Appendix 17.1 – Key Assessment Assumptions and Limitations of Assessment Methodologies

Assessment Methodology	Key Assessment Assumptions	Limitations of Assessment Methodologies / Assumptions	Prior Agreements with EPD/Other Authorities		Proposed Alternative Assessment Tools / Assumptions (if applicable)
			EIA Study Brief Clause Reference	Relevant Documentation	
Air Quality Impact					
Construction Phase					
The air quality impact assessment followed: • Annex 4 and Annex 12 of the EIAO-TM • Clause 3.4.3 of the EIA Study Brief (ESB-346/2021) • Guidelines on Assessing the 'TOTAL' Air Quality Impacts. **PATHv2.1**: estimate future background	<u>Background Contributions</u> • Background pollutant concentrations from PATHv2.1 was adopted to estimate future concentrations during the construction years. Dataset of Year 2030 was adopted.	The construction programme is indicative and subject to contractors' actual operation. A comprehensive EM&A programme would be conducted to ensure the proper implementation of measures and the compliance of AQOs during the construction of NOL.	N/A	N/A	N/A
Operational Phase					
N/A	No air quality impact is expected from NOL with emission free electrically powered trains and thus the exhaust air from railway operations would be insignificant.	N/A	N/A	N/A	N/A
Airborne Noise Impact					

Assessment Methodology	Key Assessment Assumptions	Limitations of Assessment Methodologies / Assumptions	Prior Agreements with EPD/Other Authorities		Proposed Alternative Assessment Tools / Assumptions (if applicable)
			EIA Study Brief Clause Reference	Relevant Documentation	
Construction Phase					
The construction noise impact assessment for the project followed: • Annex 5 and Annex 13 of the EIAO-TM • GW-TM • Clause 3.4.4 of the EIA Study Brief (ESB-346/2021)	For the SWLs of the PME, reference was made to Table 3 of the GW-TM, "Sound power levels of other commonly used PME" published by EPD, the Quality Powered Mechanical Equipment (QPME) System available at EPD's website, PME specification published by equipment manufacturer, etc.	The prediction of construction noise impacts was based on GW-TM, "Sound power levels of other commonly used PME" published by EPD, , QPME system and PME specification published by equipment manufacturer. The actual situation may be better than that of the prediction.	N/A	Noise Impact Assessment Methodology Paper	N/A
	It was assumed that all PME items required for a particular construction activity would be located at the notional position of work zones where such activity is to be performed. The PME items were organised into groups required for each discrete task of the construction works. The sound pressure level (SPL) of each construction task was calculated, depending on the number of plant items involved and the distance from the NSR. A positive 3 dB façade correction was added to the predicted noise levels to account for the façade effect at each assessment point. The noise levels at the NSRs were then predicted by adding up the SPLs of all concurrent construction tasks from the Project. Notional source positions that are at distances greater than 300m from the NSRs were excluded from the assessment.	Worst case assumptions were assumed in order to provide conservative noise impact assessments such as locating all the items of PME at the notional source.	N/A	• EIAO-TM • GW-TM	N/A
Operational Phase (Fixed Plant Noise)					

Assessment Methodology	Key Assessment Assumptions	Limitations of Assessment Methodologies / Assumptions	Prior Agreements with EPD/Other Authorities		Proposed Alternative Assessment Tools / Assumptions (if applicable)
			EIA Study Brief Clause Reference	Relevant Documentation	
The fixed plant noise impact assessment for the project followed: • Annex 5 and Annex 13 of the EIAO-TM • IND-TM • Clause 3.4.4 of the EIA Study Brief (ESB-346/2021) The maximum permissible sound power levels (Max. SWLs) were determined for future detailed design of the fixed plant given that the noise specification of the proposed fixed plant may not be available during the EIA Study. For the assessment of noise from the fixed plant, the Max. SWLs of the identified fixed noise sources were determined by adopting standard acoustics principles. The following formula is used for calculating the Max. SWLs of the fixed plant: SPL = Max SWL – DC + FC + BC where SPL: Sound Pressure Level, in	It is assumed that all the fixed plant within the same location would be operated at the same time as worst-case scenario.	This worst-case scenario will act as a conservative approach in predicting fixed plant noise levels.	N/A	Noise Impact Assessment Methodology Paper	N/A
	Screening correction offered by buildings or other structures such as office and residential buildings was taken into account in calculating the predicted noise levels. Barrier correction of -10 dB(A) would be applied if the direct line of sight between the noise source and NSR is blocked by buildings or natural terrains, while a barrier correction of -5 dB(A) was applied for NSR do not have direct line of sight to the fixed plant. A positive 3 dB(A) was added to predicted noise levels at the NSRs due to the façade effect.	N/A	N/A	Noise Impact Assessment Methodology Paper	N/A
	Corrections of tonality, intermittency or impulsiveness were not included owing to the lack of design/supplier information at this preliminary design stage.	N/A	N/A	Noise Impact Assessment Methodology Paper	N/A

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			EIA Study Brief Clause Reference	Relevant Documentation	
dB(A); Max SWL: Maximum Allowable Sound Power Level, in dB(A); DC: Distance Attenuation, in dB(A) (i.e. 20 log D + 8 [where D is the distance in metres]); FC: Facade Correction, in dB(A) (i.e. 3 dB(A)); and BC: Barrier Correction, in dB(A)					
Operational Phase (Rail Noise)					
The rail noise impact assessment for the project followed: • Annex 5 and Annex 13 of the EIAO-TM • Clause 3.4.4 of the EIA Study Brief (ESB-346/2021)	N/A	N/A	Section 3.1 of Appendix C	Noise Impact Assessment Methodology Paper	N/A
Ground-borne Noise Impact					
Construction Phase					
The ground-borne noise impact assessment for the project followed: • Annex 5 and Annex 13 of the EIAO-TM • IND-TM	<u>Reference Vibration Sources</u> Hydraulic Breaker: 0.298 mm/s Rock Drill: 0.536 mm/s TBM: 2.5 mm/s	The assumed values will act as conservative approach Safety factor may not be necessary and good coupling may not occur at all locations in	Section 2.1.2 of Appendix C	Ground-borne Noise Impact Assessment Methodology Paper	N/A

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			EIA Study Brief Clause Reference	Relevant Documentation	
• The method recommended by the U.S. Department of Transportation and Federal Transit Administration • Projection methodologies previously adopted the approved EIA Reports for Shatin to Central Link (Tai Wai to Hung Hom Section), Shatin to Central Link (Hung Hom to Admiralty Section) and Improvement of Lion Rock Tunnel	Distance Attenuation (C_{dist}) Cdist = 20 x log (R/R0), where R: separation between the tunnel boundary and the GBNSR R_0: reference distance of the vibration measurement (i.e. 5.5m) Soil Damping ($C_{damping}$) No damping attenuation was adopted as conservative approach Coupling Loss into Building Foundation, ($C_{building}$) It was assumed to be zero as conservative approach Coupling Loss per Floor (C_{floor}) Coupling loss of 1 dB reduction per floor was assumed in this assessment for a conservative approach Conversion from Floor Vibration to Noise Levels (C_{noise}) A -27dB correction was assumed for conversion of vibration to noise Noise Level Increase due to Multiple Sources	practice			

Assessment Methodology	Key Assessment Assumptions	Limitations of Assessment Methodologies / Assumptions	Prior Agreements with EPD/Other Authorities		Proposed Alternative Assessment Tools / Assumptions (if applicable)
			EIA Study Brief Clause Reference	Relevant Documentation	
	(C_{multi}) A separation distance of at least 50m apart for two TBMs operating simultaneously was assumed Cumulative Effect due to Neighbouring Sites (C_{cum}) Cumulative impact was not anticipated Conversion to A-weighted Noise A conversion factor of -20 dB(A) was adopted for conversion to A-weighted noise				
Operational Phase					
The methodology for the vibration and ground-borne noise impact assessment followed: • FTA Guidance Manual • Methodologies adopted in West Island Line, Express Rail Link, and South Island Line (East) EIA Studies **MoleRat**: assess operational ground-borne noise levels	Trackform Alternatives or Insertion Loss (TIL) Attenuation of low noise trackforms was included in the assessment, if necessary. Tunnel Coupling Factor (TCF) • The TCF was referenced to the previously approved EIA studies. Turnout and Crossover Factor (TOC) • 10dB increase was allowed for each turnout. Line Source Response (LSR) Assumptions to allow one point source response (PSR) to be taken as representative along the NOL alignment were adopted in the determination of the LSR. They include:	N/A	Section 3.1 of Appendix C	Ground-borne Noise Impact Assessment Methodology Paper	N/A

Assessment Methodology	Key Assessment Assumptions	Limitations of Assessment Methodologies / Assumptions	Prior Agreements with EPD/Other Authorities		Proposed Alternative Assessment Tools / Assumptions (if applicable)
			EIA Study Brief Clause Reference	Relevant Documentation	
	• ground is layer-wise homogeneous; • ground is transversely isotropic along the alignment over the length of the train; and • ground is between the alignment segment and the vibration receivers at which the LSR is to be determined. Building Coupling Factor (BCF) • zero for structures founded on rock Building Vibration Response (BVR) • 6 dB correction was adopted for resonance amplification • 2 dB reduction per floor was assumed for floor-to-floor attenuation Conversion to Noise (CTN) • -27 dB reduction was assumed Safety Factor • 5 dB was adopted as safety factor Other Assumptions • For the case where the tunnel will be in rock and the GBNSR is piled down to rock, the vibration path was assumed to be across the rock and up the piles into the building				

Assessment Methodology	Key Assessment Assumptions	Limitations of Assessment Methodologies / Assumptions	Prior Agreements with EPD/Other Authorities		Proposed Alternative Assessment Tools / Assumptions (if applicable)
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	• For the cases where the tunnel will be in soft ground, the GBNSR is not on piles or the GBNSR is on piles not down to rock, the vibration path was assumed to be through the ground along a slant path to the nearest part of the GBNSR or piles • Where piling details are not known and the tunnel will be in rock, it was assumed that the piles are down to rock (worst case assumption) • Assessment points for some planned development were conservatively assigned at the boundary of the site				
Water Quality Impact					
The water quality impact assessment followed: • Annexes 6 and 14 of the EIAO-TM • Clause 3.4.5 of the EIA Study Brief (ESB-346/2021)	Nil	N/A	N/A	N/A	N/A
Sewerage and Sewage Treatment Implications					
The sewerage and sewage impact assessment followed: • Annexes 6 and 14 of the EIAO-TM • Water Pollution Control Ordinance (Cap. 358)	*Population Factor and Unit Flow Factor* *Population Factor* • Non-public E&M rooms - 35m^2/worker • Concession (retail area) - 25m^2/worker • Concession (food & beverage) - 5.1worker/100m^2	N/A	N/A	Sewerage and Sewage Impact Assessment Methodology Paper	N/A

<table>
<tr><th rowspan="2">Assessment Methodology</th><th rowspan="2">Key Assessment Assumptions</th><th rowspan="2">Limitations of Assessment Methodologies / Assumptions</th><th colspan="2">Prior Agreements with EPD/Other Authorities</th><th rowspan="2">Proposed Alternative Assessment Tools / Assumptions (if applicable)</th></tr>
<tr><th>EIA Study Brief Clause Reference</th><th>Relevant Documentation</th></tr>
<tr><td>• Sewerage Manual published by DSD
• Report No. EPD/TP 1/05 Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning Version 1.0 published by EPD
• Discharge Unit Method of the Plumbing Engineering Services Design Guide published by Chartered Institute of Plumbing and Heating Engineering</td><td>• Non-public operation room - 25m^2/worker
Unit Flow Factor
• J2 Electricity, Gas & Water - 0.33 m^3/head/day
• J4 Wholesale & Retail - 0.28 m^3/head/day
• J10 Restaurants & Hotels - 1.58 m^3/head/day
• Territorial Average - 0.28 m^3/head/day

Discharge Units for Sanitary Fitments
<table><tr><th>Appliances</th><th>Discharge Units (L/s)</th></tr><tr><td>Wash Basin</td><td>0.3</td></tr><tr><td>Urinals with Basin</td><td>0.4</td></tr><tr><td>Washing Closet with 6L Cistern</td><td>1.5</td></tr><tr><td>Shower</td><td>0.5</td></tr><tr><td>Cleaner's Sink</td><td>0.3</td></tr><tr><td>Cleansing Point</td><td>0.5</td></tr></table>
<u>Frequency of Use ‘K Factor’</u>
‘K factor’ of 1.0 was adopted for sewage flow estimations for the proposed rail stations

Peaking Factors (P)</td><td></td><td></td><td></td><td></td></tr>
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			EIA Study Brief Clause Reference	Relevant Documentation	
	(see table below)				

Population Range	P (including stormwater allowance) for facility with existing upstream sewerage	P (excluding stormwater allowance) for facility with new upstream sewerage
a) For sewers		
<1,000	8	6
1,000 - 5,000	6	5
5,000 - 10,000	5	4
10,000 - 50,000	4	3
> 50,000	Max ($7.3/N^{0.15}$, 2.4) (1)	Max ($6/N^{0.175}$, 1.6) (1)
b) Sewage Treatment Works, Preliminary Treatment Works and Pumping Station		
<10,000	4	3
10,000 - 25,000	3.5	2.5
25,000 - 50,000	3	2
> 50,000	Max ($3.9/N^{0.065}$, 2.4) (1)	Max ($2.6/N^{0.065}$, 1.6) (1)

Note:

N is the contributing population in thousands, where contributing population is the calculated total average flow / 0.27 m3/person/day.

Catchment Inflow Factor (P_{CIF})

- P_{CIF} of 1 was adopted.

Assessment Methodology	Key Assessment Assumptions	Limitations of Assessment Methodologies / Assumptions	Prior Agreements with EPD/Other Authorities		Proposed Alternative Assessment Tools / Assumptions (if applicable)
			EIA Study Brief Clause Reference	Relevant Documentation	
Waste Management Implication					
The waste management assessment followed: • Annex 7 and Annex 15 of the EIAO-TM • Clause 3.4.7 of the EIA Study Brief (ESB-346/2021) Waste to be generated includes both inert and non-inert C&D materials, general refuse, chemical waste and land-based sediments The types and quantities of the waste to be generated during construction and operational phases were estimated, together with their disposal options and potential environmental impacts evaluated	• Waste generated in the construction phase are determined based on the latest construction methodology. • Sediment quantities to be excavated in the construction phase are determined based on the latest LRP and the available sampling and testing results.	• Some proposed sediment sampling locations were inaccessible. The sediment sampling & testing works for inaccessible location should be conducted in the later stage (i.e. after land resumption)	Section 3 of Appendix F	• Sediment Sampling and Testing Plan (SSTP), Preliminary Sediment Quality Report, Sediment Quality Report	N/A
Land Contamination					
The land contamination assessment followed: • Annex 19 of the EIAO-TM Guidelines for Assessment of Impact on Sites of Cultural Heritage and Other Impacts	The assessment was conducted based on desktop review of the site history and site surveys for identification of any potentially contaminated areas	• Some identified potentially contaminated sites were inaccessible and site surveys were only conducted along the site boundary of these sites. Site	N/A	• Contamination Assessment Plan (CAP)	N/A

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			EIA Study Brief Clause Reference	Relevant Documentation	
(Section 3: Potential Contaminated Land Issues) • Guidance Note for Contaminated Land Assessment and Remediation • Guidance Manual for Use of Risk-Based Remediation Goals (RBRGs) for Contaminated Land Management • Practice Guide for Investigation and Remediation of Contaminated Land • Clause 3.4.8 of the EIA Study Brief (ESB-346/2021)		re-appraisal should be conducted in the later stage (i.e. after land resumption) • A supplementary Contamination Assessment Plan (CAP) should be prepared after site re-appraisal. A Contamination Assessment Report (CAR) should be prepared to present findings of SI works and a Remediation Action Plan (RAP) should be prepared to formulate appropriate remedial measures if contamination is identified. A Remediation Report (RR) should be prepared after completion of any necessary remediation works for EPD's approval. General mitigation measures for remediation works include: • Properly design and execute excavation profiles with attention to the relevant requirements for environment, health and safety;			

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			EIA Study Brief Clause Reference	Relevant Documentation	
		• Carry out excavation during dry season as far as possible to minimise contaminated runoff from contaminated soils; • Supply suitable clean backfill material (or treated soil) after excavation; • Line and bund stockpiling site(s) with impermeable sheeting. Stockpiles should be fully covered by impermeable sheeting to reduce dust emission; • Suitably cover vehicles containing any excavated materials to limit potential dust emissions or contaminated wastewater run-off, and truck bodies and tailgates should be sealed to prevent any discharge during transport or during wet conditions; • Enforce speed control for the trucks carrying contaminated materials; • Establish and use vehicle wheel and body washing facilities at the site's exit points; and			

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<tr><th>EIA Study Brief Clause Reference</th><th>Relevant Documentation</th></tr>
<tr><td></td><td></td><td>• Implement pollution control measures for air emissions (e.g. from biopile blower and handling of cement), noise emissions (e.g. from blower or earthmoving equipment), and water discharges (e.g. runoff control from treatment facility) and comply with relevant regulations and guidelines.</td><td></td><td></td><td></td></tr>
<tr><td colspan="6">Ecological Impact (Terrestrial and Aquatic)</td></tr>
<tr><td>The ecological impact assessment (terrestrial and aquatic) followed:
• Annexes 8 and 16 of the EIAO-TM
• EIAO Guidance Notes (No. 7/2010 and No. 10/2010)
• Clause 3.4.9 of the EIA Study Brief (ESB-346/2021)</td><td>The assessment was undertaken based on the results of literature review and ecological field surveys</td><td>N/A</td><td>Section 2 of Appendix H</td><td>• Ecological Impact Assessment Methodology Paper
• Methodology Statement on Bird Flight Path Surveys agreed by AFCD in Jan 2022</td><td>N/A</td></tr>
<tr><td colspan="6">Fisheries Impact</td></tr>
<tr><td>The fisheries impact assessment followed:
• Annexes 9 and 17 of the EIAO-TM</td><td>Fisheries baseline condition was identified through literature review and fishpond survey was conducted to collect up-to-date baseline information and verify the information from literature review.</td><td>N/A</td><td>N/A</td><td>Fisheries Impact Assessment Methodology Paper</td><td>N/A</td></tr>
</table>

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			EIA Study Brief Clause Reference	Relevant Documentation	
• Clause 3.4.10 of the EIA Study Brief (ESB-346/2021)					
Landscape and Visual Impact					
The landscape and visual impact assessment followed: • Annexes 10 and 18 of the EIAO-TM • EIAO Guidance Note No.8/2010 “Preparation of Landscape and Visual Impact Assessment under the EIAO” • Clause 3.4.11 of the EIA Study Brief (ESB-346/2021) Landscape The methodologies include site visits and desktop studies, identification of potential landscape changes, mitigation measures and prediction of the significance of residual impact Visual The methodologies include identification of visual sensitive receivers, potential sources of visual changes, mitigation	N/A	N/A	N/A	Landscape and Visual Impact Assessment Methodology Paper	N/A

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			EIA Study Brief Clause Reference	Relevant Documentation	
measures and prediction of the significance of residual impact					
Cultural Heritage Impact					
The cultural heritage impact assessment followed: • Annexes 10 and 19 of the EIAO-TM • Guidelines for Cultural Heritage Impact Assessment • Clause 3.4.12 of the EIA Study Brief (ESB-346/2021)	N/A	N/A	N/A	• Cultural Heritage Impact Assessment Methodology Paper • Archaeological Baseline Review Report, Archaeological Action Plan and Archaeological Impact Assessment Report submitted to AMO	N/A
Hazard to Life					
The risk assessment for the Project followed: • Annex 4 of the EIAO-TM • Clause 3.4.13 of the EIA Study Brief (ESB-346/2021) Au Tau Water Treatment Works (AT WTW) has been delisted	*Tunnel Sections and Underground Tunnel* • The maximum rate of blasting was assumed to be 6 blasts per day (i.e. 2 blasts per portal/opening per day, 24-hour working) and 7 working days a week (no holiday) • The amount of explosives to be used was estimated based on the volume of rock being	The assumptions were made based on conservative approach and referenced to the previously approved EIA Studies	N/A	Hazard to Life Assessment Methodology Paper	N/A

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from the PHI Register and therefore, a Quantitative Risk Assessment is not required Domino effects of high pressure town gas transmission pipelines were studied Various options including alternatives of magazine sites, quantities and frequency of explosives deliveries, etc., were evaluated in cost-benefit analysis The use, transport and overnight storage of explosives for tunnel associated construction works of NOL was reviewed and evaluated **Fault Tree Analysis (FTA)**: estimate failure rates or probabilities for hazardous scenarios. Human Error Assessment and Reduction Technique is carried out to determine the human error probabilities of the events	blast and the amount of explosive required per blast face *Connection Adits* • The cross-sectional areas of the connection adits were used to estimate the daily explosive requirement The daily explosive requirement was adjusted to provide a maximum of 3 days storage capacity to cater for circumstances that might cause delay in daily magazine replenishment deliveries 800 TNT eqv. kg was adopted as the daily explosives requirement for worst case scenario, assuming 40% detonating cord and 60% cartridged emulsion The daily explosives requirement was based on the use of 125g emulsion cartridge as primers and did not account for other situations which might require additional explosive quantities The assessment scenarios for the transport and overnight storage of explosives were assumed to be detonation of full load of explosives in one store in the magazine site and in one contractor truck on public roads respectively				

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ESTC model: estimate the number of fatalities **Cost-benefit Analysis:** evaluate the cost-effectiveness of mitigation measures and demonstrate that all reasonably practicable measures have been taken to reduce risks	The population in Year 2029 in Yuen Long was assumed to be the same as the base year as Year 2019, while a population growth rate of 3.9% was adopted for the population projection within Northwest New Territories The cases of 5 MIC and 6 MIC detonation occurring simultaneously was assumed to be the same as 4 MIC detonation The probability of the second human error of the same type was assumed as 0.01 The average transport length within tunnel was assumed to be half the total length for all deliveries Boulder size was assumed to be 5m and with 1% probability to fall when a ground vibration greater than PPVc was experienced A 1% probability of significant damage to a pipe upon ignition and cause fatality was assumed could be resulted from 25mm/s PPV Average vehicle speed was assumed to be 30 miles/hr (i.e. 48 km/hr)				

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	A stopping distance of around 23m was assumed 1 death was assumed for the failure of retaining wall that causes the collapse of a road for the lanes affected A landslide caused with detonation of explosives was assumed to cause a travel angle of 30° The loss of life of an occupant given a vehicle is hit by a rock and a falling boulder were assumed to be 0.2 and 0.1 respectively It was assumed that the vibration effect would be additive when more than one blasthole charge was being detonated at the same time No credit was given for people to escape Maximum transportation rate was assumed to be 200 TNT eqv. kg per trip Maximum storage of explosives was assumed to be 400 TNT eqv. kg per store, i.e. 800 TNT eqv. kg in total Traffic jam with explosive initiation following a				

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	vehicle fire was assumed to occur on each lane on either side of the road				