding natural habitat;
- placement of equipment in designated areas within the existing disturbed land;
- spoil heaps should be covered at all times;
- construction activities should be restricted to the proposed works boundary; and
- disturbed areas to be reinstated immediately after completion of the works.

6.26 The proposed mitigation measures are considered adequate overall to fully mitigate all identified terrestrial impacts.

*Marine Ecology and Fisheries*

6.27 The Project largely comprises marine works in the form of reclamations,

tunnelling and marine viaduct works which could affect the marine ecological sensitive receivers and fisheries resources and operations both, temporarily during construction or permanently as a result of habitat losses.

6.28 The North-western waters provides habitat for a number of key sensitive receivers including the following:

- Chinese White Dolphins (*Sousa chinensis*);
- Marine benthic macrofauna;
- Intertidal flora and fauna including seagrasses, mangroves and horseshoe crabs;
- Corals;
- Artificial reefs (ARs) at Airport East Exclusion Zone and Sha Chau;
- the Sha Chau and Lung Kwu Chau Marine Park;
- SSSIs at San Tau and Tai Ho Wan;
- Ma Wan Fish Culture Zone (FCZ); and
- Spawning/nursery grounds for fish and shrimp.

6.29 The selected scheme has avoided or minimised impacts to the marine ecological environment and fisheries resources through the following:

- avoiding the coral and horseshoe crab habitats at Tai Mo To inter-tidal and sub-tidal areas;
- minimising impacts to prime dolphin habitat at Tai Mo To;
- avoiding large areas of dredging work and reducing impact on the seabed, benthic community and fisheries by using TBM instead of IMT;
- combining the TM-CLKL southern landfall reclamation with the HKBCF to minimize reclamation area and thus also reduce habitat and fishing ground loss; and
- use of non-dredge reclamation techniques where possible to avoid sediment dredging and removal.

6.30 In addition, based upon the water quality modelling, impacts associated with elevated suspended solids and changes to flows during the construction and operation phases are not expected with the exception of impacts on the artificial reef as noted above. Notwithstanding, besides the effects on the artificial reef, the following significant impacts are also predicted:

- Construction phase impacts on the Chinese White Dolphin including:
  - Blockages of travel corridor;
  - Acoustic disturbance from dredging and reclamation;
  - Acoustic disturbance from sheet and bored piling ; and
  - Injury/Mortality or Disturbance from Vessel Traffic.
- Operation phase impacts on the Chinese White Dolphin from permanent loss of habitat.

6.31 With respect to the fisheries resources and operation, while the project related reclamation works would results in some losses of fishing grounds both permanently for the footprints of the Project and temporarily for the working areas, the associated impacts are not significant as it only represents a small fraction of available fishing grounds in Hong Kong waters and the affected areas are not particularly productive.

6.32 In order to mitigate the predicted impacts, the following mitigation measures and ecological monitoring have been recommended:

- pre, during and post construction Dolphin Monitoring;
- use of acoustic decoupling methods to minimise noise being transmitted through the dredging and reclamation barges;
- no driving of metal casing for bored piling during the peak dolphin calving season of May and June;
- 250m dolphin exclusion zone during dredging, reclamation, sheet piling and bored piling works;
- deployment of artificial reef of same size as that to be affected in conjunction with the HKBCF project; and
- re-created habitat at new seawalls constructed at southern and northern landfall reclamations.

6.33 The application of the above mitigation measures, together with the proposed ecological monitoring is considered sufficient to mitigate the predicted impacts from the TM-CLKL and, therefore, overall no adverse residual ecological impacts are predicted for either the construction or operation phases of the Project. Significant impacts to fisheries resources in the study area are not expected based upon the fact that the mitigation measures recommended to protect water quality sensitive receivers would, also, be adequate to minimise adverse impacts to fisheries resources.

6.34 In addition to the impacts above, there will be a permanent loss of coral habitat containing some colonies at Pillar Point, although provision of new seawall would help with the recolonisation of the corals and the impact would not be significant given the low ecological value of the habitat. However, as an additional precautionary and enhancement measure, coral translocation is recommended subject to the findings of a pre-construction baseline survey and further discussions with the relevant authorities.

6.35 In addition to the above, deployment of an extra area of artificial reef, twice the size of that affected is also recommended as an ecological and fisheries enhancement measure.

*Waste and Contaminated Land*

6.36 No contaminated land will be affected by the Project.

6.37 In respect of waste management, a series of waste management measures to control the sorting, storage, handling, transportation and disposal of all forms of waste that may arise from the Project have been determined.

6.38 The largest waste stream by volume will be dredged mud. Review of sediment quality data undertaken for the EIA shows that the sediments are overall not contaminated, but with a small proportion having some metal contamination. Transfer of some of the uncontaminated material to Mainland China is proposed, with the rest being disposed of in Hong Kong's marine mud pits.

6.39 Construction and demolition waste arising from excavation and site formation works will be re-used on site as far as possible. Other waste streams are relatively low in volume. Types and quantities of all residual wastes expected to arise during construction and operation have been identified, quantified and suitable disposal sites identified. Measures have been identified to ensure safe handling of chemicals and disposal of sewage and other effluents including storm drainage during both the construction and operation phases are recommended.

6.40 All the recommended measures are practicable and can be implemented and no adverse residual impacts are predicted if these measures are instigated.

*Landscape and Visual*

6.41 The proposed development and associated works follow in principle the planning intentions from Revised Concept Plan for Lantau and the OZPs. However, the scale of TM-CLKL, together with concurrent projects, namely, TMWB, HKLR and HKBCF, will inevitably result in some potential landscape and visual impacts.

6.42 There will be permanent loss of 16.5ha seawater body near Pillar Point for the northern landfall reclamation, 19.1ha seawater body east of the HKBCF for the southern landfall reclamation and a further 0.2ha for the southern marine viaduct due to TM-CLKL, and a further loss of 138ha for the HKBCF, 27ha for the HKLR, 72 ha for the Planned Lantau Logistic Park, 40 ha for the Planned Lantau Logistics Park Extension and approximately 160 ha for the Future Tung Chung East & West Developments. The landscape impact can only be slightly mitigated by minimizing area and construction period. Therefore, the overall residual impact on Seawater body and shoreline near Pillar Point (LR01) and Seawater body and shoreline north of Tai Ho Wan (LR08) are considered as moderate.

6.43 The alignment of TM-CLKL will definitely encroach upon the current Temporary River Trade Golf (LR03) to make room for the toll plaza of TM-CLKL. It is considered that the landscape impact on LR03 is moderate during construction and operation phases.

6.44 The toll plaza, associated slope works and retaining walls of TM-CLKL will cause a significant loss of trees in tall shrubland and disturbed hillside plantation area at Pillar Point (LR04). With the proposed mitigation measures including the re-vegetation of woodland/shrubland and hillside screening planting, it is considered that the landscape impact on LR04 is moderate during construction and operation phases.

6.45 The natural terrain hazard mitigation works of TM-CLKL will affect a small area of the edge of North Lantau (Extension) Country Park. It is considered that the overall residual impact on the vegetation at Tai Ho and Pak Mong (LR11) is slight.

6.46 Based on the tree survey on TM-CLKL, approximately 5,400 trees were surveyed within the study boundary. Approximately, 4,040 trees will be affected by TM-CLKL. Of the affected trees, approximately 100 trees are proposed to be transplanted, approximately 3,460 trees are proposed to be felled, approximately 480 weed trees (*Leucaena leucocephala*) are proposed to be removed. Trees surveyed within the proposed works boundary are primarily common species. There are no LCSD Champion Trees, Registered Old and Valuable Trees. However, there is an *Aquilaria sinensis* listed as protected species under Cap 586 Protection of Endangered Species of Animals and Plants Ordinance. It will be affected by the proposed works and is proposed to be transplanted. Approximately 6,300 new trees will be planted to compensate for the felled trees. Further soft landscape works are proposed to further enhance greenery. The overall residual impact on trees and other soft landscape is considered as acceptable with mitigation measures.

6.47 With the proposed mitigation measures including the re-vegetation of woodland/shrubland and hillside screening planting, the Siu Lang Shui Upland and Hillside Landscape (LCA01) will still suffer moderate landscape impact during construction and operation stages due to the loss of trees which changes the landscape character.

6.48 With the proposed mitigation measures including the aesthetic design of the built structures, minimizing construction area, the Inshore Water Landscape near Pillar Point (LCA04) and the Inshore Water Landscape near Tai Ho (LCA09) will still

suffer moderate landscape impact due to the proposed reclamation for northern landfall, and southern landfall of TM-CLKL and HKBCF respectively.

6.49 Kap Shui Mun and Ma Wan Channel to Urmston Road is a unique public asset and natural visual resources as viewed from Lantau, providing an open seascape along the northern coast of Lantau Island and the south coast of Tuen Mun. The proposed TM-CLKL, particularly the marine viaduct from the southern landfall reclamation at HKBCF to North Lantau Highway at Tai Ho, together with HKLR and HKBCF, will induce partial blockage of views and permanent loss of open seascape view. The cumulative visual impacts can only be slightly mitigated by minimizing area, avoidance of excessive height and bulk of buildings and structures and construction period.

6.50 There will be unavoidably moderate residual impact on residents of Butterfly Estate, Siu Shan Court, Wu King Estate, Melody Garden, Richland Garden, Pierhead Garden, Miami Beach Towers, Marina Garden, Shi Hei Court, Yuet Wu Villa (R1), the residents of Seaview Crescent, Coastal Skyline, Caribbean Coast, residential development in CDA zone (R4), Planned theme park/major recreational uses (OU10), Planned Lantau Logistics Park (OU11), Possible planned Lantau Logistics Park Extension or other compatible uses (including recreation uses) (OU12) and Planned residential area of Tung Chung users (R8). For the Planned residential uses at the future Tung Chung East Development (R6), the residual impacts are still considered to be moderate given their high sensitivity and close proximity to the source of impacts.

6.51 With mitigation measures during construction and operation phases, notably to produce an attractive and more pleasing overall form and appearance of the viaduct by aesthetic design, overall, it is considered that the residual landscape and visual impacts of the proposed TM-CLKL are acceptable.

*Cultural Heritage*

6.52 No marine archaeology resources were identified in the study area and, therefore, as no impacts are predicted, no mitigation measures are needed. In terms of terrestrial archaeology, the two identified areas of archaeological potential based on geological map are limited to areas where existing impacts would have damaged or destroyed any existing archaeological material. As such, no further investigation is recommended for these archaeological resources.

6.53 One grave will be within the footprint of the proposed toll plaza. However, the design of the toll plaza has been arranged so as to preserve the grave in-situ, with a minimum 1.0m permanent setback provided. With the 1.0m set back of the permanent structure, a minimum of 0.7m clearance from the grave can be maintained during construction. The footpath connection from the adjacent Lung Mun Road to the grave will, also, be maintained during construction and reprovided after the works have been completed. No mitigation will be required during the operation phase.

*Landfill Gas Hazard*

6.54 The Toll Plaza of the Project resides within the 250m consultation zone of the Pillar Point Valley Landfill. Therefore, landfill gas hazard has been evaluated to determine the potential landfill gas hazard to the Project during construction and operation phases.

6.55 A qualitative landfill gas hazard assessment using the source-pathway-receptor model has been conducted to evaluate the potential landfill gas hazard to the Project. The overall risk level during construction phase and operation phase are both Medium.

6.56 Provided that all the recommended protection measures (such as proper ventilation, protective membrane, provision of adequately ventilated voids under building structures, proper monitoring, etc.) are implemented properly, the safety of the site workers and all personnel and users presence at the Project site would be safeguarded and there would be no adverse impact anticipated on the Project.

## 7. CUMULATIVE ASSESSMENT

7.1 As detailed in Section 4 above, there are many projects proposed to be either constructed or implemented at the same time as the TM-CLKL and, therefore, there is the potential for cumulative impacts to occur. Not all parameters would be significantly affected by potential cumulative impacts and the key issues will relate to: air quality, water quality, and marine ecology and fisheries.

7.2 As noted above, cumulative operation air quality impacts, taking into account all background sources in the broad study area and the Pearl River Delta, and traffic induced emissions from open roads, tunnels and ventilation buildings and the HKBCF, did not result in any unacceptable impacts at the air sensitive receivers.

7.3 In terms of water quality, in addition to modelling the concurrent TM-CLKL, HKBCF and HKLR, the assessment has also covered all other relevant concurrent projects that might result in both the construction and operation impacts. The modelling showed that no significant concurrent impacts would result and the project construction phase plumes generally do not coincide with other concurrent plumes except over a small area to the north-west and east of the project site.

7.4 The key cumulative issue for marine ecology and fisheries is habitat/fishing ground loss. The TM-CLKL would results in 47ha of permanent habitat loss for dolphins, corals, benthos and fishing grounds for fisheries. While this figure can increase notably when other concurrent projects are taken into account, the anticipated cumulative impacts are not expected to be significant for the general marine ecology and fisheries of the study area, except for the dolphins. Notwithstanding the contribution from the TM-CLKL is expected to be small overall and not significant.

7.5 However, in order to address the cumulative impacts from all the projects and compensate for the cumulative Chinese White Dolphin and fisheries habitat loss, the Government has made a commitment to seek to designate the Brothers Islands as a marine park for enhancing the CWD habitat 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 three projects. A study will be conducted to confirm the details of the proposed marine park before the commencement of the statutory procedures as stipulated in the Marine Parks Ordinance. The Government's commitment to the marine park and its 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. With respect to fisheries, the fisheries resources of the area will be better managed with the establishment of the new marine park and implementation of management measures, and together with the other ecological enhancement measures, will enhance the long-term

sustainability of the fisheries industry in the area.

## 8. ENVIRONMENTAL MONITORING AND AUDIT

8.1 In accordance with the EIA, EM&A procedures are required during the design, construction and operation phases of the project implementation. The EM&A works during the design phase shall comprise an iterative audit process of specific design elements and the preparation of specifications. The following specification are recommended to be prepared during the design phase:

- bored piling monitoring programme;
- pre, during and post construction dolphin monitoring;
- 250m dolphin exclusion zone for use during dredging, reclamation, bored piling and sheet piling works;
- acoustic decoupling methods for use during reclamation and dredging works;
- marine vessel control specifications;
- deployment of an artificial reef;
- hoarding for protection of pitcher plants;
- coral translocation;
- design of toll plaza for grave G1 set back and protection; and
- landscape design.

8.2 During the construction and operation phases, the EM&A requirements are divided into environmental monitoring and/or project auditing in the form of site inspection and supervision. Environmental monitoring for dust, noise, ecology and water quality during the construction phase is recommended in order to ensure all proposed mitigation measures are implemented and effective. All of these parameters will also be subject to audit through site supervision.

8.3 Site supervision and procedures audit will be required during the construction phase to ensure the proper handling, storage, transportation and disposal of the various waste arising from the Project. Audit of the implementation of the design elements and mitigation measures to avoid ecological, landscape and visual and heritage impacts have also been recommended by the EIA, and thus, monitoring in the form of regular site inspections shall also be required to ensure mitigation measures are being implemented and are effective. EM&A for both ecology and landscape and visual resources will extend through the construction phase and into the operation phase to ensure planting and replanting have been effective.

8.4 In addition, the Project Proponent will set up an Environmental Protection Office (ENPO), or equivalent, to oversee the concurrent construction projects in North Lantau area.

## 9. OVERALL CONCLUSIONS

9.1 The design of the proposed road has been optimised to minimise the extent and magnitude of environmental impacts, particularly minimisation of marine habitat loss and seabed disturbance. Thus, the proposed Tuen Mun – Chek Lap Kok Link represents the best available environmental option which also meets the fundamental engineering and other constraints.

9.2 Where the implementation of the new road alignment will result in some potential impacts, a comprehensive range of mitigation measures has been recommended to reduce these impacts to acceptable levels along with the environmental management regime detailed in the Environmental Monitoring and Audit Manual.

9.3 With the adoption of these mitigation measures, the Project will not result in any unacceptable residual environmental impacts within the overall scope and benefits of the Project.