

## 4 NOISE

### 4.1 INTRODUCTION

This Section presents a detailed study of potential construction and operational noise impacts associated with the planned developments in Sham Tseng Development.

Noise impacts affecting the existing and those planned Noise Sensitive Receivers (NSRs) at the proposed sites will be assessed according to the standards specified in the *Environmental Impact Assessment Ordinance (EIAO)*, *Noise Control Ordinance (NCO)* and their subsidiary Technical Memoranda.

Practical mitigation measures will be recommended, where necessary, to reduce the noise impacts to within stipulated limits or other appropriate guidelines. Further environmental control measures will also be explored to minimise the residual impacts. The requirements of Environmental Monitoring and Audit (EM&A) during the construction and operational phase will also be outlined, where appropriate.

### 4.2 ENVIRONMENTAL LEGISLATION AND CRITERIA

#### 4.2.1 Construction Noise

The principal legislation on the control of construction noise is the NCO. Various Technical Memoranda (TMs), which stipulate control approaches and criteria, have been issued under the NCO. The following TMs are applicable to the control of noise from construction activities:

- *Technical Memorandum on Noise from Percussive Piling (PP-TM)*;
- *Technical Memorandum on Noise from Construction Work other than Percussive Piling (GW-TM)*; and
- *Technical Memorandum on Noise from Construction Work in Designated Areas (DA-TM)*.

Apart from the above, the EIAO also provides means to assess construction noise impacts. The *Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM)*, issued under the EIAO, gives guidelines and noise criteria for evaluating construction noise impacts.

### *Percussive Piling*

Percussive Piling is prohibited at any time on Sundays and public holidays and during the weekday evening and night-time hours (1900-0700 hours, Monday through Saturday). A Construction Noise Permit (CNP) is required for such works during the weekday daytime hours (0700-1900 hours, Monday through Saturday).

When assessing a CNP application for the carrying out of percussive piling, the Environmental Protection Department (EPD) is guided by the PP-TM. The EPD will look at the difference between the Acceptable Noise Levels (ANLs), as promulgated in the PP-TM, and the Corrected Noise Levels (CNLs) in conjunction with the proposed piling activities. Depending on the level of noise impact on nearby NSRs, the EPD would allow 3, 5 or 12 hours of daily piling time (see *Table 4.2a*).

**Table 4.2a** *Permitted Hours of Operation for Percussive Piling (Not Involving the Use of Diesel, Pneumatic and/ or Steam Hammers)*

<b>Amount by which CNL exceeds ANL</b>	<b>Permitted hours of operation on any day not being a holiday</b>
more than 10 dB(A)	0800 to 0900 and 1230 to 1330 and 1700 to 1800
between 0 dB(A) and 10 dB(A)	0800 to 0930 and 1200 to 1400 and 1630 to 1800
no exceedance	0700 to 1900

For any educational institutions, hospitals or medical clinics identified for this EIA Study, the ANLs should be adjusted by a -10 dB(A) correction factor in the subsequent noise assessment, taking account of the relative noise sensitivity of these uses.

As issuance of CNP by the Noise Control Authority regarding percussive piling would depend on the application submitted according to the procedures laid down in the PP-TM, noise assessment with respect to percussive piling activities have been excluded in this study.

### *General Construction Works*

Under the EIAO, noise impact arises from general construction works during normal working hours (i.e. 0700 to 1900 hours on any day not being a Sunday or public holiday) at the openable windows of buildings is to be assessed in accordance with the noise criteria as given in the EIAO-TM. The EIAO-TM noise standards are presented in *Table 4.2b* below.

**Table 4.2b** *EIAO-TM Daytime Construction Noise Standard ( $L_{eq, 30 min}$  dB(A))*

<b>Use</b>	<b>Noise Standard</b>
Domestic Premises	75

The NCO provides statutory controls on general construction works during the restricted hours (i.e. 1900-0700 hours Monday to Saturday and at any time on Sundays and public holidays). The use of powered mechanical equipment (PME) for the carrying out of construction works during the restricted hours will require a CNP. The EPD is guided by the GW-TM when assessing such an application.

When assessing an application for the use of PME, the EPD will compare the ANLs, as promulgated in GW-TM, and the CNLs (after accounting for factors such as barrier effects and reflections) associated with the proposed PME operations. A CNP will be issued if the CNL is equal to or less than the ANL. The ANLs are related to the noise sensitivity of the area in question and different Area Sensitivity Ratings have been drawn up to reflect the background characteristics of different areas. The relevant ANLs are shown in *Table 4.2c* below.

**Table 4.2c** *Acceptable Noise Levels (ANL,  $L_{eq, 5 min}$  dB(A))*

Time period	Area Sensitivity Rating		
	A	B	C
All days during the evening (1900-2300 hours) and general holidays (including Sundays) during the day and evening (0700-2300 hours)	60	65	70
All days during the night-time (2300-0700 hours)	45	50	55

Practicable direct mitigation measures would be recommended, where appropriate, to ensure that the noise levels are reduced to within the noise standards.

#### 4.2.2 *Road Traffic Noise*

The assessment of road traffic noise during the operational phase of the project is within the scope of EIAO-TM. The relevant criteria are shown in *Table 4.2d*.

**Table 4.2d** *EIAO-TM Road Traffic Noise Standards*

Uses	Road Traffic Noise ( $L_{10, (1 hr)}$ dB(A))
Domestic Premises	70
Offices	70
Educational Institutions	65

Any road traffic noise levels, predicted at 1 m from the sensitive facades of any noise sensitive premises, exceeding these criteria are considered to cause adverse environmental impacts. Practicable direct noise mitigation measures would be recommended, where appropriate, to ensure that the noise levels are reduced to within the noise standards.

If, after implementation of direct technical remedies, any facades of existing sensitive uses are still exposed to predicted noise levels exceeding the relevant noise criteria, provision of indirect technical remedies in the form of acoustic insulation and air-conditioning should be considered under the EIAO-TM. The eligibility for indirect technical remedies will be tested against the following criteria:

- i) The predicted overall noise level from the new road, together with other traffic noise in the vicinity must be above the specified noise levels ( $L_{10, \text{peak hour}} 70 \text{ dB(A)}$  for residential dwellings);
- ii) The predicted overall noise levels is at least 1.0 dB(A) more than the prevailing traffic noise level, i.e. the total traffic noise level existing before the works to construct were commenced; and
- iii) The contribution to the increase in the predicted overall noise level from the new road must be at least 1.0 dB(A).

For the purpose of this Study, all roads are described as either:

- *existing roads*: include existing roads which will remain either completely unchanged or which will undergo only minor alterations;
- *new roads*: include roads which will be built as part of the proposed scheme as well as existing roads which will be substantially altered.

### 4.2.3 Fixed Noise Sources

Assessment of noise from fixed sources, including that from industrial-type establishments, is governed by the EIAO-TM and *Technical Memorandum for the Assessment of Noise from Places Other Than Domestic Premises, Public Places or Construction Sites* (IND-TM). The IND-TM establishes Acceptable Noise Levels (ANLs) for fixed noise sources depending upon the sensitivity of the area where the NSR is located. The relevant ANLs are shown in *Table 4.2e*.

**Table 4.2e** *Acceptable Noise Levels (ANL,  $L_{eq, 30 \text{ min}}$  dB(A))*

Time Period	Area Sensitivity Rating		
	A	B	C
Day and Evening (0700 to 2300 hours)	60	65	70
Night (2300 to 0700 hours)	50	55	60

Noise assessments will normally be conducted in accordance with the IND-TM, which lays down statutory ANLs. However, in order to plan for a better environment, the level of the intruding noise at the facade of the nearest sensitive use should be at least 5 dB(A) below the appropriate ANL or, the prevailing background noise levels, whichever is lower.

The Sham Tseng Development is composed of high-rise developments, with the proposed Sham Tseng Bypass and widened Castle Peak Road in the vicinity. According to the IND-TM, an Area Sensitivity Rating of B should be assigned for the Study Area. For planning purposes, the noise limits during daytime and evening period will be 60 dB(A) and that during night-time will be 50 dB(A).

In any event, the ASR assumed here is for indicative assessment only given, for example, details of the plan layout are not yet available and the buildings layout is only provisional. It should be noted that fixed noise sources are controlled under Section 13 of the NCO. Nothing in this Report shall bind the Noise Control Authority in assessing noise from these sources upon the receipt of complaints. The Authority shall assess the noise impacts based on then prevailing conditions / situations.

#### **4.2.4**      *Aircraft Noise*

Under the EIAO-TM, exposure to aircraft noise is described in terms of Noise Exposure Forecast (NEF) contours. For the Hong Kong International Airport at Chek Lap Kok, the NEF 25 Contour is adopted as the criterion for land uses including domestic premises, hotels and hostels, educational institutions, places of public workshop, courts of law, hospitals and clinics. As such, the above mentioned uses should not be located within the NEF 25 Contour for the Chek Lap Kok Airport to avoid aircraft noise impacts.

#### **4.2.5**      *Ferry and Vessel Noise*

Under the NCO, public piers are regarded as 'public places' and as such, there are no statutory noise control standards that may be applied. For the purpose of this study, reference has been made to existing "Kaito" operations.

#### **4.2.6**      *Public Transport Terminus (PTT)*

There are no objective criteria and assessment methodology for a Public Transport Terminus (PTT) stipulated in the EIAO-TM or the NCO. Although the major noise sources associated with PTTs are road vehicles, road traffic noise standard could not be considered as the most appropriate criteria, as road vehicles within the PTTs are considered a relatively fixed source when compared with free flowing traffic movements on a through road.

As such, the IND-TM control criteria have been adopted as the noise planning guidelines for the proposed PTTs due to the nature of activities inside the PTTs and the characteristic of the resultant noise emissions. It should be reminded that the planning of the PTT should make reference to Section 4.2.14 of the HKPSG.

## 4.3 DESCRIPTION OF THE ENVIRONMENT

### 4.3.1 *Baseline Conditions*

The Sham Tseng Development will be located to the south of Sham Tseng Village. There are a number of residential developments, including Golden Villa, Sham Tseng Tung Tsuen, Rhine Terrace, Rhine Garden, Lido Garden, Sham Tseng Village, Pai Min Kok Village, Sea Crest Villa Phases 1 to 4 and other residential dwellings located along the existing coastline. Castle Peak Road runs along the existing coastline of Sham Tseng, with Tuen Mun Road located further to the north. Garden Bakery is located to the east adjacent to the former San Miguel Brewery and Union Carbide sites which are under redevelopment to private residential uses.

Both Tuen Mun Road and Castle Peak Road, with high volume of traffic flows, are the major influencing factors of the existing noise environment in the area.

### 4.3.2 *Future Conditions*

The proposed developments on Sham Tseng Development will include the following road works:

- construction of Sham Tseng Bypass, including two road junctions' modification where the Bypass connects to the widened sections of Castle Peak Road; and
- two development access roads connecting to Castle Peak Road.

Since the proposed Bypass will be put under the promenade, it would have little contribution to the increase of ambient noise level in the vicinity. Hence, it is anticipated that the increase of ambient noise of the area will likely be dominated by the traffic generated from the operation of the improved Castle Peak Road. The site of Garden Bakery is zoned as CDA development under the latest Tsuen Wan West Outline Zoning Plan (No. S/TWW/11). However, as there is no current plan for redevelopment, it has been assumed as a worst case that the Garden Bakery will be operating when the residential developments on the reclamation are occupied.

As Castle Peak Road widening works will be within 300 m from the Study Area boundary, assessment of the cumulative construction and operational noise impacts from these road works have also been included in this assessment.

### 4.3.3 *Identification of Sensitive Receivers*

#### *Construction Phase*

Representative NSRs, as defined in EIAO-TM and NCO, have been identified. *Table 4.3a* lists all the representative NSRs within the Study Area and their sensitive uses. Locations of the NSRs are shown in *Figures 4.3a* and *4.3b*.

**Table 4.3a Noise Sensitive Receivers During Construction Phase**

NSR Ref.	Description	Sensitive Uses
C1	Golden Villa	Residential Use
C2	Sham Tseng Tung Tsuen	Residential Use
C3	Sham Tseng Tung Tsuen	Residential Use
C4	Rhine Terrace	Residential Use
C5	Rhine Garden Tower 5	Residential Use
C6	Former Union Carbide Site Tower 2	Residential Use
C7	Lido Garden Tower 3	Residential Use
C8	Sham Tseng Village	Residential Use
C9	Sham Tseng Kau Tsuen	Residential Use
C10	Sea Crest Villa Block 1	Residential Use
C11	Sea Crest Villa Block 5	Residential Use
C12	Sea Crest Villa Block 7	Residential Use
C13	Pai Min Kok Village 13A	Residential Use
C14a	DD 387 Lot 99 (Residential Building)	Residential Use
C14b	DD 387 Lot 99 (Residential Building)	Residential Use
C15a	Residential Buildings at former San Miguel Brewery	Residential Use
C15b	Residential Buildings at former San Miguel Brewery	Residential Use
C16	Goldenville	Residential Use
C17	Dragon Garden	Residential Use
C18	Sea Crest Villa Block 11	Residential Use
C19	Victoria Valerie's Court	Residential Use
C20	Villa Alfavista	Residential Use

The current Study covers the following key activities:

- formation of about 15.2 ha of land by reclamation;
- construction of about 1100 m of seawall;
- construction of Sham Tseng Bypass (about 2400 m) including connections to the proposed widening of Castle Peak Road;
- construction of about 600 m of waterfront promenade integrated with the Sham Tseng Bypass;
- construction of a government complex (as re-provisioning of existing Anglers' Beach) to accommodate a leisure centre, with swimming pool and other sports facilities, and social welfare facilities;
- construction of sewage treatment facilities;
- construction of a sewage pumping station and sewerage pipework;
- construction of about 450 m of nullah, infrastructure drainage works and mainlaying works;
- construction of about 900 m of access roads;
- construction of a stub pier to replace an existing 'kaito' pier;
- diversion of an existing 200 mm diameter submarine water pipeline and extension of a 300 mm diameter water main adjacent to Castle Peak Road;
- construction of a Public Transport Terminus and public toilet;
- construction of environmental mitigation measures; and
- construction of a salt water pumping station.

Other activities such as the construction of the CDA and housing developments are not included in the current study.

### *Operational Phase*

The future noise sensitive land uses on the new reclamation will mainly consist of educational institutions and residential developments including care homes for handicapped peoples. *Table 4.3b* lists all the representative NSRs. Locations of the NSRs are shown in *Figures 4.3c, 4.3c-1, 4.3d* and *4.3e*.

**Table 4.3b** *Noise Sensitive Receivers During the Operational Phase*

NSRs.	Description	mPD	Height of Assessment Points - [m (Floor)]		
			Low Level	Mid Level	Top Level
<i>Existing Noise Sensitive Receivers</i>					
N1	Sea Crest Villa Block 10	32.4	5 (1/F)	62 (20/F)	83 (27/F)
N2	Sea Crest Villa Block 9	32.4	5 (1/F)	62 (20/F)	101 (33/F)
N3	Sea Crest Villa Block 8	32.4	5 (1/F)	62 (20/F)	101 (33/F)
N4	Sea Crest Villa Block 7	32.4	5 (1/F)	62 (20/F)	83 (27/F)
N5	Sea Crest Villa Block 6	54	5 (1/F)	62 (20/F)	86 (28/F)
N6	Sea Crest Villa Block 6	54	5 (1/F)	62 (20/F)	86 (28/F)
N7	Sea Crest Villa Block 5	54	5 (1/F)	62 (20/F)	86 (28/F)
N8	Sea Crest Villa Block 4	50	5 (1/F)	62 (20/F)	107 (35/F)
N9	Sea Crest Villa Block 2	50	5 (1/F)	62 (20/F)	107 (35/F)
N10	Sea Crest Villa Block 1	50	5 (1/F)	62 (20/F)	107 (35/F)
N11	Lido Garden Tower 1	10.8	5 (1/F)	62 (20/F)	107 (35/F)
N12	Lido Garden Tower2	10.8	5 (1/F)	62 (20/F)	107 (35/F)
N13	Lido Garden Tower3	10.8	5 (1/F)	62 (20/F)	107 (35/F)
N14	Lido Garden Tower4	10.8	5 (1/F)	62 (20/F)	107 (35/F)
N15	Lido Garden Tower 5	10.8	5 (1/F)	62 (20/F)	107 (35/F)
N16	Former Union Carbide Site Tower 2	4.5	23 (3/F)	80 (20/F)	170 (50/F)
N17	Former Union Carbide Site Tower 2	4.5	23 (3/F)	80 (20/F)	170 (50/F)
N18	Former Union Carbide Site Tower 2	4.5	23 (3/F)	80 (20/F)	170 (50/F)
N19	Former Union Carbide Site Tower 3	4.5	23 (3/F)	80 (20/F)	170 (50/F)
N20	Residential Development at Former San Miguel Brewery	27.8	5 (1/F)	62 (20/F)	167 (55/F)
N21	Rhine Terrace	44.8	5 (1/F)	62 (20/F)	92 (30/F)
N22	Pai Min Kok Village 13A	32	4.5 (1/F)	\	\
N23	DD 387 Lot 99 (Residential Building)	18.9	4.5 (1/F)	\	\
N24	Sham Tseng Tung Tsuen 22	68	4.5 (1/F)	\	\
N25	Golden Villa	35.2	4.5 (1/F)	\	\
N26	Golden Villa	35.2	4.5 (1/F)	\	\
N27	Golden Villa	35.2	4.5 (1/F)	\	\



NSRs.	Description	mPD	Height of Assessment Points - [m (Floor)]		
			Low Level	Mid Level	Top Level
N28	Golden Villa	35.2	4.5 (1/F)	\	\
N29	Goldenville	31.5	4.5 (1/F)	\	\
N30	Dragonette	10.6	1.5 (G/F)	\	\
N31	Dragon Garden	29	1.5 (G/F)	\	\
N32	Dragon Garden	25.6	4.5 (1/F)	\	\
N33	Sea Crest Villa Block 11	45.7	5 (1/F)	62 (20/F)	86 (28/F)
N34	Sea Crest Villa Block 12	45.7	5 (1/F)	62 (20/F)	92 (30/F)
N35	Sea Crest Villa Block 13	45.7	5 (1/F)	62 (20/F)	74 (24/F)
N36	Victoria Valerie's Court	36.9	4.5 (1/F)	\	\
N37	Villa Alfavista	7.9	4.5 (1/F)	\	\
N38	Villa Alfavista	7.9	4.5 (1/F)	\	\
N39	Village House, Tsing Lung Tau Village	8	4.5 (1/F)	\	\
N40	Lung Tang Court	9	4.5 (1/F)	17 (5/F)	32 (10/F)
N41	Village House	11.2	4.5 (1/F)	\	\
N42	Village House	11.2	4.5 (1/F)	\	\
<i>Planned Sensitive Receivers</i>					
N211 - N221	Planned Residential Development Area 2	5.5	5 (1/F) 8(2/F) <sup>(1)</sup>	62 (20/F)	110 (36/F), 131 (43/F) <sup>(2)</sup>
N122 - N130	Planned CDA Area 4	14	5 (1/F)	62 (20/F)	167 (55/F)
N131 - N136	Planned CDA Area 5	5.5	5 (1/F)	62 (20/F)	113 (37/F)
N152 - N155	Planned Secondary School Area 3	5.5	5.7 (1/F)	16.1 (4/F)	26 (7/F)

**Note:**  
(1) The low level assessment point for N212 & N214 are at 2/F.  
(2) The top level assessment point for N211 to N214 are at 36/F, and for N215 to N221 are at 43/F.

A government complex building with social welfare facilities is planned at Area 6. Since the building will be equipped with air-conditioning as an architectural provision and it will not rely upon open windows for ventilation, it is excluded from the noise assessment.

#### 4.4 ASSESSMENT METHODOLOGIES

##### 4.4.1 Construction Phase

A methodology for assessing construction noise other than percussive piling has been developed based on the GW-TM. In general, the methodology is as follows:

- locate representative NSRs that may be affected by the works;
- determine plant teams for corresponding construction activities; based on available information or agreed plant inventories;
- assign sound power levels (SWLs) to the PME proposed based on the GW-TM or other sources;

- calculate the correction factors based on the distance between the NSRs and the notional noise source position of the work sites;
- apply corrections such as potential screening effect and acoustic reflection, if any, in the calculations; and
- predict construction noise levels at NSRs in the absence of any mitigation measures.

The total sound power level (SWL) associated with each activity has been established based on the assumed plant inventory, and the details are presented in *Annex F*. The notional point of each work site has been established in accordance with the procedure stated in the GW-TM. Noise impacts at NSRs were evaluated by comparing the predicted noise levels with the EIAO-TM daytime construction noise limits ( $L_{eq, 30 \text{ min}} \text{ dB(A)}$ ), as given in *Section 4.2.1*.

Mitigation measures will be considered when noise impacts at the NSRs are identified. A re-evaluation of the total SWL for each construction activity will be made by assuming the use of practical mitigation measures such as quiet plant, the use of barriers and restricting the operation of construction equipment.

Evening and night-time construction works will not be required for this Study and, therefore, noise criteria stipulated for the restricted hours period are not applicable. If construction work is required during the restricted hours, it is the responsibility of the contractors to comply with the requirements of the NCO and relevant TMs. The contractor should submit CNP applications and will be assessed by the EPD. Conditions stipulated in CNPs, if issued, should be strictly followed.

#### 4.4.2 *Road Traffic Noise*

Road traffic noise calculations have been undertaken in accordance with the UK methodology *Calculation of Road Traffic Noise (CRTN)*, which is required by the EPD.

The road scheme within the Study Area and the surrounding road network have been divided into 145 road segments, each of which has been assigned with one of 57 road layouts. A road layout defines the road width, surface type, traffic condition and if applicable, the height and locations of roadside barriers. The segmentation process was carried out in accordance with the CRTN procedure and the noise modelling was carried out using *HFANoise* road traffic noise model, developed by Halcrow Fox Associate, which fully implements CRTN procedures and methodologies. Hard ground, as defined in CRTN, has been assumed throughout the Study Area and all other features that may result in noise screening will be defined in the model.

In order to predict impacts from future traffic conditions, the EPD recommends that, in line with CRTN procedures, traffic noise should be modelled based on the worst case year traffic forecast within 15 years upon

operation of the road works or occupation of the NSRs or uses. There are two scenarios of residential development proposal for Area 2: for HOS/PSPS or private developer. Since the traffic generation pattern for each scenario is different, two sets of traffic forecast have been produced. Based on the scenario where Area 2 is to be developed by private developers, the road junction capacity will reach saturation by Year 2016. If Area 2 is to be developed as a HOS/PSPS site, the road junction capacity will reach saturation by Year 2019. The traffic forecasts for both scenarios are presented in *Table 4.4a* and *4.4b* respectively. As shown in the tables, the forecast for Year 2019 presents the worst case scenario for all roads except a few sections of Castle Peak Road. The forecasting year for 2016 reviewed that the section of Castle Peak Road between the Western Development Access and the east of the Sham Tseng Bypass, is slightly higher, at approximately 1%, than the forecast for 2019. Since the percentage of heavy vehicle remains unchanged for both scenarios and the other road section will have some reduction in the projected traffic flow, it is envisaged that the potential increase in road traffic noise from this section of Castle Peak Road will be insignificant. Therefore, the peak hour traffic forecast for Year 2019 have been used for the purpose of this assessment as a worst case year in this EIA. *Figure 4.4a* present the traffic data used in road traffic noise assessment (peak hour traffic forecasts). *Figure 4.4a-1* presents the computer plot of road segments. The traffic figures presented are calculated based on the forecasting methodology and assumptions agreed by the Transport Department.

Traffic noise impacts were then assessed against the EIAO-TM road traffic noise limits of  $L_{10, \text{peak hour}} 70 \text{ dB(A)}$  for residential uses,  $L_{10, \text{peak hour}} 65 \text{ dB(A)}$  for educational institutions and  $L_{10, \text{peak hour}} 55 \text{ dB(A)}$  for convalescent homes. Any predicted levels exceeding the EIAO-TM road traffic noise limits are considered to constitute significant impacts and practicable direct mitigation measures will be recommended.

*Figures 4.4b, 4.4c* and *4.4d* show the location of the new roads in this proposed development. The potential noise impacts arising from the local roads, estate roads or village accesses have been excluded in this Study as it is envisaged that traffic flows on these roads would be low and would not pose a significant noise impacts on the nearby NSRs. A sample of road traffic noise calculation is presented in *Annex G5*.

Noise levels have been predicted at a total of 82 assessment points representing approximately 1970 residential dwelling, and 1 planned school (based on the Year 2000 standard school layout).

In accordance with the EIAO-TM Annex 13 S.6, direct mitigation measures would be considered to redress traffics from Schedule 2 designated road projects and to protect planned NSRs recommended in this Schedule 3 designated project. However, such measures would not be extended to existing roads to protect the existing NSRs affected by traffic noise from existing road.

The potential reflection by the hillside to the north of Castle Peak Road has been examined but was not considered to be an issue. Firstly the topography of the hillside is such that it is more a slope rather than a vertical wall. Reflections, if any, are likely to be directed skywards. Secondly, the hillside slopes are uneven and do not act as a smooth plane. Reflections, if any, are likely to be highly diffused. Thirdly and most importantly, the slopes are heavily vegetated and could be regarded as soft surfaces thereby rendering negligible reflection.

#### **4.4.3**      *Fixed Plant Noise*

Basic acoustic principles have been used for the assessment. To ensure that no exceedances of noise criteria will result from the various types of fixed plant arising within the development area, the maximum permissible SWLs in dB(A) for the different types of fixed plant were calculated based on the measured distances of the nearest NSRs to the potential noise sources. For the existing fixed plant, on-site noise measurement will also be presented for reference.

**Table 4.4a Traffic Forecasts for the Year 2019, Peak Hour (for the scenario of HOS/PSPS at Area 2)**

<b>Road</b>	<b>From</b>	<b>To</b>	<b>Traffic Flow (veh/hr)</b>	<b>Percentage of Heavy Vehicles (%)</b>	<b>Speed (km/hr)</b>
Tuen Mun Road (2-way)	Tsing Lung Tau	Sham Tseng Interchange	7760	50	80
Tuen Mun Road (2-way)	Sham Tseng Interchange	Ting Kau	8810	54	70
Castle Peak Road (EB)	Tsing Lung Tau	West of Sham Tseng Bypass	2338	37	70
Castle Peak Road (WB)	West of Sham Tseng Bypass	Tsing Lung Tau	1332	37	70
Castle Peak Road (2-way)	West of Sham Tseng Bypass	Sham Tseng Tsuen Road	1530	25	50
Castle Peak Road (2-way)	Western Development Access	Sham Tseng Tsuen Road	1950	25	50
Castle Peak Road (2-way)	Sham Tseng Tsuen Road	Sham Hong Road	1920	25	50
Castle Peak Road (2-way)	Sham Hong Road	Sham Tseng Interchange Slip Roads	2430	25	50
Castle Peak Road (2-way)	Sham Tseng Interchange Slip Roads	Sham Tsz Street	1700	25	50
Castle Peak Road (EB) (Slip C)	Sham Tsz Street	East of Sham Tseng Bypass	1050	26	50
Castle Peak Road (EB)	East of Sham Tseng Bypass	Ting Kau	2689	36	70
Castle Peak Road (WB)	Ting Kau	East of Sham Tseng Bypass	1231	36	70
Castle Peak Road (WB) (Slip D)	East of Sham Tseng Bypass	Sham Tsz Street	520	26	50
Castle Peak Road (EB) (Slip A)	West of Sham Tseng Bypass	Sham Tseng Tsuen Road	800	25	50
Castle Peak Road (WB) (Slip B)	Sham Tseng Tsuen Road	West of Sham Tseng Bypass	730	25	50
Sham Tseng Bypass (EB)	Sea Crest Villa Phase 3	Golden Villa	1640	41	70
Sham Tseng Bypass (WB)	Golden Villa	Sea Crest Villa Phase 3	700	41	70
Sham Tseng Interchange Slip Roads (2-way)	Castle Peak Road	Tuen Mun Road	1990	22	50

**Table 4.4b Traffic Forecasts for the Year 2016, Peak Hour (for the scenario of private development at Area 2)**

<b>Road</b>	<b>From</b>	<b>To</b>	<b>Traffic Flow (veh/hr)</b>	<b>Percentage of Heavy Vehicles (%)</b>	<b>Speed (km/hr)</b>
Tuen Mun Road (2-way)	Tsing Lung Tau	Sham Tseng Interchange	7540	50	80
Tuen Mun Road (2-way)	Sham Tseng Interchange	Ting Kau	8600	54	70
Castle Peak Road (EB)	Tsing Lung Tau	West of Sham Tseng Bypass	2270	37	70
Castle Peak Road (WB)	West of Sham Tseng Bypass	Tsing Lung Tau	1300	37	70
Castle Peak Road (2-way)	West of Sham Tseng Bypass	Sham Tseng Tsuen Road	1490	25	50
Castle Peak Road (2-way)	Western Development Access	Sham Tseng Tsuen Road	1960	25	50
Castle Peak Road (2-way)	Sham Tseng Tsuen Road	Sham Hong Road	1930	25	50
Castle Peak Road (2-way)	Sham Hong Road	Sham Tseng Interchange Slip Roads	2460	25	50
Castle Peak Road (2-way)	Sham Tseng Interchange Slip Roads	Sham Tsz Street	1710	25	50
Castle Peak Road (EB) (Slip C)	Sham Tsz Street	East of Sham Tseng Bypass	1060	26	50
Castle Peak Road (EB)	East of Sham Tseng Bypass	Ting Kau	2640	36	70
Castle Peak Road (WB)	Ting Kau	East of Sham Tseng Bypass	1190	36	70
Castle Peak Road (WB) (Slip D)	East of Sham Tseng Bypass	Sham Tsz Street	500	26	50
Castle Peak Road (EB) (Slip A)	West of Sham Tseng Bypass	Sham Tseng Tsuen Road	780	25	50
Castle Peak Road (WB) (Slip B)	Sham Tseng Tsuen Road	West of Sham Tseng Bypass	720	25	50
Sham Tseng Bypass (EB)	Sea Crest Villa Phase 3	Golden Villa	1600	41	70
Sham Tseng Bypass (WB)	Golden Villa	Sea Crest Villa Phase 3	670	41	70
Sham Tseng Interchange Slip Roads (2-way)	Castle Peak Road	Tuen Mun Road	1990	22	50

## 4.5.1

*Construction Noise*

Potential sources of noise impact during construction comprises the use of Powered Mechanical Equipment (PME) on site for each activity during different construction stages. This assessment is based on the main construction activities during the period of year 2004 and year 2012.

A list of preliminary construction activities and their dates of commencement and completion is shown in *Figure 2.7b*. As the scale and size of the construction activities are complex, the construction activities have been broken down into 9 stages on an annual basis (i.e. from year 2004 to year 2012) to allow for the assessment of cumulative impact from concurrent activities. The 9 stages of construction activities considered for cumulative noise impact are summarised in *Table 4.5a*.

**Table 4.5a** *Summary of Construction Activities for Cumulative Impact Assessment*

Activity ID	Description
<i>Stage 1 - Year 2004</i>	
101	Dredging Underneath Seawall
102	Construction of Seawall - Rockfilling
<i>Stage 2 - Year 2005</i>	
109	Diversion and Permanent Extension of Outfall No.3 - Drainage Diversion
202	Dredging Underneath Temporary and Permanent Seawall
203	Construction of Temporary Seawall
204	Construction of Permanent Seawall - Rockfilling
<i>Stage 3 - Year 2006</i>	
209	Filling Behind Phase 2 Seawall - Public Fill
306	Filling Behind Seawall - Public Fill
309	Construction of Western Nullah - Borepiling
310	Construction of Western Nullah - Excavation
311	Construction of Western Nullah - Blockworks & Concrete Lining
312	Construction of Western Nullah - Deck Slab
313	Construction of Eastern Nullan - Borepiling
314	Construction of Eastern Nullah - Excavation
<i>Stage 4 - Year 2007</i>	
210	Filling Behind Phase 2 Seawall - Public Fill
307	Filling Behind Seawall - Public Fill
308	Drainage Diversion (Reclamation Phase 3)
309	Construction of Western Nullah - Borepiling
310	Construction of Western Nullah - Excavation
311	Construction of Western Nullah - Blockworks & Concrete Lining
312	Construction of Western Nullah - Deck Slab
313	Construction of Eastern Nullan - Borepiling

Activity ID	Description
314	Construction of Eastern Nullah - Excavation
315	Construction of Eastern Nullah - Blockworks & Concrete Lining
316	Construction of Eastern Nullah - Deck Slab
317	Construction of Eastern Nullah - Drainage Diversion
403	Bypass/Promenade Foundation, Phase 3
408	Construction of Access Road, Drains and Watermains, Phase 3
<i>Stage 5 - Year 2008</i>	
219	Extension of Outfall No. 2 - Drainage Diversion
402	Bypass/Promenade Foundation, Phase 2
404	Bypass/Promenade Foundation, Phase 4
405	Construction of Bypass
406	Construction of Access Road, Drains and Watermains, Phase 1
409	Construction of Access Road, Drains and Watermains, Phase 4
412	Drainage Network
413	Sewerage Network
414	Sewage Pumping Station, Area 4
417	Construction of Sewerage Treatment Facilities for Sham Tseng Development in Area 6
418	Construction of Government Complex in Area 6
<i>Stage 6 - Year 2009</i>	
404	Bypass/Promenade Foundation, Phase 4
405	Construction of Bypass
417	Construction of Sewerage Treatment Facilities for Sham Tseng Development in Area 6
418	Construction of Government Complex in Area 6
<i>Stage 7 - Year 2010</i>	
405	Construction of Bypass
417	Construction of Sewerage Treatment Facilities for Sham Tseng Development in Area 6
418	Construction of Government Complex in Area 6
<i>Stage 8 - Year 2011</i>	
405	Construction of Bypass
416	Construction of Salt Water Pumping Station in Area 1
418	Construction of Government Complex in Area 6
<i>Stage 9 - Year 2012</i>	
405	Construction of Bypass
416	Construction of Salt Water Pumping Station in Area 1

A detailed plant inventory has been established and is presented in *Table F1-1 (Annex F)*. The SWLs for each construction activity obtained from GW-TM is also indicated in *Table F1-1 (Annex F)*.

Construction noise assessment has been undertaken and is described in *Section 4.6.1*.



#### 4.5.2

#### *Road Traffic Noise*

During the operational phase, road traffic noise will be the dominant noise source within the Study Area and will potentially affect both the existing and planned noise sensitive developments.

Sources of noise within Sham Tseng Development are identified to be road traffic on the proposed Bypass, development access roads and local access roads. As mentioned in *Section 4.4.2*, it is envisaged that the dominant noise source would be the traffic on the proposed Bypass while the traffic flow on local access roads would be low. Hence, these local roads would have limited potential for noise impacts. Notwithstanding the above, local roads are often characterised by high level of roadside activities with building developments located in close proximity. This often renders the implementation of noise barriers impractical.

Tuen Mun Road and the widened Castle Peak Road are also sources of traffic noise affecting the future high-rise residential uses in Area 2, Area 4, Area 5, the schools in Area 3 and also the proposed development in Area 6. The predicted future traffic volume on these roadways is large and with high percentage of heavy vehicles in the traffic stream.

Assessment of road traffic noise, with the main focus on traffic noise impacts associated with the proposed Bypass, Tuen Mun Road and the widened Castle Peak Road has been undertaken and is described in *Section 4.6.2*. With reference to the *Castle Peak Road Improvement between Area 2 and Ka Loon Tsuen, Tsuen Wan D & C Consultancy, Final Review Report, May 1998*, Highways Department, the recommended mitigation measures on the widened Castle Peak Road have been incorporated into this assessment accordingly.

#### 4.5.3

#### *Fixed Noise Sources*

Potential fixed noise sources within the Study Area have been identified as follows:

- public pier, Area 1;
- salt water pumping station, Area 1;
- underground sewage pumping station, Area 4;
- PTT, Area 4;
- refuse collection point, Area 6;
- sewage treatment facilities for Sham Tseng Development, Area 6;
- sewage treatment works, Area 7;
- electricity sub-station, Area 7; and
- the Garden Bakery.

#### 4.5.4 Aircraft Noise

The Sham Tseng Development is located outside the NEF 25 Contour for the Hong Kong International Airport at Chek Lap Kok and therefore aircraft noise is not anticipated to be an environmental issue. However,  $L_{max}$  values associated with aircraft flyover events will be presented for reference.

#### 4.6 PREDICTION AND EVALUATION OF ENVIRONMENTAL IMPACTS

##### 4.6.1 Construction Noise

The unmitigated predicted noise levels at the worst-case representative NSRs for each construction activity have been predicted and the results are given in *Table F2-1 (Annex F)*. *Figure 4.3a* shows the locations of noise assessment points during the construction phase. The predictions were conducted taking into account of distance attenuation and possible screening effects.

##### *Reclamation Phase 1*

*Table F2-1 (Annex F)* indicated that the unmitigated construction activities would cause no exceedances of the daytime construction noise criterion at all NSRs.

Mitigation measures are therefore not required for these NSRs in order to alleviate the noise impacts during the reclamation phase 1.

##### *Reclamation Phases 2 & 4*

*Table F2-1 (Annex F)* indicated that some of the unmitigated construction activities would cause exceedances of the daytime construction noise criterion at some nearby NSRs. These construction activities are summarised in *Table 4.6a* below.

**Table 4.6a Exceedances of Daytime Construction Noise Criteria - Reclamation Phases 2 & 4**

Description (Activity ID)	NSRs Exceeding Daytime Noise Criteria
Filling Behind Phase 2 Seawall - Installation of Band Drains (208)	· Lido Garden Tower 3 (C7)
Filling Behind Phase 2 Seawall - Public Fill Up to +5.5 mPD (210)	· Lido Garden Tower 3 (C7) · San Miguel Brewery (C15a & C15b)
Extension of Outfall No.2 - Drainage Diversion (219)	· Sea Crest Villa Block 1 (C10)

Mitigation measures (see *Section 4.7*) are therefore required for these NSRs in order to alleviate the noise impacts during reclamation Phases 2 and 4.

##### *Reclamation Phase 3*

Table F2-1 (Annex F) indicated that some of the unmitigated construction activities would cause exceedances of the daytime construction noise criterion at some nearby NSRs. These construction activities are summarised in Table 4.6b below.

**Table 4.6b Exceedances of Daytime Construction Noise Criteria - Reclamation Phase 3**

Description (Activity ID)	NSRs Exceeding Daytime Noise Criteria
Filling Behind Seawall - Public Fill (+2.5 mPD to 5.5 mPD) (307)	<ul style="list-style-type: none"> <li>· Former Union Carbide Site Tower 2 (C6)</li> <li>· Former San Miguel Brewery Site (15b)</li> </ul>
Drainage Diversion (308)	<ul style="list-style-type: none"> <li>· Former Union Carbide Site Tower 2 (C6)</li> <li>· Former San Miguel Brewery Site (15b)</li> </ul>
Construction of Western Nullah - Excavation (310)	<ul style="list-style-type: none"> <li>· Lido Garden Tower 3 (C7)</li> </ul>
Construction of Western Nullah - Deck Slab (312)	<ul style="list-style-type: none"> <li>· Lido Garden Tower 3 (C7)</li> <li>· Former San Miguel Brewery Site (C15a &amp; C15b)</li> </ul>
Construction of Eastern Nullah - Excavation (314)	<ul style="list-style-type: none"> <li>· Former Union Carbide Site Tower 2 (C6)</li> <li>· Former San Miguel Brewery Site (C15b)</li> </ul>
Construction of Eastern Nullah - Blockworks & Concrete Lining (315)	<ul style="list-style-type: none"> <li>· Former Union Carbide Site Tower 2 (C6)</li> <li>· Former San Miguel Brewery Site (C15b)</li> </ul>
Construction of Eastern Nullah - Deck Slab (316)	<ul style="list-style-type: none"> <li>· Former Union Carbide Site Tower 2 (C6)</li> <li>· Former San Miguel Brewery Site (C15b)</li> </ul>
Construction of Eastern Nullah - Drainage Diversion (317)	<ul style="list-style-type: none"> <li>· Former Union Carbide Site Tower 2 (C6)</li> <li>· Former San Miguel Brewery Site (C15b)</li> </ul>
Drainage Diversion - Outfall No. 1 (318)	<ul style="list-style-type: none"> <li>· Former Union Carbide Site Tower 2 (C6)</li> <li>· Former San Miguel Brewery Site (C15b)</li> </ul>
Drainage Diversion - Outfall No. 4 (319)	<ul style="list-style-type: none"> <li>· Former Union Carbide Site Tower 2 (C6)</li> <li>· Former San Miguel Brewery Site (C15b)</li> </ul>

Mitigation measures (see Section 4.7) are therefore required for these NSRs in order to alleviate the noise impacts during the reclamation Phase 3.

#### *Infrastructural Works*

Table F2-1 (Annex F) indicated that some of the unmitigated construction activities would cause exceedances of the daytime construction noise criterion at some nearby NSRs. These construction activities are summarised in Table 4.6c below.

**Table 4.6c Exceedances of Daytime Construction Noise Criteria - Infrastructural Works**

<b>Description (Activity ID)</b>	<b>NSRs Exceeding Daytime Noise Criteria</b>
Bypass/Promenade Foundation, Phase 1 (401)	<ul style="list-style-type: none"> <li>· Sea Crest Villa Block 7 (C12)</li> <li>· DD 387 Lot 99 (C14a &amp; C14b)</li> </ul>
Bypass/Promenade Foundation, Phase 3 (403)	<ul style="list-style-type: none"> <li>· Golden Villa (C1)</li> </ul>
Construction of Bypass (405)	<ul style="list-style-type: none"> <li>· Golden Villa (C1)</li> <li>· Sea Crest Villa Block 7 (C12)</li> <li>· DD 387 Lot 99 (C14a and C14b)</li> </ul>
Construction of Access Road, Drains and Watermains, Phase 1 (406)	<ul style="list-style-type: none"> <li>· Sea Crest Villa Block 7 (C12)</li> </ul>
Construction of Access Road, Drains and Watermains, Phase 2 (407)	<ul style="list-style-type: none"> <li>· Former San Miguel Brewery Sites (C15a &amp; C15b)</li> </ul>
Construction of Underpass for Slip Road B (410)	<ul style="list-style-type: none"> <li>· Sea Crest Villa Block 7 (C12)</li> <li>· DD 387 Lot 99 (C14b)</li> <li>· Goldenville (C16)</li> <li>· Dragon Garden (C17)</li> <li>· Sea Crest Villa Block 11 (C18)</li> <li>· Villa Alfavista (C20)</li> </ul>
Construction of Open Section for Slip Road B (411)	<ul style="list-style-type: none"> <li>· Sea Crest Villa Block 7 (C12)</li> <li>· DD 387 Lot 99 (C14b)</li> <li>· Sea Crest Villa Block 11 (C18)</li> <li>· Victoria Valerie's Court (C19)</li> <li>· Villa Alfavista (C20)</li> </ul>
Drainage Network (412)	<ul style="list-style-type: none"> <li>· Former Union Carbide Site Tower 2(C6)</li> <li>· Goldenville (C16)</li> <li>· Sea Crest Villa Block 11 (C18)</li> <li>· Victoria Valerie's Court (C19)</li> <li>· Villa Alfavista (C20)</li> </ul>
Sewerage Network (413)	<ul style="list-style-type: none"> <li>· Former Union Carbide Site Tower 2(C6)</li> </ul>
Sewage Pumping Station, Area 4 (414)	<ul style="list-style-type: none"> <li>· Former Union Carbide Site Tower 2(C6)</li> <li>· Former San Miguel Brewery Site (C15b)</li> </ul>
Government Complex (418)	<ul style="list-style-type: none"> <li>· Former Union Carbide Site Tower 2 (C6)</li> <li>· Former San Miguel Brewery Site (C15b)</li> </ul>

Mitigation measures (see *Section 4.7*) are therefore required for these NSRs in order to alleviate the noise impacts during the construction phase.

### Cumulative Noise Impacts

The summary of construction activities for cumulative impact presented in *Table 4.5a* are considered as "worst case" since all construction activities during each construction stage are assumed to operate concurrently throughout the year. A summary of cumulative construction noise impacts is shown in *Table 4.6d*.

#### *Stage 1 Construction (Year 2004)*

The cumulative noise levels at all NSRs are predicted to be comply with the daytime construction noise levels criterion. Mitigation measures (see *Section 4.7*) are therefore not required.

#### *Stage 2 Construction (Year 2005)*

The cumulative noise levels at all NSRs are predicted to be comply with the daytime construction noise levels criterion. Mitigation measures (see *Section 4.7*) are therefore not required.

#### *Stage 3 Construction (Year 2006)*

Exceedances of the daytime construction noise criterion are predicted at the former Union Carbide Site Tower 2 (C6), Lido Garden Tower 3 (C7) and the former San Miguel Brewery Sites (C15a & C15b). Mitigation measures (see *Section 4.7*) are therefore required to alleviate the noise impacts.

#### *Stage 4 Construction (Year 2007)*

Exceedances of the daytime construction noise criterion are predicted at Sham Tseng Tung Tsuen (C2), Rhine Terrace (C4), the former Union Carbide Site Tower 2 (C6), Lido Garden Tower 3 (C7), Sea Crest Villa Block 1 (C10), and the former San Miguel Brewery Sites (C15a & C15b). Mitigation measures (see *Section 4.7*) are therefore required to alleviate the noise impacts.

#### *Stage 5 Construction (Year 2008)*

Exceedances of the daytime construction noise criterion are predicted at Golden Villa (C1), Sham Tseng Tung Tsuen (C2), the former Union Carbide Site Tower 2 (C6), Lido Garden Tower 3 (C7), Sham Tseng Village (C8), Sea Crest Villa Blocks 1, 5 and 7 (C10, C11 and C12), Pai Min Kok Village 13A (C13), DD387 Lot 99 (C14a and C14b), the former San Miguel Brewery Sites (C15b), Goldenville (C16), Dragon Garden (C17), Victoria Valerie's Court (C19) and Villa Alfavista (C20). Mitigation measures (see *Section 4.7*) are therefore required to alleviate the noise impacts.

#### *Stage 6 Construction (Year 2009)*

Exceedances of the daytime construction noise criterion are predicted at Golden Villa (C1), the former Union Carbide Site Tower 2 (C6), Sea Crest Villa Block 7 (C12), Pai Min Kok Village (C13), DD387 Lot 99 (C14a and C14b), the former San Miguel Brewery Site (C15b). Mitigation measures (see *Section 4.7*) are therefore required to alleviate the noise impacts.

*Stage 7 Construction (Year 2010)*

Exceedances of the daytime construction noise criterion are predicted at Golden Villa (C1), the former Union Carbide Site Tower 2 (C6), Lido Garden Tower 3 (C7), Sham Tseng Village (C8), Sea Crest Villa, Block 1 (C10), Sea Crest Villa Block 7 (C12), DD387 Lot 99 (C14a and C14b), the former San Miguel Brewery Site (C15a & C15b). Mitigation measures (see *Section 4.7*) are therefore required to alleviate the noise impacts.

*Stage 8 Construction (Year 2011)*

Exceedances of the daytime construction noise criterion are predicted at Golden Villa (C1), the former Union Carbide Site Tower 2 (C6), Sea Crest Villa Block 7 (C12), DD387 Lot 99 (C14a and C14b), the former San Miguel Brewery Site (C15b). Mitigation measures (see *Section 4.7*) are therefore required to alleviate the noise impacts.

*Stage 9 Construction (Year 2012)*

Exceedances of the daytime construction noise criterion are predicted at Golden Villa (C1), Sea Crest Villa Block 7 (C12) and DD387 Lot 99 (C14a and C14b). Mitigation measures (see *Section 4.7*) are therefore required to alleviate the noise impacts.

**Table 4.6d Predicted Construction Noise Level (dB(A))**

NSR Ref.	Description	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6	Stage 7	Stage 8	Stage 9
C1	Golden Villa	-	-	61	71	84	84	84	84	83
C2	Sham Tseng Tung Tsuen	-	-	69	76	76	74	75	74	72
C3	Sham Tseng Tung Tsuen	-	-	64	73	73	70	70	69	66
C4	Rhine Terrace	-	-	67	76	74	71	71	70	65
C5	Rhine Garden Tower 5	-	-	65	74	70	68	68	67	-
C6	Former Union Carbide Site Tower 2	-	65	83	92	88	85	85	84	74
C7	Lido Garden Tower 3	63	70	83	85	77	75	81	71	69
C8	Sham Tseng Village	62	62	56	68	76	73	76	68	68
C9	Sham Tseng Kau Tsuen	-	58	53	65	71	67	67	63	63
C10	Sea Crest Villa Block 1	63	63	75	78	79	72	77	69	69
C11	Sea Crest Villa Block 5	67	62	69	71	76	75	73	70	70
C12	Sea Crest Villa Block 7	71	66	66	69	79	81	78	78	78
C13	Pai Min Kok Village 13A	70	64	67	69	76	78	74	72	72
C14a	DD 387 Lot 99	66	59	-	-	86	86	86	86	86
C14b	DD 387 Lot 99)	66	59	-	-	90	90	90	89	89
C15a	Former San Miguel Brewery Site	61	74	80	83	74	71	77	66	66
C15b	Former San Miguel Brewery Site	60	68	84	92	82	79	81	78	73
C16	Goldenville	-	-	-	-	91	-	-	-	-
C17	Dragon Garden	-	-	-	-	79	-	-	-	-
C18	Sea Crest Villa Block 11	-	-	-	-	73	-	-	-	-
C19	Victoria Valerie's Court	-	-	-	-	78	-	-	-	-
C20	Villa Alfavista	-	-	-	-	83	-	-	-	-

Road traffic noise modelling for year 2019 has been undertaken at representative NSRs (which would be affected by the Project) and the prediction results are given in *Table G1 (Annex G)*. Noise predictions have been made at three representative receiver heights and at the worst impacted facades of NSRs. Information on the number of storeys, dwellings and ground levels in mPD for existing sensitive uses is shown in *Table 4.3b*. Locations for noise assessment are shown in *Figures 4.3c, 4.3d and 4.3e*. The assessment of impacts associated with the Project during the worst prediction year would base on the prediction results and compare with the road traffic noise standards stipulated in EIAO-TM.

#### *Existing Noise Sensitive Receivers*

##### Sea Crest Villa (Phases 1, 2 & 3)

As indicated in *Table G1 (Annex G)*, the noise levels at Sea Crest Villa Blocks 1, 5 and 6 (N5, N6, N7 & N10) will comply with the road traffic noise criterion of  $L_{10, \text{peak hour}} 70 \text{ dB(A)}$ . Therefore, mitigation measures will not be required for these NSRs.

The predicted noise levels at Sea Crest Villa Blocks 2 and 4 (N8 and N9) will be dominated by the road traffic noise from the existing road network. The noise levels from the existing road network will already exceed the road traffic noise criterion of  $L_{10, \text{peak hour}} 70 \text{ dB(A)}$ . The predicted result indicated that the noise contribution from the proposed Bypass is at least 12 dB(A) below the existing road network and also within the road traffic noise criterion. These NSRs are therefore excluded from the consideration of mitigation measures as it would be ineffective to provide mitigation measures on the proposed Bypass.

The noise levels at Sea Crest Villa Blocks 7, 8, 9 and 10 (N1, N2, N3 & N4) will exceed the road traffic noise criterion of  $L_{10, \text{peak hour}} 70 \text{ dB(A)}$  indicating road traffic noise from the proposed Bypass will pose adverse impacts at these NSRs. Therefore, mitigation measures (see *Section 4.7*) on the proposed Bypass will be required for these NSRs.

##### Lido Garden

The predicted overall noise levels at Lido Garden Towers 1 to 5 (N11 to N15) will comply with the road traffic noise criterion of  $L_{10, \text{peak hour}} 70 \text{ dB(A)}$ . Therefore mitigation measures will not be considered for these NSRs.

##### Former Union Carbide Site

The predicted overall noise levels at the former Union Carbide Site Towers 2 and 3 (N16 to N19) will comply with the road traffic noise criterion of  $L_{10, \text{peak hour}} 70 \text{ dB(A)}$ . Therefore mitigation measures will not be considered for these NSRs.

##### Residential Development at the Former San Miguel Brewery Site



As indicated in *Table G1 (Annex G)*, noise level at the top floor receiver (N20) will exceed the road traffic noise criterion of  $L_{10, \text{peak hour}} 70 \text{ dB(A)}$ . However, the predicted result indicated that the noise contribution will be dominated by road traffic noise from the existing road network. Therefore this NSR is excluded from the consideration of mitigation measures as it would not be effective to provide mitigation measures on the new road.

#### Rhine Terrace

The noise levels at Rhine Terrace (N21) will comply with the road traffic noise criterion of  $L_{10, \text{peak hour}} 70 \text{ dB(A)}$  indicating traffic noise from the proposed Bypass will not cause any adverse impacts at this NSR. Therefore mitigation measures will not be considered for this NSR.

#### Pai Min Kok Village 13A

The noise levels at the village house 13A in Pai Min Kok Village (N22) will comply with the road traffic noise criterion of  $L_{10, \text{peak hour}} 70 \text{ dB(A)}$  indicating traffic noise from the proposed Bypass will not cause any adverse impacts at this NSR. Therefore mitigation measures on the proposed Bypass will not be considered for this NSR.

#### DD387 Lot 99

As indicated in *Table G1 (Annex G)*, the noise levels at the residential buildings (N23) will be dominated by road traffic noise from the proposed Bypass as well as the existing roads and will exceed the road traffic noise criterion of  $L_{10, \text{peak hour}} 70 \text{ dB(A)}$ . Since there is no operable window located at the western and northern facades of the buildings, only the eastern façade will be affected by the traffic noise and mitigation measures (see Section 4.7) will only be required for that facade.

#### Sham Tseng Tung Tsuen 22

The noise levels at Sham Tseng Tung Tsuen (N24) will comply with the road traffic noise criterion of  $L_{10, \text{peak hour}} 70 \text{ dB(A)}$ . Therefore, mitigation measures will not be considered for this NSR.

#### Golden Villa

The noise levels at the western facade of Golden Villa (N25) will comply with the road traffic noise criterion of  $L_{10, \text{peak hour}} 70 \text{ dB(A)}$  indicating traffic noise from the proposed Bypass will not cause any adverse impacts at this NSR. Therefore mitigation measures on the proposed Bypass will not be considered for this NSR.

However, the predicted road traffic noise exceedance at the southern and eastern facades of Golden Villa (N26, N27 & N28) indicating the traffic noise

from the proposed Bypass will cause adverse impact at these NSR. Therefore mitigation measures (see *Section 4.7*) will be required.

#### Goldenville

The predicted noise levels at Goldenville (N29) will be dominated by road traffic noise from the proposed Bypass as well as the existing roads and will exceed the road traffic noise criterion of  $L_{10, \text{peak hour}} 70 \text{ dB(A)}$ , therefore mitigation measures (see *Section 4.7*) will be required for this NSR.

#### Dragonette

The predicted noise levels at Dragonette (N30) will comply with the road traffic noise criterion of  $L_{10, \text{peak hour}} 70 \text{ dB(A)}$  indicating traffic noise from the proposed Bypass will not cause any adverse impacts at this NSR. Therefore mitigation measures on the proposed Bypass will not be considered for this NSR.

#### Dragon Garden

The predicted noise levels at Dragon Garden (N31) will be dominated by road traffic noise from the proposed Bypass as well as the existing roads and will exceed the road traffic noise criterion of  $L_{10, \text{peak hour}} 70 \text{ dB(A)}$ , therefore mitigation measures (see *Section 4.7*) will be required for this NSR.

The predicted noise levels at Dragon Garden (N32) will comply with the road traffic noise criterion of  $L_{10, \text{peak hour}} 70 \text{ dB(A)}$  indicating traffic noise from the proposed Bypass will not cause any adverse impacts at this NSR. Therefore mitigation measures on the proposed Bypass will not be considered for this NSR.

#### Sea Crest Villa (Phase 4)

The predicted noise levels at Sea Crest Villa Blocks 11, 12 & 13 (N33, N34 and N35) will be dominated by the road traffic noise from the existing road network. The noise levels from the existing road network will already exceed the road traffic noise criterion of  $L_{10, \text{peak hour}} 70 \text{ dB(A)}$ . The predicted result indicated that the noise contribution from the proposed Bypass is at least 7 dB(A) below the existing road network and also within the road traffic noise criterion. These NSRs are therefore excluded from the consideration of mitigation measures as it would be ineffective to provide mitigation measures on the proposed Bypass.

#### Victoria Valerie's Court

The predicted noise levels at Victoria Valerie's Court (N36) will be dominated by the road traffic noise from the existing road network. The noise levels from the existing road network will already exceed the road traffic noise criterion of  $L_{10, \text{peak hour}} 70 \text{ dB(A)}$ . The predicted result indicated that the noise contribution from the proposed Bypass is at least 7 dB(A) below the existing road network and also within the road traffic noise criterion. This NSR is therefore excluded from the consideration of mitigation measures as it would be ineffective to provide mitigation measures on the proposed Bypass.

#### Villa Alfavista

The predicted noise levels at Villa Alfavista (N37 and N38) will be dominated by the road traffic noise from the existing road network. The noise levels from the existing road network will already exceed the road traffic noise criterion of  $L_{10, \text{peak hour}} 70 \text{ dB(A)}$ . The predicted result indicated that the noise contribution from the proposed Bypass is at least 19 dB(A) below the existing road network and also within the road traffic noise criterion. These NSRs are therefore excluded from the consideration of mitigation measures as it would be ineffective to provide mitigation measures on the proposed Bypass.

#### Village House, Tsing Lung Tau Village

The predicted noise levels at Village House, Tsing Lung Tau Villa (N39) will be dominated by the road traffic noise from the existing road network. The noise levels from the existing road network will already exceed the road traffic noise criterion of  $L_{10, \text{peak hour}} 70 \text{ dB(A)}$ . However, the predicted result indicated that the noise contribution will be dominated by road traffic noise from the existing road network. Therefore this NSR is excluded from the consideration of mitigation measures as it would not be effective to provide mitigation measures on the new road.

#### Lung Tang Court

The predicted noise levels at Lung Tang Court (N40) will be dominated by the road traffic noise from the existing road network. The noise levels from the existing road network will already exceed the road traffic noise criterion of  $L_{10, \text{peak hour}} 70 \text{ dB(A)}$ . However, the predicted result indicated that the noise contribution will be dominated by road traffic noise from the existing road network. Therefore this NSR is excluded from the consideration of mitigation measures as it would not be effective to provide mitigation measures on the new road.

#### Village House (N41 and N42)

The predicted overall noise levels at this village house (N41 & N42) will comply with the road traffic noise criterion of  $L_{10, \text{peak hour}} 70 \text{ dB(A)}$ . Therefore mitigation measures will not be considered for these NSRs.

#### *Planned Noise Sensitive Receivers*

## Residential Development in Area 2

Area 2 comprises a residential development with a plot ratio of 5 (N211 to N221). The proposed noise mitigation measures to adopt a special building design including single aspect blocks with blank façade facing Castle Peak Road has been agreed by the Housing Department (see Figure 4.3c-1) and Lands Department as one of the feasible options. Lands Department further advised that flexibility should be maintained for the developers to design the layout, form and disposition of the buildings to be erected thereon. The land sale conditions will require the developers to implement mitigation measures recommended in the report, including the single aspect blocks unless alternative mitigation measures can be worked out to achieve the same environmental performance. Other mitigation measures, such as off-site noise barrier, would be re-examined at the detailed design stage of the project.

The predicted noise levels indicated that at all the representative NSRs for this site will comply with the road traffic noise criteria of  $L_{10, \text{peak hour}} 70 \text{ dB(A)}$ . Therefore mitigation measures will not be considered for these NSRs.

The total number of flats within the planned residential development in Area 2 are about 1720 and all units were found complying with the traffic noise criterion.

## CDAs in Areas 4 and 5

The residential areas in Areas 4 and 5 are proposed for private housing development.

The predicted noise levels indicated that at all the representative NSRs for the two sites (N122 to N136) will comply with the road traffic noise criterion of  $L_{10, \text{peak hour}} 70 \text{ dB(A)}$ . Therefore mitigation measures will not be considered for these NSRs.

The total number of flats within the planned CDA site are 2710, the overall compliance rate for this scheme was 100%.

## Educational Uses in Area 3

For the secondary school (N152 to N155) located to the west of Area 3, exceedances of road traffic noise criterion of  $L_{10, \text{peak hour}} 65 \text{ dB(A)}$  were predicted at about 13 noise sensitive rooms (i.e. 5 classrooms and 8 function-rooms). The predicted noise contribution will be dominated by road traffic noise from the existing road network. Therefore, mitigation measures (see *Section 4.7*) will be required to protect these classrooms from road traffic noise impacts.

### 4.6.3

#### *Fixed Noise Sources*

Fixed plant noise from the salt water pumping station, underground sewage pumping station, PTT, refuse collection point, sewage treatment facilities, electricity sub-station and the Garden Bakery would impact on the surrounding NSRs. Taking into account the distance separation between the noise sources and the closest receiver, the maximum permissible SWLs were calculated for the different types of fixed plant, using basic acoustic principles. Results are shown in *Table 4.6e*.

Mechanical ventilation system will be provided to improve the underpass air quality. Since jet fans will be installed inside the underpass, noise impact to the nearby NSRs is not envisaged.

**Table 4.6e** *Maximum Permissible SWLs for Different Types of Fixed Plant ( $L_{eq, 30 min}$  dB(A))*

Fixed Plant Source	The closest NSR	Approximate separation distance from the closest NSR	Maximum Permissible SWL, dB(A)
Salt Water Pumping Station, Area 1	Residential Development, Area 2	30 m	95 / 85 <sup>(1)</sup>
Underground Sewage Pumping Station, Area 4	Educational Uses, Area 3	10 m	85 / 75
Refuse Collection Point, Area 6	Union Carbide	15 m	89 / 79
Sewage Treatment Facilities for Sham Tseng Development, Area 6	CDA, Site 5	30 m	95 / 85
Ting Kau and Sham Tseng Sewage Treatment Works, Area 7 <sup>(2)</sup>	CDA, Site 5	180 m	110 / 100
Electricity Sub-Station, Area 7 <sup>(2)</sup>	CDA, Site 5	190 m	111 / 101

**Notes:**  
 (1) X/Y where X is the daytime SWL and Y is the night-time SWL.  
 (2) Noise level for TKSTSTW is predicted at the reserved site boundary of Area 7.

Adverse noise impacts at the above NSRs (as shown in *Table 4.6e*) would not be expected provided that the maximum permissible SWLs from each noise source are adopted in the detailed design stage.

Drawing reference from industry experience, the recommended maximum permissible SWLs are not particularly onerous and could be achieved by using conventional plant with standard acoustic treatment and building design where necessary. It is envisaged that with good planning and design practices, the concerned SWLs could be met without much difficulties.

### *Salt Water Pumping Station, Sewage Treatment Facilities, Sewage Pumping Station and Electricity Sub-station*

As far as possible, there should be no opening of the salt water pumping station structure in Area 1 facing the residential site in Area 2. If necessary, other widely accepted good design practices such as adopting silencers for ventilating fans, acoustic doors, acoustic louvres and absorptive wall lining could be adopted. Moreover, vent ducts rather than plain openings could also be used to facilitate ventilation and this could be further considered during the detailed design stage.

For the Ting Kau and Sham Tseng Sewage Treatment Works in Area 7, sound pressure levels (dB(A)) at 1m from source for the E & M Installations have been proposed in the *Ting Kau and Sham Tseng Sewerage Scheme, Environmental Impact Assessment Study, Final Report, October 1995*. In order to predict a worst-case scenario, a total sound pressure level of 88 dB(A) at the site boundary of Area 7 has been taken as a reference for this assessment. As indicated in the *Table 4.6e* the noise level for the planned TKSTSTW during daytime and night-time are predicted to be well below the previous prediction. Therefore, the recommended requirement on the planned TKSTSTW in Area 7 which has been stated in the above EIA Report would be adequate for the development on STD and mitigation measures are not required.

To minimize potential noise impact from the operating pumps of the sewage pumping station, all pumps and associated E&M equipments will be located underground and totally housed inside the structure. If necessary, other widely accepted good design practices such as adopting silencer for the extraction fans of the de-odourizer, acoustic doors, acoustic louvers and absorptive wall lining should be adopted. Extraction fans of the de-odouriter will be installed at the top slab of the structure and will be located away from the sensitive receivers. The noise level at the nearest noise sensitive receivers must satisfy the EIAO-TM criteria.

### *Public Transport Terminus*

For the proposed Public Transport Terminus (PTT) located at the south-western corner of Area 4, it is expected that noise impact would be minimal provided that the recommendations promulgated in HKPSG will be implemented and the reverberation noise guideline of not exceeding 2 seconds at 500 Hz to be followed. According to HKPSG, the following considerations should be made to ameliorate the potential impact:

- locate the facilities so that there is no line-of-sight at the NSRs; provide screening to the noise source as far as possible by making use of natural landscape, embankment or noise tolerant buildings;
- avoid locating open-form PTT in proximity to NSRs;
- consider adopting a complete podium decking over noisy facilities; and

- locate lairs and sidings away from NSRs and separate them with high solid barriers.

It is considered noise arising from vehicles movement inside the PTT would be essentially contained by its structural, form comprising the PTT located under a podium (i.e. decked over). Additionally, the use of noise absorptive walls and roof linings inside the proposed PTT is recommended to achieve further noise reduction. The reverberation noise guideline of not exceeding 2 seconds at 500 Hz should be followed.

The above indicative maximum SWLs for all sources have been calculated. Since no detail information on the proposed developments is presently available, the source was assumed to be at the site boundary to represent the worst-case.

#### *Refuse Collection Point*

For the proposed refuse collection point (RCP) in Area 6, noise impacts would be further reduced by constructing an enclosed structure and all noisy activities associated with the RCP such as the compaction of the refuse will be undertaken within the enclosure via refuse collection vehicle. It is also recommended that the RCP should be located away from NSRs, where possible.

#### *Kaito Noise*

It has been identified that the major noise source of the Kaito is the engine at the stern of the vessel. The potential Kaito noise impact was predicted by measuring the noise levels from existing Kaito operation between Sham Tseng and Ma Wan. The measurement was undertaken at the pier and about 10 m from the Kaito. The measured results show that the average noise level from the Kaito was about 68 dB(A) while the background noise at the same location was just over 67 dB(A). Since the stern of Kaito was not facing the pier, while the passengers accessed the pier at the bow of the Kaito, potential noise screening due to the Kaito per se was identified. An additional 5 dB(A) was applied to the measured Kaito noise in the calculation. Distance from the reprovisioned stub pier to the nearest housing block of planned residential development in Area 2 is about 150 m. The assessment predicted the Kaito noise at the NSR will be about 42 dB(A). Adverse noise impact due to Kaito is not therefore predicted.

#### *Aircraft Noise*

It is recognised that the location of the proposed development area falls outside the NEF 25 contour. For reference purposes, the measured maximum noise level associated with aircraft flyover events currently at Sham Tseng and

Tsing Lung Tau would be up to  $L_{\max}$  78 dB(A)<sup>(1)</sup> (the range being 63 to 78 dB(A) with about 1% of the samples exceeding 75 dB(A)). Considering that

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(1) Information obtained from the Civil Aviation Department's web site.

the reclamation will extend sensitive uses towards the flight paths by a maximum 200 m no change to the  $L_{max}$  range is predicted.

#### *Noise from Garden Bakery*

The noise level prediction was made at the nearest planned NSR, the proposed Planned CDA Site in Area 5. Noise measurements have been undertaken in the vicinity of the Garden Bakery in order to estimate the sound pressure level (SPL) of the facility. A sound power level (SWL) of 110 dB(A) was established.

A SPL of 46 dB(A) was predicted at the NSR taking into account the 160 m separation from the building to the Garden Bakery and also substantial noise screen to be provided by the buildings of Union Carbide and the proposed Social Welfare facilities in Area 6.

As the fixed noise impact from Garden Bakery on the nearest NSR is predicted to be below the night-time criterion of 50 dB(A), therefore mitigation measures is not required.

## **4.7 MITIGATION OF ADVERSE ENVIRONMENTAL IMPACTS**

### **4.7.1 Construction Noise**

Mitigation measures for each phase of construction site are listed below, and the following forms of mitigation measures are recommended and should be incorporated into the Contract Specification:

- good site practice to limit noise emissions at source;
- selection of quiet plant and working methods;
- reduction in number of plant operating in critical areas close to NSRs; and
- use of movable noise barriers; and
- restriction in the operating PME time usage.

The Contractor may develop a different package of mitigation measures to meet the required noise standards, but the following illustrates a feasible approach to mitigate the predicted noise impacts during the construction phase.

#### *Good Site Practice*

Good site practice and noise management can reduce the noise impact from construction site activities on nearby NSRs. The following package of measures should be followed during each phase of construction:

- only well-maintained plant should be operated on-site and plant should be serviced regularly during the construction works;
- machines and plant that may be in intermittent use should 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 nearby NSRs;
- silencers or mufflers on construction equipment should be utilised and should be properly maintained during the construction works;
- mobile plant should be sited as far away from NSRs as possible; and
- material stockpiles and other structures should be effectively utilised, where practicable, to screen noise from on-site construction activities.

#### *Selecting Quiet Plant and Working Methods*

The use of quiet plant is identified to be a feasible solution to tackle the adverse impacts associated with the construction works. The Contractor may be able to obtain particular models of plant that are quieter than standard types given in the GW-TM. The benefits achievable in this way will depend on the details of the Contractors' chosen methods of working, and it is considered too restrictive to specify that a Contractor has to use specific items of plant for the construction operations. It is therefore both preferable and practical to specify an overall plant noise performance specification to apply to the total SWL of all plant to be used on site so that the Contractor is allowed flexibility to select plant to suit his needs.

Quiet plant is defined as PME whose actual SWL is less than the value specified in the GW-TM for the same piece of equipment. Examples of SWLs for specific silenced PME taken from a British Standard, namely *Noise Control on Construction and Open Sites, BS5228 : Part 1 : 1997*, which are known to be used are given in *Table 4.7a*.

**Table 4.7a** *Sound Power Levels for Specific Silenced PME*

<b>PME</b>	<b>BS5228 Table no.</b>	<b>Ref no.</b>	<b>SWL dB(A) max</b>
Asphalt Paver	C.8	24	101
Breaker	C.2	10	110
Bulldozer	C.9	2	104
Circular Saw	C.7	75	105
Concrete Lorry Mixer	C.6	35	100
Concrete Pump	C.6	22	106
Truck	C.9	27	105
Excavator	C.3	97	105
Generator	C.7	62	100
Grader	C.9	11	110
Lorry	C.8	16	108
Mobile Crane	C.7	114	101
Poker Vibrator	C.6	32	100
Road Roller	C.8	27	104

With the above quiet plant substituted in the equipment inventories given in *Table F1-2 (Annex F)*, the mitigated noise levels at each NSR are shown in *Table F2-2 (Annex F)*. With the use of quiet plant on site, the overall maximum noise reduction to the worst predicted noise levels for each construction activities associated with the infrastructural construction was up to about 12 dB(A).

With the implementation of the above measures, exceedances of the daytime construction noise criterion are still predicted at Golden Villa (C1), the former Union Carbide Site Tower 2 (C6), Lido Garden Tower 3 (C7), Sea Crest Villa Block 7 (C12), DD387 Lot 99 (C14a and C14b), the former San Miguel Brewery (C15a & C15b) and Goldenville (C16). In order to reduce the noise impacts at these NSRs, further mitigation measures are therefore required.

#### *Use of Temporary and Movable Noise Barriers*

Based on site geometry, NSRs in the vicinity of the work site are not expected to be protected by the use of temporary noise barriers located along site boundaries. However, movable barriers could be very effective in providing noise screening from particular plant. It is anticipated that a movable noise barrier with a skid footing and a cantilevered upper portion located close to the noise generating part of the PME such that the line of sight could be blocked by the barriers when viewed from NSRs, can produce at least 10 dB(A) screening for stationary plant and 5 dB(A) for mobile plant. The noise screening benefit for each plant considered in this assessment is listed below:

- stationary plant - assuming 10 dB(A) reduction: breaker, poker vibrator, circular saw, air compressor, generator, bar bender and cutter; and
- mobile plant - assuming 5 dB(A) reduction: excavator, mobile crane, grader, road roller, bore-piling machine, concrete mixer, concrete pump, loader and asphalt paver.

The effect with the use of quiet plant and movable barriers are presented in *Table F2-3 (Annex F)*. Noise reduction of up to 4 dB(A) could be achieved by installing movable barriers close to the PMEs in operation.

#### *Reducing the Number of Plant Operating in Critical Areas Close to NSRs*

With the use of quiet plant, exceedances of the daytime construction noise criteria are still predicted and further mitigation measures have been investigated. In general the number of plant should be left to the choice of the Contractor. However, in some cases it may be appropriate to restrict the number of particularly noisy plant operating within certain parts of the site that are very close to the NSRs. The result of limiting the number of plant working concurrently are presented in *Table F2-4 (Annex F)*.

With the incorporation of quiet plant, the use of movable noise barriers and limiting the number of plant operating concurrently for the construction activities, further noise reduction of up to 3 dB(A) has been achieved for the

construction of reclamation; while further noise reduction up to 4 dB(A) has been achieved for the infrastructural works.

With the implementation of the above measures, exceedances of the daytime construction noise criterion are still predicted at Golden Villa (C1), the former Union Carbide Site Tower 2 (C6), Sea Crest Villa Block 7 (C12), DD387 Lot 99 (C14a and C14b), the former San Miguel Brewery Site (C15b) and Goldenville (C16). In order to reduce the noise impacts at these NSRs, further mitigation measures are therefore required.

#### *Restriction in the Operating PME Time Usage*

In general, the percentage of time that the noisy equipment is in operation may need to be controlled so as to reduce the noise emissions during critical construction stages. In this assessment, restriction on PME usage has been tested by limiting the operating time of PMEs to 50% and 25%, with a reduction in noise emission of up to 6 dB(A) could be achieved. The proposed reduction of the operating time of certain plant is considered feasible by the Engineering Team and would still meet the intended Project implementation programme.

Table F2-5 in Annex F presents the noise levels with the implementation of all the above mitigation measures. Results predict that with all the above proposed mitigation measures in place, no exceedances at the identified NSRs.

#### **4.7.2**

#### ***Road Traffic Noise***

The assessment in Section 4.6.2 indicates that the area adjacent to the proposed Bypass and the proposed widening section of Castle Peak Road without mitigation will be affected by road traffic noise which exceed the EIAO-TM road traffic noise criteria. Mitigation measures will be necessary to alleviate the noise impacts. Figures 4.7a to 4.7b present the proposed mitigation measures at different areas of concern. Figure 4.7c presents proposed direct mitigation measures. Predicted noise levels with the implementation of suggested measures are shown in Tables G2, G3 and G4a (Annex G).

The mitigation measures were recommended in such a way to demonstrate a workable scenario to minimise the impact of traffic noise based on the development option of the Study Area and the traffic forecasts. It was considered that the direct technical remedies proposed were practical, feasible, implementable, and effective to reduce the level of noise impact at NSRs. In case residual noise impacts were identified after all the direct technical remedies were exhausted, further investigations to explore alternatives or options for reducing the residual impacts should be carried out, especially during the detailed design stage.

As a general practice in providing adequate insertion loss, the material for constructing barriers and enclosures should have a minimum surface density of 7 kg/m<sup>2</sup>.

## *Existing Noise Sensitive Receivers*

### Goldenville

Mitigation measures in the form of 5 m high vertical barriers located along the central reserve of Sham Tseng Bypass and also the southern side of eastbound Sham Tseng Bypass have been proposed. Sensitive uses at NSR N29 of Goldenville would be protected with the recommended measures. Details of the proposed mitigation measures are shown in *Table 4.7b - Item 1* and *Figure 4.7a*.

### Sea Crest Villa and DD387 Lot99

Mitigation measures in the form of a semi-enclosure located along the northern side of eastbound Sham Tseng Bypass/Castle Peak Road, promenade extension at the western end of the proposed promenade, a cantilever barrier comprising a 6 m vertical section and a 3 m horizontal section located along the central reserve of Sham Tseng Bypass/Castle Peak Road (this to be merged with the semi-enclosure) and a 3.5 m high vertical barrier along the southern side of westbound Bypass were proposed. Sensitive uses at Sea Crest Villa Blocks 7, 8, 9 and 10 (N1, N2, N3 & N4) and the residential buildings at DD387 Lot99 would be protected with the recommended measures. Details of the proposed mitigation measures are shown in *Table 4.7c - Items 2 & 3* and *Figure 4.7a*. The associated cross-section drawings of direct mitigation measures are indicated in *Figures 4.7a-1 to 4.7a-4*.

The above recommendation on extending the promenade to the western end of the Bypass is not just for noise mitigation purposes. It is a confirmed planning objective to serve other purposes, such as to facilitate visual continuity as well as to provide more amenity areas.

### Golden Villa

Mitigation measures in the form of 6 m high vertical barriers located along the northern side of Castle Peak Road and 5 m vertical barrier along the central reserve of Castle Peak Road have been proposed. Sensitive uses at NSRs N26, N27 and N28 of Golden Villa would be protected with the recommended measures. Details of the proposed mitigation measures are shown in *Table 4.7c - Item 4* and *Figure 4.7b*. The associated cross-section of direct mitigation measures at Eastern Connection is shown in *Figures 4.7b-1 & 4.7b-2*.

## *Planned Noise Sensitive Receivers*

### Educational Uses in Area 3

In order to mitigate the road traffic noise impacts on the proposed school, the use of 3m solid wall along the site boundary of the proposed school has been tested (See *Figure 4.7c*). The predicted noise levels were presented in *Table G-3*. However, the noise levels were predicted as no significant difference from the result as shown in *Table G-2*. Therefore, the scheme of using 3m boundary

wall for the proposed school has been considered to be ineffective to mitigate the exceedances of road traffic noise.

Due to the limited site area, further setback distance of the proposed school is considered impracticable. After exhausting all the above mitigation measures, the use of noise insulation and installation of air conditioning system should be implemented, as a last resort, to protect the affected NSRs. The estimated number of rooms for Indirect Technical Remedies were found to be in a total of 13 noise sensitive rooms (including 5 classrooms and 8 function-rooms).

**Table 4.7b** *Direct Mitigation Measures for Road Traffic Noise*

<b>Item</b>	<b>NSR Location</b>	<b>Mitigation Measures</b>	<b>Location of Noise Barrier, approximate chainages</b>
1	Goldenville	(1) 5 m vertical barrier along the central reserve of Sham Tseng Bypass, in absorptive material	(1) 30 m long starting from CH: 570 to CH: 600
		(2) 5 m vertical barrier along the southern side of eastbound Sham Tseng Bypass, in absorptive material	(2) 50 m long starting from CH: 600 to CH: 650
2	Sea Crest Villa Blocks 8, 9 & 10	(3) Semi-enclosure located along the northern side of eastbound Sham Tseng Bypass of 130 m long with cantilever 3 m from central reserve	(3) 130 m long starting from CH: 600 to CH: 725
		(4) Promenade extension along the western end (also serving planning purposes)	(4) 380 m long starting from CH: 725 to CH: 1100
3	DD 387 Lot 99	(5) 3.5 m vertical barrier along the southern side of the westbound Sham Tseng Bypass, in reflective material	(5) 100 m long starting from CH: 700 to CH: 800
4	Golden Villa	(6) 6 m vertical barrier along the northern side of Castle Peak Road eastbound, in reflective material	(6) 170 m long, relevant to CH: 2150 to CH: 2325
		(7) 5 m vertical barrier along the central reserve of Castle Peak Road, in reflective material	(7) 100 m long starting from CH: 2150 to CH: 2255

## 4.8 *EVALUATION OF RESIDUAL IMPACT*

### 4.8.1 *Construction Noise*

As can be seen from the discussions in *Section 4.7.1*, with the implementation of all the described mitigation measures, construction noise levels at all the identified NSRs were reduced to below the relevant daytime noise criteria. These mitigation measures include the use of quieter plant, the erection of movable noise barriers, the reduction in the number of plant operating in critical areas close to NSRs and the restriction in the operating PME time usage.

A summary of predicted construction noise levels resulted from the preferred mitigation measures is shown in *Table 4.8a*.

**Table 4.8a** *Predicted Construction Noise Level With Mitigation Measures (dB(A))*

<b>NSR Ref.</b>	<b>Description</b>	<b>Stage 1</b>	<b>Stage 2</b>	<b>Stage 3</b>	<b>Stage 4</b>	<b>Stage 5</b>	<b>Stage 6</b>	<b>Stage 7</b>	<b>Stage 8</b>	<b>Stage 9</b>
C1	Golden Villa	-	-	50	54	67	67	67	67	67
C2	Sham Tseng Tung Tsuen	-	-	58	60	61	60	60	59	55
C3	Sham Tseng Tung Tsuen	-	-	53	56	58	56	56	55	49
C4	Rhine Terrace	-	-	55	59	60	58	58	56	49
C5	Rhine Garden Tower 5	-	-	53	57	57	55	55	54	-
C6	Former Union Carbide Site Tower 2	-	64	71	75	74	71	71	71	57
C7	Lido Garden Tower 3	63	69	71	73	64	61	67	58	57
C8	Sham Tseng Village	61	61	56	60	64	58	62	57	57
C9	Sham Tseng Kau Tsuen	-	57	53	57	58	53	50	47	47
C10	Sea Crest Villa Block 1	62	62	63	65	67	57	63	59	59
C11	Sea Crest Villa Block 5	66	62	57	59	62	60	59	61	61
C12	Sea Crest Villa Block 7	70	66	54	56	64	65	62	63	63
C13	Pai Min Kok Village 13A	69	64	55	57	62	63	58	61	61
C14a	DD 387 Lot 99	65	59	-	-	70	70	70	70	70
C14b	DD 387 Lot 99	65	59	-	-	73	73	73	73	73
C15a	Former San Miguel Brewery Site	60	73	68	70	60	57	63	54	54
C15b	Former San Miguel Brewery Site	59	67	72	75	68	66	67	65	56
C16	Goldenville	-	-	-	-	73	-	-	-	-
C17	Dragon Garden	-	-	-	-	62	-	-	-	-
C18	Sea Crest Villa Block 11	-	-	-	-	56	-	-	-	-
C19	Victoria Valerie's Court	-	-	-	-	61	-	-	-	-
C20	Villa Alfavista	-	-	-	-	66	-	-	-	-



A summary of the recommended mitigation measures for each construction activities is presented in *Table 4.8b* below.

**Table 4.8b** *Summary of Proposed Mitigation Measures for Construction Noise Assessment*

Activity ID	Description	Mitigation Measures
<b>Reclamation Phase 1</b>		
101	Dredging Underneath Seawall	Reducing the operating usage of tug boat to 25% on-time.
102	Construction of Seawall - Rock Mount	No mitigation measures required.
103	Construction of Seawall - Blockworks	No mitigation measures required.
104	Construction of Seawall - Installation of Rock Armour	No mitigation measures required.
105	Filling Behind Seawall - Forming of Sand Blanket	No mitigation measures required.
106	Filling Behind Seawall - Public Fill (+2.5 mPD)	No mitigation measures required.
107	Filling Behind Seawall - Public Fill (+2.5 mPD to +5.5 mPD)	Use of quiet PME. Movable noise barriers located close to mobile crane, excavator, grader and road roller. Reducing the operating usage of tug boat to 25% on-time.
108	Diversion and Permanent Extension of Outfall No.3 - Drainage Diversion	Use of quiet PME. Movable noise barriers located close to mobile crane and excavator.
109	Diversion and Permanent Extension of Outfall No.3 - Blockworks for Construction of Remaining Outfall	No mitigation measures required.
110	Construction of Kaito Pier and Commissioning Pier - Piling	Use of quiet PME.
111	Construction of Kaito Pier and Commissioning Pier - Deck of Kaito Pier and Other Facilities	Use of quiet PME. Movable noise barriers located close to mobile crane and concrete mixer.
<b>Reclamation Phases 2 &amp; 4</b>		
201	Decommissioning of Existing Kaito Pier	Use of quiet PME. Movable noise barriers located close to hydraulic breaker.
202	Dredging Underneath Temporary and Permanent Seawall	Reducing the operating usage of tug boat to 25% on-time.
203	Construction of Temporary Sloping Seawall	No mitigation measures required.
204	Construction of Permanent Seawall - Rock Mount	Reducing the operating usage of tug boat to 25% on-time.

<b>Activity ID</b>	<b>Description</b>	<b>Mitigation Measures</b>
205	Construction of Permanent Seawall - Blockworks	No mitigation measures required.
206	Construction of Permanent Seawall - Installation of Rock Armour	No mitigation measures required.
207	Filling Behind Phase 2 Seawall - Forming of Sand Blanket	No mitigation measures required.
208	Filling Behind Phase 2 Seawall - Installation of Vertical Drains	Use of quiet PME. Movable noise barriers located close to excavator and mobile crane.
209	Filling Behind Phase 2 Seawall - Public Filling (up to +2.5 mPD)	No mitigation measures required.
210	Filling Behind Phase 2 Seawall - Public Filling (+2.5 mPD to +5.5 mPD)	Use of quiet PME. Movable noise barriers located close to mobile crane, excavator, grader and road roller. Reducing the operating usage of tug boat to 25% on-time.
211	Surcharge Behind Phase 2 Seawall - Placement of Surcharge	Use of quiet PME. Movable noise barriers located close to grader.
212	Surcharge Behind Phase 2 Seawall - Removal of Surcharge	Use of quiet PME. Movable noise barriers located close to grader.
213	Filling Behind Phase 4 Seawall - Forming of Sand Blanket	No mitigation measures required.
214	Filling Behind Phase 4 Seawall - Installation of Vertical Drains	Use of quiet PME. Movable noise barriers located close to excavator and mobile crane.
215	Filling Behind Phase 4 Seawall - Public Fill up to +2.5 mPD	No mitigation measures required.
216	Filling Behind Phase 4 Seawall - Public Fill up to +5.5 mPD	Use of quiet PME. Movable noise barriers located close to mobile crane, excavator, grader and road roller.
217	Surcharge Behind Phase 2 Seawall - Placement of Surcharge	Use of quiet PME. Movable noise barriers located close to grader.
218	Surcharge Behind Phase 2 Seawall - Removal of Surcharge	Use of quiet PME. Movable noise barriers located close to grader.
219	Extension of Outfall No.2 - Drainage Diversion	Use of quiet PME. Movable noise barriers located close to mobile crane and excavator.
220	Extension of Outfall No.2 - Blockworks for the Construction of Remaining Outfall	No mitigation measures required.
<b>Reclamation Phase 3</b>		
301	Dredging Underneath Seawall	No mitigation measures required.

Activity ID	Description	Mitigation Measures
302	Construction of Permanent Seawall - Rock Mount	No mitigation measures required.
303	Construction of Permanent Seawall - Blockworks	No mitigation measures required.
304	Construction of Permanent Seawall - Installation of Rock Armour	No mitigation measures required.
305	Filling Behind Seawall - Forming of Sand Blanket	No mitigation measures required.
306	Filling Behind Seawall - Public Fill (+2.5 mPD)	Reducing the operating usage of tug boat to 25% on-time.
307	Filling Behind Seawall - Public Fill (+2.5 mPD to +5.5 mPD)	<p><i>Phasing Group 1:</i> Use of quiet PME. Movable noise barriers located close to mobile crane and excavator. Reducing the operating usage of barge and excavator to 50 % on-time, and tug boat to 25% on-time.</p> <p><i>Phasing Group 2:</i> Use of quiet PME. Movable noise barriers located close to grader and road roller. Reducing the number of grader to 1 and road roller to 4. Reducing the operating usage of grader to 50 % on-time.</p>
308	Construction of Temporary Diversion Channel while Topping up with Public Fill up to +2.5 mPD	<p>Use of quiet PME. Movable noise barriers located close to mobile crane and excavator. Reducing the number of excavator to 1. Reducing the operating usage of excavator and derrick lighter barge to 50% on-time.</p>
309	Construction of Western Nullah - Borepiling	No mitigation measures required.
310	Construction of Western Nullah - Excavation	<p>Use of quiet PME. Movable noise barriers located close to excavator.</p>
311	Construction of Western Nullah - Blockworks & Concrete Lining	<p>Use of quiet PME. Movable noise barriers located close to mobile crane.</p>
312	Construction of Western Nullah - Deck Slab	<p>Use of quiet PME. Movable noise barriers located close to mobile crane, concrete mixer and concrete pump. Reducing the operating usage of truck to 25% on-time.</p>

<b>Activity ID</b>	<b>Description</b>	<b>Mitigation Measures</b>
313	Construction of Eastern Nullah - Borepiling	Use of movable noise barriers located close to bore pile machine. Reducing the number of bore pile machine to 2.
314	Construction of Eastern Nullah - Excavation	Use of quiet PME. Movable noise barriers located close to excavator. Reducing the number of excavator to 2. Reducing the operating usage of excavator to 50% on-time.
315	Construction of Eastern Nullah - Blockworks & Concrete Lining	Use of quiet PME. Movable noise barriers located close to mobile crane.
316	Construction of Eastern Nullah - Deck Slab	Use of quiet PME. Movable noise barriers located close to mobile crane, concrete mixer and concrete pump. Reducing the number of mobile crane to 2 and the number of truck to 1. Reducing the operating usage of truck to 25% on-time and concrete pump to 50% on-time.
317	Construction of Eastern Nullah - Drainage Diversion	Use of quiet PME. Movable noise barriers located close to mobile crane. Reducing the number of truck to 1. Reducing the operating usage of truck to 25% on-time.
318	Extension of Outfall No.1 and 4 - Drainage Diversion - Outfall No.1	Use of quiet PME. Movable noise barriers located close to excavator. Reducing the number of both of mobile crane and excavator to 1.
319	Extension of Outfall No.1 and 4 - Drainage Diversion - Outfall No.4	Use of quiet PME. Movable noise barriers located close to mobile crane and excavator. Reducing the number of both of mobile crane and excavator to 1.
<b><i>Infrastructural Works</i></b>		
401	Bypass/Promenade Foundation - Phase 1	Use of quiet PME. Movable noise barriers located close to piling machine, concrete mixer and mobile crane. Reducing the number of piling machine to 3 and the number of truck to 1. Reducing the operating usage of truck to 25% on-time.

Activity ID	Description	Mitigation Measures
402	Bypass/Promenade Foundation - Phase 2	<p>Use of quiet PME.</p> <p>Movable noise barriers located close to piling machine, concrete mixer and mobile crane.</p> <p>Reducing the operating usage of truck to 25% on-time.</p>
403	Bypass/Promenade Foundation - Phase 3	<p>Use of quiet PME.</p> <p>Movable noise barriers located close to piling machine, concrete mixer and mobile crane.</p> <p>Reducing the number of piling machine to 3 and the number of truck to 1.</p> <p>Reducing the operating usage of truck to 25% on-time.</p>
404	Bypass/Promenade Foundation - Phase 4	<p>Use of quiet PME.</p> <p>Movable noise barriers located close to piling machine, concrete mixer and mobile crane.</p>
405	Construction of Bypass	<p><i>Phasing Group 1:</i></p> <p>Use of PME.</p> <p>Movable noise barriers located close to excavator.</p> <p>Reducing the operating usage of truck to 25% on-time.</p> <p><i>Phasing Group 2:</i></p> <p>Use of PME.</p> <p>Movable noise barriers located close to road roller, asphalt paver and loader.</p> <p>Reducing the operating usage of lorry to 25% on-time.</p>
406	Construction of Road Works, Drains and Watermains, Phase 1	<p>Use of quiet PME.</p> <p>Movable noise barriers located close to excavator, road roller, asphalt paver, loader, mobile crane and concrete lorry mixer.</p> <p>Reducing the number of truck to 1.</p> <p>Reducing the operating usage of both of truck and lorry to 25% on-time.</p>
407	Construction of Road Works, Drains and Watermains, Phase 2	<p>Use of quiet PME.</p> <p>Movable noise barriers located close to excavator, road roller, asphalt paver, loader, mobile crane and concrete lorry mixer.</p> <p>Reducing the operating usage of both of truck and lorry to 25% on-time.</p>

Activity ID	Description	Mitigation Measures
408	Construction of Road Works, Drains and Watermains, Phase 3	<p>Use of quiet PME.</p> <p>Movable noise barriers located close to excavator, road roller, asphalt paver, loader, mobile crane and concrete lorry mixer.</p> <p>Reducing the operating usage of both of truck and lorry to 25% on-time.</p>
409	Construction of Road Works, Drains and Watermains, Phase 4	<p>Use of quiet PME.</p> <p>Movable noise barriers located close to excavator, road roller, asphalt paver, loader, mobile crane and concrete lorry mixer.</p> <p>Reducing the operating usage of both of truck and lorry to 25% on-time.</p>
410	Construction of Slip Road B - Underpass	<p><i>Phasing Group 1:</i></p> <p>Use of PME.</p> <p>Movable noise barriers located close to piling machine, concrete lorry mixer, concrete pump and excavator.</p> <p>Reducing the number of both of excavator and truck to 1.</p> <p>Reducing the operating usage of both of concrete lorry mixer and excavator to 50% on-time, and truck to 25% on-time.</p> <p><i>Phasing Group 2:</i></p> <p>Use of quiet PME.</p> <p>Movable noise barriers located close to mobile crane, loader, asphalt paver and road roller.</p> <p>Reducing the operating usage of mobile crane, loader, asphalt paver and road roller to 50% on-time.</p>
411	Construction of Slip Road B - Open Section	<p>Use of quiet PME.</p> <p>Movable noise barriers located close to excavator, truck, mobile crane, loader, asphalt paver and road roller.</p> <p>Reducing the number of both of excavator and truck to 1.</p> <p>Reducing the operating usage of truck to 25% on-time.</p>
412	Drainage Network	<p>Use of quiet PME.</p> <p>Movable noise barriers located close to excavator and mobile crane.</p> <p>Reducing the operating usage of both of excavator and mobile crane to 50% on-time and truck to 25% on-time.</p>
413	Sewerage Network	<p>Use of quiet PME.</p> <p>Movable noise barriers located close to excavator and mobile crane.</p>

Activity ID	Description	Mitigation Measures
414	Sewage Pumping Station, Area 4	Use of quiet PME. Movable noise barriers located close to excavator and mobile crane. Reducing the operating usage of truck to 25% on-time.
415	Water Main Reprovision	Use of quiet PME. Movable noise barriers located close to excavator, concrete mixer, bulldozer and road roller. Reducing the operating usage of both of truck and tug boat to 25% on-time.
416	Salt Water Pumping Station, Area 1	Use of quiet PME. Movable noise barriers located close to piling machine, excavator, air compressor, breaker, generator, concrete lorry mixer, poker vibrator, bar bender and cutter, mobile crane and circular saw.
417	Sewage Treatment Facilities for Sham Tseng Development, Area 6	Use of quiet PME. Movable noise barriers located close to piling machine, excavator and concrete mixer. Reducing the operating usage of truck to 50% on-time.
418	Government Complex, Area 6	Use of quiet PME. Movable noise barriers located close to piling machine, excavator, air compressor, hand-held breaker, generator, concrete lorry mixer, poker vibrator, bar bender and cutter, mobile crane and circular saw. Reducing the operating usage of both of truck and lorry to 50% on-time.

#### 4.8.2

#### *Road Traffic Noise*

According to the assessment result, it is estimated that approximately 575 existing NSRs dwellings would be affected by traffic noise impact and in which around 250 dwellings would be protected and also around 250 dwellings would be benefited by the recommended noise mitigation measures. Residual impacts were predicted at about 325 dwellings due to existing road contribution.

With the implementation of the recommended mitigation measures, all the planned NSRs would be in compliance with the relevant road traffic noise criteria except for the planned NSRs in Area 3.

For the planned Area 3 NSRs for educational uses, it is predicted that approximately 13 noise sensitive rooms (NSRs N152 to N155) would require indirect technical remedies in the form of window insulation and air conditioning. Operational noise criterion for these premises is 65 dB(A).

In any case, the exact requirement of mitigation measures for the about educational uses will be subject to the assessment result, in accordance with the Class Assessment Document issued by the Architectural Services Department, during the stage of the Preliminary Project Feasibility Study.

#### **4.9 ENVIRONMENTAL MONITORING AND AUDIT**

Noise produced during the construction phase will impact upon nearby NSRs as assessed in *Section 4*. The construction noise criteria of 75 dB(A) and 70 dB(A) may be exceeded at some of the representative NSRs. Hence, noise mitigation measures were recommended to reduce the noise impact whenever possible as presented in *Table 4.8b* in *Section 4.8.1*.

Environmental monitoring and audit for operational noise is required to ensure the traffic noise criteria is complied at the NSRs.

EM&A locations and requirements are discussed in *Section 13.3* and the separate EM&A Manual.

#### **4.10 CONCLUSION**

##### **4.10.1 Construction Phase**

Unmitigated construction activities of Sham Tseng Development would cause exceedances of the daytime construction noise criteria at most of the nearby NSRs during the normal working hours. The most affected areas are the residential buildings at the former Union Carbide Site, DD 387 Lot 99, the former San Miguel Brewery Site and Goldenville.

Therefore, adequate control measures will be necessary for the construction works to minimise the associated noise impact. Mitigation measures including the use of quiet plant, on-site movable noise barriers, limiting the number of plant operating concurrently and restricting the operating PME time usage to 50% and 25% are required. With the implementation of all the recommended mitigation measures, construction noise levels at all the identified NSRs were predicted to fall within the relevant criteria. It is also recommended that regular monitoring of noise at NSRs will be required during the construction phase.

##### **4.10.2 Operational Phase**

This assessment has predicted that the traffic noise levels from the proposed development at year 2019 will result in exceedances of the road traffic noise



criterion at some of the existing NSRs in Sea Crest Villa, Goldenville, Dragon Garden, Golden Villa and the planned educational uses in Area 3.

The best practicable mitigation package is recommended to comply with the road traffic noise criterion, comprising a combination of 3.5 m and 6 m high roadside vertical barriers, cantilever noise barriers of 6 m vertical section and 3 m horizontal section, semi-enclosure and extension of the promenade at the western end. Details of direct mitigation measures on road traffic noise are shown in *Table 4.7b*, and *Figures 4.7a to 4.7d*.

Residual impacts at the identified receivers with the implementation of the recommended direct mitigation measures have been assessed. The assessment indicates that 13 noise sensitive rooms in the planned Area 3 secondary school would require indirect technical remedies in the form of window insulation and air-conditioning.

Noise impacts from the identified fixed noise sources would not be insurmountable to the nearby NSRs provided that the SWLs from the different fixed plants did not exceed the maximum permissible SWLs as indicated in *Table 4.6e*.