

Section 3

NOISE

3 NOISE

3.1 Introduction

Construction Phase

- 3.1.1 As the noise sensitive receivers (NSRs) near the WCR working area will be subjected to daytime, and possibly restricted-hour construction noise, a noise monitoring programme shall be undertaken to include daytime and restricted-hour (if necessary) noise measurement at the sensitive receivers. The programme shall be carried out by the ET to ensure that the noise level of construction works complies with the criteria of the Noise Control Ordinance (NCO) and other adopted noise standards.

Operational Phase

- 3.1.2 As noise sensitive receivers close to WCR will be exposed to traffic noise during the operational phase, a noise monitoring programme shall be developed by the IC(E) to include noise measurements at noise sensitive receivers during the peak traffic hour. The programme shall be undertaken to ensure that the traffic noise levels are comparable to those predicted in the Environmental Impact Assessment (EIA).

3.2 Noise Parameters

Construction Phase

- 3.2.1 The construction noise level shall be measured in terms of the A-weighted equivalent continuous sound pressure level (L_{eq}). $L_{eq(30\text{min})}$ shall be used as the monitoring parameter for the time period between 0700-1900 hours on normal weekdays. For all other time periods, $L_{eq(3 \times 5\text{min})}$ shall be employed for comparison with the NCO criteria.
- 3.2.2 As supplementary information for data auditing, statistical results including the L_{10} and L_{90} shall also be obtained for reference. A sample data record sheet is shown in *Annex A* for reference.

Operational Phase

- 3.2.3 The traffic noise level shall be measured within the first year of the road opening. Measurements shall be made in terms of the A-weighted L_{A10} over 3 separate 30-minute periods each within the peak traffic hour. At each point, measurements shall be taken at the specified floor (see *Table 3.4b*). A traffic census including traffic flow and the percentage of heavy vehicles (for definition of heavy vehicles refer to CRTN) shall also be conducted during the measurement period and the average speed of vehicles estimated. A sample data record sheet is shown in *Annex A* for reference.

3.3 Monitoring Equipment

- 3.3.1 As referred in the Technical Memorandum (TM) on Noise From Construction Work other than Percussive Piling (GW-TM) issued under the Noise Control Ordinance (NCO), sound level meters in compliance with the International Electrotechnical Commission Publications 651: 1979 (Type 1) and 804: 1985 (Type 1) specifications shall be used for carrying out the noise monitoring. Immediately prior to and following each noise measurement the accuracy of the sound level meter shall be checked using an acoustic calibrator generating a known sound pressure level at a known frequency. Measurements may be accepted as valid only if the calibration levels taken before and after the noise measurement are within 1.0 dBA.

3.3.2 Noise measurements shall be undertaken in accordance with standard acoustical principles and practices in relation to weather conditions.

3.3.3 The ET Leader is responsible for the provision and maintenance of the monitoring equipment. The ET Leader shall ensure that sufficient noise measuring equipment and associated instrumentation are available for carrying out the baseline monitoring, regular impact monitoring and ad hoc monitoring. All the equipment and associated instrumentation shall be clearly labelled.

3.4 Monitoring Locations

3.4.1 The noise monitoring locations are summarised in *Table 3.4a* and *3.4b* for the construction phase and operational phase and are shown in *Figure 3.4a*, *3.4b* for construction and *3.4c* for operation. The status and locations of noise sensitive receivers may change after issuing this Manual. If such cases exist, the ET Leader shall propose updated monitoring locations and seek approval from the ER, and agreement from the IC(E) and EPD of the proposed locations.

Table 3.4a Construction Noise Monitoring Stations

Noise Monitoring Station	Noise Monitoring Location
NM1 (NSR 107)	Hoi Bun School
NM2 (NSR 115)	Sam Ka Tsuen Village House
NM3 (NSR 210)	Lei Yue Mun Housing Site Block 1
NM4 (NSR 301)	Church
NM5 (NSR 608)	Yau Tong Bay Primary School
NM6 (NSR 704)	Cha Kwo Ling Site
NM7 (NSR 903)	Junk Bay

Table 3.4b Operational Noise Monitoring Stations

Noise Monitoring Station	Location	Floor
ONM1 (NSR 202)	Lei Yue Mun Housing site Block 4	Medium floor
ONM2 (NSR 602)	Yau Tong Bay	Medium floor
ONM3 (NSR 609)	Yau Tong Bay School	Top floor
ONM4 (NSR 701)	Cha Kwo Ling Site	Medium floor

3.4.2 When alternative monitoring locations are proposed, the monitoring locations shall be chosen based on the following criteria and all monitoring locations, as well as their Area Sensitivity Rating (ASR)⁽¹⁾, will be subject to approval from the EPD and in each case approval must be gained before the commencement of any monitoring.:

- (a) Alternative locations shall be similarly exposed to potential noise impacts;
- (b) It shall be close to the noise sensitive receivers; and
- (c) Shall be located so as to cause minimal disturbance to local residents.

⁽¹⁾ For construction noise only.

3.4.3 The construction noise monitoring station shall normally be at a point 1 m from the exterior of the sensitive receivers building facade and be at a position 1.2 m above the ground. If there is a problem with access to the normal monitoring position, an alternative position may be chosen, and a correction to the measurements shall be made. For reference, a correction of +3dB(A) shall be made to the free field measurements. The ET Leader shall agree with the IC(E) the monitoring position and the corrections adopted. Once the positions of the monitoring stations are chosen, the baseline monitoring and the impact monitoring shall be carried out at these same positions.

3.4.4 The operational noise monitoring shall be carried out at a distance of 1 m from the openable window and 1.2 m above the floor level of the noise sensitive receivers identified in *Table 3.4b*. The ET Leader shall agree with the IC(E) on any necessary corrections adopted.

3.5 Baseline Monitoring

3.5.1 The ET Leader shall carry out baseline noise monitoring prior to the commencement of the construction works. The baseline monitoring shall be carried out daily for a period of at least two weeks. A schedule on the baseline monitoring shall be submitted to the ER for approval before the monitoring starts.

3.5.2 There shall not be any construction activities in the vicinity of the stations during the baseline monitoring. Baseline monitoring measurements shall be evenly spread throughout the assessment period to be conducted at some frequency and duration throughout all periods of the day for which works are anticipated to be constructed (e.g. daytime, evening and night-time).

3.5.3 In exceptional cases, when insufficient baseline monitoring data or questionable results are obtained, the ET Leader shall liaise with EPD to agree an appropriate set of data to be used as a baseline reference and submit to the ER for approval.

3.5.4 No baseline operational noise monitoring is required.

3.6 Impact Monitoring

Construction Noise

3.6.1 Noise monitoring shall be carried out at all the designated monitoring stations. The monitoring frequency shall depend on the scale of the construction activities. The following is an initial guide on the regular monitoring frequency for each station on a per week basis when noise generating activities are underway:

- (a) One set of measurements between 0700-1900 hours on normal weekdays;
- (b) One set of measurements between 1900-2300 hours;
- (c) One set of measurements between 2300-0700 hours of next day; and
- (d) One set of measurements between 0700-1900 hours on holidays.

General construction work carried out during restricted hours is controlled by CNP system under the NCO.

3.6.2 For the measurements (b), (c) and (d) above, one set of measurements shall at least include 3 consecutive $L_{eq(5\text{ min})}$ results.

3.6.3 In case of non-compliance with the construction noise criteria, more frequent monitoring as specified in the Action Plan in *Section 3.7* shall be carried out. This additional monitoring shall be continued until the recorded noise levels are rectified or proved to be

irrelevant to the construction activities.

Operational Noise

3.6.4 Noise monitoring shall be carried out at all the designated traffic noise monitoring stations (*Figure 3.4c*). The following is an initial guide on the traffic noise monitoring requirements during the operational phase:

- (a) All specified monitoring locations (at selected floor heights) within the first year of the road opening;
- (b) The measurement period shall be three half hour periods during the peak traffic hour;
- (c) A concurrent census of traffic flow and percentage heavy vehicle (as specified in CRTN) shall be conducted for the widened road and the existing road network in the vicinity of each measuring point; and
- (d) The average vehicle speed estimated.

3.6.5 Measured noise levels shall be compared with predicted noise levels by applying appropriate conversion corrections to allow for the traffic conditions at the time measurement.

3.7 Event and Action Plan for Noise

Construction Noise

3.7.1 The Action and Limit Levels for construction noise are defined in *Table 3.7a*. Should non-compliance of the criteria occur, action in accordance with the Action Plan in *Table 3.7b*, shall be carried out.

Table 3.7a Action and Limit Levels for Construction Noise

Time Period	Action	Limit
0700-1900 hrs on normal weekdays	When one documented complaint is received	75* dB(A)
0700-2300 hrs on holidays; and 1900-2300 hrs on all other days		60/65/70** dB(A)
2300-0700 hrs of next day		45/50/55** dB(A)

* Reduce to 70 dB(A) for schools and 65 dB(A) during school examination periods.

** To be selected based on Area Sensitivity Rating (as approved by EPD).

Table 3.7b Event/Action Plan for Construction Noise

EVENT	ACTION			
	ET Leader	IC(E)	ER	Contractor
Action Level	<ol style="list-style-type: none"> 1. Notify IC(E) and ER 2. Carry out investigation 3. Report the results of investigation to the IC(E) and ER 4. Increase monitoring frequency to check mitigation effectiveness 	<ol style="list-style-type: none"> 1. Review the analysed results submitted by the ET 2. Review the proposed remedial measures by the Contractor and advise the ER accordingly 3. Supervise the implementation of remedial measures 	<ol style="list-style-type: none"> 1. Confirm receipt of notification of failure in writing 2. Notify Contractor 3. Require Contractor to propose remedial measures for the analysed noise problem 4. Discuss the noise mitigation proposals with ET and IC(E) and instruct the Contractor to implement the agreed mitigation measures 5. Ensure remedial measures are properly implemented 	<ol style="list-style-type: none"> 1. Submit noise mitigation proposals to ER 2. Implement noise mitigation proposals
Limit Level	<ol style="list-style-type: none"> 1. Notify IC(E), ER, EPD 2. Identify source 3. Repeat measurement to confirm findings 4. Increase monitoring frequency to daily 5. Carry out analysis of Contractor's working procedures to determine possible mitigation to be implemented 6. Inform IC(E), ER and EPD the causes & actions taken for the exceedances 7. Assess effectiveness of Contractor's remedial actions and keep IC(E), EPD and ER informed of the results 8. If exceedance stops, cease additional monitoring 	<ol style="list-style-type: none"> 1. Review Contractor's remedial actions to assure their effectiveness and advise the ER accordingly 2. Supervise the implementation of the remedial measures 	<ol style="list-style-type: none"> 1. Confirm receipt of notification of failure in writing 2. Notify Contractor 3. Require Contractor to propose remedial measures for the analysed noise problem 4. Discuss the noise mitigation proposals with ET and IC(E) and instruct the Contractor to implement the agreed mitigation measures 5. Ensure remedial measures are properly implemented 6. If exceedance continues, consider what portion of the work is responsible and instruct the Contractor to stop that portion of work until the exceedance is abated 	<ol style="list-style-type: none"> 1. Take immediate action to avoid further exceedance 2. Submit proposals for remedial actions to ER within 3 working days of notification 3. Implement the agreed proposals 4. Resubmit proposals if problem still not under control 5. Stop the relevant portion of works as determined by the ER until the exceedance is abated

3.8 Noise Mitigation Measures

Construction Noise

- 3.8.1 The EIA Report has recommended construction noise control and mitigation measures. The Contractor shall be responsible for the design and implementation of these measures.

Good Site Practice

1. Good site practice and noise management can considerably reduce the impact of construction activities on nearby NSRs. The following package of measures shall be followed during each phase of construction:
 - (a) Only well-maintained plant shall be operated on-site and plant shall be serviced regularly during the construction works;
 - (b) Machines and plant that may be in intermittent use shall be shut down between work periods or shall be throttled down to a minimum;
 - (c) Plant known to emit noise strongly in one direction, shall, where possible, be orientated to direct noise away from nearby NSRs;
 - (d) Silencers or mufflers on construction equipment shall be utilised and shall be properly maintained during the construction works;
 - (d) Mobile plant shall be sited as far away from NSRs as possible; and
 - (e) Material stockpiles and other structures shall be effectively utilised, where practicable, to screen noise from on-site construction activities.

Selecting Quieter Plant and Working Methods

2. 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 for each of the measures proposed will depend on the details of the Contractor's chosen methods of working, and it is considered too restrictive to specify items of plant that a Contractor has to use during construction activities. It is therefore both preferable and practical to specify an overall plant noise performance specification to apply to the total Sound Power Level (SWL) of all plant on the site, so that the Contractor is allowed some flexibility to select plant to suit his needs.
3. It should be noted that various types of silenced equipment can be found in Hong Kong. However, the EPD, when processing a CNP application, will apply the noise levels contained in the relevant statutory TM, unless the noise emission of a particular piece of equipment can be validated by certificate or demonstration.

Temporary Noise Barriers

4. In general, noise barriers located between noisy construction activities and NSRs could give up to 5 dB(A) reduction from screening (estimated in accordance with the GW-TM). It would be possible for the Contractor to provide barriers, in the form of site hoardings, to achieve this level of reduction. Certain types of PME, such as generators and compressors, can be completely enclosed giving a total noise reduction of 10 dB(A) or more. Vertical barriers that can be located close to noisy plant can also be very effective at screening NSRs from particular plant.
5. By considering the above methods of mitigation, it is possible to develop a mitigation package, which can be adopted to minimise potential noise impacts. Three possible mitigation options have been considered as follows:

(a) *Mitigation Option 1 (Mit 1)*

- Mitigation Option 1 utilises quiet plant where appropriate. The revised inventory of plant noise data and the corresponding construction noise levels are presented in *Table A3* and *A6* in *Annex A* of the EIA Report, respectively.

(b) *Mitigation Option 2 (Mit 2)*

- In areas where Mitigation Option 1 proves insufficient to protect NSRs from noise impacts, further mitigation will be required in the form of noise barriers. It is anticipated that a noise barrier with a skid footing and cantilevered upper portion, located close to the noise generating part of the PME such that the line of sight between source and receiver is broken, can provide at least 10dB(A) screening for stationary plant and 5dB(A) for mobile plant.

(c) *Mitigation Option 3 (Mit 3)*

- In areas where Mitigation Option 2 proves insufficient to adequately protect NSRs from noise impacts, further mitigation will be required. This may involve imposing restrictions on the number of plant which may operate at any given time. This option may also include the use of more extensive movable barriers which should be used to screen working cells in which mobile plant are likely to operate. Using this method the maximum achievable barrier attenuation for mobile sources can be increased to 10 dB(A). The barriers used to screen mobile plant shall be positioned around discrete working cells with their location and dimensions selected to ensure that no line of sight exists between the specified NSR and the mobile plant.

6. Details of the construction mitigation are provided in the Environmental Implementation Schedule presented in *Section 11* of this Manual. If the above measures are not sufficient to restore the construction noise quality to an acceptable level, upon the advice of ET Leader, the Contractor shall liaise with the ET Leader to develop alternative mitigation measures which shall be implemented upon approval from the ER.
7. Dredging and seawall construction works likely to take place within 100 m of Hoi Bun School should be scheduled to coincide with school holiday and at the very least must avoid the examination period. If appropriate scheduling of these activities is not possible to prevent noise impacts, a last resort the provision of indirect noise mitigation in the form of Type I glazing as recommended in the EIAO-TM should be considered.

Operational Noise

3.8.2

The EIA Study has recommended operational noise mitigation measures. The location of the mitigation measures are shown in *Annex B2-11 through B2-14* of the EIA Report and are described in the following paragraphs. In some cases *indirect* noise mitigation, in the form of acoustic glazing and the provision of air-conditioning, are deemed necessary. This form of mitigation is considered only as a last resort having exhausted all feasible *direct* alternatives.

Yau Tong Centre and Lei Yue Mun, Ko Chiu Road and Yau Tong Housing Estates

1. A 210 m noise enclosure on Lei Yue Mun slip roads (extending from the abutment to just before Lei Yue Mun Roundabout) is proposed in this area to provide protection to as many NSRs as possible. This enclosure will be made up of two

sections. The 130 m section closest to the roundabout will be enclosed on both sides as well as the roof. The second section (CH 510.00 - CH 430.00), 80 m in length, will be open along the western side.

2. Residual impacts attributable to WCR will arise at three assessment points. Direct noise mitigation have been considered in this area, however these options have been rejected on either planning or engineering grounds. As a last resort, it is recommended that residual impacts in this area are abated using indirect technical remedies, in the form of window insulation and air-conditioning.

Yau Tong Coastal Section

3. Consultation with the Engineers for the SEK Route T2 Study has revealed that under this development a cantilever barrier (comprising of a 5.5 m vertical section and a 3.5 m cantilevered section protruding from the top) will be provided alongside the Cha Kwo Ling slip road. This barrier is necessary to prevent noise criteria exceedances at the proposed development in the Cha Kwo Ling. Its provision will, however remain the responsibility of the SEK Route T2 Scheme. The mitigation to be provided in this area under the WCR Scheme includes the following:
 - (a) Absorptive cantilever noise barriers along the northern edge of both carriage ways of WCR in the vicinity of Cha Kwo Ling;
 - (b) Semi-enclosure along the eastern bound carriageway of WCR between Sam Ka Tsuen Typhoon Shelter and the western end of the Yau Tong Bay CDA Site;
 - (c) Vertical barrier along eastern edge of slip road D01; and
 - (d) Cantilever barrier at Yau Tong Bay adjacent to Cha Kwo Ling Road.

Cantilever Noise Barriers at Cha Kwo Ling

4. Absorptive cantilever noise barriers with a maximum vertical height of 6 m will be required along the northern edges of each WCR carriageway between the interface of WCR and SEK T2 and the EHC ventilation building (approximately CH1500.00- CH1700.00). This will protect NSRs within the Cha Kwo Ling Site (NSR 7) from traffic noise criteria exceedances.

Semi-enclosure along WCR Alignment

5. Along this portion of the WCR the NSRs will be both closer to and taller than those along the Cha Kwo Ling portion. A semi-enclosure, spanning across the eastern bound carriageway of the main WCR alignment is therefore proposed to protect the high rise residential coastal development which will overlook the WCR. The semi-enclosure will be approximately 1.2 km in length extending from the Sam Ka Tsuen Typhoon Shelter to the EHC ventilation building (CH 2900.00 - CH 1700.00). This will be sufficient to protect all those properties which directly overlook WCR in this area.
6. An 8 m high semi-enclosure would be required only in the vicinity of traffic sign gantry to allow an unobstructed view of the traffic signs on the gantry. A 6.8 m semi-enclosure would be required for the remaining portion of the roadway.

Vertical Barrier along Slip Road D01

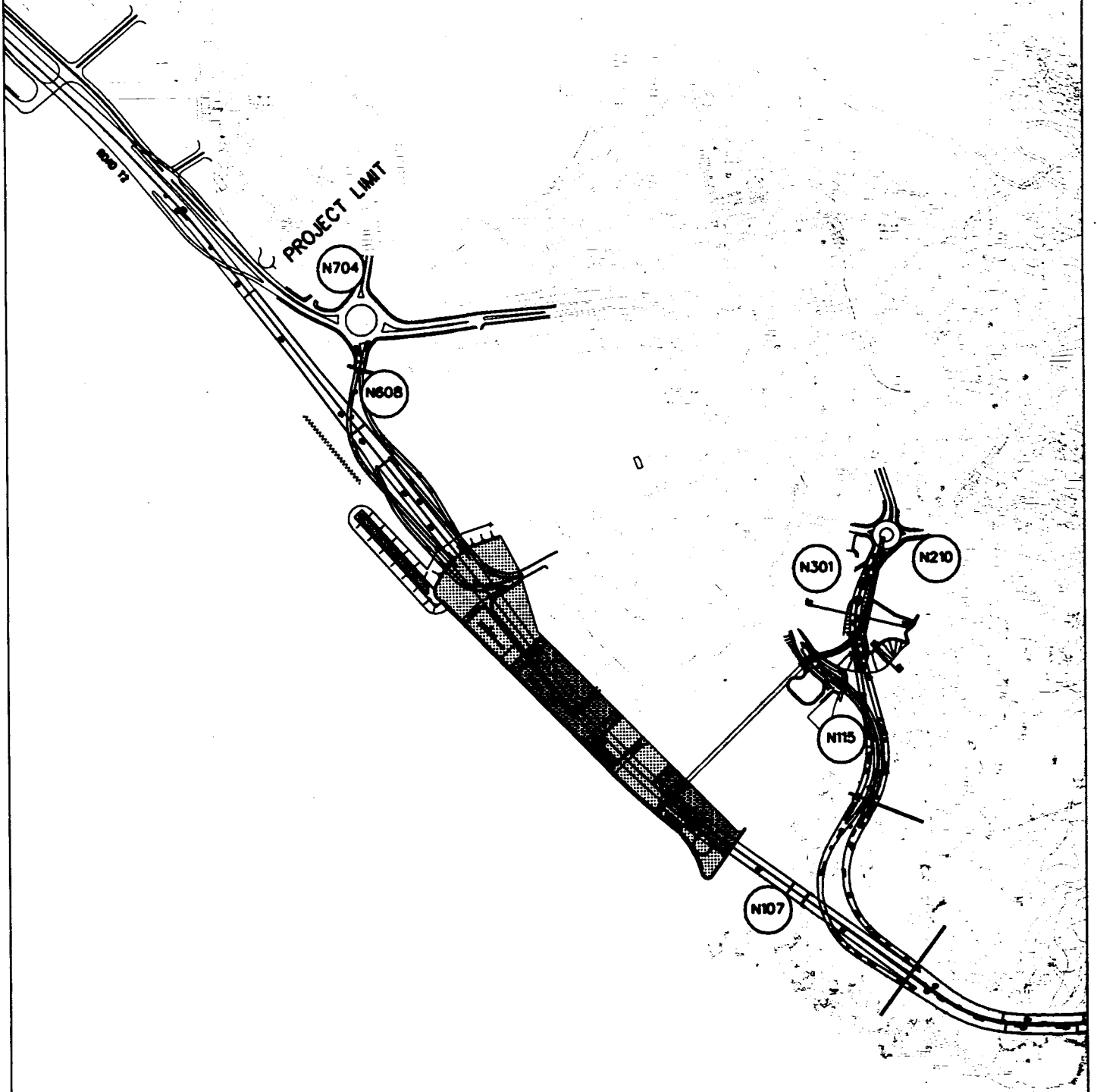
7. A 150 m long noise barrier is recommended in this section along the outside of the eastern bound carriageway of the Slip Road D01 (CH 150.00 - CH 300.00). This barrier will be a vertical barrier of height 2 m for the first 100 m (CH 150.00 - CH 200.00) increasing to 3 m in height for the remaining 50 m. This barrier will

contribute to the overall protection of two schools within the Yau Tong Bay Development (N607 and N608).

Cantilever Boundary Barrier for Yau Tong Bay Development

8. The layout of the proposed Yau Tong Bay development includes the provision of a 3 m vertical barrier alongside the boundary with Cha Kwo Ling Road. It is predicted, however, that following the opening of the WCR that this barrier will not be adequate to prevent traffic noise exceedances at the schools adjacent to Cha Kwo Ling Road (N609 and N610). It is therefore recommended that this barrier is extended to a cantilever barrier comprising of a 5 m vertical section and a 2 m cantilevered section positioned at 3 m from the road edge.

3.8.3 The operational noise mitigation measures are summarised in the Implementation Schedule presented in *Section 11* of this Manual. Further details are provided in the EIA Report.



WCR, TKO YAU TONG RECLAMATION AREA
CONSTRUCTION NOISE MONITORING LOCATIONS

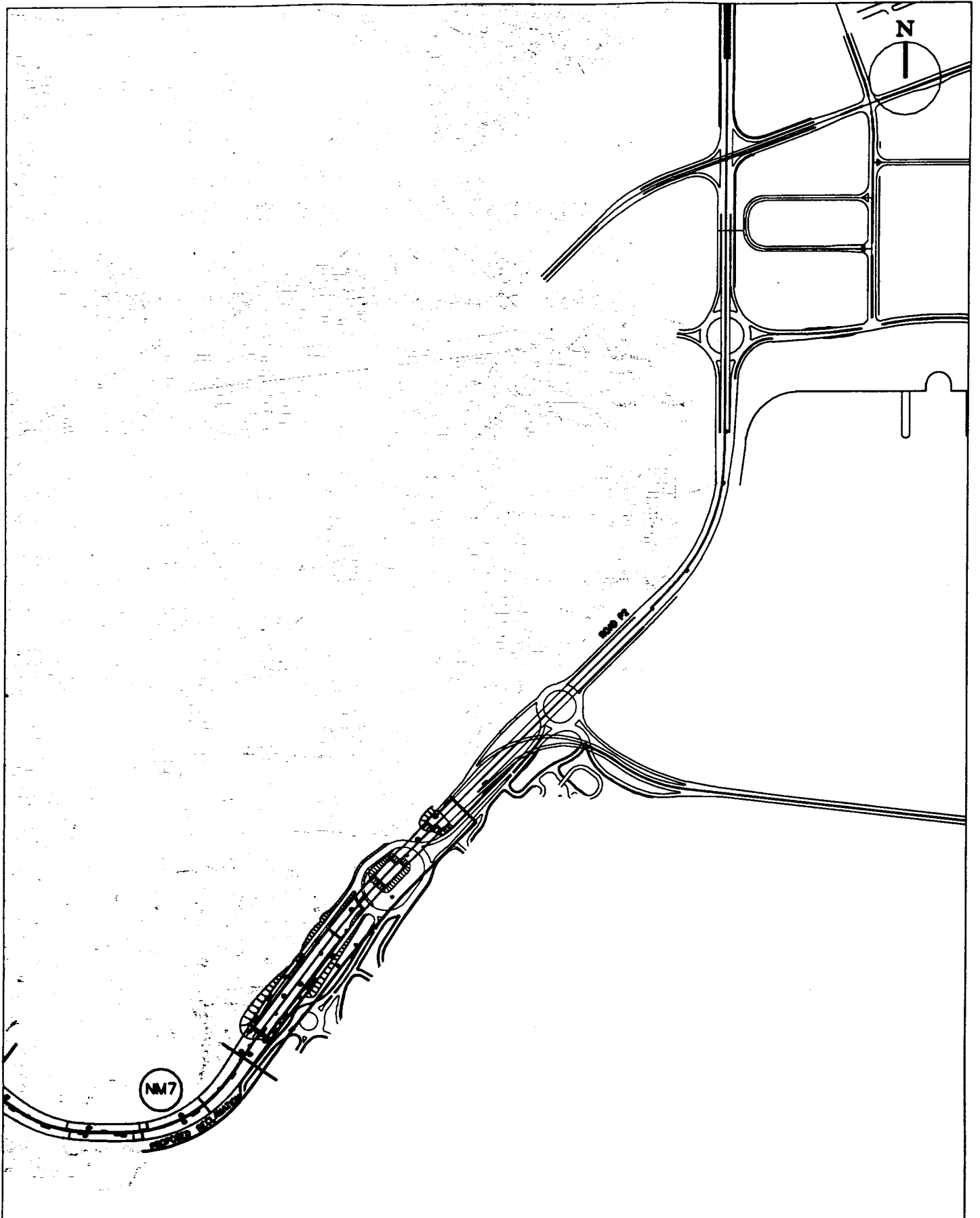
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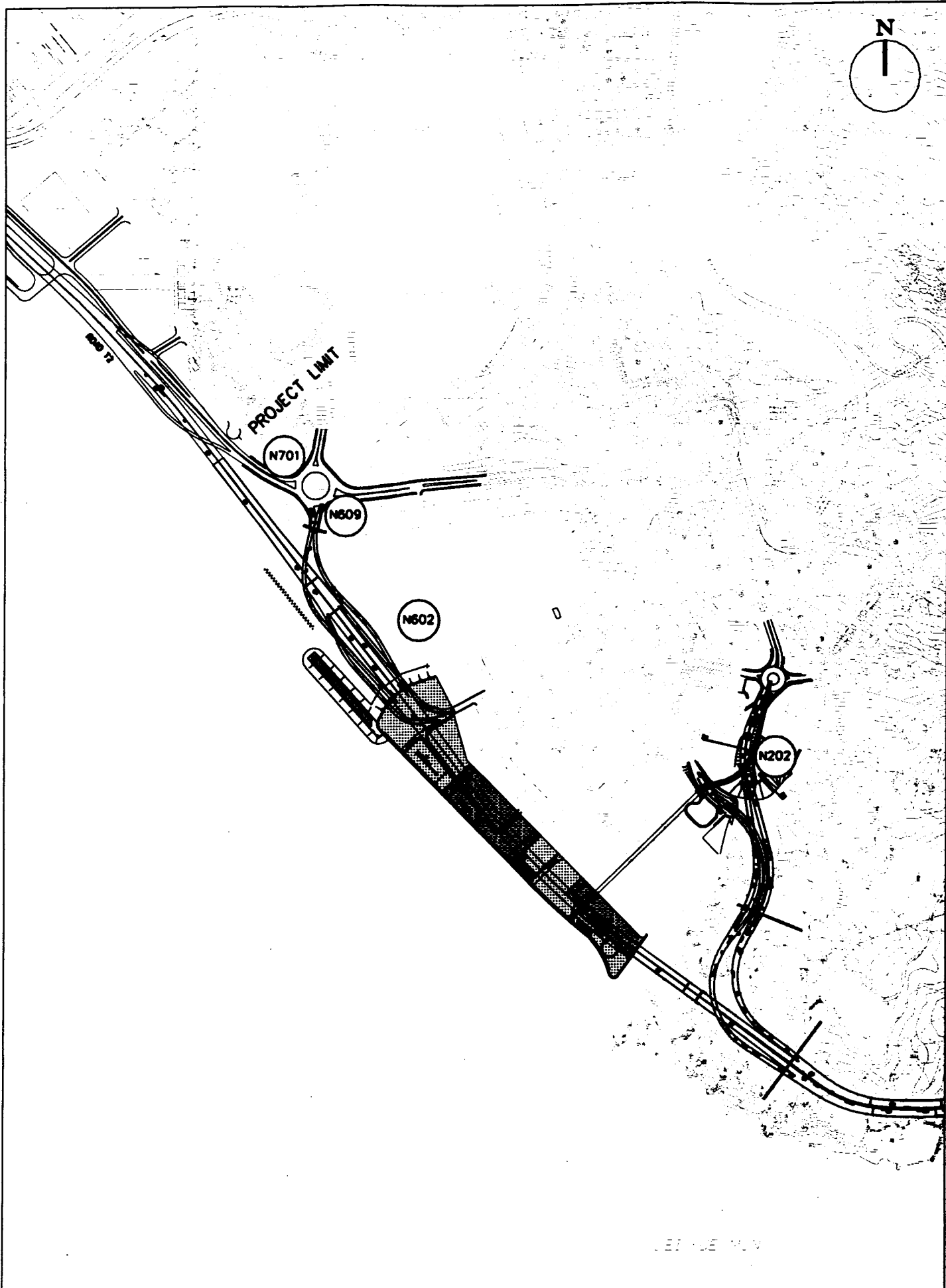
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KEY
 NM7 (N903) - Junk Bay

WCR, TKO - CONSTRUCTION NOISE MONITORING LOCATIONS

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WCR, TKO YAU TONG RECLAMATION AREA
OPERATIONAL NOISE MONITORING LOCATIONS

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