

14 CONCLUSIONS

14.1 Introduction

14.1.1 This EIA report has assessed the potential environmental impacts associated with the construction and operation of the Project based on the preliminary engineering design information available at this stage. The assessment has been conducted, in accordance with the Study Brief No. ESB-323/2019 under the EIAO for the Project and the EIAO-TM, covering the following environmental issues.

- Air Quality Impact
- Noise Impact
- Water Quality Impact
- Waste Management Implication
- Land Contamination
- Ecological Impact
- Cultural Heritage
- Landscape and Visual Impact
- Hazard to Life

14.1.2 The findings of this EIA Study have determined the likely nature and extent of environmental impacts predicted to arise from the construction and operation of the Project. During the EIA process, specific environmental control and mitigation measures have been identified and incorporated into the planning and design of the Project in order to achieve compliance with environmental legislation and standards during both the construction and operation phases. An environmental monitoring and audit (EM&A) programme has also been developed. The Implementation Schedule listing the recommended mitigation measures is presented in **Section 13**.

14.1.3 A summary of the environmental outcomes/benefits that have accrued from the environmental considerations and analysis during the EIA Study and the implementation of environmental control measures of the Project are presented in the sections below. The key assessment assumptions and limitations of methodologies and summary of environmental impacts are presented in **Appendices 14.1** and **14.2**, respectively.

14.2 Environmental Benefits of the Project

14.2.1 The Project can enhance smoother traffic flows of the tunnel tubes of the LRT and connection roads which would alleviate the air quality and noise impacts associated with traffic congestion during peak hours. Although certain locations of LRTR at Shatin side may be nearer to local sensitive receivers due to the road widening works, noise mitigation measures such as noise barriers and semi-enclosures will be constructed under the Project. These noise mitigation measures could also help to reduce the existing noise impact on the adjacent sensitive receivers such as residential uses, hospital, etc..

14.3 Incorporation of Environmentally Friendly Options

14.3.1 Avoidance of environmental impacts is one of the main considerations throughout evaluation and development of alignment options. In case due to limitation of actual site condition that environmental impacts could not be completely avoided, environmentally friendly alternatives or designs were taken as much as practicable for compliance with EIA study brief requirements. The following approaches avoiding adverse environmental impacts have been suitably incorporated into the layout of the preferred alignment option.

Avoidance of substantial portal slope and site formation works at natural habitat for the new middle third tunnel tube of LRT at both Kowloon and Shatin Portals

14.3.2 During discussion on the LRT's new tunnel tube alignment as presented in **Section 2.5**, three alignments are considered for determination of the recommended option on LRT's new tunnel tube alignment in view of environmental impacts to the surroundings. It follows that the LRT

new tunnel tube's alignment to be constructed between the existing LRT's tunnel tubes (i.e. a disturbed terrain) as the recommended option for which it would generate least environmental impacts to the natural habitat in terms of construction works.

Minimization of encroachment from tunnel ancillary facilities upon Lion Rock Country Park

- 14.3.3 Considerations have been given to location of reprovisioned tunnel administration building and car park to minimize the encroachment on LRCP, as discussed in **Section 2.5.17 to 2.5.25**. Other alternative locations were considered but ultimately not adopted given the extensive excavation/filling works and/or more woodland and plantation loss compared to the proposed location.

Minimization of encroachment from the proposed LRTR widening works upon Lion Rock Country Park and woodland area

- 14.3.4 Options on the road widening works along LRTR, namely, uphill and downhill options, have been reviewed and presented in **Section 2.5.27**. Taking into consideration that the LRCP and woodland area are located at the uphill side of the LRTR, the proposed road widening works towards downhill side along LRTR is adopted as the recommended option for the purpose of minimizing encroachment upon the LRCP and woodland area and hence minimizing impacts from the Project.

Minimization of environmental impacts due to the proposed natural terrain hazard mitigation measures (NTHMM)

- 14.3.5 Considerations have also been given to minimize the environmental impacts due to the proposed natural terrain hazard mitigation measures both within and outside the LRCP. As discussed in **Section 2.6.2**, for NTHMM outside the LRCP, erection of flexible barriers instead of sizable rigid barriers is proposed on hill slopes to minimize the extent of excavation work and number of tree felling at uphill side along LRTR. For NTHMM within the LRCP, to avoid the impacts from construction works on natural habitat on hill slopes, construction of rigid barrier at the developed/paved area of bottom slope within the LRCP is adopted with an aim of minimizing the extent of excavation work and number of tree felling.

14.4 Environmental Design Recommended

- 14.4.1 Other than initiatives to avoid environmental impacts as summarized in **Section 14.3**, further efforts have been exercised to minimize impacts. The need for any environmental designs required to mitigate the associated impacts have also been identified and will be implemented, as appropriate. A summary of these approaches is given below:

- Adoption of environmentally friendly construction method;
- Adoption of engineering design which mitigates environmental impacts;
- Phased Construction Programme;
- Implementation of trip-ticket system; and
- Implementation of environmental monitoring and auditing system.

Adoption of Environmentally Friendly Construction Method

- 14.4.2 Precast construction method will be adopted as far as possible, which minimize the extent and duration of construction activities required on site and hence the potential environmental impacts in the vicinity during construction. Other construction methods such as an adoption of prefabricated steel formwork for minimizing the C&D materials generated will also be considered when precast construction method is not feasible. Tunnel Boring Machine (TBM) instead of blasting is adopted for tunnel construction to avoid explosive-related hazard to life. The use of quieter PME (e.g. hydraulic crusher) and quieter construction method (e.g. Press-

in method / chemical expansion) as discussed in Sections 4.6 have also been considered in this Study.

Adoption of Engineering Design which Mitigates Environmental Impacts

- 14.4.3 Noise barriers and enclosures are proposed to mitigate noise impact due to the project. Aesthetically pleasing design of footbridges, noise barriers and enclosures, such as combination of tinted or transparent panels, and provision of buffer planting / roadside planting minimizes the visual impact to an acceptable level. Provision of green roof at tunnel buildings and greening works at slopes and associated structures also mitigates potential landscape and visual impact.

Phased Construction Programme

- 14.4.4 The proposed widening works along LRTR at Shatin side are divided into four work zones and with major site formation and foundations works of adjacent work zones sequenced to be constructed at different phases under construction programme, to avoid excessive cumulative environmental impacts to the nearby sensitive receivers. The construction programme and sequence of works of the Project were also planned to minimize the cumulative environmental impacts with other concurrent projects.

Implementation of Trip-Ticket System

- 14.4.5 In order to monitor, document and verify the disposal of C&D materials at landfills and public fill reception facilities, as appropriate, and to control fly tipping, a trip-ticket system for disposal of construction and demolition materials would be implemented.

Implementation of Environmental Monitoring and Auditing System

- 14.4.6 In addition to the mitigation measures as described in the Implementation Schedule of Recommended Mitigation Measures as given in **Section 13**, 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.

14.5 Key Environmental Problems Avoided and Environmentally Sensitive Areas Protected

- 14.5.1 The key approaches adopted in the current design of the Project as summarized in **Sections 14.3** and **14.4** avoid, minimize and mitigate environmental impacts. Some of these approaches have contributed to avoid a number of environmental problems and to protect a number of environmentally sensitive areas. **Table 14.1** presents the key environmental problems that have been avoided and any sensitive areas protected by these approaches.

Table 14.1 Summary of Key Environmental Problems Avoided and Sensitive Areas Protected

Design Approach	Environmental Problems Avoided and Sensitive Areas Protected
Optimisation of Project footprint (<u>Section 2</u>)	<ul style="list-style-type: none"> When formulating the design and layout of the proposed works, avoid and minimize encroachment / direct impacts to sites of conservation importance such as LRCP and Beacon Hill SSSI to the maximum practicable extent Avoided habitat loss for the area of stockpiling
Adoption of environmental friendly construction method (<u>Section 2</u>)	<ul style="list-style-type: none"> Adoption of pre-cast construction elements as far as practical replacing traditional cast in-situ construction to reduce the adverse impacts to the sensitive receivers Adoption of prefabricated steel formwork replacing conventional timber formwork to lessen the C&D materials generated

Design Approach	Environmental Problems Avoided and Sensitive Areas Protected
	<ul style="list-style-type: none"> Adoption of Tunnel Boring Machine (TBM) instead of blasting for tunnel construction to avoid explosive-related hazard to life
Appropriate design of NTHMM (Section 2)	<ul style="list-style-type: none"> Adoption of flexible barriers instead of rigid barriers as NTHMMs to minimize the impacts from construction work outside LRCP Construction of rigid barriers at the developed/paved area rather than proposing large-scale soil nailing works at the uphill slope located within LRCP to minimize the impacts from construction work within LRCP
Phased Construction Programme for road widening of LRTR (Section 2)	<ul style="list-style-type: none"> Minimize the cumulative construction phase environmental impact on the nearby sensitive receivers by staggered construction programme
Impacts of noise mitigation measures on ardeid flight path avoided (Section 8)	<ul style="list-style-type: none"> Avoid disturbance on ardeid flight path
Implementation of EM&A System (Section 12)	<ul style="list-style-type: none"> Ensure all the recommended measures are properly in place and their effectiveness

14.6 Summary of Environmental Findings

Air Quality Impact

- 14.6.1 Potential construction dust impact would arise from site clearance, demolition, excavation, tunnel construction, slope works, road works construction and wind erosion. Cumulative impact from dust emission from construction activities, vehicular emission from open road, existing portals and ventilation buildings, emission from chimneys and concurrent projects within 500m study area has been evaluated. The prediction results concluded that cumulative TSP, RSP and FSP concentrations at all ASRs would comply with criteria stipulated in EIAO-TM and AQOs and no adverse construction dust impact would be anticipated with the implementation of dust control measures, i.e., watering once every two hours, and installation of sealed door and dust collector with at least 80% dust removal efficiency for the tunnel mined by drill and break.
- 14.6.2 Cumulative operational phase air quality impact arising from the operation of new tunnel tube, refurbished existing tunnels, associated portal and ventilation building and widened roads, and other existing sources such as vehicular emission from open roads and emission from chimneys within 500m study area has been evaluated. The prediction results concluded that the cumulative NO₂, RSP and FSP concentration at all ASRs would comply with the criteria stipulated in AQOs and no adverse air quality impact would be anticipated arising from the operation of the Project.

Noise Impact

Construction Noise

- 14.6.3 This assessment has presented the construction noise impacts of the Project during normal daytime working hours. The assessment results indicated that the mitigated noise levels at all NSRs would comply with the noise criteria set out in the EIAO-TM with the implementation of the proposed noise mitigation measures, including the use of QPME, deployment of construction noise barriers, sequencing operation of construction activities at critical area, reduction of PME at critical works area and avoiding carrying out particular noisy construction activities during examination periods. Adverse noise impact arising from construction works of the Project during non-restricted hours would not be anticipated.

- 14.6.4 Four concurrent projects were identified within 300m assessment area, namely, Revised Trunk Road T4 in Sha Tin, In-situ Reprovisioning of Sha Tin Water Treatment Works - South Works - Designs and Construction, Relocation of Diamond Hill Fresh Water and Salt Water Service Reservoirs to Caverns and The Proposed Drainage Improvement Works at Chui Tin Street and Chui Tin Street Soccer Pitch. At Shatin side, there would be no programme overlapped between the Project and Revised Trunk Road T4 in Sha Tin. According to the construction programme provided by the project proponent of In-situ Reprovisioning of Sha Tin Water Treatment Works – South Works, major construction works of this concurrent project would be completed before the commencement of the construction of the Project, hence, no cumulative construction noise impact would be anticipated. For the Proposed Drainage Improvement Works at Chui Tin Street and Chui Tin Street Soccer Pitch, considering only small-scale construction works would be involved for the drainage improvement works and the associated work site would be located far away from the Project (>200m), no significant cumulative construction noise impact would be anticipated. At Kowloon side, the construction activities of project “Relocation of Diamond Hill Fresh Water and Salt Water Service Reservoirs to Caverns” may be overlapped with the construction activities at Kowloon work site of the Project. Cumulative construction noise impact from this concurrent project during normal daytime working hours was evaluated and was considered insignificant.
- 14.6.5 Construction ground-borne noise impacts arising from tunneling, rock breaking/drilling associated with the operation of TBM and concerned PME (such as hydraulic breaker, drill rig, and hand-held breaker) were found to comply with noise criteria. No adverse construction ground-borne noise impacts would be predicted.
- 14.6.6 An indicative assessment has been undertaken for possible construction activities during restricted hours (1900 – 0700 hours) associated with the Project. Provided that appropriate noise mitigation measures would be implemented, the predicted airborne and ground-borne noise levels would comply with the noise criteria set out in the Technical Memorandum on Noise from Construction Work other than Percussive Piling under Noise Control Ordinance (NCO). It should be noted that the results of the construction noise impact assessment for construction activities during restricted hours are for indicative purposes, the Noise Control Authority will process any Construction Noise Permit application based on the NCO and the relevant technical memoranda in addition to considering the contemporary situations / conditions.

Road Traffic Noise

- 14.6.7 Road traffic noise impact assessment has been conducted. The predicted overall noise levels would exceed the respective noise criteria at most of the NSRs in the unmitigated scenario at the assessment year 2041. However, the exceedance predicted at the NSRs in Kowloon side would be solely due to the traffic noise from other existing roads. The predicted “Project roads” noise levels at NSRs of Kowloon side would comply with the respective criteria and the “Project roads” contribution to the overall noise level would be less than 1.0 dB(A), indicating the “Project roads” noise contribution would be insignificant under the unmitigated scenario. No further direct noise mitigation measures on “Project roads” at Kowloon side are considered effective in mitigating the noise impact.
- 14.6.8 In Shatin side, various types of noise barriers and semi-enclosures have been proposed as direct noise mitigation measures. The predicted “Project roads” noise levels at the representative NSRs would comply with the noise criteria with the mitigation measures in place. However, the predicted overall noise levels at some NSRs would still exceed the noise criteria under the mitigated scenario. The major noise source would be the other existing roads, such as non-Project Road section of LRTR, Hung Mui Kuk Road and Sha Tin Road. The predicted noise levels of “Project roads” contribution to the overall noise levels would be less than 1.0 dB(A), indicating the “Project roads” noise contribution would be insignificant under the mitigated scenario. No further direct noise mitigation measures on “Project roads” at Shatin side are considered effective in mitigating the noise impact.

- 14.6.9 Eligibility tests have been conducted and the results showed that none of the NSRs would be eligible for consideration of indirect mitigation measures under the EIAO-TM.

Tunnel Portal Noise Impact

- 14.6.10 Since no NSR has been identified within 300m of the Shatin Portal, no adverse tunnel portal noise impact would be anticipated from the Shatin Portal. On the other hand, one NSR was identified within 300m of the Kowloon Portal. Since the NSR is not located in the close vicinity of the portal and the highly directional nature of portal noise, the associated portal noise impact is expected to be insignificant. No mitigation measures would be required.

Fixed Noise Source

- 14.6.11 Quantitative operation phase fixed noise source assessment on vent shaft noise from ventilation buildings has been conducted. The predicted noise level at the representative NSR at Kowloon side of Project area would meet the relevant criteria. On the other hand, no NSR was identified within 300m assessment boundary of Shatin ventilation building. Therefore, no adverse fixed noise source impact would be anticipated for both Kowloon side and Shatin side ventilation buildings, and no mitigation measures would be required.

Water Quality Impact

- 14.6.12 The potential water quality impacts from the construction works are associated with the general construction activities, construction site run-off, groundwater infiltration arising from tunnel boring, groundwater from contaminated areas and contaminated site runoff, construction in close proximity of inland watercourses, water pollution from culvert modification works, accidental spillage of chemicals and sewage effluent from construction workforce. Provided that proper site management practices and the mitigation measures including adequate construction site drainage, provision of sediment removal facilities, practical groundwater control measures and chemical toilets would be implemented, no adverse water quality impact during construction phase would be anticipated. Water quality monitoring and regular site inspection will be implemented for the construction works to ensure that the recommended mitigation measures are properly implemented.

- 14.6.13 The key potential sources of water quality impacts during operation phase would be related to non-point source stormwater runoff, sewage from the new administration building and ventilation buildings, wastewater from washing and maintenance operation, and tunnel run-off and drainage. Adequate drainage system with silt traps and oil interceptors should be provided to collect the stormwater runoff. All sewage and wastewater generated from the New Administration Building, Car Parking Area and Ventilation Buildings would be treated by on-site STP (nearby/adjoining new administration building) and septic tank with soakaway systems (nearby/adjoining new ventilation buildings). With proper design of drainage and sewerage systems and implementation of the recommended mitigation measures, no adverse water quality impact during operation phase would be anticipated.

Waste Management Implication

- 14.6.14 C&D materials (from site formation works for tunnelling works, excavation, construction of adits, tunnel associated buildings and structures (e.g. ventilation buildings and new administration building etc.), demolition of existing buildings, slope formation works, retaining works and road widening/ reconfiguration works), general refuse (from workforce) and chemical waste (from maintenance of equipment and potential asbestos waste from building demolition) would be generated during the construction phase. Provided that these wastes are handled, transported and re-use/disposed of in a proper manner and that the recommended good site practices are strictly followed, adverse environmental impacts in relation to hazard, air and odour emissions, noise, wastewater discharge and public transport would not be expected.

- 14.6.15 Reduction measures have been recommended to minimise the amount of materials generated in the Project. Approximately 1,338,050 m³ of inert materials and 107,044 m³ of non-inert

materials would be generated during the construction phase of the Project. 53,800 m³ of inert material would be reused on site while the remaining 1,284,250 m³ of surplus C&D inert material would be recycled or transported to PFRFs for beneficial reuse in other projects. Non-inert waste would be recycled as far as possible before disposed to landfill. Opportunities in minimisation of generation and maximisation of reuse would be continually investigated during the detailed design and construction phases. The other materials that cannot be reused or recycled would be disposed to designated outlets.

- 14.6.16 The main waste types generated during the operation of the Project would be screening, grits, sludge (from the operation of on-site Sewage Treatment Plant (STP)), general refuse (from staff and office activities) and chemical waste (from maintenance activities). Adverse impacts would not be anticipated if the mitigation measures are strictly followed.

Land Contamination

- 14.6.17 A site appraisal, in the form of desktop review and site walkover, was conducted from August 2020 to February 2022 to identify any current/historical potentially contaminating and uses within the Project Area. Based on the site appraisal, a total of 11 facilities / areas were identified with potential land contamination concerns at the tunnel portal areas within the Project Area.
- 14.6.18 A sampling and testing programme, targeting the concerned facilities / areas identified within the Project Area had been proposed and documented in the CAP. A total of 35 sampling locations were proposed for soil and groundwater sample collection. The collected samples will be tested for the COCs (i.e. metals, VOCs, SVOCs, PCR and PCBs).
- 14.6.19 As the concerned facilities of the LRT are still in operation and the demolition and construction works will not commence until 2026-2027, there could be change in site activities and land uses within the Project Area prior to development which may cause further contamination issues. Site re-appraisal should be carried out for the whole Project Area at a later stage of the Project in order to address any new contamination issues caused by the (i) changes in operation of the identified potentially contaminated site and (ii) changes in land use within the Project Area. The submission of supplementary CAP(s), associated SI works and any necessary remediation should be carried out at the concerned facilities and any new contaminated area identified in the site re-appraisal, prior to the commencement of construction at the potentially contaminated area(s). The recommended further assessment and remediation works, including the submission of supplementary CAP(s), CAR/RAP(s) and RR(s) would follow relevant Guidance Manual, Guidance Note and Practice Guide.
- 14.6.20 With the implementation of the recommended further works for the Project, any soil/groundwater contamination would be identified and properly treated prior to the construction works. No insurmountable land contamination impacts to the Project are therefore anticipated.

Ecology Impact

- 14.6.21 Literature review and ecological field surveys have been conducted. Eleven habitat types, including woodland, mixed woodland, plantation, shrubland, village/orchard, active agricultural land, abandoned agricultural land, developed area, pond, natural watercourse and modified watercourse, were identified within the 500 m ecological assessment area. Direct impacts arising from the proposed aboveground works include permanent loss (14.80 ha) and temporary loss (2.75 ha) of habitats. Over 69% permanent habitat loss would be largely located at Shatin side and along the existing Lion Rock Tunnel Road. Direct impacts on recognised sites of conservation importance (e.g. Beacon Hill SSSI and LRCP) are largely avoided. About 0.16 ha woodland, 0.17 ha plantation, <0.01 ha modified watercourse and 0.81 ha developed area at LRCP would be permanently affected. About 0.09 ha woodland, 0.16 ha plantation and 0.33 ha developed area also at LRCP would be temporarily affected. To address the permanent (0.16 ha) and temporary (0.09 ha) impacts on woodlands within LRCP, provision of compensatory woodland (at least 0.25 ha) near the project footprint in accordance with the Final Woodland Compensation Plan is recommended as mitigation and

- enhancement measures. Temporarily affected area within the Project footprint, including those within LRCP, would be reinstated by woodland mix planting according to the Final Reinstatement Plan.
- 14.6.22 To avoid and protect the five flora species of conservation importance recorded in close proximity of the footprint of NTHMMs (including one seedling of Incense Tree, one individual of Ailanthus and three clumps of Luofushan Joint-fir near the rigid barriers within LRCP; and four individuals of Butulang Canthium, one individual of Hong Kong Pavetta and three individuals of Ailanthus near the proposed flexible barriers outside LRCP) near the flexible barriers outside LRCP) during the construction of the NTHMMs, all the identified flora species of conservation importance above shall be preserved on site with provision of plant protection zones with sturdy fencing during the construction phase.
- 14.6.23 A total of four flora species of conservation importance (including one individual of Incense Tree, nine individuals of Butulang Canthium, 19 individuals of Ailanthus along LRTR and nine individuals Rhodoleia near Lung Cheung Road Park) were recorded within the Project footprint. To minimize impacts, a detailed vegetation survey would be conducted and a Final Plant Preservation and Transplantation Proposal should be prepared accordingly prior to the commencement of construction works to identify potentially affected flora species of conservation importance and recommend appropriate measures.
- 14.6.24 The section of natural watercourse S7 outside the Project footprint was likely to be a potential breeding/nursery ground of Small Clubtail (nymph) and Lesser Spiny Frog (tadpoles). Another reptile species of conservation importance (Tokay Gecko) was recorded at developed area near LRT portals at Shatin outside the Project footprint. No direct impact on these species is anticipated as no construction activities would be carried out at their recorded habitats. Precautionary measure such as a pre-construction survey in natural habitats within and in the surrounding of the Project footprint is recommended (e.g. woodland, mixed woodlands and natural watercourse within and near the Project footprint) to verify the findings of ecological field surveys prior to the commencement of construction activities. In case any fauna species of conservation importance recorded would be directly impacted, a Protection and Translocation Proposal should be prepared to recommend suitable mitigation measures.
- 14.6.25 Other potential direct impacts may include direct harm / mortality to wildlife and bird collision, while potential indirect impacts may include dust, noise, site runoff, groundwater infiltration and glare to natural habitats and wildlife in the vicinity. Given the Project footprint mainly involves habitats of limited ecological values (e.g. developed area, plantation) and other areas located at and along existing LRTR currently exposed to heavy disturbance, thus the indirect impacts are anticipated to be minor/minor to moderate. Implementation of good site practices (e.g. provision of screening, control of glare / lighting, groundwater infiltration minimization measures, water quality impact control measures, etc.) would minimize the potential indirect impacts. Carefully design of noise barriers (e.g. location, use of tinted materials and superimposing dark patterns or strips) would minimize the potential impact of bird collision.
- 14.6.26 Site audit and inspection for the implementation of the mitigation measures for minimization of indirect impact (e.g. glare, air quality, noise) should be carried out at least once per week throughout the construction phase by ET. Regular site inspections covering the Project boundary within LRCP and the ecological compensatory plantings should be conducted as early as possible once the Project commences to ensure that all construction activities are confined to the Project footprint and that the proposed mitigation measures are implemented appropriately and effectively.
- 14.6.27 Upon completion of the woodland compensatory planting works, a maintenance and monitoring programme should be undertaken during the planting and establishment period which normally takes at least 9 years. The Contractor should regularly maintain the planted individuals, including watering, weeding, pest control and replanting works, where necessary. A monitoring programme would be conducted to monitor the health condition and survival of the woodland compensatory planting. The management and maintenance of the established woodland compensation area will be regulated by the *DEVB TCW No. 6/2015*, and should be continue until the plantings are fully established (which normally takes at least 9 years) and

before hand over of the established woodland to the long-term maintenance party identified and agreed in accordance with the *DEVB TCW No. 6/2015* after the establishment period for ad hoc maintenance.

- 14.6.28 As an additional precautionary measure, surface water level monitoring at natural watercourses within LRCP, Beacon Hill SSSI and in the vicinity of the tunnelling works would be conducted during the construction and the operation stages. In particular, monthly monitoring should be conducted at watercourses S6 to S8 to monitor parameters (including water depth and water velocity) and remedial measures should be recommended, where necessary, if any abnormal significant decrease of the water level is arising from the Project.
- 14.6.29 With the implementation of the recommended mitigation measures along with EM&A activities, no unacceptable adverse residual impacts would be expected during construction or operation phases.
- 14.6.30 Four projects, including “Revised Trunk Road T4 in Sha Tin”, “Relocation of Diamond Hill Fresh Water and Salt Water Service Reservoirs to Cavern”, “In-situ Reprovisioning of Sha Tin Water Treatment Works – South Works” and “The Proposed Drainage Improvement Works at Chui Tin Street and Chui Tin Street Soccer Pitch” are likely to be constructed/operated concurrently with the LRT Project. Given the scale of impacts on natural habitats under the concurrent projects are minor and a majority of the project sites are urbanised and relatively disturbed, with the implementation of the proposed mitigation measures (e.g. staggered construction works period, adoption of good site practices, transplantation of flora species of conservation importance, etc.) under the projects, no unacceptable adverse cumulative impacts are anticipated.

Cultural Heritage Impact

- 14.6.31 Ex Kowloon Canton Railway Beacon Hill Tunnel (Government Historic Site) is located approximately at 90m from the Project Boundary. No direct impact would be anticipated on Ex Beacon Hill Tunnel but indirect impacts including ground-borne vibration, tilting and settlement, would be anticipated during the construction phase. Pre and post condition survey of Ex Beacon Hill Tunnel (Government Historic Site) should be conducted by professional qualified building surveyor or engineer. Monitoring of vibration, settlement and tilting incorporated with a set of AAA system shall be employed for the Ex Beacon Hill Tunnel during the construction phase, measuring inside the tunnel tube at locations closest to the works. A monitoring proposal should be submitted to AMO for agreement before the commencement of works.
- 14.6.32 Lau Ancestral Hall (Sha Tin Tau) (Grade 3), Tsang Tai Uk (Grade 1) and High Rock Christian Camp (Grade 2) are located at approximately 160m to 280m from the Project Boundary. No adverse impact would be anticipated on these historic buildings during the construction phase.
- 14.6.33 The first lion rock tunnel will be subjected to expansion during the construction phase, while the second lion rock tunnel will undergo refurbishment. It is suggested that fonts on both sides of the portals of the two tunnels should be kept or replicated and placed on similar position as the current setting. Most of the associated buildings of the Lion Rock on both sides of the portals will be demolished. Colour scheme of the associated buildings of the tunnels is suggested to be adopted to the new administrative buildings. Moreover, the two commemorative plaques marking the opening ceremony of the tunnel should be kept at prominent position at the new administrative buildings visible to all guests. Detailed photographic recording on the Lion Rock Tunnel and its associated buildings (both exterior and interior) should be conducted before any works to commence. A copy of the photographic documentation should be provided to AMO for record.
- 14.6.34 Other twelve non-graded buildings identified within the 300m assessment area contained very low cultural heritage significance. No impact assessment is anticipated due to considerable distance from proposed works. Hence, no mitigation measure is required to be carried out on these buildings.

- 14.6.35 The archaeological potential in the assessment area is negligible. No archaeological impact would be anticipated during the construction phase of the Project. As a precautionary measure, AMO should be informed immediately in case of discovery of antiquities or supposed antiquities in the course of works, so that appropriate mitigation measures, if needed, can be timely formulated and implemented in agreement with AMO.
- 14.6.36 No adverse impact would be anticipated on both built heritages and archaeology during the operational phase.

Landscape and Visual Impact

- 14.6.37 The Project will inevitably result in some landscape and visual impacts during construction and operation phases. These impacts have been minimized through careful consideration of alternatives to minimize direct conflict with LRCP, minimization of works areas, and incorporation of aesthetic external designs and appropriate landscape and visual treatments along the LRT Road.
- 14.6.38 Based on a broad brush tree estimate among the approximate 5,018 existing trees including 26 individual trees surveyed, approximate 2,925 existing trees (including 2,910 nos. of existing trees in tree groups, 14 nos. of trees of particular interest and 1 no. of potential tree of particular interest) will be unavoidably affected by the Project in which approximate 300 nos. of affected trees are within Lion Rock Country Park. None of them are OVTs. The major affected tree species include *Acacia confusa*, *Casuarina equisetifolia*, *Eucalyptus robusta*, *Eucalyptus tereticornis*, *Lophostemon confertus*, *Schima superba* and *Sterculia lanceolata*. Among the 26 individual trees surveyed, 14 nos. of *Ailanthus fordii* with conservation importance located on the slopes along the LRT Road and 1 no. of potential tree of particular interest *Ficus elastica* located on the slope in Lung Cheung Road Park are in direct conflict with the construction of road improvement works. All of the 15 affected individual trees are outside Country Park boundary.
- 14.6.39 Under the proposed scheme for the Project, opportunities for tree compensation within the Project boundary has been fully explored and incorporated in the proposed mitigation measures as much as practicable. Compensatory tree planting in heavy standard size is proposed at roadside flat areas mainly near the tunnel portal area and toll plaza administration area in Tai Wai. To minimize the impact on loss of existing vegetation along the LRT road, compensatory woodland tree mix planting by native whip trees on slopes is proposed, mainly on the affected slopes to be reinstated along the LRT Road and at the road verge area in Hung Mui Kuk junction, subject to the gradient of the proposed new slopes. To compensate the loss of woodland in toll plaza administration area and portal area in Tai Wai, off-site woodland compensation area is proposed under Ecological Section of this EIA Report. The proposed species are commonly used in roadside environment and be native for areas adjoining woodland area where appropriate, so as to enhance the surrounding landscape and ecological value. Reference could be made to Greening Master Plan issued by CEDD and Street Tree Selection Guide promulgated by DEVB. Tree Preservation and Removal Proposals including compensation planting scheme shall be submitted in accordance with DEVB TC(W) No. 4/2020 - Tree Preservation.
- 14.6.40 Within the Project Boundary, a minimum of 145 heavy standard trees will be proposed at roadside flat areas mainly near the tunnel portal area and toll plaza administration area in Tai Wai and road verge area in Kowloon side, and total area of approximate 7,720m.sq. will be proposed as compensatory woodland tree mix planting of about 2,070 tree whips within site. In addition, approximately 0.3ha off-site woodland compensation area with approximately 1,200 nos. of native seedlings/whip tree is proposed. Mix of native tree species will be proposed in reference to Guiding Principles on Use of Native Plant Species in Public Works Projects promulgated by DEVB to improve the vegetation diversity, enhance ecological value and re-creation of vegetation habitat particular for areas adjoining the Lion Rock Country Park.
- 14.6.41 With the implementation of proposed mitigation measures, it is predicted that there would be moderate residual impact on existing landscape resources (LR-1.1, LR-1.2, LR-3.1, LR-3.2, LR-3.3 and LR-4.2) during construction, and slight to insubstantial impact on day 1 of

- operation. The residual impact on these landscape resources would be further reduced to insubstantial when the proposed compensatory planting, buffer planting and woodland mix planting become mature in year 10 of operation.
- 14.6.42 It is predicted that there would be moderate to slight residual impact on landscape character areas (LCA-1.1, LCA-1.2, LCA-1.3, LCA-1.4, LCA-2.1, LCA-2.2, LCA-3.2, LCA-4.1, LCA-5.1 and LCA-5.2) during construction and slight impact on day 1 of operation. The residual impact on these landscape character areas would be further reduced to insubstantial when the proposed compensatory planting, buffer planting and woodland mix planting become mature in year 10 of operation.
- 14.6.43 Appropriate landscape and visual mitigation measures are proposed during construction phase, including preservation of existing vegetation, control of night-time lighting glare, erection of decorative screen hoarding, management of construction activities and facilities, reinstatement of temporarily disturbed landscape areas and minimize the direct conflict with Lion Rock Country Park, and during operation phase, including compensatory tree planting for loss of existing trees, compensatory woodland mix planting on soil slopes, aesthetically pleasing design of aboveground structures, aesthetically pleasing design of highways structures and slope associated structures, aesthetically pleasing design of footbridges, noise barriers and noise enclosures, provision of green roof, provision of buffer planting / roadside planting and greening works on slopes and associated structures, to alleviate the potential impacts. Regarding mitigated visual impact, it is predicted that there would be moderate residual impact on residential VSRs in R-02, R-03, R-04, R-06 and R-07, recreational VSR in O-04, institutional VSR in I-01 and travelling VSR in T-02, and slight residual impact on residential VSRs in R-01 and R-10, recreational VSR in O-01 and O-03 and traveling VSRs in T-01, T-03 and T-05 during construction. The residual impact on most of these VSRs would be slight on day 1 of operation and be further reduced to insubstantial when the proposed tree planting becomes mature in year 10 of operation. The residual impact on several VSRs R-04, R-07, I-01 and T-02 with overview on the proposed noise semi-enclosure or proposed tunnel administration building, and O-04 viewing to the proposed noise semi-enclosure at a close distance would maintain as moderate throughout the operation phase. The residual impact on VSR O-03 overlooking the whole LRT Road in Shatin at an elevated view and VSR R-02 viewing to the proposed tunnel administration building and toll plaza area in relatively long distance would maintain as slight in year 10 of operation. There would be insubstantial residual impact on other VSRs within the visual envelope during the construction and operation of the Project.
- 14.6.44 As a whole, the residual landscape and visual impacts of the proposed Project is considered acceptable with the proposed mitigation measures implemented during construction and operation phases.
- Hazard to Life
- 14.6.45 There is a Potentially Hazardous Installation (Sha Tin Water Treatment Works) and the LPG storage installation at Worldwide Gardens located within the assessment area of the Project.
- 14.6.46 According to the latest information provided by the Water Supplies Department (WSD), it is understood that the upgrading works of the disinfection facilities in Sha Tin WTW will be completed in Year 2022, and all chlorine drums in Sha Tin WTW would be removed by Q4 2022 after the on-site chlorine generation (OSCG) plant is put into operation. Based on the tentative construction programme of this Project, the construction works for this project will be commenced in Year 2025, at which time the upgrading works of the Sha Tin WTW would already been completed. As such, risk impact due to storage of liquid chlorine in Sha Tin WTW would not be expected during the construction and operation phases of this Project, and thus no hazard to life assessment for the Sha Tin WTW is required.
- 14.6.47 A full quantitative risk assessment was carried out for the Project Site near the LPG Compound. The assessment was based on information collected from Census & Statistics Department, Hong Kong Observatory, Planning Department, Transport Department and site visits made by the Consultant.

- 14.6.48 The maximum individual risk contour of 1×10^{-6} per year contour extends approximately 60m from the LPG Compound. Given there is no offsite risk with frequency greater than 1×10^{-5} per year, individual risk is considered acceptable and in compliance with the Hong Kong Risk Guidelines. Part of the FN curve (i.e. between 3 and 6 fatalities) falls within the “ALARP” region and this trend is applicable for all assessed scenarios (i.e. Year 2033 – Base Case, Year 2033 – Construction Phase and Year 2041 – Operation Phase). The total PLLs for all assessed scenarios were found to be about 3.84×10^{-5} per year and the proposed Project works area accounts for 2.87×10^{-8} per year (0.07% of total PLL) during construction phase. Thus, the PLL contribution to the proposed Project works area as compared with the overall risk level was considered negligible.
- 14.6.49 The EIA study concluded that the individual risks comply with the Hong Kong Risk Guidelines as stipulated in HKPSG. Although the societal risks partially fall within the “ALARP” region for all assessed scenarios, it is worth noting that the PLL contribution to the proposed Project works area as compared with the overall risk level is considered negligible (i.e. 2.87×10^{-8} per year), and there are no practicable risk mitigation measures identified to further reduce the risk level at the project works area. Nonetheless, good safety practices are recommended to further manage and minimize the potential risks during construction phase of the Project. Regular audit during construction phase is recommended.

14.7 Environmental Protection Measures Recommended

- 14.7.1 Mitigation measures have been recommended to further reduce the environmental impacts during construction and operation phases of the Project. Key recommended mitigation measures and any associated benefits are summarized in **Table 14.2** below.

Table 14.2 Summary of Mitigation Measures and Associated Environmental Benefit

Environmental Aspect	Mitigation Measures and any Associated Benefit
Air Quality Impact	<ul style="list-style-type: none"> • Watering once every 2 hours on work areas, exposed surface and unpaved road to reduce dust emission. • Sealed door and dust collector with dust removal efficiency of at least 80% at the opening of tunnel mined by drill and break. • Implementation of dust suppression measures as required in the Air Pollution Control (Construction Dust) Regulation to minimize construction dust impact. • With implementation of the above measures, potential air quality would be minimised/avoided. No adverse air quality impact would be anticipated
Noise Impact	<p>Construction Phase:</p> <ul style="list-style-type: none"> • NSRs are protected with implementation of the proposed noise mitigation measures, including the use of QPME, deployment of construction noise barriers, sequencing operation of construction activities at critical area, reduction of PME at critical works area and avoiding to carry out particular noisy construction activities during examination periods. The predicted mitigated construction noise levels arising from the Project at all NSRs selected for the construction noise impact assessment would comply with the EIAO-TM construction noise criteria during non-restricted hours and restricted hours. <p>Operation Phase:</p> <ul style="list-style-type: none"> • Provision of low-noise road surfacing polymer modified friction course (PMFC) (i.e. a type of low noise road surfacing) as standard surfacing material • Provision of a total of 170m long vertical noise barrier, 240m long cantilever noise barriers, and 1300m long semi- enclosure on Project Road sections (refer to Table 4.22, 60604728/R42b/Figure 4.4, 60604728/R42b/Figure 4.4.2, 60604728/R42b/Figure 4.4.3 and 60604728/R42b/Figure 4.4.4) can protect 1,239 dwellings.

Environmental Aspect	Mitigation Measures and any Associated Benefit
Water Quality Impact	<p>Construction Phase:</p> <ul style="list-style-type: none"> • Implementation of mitigation measures and good site practices in ProPECC PN 1/94 “Construction Site Drainage”, and precaution measures in ETWB Technical Circular (Works) No. 5/2005 • Provision of temporary sanitary facilities, such as chemical toilets, for construction workforce • Implementation of groundwater infiltration minimisation strategies and post-grouting • Adoption of proper interception and treatment of contaminated site runoff and wastewater from land decontamination in compliance with the TM-DSS, and proper treatment or recharge of contaminated groundwater in compliance with the TM-DSS • With implementation of the above measures, potential water quality would be minimised/avoided. No adverse water quality impact during construction phase would be anticipated <p>Operation Phase:</p> <ul style="list-style-type: none"> • Adequate design in on-site STP adopted MBR with UV disinfection, an emergency storage tank with 2 hours of ADWF capacity and grease trap for sewage and wastewater generated from administration building which designed with reference to EPD’s “Guidelines for the Design of Small Sewage Treatment Plant”. • Provision of dual or standby power supply, standby sewage treatment units, flow sensors and alarm systems for the on-site STP. • Provision of spare parts such as electrical and mechanical components of the on-site STP in case of break down / emergency. • Adequate design in septic tank with soakaway system and active carbon filter for sewage and wastewater generated from ventilation buildings which take into account the guidelines in ProPECC PN 5/93. • Adequate design in on-site STP, petrol interceptor and sedimentation tank for wastewater generated from washing and maintenance operation. • Regular test, maintenances and replacement of membranes or equipment to maintain a good operation condition. • Regular maintenance to all wastewater treatment system, including the on-site STP, septic tank with soakaway system, grease traps, active carbon filter system, petrol interceptor, sedimentation tank, etc. • With implementation of the above measures, potential water quality would be minimised/avoided. No adverse water quality impact during operation phase would be anticipated
Waste Management Implications	<ul style="list-style-type: none"> • Implementation of good site practices, waste reduction measures and proper storage, collection and transport of waste to ensure no adverse environmental impact in relation to hazard, air/odour emissions, noise, wastewater discharge or public transport.
Land Contamination	<ul style="list-style-type: none"> • Subject to the finding of supplementary CAR(s) / site appraisal, if contamination is identified, the remediation measures for remediation works as stated in RR(s) should be implemented to ensure soil/groundwater contamination, if any, would be identified and properly treated prior to construction works.
Ecological (Terrestrial) Impact	<ul style="list-style-type: none"> • Avoidance of encroachment on recognised sites of conservation importance (i.e. LRCP (about 197 ha) and Beacon Hill SSSI (about 34 ha) within the assessment area as far as possible. • Carefully design of the detailed layout of the construction works to avoid/minimise direct impact on flora species of conservation

Environmental Aspect	Mitigation Measures and any Associated Benefit
	<p>importance recorded in the project footprint. If direct impact is unavoidable, mitigation measures to (e.g. transplant, compensate) the flora species of conservation importance should be conducted, where possible, according to Final Plant Preservation and Transplantation Proposal to be submitted at later stage.</p> <ul style="list-style-type: none"> • Reinstatement of temporarily affected area within the Project footprint (about 1.48 ha), including those within LRCP (about 0.25 ha), by woodland mix planting upon completion of works according to the Final Reinstatement Plan to be submitted at later stage. • Direct impact on fauna species of conservation importance and their key habitats are avoided. Precautionary measure such as a pre-construction survey in natural habitats within and in the surrounding of the Project footprint is recommended (e.g. woodland, mixed woodlands and natural watercourse within and near the Project footprint) prior to the commencement of construction activities. In case any fauna species of conservation importance recorded would be directly impacted, a Protection and Translocation Proposal should be prepared to recommend suitable mitigation measures at later stage. • Permanent (0.16 ha) and temporary (0.09 ha) loss of woodlands within LRCP would be unavoidable. While the temporarily affected woodlands would be reinstated by woodland mix planting upon completion of works, provision of compensation woodland in ratio not less than 1:1 in terms of area (i.e. at least 0.25 ha) in accordance with the Woodland Compensation Plan is recommended as mitigation and enhancement measures. • Implementation of good site practices (e.g. provision of screening, control of glare / lighting, groundwater infiltration minimization measures, etc), regular site inspection and monitoring requirement. • Implementation of groundwater infiltration minimization measures (e.g. groundwater control strategies, post-grouting) as stated in the Water Quality Section above and <u>Section 5</u> of the EIA Report. • Adoption of NTHMMs with smaller footprint (rigid barriers and flexible barriers) to avoid and minimize the potential impacts to LRCP, natural habitats and associated vegetation. <p>Operation Phase:</p> <ul style="list-style-type: none"> • Implementation of good site practices and mitigation measures (e.g. planting of peripheral screening plants/vertical green, control of glare / lighting) measures to minimize potential indirect impacts including dust, noise, site runoff, groundwater infiltration and glare) to natural habitats and wildlife in the vicinity • Carefully design of the noise barrier (e.g. location, use of tinted materials and superimposing dark patterns or strips on the noise barrier) to avoid and minimize bird mortality from collision.
Impact on Cultural Heritage	<p><u>Avoidance of impact on Ex-Kowloon-Canton Railway Beacon Hill Tunnel and non-graded buildings and structures including Lion Rock Valve House, Lion Rock High Level No.1 Primary Service Reservoir, Lion Rock Low Level Primary Service Reservoir, Radio Television Hong Kong Broadcasting House during construction phase:</u></p> <ul style="list-style-type: none"> • Monitoring of vibration, settlement and tilting incorporated with a set of Alert, Alarm and Action (AAA) system <p><u>Maintenance of the original sentiment of Lion Rock Tunnel and associated buildings with following measures:</u></p> <ul style="list-style-type: none"> • Fonts on both sides of the portals of the two tunnels should be kept

Environmental Aspect	Mitigation Measures and any Associated Benefit
	<p>or replicated and placed on similar position as the current setting</p> <ul style="list-style-type: none"> • The colour scheme of associated buildings could be adopted to the new administrative buildings in order to maintain the original sentiment. • The two commemorative plaques marking the opening ceremony of the tunnel should be kept at prominent position at the new administrative buildings visible to all guests. • Detailed photographic recording on the Lion Rock Tunnel and its associated buildings (both exterior and interior) should be conducted before any works to commence. A copy of the photographic documentation should be provided to AMO for record.
Landscape and Visual Impacts	<p>Construction Phase:</p> <ul style="list-style-type: none"> • Preservation of Existing Vegetation • Control of Night-time Lighting Glare • Erection of Decorative Screen Hoarding • Management of Construction Activities and Facilities • Reinstatement of Temporarily Disturbed Landscape Areas • Minimize the Direct Conflict with Lion Rock Country Park • Minimize Disturbance on Watercourses <p>Operation Phase:</p> <ul style="list-style-type: none"> • Compensatory Tree Planting (min. 145 heavy standard trees) for Loss of approximate 2,925 nos. of Existing Trees • Compensatory Woodland Mix Planting (7,720m.sq.) within site (about 2,070 tree whips) and provision of off-site compensation woodland (about 0.3 ha or 1,200 native seedlings/whip trees) • Aesthetically pleasing design of Aboveground Structures • Aesthetically pleasing design of Highways Structures and Slope Associated Structures • Aesthetically pleasing design of footbridges, noise barriers and noise enclosures • Provision of Green Roof • Provision of Buffer Planting / Roadside Planting • Greening Works on Slopes and associated structures <p>With the implementation of proposed mitigation measures, the residual landscape and visual impacts would be further minimized throughout the operation phase when the proposed compensatory planting, buffer planting and woodland mix planting become mature in year 10 of operation to blend in with the adjacent landscape and visual setting of the area.</p>
Hazard to Life	<ul style="list-style-type: none"> • Establishment of emergency response plans. • Safety/emergency response training and drills for all personnel. • Maintain the number of construction workers onsite to a minimum to minimise any potential risk.

14.8 Estimation of Population Protected

14.8.1 Population and environmental sensitive areas in the vicinity of the Project site have been protected through the avoidance and/or minimization of environmental impacts from the construction and operation of the Project. Population protected from air quality impacts include air sensitive receivers within 500m from the Project Boundary including residential buildings, commercial buildings, industrial buildings, cultural uses, educational uses, recreational uses, places of public worship, and government/institutional or community uses.

Population protected from noise impacts include noise sensitive receivers within 300m from the Project Boundary including estimated 1,239 residential dwellings. Population protected from water quality impacts include water sensitive receivers within 500m from the Project Boundary.

14.9 Compensation Area Included

14.9.1 The permanent and temporary loss of woodlands within LRCP are about 0.16 ha and 0.09 ha respectively. While the temporarily affected woodlands would be reinstated by woodland mix planting upon completion of works, an addition of 0.09 ha compensation woodland would be provided as enhancement measures. Thus, to compensate the unavoidable loss of woodland within LRCP (about 0.25 ha), provision of compensation woodland in a ratio not less than 1:1 in terms of area should be carried out in accordance with the Final Woodland Compensation Plan to be submitted at later stage. Woodland compensation area of about 0.3 ha area is preliminary identified at an agricultural land habitat west to the Sha Tin South Fresh Water Service Reservoir within assessment area.

14.10 Overall Conclusion

14.10.1 The findings of this EIA have provided information on the nature and extent of environmental impacts arising from the construction and operation of the Project. The EIA has, where appropriate, identified mitigation measures to ensure compliance with environmental legislation and standards.

14.10.2 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.