

## 5 Noise

### 5.1 Legislation, Standards and Guidelines

#### 5.1.1 General

**5.1.1.1** The relevant legislation and associated guidance applicable to the present study for the assessment of noise impact include:

- Noise Control Ordinance (NCO) (Cap.400);
- Environmental Impact Assessment Ordinance (EIAO) (Cap. 499);
- Technical Memoranda (TM) on Noise from Construction Work other than Percussive Piling (TM-GW);
- TM on Noise from Percussive Piling (TM-PP); and
- TM on Noise on Construction Work in Designated Areas (TM-DA); and
- TM on Noise from Places other than Domestic Premises, Public Places or Construction Sites (TM-Places); and
- Technical Memorandum on Environmental Impact Assessment Process (TM-EIAO).

#### 5.1.2 Construction Noise

##### Construction Noise during Normal Hours

**5.1.2.1** The NCO provides the statutory framework for noise control in Hong Kong. Assessment procedures and standards are set out in the respective TM promulgated under NCO.

**5.1.2.2** To ensure a better environment, the TM-EIAO promulgated under the EIA Ordinance has imposed more stringent criteria. For construction, there is no statutory limit on daytime construction noise under the NCO and related TMs. There is statutory control on construction noise during daytime on general holidays (including Sundays). Nevertheless, the TM-EIAO stipulates criteria of 65 - 75dB(A) for daytime construction activities, as shown in the following **Table 5.1**.

**Table 5.1** Noise standards for daytime construction activities

Uses	Noise Standards <sup>[1], [2]</sup> , $L_{eq}$ (30 mins) dB(A)
	0700 – 1900 hours on any day not being a Sunday or general holiday
All domestic premises including temporary housing accommodation	75

Uses	Noise Standards <sup>[1], [2]</sup> , $L_{eq}$ (30 mins) dB(A)
	0700 – 1900 hours on any day not being a Sunday or general holiday
Hotel and hostels	75
Educational institutions including kindergartens, nurseries and all others where unaided voice communication is required	70 65 (During examination)

Note:

[1] The above standards apply to uses that rely on opened windows for ventilation.

[2] The above standards should be viewed as the maximum permissible noise levels assessed at 1m from the external facade.

### **Construction Noise during Restricted Hours**

**5.1.2.3** The NCO also provides statutory control on general construction works during restricted hours (i.e. 1900 to 0700 hours (of the next day) from Monday to Saturday and at any time on Sundays or public holidays). The use of Powered Mechanical Equipment (PME) for construction works during restricted hours would require a Construction Noise Permit (CNP). The TM-GW details the procedures adopted by Environmental Protection Department (EPD) for assessing such application. The granting of a CNP is subject to conditions stated in the CNP and it may be revoked at any time for failure to comply with the permit conditions.

**5.1.2.4** In addition to the general controls on the use of PME during restricted hours, the use of Specified Powered Mechanical Equipment (SPME) and the undertaking of Prescribed Construction Work (PCW) during the restricted hours in a designated area are controlled by the TM-DA. Construction plant or equipment classified as SPME under the TM-DA includes hand-held breakers, bulldozers, concrete lorry mixers, dump trucks and vibratory pokers. The PCW includes the erection or dismantling of formwork or scaffolding, hammering, loading, unloading or handling of rubble, wooden boards, steel bars, wood or scaffolding material, and the disposal of rubble through plastic chutes.

**5.1.2.5** The TM-DA details the procedures that should generally be adopted by the Noise Control Authority for assessing the use of SPME during restricted hours and for determining whether a CNP would be issued.

**5.1.2.6** Maximum noise levels from construction activities during restricted hours at affected Noise Sensitive Receivers (NSRs) are controlled under the TMs and shall not exceed the specified Acceptable Noise Levels (ANLs). These ANLs are stipulated in accordance with the Area Sensitivity Ratings (ASRs) established for the NSRs. The ANLs for

construction works in Designated Areas are more stringent than those given in the TM-GW and summarized in **Table 5.2**.

**Table 5.2** ANLs for construction during restricted hours

Time Period	ANL, dB(A)		
	ASR A	ASR B	ASR C
All weekdays during the evening (1900 to 2300 hours), and general holidays (including Sundays) during the day-time and evening (0700 to 2300 hours)	60 (45)	65 (50)	70 (55)
All days during the night-time (2300 to 0700 hours)	45 (30)	50 (35)	55 (40)

Note:

[1] Figures in brackets are ANLs for SPME construction work in designated areas.

**5.1.2.7** As defined in Noise Control Designated Area Plan No. EPD/AN/NT-02, Fortune Garden, Casa Brava etc. are within the Designated Area. However, the works area under the Project is not within the Designated Area.

**5.1.2.8** Despite any description made in this EIA, there is no guarantee that a CNP will be issued for the project construction. The Noise Control Authority will consider a well-justified CNP application, once filed, for construction works within restricted hours as guided by the relevant TMs issued under the NCO. The Noise Control Authority will take into account contemporary conditions / situations of adjoining land uses and any previous complaints against construction activities at the Project Site before making a decision in granting a CNP. Nothing in this EIA report shall bind the Noise Control Authority in making a decision. If a CNP is to be issued, the Noise Control Authority shall include in it any conditions demand. Failure to comply with any such conditions will lead to cancellation of the CNP and prosecution under the NCO. According to the proposed construction methodology for the Project, night-time construction is not anticipated.

### **Percussive Piling**

**5.1.2.9** Under the TM-PP, CNPs are also required for percussive piling involving the use of diesel, pneumatic and / or steam hammer. This TM specifies the permitted hours and other conditions for percussive piling. **Table 5.3** lists the acceptable percussive piling noise levels for various types of NSR.

**Table 5.3** ANLs for percussive piling

NSR Window Type or Means of Ventilation	ANL, dB(A)
(i) NSR (or part of NSR) with no window or other opening	100
(ii) NSR with central air conditioning system	90
(iii) NSR with windows or other openings but without central air conditioning system	85

**5.1.2.10** Depending on the numbers and types of piling machines and the separation from NSRs, percussive piling may be restricted to 12, 5 or 3 hours per day. For NSRs that are particularly sensitive to noise, such as hospitals, medical clinics, educational institutions and courts of law, a further reduction of 10 dB(A) shall be applied to the above ANLs. According to the proposed construction methodology for the Project, percussive piling is not anticipated.

### 5.1.3 Operational Noise

**5.1.3.1** The TM-EIAO (Annex 5 of TM) has stipulated the noise standards for various noise sources as shown in **Table 5.4**. It should, however, be noted that the following noise criteria are only applicable to uses that rely on opened windows for ventilation.

**Table 5.4** Noise standards for operational phase

Common Uses	Noise Standards <sup>[1], [2]</sup>				
	Aircraft Noise (Noise Exposure Forecast: NEF)	Helicopter Noise L <sub>max</sub> dB(A) 0700-1900 hours	Road Traffic Noise L <sub>10</sub> (1hour) dB(A)	Rail Noise	Fixed Noise Sources
All domestic premises including temporary housing accommodation	25	85	70	(a) The appropriate ANLs shown in Table 2 of the Technical Memorandum for the Assessment of Noise from Places Other than Domestic Premises, Public Places or Construction Sites and (b) L <sub>max</sub> (2300-0700 hours) = 85dB(A)	(a) 5dB(A) below the appropriate ANLs shown in Table 2 of the Technical Memorandum for the Assessment of Noise from Places Other than Domestic Premises, Public Places or Construction Sites, or (b) the prevailing background noise levels (For quiet areas with level 5 dB(A) below the ANL)
Hotel and hostels	25	85	70		
Offices	30	90	70		
Educational institutions including kindergartens, nurseries and all others where unaided voice communication is required	25	85	65		
Places of public Worship and courts of law	25	85	65		
Hospitals, clinics, convalescences and homes for the aged, diagnostic rooms, wards	25	85	55		

Notes:

[1] The above standards apply to uses that rely on opened windows for ventilation.

[2] The above standards shall be viewed as the maximum permissible noise levels assessed at 1m from the external facade.

### **Fixed Noise Sources**

**5.1.3.2** Operational noise from fixed noise sources is controlled under the TM-Places. To plan for a better environment, the TM-EIAO has specified the following requirements for the planned fixed noise sources, whichever is more stringent.

- 5dB(A) below the appropriate ANLs in the TM-Places; or
- the prevailing background noise levels (For quiet areas with level 5dB(A) below the ANL).

**5.1.3.3** Besides, ANL stipulated in the TM-Places has been adopted in the evaluation of potential cumulative fixed noise sources impact assessment from existing and planned fixed noise sources.

**5.1.3.4** The ANLs for different ASRs during different periods are summarised in **Table 5.5**.

**Table 5.5** ANLs for fixed noise sources

Time Period	ANL, dB(A)		
	ASR A	ASR B	ASR C
Day (0700 to 1900 hours)	60	65	70
Evening (1900 to 2300 hours)	60	65	70
Night (2300 to 0700)	50	55	60

**5.1.3.5** For assessing fixed noise sources, the ASRs at the NSRs are defined in accordance with TM-Places. More details are discussed in **Section 5.5**.

### **Road Traffic Noise**

**5.1.3.6** The Project itself is not a pollution source and the potential road traffic noise impact would be from the small amount of induced traffic. As advised by the Traffic Engineer, there would be an induced traffic of around 120 vehicles during peak hour of the operation of the Project which is equivalent to about 10% of that along Ting Kok Road at the same period in Year 2024 (i.e. commencement year). The predicted road traffic noise level at the most exposed facade at Fortune Garden adjacent and facing the access road is 68dB(A) and hence will be less than the criterion of  $L_{10\ 1\ hour}$  70 dB(A). Adverse road traffic noise impact is not anticipated.

## **5.2 Description of the Environment**

### **5.2.1 Existing Environment**

**5.2.1.1** As discussed in **Section 1**, the location of the Project is approximately 53 ha (**Figure 1.1**). It is bounded by Ting Kok Road to the north, Tai Po Industrial Estate (TPIE) to the west and Tolo Harbour to the east and

south. The environ in the vicinity is affected by road traffic from Ting Kok Road and industrial operations in TPIE.

## 5.2.2 Prevailing Noise Levels

**5.2.2.1** Prevailing noise levels have been measured in the Project Site in January and July 2018 during daytime, evening and night-time periods. Based on the layout as shown in **Figure 5.1**, the fixed noise source during operational phase at the Project Site include the four pumping stations, relocated leachate pumping station and the plant room exhaust of the ancillary facilities. **Figure 5.1** shows the location of prevailing noise measurements. A summary of the results is given in the **Table 5.6**.

**Table 5.6** Prevailing noise measurements

Monitoring Location <sup>[1]</sup>	Prevailing Noise Levels, dB(A)		
	Day <sup>[5]</sup>	Evening <sup>[5]</sup>	Night <sup>[5]</sup>
East of Shuen Wan Landfill PNM-1 <sup>[2]</sup>	42 – 48	42 – 44	40 – 42
Casa Brava PNM-2 <sup>[3]</sup>	67 – 69	63 - 65	57 - 58
Planned Residential Site PNM-3 <sup>[4]</sup>	48 - 50	47 - 48	45 - 47

Notes:

[1] PNM represents prevailing noise measurement location.

[2] Measurements conducted without facade correction in January 2018.

[3] Measurements conducted without facade correction in July 2018.

[4] Measurements conducted without façade correction in October 2018.

[5] Day: 0700 to 1900 hours, Evening: 1900 to 2300 hours, Night: 2300 – 0700 hours.

[6] The noise measurement descriptor is A-weighted equivalent continuous sound pressure level ( $L_{eq}$ ) measured using Type 1 sound level meter. A series of measurements with duration of 20-30 minutes were taken which were steady and representative of prevailing background noise.

## 5.3 Noise Sensitive Receivers

**5.3.1.1** With reference to Annex 13 of the TM-EIAO, NSRs shall include residential uses (all domestic premises including temporary housing), institutional uses (educational institutions including kindergartens and nurseries), hospitals, medical clinics, homes for the aged, convalescent homes, places of public worship, libraries, courts of law, performing arts centres, auditoria and amphitheatres, country parks and others.

**5.3.1.2** The assessment area for noise impact should generally be defined by a distance of 300m from the Project boundary and the associated works. Representative NSRs within 300m from the boundary of the Project and the works of the Project have been identified with the first layer of NSRs selected for assessment. These NSRs include both the existing and committed and planned sensitive developments during both construction and operational phases.

**5.3.1.3** The representative existing and committed and planned NSRs are identified by means of reviewing topographic maps, aerial photos, land status plans, relevant Outline Zoning Plans (OZP) (Draft Tai Po OZP

No.S/TP/27), Development Permission Area Plans, Outline Development Plans, Layout Plans and other relevant published land use plans, including plans and drawings published by Lands Department and any land use and development applications approved by the Town Planning Board, and supplemented by site inspections. Photos of the representative existing NSRs are shown in **Appendix 5.1**.

### **Provision of Option for Staff Quarters and Overnight Accommodations**

**5.3.1.4** As discussed in **Section 2**, in order to allow for more flexible uses and development of the Project to suit contemporary circumstances and operational requirements, the provision for staff quarters and overnight accommodations have been duly considered.

**5.3.1.5** These staff quarters and overnight accommodations are strategically located close to and overlooking onto the east and south seafront instead of Ting Kok Road and the Tai Po Industrial Estate. The separation distances from Ting Kok Road and Tai Po Industrial Estate are about 350 – 780m and 320 – 520m respectively. Besides, all the staff quarters and overnight accommodations are 1-2 storeys only and the upper roof structures are built into the slope and form part of the golf course. Hence, both the staff quarters and overnight accommodations would be substantially screened by the proposed golf course terrain which would reach a maximum height of about 42mPD.

**5.3.1.6** The representative NSRs identified are summarised in **Table 5.7** and their locations are shown in **Figure 5.1**.

**Table 5.7** Existing, committed and planned representative NSRs

NSR <sup>[1]</sup>	Uses <sup>[2]</sup>	No. of Storey <sup>[3]</sup>	Approx. Distance from Project Site (m)
<b>Existing NSRs</b>			
Fortune Garden	R	3	35
Casa Brava	R	3	200
Village House at 53 Ting Kok Road	R	3	110
Casa Marina I	R	3	225
<b>Planned NSRs</b>			
Planned Residential Site <sup>[4]</sup>	R	5 <sup>[5]</sup>	170
Planned Staff Quarters and Overnight Accommodation <sup>[6]</sup>	R	1 – 2	Within the project boundary

Note:

[1] The assessment will only include NSRs which rely on opened windows for ventilation.

[2] R – Residential premises.

[3] The no. of storeys only accounts for residential floors.

[4] The planned NSR will only be considered during operational phase (i.e. fixed noise sources from the Project Site).

[5] The maximum allowable building height (in number of storeys) stated in the OZP.



[6] All the planned staff quarters and overnight accommodation will be facing southeast within the ancillary facilities and rely on opened windows for ventilation. In addition, all the planned staff quarters and overnight accommodation will be located more than 300m from Ting Kok Road to the north, 700m from cement works to the east, more than 300m from TPIE to the west with screening of existing topography at the centre part of the Project Site. There would be no line of sight from the planned staff quarters and overnight accommodation to Ting Kok Road. Hence, adverse road traffic noise impacts and existing fixed noise sources impacts are not anticipated. Section drawings of the planned staff quarters and overnight accommodation are given in **Appendix 5.10**. There will be a small barge travel along eastern side of the Project Site at about 250m (See also **Section 3.5.4** for details). Based on site visits in January, July and October of 2018, marine traffic noise is not noticeable and hence marine traffic noise impacts are not anticipated. Considering the small barge will be manoeuvring at about 250m with low speed, marine traffic impacts are not anticipated.

## 5.4 Construction Noise Assessment

### 5.4.1 Construction Noise Impact Assessment Methodology

**5.4.1.1** Construction noise assessment has been conducted based on the following procedures:

- Determine the assessment area which includes an area within 300m from the site boundary of the Project and associated works;
- Identify and locate representative NSRs that may be affected by the works;
- Obtain the construction method and work sequence for the construction period;
- Obtain the construction plant inventory for each corresponding construction work sequence;
- Determine the Sound Power Levels (SWLs) of the plant items according to the information stated in the TM-GW or other recognized sources of reference, where appropriate;
- Calculate the correction factors based on the distance between the NSRs and the notional noise source positions of the worksites;
- Apply corrections for façade, distance, barrier attenuation, acoustic reflection where applicable;
- Predict construction noise levels at the NSRs;
- Quantify the level of impact at the NSRs, in accordance with TM-GW;
- Predict the cumulative noise impacts for any concurrent construction works in the vicinity of the proposed work;
- For any exceedance of noise criteria, all practical mitigation measures such as alternative construction methodology, quiet plant, silencer, enclosure, etc, shall be examined to alleviate the predicted noise impacts as much as practicable;



- The feasibility, practicability, programming and effectiveness of the recommended mitigation measures will be assessed. Any direct mitigation measures recommended will be documented in the report. Specific reasons for not adopting certain direct mitigation measures to reduce the noise to a level meeting the criteria in the TM or to maximize the protection for the NSRs as far as possible will be clearly substantiated and;
- Upon exhausting all direct mitigation measures and the mitigated noise impact still exceeds the relevant criteria in Annex 5 of the TM, residual construction noise impact will be identified, predicted and evaluated in accordance with section 4.4.3 of the TM; and
- Consideration of noise mitigation measures will follow Annex 13 of TM-EIAO and EIAO Guidance Note “Preparation of Construction Noise Impact Assessment under the Environmental Impact Assessment Ordinance” [GN 9/2010].

## 5.4.2 Identification of Construction Noise Impact

### Identification of Assessment Area and Noise Sensitive Receivers

- 5.4.2.1** For construction noise assessment, the assessment area includes those within 300m from the boundary of the Project and the works of the Project. Representative NSR locations that would be affected by the construction activities have been selected from **Table 5.7**. They are also shown in **Figure 5.1**.

### Inventory of Noise Sources

- 5.4.2.2** Key construction activities have been identified for noise assessment. The major construction works would include the following activities:

- Site formation;
- Vegetation cutting and trimming;
- Construction of access road with water storage tanks below;
- Construction of water mains at Ting Kok Road; and
- Construction of ancillary facilities.

- 5.4.2.3** Five potential concurrent projects have been identified in **Section 2.11** which includes the following:

- Shuen Wan Landfill Restoration Contract;
- Food Waste Pre-treatment Facilities for Food Waste/Sewage Sludge Anaerobic Co-Digestion Pilot Trial in Tai Po Sewage Treatment Works (TPSTW);
- Upgrading of Sewage Pumping Stations and Sewerage along Ting Kok Road;
- Columbarium Development at Shuen Wan Landfill, Tai Po; and

- Development of a Bathing Beach at Lung Mei, Tai Po.

**5.4.2.4** Construction works for the Shuen Wan Landfill Restoration Contract were completed in November 1997, and so cumulative construction noise impact is not anticipated. The Food Waste Pre-treatment Facilities for Food Waste/Sewage Sludge Anaerobic Co-Digestion Pilot Trial is scheduled to be completed in January 2019. Since construction works for the Project will commence in early 2021, there will be no overlap between the two projects, and cumulative construction noise impact is not anticipated.

**5.4.2.5** The upgrading works for the sewage pumping station and sewerage along Ting Kok Road will commence in late 2018 and is anticipated to be completed by 2022. Refer to the project profile “Agreement No. CE 8/2014(DS) Upgrading of Sewage Pumping Stations and Sewerage along Ting Kok Road – Investigation, Design and Construction”, the Contractor will schedule and coordinate on-site to avoid overlapping of major noisy construction activities with other concurrent projects.

**5.4.2.6** The Columbarium Development project is still under planning stage and the programme is yet to be confirmed. On the other hand, the bathing beach at Lung Mei is situated more than 3km away from the Project. Therefore, cumulative construction noise impact during from these projects are not included.

#### **Utilization Rates and SWLs of Powered Mechanical Equipment**

**5.4.2.7** Practically, the PME's will not be operating for all times within a worksite. The utilization rates would depend on the construction sequences, work fronts scale and construction nature. **Appendix 5.2** tabulates the adopted utilisation rates. The construction plant inventory has been developed together with the construction programme to achieve the completion dates as given in **Appendix 2.2** of the EIA Report. The construction sequence / programme, zoning arrangement for construction activities, inventory and utilization rates of PME's, etc. have been reviewed by the Engineer and confirmed to be practicable.

### **5.4.3 Prediction and Evaluation of Construction Noise Impact**

#### **Phases of Construction**

**5.4.3.1** As discussed in above section, the construction activities include site clearance, formation, construction of access road, water mains, water storage tanks, ancillary facilities, etc. The construction programme with phases of construction has been given in **Appendix 2.2**. Based on the latest construction programme, construction is expected to commence in early 2021 and will be completed in late 2023. The whole duration will be about 36 months. Since the Project Site is about 53ha, and there will be three stages, the works will be further subdivided into different works area as shown in **Appendix 5.4**.

#### **Scenarios**

**5.4.3.2** An in-house program has been used for construction noise calculations. Initially, program runs were conducted without any mitigation

measures (i.e. the “Unmitigated Scenario”). Where noise level exceedance was identified, further runs would be made assuming different combinations of mitigation measures to be incorporated (i.e. the “Mitigated Scenario”).

### **Prediction of Noise Impact**

**5.4.3.3** According to the latest engineering design, construction would mainly comprise activities including site clearance, formation, construction of access road, water mains, water storage tanks, ancillary facilities, etc. as described in **Section 5.4.2**. The corresponding SWLs of these activities have been estimated according to the PME’s SWLs and the assessment methodology in the TM-GW. **Appendix 5.2** presents the SWLs for each PME. **Appendix 5.3** gives the plant inventory adopted for each workfront and **Appendix 5.4** shows the locations of workfronts adopted for this construction noise assessment.

**5.4.3.4** **Appendix 5.5** presents the calculated construction noise impacts at selected representative NSRs under unmitigated scenario. The predicted construction noise impacts at the NSRs under unmitigated scenario are summarised in **Table 5.8**.

**Table 5.8** Predicted construction noise impact at NSRs under unmitigated scenario (Project only)

NSR <sup>[1]</sup>	NAP <sup>[2]</sup>	Uses <sup>[3]</sup>	L <sub>eq</sub> (30 mins), dB(A)		
			Criterion	Unmitigated Noise Level	Exceedance
Fortune Garden	N1 – 01	R	75	86	11
	N1 - 02	R	75	85	10
	N1 - 03	R	75	85	10
Village House at 53 Ting Kok Road	N2 – 01	R	75	83	8
Casa Brava	N3 – 01	R	75	74	-
Casa Marina I	N4 – 01	R	75	76	1

Note:

[1] The assessment will only include NSRs which rely on opened windows for ventilation.

[2] NAP – Noise assessment point.

[3] R – Residential premises.

**5.4.3.5** It can be seen from the above **Table 5.8** that without any mitigation measures, exceedances of noise criteria range from 1 to 11 dB(A) for existing residential premises. Mitigation measures are therefore required.

**5.4.3.6** The total number of dwellings, classrooms and other noise sensitive receivers that will be exposed to noise impact exceeding the criteria set in Annex 5 in the TM-EIAO have been calculated. It is predicted that a

total of about 25 dwellings will be exposed to construction noise impact under unmitigated scenario.

## 5.4.4 Mitigation of Construction Noise Impact

**5.4.4.1** The predicted noise levels show that the unmitigated construction noise impacts would exceed the daytime noise criteria. Mitigation measures are therefore required. The following mitigation measures have been considered:

- Good site practices to limit noise emissions at the source;
- Use of quality powered mechanical equipment (QPME);
- Use of temporary noise barriers to screen noise from relatively static PMEs; and
- Alternative use of plant items within one worksite, wherever practicable.

**5.4.4.2** The above mitigation measures would need to be implemented in worksites as good practices where appropriate. Detailed descriptions of these mitigation measures are given in the following sections.

### **Good Site Management Practices**

**5.4.4.3** Good site practice and noise management techniques could considerably reduce the noise impact from construction site activities on nearby NSRs. The following measures should be practised during each phase of construction.

- only well-maintained plant should be operated on-site and plant should be serviced regularly during the construction programme;
- machines and plant (such as trucks, breakers) 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, where possible, be orientated so that the noise is directed away from nearby NSRs;
- silencers or mufflers on construction equipment should be properly fitted and maintained during the construction works;
- mobile plant should be sited as far away from NSRs as possible and practicable; and
- material stockpiles, site office and other structures should be effectively utilised, where practicable, to screen noise from on-site construction activities.

**5.4.4.4** The benefits of these techniques can vary according to specific site conditions and operations. The environmental noise climate would certainly be improved with these control practices, although the

improvement can only be quantified during implementation when specific site parameters are known.

### **Use of Quality Powered Mechanical Equipment**

**5.4.4.5** The use of quiet plant associated with the construction works is made reference to the PME listed in the QPME system and other commonly used PME listed in EPD web pages as far as possible. It is generally known (supported by field measurement) that particular models of construction equipment are quieter than standard types given in the TM-GW. Whilst it is generally considered too restrictive to specify that the Contractor has to use specific models or items of plant, it is reasonable and practicable to set plant noise performance specifications for specific PME so that some flexibility in selection of plant is allowed. A pragmatic approach would be to request that the Contractor independently verifies the noise level of the plant proposed to be used and demonstrates through furnishing of these results, that the plant proposed to be used on the Project Site meets the requirements.

### **Use of Movable Noise Barrier for Relatively Fixed Plant Source**

**5.4.4.6** Movable temporary noise barriers that can be located close to noisy plant and be moved concurrently with the plant along a worksite can be very effective for screening noise from NSRs. A typical design which has been used locally is a wooden framed barrier with a small-cantilevered upper portion of superficial density no less than  $7\text{kg/m}^2$  on a skid footing with 25mm thick internal sound absorptive lining. This measure is particularly effective for low level zone of NSRs. A cantilevered top cover would be required to achieve screening benefits at upper floors of NSRs.

**5.4.4.7** Movable temporary noise barriers will be used for some PME (e.g. excavator). It is anticipated that suitably designed barriers could achieve at least 5dB(A) reduction for movable plant.

**5.4.4.8** The feasibility, practicability, programming and effectiveness of the above mitigation measures have been reviewed by engineer.

**5.4.4.9** A summary of the movable temporary noise barrier adopted for various PMEs is given in **Appendix 5.2** and indicative drawing for is shown in **Appendix 5.6**, and the associated noise reduction is summarised in **Table 5.9**.

**Table 5.9** Summary of barrier adopted for PMEs

PME	Attenuation, dB(A)
Excavator, wheeled/tracked	-5
Loader, wheeled	-5
Road roller	-5
Dump truck (5.5 tonne < gross vehicle weight ≤ 38 tonne)	-5
Crane, mobile/barge mounted (diesel)	-5
Lorry, 5.5 tonnes < gross vehicle weight ≤ 38 tonnes	-5

PME	Attenuation, dB(A)
Piling, earth auger, auger	-5
Breaker, hand held, mass > 35kg	-10
Concrete pump, stationary / lorry mounted	-10

#### Alternative Use of Plant Items within One Worksite

**5.4.4.10** In practice, some plant items will operate sequentially within the same worksite, and certain reduction of the predicted noise impacts could be achieved. However, any additional control on the sequencing of plant will impose a restrictive constraint to the Contractor on the operation and planning of plant items, and the implementation of the requirement would be difficult to be monitored. Hence, sequencing operation of PME has not been taken into consideration.

#### Assessment Results of Construction Noise under Mitigated Scenario

**5.4.4.11** Appendix 5.7 presents the calculated construction noise impacts at selected representative NSRs with the adoption of the above mitigation measures. The predicted construction noise impacts at the NSRs under mitigated scenario are summarised in **Table 5.10**.

**Table 5.10** Predicted construction noise impact at NSRs under mitigated scenario

NSR <sup>[1]</sup>	NAP <sup>[2]</sup>	Uses <sup>[3]</sup>	Leq (30 mins), dB(A)		
			Criterion	Mitigated Noise Level	Exceedance
Fortune Garden	N1 - 01	R	75	73	-
	N1 - 02	R	75	72	-
	N1-03	R	75	73	-
Village House at 53 Ting Kok Road	N2 - 01	R	75	70	-
Casa Brava	N3 - 01	R	75	61	-
Casa Marina I	N4 - 01	R	75	63	-

Note:

[1] The assessment will only include NSRs which rely on opened windows for ventilation.

[2] NAP – Noise assessment point.

[3] R – Residential premises.

**5.4.4.12** It can be seen from the above **Table 5.10** that construction noise impact arising from the Project at all existing NSRs will be mitigated after implementation of the recommended noise mitigation measures. The construction noise impact of the five potential concurrent projects have been evaluated in **Section 5.4.2.3** to **Section 5.4.2.6**. No cumulative construction noise impact is anticipated for those projects without overlapping of programme or located far away from the Project. For the Upgrading of Sewage Pumping Stations and Sewerage along Ting Kok Road, the contractor of that project will be required to schedule and coordinate to avoid overlapping of major dusty and noisy construction activities. It should be noted that the construction works involved for

that project would be mainly along Ting Kok Road and footprint of SPS would be rather small. Hence, cumulative construction noise impacts are considered insignificant. In view of the above, adverse cumulative construction noise impacts are not anticipated.

## 5.4.5 Evaluation of Residual Construction Noise Impact

**5.4.5.1** Construction noise impact arising from the Project can be properly mitigated by implementing the proposed noise mitigation measures. Adverse residual noise impacts are thus not anticipated. No existing dwelling and other noise sensitive elements would be exposed to adverse residual noise impact exceeding the criteria set in Annex 5 in the TM-EIAO.

## 5.5 Fixed Noise Sources Impact Assessment

### 5.5.1 Fixed Noise Sources Impact Assessment Methodology

**5.5.1.1** Fixed noise sources impact assessment has been conducted based on the following procedures.

- Determine the assessment area;
- Identify and locate representative NSRs that may be affected by the noise sources;
- Determine the noise criteria for both daytime, evening and night-time;
- Use standard acoustic principle for attenuation and directivity for plantroom exhaust, pumping stations, relocated leachate station;
- Divide route of golf course machinery into multiple segments and use standard acoustic principle for attenuation and directivity for each segment. Sum up the contribution from each segment to obtain the contribution from tractor/aerator/mower;
- Adopt correction of tonality, impulsiveness and intermittency as stipulated in TM-Places;
- Calculate the noise impacts using assumed plant inventories and utilisation schedule for worst case scenario; and
- Cumulative impacts will be included.

### 5.5.2 Identification of Fixed Noise Sources Impact

#### **Identification of Assessment Area and Noise Sensitive Receivers**

**5.5.2.1** The assessment area for fixed noise sources should be i) 300m assessment area for planned fixed noise sources and ii) 300m assessment area for planned NSRs affected by planned and existing fixed noise sources. For operational fixed noise sources assessment, representative NSR locations have been selected from **Table 5.7**.



Photos of existing NSRs are given in **Appendix 5.1**. Prevailing noise measurements have been conducted for determination of the assessment criteria as shown in **Table 5.11** below:

**Table 5.11** Noise criteria for fixed noise sources assessment

NAP	NSR	Time Period	ASR <sup>[1]</sup>	ANL-5 dB(A) [A]	BNL <sup>[2]</sup> , dB(A) [B]	Reference NM <sup>[3]</sup>	Criteria dB(A) Min. of [A] & [B]
<b>Existing NSRs</b>							
N1-01	Fortune Garden	Day & Evening	A	55	45	PNM-1	45
		Night	A	45	43		43
N1-02	Fortune Garden	Day & Evening	A	55	45	PNM-1	45
		Night	A	45	43		43
N1-03	Fortune Garden	Day & Evening	A	55	45	PNM-1	45
		Night	A	45	43		43
N2-01	Village House at 53 Ting Kok Road	Day & Evening	C	65	67	PNM-2	65
		Night	C	55	60		55
N3-01	Casa Brava	Day & Evening	C	65	67	PNM-2	65
		Night	C	55	60		55
N4-01	Casa Marina I	Day & Evening	A	55	50	PNM-3	50
		Night	A	45	48		45
<b>Planned NSRs</b>							
PN4-01	Planned Residential Development	Day & Evening	A	55	50	PNM-3	50
		Night	A	45	48		45

Note:

[1] Based on approved “*Upgrading of Sewage Pumping Stations and Sewerage along Ting Kok Road*”, the ASR rating for the NSRs located vicinity of N2-01 Village House at 53 Ting Kok Road is classified as “C” thus the same ASR rating will be adopted.

[2] Prevailing background noise level with facade correction.

[3] Prevailing noise measurement location.

### **Inventory of Noise Sources**

**5.5.2.2** Key planned noise sources have been discussed below and illustrated in **Appendix 5.8**. The inventory of noise source has been confirmed with the Project Proponent.

- Plantroom exhaust at the ancillary facilities;
- Pumping stations for drainage / irrigation systems / sewerage system;

- Relocated leachate pumping stations; and
- Golf course machinery such as mowers, aerators, tractors.

**5.5.2.3** Operation of Public Address (PA) system is not required within Project Site.

**5.5.2.4** Five potential concurrent projects have been identified in **Section 2.11** which includes the following:

- Shuen Wan Landfill Restoration Contract;
- Food Waste Pre-treatment Facilities for Food Waste/Sewage Sludge Anaerobic Co-Digestion Pilot Trial in TPSTW;
- Upgrading of Sewage Pumping Stations (SPSs) and Sewerage along Ting Kok Road;
- Columbarium Development at Shuen Wan Landfill, Tai Po; and
- Development of a Bathing Beach at Lung Mei, Tai Po.

**5.5.2.5** Construction works for the Shuen Wan Landfill Restoration Contract were completed in November 1997, and the operational phase mainly comprises environmental monitoring and maintenance works. Based on the information provided by the operator of Shuen Wan Landfill, day-to-day maintenance works mainly involve mowing the areas around the existing vent pipes and surrounding greenery area near EPD's landfill site office at the western portion of the Project site. Only a few hand-held grass mowers would be used for mowing. At each location around the vent pipes and surrounding greenery area near EPD's landfill site office, the mowing only last for a few minutes. The distance between the nearest NSR (e.g. Fortune Garden) and vent pipe is about 30m. Also, no noise complaints have been received since 1997 from nearby residential developments (e.g. Fortune Gardens). Therefore, cumulative operational noise impact is not anticipated.

**5.5.2.6** The site of the Food Waste Pre-treatment Facilities for Food Waste/Sewage Sludge Anaerobic Co-Digestion Pilot Trial is situated far away (i.e. more than 300m) from the identified NSRs. The closest NSR is N2-01 (Village House at 53 Ting Kok Road) which is located at about 350m away. The FWPF is screened by the proposed golf course, existing Kee Wah Group Limited, existing Tai Po East Fire Station and existing Drainage Services Department Ting Kok Road Pumping Station. Hence, cumulative operational noise impact assessment is not anticipated.

**5.5.2.7** Refer to the project profile "Agreement No. CE 8/2014(DS) Upgrading of Sewage Pumping Stations and Sewerage along Ting Kok Road – Investigation, Design and Construction", the operation of the No. 5 SPS (TKRSPS No. 5) located south of the Tai Po East Fire Station will commence in 2022. Hence, the fixed noise impact from the SPS has been included in the fixed noise sources assessment.

**5.5.2.8** The Columbarium Development project is still under planning stage and the programme is yet to be confirmed. On the other hand, the

development of a bathing beach at Lung Mei is situated more than 3km from the Project. Thus, the fixed noise sources during operational phase from these two projects will not be included in the cumulative fixed noise impact assessment.

### 5.5.3 Prediction and Evaluation of Fixed Noise Sources Impact

#### Scenarios

**5.5.3.1** The fixed noise sources impact assessment of unmitigated scenario, and mitigated scenario of worst operation mode representing the maximum noise emission is conducted with respect to the criteria set out in Annex 5 of the TM-EIAO. For planned fixed noise sources of plant room exhaust, pumping station and relocated leachate pumping station, the maximum allowable SWL under worst operation mode with 100% operation will be predicted based on backward calculation of separation distance and relevant noise criteria. For golf course machinery, the worst operation mode has been based on best available information. Details for the operation of golf course machinery will be discussed in following sections. Validity of the operation modes have been confirmed with the Project Proponent.

#### **Golf course machinery such as mowers, aerators, tractors**

**5.5.3.2** According to the latest layout of the golf course (**Figure 2.1**), an 18-hole golf course with a driving range would be provided. As discussed in **Section 2**, the operational hours of the golf playing area normally would be tentatively from 7am till dark. In summer time when the daylight is longer, it is anticipated to close at around 6pm. During winter period when daylight is shorter, it might be closed as early as 5pm. The driving range operating hours will be tentatively from 7am to 10pm for both summer time and winter time.

**5.5.3.3** According to the latest information provided by Project Proponent, the golf course machinery would be used from 7am till 11pm (i.e. operation of golf course machinery during night-time period is not allowed). The golf course machinery would mainly consist of tractor / mower / aerator. The operation of tractor, aerator and mower would be mainly in the green, tee and fairway. Golf course machinery would not be used in the areas occupied by shrubs, bushes or trees. In addition, there would be no concurrent use of golf course machinery in different holes at any one time.

**5.5.3.4** Typically, the tractor would be driven from the ancillary facilities to one of the holes to conduct maintenance activities. For example, the tractor would be used to transport the mower or aerator to hole no. 9 travelling along the green, tee, fairway at about 150m at about 10km/h which is nearest hole to the existing NSRs, Fortune Garden. The tractor engine would then be turned off. In addition, the tractor would not operate along the access path nearest to golf course hole no.9. The mower or aerator would then be unloaded from the tractor and they would manoeuvre over green / tee / fairway. Either the mower or aerator would be operated at any one time. As advised by Project Proponent, the usage of mower or aerator would be about 70% of the

time in any 30-minute period. A typical route of the golf course machinery is presented in **Appendix 5.8**.

**5.5.3.5** As advised by Project Proponent, quiet tractor / mower / aerator equipment, such as electric or battery models would be selected to reduce the fixed noise sources impacts. In addition, a detailed noise management plan for the golf course machinery would be submitted to EPD for approval before operation.

### **Prediction of Fixed Noise Sources Impact under Unmitigated Scenario**

**5.5.3.6** The potential fixed noise impacts from the plant room exhaust, TKRSPS No. 5, pumping stations, relocated leachate station and golf course machinery within the Project Site have been included in this assessment. The location of the fixed noise sources is presented in **Appendix 5.8**. **Table 5.12** shows the maximum allowable SWL. Detailed calculation is shown in **Appendix 5.9**. The locations of the planned fixed noise sources are shown in **Appendix 5.8**.

**Table 5.12** Summary of maximum allowable SWL

Plant ID	Plant Item	Maximum Allowable SWL, dB(A)	
		Day and evening time (0700-2300 hours)	Night time (2300 – 0700 hours)
PLA-01	Plant room exhaust	73	73
PLA-02	Plant room exhaust	73	73
PUM-01	Pumping Station for Drainage No.1	80	80
PUM-02	Pumping Station for Drainage No.2	80	80
PUM-03	Pumping Station for Irrigation	80	80
PUM-04	Pumping Station for Sewage	80	80
LEAPUM	Relocated Leachate Pumping Station	80	80
Tractor	Tractor	100	N/A <sup>[1]</sup>
Mower	Mower	84	N/A <sup>[1]</sup>
Aerator	Aerator	98	N/A <sup>[1]</sup>
TKRSPS No. 5 <sup>[2]</sup>	Sewage Pumping Station	76	76

Note:

[1] There will be no operation of golf course machinery during the night-time period.

[2] The maximum allowable SWL of the TKRSPS No. 5 is taken from the project profile “Agreement No. CE 8/2014(DS) Upgrading of Sewage Pumping Stations and Sewerage along Ting Kok Road – Investigation, Design and Construction”.

**5.5.3.7** A 3dB(A) facade correction and 3dB(A) tonality correction have been applied in noise analysis. Typically, a noise reduction of 10dB(A) and 20dB(A) is possible with the application of silencer installation and

special acoustic enclosure at various units for pumping station and plant room exhaust. These predicted maximum allowable SWL are in similar range as those predicted in other EIA reports (e.g. Approved EIA report for North East New Territories New Development Areas (AEIAR-175/2013) and Tung Chung New Town Extension (AEIAR-196/2016)).

**5.5.3.8** The Contractor shall enclose noisy plants and install acoustic silencers, acoustic louvre or acoustic enclosure as appropriate to ensure the specified maximum SWLs as shown in **Table 5.12** will not be exceeded. The future design and selection of the equipment shall also aim to reduce the effect of tonality at the NSRs as much as practicable. However, the Contractor shall also take into account the latest available information at time of detailed design to review and update the maximum allowable SWL as appropriate.

**5.5.3.9** Typical catalogue of tractor, aerator and mower are given in **Appendix 5.8a**. However, as advised by Project Proponent, quiet tractor / mower / aerator equipment, such as electric or battery models would be selected to reduce the fixed noise sources impacts.

**5.5.3.10** The predicted fixed noise sources impacts at NSRs are given in **Table 5.13**.

**Table 5.13** Predicted fixed noise sources impacts at NSRs

NAP	NSR	Time Period	ASR <sup>[1]</sup>	Max. Predicted SPL, dB(A)	Criteria dB(A)	Compliance [Y/N]
N1 - 01	Fortune Garden	Day & Evening	A	52	45	N
		Night		32	43	Y
N1 - 02	Fortune Garden	Day & Evening	A	52	45	N
		Night		32	43	Y
N1 - 03	Fortune Garden	Day & Evening	A	51	45	N
		Night		34	43	Y
N2 - 01	Village House at 53 Ting Kok Road	Day & Evening	C	47	65	Y
		Night		31	55	Y
N3 - 01	Casa Brava	Day & Evening	C	45	65	Y
		Night		37	55	
N4 - 01	Casa Marina I	Day & Evening	A	46	50	Y
		Night		31	45	
PN4-01	Planned Residential Development	Day & Evening	A	46	50	Y
		Night	A	31	45	Y

Note:

[1] Based on approved “*Upgrading of Sewage Pumping Stations and Sewerage along Ting Kok Road*”, the ASR rating for the NSRs located vicinity of N2-01 Village House at 53 Ting Kok Road is classified as “C” thus the same ASR rating will be adopted.

**5.5.3.11** For the planned NSRs of staff quarters and overnight accommodation within the Project boundary, no line of sight is anticipated from the operation of golf course. Section drawings are given in **Appendix 5.10**. Hence, adverse fixed noise impact is not anticipated.

**5.5.3.12** The cumulative fixed noise sources impact arising from the Project have been assessed. Potential neighbouring concurrent projects have also been considered and evaluated under **Section 5.5.2.5** to **Section 5.5.2.8**, and the committed project for the operation of the No. 5 SPS (TKRSPS No. 5) has been included in the assessment. Results presented in **Table 5.13** demonstrate that the cumulative fixed noise sources at most of the NSRs will be within the respective noise criteria except for the existing NSRs at Fortune Garden. Hence, mitigation measures are required.

**5.5.3.13** The total number of dwellings, classrooms and other noise sensitive receivers that will be exposed to noise impact exceeding the criteria set in Annex 5 in the TM-EIAO have been calculated. It is predicted that a total of about 25 dwellings will be exposed to construction noise impact under unmitigated scenario.

#### **Mitigation of Fixed Noise Sources Impact**

**5.5.3.14** For the proposed noise sources which are located near to NSRs, the following tentative noise mitigation measures are considered:

- All the pumps and noisy plants should be enclosed inside a building structure;
- Proper selection of quiet plant aiming to reduce the tonality at NSRs;
- Installation of silencer / acoustic enclosure / acoustic louvre for the exhaust of ventilation system;
- Openings of ventilation systems should be located away from NSRs as far as practicable and oriented away from the NSRs; and
- Installation of absorptive noise barrier (with density of absorption material of  $48\text{kg/m}^3$ ) for the aerator which would duly shield the engine and other noisy parts of the aerator as far as practicable.

**5.5.3.15** The feasibility, practicability, programming and effectiveness of the above mitigation measures have been reviewed by engineer.

#### **Prediction of Fixed Noise Sources Impact under Mitigated Scenario**

**5.5.3.16** With the provision of mitigation measures, the predicted fixed noise sources impacts at NSRs are given in **Table 5.14**. **Appendix 5.11** presents a sketch of the absorptive noise barrier installed for the aerator.

**Table 5.14** Predicted fixed noise sources impacts at NSRs

NAP	NSR	Time Period	ASR	Max. Predicted SPL, dB(A)	Criteria dB(A)	Compliance [Y/N]
N1 - 01	Fortune Garden	Day & Evening	A	44	45	Y
		Night		32	43	Y
N1 - 02	Fortune Garden	Day & Evening	A	44	45	Y
		Night		32	43	Y
N1 - 03	Fortune Garden	Day & Evening	A	44	45	Y
		Night		34	43	Y

**5.5.3.17** Section 5.5.2.5 to Section 5.5.2.8 has identified and evaluated five potential neighbouring concurrent projects including Shuen Wan Landfill Restoration Contract, Food Waste Pre-treatment Facilities for Food Waste/Sewage Sludge Anaerobic Co-Digestion Pilot Trial in TPSTW, Upgrading of Sewage Pumping Stations and Sewerage along Ting Kok Road, Columbarium Development at Shuen Wan Landfill and Development of a Bathing Beach at Lung Mei. Among these concurrent projects, the operation noise of the Upgrading of Sewage Pumping Stations and Sewerage along Ting Kok Road shall be assessed in conjunction with that of the Project. From **Table 5.14**, cumulative fixed noise sources impact arising from the Project and the committed project for the operation of the TKRSPS No. 5 SPS concurrent projects at NSRs will be within the respective noise criteria. In view of the above, adverse cumulative fixed noise sources impact is not anticipated.

## 5.5.4 Evaluation of Residual Fixed Noise Sources Impact

**5.5.4.1** Fixed noise sources impact arising from the Project can be properly mitigated by implementing the proposed noise mitigation measures. Adverse residual noise impacts are thus not anticipated. No existing and planned dwellings and other noise sensitive elements would be exposed to adverse residual noise impact exceeding the criteria set in Annex 5 in the TM-EIAO.

## 5.6 Conclusion

### 5.6.1 Construction Phase

**5.6.1.1** Construction noise associated with the use of PME for different stages of construction has been conducted. With the implementation of practical mitigation measures including good site management practices, use of movable noise barrier, use of “quiet” plant and



working method, construction noise impacts at all of the neighbouring residential noise sensitive uses would be controlled to acceptable levels.

## **5.6.2 Operational Phase**

**5.6.2.1** Fixed noise sources impact assessment has been conducted. Noise impact from planned fixed noise sources could be effectively mitigated by implementing noise mitigation measure at source during the project implementation stage. With the adoption of the proposed maximum permissible SWLs for the proposed fixed plant, the impact noise levels at representative NSRs complies with the relevant noise criteria for both existing and planned fixed noise sources. Therefore, adverse fixed noise sources impact on the NSRs is not anticipated.