# 15 Summary of Environmental Outcomes

## 15.1 Population and Environmental Sensitive Areas Protected

### 15.1.1 Lion Rock Country Park

Lion Rock Country Park, covering a total area of about 557ha, is one of the three earliest country parks in Hong Kong. The Lion Rock has a narrow mountain range stretching from east to west and the southern slopes are covered with thin vegetation and the northern slopes are nourished by abundant streams. Some studies have indicated this country park is rich in biodiversity (e.g. woodland, fauna, flora, avifauna, natural streams etc). Since its establishment in 1977, Lion Rock Country Park has become one of the most popular places for local communities and tourists to enjoy and appreciate the nature environment.

Given the key objective of the Project is to provide efficient rail base transportation connecting Tai Wai to the urban area in Kowloon, the alignment has inevitably to pass through the Lion Rock Country Park. However, in order to protect the ecological and landscape resources of Lion Rock Country Park, the alignment has been designed to run deep within the rock layer.

The tunnel construction methodology has also been carefully selected to avoid environmental impacts. A combination of drill-and-blast and mined tunnelling method would be adopted for the entire tunnel section, and there are no permanent and temporary above-ground works areas within the entire Lion Rock Country Park. The ventilation building is located at Ma Chai Hang Recreation Playground near Chuk Yuen which is beyond the Lion Rock Country Park.

### 15.1.2 Urban Districts along the Project

In order to serve the population in the urban area in Kowloon, the alignment of Project will inevitably encroach into the urbanised districts of Wong Tai Sin, Diamond Hill, Kowloon City, To Kwa Wan, Ma Tai Wai and Ho Man Tin areas, which have been highly developed with residential and industrial buildings.

In order to minimise the potential environmental nuisance during construction phase, drill-and-blast and bored tunnelling construction methods have been fully considered. Out of the 11km long of the entire Project alignment, the use of drill-&-blast and bored tunnelling would constitute about 6km which is about 55% of the total length.

It can also be seen from **Section 2** that the majority (~ 70%) of the alignment (including the urban areas in Chuk Yuen, Diamond Hill etc) has adopted a tunnel form so as to minimise any nuisance during the operational phase.

### 15.1.3 Tei Lung Hau Stream and Ka Tin Court Stream

Tei Lung Hau Stream is a freshwater stream located at Hin Keng area. According to the ecological survey results, Predaceous Chub, Lesser Spiny Frog, Hong Kong Cascade Frog and three damselflies, including Indochinese Copperwing (*Mnais mneme*), White-banded Shadowdamsel (*Protostica taipokauensis*) and Emerald Cascader (*Zygonis iris*), with high conservation concern are present.

Ka Tin Court Stream is another freshwater stream located in the Hin Keng area with moderate to low ecological importance. The stream is an important habitat for Predaceous Chub, Lesser Spiny Frog which are of high conservation value.

These natural streams are nursery/ breeding ground for fish, crustacean and amphibian.

Ka Tin Court Stream is distant from the proposed works site and therefore would not be affected by this project in anyway. Tei Lung Hau Stream is located in the vicinity of the Hin Keng tunnel portal where re-grading of the existing slope is proposed. To protect the natural habitat of Tei Lung Hau Stream, the proposed slopeworks and the tunneling works have

been designed to avoid any adverse impact on the water quality and ecology of this freshwater stream.

### 15.1.4 Secondary Woodland

There is a secondary woodland near to the tunnel portal at Hin Keng and to the south of Tei Lung Hau Stream. There will be no construction work at the secondary woodland. The major works at this area would be either drill-and-blast tunneling or mined tunneling which is deep underground. Some temporary minor above-ground works may be required subject to further investigation. However, adverse impact on the secondary woodland in this area will be avoided as far as practicable by all necessary means.

## 15.2 Environmentally Friendly Design and Benefit

### 15.2.1 Use of Green Roof

The Government has been actively promoting greening in buildings to improve the environment. This includes actively implementing rooftop greening where practicable to enhance the cityscape and mitigate the heat island effect in urban areas. The Architectural Services Department completed the Study on Green Roof Application in Hong Kong in 2007 which reviewed the latest concepts and design technology of green roof and recommended technical guidelines suitable for application in Hong Kong, covering various aspects including choice of plants, waterproofing layer, thermal insulating layer, drainage layer, planting soil, irrigation as well as maintenance and repair.

According to the "Study of Green Roof Application in Hong Kong" by Architectural Services Department, the application of green roofs has the following potential benefits:

**Amenity and Aesthetic Benefits**

- It would contribute to aid visual green space continuity throughout urban area.
- Psychological studies have demonstrated the restorative effect of natural scenery holds the viewer's attention, diverts their awareness away from themselves and worrisome thoughts and elicits a meditation-like state. The variety of sounds, smells, colours and movement provided by plants, although not quantifiable, can add significantly to human health and wellness.

**Environmental Benefits**

- Vegetation has a cooling effect by dissipating some for the city heat through the process of evapo-transpiration. Hence, the use of green roofs has beneficial effects in the reduction of the heat island effect.
- The application of green roofs can reduce the total run-off by absorbing water and returning it to the air, reducing the amount of water available for run-off and spreading the residual run off over a longer period (by storing it for a period before it runs-off, the roof acts as a buffer between the weather and drainage systems).

**Sustainability**

- Green roofs can contribute to building insulation and energy efficiency. The shading effect of vegetation reduces temperatures of buildings partly through shading and partly through evapo-transpiration. The insulation benefits of green roofs can reduce solar heat gain during the day and provide savings in regular building maintenance cost and contribute to saving more energy (and hence more sustainable), especially for the HIK.

- Studies have demonstrated that green roofs, when properly constructed, can extend the life of a roof. Degradation by ultraviolet light and the constant expansion and contraction caused by daily extremes of temperature are the prime cause of the disintegration, cracking, delamination and splitting of roofing materials. Green roofs insulate the materials from ultraviolet light and reduce the thermal extremes, thus prolonging roof life.

The use of green roofs has also been actively considered in the Project. According to the latest design, green roof would be implemented in the HIK, Hin Keng viaduct and tunnel box, and MCV, EA/EEA at Wong Tai Sin etc. These green roofs would provide significant environmental benefits to the community and the Project.

### 15.2.2 Optimal Use of Drill-&-Blast and Bored Tunnelling

Drill-and-blast and bored tunnelling construction method will be adopted in design of Project as far as practical, including HIK Portal to DIH, DIH to KAT and TKW to MTW (see **Section 3** for details and **Section 15.1.2** for discussion). Temporary above-ground works in these areas would be much less. This would help to minimise the potential impacts to the urbanised areas, including construction dust and noise impacts.

### 15.2.3 Optimal Use of Tunnels

During the design of Project, the construction of approximately 70% of the alignment sections, including HIK Portal to DIH, DIH to KAT, KAT to TKW, TKW to MTW, MTW to HOM and HOM to tunnel portal at Winslow Street has adopted the form of a tunnel (see **Section 3** for details and **Section 15.1.2** for discussion). This would help to minimise the potential nuisance such as airborne noise, landscape and visual impacts etc during the operational phase.

### 15.2.4 Avoid Physical Encroachment on Lung Tsun Stone Bridge

Lung Tsun Stone Bridge has been identified as an important archaeological resource in close proximity to the alignment. The alignment has been designed to totally avoid Lung Tsun Stone Bridge.

For the Former Kowloon City Pier adjoining the south of Lung Tsun Stone Bridge, a vertical separation can be maintained to avoid impacts.

A horizontal buffer zone would be maintained for the Lung Tsun Stone Bridge and Former Kowloon City Pier.

### 15.2.5 Use of Semi-Underground Design for DHS

The cultural significance of the 3 historical buildings within the former Tai Hom Village site has been fully recognised during the early stage of the project. The current design of the DHS has adopted a semi-underground design.

The physical conditions of the Former Royal Airforce Hanger and the Stone House No 4 are not satisfactory for total preservation. The condition of Pillbox is better and may be feasible for total preservation. A conservation plan would be separately submitted to agree on the most appropriate approach to preserve these 3 historical buildings.

### 15.2.6 Locations of Stockpiling Area

It is known that stockpiles would inevitably generate fugitive dust during the construction phase. Hence, the locations of the stockpiling areas have been carefully selected at Kai Tak as the area is currently unoccupied and away from the existing residential areas. Hence, adverse dust impacts during the SCL construction can be minimised.

## 15.3 Summary of Measures Adopted to Minimize Environmental Impacts

The various chapters of this EIA Report have presented key measures to minimise the potential environmental impacts associated with the Project in the planning, design, construction and operation stages. Key measures to minimise the environmental impacts are summarised below.

### 15.3.1 Route Selection and Tunneling Methodology

Minimising environmental impacts has been one of the key design objectives throughout the planning and design process. Where practicable, protection of environmental sensitive areas has been considered. **Sections 15.1 and 15.2** have described the population and environmental sensitive areas protected, and the environmental friendly design adopted. A summary of these is given below:

- Avoidance of the Lion Rock Country Park which is a key landscape and ecological resources in HK (see **Section 15.1.1**);
- Majority (about 70%) of the alignment (including the urban areas in Chuk Yuen, Diamond Hill ec) has adopted a tunnel form so as to minimize any nuisance during the construction phase (see **Section 15.1.2**);
- Avoidance of the adverse impacts on the Tei Lung Hau Stream and Ka Tin Court Stream which are natural stream with ecological value (see **Section 15.1.3**)
- Avoidance of the secondary woodland near to the portal at Hin Keng and to the south of Tei Lung Hau Stream (see **Section 15.1.4**);
- Optimize the use of green roof where practicable for above ground structures to introduce green elements to the local community (see **Section 15.2.1**)
- Optimise the use of drill-&-blast and bored tunneling to reduce temporary above-ground works in urban areas to minimize potential impacts such as construction dust and noise (see **Section 15.2.2**)
- Optimise the use of tunnels to minimize the potential nuisance such as airborne noise, landscape and visual impacts etc during the operational phase (see **Section 15.2.3**);
- Avoidance of physical encroachment on Lung Tsun Stone Bridge which is an important archaeological resource (see **Section 15.2.4**);
- Use of semi-underground design for DHS to minimize the operational noise impacts and provide opportunity for preserving the 3 historical buildings (see **Section 15.2.5**); and
- Reduction as far as practicable in the size of aboveground structures and temporary works areas during the design and planning stage.

The possibility of using exiting depots so as to avoid having a new train stabling sidings has been considered. Other than existing depots, the investigation has also considered other areas including Shatin Pass Quarry, Hin Keng, Tai Shui Hang, Wu Kai Sha CDA Site, Kai Tak, Diamond Hill CDA Site and Former Hung Hom Freight Yard. After considering the operational requirements for allowing proper function of the stabling siding (e.g. location requirements, stabling capacity, need for maintenance works, adequacy for length and width etc), it is concluded that only the Diamond Hill CDA Site and former Hung Hom Freight Yard would be considered as feasible locations for train stabling sidings for SCL (TAW-HUH).

### 15.3.2 Cultural Heritage

For the construction phase, survey-cum-excavation will be conducted prior to the construction works at the former Tai Hom Village, which is an archaeological site where presence of the sparse Tang/ Song Dynasty layer has been identified. A similar survey-cum-excavation would also be conducted for the excavation area, where the open cut of TKW and the associated tunnel overlap with the Sacred Hill (North) Study Area. An Archaeological Action Plan will be submitted to the Antiquities and Monuments Office (AMO) for agreement.

For Lung Tsun Stone Bridge and Former Kowloon City Pier, which are also archaeological sites, a buffer zone would be maintained throughout the construction period when construction activities are required in the vicinity.

There are 3 built heritage in the former Tai Hom Village, including the Former Royal Air Force Hangar, Old Pillbox and the Stone House. Documentation would be conducted prior to disassembling for these 3 built heritage. Portions of the Hangar which is of historical interest and the Old Pill Box would be temporarily stored. The retained portions of the hangar together with a model will be displayed within the CDA site as per the conservation plan. The Old Pillbox would require reinstatement as per the conservation plan to be separately agreed with AMO.

### 15.3.3 Ecology

As discussed in **Section 15.3.1**, all important ecological resources such as Country Park, secondary woodland and natural stream, etc. have been avoided. However, there may still be some individuals of tree species *Aquilaria sinensis* near the Hin Keng Portal to be potentially affected. A transplantation plan will be drawn up and details of the transplantation methodologies and programme along with post-transplantation monitoring will be included.

For works sites at DHS, DIH and Kai Tak Barging Point, precautionary checks of the vegetation for the presence of nesting birds would also be carried out before vegetation clearance. Tree compensation would also be made according to ETWB TCW 2/2006 as far as practicable. In addition, other good site practices would also be implemented during the construction phase.

### 15.3.4 Landscape and Visual

Landscape and visual impacts arising from the construction works would be minimized with the implementation of the following recommended mitigation measures:

- Erection of decorative screen during construction stage
- Management of facilities on work sites
- Transplanting of trees of medium to high survival rate that may be affected by the works

During operational phase, the following mitigation measures would be implemented to minimize the landscape and visual impacts.

- Compensation tree planting proposed to compensate for felled trees
- Buffer tree planting to provide screening to ventilation shafts/plant, engineering structures and associated facilities
- Reinstatement of landscape areas temporarily disturbed during construction phase
- Aesthetic landscape and architectural treatment on stations / entrances/ ventilation shafts
- Reinstatement of excavated area due to temporary works

- Aesthetic landscape and architectural treatment for DIH
- Roof greening of large built structures
- Aesthetic design on noise barriers

### 15.3.5 Construction Dust

The extent of temporary works sites that may generate fugitive dust have been reduced to minimize the dust impacts as much as practicable. However, given the relatively short separation with receivers in the urban context, dust suppression measures such as frequent watering would be implemented to minimize the potential construction dust impact and comply with the regulatory requirements.

In addition, other dust suppression measures stipulated in the Air Pollution Control (Construction Dust) Regulation and good site practices would be in place to further minimize construction dust impact. Some examples of these good site practices include:

- Any excavated or stockpile of dusty material should be covered entirely by impervious sheeting or sprayed with water to maintain the entire surface wet and then removed or backfilled or reinstated where practicable within 24 hours of the excavation or unloading;
- Any dusty materials remaining after a stockpile is removed should be wetted with water and cleared from the surface of roads;
- A stockpile of dusty material should not be extend beyond the pedestrian barriers, fencing or traffic cones;
- The load of dusty materials on a vehicle leaving a construction site should be covered entirely by impervious sheeting to ensure that the dusty materials do not leak from the vehicle;
- Where practicable, vehicle washing facilities with high pressure water jet should be provided at every discernible or designated vehicle exit point. The area where vehicle washing takes place and the road section between the washing facilities and the exit point should be paved with concrete, bituminous materials or hardcores;
- When there are open excavation and reinstatement works, hoarding of not less than 2.4m high should be provided as far as practicable along the site boundary with provision for public crossing. Good site practice shall also be adopted by the Contractor to ensure the conditions of the hoardings are properly maintained throughout the construction period.

### 15.3.6 Airborne Noise

The extent of temporary works sites where construction plant would be operating has been reduced to minimize the airborne construction noise impacts as much as practicable. However, given the relatively short separation with receivers in the urban context, extensive mitigation measures would be required. Further measures that had been considered throughout the design process to minimize the construction noise impacts include:

- Use of quiet plant and working methods
- Use of temporary noise barriers, and enclosures for relatively static plant etc.

However, cumulative construction noise impacts at a number of receivers that are close to the temporary works sites (see **Sections 8.4.9 and 8.4.10**) would still exceed the construction noise criteria but the impacts have been minimized with implementation of all practicable mitigation measures..

For the operational phase, the airborne railway noise impacts have been reduced in the first place by adopting a semi-underground design for DHS. There would not be adverse operational train noise impacts from the train stabling sidings.

The trains running along the new at-grade track at Hin Keng and Hung Hom would however still generate certain noise impacts. In order to control the noise impacts to acceptable levels, it has been recommended to construct a package of noise barriers along some sections of the track to comply with the statutory requirements.

### 15.3.7 Groundborne Noise

The predicted groundnoise noise levels would comply with the statutory requirements and impacts are considered insignificant. Additional noise mitigation measures are therefore not required.

### 15.3.8 Water Quality

Good site practices such as temporary drainage, dike or embankment for flood protection, efficient silt removal facilities, covering exposed areas with tarpaulin, vehicular washing facilities at construction site exits, oil interceptors etc would be implemented to minimize water quality impacts during the construction phase. Examples of mitigation measures during construction and operation phases are presented below.

For the construction phase, the following measures would be implemented:

- Cut-&-cover/ open cut tunnelling work should be conducted sequentially to limit the amount of construction runoff generated from exposed areas during the wet season as far as practicable.
- During tunneling work, uncontaminated discharge should pass through sedimentation tanks prior to off-site discharge.
- During tunneling work, the wastewater with a high concentration of SS should be treated (e.g. by sedimentation tanks with sufficient retention time) before discharge. Oil interceptors would also be required to remove the oil, lubricants and grease from the wastewater.
- During tunneling work, direct discharge of the bentonite slurry (as a result of D-wall and bored tunnelling construction) is not allowed. It should be reconditioned and reused wherever practicable. Temporary storage locations (typically a properly closed warehouse) should be provided on site for any unused bentonite that needs to be transported away after all the related construction activities are completed.
- For dredging work for the Kai Tak Barging facilities, mitigation measures such as the use of closed grabs and silt curtain have been recommended.
- Use of portable toilet to collect sewage from the workforce.
- In case seepage of groundwater occurs, groundwater should be pumped out from the works areas near to Victoria Harbour, and discharged into the storm system via silt removal facilities. Groundwater from dewatering process should also be discharged into the storm system via silt traps.
- Proper handling of chemical waste.

For the operational phase, the following mitigation measures would be implemented:

- Track runoff from train stabling sidings (covered section) and tunnel should pass through oil/grit interceptors/chambers to remove oil, grease and sediment before being pumped to the public foul drainage system;

- Track runoff from the fan area and launching/ retrieval tracks (open track section)should pass through oil/grit interceptors/chambers to remove oil, grease and sediment before being pumped to the public storm water drain system;
- The silt traps and oil interceptors should be cleaned and maintained regularly; and
- Oily contents of the oil interceptors should be transferred to an appropriate disposal facility, or to be collected for reuse, if possible.

### 15.3.9 Waste Management

The amount of C&D material that would need to be transported off site has been minimized as far as practicable in the design. The opportunity for re-using C&D material has been fully considered and implemented where practicable. Good site practices have been recommended for chemical waste, general refuse and disposal of chemical waste will follow the relevant ordinances.

### 15.3.10 Land Contamination

A total volume of 39$m^3$ is required to be disposed of at the landfill as a last resort after consideration of other remediation options. The remediation action plan and specification for remediation works has been detailed in the endorsed Remediation Action Plan (RAP).

### 15.3.11 Hazard to Life

An ALARP assessment has been undertaken considering a wide range of mitigation measures and the results show compliance with the ALARP principles and that the risk would be reduced to as low as reasonably practicable provided that the recommendations presented in the Hazard to Life chapter are followed.

Key recommended mitigation measures for the storage, transport and use of explosives to be implemented:

- The temporary magazine store should be designed, operated and maintained in accordance with Mines Division guidelines and appropriate industry practice. Recommendations address a suitable work control system, maintenance, housekeeping, security and traffic management to ensure the safe storage and handling of explosives.
- Design of explosives delivery vehicles should comply with CEDD Mines Division's requirements and ensure that selected drivers and their attendants have good safety records with the provision of adequate training including emergency response. Recommendations address safety requirements of the delivery vehicle and responsibilities for the driver and attendants to ensure the safe transport and handling of explosives.
- The explosives deliveries should be coordinated with other potentially interfacing projects (e.g. Shatin Water Treatment Works) and the preferred transport route should be used as much as practicable. Only the required quantity of explosives for a given blast should be transported and detonators shall not be transported in the same vehicle with other Class 1 explosives.
- Competent site staff and blasting personnel shall be employed to ensure that the blasting works are coordinated and in strict compliance with the blasting permit conditions. Mitigation measures such as blast doors or heavy duty blast curtains would be installed at suitable locations to prevent flyrock and control air overpressure. Recommendations address development of procedures for security, working conditions, and contingencies to ensure safe blasting works.

- General recommendations for an emergency response plan and communication procedures in agreement with HKCG to ensure fuel gas safety for any construction works near gas facilities and gas pipes.

Key recommended mitigation measures to reduce the risks due to the Shatin Water Treatment Works PHI:

- Installation of on-site gas monitors in all relevant SCL construction/operation areas.
- Establishment of emergency response and evacuation plans including procedures for ventilation system control, SCL train traffic management, and training and drills for all personnel.

### 15.3.12 Environmental Monitoring and Auditing

In addition to the mitigation measures as described above (see more details in the Environmental Mitigation Implementation Schedule), a comprehensive environmental monitoring and auditing programme would be implemented to cover various aspects of concern. An independent environmental checker would also be employed to ensure that all the necessary mitigation measures are implemented in a timely and orderly manner.

### 15.3.13 Overall

Mitigation measures and good site practices to minimize the environmental impacts were recommended throughout the impact assessments of air quality, noise, water quality, waste management, landscape and visual, and ecology. These measures were consolidated in an Implementation Schedule which specifies the responsibility, methodology and timing of implementation, such that effective and appropriate implementation of the measures can be assured.