

4 Noise Impact

4.1 Introduction

This chapter presents the assessment of potential noise impacts which may arise during the construction, operation and restoration & aftercare stages of the NENT Landfill Extension. Noise impacts associated with the construction activities and the use of powered mechanical equipment during the construction, operation and restoration phases are all within the noise criteria. The implementation of good site practices as recommended will provide further protection of the sensitive receivers.

The noise impact assessment has been conducted in accordance with the requirements of Annex 5 and Annex 13 of the TM-EIAO as well as the requirements set out under Clause 3.4.2 of the EIA Study Brief.

4.2 Environmental Legislation, Standards and Guidelines

The relevant legislation and associated guidance notes applicable to the study for the assessment of noise implications include:

- Noise Control Ordinance (NCO), Cap 400;
- TM for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites (TM-Places);
- Technical Memorandum on Noise from Construction Work other than Percussive Piling (TM-GW); and
- Technical Memorandum on Environmental Impact Assessment Process (TM-EIAO).

4.2.1 Construction, Restoration & Aftercare Noise

Noise during construction, restoration and aftercare phases is governed by the Noise Control Ordinance (NCO) (Cap 400) and the EIAO. Guidelines concerning the assessment methodology and relevant criteria are provided in the relevant Technical Memoranda (TMs). These TMs prescribe the maximum permitted noise levels for the use of Powered Mechanical Equipment (PME) and certain construction activities and processes, according to the type of activity or equipment used, the perceived noise climate of the area, and the working hours of equipment operation and usage. The following TMs are applicable to the control of noise from construction and restoration activities:

- TM-GW; and
- TM-EIAO.

4.2.1.1 Daytime Noise Standards

Noise generated by general construction works during normal working hours (i.e. 0700 to 1900 hours on any day not being a Sunday or public holiday) is governed by TM-EIAO. The recommended noise standards are presented in Table 4.1.

Table 4.1: Daytime construction noise limit

Uses	Noise Standard ($L_{eq, 30 \text{ min}}$ dB(A))
Domestic Premises	75
Educational Institutions (normal periods)	70
Educational institutions (during examination periods)	65

Note: The standard above applies to uses which rely on open window for ventilation

4.2.1.2 Noise Standards for Restricted Hours

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

The study area does not fall within any designated area under the NCO, and construction noise criteria set out in the TM-GW should therefore be applicable to this NENT Landfill Extension Project.

Maximum allowable noise levels from construction activities during restricted hours at the affected NSRs are governed by the TMs and shall not exceed the specified Acceptable Noise Levels (ANLs). These ANLs are stipulated in accordance with the Area Sensitivity Ratings (ASR) established for the NSRs, and the Basic Noise Levels (BNLs) is stated in Table 4.2.

Table 4.2 : BNLs for construction noise other than percussive piling

Time Period	Basic Noise Levels for Area Sensitivity Ratings, dB(A)		
	A	B	C
All weekdays during the evening (1900 to 2300 hours), and general holidays (including Sundays) during the day and evening (0700 to 2300 hours)	60	65	70
All days during the night-time (2300 to 0700 hours)	45	50	55

4.2.1.3 Construction Noise Permits

Despite any description or assessment made in this EIA Report on construction noise aspects, there is no guarantee that a CNP will be issued for the landfill 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 site before making a decision in granting a CNP. Nothing in the 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 action under the NCO.

4.2.2 Operational Noise

4.2.2.1 Road Traffic Noise

The TM-EIAO provides guidance on acceptable road traffic noise levels for uses which rely on open windows for ventilation. The relevant criteria are shown in Table 4.3.

Table 4.3: Road traffic noise standards

Uses	Road Traffic Noise, L _{10,1hr} dB(A)
Domestic Premises	70
Hotel and Hostels	70
Offices	70
Educational Institutions	65
Hospital & Clinics	55
Places of public worship and courts of law	65

Note: The above criteria apply to noise sensitive uses measured at 1m from external façade of premises which rely on open window for ventilation.

4.2.2.2 On-Site Operational Noise

On-site operational noise sources including fixed noise sources, such as ammonia stripping plant and leachate treatment plant, on-site traffic noise due to refuse vehicle movement and waste filling noise are controlled under the NCO and TM-Places. For planning purpose, the TM-EIAO has specified the following standards:

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

The ANLs for different Area Sensitivity Ratings are summarised in Table 4.4 below.

Table 4.4: Operational noise criteria for fixed noise sources

Time Period	ANL, dB(A)			ANL-5, dB(A)		
	ASR A	ASR B	ASR C	ASR A	ASR B	ASR C
Day (0700 to 1900 hours)	60	65	70	55	60	65
Evening (1900 to 2300 hours)	60	65	70	55	60	65
Night (2300 to 0700 hours)	50	55	60	45	50	55

A number of noise surveys were conducted at representative noise sensitive receivers (NSRs) in February 2005 and March 2006 to determine the prevailing noise levels. Results indicated that the daytime time noise levels were in the range of 44 to 71 dB(A), evening time noise levels were below 50 dB(A); and the nighttime noise levels were in the range of 39-49 dB(A). Other than SR1, SR2, SR3, SR5 & SR10, the background noise levels for daytime, evening & nighttime at the surveyed locations was generally lower than the relevant ANL. The prevailing background noise levels at these locations would therefore be adopted as the assessment criteria. Applicable daytime background noise levels at SR2, SR3 & SR5 and nighttime background noise level at SR1 & SR10 are the planning criteria of 55 dB(A) and 45 dB(A) respectively. A summary of the prevailing noise levels at the NSRs and the noise criteria for operation noise is given in Table 4.5.

Table 4.5: Summary of noise criteria for operational noise

NSR	Time Period ^[1]	Prevailing Noise Level, dB(A) (1)	Area Sensitivity Rating	ANL-5 dB(A) (2)	Criteria dB(A) Min. of (1) & (2)
SR1	Day	51	A	55	51
	Evening	47	A	55	47
	Night	46	A	45	45
SR2	Day	57	A	55	55
	Evening	42	A	55	42
	Night	41	A	45	41
SR3	Day	63	A	55	55
	Evening	40	A	55	40
	Night	39	A	45	39
SR4	Day	53	A	55	53
	Evening	50	A	55	50
	Night	45	A	45	45
SR5	Day	71	A	55	55
	Evening	43	A	55	43
	Night	42	A	45	42
SR6	Day	43	A	55	43
	Evening	42	A	55	42
	Night	40	A	45	40
SR7	Day	52	A	55	52

NSR	Time Period ^[1]	Prevailing Noise Level, dB(A) (1)	Area Sensitivity Rating	ANL-5 dB(A) (2)	Criteria dB(A) Min. of (1) & (2)
SR8	Evening	48	A	55	48
	Night	44	A	45	44
	Day	44	A	55	44
	Evening	42	A	55	42
	Night	41	A	45	41
SR9	Day	44	A	55	44
	Evening	40	A	55	40
	Night	39	A	45	39
SR10	Day	53	A	55	53
	Evening	49	A	55	49
	Night	49	A	45	45

Note:

^[1] Day: 0700 to 1900 hours, Evening: 1900 to 2300 hours, Night: 2300 to 0700 hours

4.3 Description of the Environment

4.3.1 Baseline Condition

The NENT Landfill Extension site is located to the southeast of the existing NENT Landfill, which is at the northern part of the New Territories near Ta Kwu Ling. An ambient noise survey was conducted in March 2006 to obtain the existing noise profile of the surrounding environment. All the noise measurements were conducted in accordance with TM-Places. The measured noise levels at the selected locations ranged from 39 to 71 $L_{eq, 30-min}$ dB(A). A summary of the measured noise levels at each sensitive receiver location is given in Table 4.6.

No audible plant operation noise from the existing NENT Landfill was perceived or recorded at the measuring locations during the noise survey.

Table 4.6: Prevailing noise levels

NSR	Description	Prevailing Noise Levels, dB(A) $L_{Aeq, 30 min}$			Remarks
		Day	Evening	Night	
SR1	Wo Keng Shan Tsuen	51	47	46	Insect, traffic noise
SR2	Village houses at Junction of Ng Chow Road and Wo Keng Shan Road	57	42	41	Traffic, Bird, Insect noise
SR3	Cheung Shan Monastery	63	40	39	Traffic, Bird, Insect noise
SR4	Miu Keng	53	50	45	Insect noise
SR5	Wing Fai Yuen	71	43	42	Insect noise
SR6	Heung Yuen Wai	43	42	40	Insect noise
SR7	Tsung Yuen Ha	52	48	44	Insect, bird noise
SR8	Ha Heung Yuen	44	42	41	Insect, bird noise
SR9	Lin Ma Hang	44	40	39	Insect, bird noise
SR10	Tung Lo Hang	53	49	49	Insect, Pig noise

Note:

^[1] Day: 0700 to 1900 hours, Evening: 1900 to 2300 hours, Night: 2300 to 0700 hours

^[2] Prevailing noise levels include +3dB(A) façade effect

Weekly plant noise monitoring for the existing NENT Landfill has been conducted by the contractor of the existing NENT Landfill since 1996. A brief summary of the findings at the

noise monitoring locations are listed in Table 4.7. Based on the statistical records, there is no justified exceedance from the NENT Landfill operation.

Table 4.7: Summary of noise monitoring locations and exceedance incidents

Monitoring Location	No. of Exceedance incidents	Date	Reasons
NSR1 Wo Keng Shan	1	13 October 1996 Exceed 1.9dB(A)	Measurements were taken near an operating air sampling unit and under strong wind condition. Therefore, the abnormality was not justified as non-compliance.
NSR2 Ha Heung Yuen	0	N/A	N/A
NSR3 Tung Lo Hang	0	N/A	N/A
NSR4 Ping Yeung	1	14 June 1998 Exceed 5dB(A)	Measured noise level was influenced by firecracker burning in the village. Therefore the abnormality was not justified as non-compliance.

4.4 Noise Sensitive Receivers

Noise sensitive receivers (NSRs) were identified in accordance with Annex 13 of the TM-EIAO. Both existing and planned uses during the construction, operation, restoration and aftercare periods of the NENT Landfill Extension are included as appropriate. The existing NSRs were identified through desktop review and site survey. There were no planned NSRs on the latest Outline Zoning Plan.

The land uses in the vicinity of the extension site include temple and residential developments. The key representative NSRs for noise assessment are given in Table 4.8 and their respective locations are shown in **Drawing No. 24315/13/201**.

Table 4.8: Representative noise sensitive receivers (NSRs)

NSR No.	NSR Description	Use	No. of Storey (including roof)	Shortest Horizontal Distance to NENT Landfill Extension Site Boundary, m
SR1	Wo Keng Shan Tsuen	Residential	3	420
SR2	Village houses at Junction of Ng Chow Road and Wo Keng Shan Road	Residential	3	1040
SR3	Cheung Shan Monastery	Religious	1	820
SR4	Miu Keng	Residential	3	990
SR5	Wing Fai Yuen	Residential	2	980
SR6	Heung Yuen Wai	Residential	3	1240
SR7	Tsung Yuen Ha	Residential	3	1790
SR8	Ha Heung Yuen	Residential	3	1330
SR9	Lin Ma Hang	Residential	3	900
SR10	Tung Lo Hang	Pig Farm / Residential	2	800

4.5 Assessment Methodologies

4.5.1 Construction, Restoration and Aftercare Noise

Construction, restoration and aftercare noise impacts have been assessed by adopting the standard acoustic principles and the methodologies described in the relevant TMs issued under the NCO, primarily the TM-GW. The following general procedures were applied to the construction, restoration and aftercare noise assessment.

- Determine the assessment area;
- Identify and locate representative NSRs that may be affected by the works;
- Obtain the methodology and work sequence for the construction period;
- Obtain the plant items for each corresponding work sequence;
- Determine the sound power levels (SWLs) of the plant items according to the information stated in the TM-GW or other recognised sources of reference;
- Calculate the correction factors based on the distance between the NSRs and the notional noise source positions of the work sites;
- Apply corrections for façade, distance, barrier attenuation, acoustic reflection where applicable. For assessment of NSRs exceeding 300m, atmospheric and ground corrections will be applied with reference to ISO 9613;
- Assess the construction and restoration works noise impacts;
- Predict noise levels at the NSRs;
- Quantify the level of impact at the NSRs in accordance with TM-GW; and
- Predict the cumulative noise impacts for activities associated with the construction phasing and restoration works at the existing landfill.

4.5.2 Road Traffic Noise

Road traffic noise calculation method is based on the UK Department of Transport "Calculation of road Traffic Noise (CRTN)". The predicted noise levels at the sensitive receivers include 2.5dB(A) facade reflection and correction factors for effects due to gradient, distance, view angle, road surface and barriers.

The CRTN compliance computer programme, RoadNoise 2000, has been used to model traffic noise on the road networks. Road traffic noise levels are presented in terms of noise levels exceeded for 10% of the one-hour period during the peak traffic flow, i.e. $L_{10,1hr}$ dB(A). Traffic noise levels at the NSRs for scenarios with and without the NENT Landfill Extension are predicted.

4.5.3 On-site Operational Noise

Major sources of operational noise are generated from the aeration lagoon of leachate treatment plant, ammonia stripping plant, refuse vehicle movement and waste filling. The sound power levels of these activities / facilities were measured at the existing NENT Landfill. The following general procedures will apply to the operational noise assessment.

- Determine the assessment area;
- Identify and locate representative NSRs that may be affected by the works;
- Obtain the plant items;
- Determine the sound power levels (SWLs) of the plant for fixed noise sources and the vehicular movement SWLs on the haul roads in accordance with BS5228;

- Calculate the correction factors based on the distance between the NSRs and the noise source positions;
- Apply corrections for façade, distance, barrier attenuation, acoustic reflection where applicable. For assessment of NSRs exceeding 300m, atmospheric and ground corrections will be applied with reference to ISO 9613;
- Predict fixed source noise levels at the NSRs; and
- Quantify the level of impact at the NSRs in accordance with TM-Places.

4.6 Construction, Restoration & Aftercare Noise Impact Assessment

4.6.1 Construction Plant Inventory

Sections 2.7 present a detailed description of the key construction activities at each phase of the NENT Landfill Extension. The construction of the landfill extension would include the following activities:

- Site clearance & formation;
- Installation of liner;
- Construction of leachate treatment works;
- Construction of ammonia stripping plant;
- Cumulative construction noise impact for construction activities associated with the construction/operation in the extension and restoration in the existing landfill; and
- Restoration & Aftercare

The above construction activities will involve the use of Powered Mechanical Equipment (PME) including excavators, truck, crane truck, compactor, dozer, generator, loader, etc. Their respective Sound Power Levels (SWLs) are given in Appendix 4.1.

The plant inventory provided in Appendix 4.2 indicates the total number of PME for each construction activity. Prediction is made with respect to the distance of NSRs from the notional source locations. Appendix 4.3 shows the locations of the NSRs and their respective distances from the notional sources.

4.6.2 Prediction and Evaluation of Noise Impact

Assessment results indicate that, under "unmitigated" scenario, the construction noise levels at the NSRs are within the criteria. The maximum unmitigated construction noise levels against the stipulated criteria at the NSRs are shown in Table 4.9. Detailed results of the construction noise assessment are given in Appendix 4.4.

Table 4.9: Predicted maximum construction noise levels at the NSRs – "unmitigated" scenario

NSR No.	NSR Description	Max Predicted Noise Level, dB(A)	Criteria	Compliance (Y/N)
SR1	Wo Keng Shan Tsuen	69	75	Y
SR2	Village houses at Junction of Ng Chow Road and Wo Keng Shan Road	57	75	Y
SR3	Cheung Shan Monastery	58	75	Y
SR4	Miu Keng	63	75	Y
SR5	Wing Fai Yuen	57	75	Y
SR6	Heung Yuen Wai	53	75	Y
SR7	Tsung Yuen Ha	60	75	Y
SR8	Ha Heung Yuen	53	75	Y
SR9	Lin Ma Hang	67	75	Y
SR10	Tung Lo Hang	66	75	Y

4.6.3 Precautionary Measures

4.6.3.1 Construction, Restoration & Aftercare Phase

The assessment results have demonstrated that daytime noise criteria would not be exceeded by the predicted construction noise levels under the unmitigated scenario. Good practices for the control of noise emissions from construction sites are still recommended to further eliminate the potential of noise impact. These include:

- Good site practices to limit noise emissions at source;
- Use of quiet plant and working methods, whenever practicable.

The above precautionary measures should be implemented in all work sites as good practices. Detailed descriptions of these precautionary measures are given in the following sections.

4.6.3.2 Good Site Practices and Noise Management Techniques

Good site practice and noise management techniques could considerably reduce the noise impact from construction site activities on nearby NSRs. The following precautionary 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 programme;
- Machines and plant (such as trucks, cranes) 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.

The above good practice to further eliminate the potential of noise impact from construction equipment will be incorporated into the contract specification. The benefits of these techniques can vary according to specific site conditions and operations. The environmental noise climate would certainly be improved through these control practices, although the improvement can only be quantified during implementation when specific site parameters are known.

4.6.3.3 Use of "Quiet" Plant and Working Methods

The use of quiet plant is a feasible solution to promote better noise impact management of the work activities. 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 DBO 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 DBO 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 site meets the requirements.

The use of quiet plant associated with the construction works is prescribed in British Standard "Noise Control on Construction and Open Sites, BS5228: Part 1: 1997" which contains the SWLs for specific quiet PME. It should be noted that while various types of

silenced equipment could be found in Hong Kong, EPD when processing a CNP application for evening or night time works may choose to apply the noise data stipulated in the TM-GW as appropriate. CNP applications which contain sufficient details of any particularly quiet items of PME or any special noise control measures which the CNP applicant proposes to employ on the site may be given special consideration by the Noise Control Authority.

Routine noise monitoring will be stipulated in the EM&A requirement to counter check the noise performance at NSR, and the preference for adopting quiet plant will be stipulated when the noise impact from construction activities exceed the limit level.

4.6.4 Daytime Cumulative Construction Noise Impacts from Construction in Landfill Extension and Restoration in Existing Landfill

Overlap between Phases 1 & 2 construction activities of the landfill extension and leachate treatment plant and restoration works at the existing landfill will occur. Construction activities at the landfill extension site would involve the use of PME such as excavator, compactor, generators, loader, crane truck, dump truck, etc. Restoration works at the existing landfill would involve the laying of a gas venting layer, an impermeable mineral layer, a drainage layer and top soil on the top of the waste body.

A sound power level of 127 dB(A) at the notional source position of the existing landfill site was assumed for the assessment of cumulative construction noise impact for the landfill extension, in reference to the estimated type and number of plant for the restoration works. The predicted cumulative noise levels at the NSRs are summarised in Table 4.10 below and detailed calculations are shown in Appendix 4.5. Results show that the predicted cumulative noise levels are within the noise criteria and residual impact is not anticipated.

Table 4.10: Cumulative construction noise impacts from existing landfill

NSR No.	Notional Distance to Existing Landfill, m	Predicted Noise Level, dB(A)			Noise Criteria	Compliance (Y/N)
		NENT Landfill Extension	Existing NENT Landfill	Cumulative		
SR1	707	64	55	65	75	Y
SR2	1326	57	55	59	75	Y
SR3	1624	58	48	58	75	Y
SR4	2182	63	45	63	75	Y
SR5	1927	57	46	57	75	Y
SR6	623	53	66	66	75	Y
SR7	995	57	62	63	75	Y
SR8	641	53	66	66	75	Y
SR9	975	67	52	67	75	Y
SR10	239	63	74	75	75	Y

4.7 Operational Noise Impact Assessment

4.7.1 Road Traffic Noise Impact Assessment

4.7.1.1 Prediction of Road Traffic Noise Levels

Road traffic noise levels associated with the NENT Landfill Extension are predicted based on the traffic data forecast. The number of vehicle trips increases gradually from 2005 to 2012 and the traffic volume will have reached the maximum level at Year 2012 due to natural waste growth. After 2012, there will be a decrease in waste as well as vehicle trips due to the change in waste catchment distribution with some wastes being diverted to other landfill sites. In 2013 when the South East Kowloon Refuse Transfer Station (SEKRTS)

commissioned, wastes from the East Kowloon will be diverted to WENT landfill through SEKRTS.

Wo Keng Shan Road is an access road for refuse vehicles to the NENT Landfill. Besides refuse vehicles, other vehicular type traffic volume along this road is expected to be low. A conservative estimate of 5 light vehicles (i.e. private car or taxi) per hour is assumed. The traffic data adopted for assessment of the "with" and "without" Project scenarios are summarized in Table 4.11.

Table 4.11: Peak Traffic flow data at Wo Keng Shan Road

	Without the Project	With the Project Peak traffic flow at Year 2012
No. of Refuse Vehicle / hour	0	90
No. of Light Vehicle per hour	5	5
Total No. of Vehicle / hour	5	95
Percentage of Heavy Vehicle	0%	95%
Speed, kph	50	50

The predicted facade noise levels at the existing NSRs are presented in Table 4.12. Roadplot and output files are shown in Appendix 4.6. As SR6 to SR10 are more than 700m away from Wo Keng Shan Road and are sufficiently screened by natural topography, the road traffic noise impact would be insignificant. In addition, a visual screen planter should be erected near the Cheung Shan Monastery by the DBO Contractor during construction phase. The extent of the planter is shown in **Drawing No. 24315/13/202**. Results indicate that all NSRs will be in compliance with the noise criteria of 70dB(A) L₁₀.

Table 4.12: Predicted maximum traffic noise levels at NSRs – "unmitigated" scenario

NSR No.	NSR Description	Noise Criteria	Predicted Noise Level, L ₁₀ dB(A) (without the Project)	Predicted Noise Level, L ₁₀ dB(A) (with the Project)	Contribution from the Project (Exceedance)
SR1	Wo Keng Shan Tsuen	70	<40	46	>1.0 dB(A) Exceedance: 0
SR2	Village houses at Junction of Ng Chow Road and Wo Keng Shan Road	70	<40	59	>1.0 dB(A) Exceedance: 0
SR3	Cheung Shan Monastery	65	46	65	>1.0 dB(A) Exceedance: 0
SR4	Miu Keng	70	<40	56	>1.0 dB(A) Exceedance: 0
SR5	Wing Fai Yuen	70	47	70	>1.0 dB(A) Exceedance: 0

4.7.2 On-site Operational Noise Impact Assessment

4.7.2.1 Identification of Noise Sources

The major on-site noise sources during operation of the Project will be the aeration process in the lagoon of the leachate treatment plant, the operation of the ammonia stripping plant, refuse vehicle movement and waste filling. For the waste filling operation, all PMEs will operate at the bottom of valley during the early stage of tipping operation. Natural topography will provide sufficient screening effect for all NSRs. The worst-case scenario will only be occurred at the later stage when the bottom part of the valley is filled up. When there is a direct line of sight of the tipping face, the natural topography cannot provide sufficient screening for NSR and noise exceedance will be encountered. The worst-affect period will be occurred during the daily cover operation when relatively large-scale compression is required.

These noise emission inventories of the landfill site operation are summarized in Table 4.13. The locations of the noise sources are shown in **Drawing No. 24315/13/203**.

Table 4.13: Noise inventories for the landfill site operation

Description	Qty	SWL, dB(A) / unit	Subtotal SWL, dB(A)	Operation period ^[4]
Leachate treatment plant	1	75 ^[1]	75	Daytime, Evening & Nighttime
Ammonia stripping plant	1	88 ^[2]	88	
Refuse vehicle / hour	90	97 ^[3]	117	Daytime
Waste filling				
<i>Compactor (CNP050)</i>	2	105		
<i>Dump truck, e.g. 5.5 tonne < gross vehicle weight ≤ 38 tonne, (CNP068)</i>	1	105		
<i>Dozer (CNP030)</i>	2	115		
<i>Backhoe (CNP081)</i>	1	112	119	

Note:

^[1] Measurement details are shown in Appendix 4.7

^[2] Measurement details are shown in Appendix 4.8

^[3] Measurement details are shown in Appendix 4.9

^[4] Daytime (0700 to 1900), Evening (1900 to 2300) and Night time (2300 to 0700)

The use of quieter equipment/plant is a feasible solution to promote better noise impact management of the work activities. It is generally known (supported by field measurement) that particular models of powered mechanical equipment are quieter than standard types given in the TM-GW. Whilst it is generally considered too restrictive to specify that the DBO Contractor have to use specific models or items of equipment/plant, it is reasonable and practicable to set noise performance specifications for specific equipment/plant so that flexibility in selection of equipment is allowed. A pragmatic approach would be to request that the DBO Contractor independently verifies the noise level of the equipment/plant to be used and demonstrates through furnishing of these results, that the equipment/plant to be used on the site meets the requirements. The preference for adopting quieter equipment/plant will be stipulated in the contract specification. It shall be applied whenever practicable to further eliminate the potential of noise impact from construction activities.

4.7.2.2 Prediction of Noise Levels from Operational Noise

Assessment results indicate that under “unmitigated” scenario, the operational noise impact will comply with the noise criteria during early stage of tipping/daily covering when the topography screening effect is adequate (Table 4.14a). For the later stage of tipping/daily covering when the topography is insufficient to screen the noise impact, there are two NSRs

exceeding the daytime criteria (Table 4.14b). Exceedance of noise criteria was predicted at SR1 and SR9 when plants are mobilized for daily covering operation at the later stage of landfill life.

The predicted evening & nighttime noise levels will comply with the evening and night time noise criteria at all NSRs during the entire landfill operating period (Table 4.15). Detailed calculations for operational noise under the un-mitigated scenario are shown in Appendix 4.10.

Table 4.14a: Predicted daytime facade noise levels without mitigation measures during the early stage of tipping/daily covering when the effect of topography screening is adequate

NSR ID	Predicted facade Noise Levels, (Leq, 30min dB(A))				CNL, Leq (30min) dB(A)	Criteria	Compliance (Y/N)
	Leachate Treatment Plant	Ammonia stripping plant	On-site refuse vehicle movement	Waste filling			
SR1	<15	26	45	48	50	51	Y
SR2	<10	16	27	40	40	55	Y
SR3	<10	<15	26	41	41	55	Y
SR4	<10	<10	24	38	38	53	Y
SR5	<10	<10	24	39	39	55	Y
SR6	<10	<15	21	38	38	43	Y
SR7	<10	<10	17	34	34	52	Y
SR8	<10	<15	21	37	37	44	Y
SR9	<10	<10	28	43	43	44	Y
SR10	<10	19	27	43	43	53	Y

Table 4.14b: Predicted daytime facade noise levels without mitigation measures during the later stage of tipping/daily covering when the effect of topography screening is inadequate

NSR ID	Predicted facade Noise Levels, (Leq, 30min dB(A))				CNL, Leq (30min) dB(A)	Criteria	Compliance (Y/N)
	Leachate Treatment Plant	Ammonia stripping plant	On-site refuse vehicle movement	Waste filling			
SR1	<15	26	45	53	53	51	N
SR2	<10	16	27	40	40	55	Y
SR3	<10	<15	26	41	41	55	Y
SR4	<10	<10	24	38	38	53	Y
SR5	<10	<10	24	39	39	55	Y
SR6	<10	<15	21	38	38	43	Y
SR7	<10	<10	17	34	34	52	Y
SR8	<10	<15	21	37	37	44	Y
SR9	<10	<10	28	48	48	44	N
SR10	<10	19	27	43	43	53	Y

Table 4.15: Predicted evening/nighttime facade noise levels without mitigation measures

NSR ID	Predicted facade Noise Levels, (Leq, 30min dB(A))		CNL, Leq (30min) dB(A)	Criteria (Evening / Nighttime)	Compliance (Y/N)
	Leachate Treatment Plant	Ammonia stripping plant			
SR1	<15	26	26	47 / 45	Y
SR2	<10	16	17	42 / 41	Y
SR3	<10	<15	16	40 / 39	Y
SR4	<10	<10	<15	50 / 45	Y
SR5	<10	<10	<15	43 / 42	Y
SR6	<10	<15	16	42 / 40	Y
SR7	<10	<10	<15	48 / 44	Y
SR8	<10	<15	16	42 / 41	Y
SR9	<10	<10	<15	40 / 39	Y
SR10	<10	19	20	49 / 45	Y

4.7.3 Mitigation Measures

Assessment results indicate that the exceedance of noise criteria at SR1 & SR9 are caused by the daily covering activities involving the use of PMEs during the later stage of the landfill operation when the effect of topography screening is inadequate. Noise mitigation measures are therefore required to alleviate the noise impacts at that stage of the landfill development. Noise emissions from the entire site could be minimised by use of quiet plant and working methods.

Routine noise monitoring will be stipulated in the EM&A programme to monitor the noise performance at NSRs, and quiet plant shall be used when the noise impact from operational activities exceed the trigger level. The type of quiet plant shall be proposed by the DBO Contractor and verified by the IEC.

The mitigation measures would need to be implemented in all work sites as good practices. Detailed descriptions of these mitigation measures are given in the following sections.

4.7.3.1 Use of "Quiet" Plant and Working Methods

British Standard "Noise Control on Construction and Open Sites, BS5228: Part 1: 1997" contains the SWLs for specific quiet PME. The SWL for quiet PME adopted for the assessment are detailed in Table 4.16.

Table 4.16: Sound power levels of quiet plant

Equipment	BS5228 Part 1 Identification	Sound Power Level, dB(A)
Dozer	BS Table C9 Ref 2	104

4.7.3.2 Assessment Results for "Mitigated" Scenario

Noise reduction from the use of quiet dozer during waste filling/daily cover operation in the operation phase has been applied in the assessment. Detailed results of operational noise assessment for "mitigated" scenario are given in Appendix 4.11. The predicted noise levels over daytime noise criteria are summarised in the following Table 4.17.

Table 4.17: Predicted facade noise levels with mitigation measures at NSRs

NSR ID	Predicted facade Noise Levels, (Leq, 30min dB(A))				CNL, (30min) dB(A)	Leq	Criteria	Compliance (Y/N)
	Leachate Treatment Plant	Ammonia stripping plant	On-site refuse vehicle movement	Waste filling				
SR1	<15	26	45	48	50	51	Y	
SR2	<10	16	27	41	41	55	Y	
SR3	<10	<15	26	37	37	55	Y	
SR4	<10	<10	24	38	38	53	Y	
SR5	<10	<10	24	40	40	55	Y	
SR6	<10	<15	21	34	34	43	Y	
SR7	<10	<10	17	34	34	52	Y	
SR8	<10	<15	21	33	33	44	Y	
SR9	<10	<10	28	43	43	44	Y	
SR10	<10	19	27	43	43	53	Y	

4.7.4 Cumulative Operational Noise Impacts from Concurrent Projects

Cumulative operational noise sources of the Project include aeration lagoon of leachate treatment plant, ammonia stripping plant and flare station at the existing landfill. The cumulative noise levels at NSRs are summarised in Table 4.18 to 4.19 below. Detailed calculations are given in Appendix 4.12. Results show that the predicted cumulative noise levels are within the noise criteria and residual impact is not anticipated.

Table 4.18: Cumulative operational noise impacts from existing landfill (Daytime)

NSR No.	Predicted Noise Level, dB(A)			Noise Criteria	Compliance (Y/N)
	The Project	Existing Landfill	Cumulative		
SR1	50	31	50	51	Y
SR2	41	25	41	55	Y
SR3	37	22	37	55	Y
SR4	38	18	38	53	Y
SR5	40	19	40	55	Y
SR6	34	25	34	43	Y
SR7	34	31	36	52	Y
SR8	33	33	36	44	Y
SR9	43	13	43	44	Y
SR10	43	39	45	53	Y

Table 4.19: Cumulative operational noise impacts from existing landfill (Evening and Nighttime)

NSR No.	Predicted Noise Level, dB(A)			Criteria (Evening / Nighttime)	Compliance (Y/N)
	The Project	Existing Landfill	Cumulative		
SR1	26	31	32	47 / 45	Y
SR2	17	25	26	42 / 41	Y
SR3	16	22	23	40 / 39	Y
SR4	<15	18	20	50 / 45	Y
SR5	<15	19	20	43 / 42	Y
SR6	16	25	26	42 / 40	Y
SR7	<15	31	31	48 / 44	Y
SR8	16	33	33	42 / 41	Y
SR9	<15	13	17	40 / 39	Y
SR10	20	39	39	49 / 45	Y

4.8 Residual Environmental Impact

Construction noise impact is predicted to be within the noise criterion. At the later stage of landfill operation, operational noise from the landfill activities will adopt quiet plant working method to control noise impact to within the criteria. Refuse vehicle traffic along Wo Keng Shan Road will comply with the traffic noise criterion. Residual noise impact is therefore not anticipated.

4.9 Conclusion

Potential noise sources and representative NSRs for the construction and operation phases have been identified. Noise prediction has been conducted to assess the impact with reference to established methodologies.

4.9.1 Construction and Restoration Phase

The assessment has been conducted based on daytime noise criteria specified in the TM-EIAO. It is predicted that the construction noise impacts associated with the construction activities on the Project site would not exceed the criteria. No adverse construction noise impact is anticipated.

4.9.2 Operation Phase

4.9.2.1 Road Traffic noise Impact

Road traffic noise at Wo Keng Shan Road has been assessed to be insignificant. Noise assessment results indicate that road traffic noise levels will comply with the noise criterion. Residual road traffic noise impact is therefore not anticipated.

4.9.2.2 On-site Operational Noise Impact

Assessment results also indicate that under "unmitigated" scenario, the operational noise impact will comply with the noise criteria during early stage of tipping when the topography screening effect is adequate. At the later stage of tipping when the topography is insufficient to screen the noise impact, assessment results indicate that the predicted noise levels at 2 sensitive receivers (SR1 & SR9) will exceed the noise criterion. With the adoption of quiet plants, operational fixed noise impacts will be controlled to within the noise criterion.