Agreement No. CE31/2014 (CE)

Engineering Study for Police Facilities in Kong Nga Po - Feasibility Study Environmental Impact Assessment Report



4 Noise Impact

4.1 Introduction

This section presents the assessment of the potential noise impacts associated with the construction and operation phases of the proposed police facilities in Kong Nga Po (KNP). Noise generated from various construction activities is the primary concern during the construction phase. Road traffic noise, fixed noise sources within the Project boundary and helicopter noise from the proposed helipad are the major noise impacts during the operation phase. Representative Noise Sensitive Receivers (NSRs) have been identified and the worst case impacts on these receivers have been assessed for various types of noise source. Suitable mitigation measures, where necessary, have been recommended to protect the NSRs and to ensure that the legislative criteria and guidelines can be satisfied.

4.2 Relevant Legislation and Guidelines

4.2.1 Construction Phase

Control over the generation of construction noise from Designated Projects (DPs) under Environmental Impact Assessment Ordinance (EIAO) in Hong Kong is governed by the EIAO and the Noise Control Ordinance (NCO). The NCO is to provide statutory controls for carrying out construction work using powered mechanical equipment and prescribed construction works during the restricted hours. The noise standards for daytime construction activities are in accordance with Table 1B of Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM) Annex 5 for construction noise of DPs. The TMs applicable to the control of noise from construction activities of proposed construction works are:

- TM on Environmental Impact Assessment Process (EIAO-TM)
- TM on Noise from Construction Work other than Percussive Piling (GW-TM)

These TMs prescribe the maximum permitted noise levels for the use of Powered Mechanical Equipment (PME) and certain construction activities and processes, according to the type of equipment or activity, the perceived noise climate of the area, and the working hours of equipment operation and usage.

4.2.1.1 General Construction Activities during Non-Restricted Hours

Noise impacts arising from general construction activities other than percussive piling during the daytime period (07:00-19:00 hours of any day not being a Sunday or general holiday) are assessed against the noise standards tabulated in **Table 4.1** below.

 Table 4.1:
 Noise Standards for Daytime Construction Activities

Noise Sensitive Uses	0700 to 1900 hours on any day not being a Sunday or general holiday, Leq (30 min), dB(A)
All domestic premises including temporary housing accommodation	75
Hotels and hostel	
Educational institutions including kindergarten, nurseries and all	70
others where unaided voice communication is required	65 during examination



Source: EIAO-TM, Annex 5, Table 1B - Noise Standards for Daytime construction Activities Notes:

(i) The above noise standards apply to uses, which rely on opened windows for ventilation.

(ii) The above standards shall be viewed as the maximum permissible noise levels assessed at 1 m from the external facade.

4.2.1.2 General Construction Activities during Restricted Hours

Noise impacts arising from general construction activities (excluding percussive piling) conducted during the restricted hours (19:00-07:00 hours on any day and anytime on Sunday or general holiday) and percussive piling during anytime are governed by the NCO.

For carrying out of any general construction activities involving the use of any Powered Mechanical Equipment (PME) within the restricted hours, a Construction Noise Permit (CNP) issued by the Authority must be obtained under the NCO. The noise criteria and the assessment procedures for issuing a CNP are specified in GW-TM published under the NCO.

Regardless of any description or assessment made in this section, in assessing a filed application for a CNP the Authority will be guided by the relevant Technical Memoranda. The Authority will consider all the factors affecting their decision taking contemporary situations/ conditions into account. Nothing in this study shall pre-empt the Authority in making their decisions, and there is no guarantee that a CNP will be issued. If a CNP is to be issued, the Authority may include any conditions they consider appropriate and such conditions are to be followed while the works covered by the CNP are being carried out. Failing to do so may lead to cancellation of the CNP and prosecution action under the NCO.

According to the construction programme, the proposed construction works would be carried out during non-restricted hours. In case of any construction activities during restricted hours, it is the contractor's responsibility to ensure compliance with the NCO and the relevant TMs. The Contractor will be required to submit CNP application to the Noise Control Authority and abide by any conditions stated in the CNP, should any be issued.

4.2.2 **Operation Phase**

4.2.2.1 Road Traffic Noise

The EIAO-TM published under Section 16(5) of the EIAO is the fundamental legislation of noise criteria for evaluating noise impact of designated projects with respect to road traffic noise. The summary of noise criteria is given in **Table 4.2** below.

Table 4.2:	Relevant Road	Traffic Noise	Standards f	or Planning	Purposes
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Noise Sensitive Uses	Road Traffic Noise Peak Hour Traffic L ₁₀ (1hour), dB(A)	
All domestic premises including temporary housing accommodation	70	
Hotels and hostel		



Noise Sensitive Uses	Road Traffic Noise Peak Hour Traffic L ₁₀ (1hour), dB(A)
Educational institutions including kindergartens, nurseries and all others where unaided voice communication is required	65

Notes:

(i) The above standards apply to uses which rely on opened windows for ventilation.

(ii) The above standards should be viewed as the maximum permissible noise levels assessed at 1m from the external façade.

4.2.2.2 Fixed Noise Sources

For fixed noise sources assessment, the Acceptable Noise Levels (ANLs) for the NSRs are determined with consideration of the Area Sensitivity Rating (ASR), which is defined in the Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites (IND-TM) issued under the NCO. The Area Sensitivity Rating depends on the type of area and the degree of impact that Influencing Factors (IFs) have on the NSRs as illustrated in **Table 4.3** below. Industrial area, major road or the area within the boundary of Hong Kong International Airport shall be considered to be an IF.

	Degree to which NSR is affected by IF			
Type of Area Containing NSR	Not Affected ^(c)	Indirectly Affected ^(d)	Directly Affected ^(e)	
(i) Rural area, including country parks ^(a) or village type developments	А	В	В	
(ii) Low density residential area consisting of low- rise or isolated high-rise developments	А	В	С	
(iii) Urban area ^(b)	В	С	С	
(iv) Area other than those above	В	В	С	

Table 4.3: Area Sensitivity Rating

Definitions:

(a) "Country park" means an area that is designated as a country park pursuant to section 14 of the Country Parks Ordinance.

(b) "Urban area" means an area of high density, diverse development including a mixture of such elements as industrial activities, major trade or commercial activities and residential premises.

(c) "Not Affected" means that the NSR is at such a location that noise generated by the IF is not noticeable at the NSR.

(d) "Indirectly Affected" means that the NSR is at such a location that noise generated by the IF, whilst noticeable at the NSR, is not a dominant feature of the noise climate of the NSR.

(e) "Directly Affected" means that the NSR is at such a location that noise generated by the IF is readily noticeable at the NSR and is a dominant feature of the noise climate of the NSR.

Fixed noise sources are controlled under the NCO and shall comply with the ANLs laid down in the Table 2 of the IND-TM. For a given Area Sensitivity Rating, the ANL, in dB(A), is given by **Table 4.4** below.



Table 4.4: Acceptable Noise Level for Fixed Noise Source

	Area Sensitivity Rating (ASR)			
Time Period	Α	В	С	
Day-time (0700 to 1900 hours)		65	70	
Evening (1900 to 2300 hours)	60		70	
Night-time (2300 to 0700 hours)	50	55	60	

Notes:

(i) The above standards apply to uses which rely on opened windows for ventilation.

(ii) The above standards should be viewed as the maximum permissible noise levels assessed at 1m from the external facade.

The proposed development is located in rural area. Therefore, the type of area containing the NSRs is considered as "Rural area, including country parks or village type developments" as defined in the IND-TM. As no IF was identified near the proposed development, the Area Sensitivity Rating of the Site shall be classified as "A" according to Table 4.3.

Noise Criteria for Planned Fixed Noise Sources / Impact

As stipulated in Annex 5 of the EIAO-TM, the noise standards for planning fixed noise source are (a) 5 dB(A) below the appropriate ANL as stipulated in the IND-TM, or (b) the prevailing background noise levels (for guiet areas with level 5 dB(A) below the ANL). As confirmed by Hong Kong Police Force (HKPF), the operation hours of the planned police facilities at KNP would be from 7am to 11pm. Therefore, no nighttime operations of fixed noise sources are anticipated in this study. The noise criteria of the planned fixed noise sources will be further discussed in the Section 4.6.2.

Noise Criteria for Cumulative Fixed Noise Sources / Impact

Cumulative fixed noise impact arising from existing noise sources (i.e. San Uk Ling Firing Range) and planned fixed noise sources would be calculated and compared against the relevant ANL criteria (i.e. 60 dB(A) for day-time and evening periods) as shown in Table 4.4.

4.2.2.3 Helicopter Noise

The proposed helipad at KNP is planned for police training restricted to 7am to 7pm only and emergency use (i.e. air ambulance, search & rescue, supporting law enforcement agencies and fire fighting) without time restriction.

Noise Criteria during Day-time Period (0700 – 1900 hours)

According to Table 1A of EIAO-TM Annex 5 "A Summary of Noise Criteria", the criteria for helicopter noise is L_{max} 90dB(A) for offices and L_{max} 85 dB(A) for domestic premises, hotels, hostels, education institutes, place of worship, hospital and clinics during 0700-1900 hours. The standards apply to uses that rely on openable windows for ventilation and the standards should be viewed as the maximum permissible noise levels assessed at 1m from the external façade.



Noise Criteria during Evening and Night-time Period (1900 – 0700 hours)

There are no specified evening and night-time criteria for assessing helicopter noise in EIAO-TM. Based on the requirements under EIAO-TM (i.e. EIAO-TM Annex 5(d) and Section 4.4.2(c)), the criteria for evaluating such helicopter noise impacts shall be determined on a case-by-case basis and that the proposed methodology should be consistent with the methodologies adopted for Hong Kong Projects having similar issues or with methodologies accepted by recognized national / international organization.

By referring to the approved EIA reports for Peng Chau Helipad (EIA-107/2005) and Helipad at Yung Shue Wan, Lamma Island (EIA-114/2005), those helipads are intended for emergency operation only. Because of emergency nature and without scheduled flight, no criteria was proposed for the helicopter operation during evening and night-time period.

Nevertheless, a literature review was conducted to determine the criteria adopted in several similar overseas cities / countries (e.g. London (United Kingdom), California (United States), Singapore, Hamilton (New Zealand) and Victoria (Australia)) for helicopter noise assessment during evening and night-time emergency operation (see **Appendix 4.11**). The findings revealed that there is no evening and night-time noise criteria or guidelines adopted for emergency helicopter operation, such as fire fighting, medical emergencies and law enforcement, etc. in those reviewed overseas cities / countries. During evening and night-time period, the use of the helipad and helicopter at KNP is for emergency operation only and has similar situations to those reviewed cities / countries.

4.3 Description of the Noise Environment

4.3.1 Description of the Environment

The Project will be located at Kong Nga Po (KNP) in the North District partly located within the old Frontier Closed Area (FCA), which has since been opened up. The major land uses in the close vicinity of the Project site comprises scattered village houses. The Project site is located adjacent to the Kong Nga Po Road and Man Kam To Road that have low traffic flows. The existing noise environment for the assessment area is dominated by low level of traffic noise from Kong Nga Po Road and Man Kam To Road.

4.3.2 Prevailing Background Noise Condition

Noise surveys were carried out in June 2015 and March 2016 to investigate the prevailing background noise condition of the surrounding environment and the Project site. The background noise measurement locations are shown in **Figure 4.1**.

The noise measurements were undertaken using Type 1 sound level meter (Rion NL-31 Serial No. 01262786). The sound level meter was checked using an acoustic calibrator generating a sound pressure level of 94.0 dB(A) at 1kHz immediately before and after the noise measurement. The measurements were accepted as valid only if the calibration levels before and after the noise measurement were agreed



54.8 / 54.6

55.6 / 55.2

52.2 / 52.0

59.9 / 56.6

to within 1.0 dB(A). Moreover, the sound level meters and acoustic calibrators are calibrated in accredited laboratories annually to ensure reliable performance. The measurement results are shown in Table 4.5.

(0700 - 2300)

(0700 - 2300)

Day-time & Evening

16:00 / 21:40

16:50 / 22:25

Measured Background Noise Levels Location Measured Noise Level in **Location Description Time Period** Start Time ID Leq (30 min)**, dB(A)*** Near NSRs N9b, N10b, Day-time & Evening M1 15:05 / 19:55 N11a, N15 (0700 - 2300)Day-time & Evening Near NSR N12a M2 14:10 / 20:35 (0700 - 2300)Day-time & Evening

Table 4.5:

Notes:

M3

M4

(*) All background noise measurements were free-field measurement. Façade correction +3dB(A) has been included.

4.4 **Construction Noise Impact Assessment**

Near NSR N13

Near NSR N14

4.4.1 **Assessment Area**

Clause 2.2.1 in Appendix C of the EIA Study Brief (ESB-276/2014) specifies that the assessment area for the construction noise impact assessment shall generally include areas within 300 metres from the boundary of the Project and the works of the Project. Details of the assessment area can be referred to Figure 4.2.

4.4.2 Identification of Representative Noise Sensitive Receivers

Noise Sensitive Receivers (NSRs) have been identified in accordance with Annexes 5 and 13 of the EIAO-TM. The NSRs have included existing, planned / committed noise sensitive developments and relevant uses earmarked on the relevant Outline Zoning Plans, Development Permission Area Plans, Outline Development Plans, Layout Plans and other relevant published land use plans, including plans and drawings published by Lands Department.

For the purpose of construction noise impact assessment, the first layer of NSRs located close to the site boundary of the Project and the works of the Project have been selected as assessment points/ identified representative NSRs within the assessment area for prediction of the noise impact levels.

According to the Outline Zoning Plans (S/NE-MKT/2 - Man Kam To, S/NE-HLH/8 - Hung Lung Hang and S/NE-FTA/2 – Fu Tei Au & Sha Ling), the assessment area mainly comprises zoning of Agriculture, Green Belt and Undetermined. No planned NSR has been identified within the assessment area.



Descriptions of all identified representative NSRs are tabulated in **Table 4.6**. The locations of representative noise sensitive receivers for construction noise impact assessment are shown in the **Figure 4.2**. Photographs of existing representative NSRs are shown in **Figure 4.3**.

	· · · · · · · · · · · · · · · · · · ·				
NSR ID	Description	Existing / Planned	Type of Use	No. of Storeys (Sensitive use only)	Ground Level (mPD)
N1a	Village House, Sha Ling	Existing	Residential	1	17.4
N2a	Village House, Sha Ling	Existing	Residential	2	19.2
N3a	Village House No. 248, Sha Ling	Existing	Residential	1	25.1
N4a	Village House, Sha Ling	Existing	Residential	1	27.4
N5a	Village House No. 272, Sha Ling	Existing	Residential	1	22.8
N6a	Village House, Sha Ling	Existing	Residential	1	21.9
N7a	Village House, Sha Ling	Existing	Residential	1	28.5
N8a	Village House, Sha Ling	Existing	Residential	1	28.0
N9a	Village House, Kong Nga Po	Existing	Residential	1	26.3
N10a	Village House, Kong Nga Po	Existing	Residential	1	26.8
N11a	Village House, Kong Nga Po	Existing	Residential	1	26.9
N12a	Village House, Kong Nga Po	Existing	Residential	1	37.3
N13	Village House, Kong Nga Po	Existing	Residential	2	22.0
N14	Village House, near Man Kam To Road	Existing	Residential	1	17.3

 Table 4.6:
 Representative Construction Noise Sensitive Receivers Identified for the Assessment

4.4.3 Identification of Noise Sources

The potential source of noise impact during the construction phase of the Project is from the use of PME for various construction activities, including site formation, improvement of road network and building works for the training facilities, firing ranges and helipad etc. PME likely to be used in the KNP site include breakers, cranes, lorries and other vehicles, air compressors, and generators etc.

Construction work for the underpass across the Kong Nga Po Road within the subject site is required for the Project. It is currently envisaged that this small-scale construction work will be carried out by cut and cover method (instead of drill and blast / bored tunnelling method). Therefore, no ground-borne noise impact is anticipated for this construction work.

4.4.3.1 Cumulative Construction Noise Impact

The construction programme for the Police Facilities in Kong Nga Po is yet to be provided but will tentatively last from Year 2018 to 2022. The proposed / committed concurrent projects that may have cumulative effects during the construction / operation phase of the Project will be assessed based on best available information. The potential concurrent projects are summarized in the following **Table 4.7**:



Table 4.7: Summary of Concurrent Projects

Concurrent Droiget	Construction Drogramma	Cumulative Impact		
	Construction Frogramme Construction F		Operation Phase	
			×	
Proposed Organic Waste Treatment Facilities, Phase 2 (OWTF2)	Late-2017 to 2019/20	\checkmark	(No adverse cumulative fixed noise impacts are anticipated)	
Proposed Man Kam To Development Corridor	No program available			
Fanling North Freshwater Service		×	×	
Reservoir (FNFSR) under North East New Territories New Development Areas (NENTNDA)	2024 to 2028	(No concurrent construction period – not assessed for cumulative impacts)	(No adverse cumulative fixed noise impact from the reservoir is anticipated)	
Columbarium, Crematorium and		×	×	
Cemetery as recommended under 2019 to 2022 the "Land Use Planning for the Closed Area Feasibility Study"		(Construction site outside 300m from the boundary of the Project)	(Fixed noise sources outside 300m from the boundary of the Project)	
Cement Plant at Sha Ling Road and Man Kam To Road	No program available			
Proposed residential development in Hung Lung Hang	No program available			

Notes: Dash (--) means cannot be taken into account as no programme is available.

The cumulative construction noise impact associated with OWTF2 will be assessed in construction noise impact assessment. The findings in the approved OWTF2 EIA report (Register No.: AEIAR-180/2013) will be adopted for the assessment of cumulative construction noise impact. As mentioned in **Table 2.3**, delay of 2.5 years for OWTF2 construction programme has been adopted in predicting cumulative construction noise level since the construction work is anticipated to commence in late 2017 based on the best available information (instead of March 2015 as stated in the approved OWTF2 EIA report).

4.4.4 Assessment Methodology

The adopted approach to assess the noise impact is in line with the Guidance Note titled "Preparation of Construction Noise Impact Assessment under the Environmental Impact Assessment Ordinance" (GN 9/2010).

In addition, the assessment of construction noise impact is based on standard acoustic principles, and the guidelines given in GW-TM issued under the NCO where appropriate. Where no sound power level (SWL) can be found in the relevant TM, reference has been made to BS 5228 Part 1:2009 or noise emission levels measured for PME used in previous projects in Hong Kong. The general approach is summarised below:



- i. Obtain the construction schedules/ programmes together with typical project-specific equipment inventory for each work stage together with the numbers of such equipment from the relevant Engineering Design Consultants;
- ii. Obtain from GW-TM, the Sound Power Level (SWL) for each PME assumed in the equipment inventory;
- iii. Select representative NSRs for the construction noise impact assessment;
- iv. Calculate the unmitigated Predicted Noise Level (PNL) and correct it for facade reflection to obtain the Corrected Noise Level (CNL) at any NSRs;
- v. If necessary, re-select typical project-specific silenced equipment and calculate the mitigated noise impact;
- vi. Compare the mitigated CNL with the noise standards to determine acceptability and the need for the Direct Mitigation Measures as specified in Appendix C, Clause 2.4 of the EIA Study Brief.

The calculation methodology is estimated with the following standard Equation 3-1:

SPL = SWL	– DC + FC	Equation 3-1
where		
SPL:	Sound Pressure Level in dB(A)	
SWL:	Sound Power Level in dB(A)	
DC:	Distance Attenuation in $dB(A) = 20 \log D + 8$ [where D is the distance in metres]	
FC:	Façade Correction in $dB(A) = +3 dB(A)$	

4.4.5 Prediction and Evaluation of Environmental Impact

The type and quantity of Powered Mechanical Equipment (PME) likely to be used for this Project and their Sound Power Levels (SWLs) are shown in **Appendix 4.1**. The type, quantity of the PME and their utilization rates has been reviewed and concluded to be practicable by the Project Engineer.

The predicted noise levels are presented in **Table 4.8**. Details of the construction noise impact at the representative NSRs are shown in **Appendix 4.1**.

Table 4.0.	omnitigated constituction Aliborne Noise impact				
NSR ID	Use	Predicted Noise Level dB(A)	Noise Criteria dB(A)	Exceedance of Noise Criteria?	Mitigation Measure required?
N1a	Residential	64- 87	75	Yes	Yes
N2a	Residential	65- 88	75	Yes	Yes
N3a	Residential	67- 88	75	Yes	Yes
N4a	Residential	68- 88	75	Yes	Yes
N5a	Residential	70- 84	75	Yes	Yes

Table 4.8: Unmitigated Construction Airborne Noise Impact



Environmental	Impact Asse	ssment Report
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NSR ID	Use	Predicted Noise Level dB(A)	Noise Criteria dB(A)	Exceedance of Noise Criteria?	Mitigation Measure required?
N6a	Residential	70- 89	75	Yes	Yes
N7a	Residential	71- 86	75	Yes	Yes
N8a	Residential	71- 86	75	Yes	Yes
N9a	Residential	75- 89	75	Yes	Yes
N10a	Residential	78-87	75	Yes	Yes
N11a	Residential	75- 86	75	Yes	Yes
N12a	Residential	76-87	75	Yes	Yes
N13	Residential	66- 77	75	Yes	Yes
N14	Residential	65- 77	75	Yes	Yes

Remarks: Bold figure denotes exceedance of relevant noise criteria.

The predicted results indicate that the unmitigated noise impact of construction activities from this Project would cause exceedance of the relevant daytime construction noise criteria. Mitigation measures are therefore required for those affected NSRs in order to alleviate the adverse noise impacts generated during the construction phase of the Project.

4.4.6 **Mitigation of Adverse Environmental Impact**

Mitigation measures for construction activities are detailed below. The following forms of mitigation measures are recommended and should be incorporated into the Contract Specifications:

- Good site practice to limit noise emissions at source;
- Selection of quieter plant;
- Use of movable noise barrier;
- Use of noise enclosure / acoustic shed; and .
- Use of noise insulating fabric.

While it is recognised that the Contractor may develop a different package of mitigation measures to meet the required noise standards, the following suite of practical and implementable measures demonstrate an approach that would be feasible to reduce noise to acceptable levels.

4.4.6.1 Good Site Practice

Good site practice and noise management can significantly reduce the impact of site activities on nearby NSRs. The following package of measures should be followed while carrying out of the Project:

Only well-maintained plant to be operated on-site and plant should be serviced regularly during the works;



- Machines and plant that may be in intermittent use to be shut down between work periods or should be throttled down to a minimum;
- Plant known to emit noise strongly in one direction, should, where possible, be orientated to direct noise away from the NSRs;
- Mobile plant should be sited as far away from NSRs as possible; and
- Material stockpiles and other structures to be effectively utilised, where practicable, to screen noise from on-site construction activities.

4.4.6.2 Selection of Quieter Plant

The Contractor may be able to obtain particular models of plant that are quieter than the standards given in the GW-TM. This is one of the most effective measures and is increasingly practicable because of the availability of quiet equipment.

Quiet plant whose actual SWL is lower than the value specified in GW-TM for the same piece of equipment. Examples of SWLs for specific silenced PME taken from EPD's QPME Inventory and "Sound Power Levels of Other Commonly Used PME" are presented in **Table 4.9**. It should be noted that various types of silenced equipment can be found in Hong Kong.

PME	Power rating/size, weight	Reference	SWL, dB(A)
Crane, mobile	213kW	EPD-01516	101
Excavator, wheeled/tracked	112.5kW	EPD-01230	99
Dump truck	5.5 tonne < gross vehicle weight ≤ 38 tonne	EPD document "Sound Power Levels of Other Commonly Used PME"	105
Poker, vibratory, handheld (electric)	0.75 kW each	EPD document "Sound Power Levels of Other Commonly Used PME"	102

Table 4.9: Quieter PME Recommended for Adoption during the Construction Phase of the Project

Whilst quieter PME are listed, the Contractor may be able to obtain particular models of plant that are quieter than the PME given above.

4.4.6.3 Use of Movable Noise Barriers

Movable noise barriers can be very effective in screening noise from particular items of plant when implementing the Project. Noise barriers located along the active works area close to the noise generating component of a PME could produce at least 10 dB(A) screening for stationary plant and 5 dB(A) for mobile plant provided the direct line of sight between the PME and the NSRs is blocked. A schematic configuration of a single movable noise barrier for PME is shown in **Figure 4.4**.

These noise barriers should be free of gaps and made of materials having a surface mass density in excess of 10 kg/m². To improve the effectiveness of noise reduction, non-flammable absorptive lining can



be adhered on the inner surface of the noise barriers. The barrier can be in the form of vertical or bend top barrier with an effective height to block the line of sight to NSRs.

4.4.6.4 Use of Noise Enclosure/ Acoustic Shed

The use of noise enclosure or acoustic shed is to cover stationary PME such as air compressor and generator. With the adoption of the noise enclosure, the PME could be completely screened, and noise reduction of 15 dB(A) can be achieved according to the EIAO Guidance Note No.9/2010. A schematic configuration of full noise enclosure for PME is shown in **Figure 4.5**.

4.4.6.5 Use of Noise Insulating Fabric

Noise insulating fabric can also be adopted for certain PME (e.g. pilling machine etc.). The Fabric should be lapped such that there are no openings or gaps on the joints. According to the approved Tsim Sha Tsui Station Northern Subway EIA Report (Register No.: AEIAR-127/2008), a noise reduction of 5 dB(A) can be achieved for the PME lapped with the noise insulating fabric.

The noise screening benefit for each item of plant considered in this assessment is listed in Table 4.10.

РМЕ	Mitigation Measures Proposed	Noise Reduction dB(A)
Air compressor	Noise enclosure	15
Generator	Noise enclosure	15
Bar bender and cutter	Movable Barrier	10
Breaker, hand-held	Movable Barrier	10
Concrete pump	Movable Barrier	10
Drill rig	Movable Barrier	10
Grout mixer	Movable Barrier	10
Grout pump	Movable Barrier	10
Saw, chain, hand-held	Movable Barrier	10
Saw, circular, wood	Movable Barrier	10
Water pump	Movable Barrier	10
Water pump, submersible	Movable Barrier	10
Concrete crusher, excavator mounted	Movable Barrier	5
Compactor, vibratory	Movable Barrier	5
Asphalt paver	Movable Barrier	5
Bulldozer	Movable Barrier	5
Concrete lorry mixer	Movable Barrier	5
Concrete pump, lorry mounted	Movable Barrier	5
Crane, mobile	Movable Barrier	5
Dump truck	Movable Barrier	5
Excavator, wheeled/tracked	Movable Barrier	5

Table 4.10: Noise Mitigation Measures for Certain PME during the Construction Phase of the Project

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PME	Mitigation Measures Proposed	Noise Reduction dB(A)
Fork lift truck	Movable Barrier	5
Lorry	Movable Barrier	5
Lorry, with crane/grab	Movable Barrier	5
Poker, vibratory, hand-held	Movable Barrier	5
Roller, vibratory	Movable Barrier	5
Welding plant	Movable Barrier	5
Piling, large diameter bored, reverse circulation drill	Noise Insulating Fabric	5

4.4.6.6 Mitigated Construction Noise Impacts

The effect of the use of quieter plant, movable barriers, noise enclosures and noise insulating fabric has been investigated for the practicable construction activities. The predicted results are presented in **Table 4.11**. Mitigated Construction Plant Inventory and details of the mitigated construction noise impact are shown in **Appendix 4.2**.

Table 4.11. Willigated Construction Andonne Noise impac	Table 4.11:	Mitigated	Construction	Airborne	Noise	Impact
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NSR ID	Use	Predicted Noise Level dB(A)	Noise Criteria dB(A)	Exceedance of Noise Criteria?	Residual Noise Impact?
N1a	Residential	52-74	75	No	No
N2a	Residential	53-75	75	No	No
N3a	Residential	55-75	75	No	No
N4a	Residential	57-74	75	No	No
N5a	Residential	59-71	75	No	No
N6a	Residential	59-75	75	No	No
N7a	Residential	60-73	75	No	No
N8a	Residential	60-72	75	No	No
N9a	Residential	61-75	75	No	No
N10a	Residential	68-75	75	No	No
N11a	Residential	66-73	75	No	No
N12a	Residential	64-75	75	No	No
N13	Residential	55-65	75	No	No
N14	Residential	53-64	75	No	No

Remarks: **Bold** figure denotes exceedance of relevant noise criteria.

With the incorporation of quieter plant, movable barriers, noise enclosures and noise insulating fabric, the results indicate that the mitigated noise impact associated with the construction activities of the Project



would comply with the day-time construction noise criteria at all representative NSRs. Therefore, adverse construction noise impact from this Project is not anticipated.

4.4.6.7 Cumulative Construction Noise Impacts

The cumulative construction noise levels from this Project and the concurrent projects are presented in **Table 4.12**. The predicted noise levels have included the cumulative impacts from other potential concurrent projects. Details of the mitigated cumulative construction noise impact are shown in **Appendix 4.2**.

NSR ID	Use	Predicted Noise Level dB(A)	Noise Criteria dB(A)	Exceedance of Noise Criteria?	Residual Noise Impact?
N1a	Residential	52-74	75	No	No
N2a	Residential	53-75	75	No	No
N3a	Residential	55-75	75	No	No
N4a	Residential	57-74	75	No	No
N5a	Residential	59-71	75	No	No
N6a	Residential	59-75	75	No	No
N7a	Residential	60-75	75	No	No
N8a	Residential	60-72	75	No	No
N9a	Residential	64-75	75	No	No
N10a	Residential	69-75	75	No	No
N11a	Residential	68-73	75	No	No
N12a	Residential	64-75	75	No	No
N13	Residential	59-69	75	No	No
N14	Residential	53-64	75	No	No

 Table 4.12:
 Mitigated Cumulative Construction Airborne Noise Impact

Remarks: **Bold** figure denotes exceedance of relevant noise criteria.

With the incorporation of quieter plant, movable barriers, noise enclosures and noise insulating fabric, the results indicate that the mitigated noise impact associated with the construction of the project and other concurrent projects would comply with the day-time construction noise criterion at all representative NSRs. Therefore, adverse construction noise impact is not anticipated.

4.4.7 Evaluation of Residual Impact

With the implementation of the proposed mitigation measures, no exceedance of cumulative noise impact during construction phase was predicted at the representative NSRs. Hence, no residual impact is anticipated.



4.5 Road Traffic Noise Impact Assessment

4.5.1 Assessment Area

Clause 3.2.1 in Appendix C of the EIA Study Brief (ESB-276/2014) specifies that the assessment area for the road traffic noise impact assessment shall generally include areas within 300 metres from the boundary of the Project and the works of the Project. Details of the assessment area can be referred to **Figure 4.6**.

4.5.2 Identification of Representative Noise Sensitive Receivers

Noise Sensitive Receivers (NSRs) have been identified in accordance with Annexes 5 and 13 of the EIAO-TM. The NSRs have included existing, planned / committed noise sensitive developments and relevant uses earmarked on the relevant Outline Zoning Plans, Development Permission Area Plans, Outline Development Plans, Layout Plans and other relevant published land use plans, including plans and drawings published by Lands Department.

For the purpose of road traffic noise impact assessment, the first layer of NSRs located close to boundary of the Project and the works of the Project have been selected as assessment points/ identified representative NSRs within the assessment area for prediction of the noise impact levels.

According to the Outline Zoning Plans (S/NE-MKT/2 – Man Kam To, S/NE-HLH/8 – Hung Lung Hang and S/NE-FTA/2 – Fu Tei Au & Sha Ling), the assessment area mainly comprises zoning of Agriculture, Green Belt and Undetermined. No planned NSR has been identified within the assessment area.

Descriptions of all identified representative NSRs are tabulated in **Table 4.13**. The locations of representative noise sensitive receivers for road traffic noise impact assessment are shown in the **Figure 4.6**. Photographs of representative existing NSRs are shown in **Figure 4.3**.

No.	NSR ID	Description	Existing / Planned	Type of Use	No. of Storeys (Sensitive use only)	1st Assessment Level (mPD)
1	N1a	Village House, Sha Ling	Existing	Residential	1	18.6
2	N1b	Village House, Sha Ling	Existing	Residential	1	18.6
3	N2a	Village House, Sha Ling	Existing	Residential	2	20.4
4	N2b	Village House, Sha Ling	Existing	Residential	2	20.4
5	N2c	Village House, Sha Ling	Existing	Residential	2	20.4
6	N3a	Village House No. 248, Sha Ling	Existing	Residential	1	26.3
7	N3b	Village House No. 248, Sha Ling	Existing	Residential	1	26.3
8	N4a	Village House, Sha Ling	Existing	Residential	1	28.6
9	N4b	Village House, Sha Ling	Existing	Residential	1	28.6
10	N4c	Village House, Sha Ling	Existing	Residential	1	28.6
11	N5a	Village House No. 272, Sha Ling	Existing	Residential	1	24.0

Table 4.13: Representative Road Traffic Noise Sensitive Receivers Identified for the Assessment



No.	NSR ID	Description	Existing / Planned	Type of Use	No. of Storeys (Sensitive use only)	1st Assessment Level (mPD)
12	N5b	Village House No. 272, Sha Ling	Existing	Residential	1	24.0
13	N6a	Village House, Sha Ling	Existing	Residential	1	23.1
14	N6b	Village House, Sha Ling	Existing	Residential	1	23.1
15	N7a	Village House, Sha Ling	Existing	Residential	1	29.7
16	N7c	Village House, Sha Ling	Existing	Residential	1	29.7
17	N8a	Village House, Sha Ling	Existing	Residential	1	29.2
18	N8b	Village House, Sha Ling	Existing	Residential	1	29.2
19	N9a	Village House, Kong Nga Po	Existing	Residential	1	27.5
20	N9b	Village House, Kong Nga Po	Existing	Residential	1	27.5
21	N9d	Village House, Kong Nga Po	Existing	Residential	1	27.5
22	N10a	Village House, Kong Nga Po	Existing	Residential	1	28.0
23	N10b	Village House, Kong Nga Po	Existing	Residential	1	28.0
24	N10c	Village House, Kong Nga Po	Existing	Residential	1	28.0
25	N12a	Village House, Kong Nga Po	Existing	Residential	1	38.5
26	N12b	Village House, Kong Nga Po	Existing	Residential	1	38.5

4.5.3 Identification of Noise Sources

The Project does involve the construction / modification of roads. During the operational phase, operation of the police facilities connecting road may pose traffic noise impacts on the nearby NSRs. The road carriageways involved within the assessment area, including the proposed police facilities connecting roads, modified Kong Nga Po Road, existing roads. **Appendix 4.3** shows the extent of the proposed project road.

The commencement of full operation of the police facilities in KNP is scheduled at Year 2023. Road traffic noise levels at the representative assessment points will be calculated based on the maximum peak hour traffic flow within a 15 years period upon commencement of full operation of the Project at Year 2023. Therefore, the traffic forecast data at Year 2038 was adopted in the road traffic noise assessment. Transport Department (TD) has no in-principle objection on adoption of this traffic forecast data (provided by the Project Traffic Consultant) for traffic noise impact assessment (see **Appendix 4.4**). The traffic forecast data and the location of road links are provided in **Appendix 4.5**. As the AM peak hour traffic flows of those dominant surrounding road links are higher than that during the PM peak hour, the AM peak hour traffic flow will be adopted in the assessment.

4.5.4 Assessment Methodology

Road traffic noise levels at the representative assessment points will be calculated based on the maximum AM peak hour traffic flow within a 15 years period upon commencement of operation of the Project i.e., the



assessment year (Year 2038). Traffic noise will be predicted using the model "RoadNoise", which has been used before in other similar EIA studies. The model has fully incorporated the procedures and methodology documented in "Calculation of Road Traffic Noise (CRTN)" (1988) published by the U.K. Department of Transport.

In accordance with the requirements specified in Appendix C, Clause 3.3.1 (b) of the EIA Study Brief, a number of specified scenarios (if applicable) should be studied as part of the road traffic noise impact assessment. These scenarios are summarized below:

- Unmitigated scenario at assessment year;
- Mitigated scenario at assessment year, if needed; and
- Prevailing scenario for indirect mitigated measures eligibility assessment, if needed.

An assessment of the unmitigated road traffic noise levels at the representative NSRs under the assessment year was carried out. If exceedance of the relevant road traffic noise criteria is predicted, direct noise mitigation measures will be considered. In case the proposed direct noise mitigation measures cannot be implemented due to site constraints and other uncertainties, indirect noise mitigation measures will also be considered.

4.5.5 Prediction and Evaluation of Environmental Impact

The unmitigated road traffic noise impacts on the representative NSRs due to operation of the proposed road sections of the Project and existing roads at Year 2038 are summarised in **Table 4.14**. Detailed breakdowns of unmitigated road traffic noise impacts are shown in **Appendix 4.6**.

Since the overall predicted road traffic noise level at NSRs will not exceed the traffic noise criteria, no adverse traffic noise impact arising from the operation of the proposed police facilities is anticipated. As such, no traffic noise mitigation measures are required.

		Noise Criteria	Predicted Road Traffic	Noise Level, L _{10 (1hr)} dB(A)
NSR ID	Use	$L_{10(1 \text{ hr})} \text{ dB(A)}$	Project Roads	Overall
N1a	Residential (Existing)	70	64	67
N1b	Residential (Existing)	70	61	65
N2a	Residential (Existing)	70	66 - 68	67 - 69
N2b	Residential (Existing)	70	59 - 61	63 - 65
N2c	Residential (Existing)	70	67 - 69	67 - 69
N3a	Residential (Existing)	70	68	68
N3b	Residential (Existing)	70	64	66
N4a	Residential (Existing)	70	66	66
N4b	Residential (Existing)	70	65	66

Table 4.14: Unmitigated Road Traffic Noise Impact in Year 2038



		Noise Criteria	Predicted Road Traffic Nois	se Level, L _{10 (1hr)} dB(A)
NSR ID	Use	$L_{10(1 hr)} dB(A)$	Project Roads	Overall
N4c	Residential (Existing)	70	59	59
N5a	Residential (Existing)	70	65	65
N5b	Residential (Existing)	70	66	66
N6a	Residential (Existing)	70	65	65
N6b	Residential (Existing)	70	65	66
N7a	Residential (Existing)	70	65	65
N7c	Residential (Existing)	70	67	68
N8a	Residential (Existing)	70	62	62
N8b	Residential (Existing)	70	62	62
N9a	Residential (Existing)	70	64	64
N9b	Residential (Existing)	70	61	61
N9d	Residential (Existing)	70	62	62
N10a	Residential (Existing)	70	61	61
N10b	Residential (Existing)	70	57	57
N10c	Residential (Existing)	70	59	59
N12a	Residential (Existing)	70	35	49
N12b	Residential (Existing)	70	42	52

The potential road traffic noise impact under the unmitigated scenario was quantified by the 11 nos. of selected residential dwellings and summarized in the Table 4.15 below. The maximum predicted road traffic noise level at each dwelling is presented against the relevant noise criteria. In short, no unmitigated road traffic noise level at NSR greater than the traffic noise criteria (i.e. exposed dwelling) is anticipated.

Table 4 15	Prodicted Noise	Impacte di	uantified by	Number	of Dwollings	(I Inmitiaated)
Table 4.15.	Fredicted Noise	impacts qu	uantineu by	Number	or Dwennings	(Uninitigated)

No.	Dwelling	NSR Group	Floor	Noise Criteria,	Maximum Predicted Level in a Dwellin	Road Traffic Noise g, L _{10 (1hr)} dB(A)
	ID.			L _{10(1 hr)} dB(A)	Project Roads	Overall
1	N01-flr1-1	N1a, N1b	1	70	64	67
2	N02-flr1-1	N2a, N2b, N2c	1	70	67	67
3	N02-flr2-2	N2a, N2b, N2c	2	70	69	69
4	N03-flr1-1	N3a, N3b	1	70	68	68
5	N04-flr1-1	N4a, N4b, N4c	1	70	66	66
6	N05-flr1-1	N5a, N5b	1	70	66	66
7	N06-flr1-1	N6a, N6b	1	70	65	66
8	N07-flr1-1	N7a, N7c	1	70	67	68



No. Dw	Dwelling	NSR Group	Floor	Noise Criteria,	Maximum Predicted Level in a Dwellin	Road Traffic Noise g, L _{10 (1hr)} dB(A)
	ID.		L _{10(1 hr)} dB(A)	Project Roads	Overall	
9	N08-flr1-1	N8a, N8b	1	70	62	62
10	N09-flr1-1	N9a, N9b, N9d	1	70	64	64
11	N10-flr1-1	N10a, N10b, N10c	1	70	61	61
12	N12-flr1-1	N12a, N12b	1	70	42	52

4.5.6 Mitigation of Adverse Environmental Impact

Since no adverse impact due to the Project roads was identified, no specific road traffic noise mitigation measure is required.

4.5.7 Evaluation of Residual Impact

The road traffic noise impact would comply with the relevant noise criterion of $L_{10(1 \text{ hr})}$ 70 dB(A) at all representative NSRs. Thus, no residual impact is anticipated.

4.6 Fixed Noise Sources Impact Assessment

4.6.1 Assessment Area

Clause 4.2.1 in Appendix C of the EIA Study Brief (ESB-276/2014) specifies that the assessment area for the fixed noise impact assessment shall generally include areas within 300 metres from the boundary of the Project and the works of the Project. Details of the assessment area can be referred to **Figure 4.1**.

4.6.2 Identification of Representative Noise Sensitive Receivers

Noise Sensitive Receivers (NSRs) have been identified in accordance with Annexes 5 and 13 of the EIAO-TM. The NSRs have included existing, planned / committed noise sensitive developments and relevant uses earmarked on the relevant Outline Zoning Plans, Development Permission Area Plans, Outline Development Plans, Layout Plans and other relevant published land use plans, including plans and drawings published by Lands Department.

For the purpose of fixed noise impact assessment, the first layer of NSRs located close to boundary of the Project have been selected as assessment points/ identified representative NSRs within the assessment area for prediction of the noise impact levels.

According to the Outline Zoning Plans (S/NE-MKT/2 – Man Kam To, S/NE-HLH/8 – Hung Lung Hang and S/NE-FTA/2 – Fu Tei Au & Sha Ling), the assessment area mainly comprises zoning of Agriculture, Green Belt and Undetermined. No planned NSR has been identified within the assessment area.



Descriptions of all identified representative NSRs are tabulated in **Table 4.16**. The locations of representative noise sensitive receivers for fixed noise impact assessment are shown in the **Figure 4.1**. Photographs of representative existing NSRs are shown in **Figure 4.3**.

NSR ID	Description	Existing / Planned	Type of Use	No. of Storeys (Sensitive use only)	Ground Level (mPD)
N9b	Village House, Kong Nga Po	Existing	Residential	1	26.3
N10b	Village House, Kong Nga Po	Existing	Residential	1	26.8
N11a	Village House, Kong Nga Po	Existing	Residential	1	26.9
N12a	Village House, Kong Nga Po	Existing	Residential	1	37.3
N13	Village House, Kong Nga Po	Existing	Residential	2	22.0
N14	Village House, near Man Kam To Road	Existing	Residential	1	17.3
N15	Village House, Sha Ling	Existing	Residential	1	21.9

Table 4.16: Representative Fixed Noise Sensitive Receivers Identified for the Assessment

The planned fixed noise sources criteria to be adopted for the NSRs are dependent on the background noise measurement results. Should the measured prevailing background noise level be lower than the ANL by more than 5dB(A), the background noise level would be adopted as the criteria. The noise criteria of the planned fixed noise sources are summarised in **Table 4.17** below.

Table 4.17: Noise Criteria of Planned Fixed Noise Sources

NSR ID.	Time Period^	ANL - 5, dB(A) [#]	Location ID of Background Noise	Background Noise Level, dB(A) *	Fixed Noise Criteria, dB(A)	
N9b, N10b,	Day-time (0700 to 1900 hours)	EE	M1	55		
N11a, N15	Evening (1900 to 2300 hours)	55		55	55	
N10a	Day-time (0700 to 1900 hours)	EE	Mo	56	55	
N12a	Evening (1900 to 2300 hours)	55	IVIZ	55		
NHO	Day-time (0700 to 1900 hours)	FF	Mo	52		
NT3	Evening (1900 to 2300 hours)	55	IVI3	52	52	
N14	Day-time (0700 to 1900 hours)	FF		60		
	Evening (1900 to 2300 hours)	55	IVI4	57	55	

Notes:

(^) The operation hours of the planned police facilities would be from 7am to 11pm. Therefore, no night-time operations of fixed noise sources are anticipated in this study.

([#]) Refer to **Table 4.3** for the Area Sensitivity Rating.

(*) Refer to **Table 4.5** for the background noise measurement results.



4.6.3 Identification of Noise Sources

Operation of planned facilities within KNP site will be considered in the fixed noise sources impact assessment. The planned fixed noise sources or facilities are identified as follows:

- Operation of firing ranges (i.e. the proposed reprovision of Lo Wu and Ma Tso Lung Firing Ranges);
- Operation of Proposed Police Training Facility (PTF);
- Operation of Weapon Training Facilities (WTF);
- Operation of police driving and traffic training facilities; and
- Operation of fixed plant noise sources such as air intake / exhaust openings for ventilation, sewage pumping station and petrol/ diesel filling station.

As confirmed by HKPF, the operation hours of the aforesaid planned facilities would be from 7am to 11pm, i.e. not operated during night-time period as the police facilities is closed during night-time except for urgent police operation. Activities involved in "urgent operations" may involve the return of concerned officers to the campus to get dressed in uniform, drawing gear and equipment, and then leaving campus by police vehicles, etc. These activities will not involve any potential fixed noise source such as powered mechanical equipment, skidding / braking driving, sirens, simulation shooting or shooting. Details please refer to **Appendix 4.7**.

In addition, the existing San Uk Ling Firing Range is located approximately 60m from the site boundary. HKPF confirmed that same type of weapons as the Lo Wu Firing Range will be used in the existing San Uk Ling Firing Range. Thus, cumulative impacts from the existing San Uk Ling Firing Range and the Police Facilities in KNP will be considered in the fixed noise impact assessment. Cheung Po Tau Firing Range is located more than 600m apart from the planned firing ranges and hence cumulative noise impact is not anticipated.

According to the design engineer, there will be no night-time operations (from 11pm to 7am) of fixed plant noise sources such as ventilation facilities, sewage pumping station and petrol/ diesel filling station anticipated during the normal operation of the planned facilities.

4.6.4 Assessment Methodology

4.6.4.1 Firing Ranges

The extent of firing range noise impacts to the identified NSRs are based on the types of weapons, shooting frequency, firing range location and line of sight from NSRs. Firing range noise impact assessment will be conducted based on the approach (including gunshot noise data) adopted in the approved EIA study "North East New Territories New Development Areas" (Register No.: AEIAR-175/2013). Details of the gunshot noise measurement results can be referred to **Appendix 4.8a**.

The following Equation 3-2 is used for calculating the SPL at the representative NSRs:



 $SPL = SWL - DC + FC + IC - 10 \log (T) + 10 \log (N)$ Equation 3-2 where SPL: Sound Pressure Level in dB(A) SWL: Sound Power Level for single mode shooting in dB(A) Distance Attenuation in $dB(A) = 20 \log D + 8$ [where D is the distance in metres] DC: FC: Façade Correction in dB(A) = +3 dB(A)IC: Impulsiveness Correction in dB(A) = +3 dB(A)T: 30 minutes = 1800s Number of shot per 30 minutes period N:

If the shooting lane is not directly adjacent to the NSR and with no direct line of sight to the noise source which is located on the other side of the NSR building or completely blocked by substantial barrier including building(s) or topographical feature(s), barrier attenuation in accordance with International Standard ISO 9613-2¹ will be adopted. Lo Wu Firing Range (reprovision) and Ma Tso Lung Firing Range (reprovision) have been designed to be located on the top of hillside within the Project site with at least 2.5m height perimeter wall / boundary wall. An extra 5m height side walls will be installed at 4-side of Ma Tso Lung Firing Range (reprovision). Adjacent NSRs with only 1 to 2 of storeys are situated at lower ground level. Thus, the direct line of sight from NSRs to the noise source will be completely blocked.

4.6.4.2 Proposed Police Training Facility (PTF)

Two to three storey buildings will be located at the PTF. HKPF confirmed that no outdoor live firing would be involved in the PTF. PTF will be a new training complex with limited noisy outdoor activity / facilities, confined to occasional vehicle sirens / simulation shooting with maximum of 4 times per day for no more than 30 minutes on each occasion. Those outdoor activity / facilities have been designed to be located on the top of hillside and incorporated with at least 2.5m height perimeter wall / boundary wall at the Project site. Adjacent NSRs with only 1 to 2 of storeys are situated at lower ground level. Thus, the direct line of sight from NSRs to the noise source will be completely blocked.

4.6.4.3 Weapon Training Facilities (WTF)

Three storey buildings will be located at the WTF providing 3,800 m² of internal area. HKPF confirmed that there will be no live firing and noisy activities would be housed indoor with non-openable window and central air-conditioning. WTF will involve only with limited noisy outdoor activity / facilities, confined to occasional vehicle sirens / simulation shooting with maximum of 4 times per day for no more than 30 minutes on each occasion. Those outdoor activity / facilities have been designed to be located on the top of hillside and incorporated with at least 2.5m height perimeter wall / boundary wall at the Project site. Adjacent NSRs with only 1 to 2 of storeys are situated at lower ground level. Thus, the direct line of sight from NSRs to the noise source will be completely blocked.

¹ ISO 9613-2: 1996(E), Acoustics - Attenuation of Sound During Propagation Outdoors, Part 2: General Method of Calculation.



Vehicle sirens / simulation shooting noise measurements were also conducted on 23 November 2015 at the existing police training facilities in Fan Garden. The measurement results are summarized in **Table 4.18** below.

Table 4.18: Measurement Results for Vehicle Sirens / Simulation Shooting

Source	Distance from source, m	Measurement Duration	Leq*, dB(A)
Vehicle Siren (Saloon Car)	4	1 minute	65.0
Vehicle Siren (Van)	4	1 minute	67.8
Simulation Shooting (Event 1)	6	2 minutes	63.5
Simulation Shooting (Event 2)	6	2 minutes	66.0

Notes:

(*) Background noise has been included in the noise measurement for conservative consideration.

4.6.4.4 Police Driving and Traffic Training Facilities (PD&TTF)

Operation of PD&TTF involves another type of fixed noise source. However, those facilities have been designed to be located on the top of hillside and incorporated with at least 2.5m height perimeter wall / boundary wall at the Project site. Adjacent NSRs with only 1 to 2 of storeys are situated at lower ground level. Thus, the direct line of sight from NSRs to the noise source will be completely blocked. As a result, it is not anticipated that noise impact from normal driving activities to the nearby NSRs would be significant. In addition, HKPF confirmed that only Straight Driving Training Track, Skid Pan and 4-wheeled Training Ground will involve skidding and/or braking driving training.

Vehicle noise measurements were conducted on 25 June 2015 and 23 November 2015 at the existing police driving and traffic training facilities in Fan Garden. The measurement results for normal driving are summarized in **Table 4.19** and the measurement results on tyre noise, skidding noise and braking noise are summarized in **Table 4.20**. Noise measurement results with worst case scenario (i.e. maximum number of vehicle per 30 minutes) will be adopted in the fixed noise impact assessment.

Table 4.19: Measurement Results for Normal Driving

Source	Distance from source, m	Measurement Duration	Leq*, dB(A)
Saloon Car	3	2 minute	59.9
Van	3	2 minute	64.7

Notes:

(*) Background noise has been included in the noise measurement for conservative consideration.

Table 4.20: Measurement Results on Tyre Noise, Skidding Noise and Braking Noise

Source	Distance from source, m	Leq, 5 mins*, dB(A)	SWL (5 mins)^, dB(A)
Saloon Car	6	82.3	105.9
Van	5	83.1	105.1

Notes:

(*) The background noise levels are in the range of 53-58 dB(A), and therefore the influence of background noise to the measurement results is insignificant.

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(^) The measured SWL (5 mins) will be assumed for 30-minute continuous vehicle movement under conservative approach.

4.6.4.5 Fixed Plant Noise Sources

Further to the Fan Garden site visit on 25 June 2015, no noisy outdoor fixed plants have been identified for serving the various training facilities. In the absence of any detailed information and noise specification for the proposed fixed plant such as ventilation facilities, sewage pumping station and petrol/ diesel filling station, the maximum allowable noise emission levels would be determined as design criteria for the development proposed in the current layout plan.

For the assessment of noise from the fixed plant, the maximum allowable sound power levels (Max SWLs) of the identified fixed noise sources were determined by adopting standard acoustics principles. The following standard Equation 3-3 is used for calculating the Max SWLs of the fixed plant:

 SPL = Max
 SWL - DC + FC
 Equation 3-3

 where
 SPL:
 Sound Pressure Level in dB(A)

 Max
 Maximum Allowable Sound Power Level in dB(A)

 DC:
 Distance Attenuation in dB(A) = 20 log D + 8 [where D is the distance in metres]

 FC:
 Façade Correction in dB(A) = +3 dB(A)

If those fixed plant directly adjacent to the NSR building but with no direct line of sight to the noise source / opening, a 5 dB(A) attenuation will be applied. If the fixed plant is not directly adjacent to the NSR and with no direct line of sight to the noise source / opening which is located on the other side of the NSR building or completely blocked by substantial barrier including building(s) or topographical feature(s), a 10 dB(A) attenuation will be applied.

If exceedance to the noise criteria is found for one NSR, the initial SWL of the dominant sources to that NSR would be gradually lowered until the corrected SPL at that NSR meets the acceptable level. The process would be repeated for other representative NSRs with exceedance in the noise criteria until all corrected SPLs at the representative NSRs meet the noise criteria. The maximum allowable SWLs of the fixed plant will then be predicted.

For those existing fixed plant noise sources, the design information is made reference to the relevant approved EIA reports or obtained from the relevant authorities. The noise impact from these sources would then be assessed with the use of the same methodology as stated above for the planned sources.

Corrections of tonality, intermittency or impulsiveness have not been considered in proposed fixed plant noise source as there are no detailed information and noise specification for these future noise sources. However, if the noise exhibits any of these characteristics during the operation of the plant, the maximum allowable SWLs should be reduced in accordance with the recommendation given in Section 3.3 of the IND-TM.



4.6.5 Prediction and Evaluation of Environmental Impact

According to the preliminary design information, fixed noise sources of the Project would mainly associate with the above ground ventilation openings, fixed plant, firing ranges and police driving and traffic training vehicles. The identified major fixed noise sources are summarised in **Table 4.21** and the corresponding locations are shown in **Figure 4.7**.

Table 4.21:	Summar	y of Fixed	Noise	Sources
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Fixed Noise Source	Existing/ Planned	Number of Units	Opening ID
Ventilation Openings of Proposed Police Training Facility	Planned	22	FS1 to FS22
Ventilation Openings of Weapons Training Facilities	Planned	4	FS23 to FS26
Multi-Storey Training Complex Ventilation Opening	Planned	4	FS27 to FS30
Lo Wu Firing Range Control Building Ventilation Opening	Planned	1	FS31
Straight Driving Training Track Control Tower Ventilation Opening	Planned	1	FS32
Ma Tso Lung Firing Range Control Building Ventilation Opening	Planned	1	FS33
Two-wheeled Driving Training Track Control Building Ventilation Opening	Planned	2	FS34 and FS38
Training Ground for Parking Training Control Building Ventilation Opening	Planned	1	FS35
Skid Pan Control Tower Ventilation Opening	Planned	1	FS36
Four-wheeled Driving Training Track Control Building Ventilation Opening	Planned	2	FS37 and FS 39
Sewage Pumping Station	Planned	1	SPS
Petrol/ diesel filling station	Planned	1	PFS
Police Driving and Traffic Training Facilities involve Skidding or Braking Driving Training	Planned	4	FW1, FW2, SKP, SDT
San Uk Ling Firing Range	Existing	1	SUL
Ma Tso Lung Firing Range (reprovision)	Planned	1	MTL
Lo Wu Firing Range (reprovision)	Planned	1	LW

4.6.5.1 Fixed Plant and Police Driving and Traffic Training Facilities (PD&TTF)

The maximum permissible SWLs of the proposed fixed plants during day-time and evening are predicted as summarised in **Table 4.22** below.

Table 4.22:	le 4.22: Maximum Permissible SWLs of the Fixed Plant					
Fixed Noise Source		Source ID	Maximum Permissible SWL, dB(A)*			
		Source ID	Day-time & Evening^			

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Fixed Noise Source	Source ID	Maximum Permissible SWL, dB(A)* Day-time & Evening^
Ventilation Openings of Proposed Police Training Facility	FS1 to FS22	90
Ventilation Openings of Weapons Training Facilities	FS23 to FS26	90
Multi-Storey Training Complex Ventilation Opening	FS27 to FS30	90
Lo Wu Firing Range Control Building Ventilation Opening	FS31	90
Straight Driving Training Track Control Tower Ventilation Opening	FS32	90
Ma Tso Lung Firing Range Control Building Ventilation Opening	FS33	90
Two-wheeled Driving Training Track Control Building Ventilation Opening	FS34 and FS38	90
Training Ground for Parking Training Control Building Ventilation Opening	FS35	90
Skid Pan Control Tower Ventilation Opening	FS36	90
Four-wheeled Driving Training Track Control Building Ventilation Opening	FS37 and FS 39	90
Sewage Pumping Station	SPS	100
Petrol/ diesel filling station	PFS	100

Notes: (*) The maximum sound power level of equipment would be specified in the tender specification to ensure the operational noise impact complying with relevant fixed noise criteria. The supplier of equipment should guarantee the specified SWLs including the characteristics of tonality, impulsiveness and intermittency, if any.

(^) The operation hours of the planned police facilities would be from 7am to 11pm. Therefore, no night-time operation of fixed plant noise sources is anticipated in this study.

With the adoption of the proposed maximum permissible SWLs of the proposed fixed plant, the noise impacts due to the operation of fixed plant and PD&TTF to the surrounding NSRs are presented in **Appendix 4.8b**. The impact noise levels at all representative NSRs complied with the relevant noise criteria. Therefore, significant fixed plant and PD&TTF noise impacts to the nearby NSRs are not anticipated.

4.6.5.2 Firing Ranges

There is no standard module of weapon used during the firing practice, i.e. a mixed use of weapon during the firing practice. Hence, it is considered reasonable to average the SWL for single mode shooting of each weapon for assessment purpose. The average SWL for single mode shooting of Lo Wu / San Uk Ling / Ma Tso Lung firing ranges are 120.3 / 120.3 / 120.2 dB(A), respectively based on the data from previous approved EIA study "North East New Territories New Development Areas" (Register No.: AEIAR-175/2013) and the shooting noise measured results. Detailed calculation is given in **Appendix 4.8b**.



HKPF provided the number of shots in a 30-minute period during a training day at the Firing Ranges as shown in **Table 4.23** below.

 Table 4.23:
 Number of Shots in 30-minute Period during a Training Day

Firing Range	Existing / Planned	Number of Shots in 30 mins
Lo Wu (reprovision)	Planned	1000
Ma Tso Lung (reprovision)	Planned	420
San Uk Ling	Existing	250

The predicted noise level at the representative NSRs due to the planned Firing Ranges and other planned fixed noise sources in KNP is shown in **Table 4.24**. The cumulative impact of the existing San Uk Ling Firing Range and the planned police facilities is summarised in **Table 4.25**. Detailed calculation of shooting noise impacts is given in **Appendix 4.8b**.

NSR ID	Use	Predicted Noise Level, dB(A)*				Noise Criteria	Exceedance of	Residual
		MTL	LW	FP & PD&TTF	Total	dB(A)	Noise Criteria?	Noise Impact?
N9b	Residential	41	50	49	53	55	No	No
N10b	Residential	42	42	55	55	55	No	No
N11a	Residential	43	43	53	54	55	No	No
N12a	Residential	42	49	54	55	55	No	No
N13	Residential	41	49	44	50	52	No	No
N14	Residential	36	42	43	46	55	No	No
N15	Residential	41	51	49	53	55	No	No

Table 4.24: Predicted Fixed Noise Impact from Planned Noise Sources

Remarks (*): (MTL) Ma Tso Lung Firing Range (reprovision); (LW) Lo Wu Firing Range (reprovision); (FP & PD&TTF) Fixed Plant and Police Driving and Traffic Training Facilities.

Table 4.25: Cur	mulative Fixed	Noise	Impact fr	rom Existing	and Planned	Noise Sources
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NSR ID	Use	Predicted N	Predicted Noise Level, dB(A)*			Exceedance of	Residual
		SUL	PNS	Total	dB(A)	Noise Criteria?	Noise Impact?
N9b	Residential	38	53	53	60	No	No
N10b	Residential	41	55	55	60	No	No
N11a	Residential	42	54	54	60	No	No
N12a	Residential	39	55	55	60	No	No
N13	Residential	44	50	51	60	No	No
N14	Residential	35	46	46	60	No	No
N15	Residential	41	53	54	60	No	No

Remarks (*): (SUL) San Uk Ling Firing Range; (PNS) Planned Noise Sources.



Based on **Table 4.24** and **Table 4.25** above, the predicted planned and cumulative fixed noise levels at all representative NSRs complied with the relevant noise criteria. Therefore, significant fixed noise impacts to the nearby NSRs are not anticipated.

4.6.6 Mitigation of Adverse Environmental Impact

By installing at least 2.5m height perimeter wall / boundary wall at the Project site and extra 5m height 4side walls at Ma Tso Lung Firing Range as well as the proposed fixed plant properly designed with full compliance to the maximum SWL listed in **Table 4.22**, there would not be any adverse impacts predicted. However, it is recommended that the following noise mitigation measures shall be also considered as far as practicable during the detailed design stage:

- Install sand bullet trap, sound absorption materials and baffle system at the planned firing ranges;
- Choose quieter plant such as those which have been effectively silenced;
- Include noise levels specification when ordering new plant (including chillier and E/M equipment);
- Locate fixed plant/louver away from any NSRs as far as practicable;
- Locate fixed plant in walled plant rooms or in specially designed enclosures;
- Locate noisy machines in a completely separate building;
- Install direct noise mitigation measures including silencers, acoustic louvres and acoustic enclosure where necessary; and
- Develop and implement a regularly scheduled plant maintenance programme so that equipment is properly operated and serviced in order to maintain a controlled level of noise.

4.6.7 Evaluation of Residual Impact

With the at least 2.5m height perimeter wall / boundary wall at the Project site and extra 5m height 4-side walls at Ma Tso Lung firing range as well as the proposed fixed plant properly designed with full compliance to the maximum allowable SWLs listed in **Table 4.22**. No residual impacts exceeding the relevant noise criteria are anticipated.

4.7 Helicopter Noise Impact Assessment

4.7.1 Introduction

The planned helipad at KNP is for police training restricted to 7am to 7pm only and emergency use (i.e. air ambulance, search & rescue, supporting law enforcement agencies and fire fighting) without time restriction.

As confirmed by GFS and HKPF, the proposed helipad will be used for police training during day-time period only. The planned frequency and duration of the police training are shown in **Table 4.26** below.



Table 4.26: HKPF Day-time Training

Description	Type A Training	Type B Training
Average no. of occasion per year	52 (weekly basis)	16
No. of helicopter used per cycle	2	1
No. of cycle per occasion	3 – 4	8-10
Duration per cycle expected	Less than 15 minutes	Less than 15 minutes
Duration per occasion expected	Less than 1 hour	Less than 2.5 hours

The existing Lo Wu Range helicopter landing site will be relocated to KNP. As confirmed by GFS, the frequency of using the existing Lo Wu Range helicopter landing site In Year 2010 - 2015 is shown in **Table 4.27** below.

Table 4.27: Frequency of using Lo Wu Range Helicopter Landing Site

Period	Year 2010	Year 2011	Year 2012	Year 2013	Year 2014	Year 2015
Day-time (7am to 7pm)	36	53	45	43	59	98
Evening and Night-time (7pm to 7am)		2		1		

4.7.2 Helicopter Noise Impact Assessment Methodology

The extent of helicopter noise impacts to the identified NSRs are depending on the type of helicopter, flight frequency, number of helicopters at the helipad, helipad location and flight route etc. Helicopter noise impact assessment will be conducted in accordance with the methodology (including International Civil Aviation Organization (ICAO) noise certificated GFS helicopters) adopted in previously approved EIA Study such as Peng Chau Helipad (Register No.: AEIAR-087/2005).

According to Table 1A of EIAO-TM Annex 5 "A Summary of Noise Criteria", helicopter noise impacts shall be assessed in terms of the L_{max} level, which is the maximum instantaneous SPL at the NSR. Since all the representative NSRs are located at considerable slant distance (over 150m) from the helicopter, helicopter noise can be considered as a "point" source (i.e. the SPL in any direction in the open will decrease at a rate of 6 dB per doubling of distance away from the source). The difference in noise levels at two different distances, R1 and R2, can be calculated using the following Equation 3-4:

Noise Lev	Noise Level Difference (dB) = 20 log ₁₀ (R2 / R1)				
where					
R1:	Reference distance from specification noise source in metres				
R2:	Distance between NSRs and noise source in metres				

Corrections will also be applied for the façade, barrier or topographical effect where application.



4.7.3 Identification of Helicopter Noise Impact

According to the master layout plan of the Project, helipad would be included in KNP site. In view of the distance of the nearby NSRs to the helipad (270 - 580m), the operation of the helicopters may cause noise impact to the nearby NSRs. Noise associated with the proposed helipad will be generated by helicopter with lateral movements and without lateral movements as described below.

With Lateral Movements

- "Approaching" Helicopter "approaching" the helipad while it is descending at an angle to the helipad surface;
- "Taking-off" Helicopter "taking-off" from the helipad while it is climbing up at an angle to the helipad surface; and
- "Flyover" Helicopter manoeuvring over the NSRs.

Without Lateral Movements

- "Hovering" Helicopter turns on the spot over the helipad to achieve the desirable orientation for touchdown / lift-off;
- "Touchdown" Helicopter descends on to the helipad surface;
- "Idling" Helicopter remains on the helipad surface with its rotary blades kept running; and
- "Lift-off" Helicopter ascends vertically from the helipad surface to achieve a hover before departure.

4.7.4 Measures to Avoid Adverse Helicopter Noise Impact

With the selected preferred option for helipad location as shown in **Figure 2.1**, further consideration was given to the future helipad design and helicopter operation modes which will affect the magnitude of helicopter noise impact to nearby NSRs, with a view to identifying the preferred design and operation modes which would minimise helicopter noise impact. Consideration was given to various aspects of the police training and emergency operation, including flight paths and flight angles for landing / taking-off. The following design and operation measures with the least impact on nearby noise sensitive receivers (NSRs) were adopter to avoid adverse helicopter noise impact to NSRs:

4.7.4.1 Restricted Helicopter Flight Path (Sector) and Flight Angle

While an unrestricted range for approach / take-off flight paths would provide greater flexibility for police training and emergency operation, some flight paths may be directly over NSRs. By restricting the range away from NSRs, the noise impacts associated with helicopter approach / take-off can be reduced. The restricted ranges of approach / taking-off flight paths of the proposed KNP helipad have been confirmed by GFS and shown in **Figure 4.8**. The restricted ranges increase the distance between the noise source (helicopter) and the NSRs so that helicopter approach / taking-off noise is reduced.



In addition, instead of adopting the guideline of 245m with approach / departure angle of 8 degree, a steeper approach / departure (take-off) angle will be adopted so that the helicopter can reach the required flyover height at a shorter distance from the helipad. This can reduce the helicopter noise impact to nearby NSRs. The flight profile of helicopter at the proposed KNP helipad is as follows:

- Approach: Descend from 150m above the helipad with an approaching angle of 16 degree, and reduce the flight speed to 0 knots in about 1 minute.
- Departure (Take-off): Climb up to 150m above the helipad with a departure angle of 12 degree, and increase the flight speed to 60 knots in about 1 minute.
- Flyover: 500ft (150m) above helipad usually with a flight speed of 60 140 knots.
- Normal Hovering: Turn on the spot at 8ft (2.5m) for Airbus Helicopters H175 to adjust the orientation to touchdown / lift-off in 8 seconds. Maximum Hovering Height of 40-50ft (12-15m) for training purpose for about 2 minutes.
- Idling: About 4 minutes.

4.7.4.2 Noise Barrier / Enclosure

The planned helipad is situated within the Project site with at least 2.5m height perimeter wall / boundary wall. Since the normal hovering height for Airbus Helicopters H175 is 2.5m and the planned helipad will be located at the hill top while the NSRs are located in lower elevations, the noise emission due to idling and normal hovering can be effectively screened by the perimeter wall / boundary wall.

When the helicopter is above the normal hovering height, a higher noise barrier is required. However, such physical structures will obstruct the manoeuvring of helicopter and cause safety concerns during operation. Therefore, substantial noise barrier is not considered as effective and engineering feasible.

4.7.4.3 Treatment of Source

While the helipad caters for more than one helicopter, simultaneous operation of two helicopters (e.g. in hovering, approaching or taking-off modes) will increase the noise emission due to these helicopter activities. As confirmed by GFS and HKPF, within the distance for the helicopter to reach the design height of the "Flyover" mode (i.e. 150m above the helipad), only one helicopter will be allowed in hovering, approaching or taking-off while another helicopter should be idling on ground. This arrangement can avoid two helicopters simultaneously hover / approach / take-off near the NSRs without any screening by the boundary wall or topographic features. By restricting the operation to one helicopter at a time, there is a better 'at-source' control of helicopter noise and the resultant helicopter noise emission would be reduced and the helicopter noise impact minimised.

4.7.5 Identification of Assessment Area

Based on the requirement set out in Clause 5.2.1(a) in Appendix C of the EIA Study Brief (ESB-276/2014), the helicopter noise impact assessment area shall be proposed for agreement of the Director before commencing the assessment. Therefore, the helicopter noise impact assessment area boundary has been



proposed based on the distance of helicopter reaching the design height of the "Flyover" operation mode (i.e. 150m above the helipad). Taking into account the minimum normal hovering height 2.5m, the horizontal distance of helicopter reaching the design height for approach and departure should be 514m (i.e. 147.5m / tan 16 degree) and 694m (i.e. 147.5m / tan 12 degree) respectively.

The proposed assessment area covering 694 metres from the boundary of helipad has been proposed and agreed by the Director and is shown in **Figure 4.8**.

4.7.6 Identification of Representative Noise Sensitive Receivers

Noise Sensitive Receivers (NSRs) have been identified in accordance with Annexes 5 and 13 of the EIAO-TM. The NSRs have included existing, planned / committed noise sensitive developments and relevant uses earmarked on the relevant Outline Zoning Plans, Development Permission Area Plans, Outline Development Plans, Layout Plans and other relevant published land use plans, including plans and drawings published by Lands Department.

For the purpose of helicopter noise impact assessment, the first layer of NSRs located close to the helipad have been selected as assessment points / identified representative NSRs within the assessment area for prediction of the noise impact levels.

According to the latest Outline Zoning Plans (e.g. S/NE-MKT/2 – Man Kam To, S/NE-HLH/8 – Hung Lung Hang and S/NE-FTA/2 – Fu Tei Au & Sha Ling, etc.), the Assessment Area mainly comprises zoning of Agriculture, Green Belt and Undetermined.

A summary of all identified representative NSRs for assessment is tabulated in **Table 4.28**. Locations and photos of representative NSRs are shown in **Figure 4.8** and **Figure 4.3** respectively.

NSR ID	Description	Existing / Planned	Type of Use	No. of Storeys (Sensitive use only)	Ground Level (mPD)
N7b	Village House, Sha Ling	Existing	Residential	1	28.5
N9c	Village House, Kong Nga Po	Existing	Residential	1	26.3
N10b	Village House, Kong Nga Po	Existing	Residential	1	26.8
N11b	Village House, Kong Nga Po	Existing	Residential	1	26.9
N12a	Village House, Kong Nga Po	Existing	Residential	1	37.3
N13	Village House, Kong Nga Po	Existing	Residential	2	22.0
N14	Village House, near Man Kam To Road	Existing	Residential	1	17.3
N15	Village House, Sha Ling	Existing	Residential	1	21.9
N16	Village House, San Uk Ling	Existing	Residential	3	19.1

Table 4.28: Representative Helicopter Noise Sensitive Receivers Identified for the Assessment



4.7.7 Inventory of Noise Sources

At present, GFS are operating two types of helicopters, i.e. Eurocopter EC 155 B1 and Eurocopter Super Puma AS332 L2. GFS are now undergoing the Helicopter Replacement Program where Eurocopter EC 155 B1 and Eurocopter Super Puma AS332 L2 will be replaced by the Airbus Helicopters H175 before the operation of the planned KNP helipad. Therefore, only the Airbus Helicopters H175 will be used in the planned KNP helipad. Noise source terms (i.e. helicopter noise level certificate) were provided by the helicopter manufacturer through GFS with ICAO Standard (Max) noise levels. The noise data are shown in **Appendix 4.9** and summarised in the following **Table 4.29**.

Table 4.29: Helicopter Noise Data (with Lateral Movements)

Flying Mode	Airbus Helicopters H175						
	ICAO Max. Noise Level EPNdB	Demonstrated Noise Level EPNdB	Lmax, dB(A)^				
Approach	98.8	95.1	85.8				
Take-off	95.8	89.8	82.8				
Flyover	93.8	91.0	80.8				

Notes:

(^) Lmax, dB(A) = EPNdB-13, with reference to "Transportation Noise Reference Book" (Nelson, 1987).

Bold: Highest EPNdB / Lmax, dB(A) noise levels were adopted in the assessment for conservative approach.

The ICAO standards do not include noise standards for helicopter in non-lateral movements, i.e., hovering, touchdown, idling and lift-off. On-site noise surveys on GFS's helicopters (e.g. Super Puma AS332 L2) were conducted at GFS helipad at Chek Lap Kok on 24 June 2003 to generate supplementary noise data in the approved Peng Chau Helipad EIA Study. The noise survey involved measurement of the L_{max} noise level generated by GFS helicopters simulating manoeuvring on and over a helipad. The measured L_{max} noise levels are summarised in **Table 4.30**.

Table 4.30: Helicopter Noise Data (without Lateral Movements)

Measurement Configurations	Super Puma AS 332 L2 / Airbus Helicopters H175	Remarks
Helicopter on Ground, Idling	82.0	Free-field Measurement at
Heliconter in the Air	90.6^	Reference Distance of 150m

Notes:

(*) Noise data of Airbus Helicopters H175 was provided by helicopter manufacturer through GFS. However, only noise data in lateral movements are available. Judging from the noise data in lateral movements presented in **Table 4.29**, Airbus Helicopters H175 is quieter than the existing Super Puma AS 332 L2 (i.e. 100.7 / 99.7 / 98.7 EPNdB for Approach / Take-off / Flyover, respectively). GFS also confirmed that the noise levels of the Airbus Helicopters H175 in non-lateral movements will be lower than that of the Super Puma AS 332 L2. For assessment purpose, the noise data of Super Puma AS 332 L2 in non-lateral movements adopted in the approved EIA report for Peng Chau Helipad (EIA-107/2005) are adopted for the Airbus Helicopters H175 as a conservative approach.

(^) Noise level was measured during the hovering mode.



4.7.8 Prediction and Evaluation of Environmental Impact with Design and Operation Measures in place

4.7.8.1 Determination of Assessment Scenarios

As confirmed by GFS and HKPF, maximum two helicopters will be deployed simultaneously for police training and emergency use (i.e. air ambulance, search & rescue, supporting law enforcement agencies and fire fighting). Only one helicopter will be allowed to hover, approach, or take-off within the assessment area while another helicopter should be idling on ground. Details of the combinations of operation modes are as follows:

- Operation Mode 1: One helicopter idling on the helipad and the rest helicopter hovering at maximum hovering height (i.e. 15m) over the helipad;
- Operation Mode 2: One helicopter idling on the helipad and the rest helicopter approaching to the helipad within the restricted ranges of approach/taking-off flight paths;
- Operation Mode 3: One helicopter idling on the helipad and the rest helicopter taking-off from the helipad within the restricted ranges of approach/taking-off flight paths;
- Operation Mode 4: One helicopter approaching to the helipad within the restricted ranges of approach/taking-off flight paths and the rest helicopter flyover along the assessment boundary;
- Operation Mode 5: One helicopter taking-off from the helipad within the restricted ranges of approach/taking-off flight paths and the rest helicopter flyover along the assessment boundary;
- Operation Mode 6: One helicopter idling on the helipad and the rest helicopter flyover along the assessment boundary;
- Operation Mode 7: One helicopter hovering at maximum hovering height (i.e. 15m) over the helipad and the rest helicopter flyover along the assessment boundary;
- Operation Mode 8: Two helicopters flyover inside / outside the assessment boundary; and
- Operation Mode 9: Two helicopters idling on the helipad.

The summary of different scenarios of the proposed helipad is provided in the following Table 4.31.

Table 4.31: Summary of Different Operation Modes

Operation		Heli	copter^ (L _{max} , dB(A	.))	Hovering / Touchdown /	Worst- case scenario
Mode	Approaching	Taking-off	Flyover	ldling	Lift-off	(Y/N)
1				A1 (82.0)	A2 (90.6)	Y
2	A1 (85.8)			A2 (82.0)		Y
3		A1 (82.8)		A2 (82.0)		Y
4	A1 (85.8)		A2 (80.8)			Y
5		A1 (82.8)	A2 (80.8)			Y



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		He	elicopter^ (L _{max} , dB(A))		Hovering /	Worst- case
Operation Mode	Approaching	Taking-off	Flyover	Idling	Touchdown / Lift-off	scenario (Y/N)
6			A1 (80.8)	A2 (82.0)		Y
7			A1 (80.8)		A2 (90.6)	Y
8			A1 (80.8), A2 (80.8)			Y
9				_ (+)		N

Notes:

(+) Since the operation mode with two helicopters idling on ground is expected to contribute less noise impacts compare with other operation modes, this scenario was not included / assessed in this study

(^) The two helicopters (A1 & A2) are of same type, i.e. Airbus Helicopters H175

Day-time Period Helicopter Noise Impacts 4.7.8.2

As described in Section 4.7.8.1, eight operation modes have been assessed in this study. Table 4.32 summarises the predicted L_{max} noise levels at the identified NSRs of the eight scenarios. Details of the calculation are provided in Appendix 4.10.

NSR	Lmax, dB(A)	Noise Criteria Lmax, dB(A)	Exceedance of Noise Criteria?	Residual Noise Impact?		
Operation Mode 1						
N7b	71	85	No	No		
N9c	77	85	No	No		
N10b	64	85	No	No		
N11b	75	85	No	No		
N12a	69	85	No	No		
N13	83	85	No	No		
N14	67	85	No	No		
N15	85	85	No	No		
N16	76	85	No	No		
Operation Mode 2						
N7b	77	85	No	No		
N9c	82	85	No	No		
N10b	84	85	No	No		
N11b	84	85	No	No		
N12a	84	85	No	No		
N13	80	85	No	No		
N14	79	85	No	No		
N15	81	85	No	No		
N16	80	85	No	No		

Table 4.32: Predicted Helicopter Noise Impact at All Representative NSRs

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NSR	Lmax, dB(A)	Noise Criteria Lmax, dB(A)	Exceedance of Noise Criteria?	Residual Noise Impact?			
Operation Mode 3							
N7b	76	85	No	No			
N9c	82	85	No	No			
N10b	84	85	No	No			
N11b	83	85	No	No			
N12a	83	85	No	No			
N13	79	85	No	No			
N14	78	85	No	No			
N15	81	85	No	No			
N16	79	85	No	No			
Operation Mode	4						
N7b	81	85	No	No			
N9c	84	85	No	No			
N10b	85	85	No	No			
N11b	84	85	No	No			
N12a	84	85	No	No			
N13	81	85	No	No			
N14	80	85	No	No			
N15	82	85	No	No			
N16	82	85	No	No			
Operation Mode	5						
N7b	81	85	No	No			
N9c	84	85	No	No			
N10b	85	85	No	No			
N11b	84	85	No	No			
N12a	84	85	No	No			
N13	80	85	No	No			
N14	79	85	No	No			
N15	82	85	No	No			
N16	82	85	No	No			
Operation Mode 6							
N7b	80	85	No	No			
N9c	80	85	No	No			
N10b	77	85	No	No			
N11b	76	85	No	No			
N12a	74	85	No	No			
N13	76	85	No	No			
N14	75	85	No	No			

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NSR	Lmax, dB(A)	Noise Criteria Lmax, dB(A)	Exceedance of Noise Criteria?	Residual Noise Impact?
N15	77	85	No	No
N16	78	85	No	No
Operation Mode	7			
N7b	80	85	No	No
N9c	82	85	No	No
N10b	77	85	No	No
N11b	79	85	No	No
N12a	75	85	No	No
N13	83	85	No	No
N14	75	85	No	No
N15	85	85	No	No
N16	80	85	No	No
Operation Mode	8			
N7b	85	85	No	No
N9c	85	85	No	No
N10b	85	85	No	No
N11b	85	85	No	No
N12a	85	85	No	No
N13	85	85	No	No
N14	84	85	No	No
N15	85	85	No	No
N16	85	85	No	No

As shown in Table 4.32, the worst-case L_{max} noise levels at the representative NSRs arising from the planned helipad comply with the relevant noise criterion of L_{max} 85 dB(A). Therefore, adverse helicopter noise impact to the nearby NSRs is not anticipated during day-time period for both scheduled flight and emergency flight. No NSR will be exposed to helicopter noise impact exceeding the relevant noise criteria.

4.7.8.3 Noise Contours for Helicopter Noise Impact

Based on the requirement set out in Clause 5.3.2(a) in Appendix C of the EIA Study Brief (ESB-276/2014), the predicted helicopter noise impact shall be presented in contours for each scenario assessed under various operation modes. The noise contours for the eight operation modes are presented in Figure 4.9.

Evening and Night-time Periods Helicopter Noise Impact 4.7.8.4

The planned helipad at KNP from 7pm to 7am is for emergency use (i.e. air ambulance, search & rescue, supporting law enforcement agencies and fire fighting) only and there would not be any scheduled events during evening and night-time periods. The frequency of using the existing Lo Wu Range helicopter



landing site from 7pm to 7am in Year 2010 – 2015 for emergency use is only 3 in total (see **Table 4.27**). The duration of each emergency use was about 7 minutes. As confirmed by GFS, only one noise complaint about the existing Lo Wu Range helicopter landing site was received in Year 2013. Those emergency uses are considered essential and inevitable to serve the community. For emergency flights particularly in evening and night-time period, helicopter noise impact would not be assessed due to its operation nature and no noise criteria or guidelines applied to such operation internationally (see **Section 4.2.3**). In fact the measures adopted to avoid adverse helicopter noise impact (see **Section 4.7.4**) would also benefit for the emergency flights with the same type of helicopter (i.e. Airbus Helicopters H175) in evening and night-time period. Notwithstanding, the planned helipad has been designed and its operation has been planned in practicable manner to avoid adverse helicopter noise impact.

4.7.8.5 Cumulative Helicopter Noise Impact

The existing Lo Wu Range helicopter landing site will be relocated to KNP and the other existing helicopter landing sites are located in Police Tactical Unit (PTU) headquarter and Fan Garden in Fanling, which are more than 3km away from the planned helipad and are infrequently used due to those sites closely surrounded by medium to high-rise noise sensitive buildings. Therefore, no cumulative noise impacts from other potential concurrent helipads are anticipated.

4.7.9 Mitigation of Helicopter Noise Impact

By installing at least 2.5m height perimeter wall / boundary wall at the Project site, limiting one helicopter in hovering, approaching or taking-off mode, restricting the approach / take-off flight paths and adopting steeper approach / departure (take-off) angles, the helicopter noise levels comply within the day-time noise criterion of L_{max} 85 dB(A). The restricted ranges of approach / take-off flight paths and flight angles represent the best arrangement to satisfy the relevant noise criterion as well as the safety and operational requirements of helicopter.

4.7.10 Evaluation of Residual Helicopter Noise Impact

The planned helipad has been designed and its operation has been planned in practicable manner to avoid adverse helicopter noise impact. The helicopter noise impact would comply with the relevant day-time noise criterion of L_{max} 85 dB(A) at all representative NSRs. No residual helicopter noise impact is anticipated.

4.8 Environmental Monitoring and Audit

4.8.1 Construction Noise

Although no residual airborne noise impact is predicted during the construction phase, to ensure that the nearby NSRs will not be subjected to unacceptable construction noise impact, an Environmental Monitoring and Audit (EM&A) programme is recommended. Details on the noise monitoring requirements, methodology and action plans would be described in the separate EM&A Manual.



4.8.2 Road Traffic Noise

No adverse road traffic noise impact is anticipated from operation of the Project, hence no environmental monitoring and audit is proposed.

4.8.3 Fixed Noise Sources

Prior to the operation phase of the Project, as part of the design process, commissioning tests should be conducted to ensure the operation noise from the proposed fixed plants (i.e. ventilation openings, sewage pumping station and petrol/ diesel filling station) would comply with the relevant EIAO-TM noise criteria.

4.8.4 Helicopter Noise

This study has incorporated all practicable means to avoid the helicopter noise impacts, including treatment of source, restricting approach / taking-off flight paths and flight angles, and implementing at lease 2.5m perimeter wall / boundary wall at the Project site without compromising flight safety. Hence, no environmental monitoring and audit is proposed.

Should the need arise, the local community may lodge noise complaint with the HKPF Office by the following means:

- Fax: 2200 4376
- Email: policecollege@police.gov.hk
- Address: Hong Kong Police College (Headquarters), 20/F, Arsenal House, 1 Arsenal Street, Wan Chai, Hong Kong

4.9 Conclusion

4.9.1 Construction Noise

The construction noise impact assessment has been conducted based on the best available information (taking into account other concurrent projects). With the implementation of the mitigation measures in form of quieter plant, movable barriers, noise enclosures and noise insulating fabric, the construction noise levels at all NSRs are predicted to comply with the noise standards stipulated in the EIAO-TM. Adverse construction noise impacts are therefore not anticipated in this project.

4.9.2 Road Traffic Noise

The potential road traffic noise impacts have been assessed based on the peak traffic flows in 2038. The predicted road traffic noise levels at all representative NSRs would comply with the relevant noise criteria. Thus, no adverse road traffic noise impact is anticipated.



4.9.3 Fixed Noise Sources

Noise impact from planned fixed noise sources could be effectively mitigated by implementing appropriate noise control measure at source during the detailed design stage. By installing at least 2.5m height perimeter wall / boundary wall at the Project site and extra 5m height 4-side walls at Ma Tso Lung firing range as well as the adoption of the maximum permissible SWLs for the proposed fixed plants (i.e. ventilation openings, sewage pumping station and petrol/ diesel filling station), the impact noise levels at all representative NSRs complies with the relevant fixed noise criteria. Therefore, adverse fixed noise sources impact to the nearby NSRs is not anticipated.

4.9.4 Helicopter Noise

The helicopter noise impact assessment has been conducted based on the best available information. After adopting the design and operation measures as confirmed with GFS which includes treatment at source, restricting approach / taking-off flight paths and flight angles, and implementing at least 2.5m height perimeter wall / boundary wall at Project site, the predicted helicopter noise levels at all representative NSRs do not exceed the day-time helicopter noise standard laid down in Annex 5 of the EIAO-TM for both scheduled flight and emergency flight. The planned helipad at KNP from 7pm to 7am is for emergency use only and there will not be any scheduled flight during evening and night-time periods. The frequency of using the existing Lo Wu Range helicopter landing site from 7pm to 7am in Year 2010 – 2015 for emergency use is only 3 in total. The duration of each emergency use was about 7 minutes. The helicopter noise impact would comply with the relevant day-time noise criterion of L_{max} 85 dB(A) at all representative NSRs. No residual helicopter noise impact is anticipated.