2 PROJECT DESCRIPTION

2.1 Purposes, Project Objectives and Environmental Benefit of the Project

2.1.1 The objective of the Project is to rehabilitate and improve the existing tunnel tubes of the Lion Rock Tunnel (LRT) and to take this opportunity to enhance the capacity of the tunnel and the connecting roads as far as possible, with a view to extending the service life of the LRT and help alleviating the traffic congestion at the LRT during peak hours and the traffic impact during maintenance.

2.1.2 Smoother traffic flows enhanced by the proposed improvement works would alleviate the air quality and noise impacts associated with traffic congestion during peak hours. Although the noise sources at certain locations may be nearer to local sensitive receivers due to the road widening works, noise mitigation measures such as noise barriers and noise enclosures will be constructed under the Project. These works could also help reduce the existing noise impact on the adjacent sensitive receivers such as residential uses, hospital, etc. Detailed noise assessments, the extent and locations of the noise mitigation measures proposed and their envisaged improvements to noise impacts are outlined in **Section 4**.

2.2 The Need for the Project

Site Location and Site History

2.2.1 The LRT is a trunk road linking traffic between Shatin and Kowloon. It consists of two tunnel tubes each with two traffic lanes.

2.2.2 Between 1962 and 1967, the 1st LRT (Kowloon bound) was constructed in association with the construction of Kowloon Portal and Sha Tin Portal. Lion Rock Tunnel Road and a series of slope feature were formed. Waterloo Road extended northward, widened and connected to Lung Cheung Road at north before 1967. The area, where was to the north of Lion Rock Tunnel Road at Sha Tin, was still dominated by farmland in 1967.

2.2.3 In 1973, the 2nd LRT (Shatin bound), which was situated to the west of and parallel to the first tunnel, was under construction in association with the construction of another Kowloon and Sha Tin Portals to accommodate the residential development along Lion Rock Tunnel Road at Sha Tin.

2.2.4 Since the early 1970s, more abandoned farmlands, which were situated at the flatland at Sha Tin, had become utilized by residential buildings and cottages. Reclamation along Shing Mun River and quarrying activities at Shui Cheun O had started before 1978. A circular loop of Hung Mui Kuk Road near World-wide Garden was constructed and connected to Lion Rock Tunnel Road at the north before 1980.

2.2.5 Between 1980 and 1983, Sha Tin Road was constructed and connected to Lion Rock Tunnel Road at the east in association with the formation of a series of slope features.

Scenario without the Project

2.2.6 The Kowloon bound and Shatin bound tunnel tubes have been put in use for over 50 years and 40 years respectively. Signs of deterioration of tunnel structures have become apparent. Due to heavy traffic demand, the time slots of only a few hours during night time for tunnel closure cannot allow comprehensive repair and strengthening works to be undertaken.

2.2.7 Being an old design, the LRT does not meet the current standards in various aspects including waterproofing, dimensions (e.g. headroom and width), smoke extraction, evacuation, durability, Traffic Control and Surveillance System (TCSS), etc.

2.2.8 As LRT and LRT Road are already operating close to or above capacity, they could not cope with the ever-growing traffic demand. This has led to long traffic queues to appear along the connecting roads including the LRT Road at Shatin side, as well as the Lung Cheung Road and Waterloo Road at Kowloon side. The ever-growing congested traffic and long traffic queues have the potential to worsen the air quality and noise impacts to the sensitive receivers along these connecting road links. Furthermore, some of the LRT traffic may also choose an alternative route and use other tunnels and roads to travel between Kowloon and Shatin instead when there is serious congestion at LRT and LRT Road. Many of these existing road links in urban Kowloon and Shatin are already operating close to or above capacity. Increase in traffic along these road links will worsen the traffic conditions and in turn also worsen the noise and air quality impacts in Kowloon and Shatin.

Scenario with the Project

2.2.9 Comprehensive rehabilitation of the two existing tunnel tubes can bring LRT up to current standard and extend its serviceable years; thereby enhancing the tunnel environment and road safety level. Enhancing the capacity of the LRT and the connecting roads as far as possible is also necessary to improve the traffic flow at this critical link between Shatin and Kowloon.

2.2.10 The Project comprises of construction of a new middle tunnel, rehabilitating the existing Shatin bound Lion Rock Tunnel tubes and enlargement of existing Kowloon bound Lion Rock Tunnel tubes. The traffic conditions within the LRT, after the implementation of the proposed improvement works, could also be enhanced, alleviating congestions and improving the traffic conditions to acceptable levels. From an environmental perspective, this could lead to smoother traffic flows which in turn could decrease the noise and air quality impacts.

2.2.11 Furthermore, road widening works are also proposed along the Lion Rock Tunnel Road which could also enhance the traffic conditions, thereby leading to smoother traffic flows and potential reduction in congestion, journey times and queue lengths at the Shatin side. At Kowloon side, the Project will provide an additional traffic lane in the form of a separate, one-lane vehicular bridge across Lung Cheung Road along Lion Rock Tunnel Road northbound. This will allow direct entry into Lion Rock Tunnel Road (northbound) for traffic from Lung Cheung Road (westbound), thereby significantly reducing the existing congestion and vehicular queue length along the nearside lane of Lung Cheung Road (westbound) and Waterloo Road (northbound).

2.2.12 Aside from reducing the noise and air quality impacts through smoother traffic movements, reduced travelling times and queue lengths, the Project also provides direct noise mitigation measures such as noise barriers to alleviate noise impact on nearby sensitive receivers along LRT Road. Existing traffic noise impacts on the nearby sensitive receivers such as those along LRT Road could be alleviated as much as possible. Detailed noise assessments, the extent and locations of the noise mitigation measures proposed and their envisaged improvements to noise impacts are outlined in **Section 4**.

2.2.13 Nevertheless, the Project will induce environmental impacts during construction such as construction noise, dusts, site runoff etc. It is envisaged that with the implementation of quieter Powered Mechanical Equipment (PME) and good site practices, the construction environmental impacts could be limited to acceptable levels. It should also be noted that while the works under the Project are designed to avoid encroachment on the Lion Rock Country Park (LRCP) and natural habitats as far as possible, encroaching into the LRCP is inevitable near the existing tunnel toll plaza and along Lion Rock Tunnel Road near Hung Mui Kuk Interchange. The impact to the LRCP has been assessed and detailed mitigation measures proposed are outlined in **Section 8**.

2.2.14 A summary of the environmental benefits and disbenefits with and without the Project is provided in **Table 2.1** below.

Table 2.1 Summary of Environmental Benefits and Disbenefits With and Without the Project

Scenarios	Environmental Benefits	Environmental Disbenefits
With Project	• Provides direct noise mitigation measures such as noise barriers to alleviate noise impact on nearby sensitive receivers along LRT Road. • Provides additional traffic capacities to the Lion Rock Tunnel and Lion Rock Tunnel Road, thereby relieving congestion and decrease the impacts to air quality and noise sensitive receivers subject to the locations. • Opportunity to improve the environmental performance (e.g. greening, aesthetics) of the tunnel ventilation and administration buildings.	• Encroachment into the LRCP and woodland, and tree felling (woodland and tree compensation will be implemented) • Large amounts of Construction and Demolition (C&D) materials will be generated due to tunnelling and site formation works (potential for re-use on-site and at other projects) • Construction phase environmental impacts such as construction noise, dust, site runoff etc. (implement good site practices)
Without Project	• No impacts to LRCP and woodland, and no tree felling. • No wastes generated. • No construction phase environmental impacts to sensitive receiver (e.g. construction noise, dust, site runoff etc.)	• Many of the existing major road links are already operating close to or above their capacity. Congestion is expected to occur more frequently not only at Lion Rock tunnel and Lion Rock Tunnel Road but also to large areas in Kowloon and Sha Tin, therefore, long term impacts to sensitive receivers would be worsen.

2.3 Location and Scope of the Project

2.3.1 The location and scope of the Project is shown in **60604728/R42b/Figure 2.2** to **60604728/R42b/Figure 2.5**. The EIA study covers the LRT, Lion Rock Tunnel Road (both Kowloon and Sha Tin sides), a section of Hung Mui Kuk Road near World-wide Garden, a short section of Waterloo Road adjoining Lion Rock Tunnel Road, and a short section of minor road works along Lung Cheung Road (E/B).

2.3.2 The scope of the Project comprises the construction of the new tunnel tube to facilitate the subsequent rehabilitation of two existing tunnel tubes, widening of the connecting roads and the associated works. The details are as follows:-

(a) Construction of a three-lane road tunnel of approximately 1.4 km long between the two existing tunnel tubes of the LRT;

(b) Enlargement of the existing Kowloon bound tunnel tube to a three-lane road tunnel, together with the construction of cross passages linking the enlarged Kowloon bound tunnel tube with the new middle tunnel;

(c) Carry out refurbishment works on the existing Shatin bound tunnel tube and replacement/rehabilitation of the existing fire services provisions;

(d) Provision of equipment including TCSS for operation of the tunnels;

(e) Demolish the existing toll plaza together and provision of equipment and facilities for free-flow tolling;

(f) Re-provision of tunnel buildings including tunnel administration building (ADB), ventilation buildings (VBs) etc., construction of a vehicular crossover bridge to support tunnel operations, and construction of footbridges and any other tunnel support facilities;

(g) Widening of LRT Road at Kowloon side to dual three-lane from the slip roads of Lung Cheung Road interchange to LRT Kowloon portal and construct a single lane vehicular bridge crossing over Lung Cheung Road for the Shatin bound direction;

(h) Widening of the slip road from Lion Rock Tunnel Road (S/B) to Lung Cheung Road (E/B) to two lanes, and realigning the slip road from Lung Cheung Road (E/B) to Lion Rock Tunnel Road (N/B);

(i) Widening of LRT Road at Shatin side to dual three-lane between the existing tunnel portal to Fung Shing Court (except a section of the northbound carriageway between the slip roads to and from Hung Mui Kuk Road which would remain two lanes);

(j) Reprovisioning of Footbridge NF74 near Fung Shing Court;

(k) Provision of noise barriers / enclosures to mitigate the road traffic noise impact on noise sensitive receivers; and

(l) Ancillary works including slope works, water mains diversion, road lighting, drainage, landscaping works, etc.

2.4 Design Changes to the Project

2.4.1 Subsequent to the issue of the EIA Study Brief (No. ESB-323/2019) in November 2019, some changes were made to the project boundary, layout and design to facilitate the project development and latest traffic needs. The project layout submitted under the Project Profile (No. PP-589/2019) is attached in **60604728/R42b/Figure 2.6** to **60604728/R42b/Figure 2.9**. In accordance with Clause 6.2 of the EIA Study Brief, it was checked if there was any key change in the scope of the Project mentioned in **Section 1.2** of the EIA Study Brief and in Project Profile (No. PP-589/2019), confirmations would have to be sought from the Director of Environmental Protection in writing on whether or not the scope of issues covered by the EIA Study Brief can still cover the key changes, and the additional issues, if any, that the EIA report must also address. It is confirmed by EPD on 28 June 2021 that the proposed changes to the project would not fundamentally alter the key scope of issues covered by the EIA Study Brief (No. ESB-323/2019). The EIA Study Brief is still valid for the preparation of the EIA Report. The reply from EPD is presented in **Appendix 2.1**.

2.5 Consideration of Alternative Options

2.5.1 Assessments have been carried out to ensure that the Project will yield the most environmental benefits. **60604728/R42b/Figure 2.11** outlines the site constraints in the vicinity of the Project. Major aspects of the Project reviewed include the following:

- Need for a new tunnel;
- Alignment of the tunnel;
- Tunnel ancillary facilities;
- Alignment of the road widening;

Need for a New Tunnel

2.5.2 The need for a new third tunnel was explored. To ensure safety to the tunnel users, the one-tube-two-way traffic arrangement (i.e. similar to the existing arrangement during routine tunnel maintenance after midnight) will have to be implemented full-time while one of the existing tunnel tubes is undergoing enlargement. However, this will reduce the traffic capacity of the LRT. Given that the LRT is one of the most heavily used road tunnels in Hong Kong, this will cause traffic impacts at both ends of the tunnel. Traffic queues and congestions are expected along the tunnel connecting roads (e.g. Lion Rock Tunnel Road, Waterloo Road, Lung Cheung Road etc.) which in turn will lead to increased air quality impacts and noise impacts. Hence a new third tunnel is needed to facilitate uninterrupted traffic during construction. Consideration has also been given for an adoption of tunnelling works instead of traditional open-cut method for the provision of additional carriageways so as to avoid direct impacts on aboveground habitats within LRCP.

New Tunnel Alignment

2.5.3 There are three alignment options for the new tunnel, namely West Option, East Option and Middle Option, which will be detailed in the following sections. Extensive environmental considerations have been taken into account during the evaluation of options in order to minimize environmental impacts and maximize environmental benefits as far as possible.

New Tunnel at West of the existing LRT Northbound Tunnel (West Option)

2.5.4 For the tunnel alignment option west to the existing LRT, it should also be noted that local constraints at the existing Kowloon portal such as the WSD service reservoirs, the new residential development at Lot No. NKIL 6579 etc. meant that the new tunnel portal at Kowloon side could only be situated at the site adjacent to the residential development of Vista Panorama along Waterloo Road northbound. In addition to the proximity of the new

tunnel portal to Vista Panorama, the tunnel would also be 200m longer than the middle option, which means that it would be substantially more expensive and that approximately 15% more tunnel excavation materials will be generated and reused as far as possible before disposal. In addition, more construction vehicles will be needed to transport these additional wastes away which in turn will also increase the impacts to air quality and noise sensitive receivers.

2.5.5 This option would also require the construction of a deep TBM retrieval shaft at the natural hillside near the existing Kowloon portal. Though not within the boundary of the LRCP, the shaft will result in substantial reduction of wooded area and substantial tree felling. It should also be noted that the west tunnel alignment option would be constructed along a potential fault line as inferred from published geological maps. Adverse ground conditions may be encountered during tunneling, potentially leading to excess groundwater ingress and ultimately drawdown of the existing groundwater table along the tunnel alignment. This could have significant impacts to the flora and fauna within LRCP and the Beacon Hill Site of Special Scientific Interest (SSSI). As such, extensive ground treatment works will be required giving rise to significant increase in construction costs and programme.

2.5.6 Besides, traffic to and from Lung Cheung Road will require large detour resulting much longer travelling time. The longer distance travelled and the traffic congestion due to the additional traffic diverted from Lung Cheung Road to the local roads may result in potential air quality and noise impacts on nearby sensitive receivers.

2.5.7 Furthermore, construction of a new private residential development is currently underway within land lot NKIL Lot 6579 (i.e. southwest of the existing Lion Rock High Level No. 2 Primary Service Reservoir) near the Kowloon Portal. Connecting roads linking along LRT Road will hence be very close to the new development and may cause potential air quality and noise impacts on future residents/stakeholders etc. during construction and operation stages. Nevertheless, the northbound traffic will enter the new tunnel earlier which will significantly reduce the traffic (and hence noise and air quality impacts) between Vista Panorama and the LRT. Tunnel alignment of the West Option is presented in **60604728/R42b/Figure 2.12**.

New Tunnel at East of the existing LRT Southbound Tunnel (East Option)

2.5.8 For the tunnel alignment option east to the existing LRT, the situation is similar to the west in that the portal is also spatially constrained by the WSD service reservoirs at the Kowloon portal, and by the CLP pylons and overhead transmission lines (OHL) at the Shatin side.

2.5.9 As for aligning the third road tunnel to the east of the existing LRT southbound tunnel tube, extensive site formation works (approximately 9,000m² plan area) will have to be carried out at the Shatin Portal, which falls within the LRCP. Any direct encroachment upon LRCP should be avoided to the maximum practicable extent and alternative alignments should be explored. The tunnel would also be longer than the Middle Option, which means that it would be substantially more expensive and that approximately more tunnel excavated materials will be generated and requiring disposal if the material could not be reused. More construction vehicles will also be needed to transport these additional wastes away which in turn will also increase the impacts to air quality and noise sensitive receivers.

2.5.10 It is also expected that the extent of site formation works will clash with the existing CLP pylons. It is unlikely to relocate the CLP pylon and overhead transmission lines. Tunnel alignment of the East Option is presented in **60604728/R42b/Figure 2.13**.

New Tunnel in between of the existing LRT Tunnels (Middle Option)

2.5.11 The alignment of the new tunnel is ultimately proposed to be in between of the existing LRT tubes. This alignment is chosen as it will not spatially conflict with existing facilities such as the WSD service reservoirs, CLP pylons and residential developments. This middle tunnel alignment is also shorter than the west and east options (approximately 1400m only), thereby being the most cost effective and will produce the least amount of excavated materials.

2.5.12 This middle alignment is also further away from the inferred fault west of the existing LRT, hence the risk of excessive groundwater drawdown (and therefore the potential adverse impacts to the habitats of the LRCP and Beacon Hill SSSI) is much smaller than the west alignment option. The middle alignment will also require the least site formation works at the portal areas and therefore envisaged to have significantly less tree felling and disturbance to the natural hillside than the east and west option. Unlike the east option, no excavation within LRCP is envisaged due to the middle tunnel alignment. Hence, adverse ecological impacts on LRCP would be comparatively smaller for Middle Option. Also, the hillside vegetation at the LRCP and Tei Lung Hau are valuable visual and landscape resources of the Project. Unlike the West and East Options, the Middle Option will only encroach a very small area of vegetation within the LRCP. In addition, the Middle Option is located between the existing tunnels where the affected portal areas are mostly disturbed slopes with plantation. The extent of excavation for the Middle Tunnel is much smaller than the West and East Options. Hence it is considered that the Middle Option will have the least visual and landscape impact. Tunnel alignment of the Middle Option is presented in **60604728/R42b/Figure 2.4** and **60604728/R42b/Figure 2.5**.

2.5.13 Comparison of the environmental benefits and disbenefits of the various tunnel alignment studied is presented in **Table 2.2** below.

Table 2.2 Comparison of Environmental Benefits and Disbenefits of various Tunnel Alignment Options

Option	Environmental Benefits	Environmental Disbenefits
West of the existing Lion Rock Tunnels (West Option)	• Impacts to air quality and noise on sensitive receivers between Vista Panorama and the LRT envisaged to be lower relative to the Middle Option.	• The portal at Kowloon will have to be at the existing plantation area along Waterloo Road directly adjacent to Vista Panorama (increased potential air quality, noise and landscape and visual impacts). • Major traffic detours at Kowloon side necessary during construction phase leading to increased traffic, congestion, travelling time and hence increased impacts to air quality and noise sensitive receivers. • Longer tunnel necessary relative to the middle option, hence more excavated materials generated and construction vehicles for material transportation needed. Hence potentially increase air quality and noise impacts. • Tunnel runs directly under the Beacon Hill SSSI, and also runs parallel to an existing fault line. Potential water drawdown during construction thereby lowering the groundwater table and affecting the LRCP and Beacon Hill SSSI. • More direct loss of natural habitats as compare with Middle

Option	Environmental Benefits	Environmental Disbenefits
		Option, and hence potential adverse ecological impacts.
In between of the existing Lion Rock Tunnels (Middle Option) (Preferred Option)	• Shortest tunnel alignment, therefore least C&D wastes generated. Shortest construction time and least number of construction vehicles envisaged. • Least visual and landscape impacts as area between tunnels considered disturbed terrain. • No major traffic detours expected during construction. • No blocking of views / visual impacts to residential developments along Waterloo Road. • Less direct loss of natural habitats as compare with East and West Options, and hence smaller adverse ecological impacts.	
East of the existing Lion Rock Tunnels (East Option)		• Extensive surface excavation necessary within LRCP at Shatin side for the new tunnel portal. Extensive tree felling. • Major traffic detours at Kowloon side necessary during construction phase leading to increased traffic, congestion, travelling time and hence increased impacts to air quality and noise sensitive receivers. • Longer tunnel necessary relative to the middle option, hence more wastes generated and construction vehicles needed for material transportation. Hence potentially increase air quality and noise impacts. • More direct loss of natural habitats as compare with Middle Option, and hence potential adverse ecological impacts.

Tunnel Ancillary Facilities

2.5.14 According to TD's planning, it is envisaged that Free-Flow Tolling System (FFTS) will be implemented at the Lion Rock Tunnel before the construction commencement of the Project in Q1 2025. As such, portion of the existing toll plaza could be decommissioned right away, with the area at existing toll booths 11 to 13 and the associated roads before and after these toll booths (i.e. south of the existing toll plaza) to be readily freed up for other usages.

Need for Cross-over Bridge

2.5.15 It should be noted that the tunnel operator will have to comply with strict rescue and recovery operational requirements. During emergency situations, the requirement on the response time of tunnel staff to reach the site of any broken-down vehicles and/or traffic accidents within the tunnel administration area (including the tunnel tubes) is two minutes. Depending on the vehicle type, the broken-down vehicle and any debris will have to be cleared and the traffic lane has to be reopened within 5 to 12 minutes of arrival of the recovery vehicle. The existing crossover facility is located adjacent to the existing ADB near the Shatin Portal. However, it will be demolished together with the ADB as both are in the way of the future traffic from the new middle tunnel. As such, a vehicular crossover bridge adjacent to the reprovisioned ADB is proposed to avoid large detours and also to meet the stringent response time and clearance time requirements during emergencies.

Need for the car park and crossover bridge to be near the Tunnel Administration Building

2.5.16 The car park is envisaged to accommodate 60 nos. of vehicles in total (which include private vehicles, Light Recovery Vehicles (LRV), Heavy Recovery Vehicles (HRV), motorcycles etc.), and is expected to be at about 4,650m² on plan in accordance with the design requirement. As advised by the tunnel operator, the driver of the rescue and recovery vehicles will be stationed in the ADB. Hence it is imperative for the car park to be located in close proximity of the ADB in order to meet the stringent response and clearance time requirements. The vehicular cross-over bridge should also be close to the car park to avoid large detours and longer travelling times which in turn increases the response time of the rescue and recovery vehicles during emergencies.

Recommended Location of Reprovisioned Tunnel Administration Building and Car Park

2.5.17 As mentioned in **Section 2.5.2**, due to heavy usage at the existing Lion Rock Tunnel, it will be necessary to construct a new, third tunnel between the existing tubes, and then divert the existing traffic to this new middle tunnel before improvement works to the existing tunnel tubes could commence. As the existing administration building (ADB) is currently located at the area between the northbound and southbound lanes near the Shatin Portal, it will be in the way of the future tunnel traffic and hence will have to be decanted and demolished prior to commissioning of the new middle tunnel. The area south of the existing toll plaza (i.e. freed up due to the implementation of FFTS) provides an ideal location for the reprovisioned ADB. The area provides an unobstructed view of the Lion Rock Tunnel Road at Shatin side, and as the area is flat and on paved (previously carriageway) area unlike other areas near the Shatin Portal, no site formation works is necessary and no potential loss of woodland and natural habitats is envisaged. Furthermore, construction of the ADB could begin immediately after commencement of construction, thereby minimizing the construction time of the Project.

2.5.18 Considerations were also previously given to locate the reprovisioned ADB at the Kowloon Portal. However, the available space at Kowloon Portal is very limited as it is heavily constrained by three existing services reservoirs (namely the Lion Rock High Level No. 1 Primary Service Reservoir, Lion Rock High Level No. 2 Primary Service Reservoir and Lion Rock Low Level Primary Service Reservoir) and the residential development at Land Lot No. NKIL6579.

2.5.19 The car park and part of the crossover bridge is proposed to be located southwest of the reprovisioned ADB. The area is a relatively flat area compared with the topographies of the

alternative locations explored, which has fewer construction constraints and potential hazards. Another advantage is the filling/excavation works required are comparatively minimal for the formation of the platform of the proposed car park when compared to other alternative locations as mentioned below. Nevertheless, avoidance of LRCP was explored. Although the proposed car park will be located within the developed area and an engineered slope within LRCP, direct impacts on woodland within LRCP is avoided and the number of affected trees is negligible as compared with other alternative locations.

Alternative Location of the Car Park

2.5.20 The following alternative locations near Shatin Portal were explored for the proposed car park and compared with the current adopted location. Please refer to **60604728/R42b/Figure 2.14** for locations of the alternatives considered as follows:-

- Location 1: Feature No. 7SW-D/FR33 (i.e. north of the existing toll plaza);
- Location 2: Feature No. 7SW-D/C47 and 7SW-D/F430 (near Tei Lung Hau);
- Location 3: Feature No. 7SW-D/C97 (east of the existing Kowloon bound tunnel); and
- Location 4: Agricultural land adjacent to the Sha Tin South Fresh Water Service Reservoir

Location 1: At Feature No. 7SW-D/FR33

2.5.21 This alternative location is situated north of the existing toll plaza. It is on the other side of the Lion Rock Tunnel Road opposite of the reprovisioned ADB. Feature No. 7SW-D/FR33 is a rock fill slope at a gradient of about 33°, which is much steeper than the recommended location of the car park. If the car park is to be located at this area, the walking distance by the response staff from the reprovisioned ADB will be longer than the recommended location, and will overall take a longer response time to reach the incident site during emergencies. This is not desirable from an operational and traffic point of view.

2.5.22 In addition, extensive filling works which will encroach upon the existing woodland downslope of 7SW-D/FR33 will be required. In general, the maturity and species composition of woodlands at Tei Lung Hau are similar to the potentially affected woodland within LRCP as stated above. The woodland near 7SW-D/FR33 is also a mature woodland which also dominated by native common species. It is estimated that about 0.71ha of woodland (in addition to 1.08 ha of plantation) will be permanently lost for this option. Given the sloping terrain of 7SW-D/FR33, there will also be additional safety risks. Falling objects from the site may roll down to Ka Tin Court downslope, and workers will have to work at a much higher height and on much steeper terrain than the recommended location. As for environmental, Ka Tin Court and Union Hospital will be subjected to prolonged construction activities in their vicinity, and therefore more adverse air quality and noise impacts. There is also the risk of harmful materials leaking into the natural watercourse downslope at the northeast of 7SW-D/FR33 which in turn affects the water quality and ultimately ecology. Notwithstanding the above, the construction cost and time need for this alternative location will also be higher than the recommended location.

Location 2: At Feature No. 7SW-D/C47 and 7SW-D/F430

2.5.23 This alternative location is situated at Tei Lung Hau which is to the east across the LRT Road. It is a knoll with elevation spanning from 92mPD to 116mPD. Gradient of 7SW-D/C47 is at about 56°. The walking distance from the reprovisioned ADB will be about 280m, which will significantly prolong the response time of rescue and recovery vehicles reaching the incident site during emergencies. Furthermore, due to the topography at Tei Lung Hau, if the car park is to be located at this area, extensive excavation will have to be carried out which will involve the near complete removal of the knoll. This will lead to a permanent woodland loss of approximately 0.62 ha, with also a plantation loss of about 0.10ha. This potentially impacted

mature woodland has a closed canopy and dominated by common native tree species. Furthermore, both 7SW-D/C47 and 7SW-D/F430 are steep slopes located directly adjacent to the busy roadway. It will pose a higher safety risks to the road users than the recommended location. There is also the risk of harmful materials leaking/falling into the natural/modified watercourses downslope at the east of 7SW-D/C47 which in turn affects the water quality and ultimately ecology. Notwithstanding the above, the construction cost and time need for this alternative location will also be higher than the recommended location.

Location 3: At Feature No. 7SW-D/C97

2.5.24 This alternative location is situated east of the existing approach road to the Kowloon bound tunnel at the Shatin Portal. Similar to other alternative locations, the car park is situated further away than the recommended location, and hence will have a longer response time for rescue and recovery vehicles to reach the incident site during emergencies. Furthermore, this alternative location lies within the LRCP. If the car park has to be located in this area, extensive excavation works leading to a permanent woodland and plantation loss of 0.47ha and 0.25ha respectively including those within LRCP will have to be carried out. This potentially impacted woodland within LRCP is a mature woodland. A closed canopy was observed and dominated species within this woodland are common native species in Hong Kong. Furthermore, the extent of excavation works is envisaged to encroach the footprint of the existing CLP cable pylon which could in turn reduce the stability of the cable tower which is highly undesirable. Feature No. 7SW-D/C97 is an existing 42° soil cut slope. This will pose higher safety risks to both road users and workers than the recommended location. If the car park has to be located in this area, the excavation works will have to be carried out directly adjacent to the existing busy roadway. There is also an engineering concern with a view to meeting stringent requirement dictated by Technical Circular for carrying out such an extensive site formation works above underground railway structures, namely, from Diamond Hill Station to Hin Keng Station along Tuen Ma Line. Notwithstanding the above, the construction cost and time need for this alternative location will also be higher than the recommended location.

Location 4: Agricultural land adjacent to the Sha Tin South Fresh Water Service Reservoir (STSFWSR)

2.5.25 Considerations were also given to locate the proposed car park at the existing agricultural land and woodland area east of the STSFWSR. Although this area is mostly flat, it is more than 640m away from reprovisioned ADB. The separation of the car park and ADB is considered too large, and the response time for rescue and recovery vehicles to arrive at the scene of incident will be significantly delayed. It is highly undesirable from an operational viewpoint. There is currently vehicular access south, west and north of STSFWSR. This access road is currently maintained by WSD for their routine maintenance of the service reservoir. However, due to security concerns, proposal for co-sharing the access road through Sha Tin South Fresh Water Service Reservoir with the tunnel operator is not acceptable from WSD's standpoint. It should also be noted that although there are vehicular accesses in the area, there is no direct access to the agricultural land in question. Site formation works will be required to construct the access road. It is estimated that if the car park is to be located in this area, the total permanent woodland loss will be about 0.35ha. There is also the risk of harmful materials leaking/falling into the natural/modified watercourses downslope at the east of the STSFWSR and west of the existing agricultural land. The proposed works at this location could, in turn, affect the water quality and ultimately ecology downstream. Notwithstanding the above, the construction cost and time need for this alternative location will also be higher than the recommended location.

Road Widening Alignment

2.5.26 There are two alignment options for the proposed road widening works along LRT Road, namely uphill or downhill of LRT Road. Extensive environmental considerations have been taken into account during the evaluation of options in order to avoid/minimize encroachment into the LRCP and maximize environmental benefits as far as possible.

Widening of LRT Road (Uphill)

2.5.27 This scheme requires road widening works to be carried out uphill of LRT Road within the LRCP and very near existing burial grounds and graves. Due to the steepness of the uphill slopes, it is envisaged that slope cutting for the road widening works will result in the loss of a substantial portion of the country park's surface and burial grounds, and removal/relocation of graves/urns will become inevitable. Hence it is considered that retaining structures will, in general, be more suitable in this case as the extent of disturbance to the upslope area is envisaged to be much smaller.

2.5.28 Given the proximity to the LRT Road, there is little to no buffer space between the uphill slopes and the carriageway of LRT Road. Therefore, widening LRT Road uphill will most probably need to occupy one southbound traffic lane. Large hoardings will also be necessary to prevent falling objects onto LRT Road during the uphill site formation works. It is also envisaged that the main access to the works areas will be via LRT Road.

2.5.29 An advantage of this scheme is that the proposed road widening works is not envisaged to be any closer to the downhill developments than the current LRT Road.

2.5.30 However, the uphill option will encroach extensively within the LRCP as compared to the downhill option. This should be avoided to the maximum practicable extent. In addition, not only does the uphill option significantly reduce the country park's green area, it will also lead to the direct loss of woodland habitats, watercourses, flora and fauna. Burial grounds, graves and urns are also scattered extensively near the periphery of LRCP. The future traffic will also be much nearer to popular recreation amenities such as Wilson Trail and the Hung Mui Kuk Nature Trails.

2.5.31 From a traffic point of view, a major drawback of the uphill option is that it is very likely that temporary closure of a southbound traffic lane will be inevitable during uphill site formation given that there is currently limited to no buffer space between the uphill slopes and LRT Road. This will create bottlenecks and greatly worsen the already congested southbound (Kowloon bound) traffic during the morning peak hours. In addition, construction traffic to the uphill works sites will have to be via LRT Road further exacerbating the traffic. Although construction traffic using LRT Road could be limited to non-peak hours, this would no doubt have a direct impact on the construction programme.

2.5.32 Extent of the uphill site formation works is also expected to be much greater than its downhill counterpart. As such, the uphill option is expected to produce much more excavated materials (i.e. more construction vehicles). Furthermore, the downhill option could better utilize the existing upgraded/up-to-standards slopes and thus is more cost effective. The risk of falling objects is also much greater for the uphill option. Also, extensive excavation, vibrations from large piling machines etc. under the uphill option may also induce relict natural terrain landslides which would have otherwise stayed dormant.

Widening of LRT Road (Downhill)

2.5.33 **60604728/R42b/Figure 2.10** shows the comparison of uphill and downhill options. Although the downhill option will be nearer to the downslope residential buildings, villages, school and hospital, and thus likely to induce more adverse impacts on air quality and noise to these sensitive receivers, mitigation measures such as noise barriers/enclosures will be provided as described in **Section 4**, it is envisaged that less encroachment upon much sensitive LRCP as well as woodland area located along uphill side by virtue of shifting the widening works towards downhill, hence less disturbance such as tree felling is anticipated. It is also envisaged that the capital costs and social costs of the uphill option are higher than the downhill option. Moreover, implementation of the uphill option will also be more difficult and time-consuming. Construction uphill is also expected to be longer. Furthermore, road widening uphill will likely require the temporary closure of one traffic lane along LRT Road and that more construction vehicles will also make use of LRT Road to access the road widening works areas. These will cause traffic congestions along LRT Road southbound

which in turn can cause air quality impacts and noise impacts to sensitive receivers along LRT Road. The alignment of road widening downhill and uphill are presented in **60604728/R42b/Figure 2.2** to **60604728/R42b/Figure 2.5** and **60604728/R42b/Figure 2.6** to **60604728/R42b/Figure 2.9** respectively.

2.5.34 Hence, it is recommended to adopt the downhill option for the Project and carry out the road widening works downhill of the existing LRT Road as far as practicable. The need of uphill works near Hung Mui Kuk is required for the road widening works to avoid direct encroachment into existing buildings of World-wide Gardens.

2.5.35 Comparison of the environmental benefits and disbenefits on the road widening works alignment studied is presented in **Table 2.3** below.

Table 2.3 Comparison of Environmental Benefits and Disbenefits of various Road Widening Works Alignment Options

Option	Environmental Benefits	Environmental Disbenefits
Road Widening Uphill	• Further away from local sensitive receivers and hence in general lower in impacts to air quality and noise sensitive receivers and visual in operation phase.	• Extensive excavation within the uphill woodland area and LRCP which induce potential impacts to the local ecology, water quality and increased tree felling. • May require to take up one existing traffic lane during excavation. This will reduce the capacity of the road and increase chance of congestion, which in turn will increase impacts to air quality and noise sensitive receivers during construction phase. • Extensive excavation and resultant large extent of retaining structures along uphill will be visually intrusive and incompatible to the natural setting of the LRCP at Shatin side, which is considered as a major landscape and visual resource.
Road Widening Downhill (Preferred Option)	• Avoid/Minimized impacts and encroachment to the LRCP and the uphill woodland area. • Minimize tree felling. • Generate much less C&D wastes in general as reduced excavation into the natural slopes, and road widening downhill requires filling which can facilitate the use of	• The widened road will be nearer to certain sensitive receivers (i.e. the residential developments located downhill of LRTR at Shatin side). Nevertheless, the impacts could be mitigated / reduced with the provision of mitigation measures such as noise barriers and/or enclosures. • The installation of noise enclosure will be key visual impact to the visually sensitive

Option	Environmental Benefits	Environmental Disbenefits
	excavated materials (say from tunnel portal excavation). • Access to the site / works area could be via the downhill local roads and avoid the busy LRTR, thereby reducing the number of construction vehicles using LRTR and hence reducing the chance of causing congestion at LRTR. Reduced the potential impacts to air quality and noise sensitive receivers.	receivers along the LRTR at Shatin side. Appropriate aesthetic pleasing design of noise enclosure could be applied to mitigate the impact.

Natural Terrain Hazard Mitigation Measures (NTHMMs)

2.5.36 Potential landslide hazards from the natural terrain above the existing Lion Rock Tunnel Road (LRTR) to the operation and road users of the LRTR is identified. Large- scale slope stabilization and debris resisting barriers are the typical mitigation measures for the natural terrain hazards.

2.5.37 Given that the natural terrain hazards identified fall within the boundary of LRCP and any proposed NTHMMs at the natural hillside would have significant environmental and ecological impacts to the habitats of the LRCP inherently, it is therefore to recommend the construction of rigid barriers at the edge of the widened LRTR (on the developed/paved areas within the boundary of LRCP) as the preventative measures of the potential landslide hazards with an aim to avoiding extensive excavation and tree felling at the LRCP area. The approximate location of the proposed rigid barriers is shown in **60604728/R42b/Figure 2.3**.

2.5.38 Aside from the proposed rigid barriers within LRCP, erection of flexible barrier is adopted for the mitigation measures of the natural terrain hazard outside LRCP. As the majority of the road widening work along LRTR outside LRCP towards downhill, erection of flexible barriers at the uphill side is chosen instead of the large-scale slope stabilization works or erection of rigid barriers, of which it will be inevitably involving extensive excavation and tree felling at the uphill side along LRTR. The approximate location of the flexible barriers has been carefully studied in order to minimise the direct environmental and ecological impacts to the natural habitat outside the boundary of LRCP and presented in **60604728/R42b/Figure 2.2 & 60604728/R42b/Figure 2.3**.

2.6 Construction Methodologies

2.6.1 This section describes the planning of the construction of the Project, covering the key aspects including the envisaged methods of natural terrain hazard mitigation measures, tunnel construction, other infrastructures and the sequence of works.

Natural Terrain Hazard Mitigation Measures (Flexible Barriers) outside LRCP

2.6.2 The erection of flexible barriers is a lean construction as the mitigation measure for natural terrain hazard against large-scale slope stabilization works and construction of rigid barriers, and mainly involves limited no. of drilling works for anchors installation including manual construction of footing for the supporting of steel posts. Also, the existing maintenance access of the slope features would be used as the temporary site access for the construction of the flexible barriers while the temporary construction plant and storage area would be located distantly away from the woodland and sensitive area in order to further minimize the disturbance to the environment and natural habitats. The location and orientation of anchors

and footings would be designed carefully to avoid unnecessary tree felling as far as practicable, and small-scale trimming of vegetation would be limited at the location of anchors and footings.

Natural Terrain Hazard Mitigation Measures (Rigid Barriers) within LRCP

2.6.3 The erection of 2 rigid barriers within LRCP primarily involves construction of reinforced concrete (RC) retaining structures with possibly mini-piles/pre-bored H piles as foundation. The foundation of the rigid barriers will be carried out by either small drilling rig or pre-bored H pile drilling rig while small-scale excavation works is also anticipated. Given the fact that the rigid barriers are to be proposed at the paved/developed areas along LRTR instead of large-scale slope stabilization works and construction of rigid barriers at the natural hillside within LRCP, it is therefore envisaged that the impact to LRCP is tremendously minimized in view of the construction scale and location of the proposed rigid barriers.

Tunnelling Method

2.6.4 Based on the available geological profile, it is envisaged that tunnel excavation will be mostly carried out in good quality granite rock masses. They are typically excavated by either drill & blast or by tunnel boring machine (TBM) or other mechanical excavation methods such as drill and break. The preferred method of tunnel construction is greatly influenced by the local constraints and nearby sensitive receivers.

2.6.5 As discussed in **Section 2.2.6**, the Kowloon bound and Shatin bound tunnel tubes have been in use for over 50 years and 40 years respectively. Signs of deterioration of the tunnel structures have become apparent. As such, the existing LRT tunnel tubes are major sensitive receivers during construction of the new middle tunnel. Given the existing conditions of the LRT and the close proximity to the proposed tunneling works (approximately 10m to 15m), it is envisaged that only a small charge weight of explosives will be permitted if blasting is adopted. It should also be noted that apart from the existing LRT tunnel tubes themselves, there are also other major sensitive receivers nearby such as the five large diameter WSD watermains which supply freshwater to a large population in Kowloon and Hong Kong Island. In addition, the large vibrations from blasting may give rise to stability concerns on the natural slopes at the tunnel portals. There are also concerns on the potential risks and hazards to life to the public during transport and handling of explosives. The concerns on hazard to life is a major environmental consideration in selecting the tunnelling method.

2.6.6 It is also envisaged that locating an explosive magazine nearby will be extremely challenging given the proximity to residential developments, water treatment works and service reservoirs, major trunk roads and strategic traffic corridors etc. Without an explosive magazine, the blasting cycle will be heavily constrained and as such, delivery of explosives by CEDD Mines Department before each blast will most likely be confined between 11am and 2pm under normal circumstances. This means that blasting has to be carried out in the afternoon. The daily transport and handling of explosives will have serious impacts to hazard to life. It is also likely that the LRT has to be closed to traffic during blasting and also after each blast to check for misfires. This is highly undesirable from a traffic point of view considering that the LRT has one of the highest usages in Hong Kong. Though not peak periods, traffic queues and congestions are also expected at connecting roads on both sides of LRT, thereby increasing the impacts to air quality and noise sensitive receivers.

2.6.7 In general, ground-borne noise impacts from TBM or drill and break tunnelling can be more easily controlled than that of drill and blast. The advance rate of the TBM could be altered, and the choice of plants and equipment used for drill and break tunnelling could be modified to cater for different site conditions and constraints. 24-hour tunneling using a TBM and drill and break is also considered feasible and this will bring significant benefits to the implementation programme.

2.6.8 Despite the potential environmental benefits of using TBM, its environmental disbenefits include generation of more C&D materials than the drill and blast method. This is due to the

fact that typically, the horizontal spatial requirements of a road tunnel is greater than the vertical one (even more so with increasing number of traffic lanes). TBM is circular so in this case, the drill and blast method could provide more flexibility for a more efficient tunnel cross section. Furthermore, given the large TBM size, the extent of site formation works at the Shatin Portal (and therefore impacts to the existing woodland) may be larger than the drill and blast method. Nevertheless, given the heavy constraints of using blasting, and with considerations on hazard to life, air quality impacts, noise impacts, cost effectiveness, safety to tunnel users, water supply, proximity to residential developments and Potentially Hazardous Installations (PHI) etc., it is recommended not to adopt blasting. Instead, mechanical excavation such as using TBM and drill and break methods should be used for the tunnelling works.

2.6.9 Comparison of the environmental benefits and disbenefits of the various tunnelling methods studied is presented in **Table 2.4** below.

Table 2.4 Comparison of Environmental Benefits and Disbenefits of various Tunnelling Methods

Option	Environmental Benefits	Environmental Disbenefits
Tunnel Boring Machine (TBM) (Preferred Option)	• Controllable production rates to minimise the adverse impacts. • More easily controlled vibrations than drill and blast method. • Potential impacts in terms of noise, dust and hazard to life restricted to near the launching area. • Existing traffic could be maintained (unlike when during and after blasting) and so no additional traffic congestion (and therefore impacts to air quality noise) due to using TBM. • No significant hazards to the public envisaged during delivery and handling of the TBM.	• Extent of site formation works (and therefore impacts to the existing woodland area) may be larger than the drill and blast method due to large TBM required. • More C&D materials are expected to be generated relative to the drill and blast method.
Drill and blast	• Duration of construction nuisance will be shorter. • Less C&D materials are expected.	• Large ground-borne noise impacts and vibrations due to blasting which could potentially affect the fauna and flora of the woodland area near the tunnel. • Closure of the existing Lion Rock Tunnels may be necessary during and after blasting to check for misfires. As the Lion Rock Tunnel is very heavily used, traffic congestion is expected along a long section of Lion Rock Tunnel Road at Shatin side and along Waterloo Road at Kowloon side, thereby increasing

Option	Environmental Benefits	Environmental Disbenefits
		impacts to air quality and noise sensitive receivers. • Transport and handling of explosives to the tunnel staging area will have to pass by many residential areas within Sha Tin, thereby posing hazards to the public.

Area for Stockpiling

2.6.10 Since the construction of the new middle third tunnel is round-the-clock and generates significant amount of excavated spoils, the stockpiling area is then proposed accordingly. The following alternative locations near Shatin Portal were explored for the proposed area for stockpiling and compared with the current adopted location. Please refer to **60604728/R42b/Figure 2.15** for locations of the alternatives considered as follows:-

- Location 1: Area immediate next to the existing toll plaza at uphill side (on Feature No. 7SW-D/F31);
- Location 2: Area at Tei Lung Hau (above Feature No. 7SW-D/C47).

Location 1: Area immediate next to the existing toll plaza at uphill side (on Feature No. 7SW-D/F31)

2.6.11 The stockpiling area immediately adjacent to the existing tunnel vehicle depot south of the existing toll plaza is one of the options at first glance, where the car parking facilities will be also proposed and located in the operation stage. For this reason, it is envisaged that there is no additional loss of woodland area and ecological impacts due to the proposed stockpiling area. However, portions of the proposed stockpiling area will be located within the woodland area as well as LRCP. This location for temporary stockpiling area is not considered in view of these issues.

Location 2: Area at Tei Lung Hau (above Feature No. 7SW-D/C47).

2.6.12 Consideration was previously given to locate the stockpiling area at Tei Lung Hau. Nevertheless, the area at Tei Lung Hau is also classified as woodland area and a watercourse runs nearby this area. As no permanent works are proposed at this area, locating the stockpiling area at this location will incur additional woodland loss and ecological impacts unavoidably, the vegetation at the hillside of Tei Lung Hau is also deemed to be a visual resource. Hence relocating the stockpiling area away from Tei Lung Hau could also minimize the visual impacts of the Project.

2.6.13 Having reviewed the above considerations, the locations 1 and 2 will not be considered for the stockpiling area and the proposed stockpiling area is now located at the north of the existing toll plaza near downhill side within the footprint of the permanent works (i.e. no additional ecological impacts) and outside of LRCP.

Construction of administration building/ ventilation buildings and tunnel associated structures

2.6.14 The Project's administration building and the Shatin ventilation building will be situated at the Shatin Portal whereas the Kowloon ventilation building will be situated at the Kowloon Portal. The ventilation buildings and administration building will be constructed by typical reinforced concrete construction method which includes i) formwork and falsework erection, ii) rebar fixing, iii) concrete pouring and curing, and iv) formwork striking and back propping.

Superstructures will adopt bottom-up construction. Construct ground floor slabs, beams, columns and walls to the lowest level and process upwards to roof level. No percussive piling is envisaged under the construction scheme. Other tunnel associated structures, such as depots, car parking facilities etc. will be constructed by cast-in-situ method using similar method. Considerations on the construction methods such as an adoption of cast in-situ instead of pre-cast have also been given to the site condition and construction scale of the tunnel associated buildings/structures. Since there is an insufficient working space allowing for storage and mobilization of the pre-cast elements, the adoption of cast in-situ for the tunnel associated buildings/structures is therefore considered as a safe mean of construction method in a view to avoiding mobilization of the pre-cast elements with a live traffic running nearby.

Construction of the road widening works along LRT Road

2.6.15 Road widening works along LRT Road would mainly comprise construction of slopes and retaining walls. The construction of the road widening roads mainly in the downhill area significantly replaced the need for massive equipment for bored piling works uphill to relatively much smaller filling and retaining structures (e.g. L-shaped walls) downhill that require simpler and more environmentally friendly equipment. The works are to a large extent governed by i) topographical constraint due to sloping ground conditions of the sites; ii) weather condition; iii) possible obstructions to the construction; and iv) geotechnical uncertainties which include ground and groundwater conditions. Owning to limited working space along LRTR, construction of L-shaped retaining structure by pre-cast element is impracticable in view of limited storage area and mobilization space required for pre-cast elements. However, to further reduce the environmental impacts, steel prefabricated formwork instead of traditional timber formwork will be adopted for the construction of L-shaped retaining structures as well as street furniture such as profile barrier as far as practical so as to minimize the C&D waste generated.

2.6.16 To avoid excessive cumulative environmental impacts to the nearby sensitive receivers, the proposed widening works along LRT Road 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 the construction programme.

2.6.17 In addition, the programme and sequence of works of this Project were planned in consideration of other nearby concurrent projects and therefore to minimize the cumulative environmental impacts during the construction stage of this Project. With regards to the road works along Lion Rock Tunnel Road, “Revised Trunk Road T4” project by Civil Engineering and Development Department (CEDD) and the “Reprovisioning of Sha Tin Water Treatment Works – South Works” project by Water Supplies Department (WSD) were considered having the highest possibility to impose cumulative negative environmental impacts to with our proposed road works to the nearby receivers which was in particular taken into account during the project planning.

2.6.18 Considering the “Revised Trunk Road T4” project by CEDD, the tentative construction works at Revised Trunk Road T4 will be completed in September 2028, while the start of the construction works under this Project at the work zone 1 near Sun Tin Wai Estate / Fung Shing Court is programmed to start in December 2028, thereby avoiding the cumulative environmental impacts, including but not limited to noise and air impacts, that may impose to the nearby sensitive receivers during the construction of the project.

2.6.19 Considering the “In-situ Reprovisioning of Sha Tin Water Treatment Works – South Works" project by WSD, the tentative construction programme for their substantial civil works will be completed by January 2025. Therefore, to minimize the cumulative impact with the said project, the substantial civil works at the Work Zone 5 at Sha Tin Portal was scheduled to commence in May 2025.

2.6.20 The details regarding the aforementioned projects can also refer to **Section 2.8** below.

2.6.21 The proposed 6.5m wide single lane elevated vehicular bridge to add an additional traffic lane along the Lion Rock Tunnel Road (N/B) across Lung Cheung Road at Kowloon side shall comprise upstand beams which shall be precast offsite, delivered and erected by mobile crane onsite. The slab shall be constructed using the cast in-situ method to avoid prolonged traffic diversion/congestion during erection which could ultimately cause air quality and noise impacts. No percussive piling is envisaged under the construction scheme.

2.6.22 Environmental friendly construction equipment such as installing sheet piles using the press-in method in-lieu of vibratory methods should be utilized as far as possible, such as during construction of the pile caps of the proposed viaduct and during site formation works for road widening.

2.7 Project Programme

2.7.1 The Project construction works are anticipated to commence in Q1 2025 with widening of Lion Rock Tunnel Road at Shatin except Toll Plaza area beginning in Q1 2025. According to the latest programme, the tentative completion year for the whole Project is 2034, with commissioning of six traffic lanes (excluding bus lanes) along LRT and LRT Road in 2034.

2.7.2 Reprovisioning of the new administration building and two new ventilation buildings shall be carried out in the early phases of construction between 2025 to 2028. At the same time, slope formation works will be carried out to form the tunnel launching area at Shatin Portal. Procurement, delivery and assembly of the TBM will also take place in this period. Tunnelling of the new middle tunnel by TBM is envisaged to commence in 2027. After commissioning of the new middle tunnel (2-lane, Kowloon bound direction) in 2029, the existing Kowloon bound traffic will be diverted to the new middle tunnel and enlargement of the existing Kowloon bound tunnel shall follow with commissioning of the 3-lane tunnel in 2032. At this time, the Kowloon bound traffic within the new middle tunnel shall be diverted to the enlarged Kowloon bound tunnel. The new middle tunnel shall then be temporarily closed off for minor modification works before commissioning the third traffic lane. Diversion of the existing Shatin bound traffic to the new middle tunnel will take place in 2034. The existing Shatin tunnel will then be closed off for refurbishment, with the refurbished tunnel expected to be completed by 2034. Concurrent to the tunnelling works, the road widening works along Lion Rock Tunnel Road at both Shatin (except toll plaza area) and Kowloon side shall be carried out between 2025 to 2033, with full commissioning of the dual 3-lane carriageway arrangement along LRT and LRT Road in 2034. Timeline showing the traffic arrangement of the tunnels is presented in **Table 2.5** below.

Table 2.5 Timeline of traffic arrangement of the tunnels

Tentative Schedule	Existing Shatin Bound Tunnel	New Middle Tunnel	Existing Kowloon Bound Tunnel
Q1 2025 – Q1 2029	2 lanes	In construction	2 lanes
Q2 2029 – Q4 2032	2 lanes	2 lanes (Kowloon bound)	Closed for Enlargement
Q4 2032 – Q4 2033	2 lanes	Closed for demolition of temporary partition wall	3 lanes
Q1 2034 – Q4 2034	Closed for Refurbishment	3 lanes (Shatin bound)	3 lanes

2.7.3 A tentative construction programme for the Project is provided in **Appendix 2.2**. This programme provides the basis for the assessments presented in the EIA Report, and tentative phasing of major construction works are outlined in **Table 2.6** below.

Table 2.6 Tentative Phasing of Major Construction Works

Major Works	Tentative Schedules
Construction of tunnel ancillary facilities at Shatin Portal (including testing and commissioning): ▪ new vehicular cross-over bridge and footbridge ▪ new administration building ▪ new ventilation building ▪ Workshops, depots, car parking facilities, FFTS gantries etc. ▪ slope formation works ▪ landscaping works Other misc. works at Shatin Portal: ▪ reprovision of surge tank ▪ watermain diversion ▪ woodland compensation* Construction of tunnel ancillary facilities at Kowloon Portal (including testing and commissioning): ▪ new ventilation building ▪ new portal structure ▪ slope formation ▪ landscaping works	Shatin Portal: Q1 2025 to Q2 2031 Kowloon Portal: Q3 2025 to Q4 2030
Tunnelling works (including testing and commissioning): ▪ Construction of new middle third tunnel tube by TBM ▪ Enlargement of existing Kowloon bound tunnel tube by drill & break method ▪ Refurbishment of the existing Shatin bound tunnel tube	New middle third tunnel tube: Q1 2025 to Q1 2029 (Construction) Q4 2032 – Q4 2033 (Closed for demolition of partition wall) Kowloon bound tunnel tube: Q2 2029 to Q4 2032 Existing Shatin bound tunnel tube: Q1 2034 to Q4 2034
Road widening works and road widening associated works at Shatin and Kowloon: ▪ road widening works ▪ slope formation works ▪ retaining wall works ▪ construction of noise mitigation measures (Shatin only) (i.e., noise barrier) ▪ Reprovisioning of Footbridge NF74 ▪ utilities diversion ▪ landscaping works including compensatory tree planting ▪ new vehicular bridge across Lung Cheung Road (Kowloon only)	Q1 2025 to Q4 2033

Note:
* Schedule refers to **Section 8.10.41**

2.8 Concurrent Projects

2.8.1 "Relocation of Diamond Hill Fresh Water and Salt Water Service Reservoirs to Cavern" project by WSD, which is a designated project, relocates the service reservoirs, including Diamond Hill Fresh Water Service Reservoir and Diamond Hill Salt Water Reservoir into caverns for releasing the existing Diamond Hill service reservoir sites for housing and/or other compatible and beneficial uses while ensuring a reliable, adequate and quality supply of water. Its construction is tentatively scheduled to commence in 2022 for major construction works in 2026 and full completion in 2027.

2.8.2 The "Revised Trunk Road T4" project by CEDD, which is a designated project, links up the end of the Project at Sha Tin Road. Based on the available information at the time of this EIA study, part of the Revised Trunk Road T4 Project involves widening of a section of Sha Tin Road near Pok Hong Estate of about 150m from dual 2-lane to dual 4-lane; and it would be carried out from 2023 to September 2028.

2.8.3 The "In-situ Reprovisioning of Sha Tin Water Treatment Works – South Works" project by WSD, which is a designated project, is to increase the treatment capacity of the South Works of Sha Tin Water Treatment Works from 364,000 m^3/day to 550,000 m^3/day to meet the anticipated increase in fresh water demand due to progressive implementation of new public and private housing developments and to reprovision the aged water treatment facilities of the South Works. Its construction is tentatively scheduled to commence in the second half of 2020 for major construction works completion in January 2025 and completion of remaining landscaping works in 2027.

2.8.4 The "Proposed Drainage Improvement Works at Chui Tin Street and Chui Tin Street Soccer Pitch" is to improve the conveyance capacity of the drainage network and relieve the flood risk in some local areas in Sha Tin and Sai Kung. Based on the available information at the time of this EIA Study, the works will include stormwater pumping storage schemes, box culverts and drainage upgrading works. Construction of the project is tentatively scheduled to commence in 2023 for phased completion in 2031.

2.8.5 Potential cumulative environmental impacts arising from these concurrent projects during the construction and operation phases of the Project have been assessed in the EIA Report. For construction phase, due to temporal overlapping of construction works of the Project and the "Relocation of Diamond Hill Fresh Water and Salt Water Service Reservoirs to Cavern" and "Proposed Drainage Improvement Works at Chui Tin Street and Chui Tin Street Soccer Pitch", cumulative environmental impact would be anticipated. For operation phase, due to the close proximity, cumulative environmental impact from "Revised Trunk Road T4" and "In-situ Reprovisioning of Sha Tin Water Treatment Works – South Works" would be anticipated. The potential cumulative impacts is presented in **Section 3, 4, 5, 8** and **10**. No cumulative impact is expected for other environmental aspects, such as waste implication, land contamination, cultural heritage, hazard to life. The location plan of the concurrent projects is presented in **60604728/R42b/Figure 2.16**.

2.9 Public Concerns

2.9.1 Consultation activity for the Project has been carried out during the application of the Project Profile under EIAO. The Project Profile was exhibited for public inspection between 25 September 2019 to 8 October 2019. Consultation with Kowloon City District Council and Wong Tai Sin District Council was conducted on 16 June 2022 and 21 June 2022 respectively, while consultation with Sha Tin District Council was scheduled to conduct in August 2022. The environmental comments received mainly focused on the ecological impacts and expressed concerns on the impacts of the proposed work on the surrounding natural habitats such as woodland and water streams. Considering these public comments, the proposed works have been designed to avoid encroaching the natural habitats as far as possible. For unavoidable habitat losses, compensation are proposed. The potential ecological and water quality impacts, and the proposed mitigation measures are presented in **Section 8** and **Section 5** of this EIA respectively.

2.9.2 There were also concerns on noise impacts due to the additional traffic generated under the Project. Noise barriers and semi-enclosures are proposed to be provided along Lion Rock Tunnel Road if necessary. The exact locations and extent of the proposed noise mitigation measures are detailed in **Table 4.22** & **60604728/R42b/Figure 4.4** and **60604728/R42b/Figure 4.4.1 to 60604728/R42b/Figure 4.4.4** in **Section 4** of this EIA. Other environmental comments include concerns over impacts to air quality, cultural heritage and waste generation and the follow-up actions to be taken are summarized in **Table 2.7**., which are addressed under **Sections 3, 9** and **6** under this EIA respectively.

Table 2.7 Summary of Concerns and Follow Up Actions

Concerns / Issues	Follow Up Actions to be Taken
▪ Road traffic noise impact due to the additional traffic generated from the Project	▪ Noise mitigation measures including noise barriers and noise-enclosure are proposed along Lion Rock Tunnel Road. As such, the predicted noise levels at nearby NSRs will comply with the road traffic noise criteria. Please refer to **Section 4.7** for road traffic noise impact assessment.
▪ Adverse water quality of watercourses near project area due to construction activities from the Project	▪ Proper site management practices and the mitigation measures as recommended in the EIA would be implemented. As such, no adverse water quality impact would be anticipated during construction phase. Please refer to **Section 5.7** for mitigation measures for minimizing water quality impact.
▪ Loss of surrounding natural habitat due to encroachment of project into LRCP	▪ Middle Option for alignment of new tunnel and downhill road widening at LRTR was adopted to reduce encroachment into LRCP and reduce loss of habitat to a minimum extent. ▪ Woodland compensatory planting is provided near Project Boundary for any unavoidable woodland loss within LRCP would be compensated off-site. Please refer to **Section 8.10** for mitigation measures for minimizing ecology impact.
▪ Increased air pollutant concentration due to construction activities and additional traffic generated from the Project	▪ Construction and operation phase air quality impact assessment was conducted in compliance with the requirements set out in the EIAO-TM. Suitable mitigation measures will be implemented during construction and operation stages as recommended in the EIA. Please refer to **Section 3.7** for air quality impact assessment.

Concerns / Issues	Follow Up Actions to be Taken
▪ Adverse impact to cultural heritage site (Tsang Tai Uk) from construction activities	▪ Project road alignment is revised. Tsang Tai Uk is now located at substantial distance from Project Site. No adverse impact is anticipated during construction phase. Please refer to **Section 9** for details of Cultural Heritage Impact Assessment.
▪ Removal of trees within LRCP and surrounding areas due to the Project	▪ Middle Option for alignment of new tunnel and downhill road widening at LRTR was adopted to reduce encroachment into LRCP and minimize removal of trees within LRCP. ▪ Compensatory tree planting is proposed for trees affected in LRCP near the tunnel portal area and toll plaza administration area. Off-site woodland compensatory planting is also provided. Please refer to **Section 10.8** for details of landscape and visual mitigation measures.
▪ Potential hydrological impacts on natural watercourses arising from construction activities	▪ Appropriate water control strategies should be implemented to minimize the groundwater infiltration during the tunnel construction. Please refer to **Section 5.7** for details of mitigation measures for minimizing groundwater infiltration. ▪ Surface water level monitoring of natural watercourses in the vicinity of the underground tunnel improvement works area should be conducted during the construction and operation stages. Please refer to **Section 8.13** for the details of monitoring on surface water level of natural watercourses.